

# **Flora Malesiana**

**Series I – Seed Plants**

**Volume 14 – 2000**

**Myristicaceae**

(W.J. J.O. de Wilde)

ISBN 90-71236-47-1

All rights reserved

© 2000 Foundation Flora Malesiana

*No part of the material protected by this copyright notice may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without written permission from the copyright owner.*

## ABSTRACT

**Flora Malesiana.** Series I, Volume 14 (2000) iv + 1–634, by W.J.J.O. de Wilde (edited by P.F. Stevens), published by the Nationaal Herbarium Nederland, Universiteit Leiden branch, The Netherlands, under the auspices of Foundation Flora Malesiana.

ISBN 90-71236-47-1

Contains the taxonomic revision of one family, *Myristicaceae*, for Malesia, i.e. the area covering the countries Indonesia, Malaysia, Brunei Darussalam, Singapore, the Philippines, and Papua New Guinea.

W.J.J.O. de Wilde, *Myristicaceae*, pp. 1–622.

A pantropical family of trees, in Malesia represented by six genera: *Endocomia* (4 species), *Gymnacranthera* (6), *Horsfieldia* (97), *Knema* (75, only one species in New Guinea), *Myristica* (152, of which the majority endemic to New Guinea), and *Paramyristica* (1, Papua New Guinea). Altogether there are 335 species of the family in the Malesian area. Some species are of economic importance, for instance *Myristica fragrans*, nutmeg.

The general part consists of 28 pages and also includes paragraphs on vegetative anatomy by P. Baas & J. Koster, on palynology by R.W.J.M. van der Ham, and on phytochemistry and chemotaxonomy by R. Hegnauer.

*Myristicaceae* are dioecious. In addition to the general keys, mainly based on male specimens, also regional keys are given for the larger genera *Horsfieldia*, *Knema*, and *Myristica*, based on female (fruiting) specimens.

For each species full references, synonymy, keys to infraspecific taxa, diagnostic descriptions, field-notes, distribution, and annotations regarding relationships or differences with resembling species are presented. Genera and species are arranged alphabetically.

This treatment is illustrated with 94 line drawings (many full-page), 6 maps, and 4 pages with colour photographs\* (inserted after p. 8).

**Index** to scientific plant names of taxa treated in this volume (accepted names and synonyms) on pp. 623–632.

**Lists** of revised families in Flora Malesiana on pp. 633–634.

\*) The grant of the Dr. Hendrik Muller's Vaderlandsch Fonds, The Hague, for the reproduction and inclusion of the colour photographs, is gratefully acknowledged.

## MYRISTICACEAE

(W. J. J. O. de Wilde, Leiden, The Netherlands)<sup>1</sup>

*Myristicaceae* R.Br., Prodr. (1810) 339, 'Myristiceae'; Warb., Monographie der Myristicaceae, Nova Acta Acad. Caes. Leop.-Carol. 68 (1897) 1–680; J. Sinclair, Gard. Bull. Sing. 16 (1958) 205–470, pl. I–XIV; Whitmore, Tree Fl. Malaya 1 (1972) 315–345; W. J. de Wilde, Blumea 30 (1984) 173–196; 39 (1994) 341–350; Beitr. Biol. Pflanzen 66 ('1991', 1992) 95–125; in Soepadmo & Saw (eds.), Tree Fl. Sabah & Sarawak 3 (2000) 335–473; Kühn & Kubitzki in Kubitzki et al., Fam. & Genera Vascular Plants 2 (1993) 457–467 (with extensive literature references). — Type genus: *Myristica* Gronov.

Dioecious or monoecious (*Endocomia*) monopodial shrubs or trees with aromatic oil-cells, (2–)5–15(–40) m high (*Virola sessilis*, Brazil, 30 cm high); stilt-roots sometimes present; branching whorled, the crown often pyramidal. *Bark* and wood exuding a watery pink or red sap on cutting. *Wood* white or soon brownish on cutting, soft; rays narrow, taniferous tubes present; growth rings usually distinct and visible to the naked eye. *Twigs* tomentose, glabrescent. *Hairs* uniseriate, often with armed cells, appearing as stellate or dendroid. *Leaves* simple, entire, alternate, usually distichous in plagiotropic shoots, exstipulate, often with indumentum on both surfaces when young, glabrescent, or remaining on the lower surface; lateral nerves distinct, interarching at the margins; reticulations sometimes faint; vernation conduplicate (Asian genera); dark dots (corky hair bases) on lower leaf surface present or absent; glands absent. *Inflorescences* from foliar axils to ramiflorous (cauline), pedunculate, compound or not, with or without bracts at base, the flowers variably arranged at the ends of the branches, or a short, woody (sub)sessile simple or 2–4-fid scar-covered wart- or worm-like brachyblast with the flowers in (sub)umbels at the end; bracts caducous. *Female inflorescences* similar to male, usually less branched. *Flowers* unisexual, mostly pedicellate; bracteole present or absent. *Perianth* gamophyllous, globose to rotate, buds 2- (*Horsfieldia*, p. p.) to 5-lobed (*Endocomia*, p. p.), cleft to variable depths, lobes little or much recurved; the female usually urceolate, larger, more swollen than the male; disc rarely present. *Androecium* with synandrium sessile or stalked (androphore), in *Myristica* mostly with a short sterile apex; anthers dorsally adnate to the column and laterally to each other, or free, in *Knema* stellately arranged around a disc, 2–45 in number, ellipsoid to linear, extrorse, opening by longitudinal slits, 2-loculed, tetrasporangiate; immature pollen sacs septate. *Ovary* monocarpellate, sessile, superior, ovoid; style absent or short, stigma 2-lobed or rarely peltate with few to many lacinations; ovule 1, mostly anatropous,  $\pm$  basal. *Fruits* (sub)globose to oblong, rarely transversely elongate, dehiscing by a longitudinal circumferential suture into 2 valves, rarely indehiscent; pericarp leathery, carnosous or subligneous, glabrous or tomentose. *Aril* (orange-)red (or yellow?), completely covering the seed, lacinate to various depths or sometimes (sub)entire, attached to the base of the seed between the hilum and the micropyle. *Seeds* with testa of three layers; albumen hard, mostly ruminant, containing oil, sometimes starch. *Embryo* small, near the base of the seed or a little above; cotyledons connate at base (peltate or cup-shaped) or free; radicle basal, cylindrical.

1) With contributions by R.W.J.M. van der Ham (palynology), R. Hegnauer (phytochemistry & chemotaxonomy), J. Koster and P. Baas (vegetative anatomy). Most of the original drawings are by J. H. van Os and some by R. van Crevel.

## DISTRIBUTION

Pantropical with c. 500 species in 20 genera, more or less equally distributed over and restricted to the three main continental areas: 8 genera (with few species) in Africa, of which 5 in Africa proper and 3 in Madagascar, 6 genera in America, and 6 in Southeast Asia, mainly Malesia.

The largest genera are *Viola* (c. 50 species) in America, and *Horsfieldia* (c. 100 species), *Knema* (c. 90 species), and *Myristica* (c. 170 species) in Asia. The latter three, together with *Endocomia* and *Gymnacranthera*, have widespread distributions; *Endocomia* occurs from S China to New Guinea (Map 1), *Gymnacranthera* from S Peninsular Thailand to New Guinea (Map 2); *Horsfieldia* occurs from Sri Lanka and S China east to the Solomon Islands and N Australia, with centres of species richness in W Malesia, mainly Borneo and New Guinea (Map 3); *Knema* has a distribution from India to W New Guinea, with a centre of diversity in W Malesia, mainly Borneo (Map 4); the genus *Myristica* has the largest distribution, from India to N Australia and far into the Pacific, with centres of speciation in W Malesia and, particularly, New Guinea (100 species) (Map 5). *Paramyristica* (1 species) is endemic to Papua New Guinea (Map 6).

In the present treatment the now official name Papua Barat has been used instead of Irian Jaya.

## HABITAT

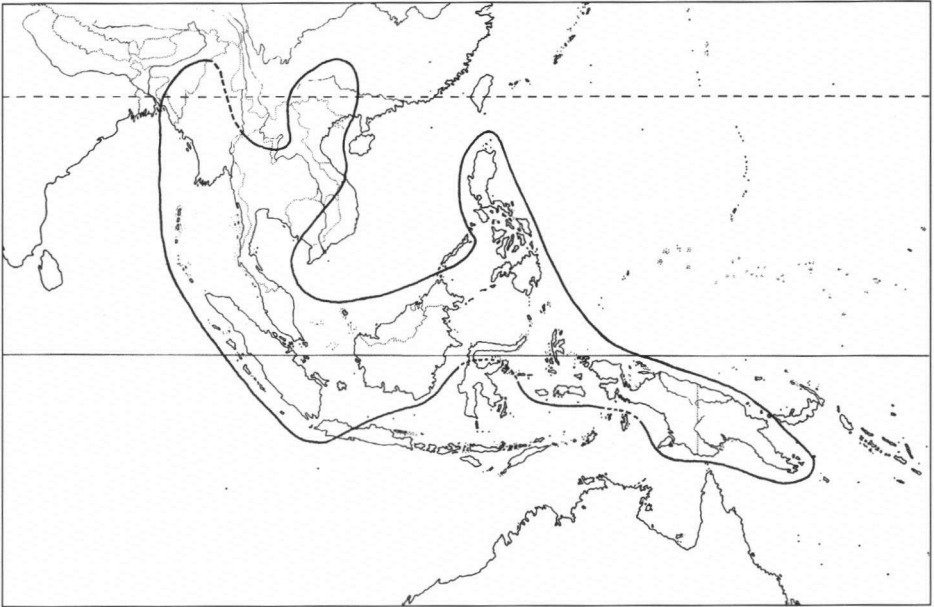
Low or medium (rarely canopy) trees in various types of primary lowland rain forest, including kerangas and marshy forest. Some species of *Horsfieldia* (in New Guinea) and several of *Knema* (e.g., Mt Kinabalu area) and *Myristica* (in New Guinea) occur in montane forest. Occasionally species are 'sciophilous nomads' (fast growing, shade tolerant), notably some *Horsfieldias* in New Guinea, and few are found in secondary forest. Sometimes *Myristicaceae* constitute a considerable component of the forest, especially of the middle storey of the lowland rain forest, but they are not gregarious.

According to Koster & Baas (1981) leaf anatomical characters are xeromorphic, which is unexpected in view of the mesic ecology of recent *Myristicaceae* (see Vegetative Anatomy').

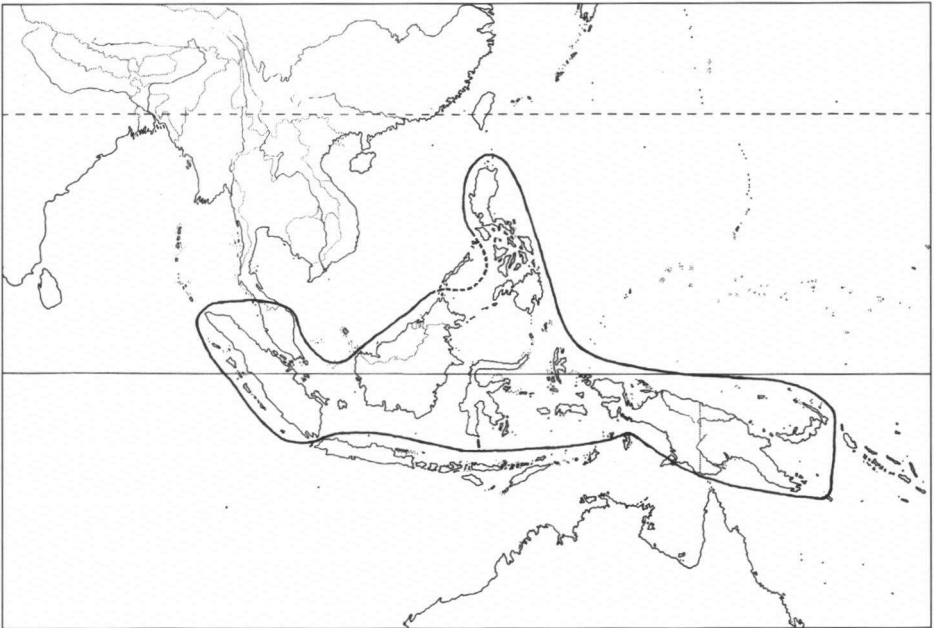
## ECOLOGY

*Pollination & flower biology* — Flowering and fruiting generally occurs throughout the year. The usually  $\pm$  carnose, yellow or brown, inside creamy, pink, or red flowers of several genera have repeatedly been reported as being fragrant, e.g. *Horsfieldia irya* and *Myristica fragrans*. Anthesis presumably is mainly nocturnal, and small beetles may effect pollination; nectar is not reported for any species. Male plants of *Myristica* produce over 50 times as many flowers as do females (Armstrong & Drummond 1986; Armstrong & Tucker 1986; Armstrong & Irvine 1989). *Myristica subalulata* and some related species are myrmecophilous, the ants possibly involved in pollination (De Wilde 1998). Besides the coloured inside of the perianth, in *Knema* also the staminal disc may be brightly (purple-red) coloured, the contrast with the creamy-white pollen possibly heightening the attraction of pollinators.

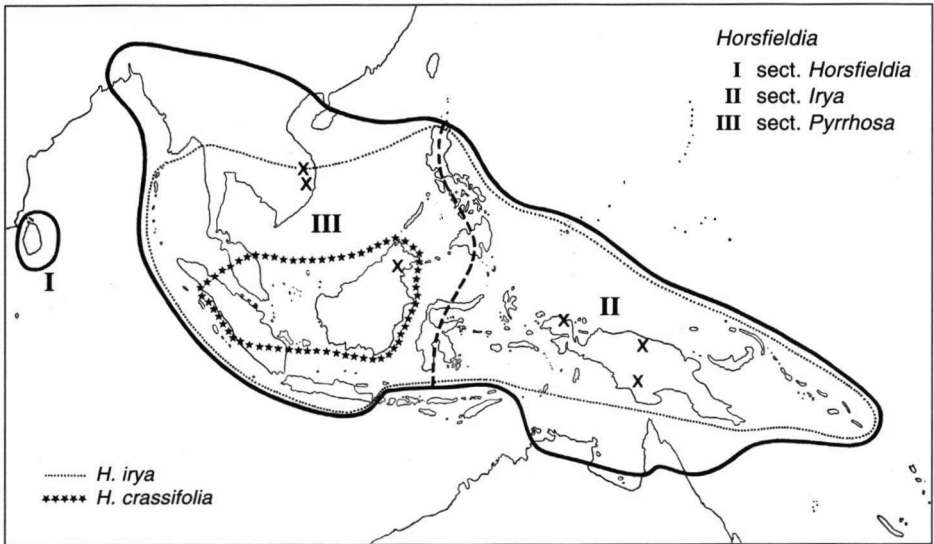
*Dispersal* — The brown-black seeds contrasting with the orange or red aril and the inner surface of the (red, pink, or white) opened pericarp attract birds and suggest bird disper-



Map 1. Distribution of the genus *Endocomia* W.J. de Wilde  
(see also p. 29).

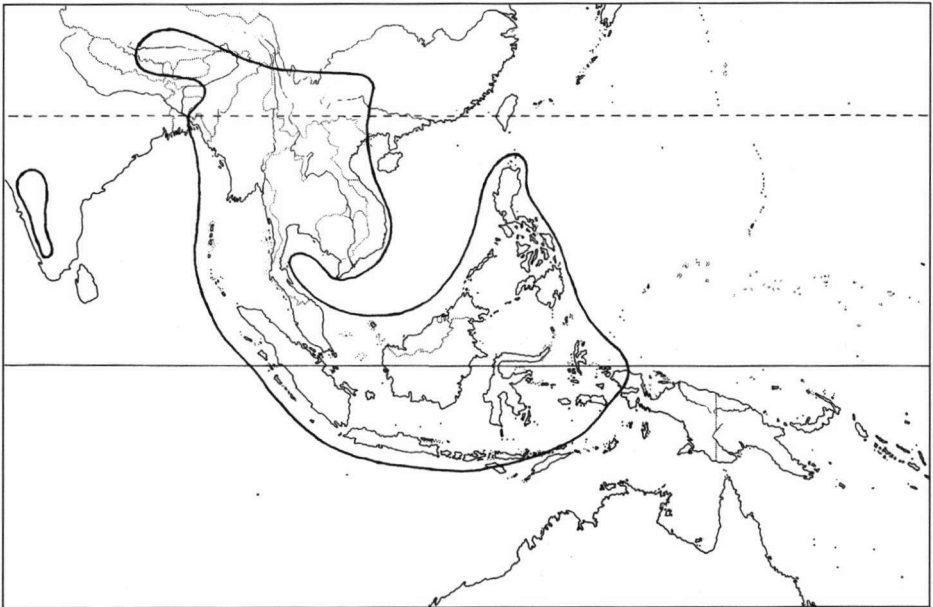


Map 2. Distribution of the genus *Gymnacranthera* (A. DC.) Warb.  
(see also p. 40).

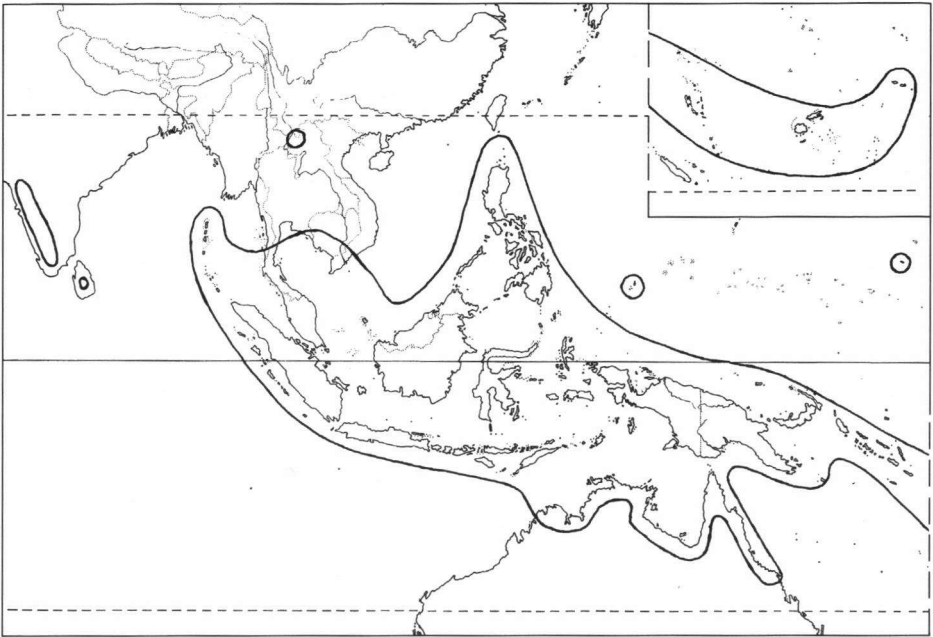


Map 3. Distribution of the genus *Horsfieldia* Willd.

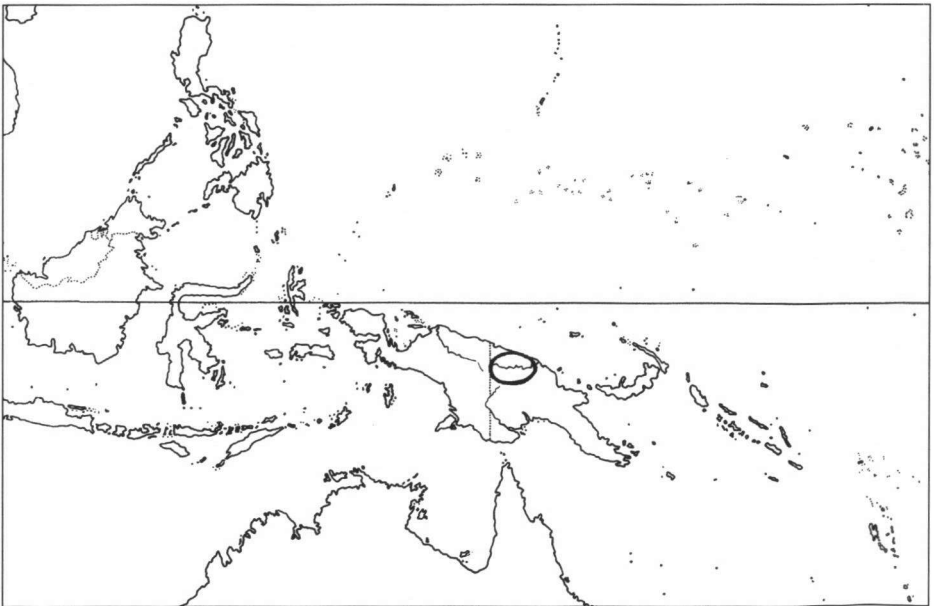
I = sect. *Horsfieldia*; II = sect. *Irya*, east of Wallace's Line (broken line); III = sect. *Pyrrhosa*, west of Wallace's Line. Distribution of *H. irya* is indicated by a dotted line, that of *H. crassifolia* by a line of asterisks. Crosses indicate the approximate areas of species with a number of perianth lobes deviating from that of section areas II and III (see p. 55 for further information).



Map 4. Distribution of the genus *Knema* Lour.  
 (see also p. 222).



Map 5. Distribution of the genus *Myristica* Gronov.  
The inlet indicates the eastern part of the total distribution area, with Pacific islands and Fiji  
(see also p. 359).



Map 6. Distribution of the genus *Paramyristica* W.J. de Wilde  
(see also p. 619).



sal (Howe & Vande Kerckhove 1980), in Asia by fruit pigeons and doves, hornbills, and birds of paradise (Sinclair 1958). Monkeys and rodents may disperse fruits or seeds as well. Dissemination by water may occur in *Horsfieldia wallichii*, of which the seeds float because of air trapped between aril and seed, and in *Horsfieldia irya*, a widespread riverine species with cavities in the endosperm. The seeds of the marsh nutmeg, *Myristica elliptica*, are reported to float, also when the aril is missing.

*Germination & seedling* — Seeds remain viable for a restricted period only, a few weeks, and germinate only in a damp, shady environment and therefore the natural reintegration of *Myristicaceae* in secondary forest is impossible. Germination is (mostly) hypogeal. The cotyledons remain within the testa, the taproot and hypocotyl emerge, the shoot is erect, initially with reduced leaves (cataphylls), mostly borne spirally: the *Horsfieldia* type (subtype) of seedling (De Vogel 1979), a common type in tropical woody dicotyledons.

*References:* Armstrong, J. E. & B. A. Drummond, *Biotropica* 18 (1986) 32–38. — Armstrong, J. E. & A. K. Irvine, *Amer. J. Bot.* 76 (1989) 74–85, 86–94. — Armstrong, J. E. & S. C. Tucker, *Floral development in Myristica (Myristicaceae)*. *Amer. J. Bot.* 73 (1986) 1131–1143. — De Vogel, E. F., *Seedlings of Dicotyledons* (1979) 1–203. Pudoc, Wageningen. — De Wilde, W. J. J. O., *Blumea* 43 (1998) 165–182. — Howe, H. F. & G. A. Vande Kerckhove, *Science* 210 (1980) 925–926. — Sinclair, J., *A revision of the Malayan Myristicaceae*. *Gard. Bull. Sing.* 16 (1958) 205–472.

#### TAXONOMY

The family *Myristicaceae* is homogeneous and clearly belongs (also phytochemically) within the *Magnoliales*. Phylogenetic analysis of the genera revealed that the family is monophyletic, of African origin (Sauquet 1998), and seemingly most related to the *Annonaceae*, mainly through the ruminant endosperm. *Canellaceae* have been suggested to be allied through the monadelphous androecium (Wilson & Maculans 1967), but according to a recent cladistic analysis of all families (APG 1998) this family is as yet not properly placed as it falls beyond the recognized basal orders. The foliage is generally strongly reminiscent of *Annonaceae*. The 3-lobed perianth reminds of *Lauraceae* and *Annonaceae*. *Myristicaceae* are distinguished, however, by their unisexual flowers with uniseriate perianth, and monocarpellate 1-ovuled female flowers.

Within the family the relationship of the genera is unclear, and initially one single genus, *Myristica* (divided into sections), was recognized until Warburg (1897) divided it into several genera. The genera of Madagascar possibly retain the most primitive characters, viz. pollen morphological, not or less consolidated stamens, and a little developed aril.

Within the larger Malesian genera, *Horsfieldia*, *Knema*, and *Myristica*, subgenera or series have been recognized (Warburg 1897; Uphof 1959; Sinclair 1968; De Wilde 1979), but as explained under these genera, the distinctions are not sharp and only allow for informal grouping of species, largely reflected in the keys to the species.

*Practical taxonomic notes* — All members of the family *Myristicaceae* can be recognized in the field by their general habit, i.e., a slender bole with monopodial crown, the branches more or less verticillate and tiered, and the rather long exstipulate distichous

leaves like those of the *Annonaceae*. The latter family differs in its flower structure, fruits, and lack of the red exudate of the cut bark. Further differences are obvious in the transversely cut twig where the bark has radiating parenchyma in the *Annonaceae*, and also the pollen is different. The genera of *Myristicaceae* can be told apart on vegetative characters only with experience, and flower, inflorescence, and fruit characters are necessary for a definite identification. Useful characters are the non-striate, usually finely lenticellate and granulate bark of the twigs in *Gymnacranthera*, or the dry leaves not readily breaking into pieces in most species of *Knema* and *Gymnacranthera* (both have reticulate sclerenchyma in the mesophyll). Certain leaf and wood anatomical characters can be used in genera diagnoses. All six Malesian genera may reach timber size.

Since myristicaceous specimens either have male flowers, or female flowers and/or fruits, keys have been constructed for both sexes, using also vegetative characters. However, specimens with only female flowers may be difficult to assign to a particular genus, and one should use both types of keys, paying particular attention to the inflorescence type.

*References:* APG (Angiosperm Phylogeny Group), An ordinal classification for the families of flowering plants. *Ann. Missouri Bot. Gard.* 85 (1998) 531–553. — De Wilde, W. J. J. O., New account of the genus *Knema* (Myristicaceae). *Blumea* 25 (1979) 321–478; in E. Soepadmo & L. G. Saw (eds.), *Tree Flora of Sabah & Sarawak* 3 (2000) 335–473. — Sauquet, H., *Phylogénie des Myristicaceae*. *Rapport de stage*. Institut Agronomique, Paris-Grignon (1998). — Sinclair, J., The genus *Myristica* in Malesia and outside Malesia. *Gard. Bull. Sing.* 18 (1968) 1–540. — Uphof, J. C. Th., in: A. Engler & K. Prantl, *Die natürlichen Pflanzenfamilien* ed. 2, 17a II (1959) 177–199. — Warburg, O., *Monographie der Myristicaceae*, *Nova Acta Acad. Caes. Leop.-Carol.* 68 (1897) 1–680. — Wilson, T. K. & L. M. Maculans, The morphology of the Myristicaceae. I. Flowers of *Myristica fragrans* and *M. malabarica*. *Amer. J. Bot.* 54 (1967) 214–220.

#### VEGETATIVE MORPHOLOGY

*Notes* — 1) Sizes given in the descriptions always relate to (measurements in) the dry state. When single measurements are given they indicate length. 2) Comprehensive discussions on the morphology of Asian *Myristicaceae* have been published by Sinclair (1958, 1961, 1968).

*Growth form* — Asian *Myristicaceae* are always trees, though sometimes only a few metres high. On germination the erect shoot, which initially develops into the orthotropic main stem, carries a number of spirally arranged cataphylls, soon passing into normal leaves. Growth is normally monopodial in flushes, and each season at the end of the new flush the leaves are produced  $\pm$  crowded into a several-leaved pseudowhorl. The plagiotropic lateral shoots hence are  $\pm$  whorled,  $\pm$  horizontal, and so are the main branches on the stem. This growth form of the trees is according to the model of Massart (Hallé et al. 1978; De Wilde 1992). In the plagiotropic shoots, usually in the herbarium specimens, the leaves are generally (sub)distichous (in Malesia in a few species of *Horsfieldia* phyllotaxis is spiral). In some species (e.g. *Gymnacranthera ocellata*, *Paramyristica sepicana*), an apical bud with bud scales is formed, the latter leaving ring-shaped scars at the base of the innovations. Buttresses are frequent, stilt-roots occasional. The monopodial crown often is  $\pm$  pyramidal in outline. Presence of stilt-roots and other characteristics have been summarized in the field-notes of most species.

*Bark* — The bark of the trunk is smooth or fissured (furrowed), scaly, or dippled, in certain species of *Myristica* and *Knema* blackish and gritty (the *penarahan arang* group of foresters). The inner bark is fibrous, red-brown. When cut the inner bark (and wood) exude a clear, pale to intense dark red sap (*kino*), usually free flowing, and typical for the family. The generally soft sapwood is pale, darkening brown-red on exposure; the heartwood often is dark-coloured; the core of old trees is commonly brittle, or reported as being rotten. Field-notes on bark and wood characteristics have been given under most species. Some photographs of bark have been published by Sinclair (1958).

*Indumentum* — Almost all Asian *Myristicaceae* have some sort of indumentum (of sparse minute hairs to thickly woolly), composed of uniseriate hairs (see 'Anatomy') which may be scale-like, stellate, or dendroid. Very often the hairs are rust-coloured and early shed, but an indumentum is usually present on the sterile apical leaf bud, the very apex of the twigs, inflorescences, and the flower buds; it may persist on the lower leaf surface, dependent on the species. The length of the hairs, viz. short (0.1 mm) versus longer (0.2 mm or more) is diagnostic. The indumentum of the fruits, if present, is always diagnostic.

The indumentum in *Myristicaceae* is also used for the distinction of genera, as explained for Malesia below in 'Vegetative anatomy' by Koster and Baas. The hairs are essentially uniseriate, but the cells may be branched to one or two sides, forming sessile (scale-like) to long-dendroid hairs.

*Twigs* — The thickness (diameter) of the twigs, measured at the apex in the distal 10 cm, and whether they are terete (as usual), (blunt) triangular, ridged (mostly at both sides in between the insertion of the petiole), or  $\pm$  flattened, can be used as diagnostic characters. The bark of the twigs may be longitudinally grooved (striate) to various degrees, and in older twigs may become characteristically longitudinally cracked and later on flaking. Colour of the bark of the twigs is usually some shade of brown, straw, or greyish (pale) and contrasting with the dark drying colour of the petiole. Only when colours are contrasting it is mentioned in the descriptions, being characteristic for certain species, especially in *Horsfieldia*, and for the whole genus *Endocomia*. The bark of the twigs may be lenticellate to various degrees, according to the species. In *Gymnacranthera* the twigs are always  $\pm$  flattened and strongly lenticellate; in *Knema* and *Endocomia* lenticels are (almost) absent. Some New Guinean *Myristicas* are characteristically myrmecophilous with part of the twigs thickened and ant-inhabited (De Wilde 1998).

*Leaves* — The leaves are simple, exstipulate, pinninerved, and spirally inserted (dispersed) on orthotropic axes. However, in the plagiotropic fertile twigs, i.e. in herbarium specimens, the leaves are usually distichous; rarely the phyllotaxis is spiral, as in some species of *Horsfieldia*. The blade varies between elliptic to lanceolate, often being broadest at or slightly above, sometimes below the middle. The margin is occasionally revolute on drying, and only then it is mentioned in the descriptions. The lower leaf surface usually is pale and may be papillose or not, or covered with alveolar material (Koster & Baas 1981, 1982), characteristic for *Knema* or, e.g., *Horsfieldia iryagedhi* and certain species of *Myristica*. The indumentum may be persistent on the lower leaf surface, but in most species of all genera it is early falling. Very characteristic for certain species in

(For legends, see page 622)



Photo 1 — *Gymnacranthera bancana* (Miq.) J. Sinclair



Photo 2 — *Gymnacranthera forbesii* (King) Warb. var. *forbesii*

(For legends, see page 622)



Photo 3 — *Gymnacranthera farquhariana* (Hook. f. & Thomson) Warb. var. *farquhariana*



Photo 4 — *Myristica fatua* Houtt. subsp. *fatua*

(For legends, see page 622)



Photo 5 — *Knema glauca* (Blume) Petermann var. *glauca*



Photo 6 — *Knema kinabaluensis* J. Sinclair

(For legends, see page 622)



Photo 7 — *Knema sumatrana* (Blume) W.J. de Wilde



Photo 8 — *Horsfieldia wallichii* Warb.



Photo 9 — *Myristica iners* Blume

*Horsfieldia*, *Knema*, and *Myristica* is the presence or absence of dark-coloured, red-brown or blackish dots and/or dashes, especially on the lower leaf surface, i.e., corky warts developed from the bases of fallen hairs, visible with a strong lens. Much finer dark spots representing tannin-conglomerations are often present. The presence or absence of dots (and dashes) is important for species distinction and for this purpose, to a lesser extent, the presence or absence of microscopic papillation on the lower leaf surface is used (to be seen with a magnification of  $\times 60$ ). In general, one should always inspect the lower leaf surface when determining a myristicaceous specimen. For the distinction of the many similar species of *Myristica* in New Guinea the size of the leaf blades is used; as arbitrary demarcation smaller or larger than about 15 cm is chosen for the leaf length. Whether the midrib and lateral nerves are raised or sunken above (they are always raised beneath) are useful taxonomic characteristics, as is the number of lateral nerves. The distinctness of the veins connecting the laterals (in the descriptions 'lines of interarching') near the blade margin, as well as the nature of the tertiary venation (in the descriptions simply 'venation') are of taxonomic importance at the species level. The size of the ultimate areoles formed by the veinlets is important for the distinction of some *Knema* species. In some species of all genera the colour of the blade on drying is used for species delimitation, i.e. green in *Knema viridis*. The angle of the lateral nerves to the midrib (in the descriptions indicated by degrees) may be diagnostic.

The sterile apical leaf bud, of a typical elongate-conical shape, has a characteristic indumentum (hairs always appressed in *Myristica*) and more or less characteristic shape and size. It consists of a single leaf only, and is present and visible as soon as the previous leaf in the flush has developed and expanded. In Asian species the vernation is conduplicate. In a few species, especially those from higher elevations, some bud scales may be present on the apical bud which ends the flush, and this is also rather characteristic for lowland taxa such as *Paramyristica* and some *Myristica* and *Gymnacranthera* species, e.g. *G. ocellata*, where these bud scales leave two distichous rows of closely set scars at the transition between innovations. In species of a (presumably) more or less seasonal environment (drought, or cold in the mountains),  $\pm$  ellipsoid or ovoid, sterile or fertile (inflorescence) buds, normally 10 mm long or much less, composed of several cataphylls, can be found axillary to leaves; in these buds the first two scales are minute and essentially placed transversely and opposite (De Wilde 1992), as is common in dicotyledons.

*References:* De Wilde, W. J. J. O., The genera of Myristicaceae as distinguished by their inflorescences, and the description of a new genus, *Bicuiba*. Beitr. Biol. der Pflanzen 66 ('1991', 1992) 95–125; Census of *Myristica* (Myristicaceae) in New Guinea anno 1994. Blumea 40 (1995) 237–344. — Hallé, F., et al., Tropical trees and forests. An architectural analysis. Springer, Berlin etc. (1978). — Koster, J. & P. Baas, Comparative leaf anatomy of the Asiatic Myristicaceae. Blumea 27 (1981) 115–173; Alveolar material in the Myristicaceae. Linn. Soc. Symp. Series, No. 10, Suppl. (1982) 131–138. — Sinclair, J., Gard. Bull. Sing. 16 (1958) 205; 18 (1961) 102–327; 33 (1968) 1–540.

#### REPRODUCTIVE MORPHOLOGY

*Inflorescences* — *Myristicaceae* are practically always dioecious, except *Endocomia*, which is monoecious, female flowers being mixed within the more numerous male flowers in each paniculate inflorescence. The inflorescences are useful for the recognition of the



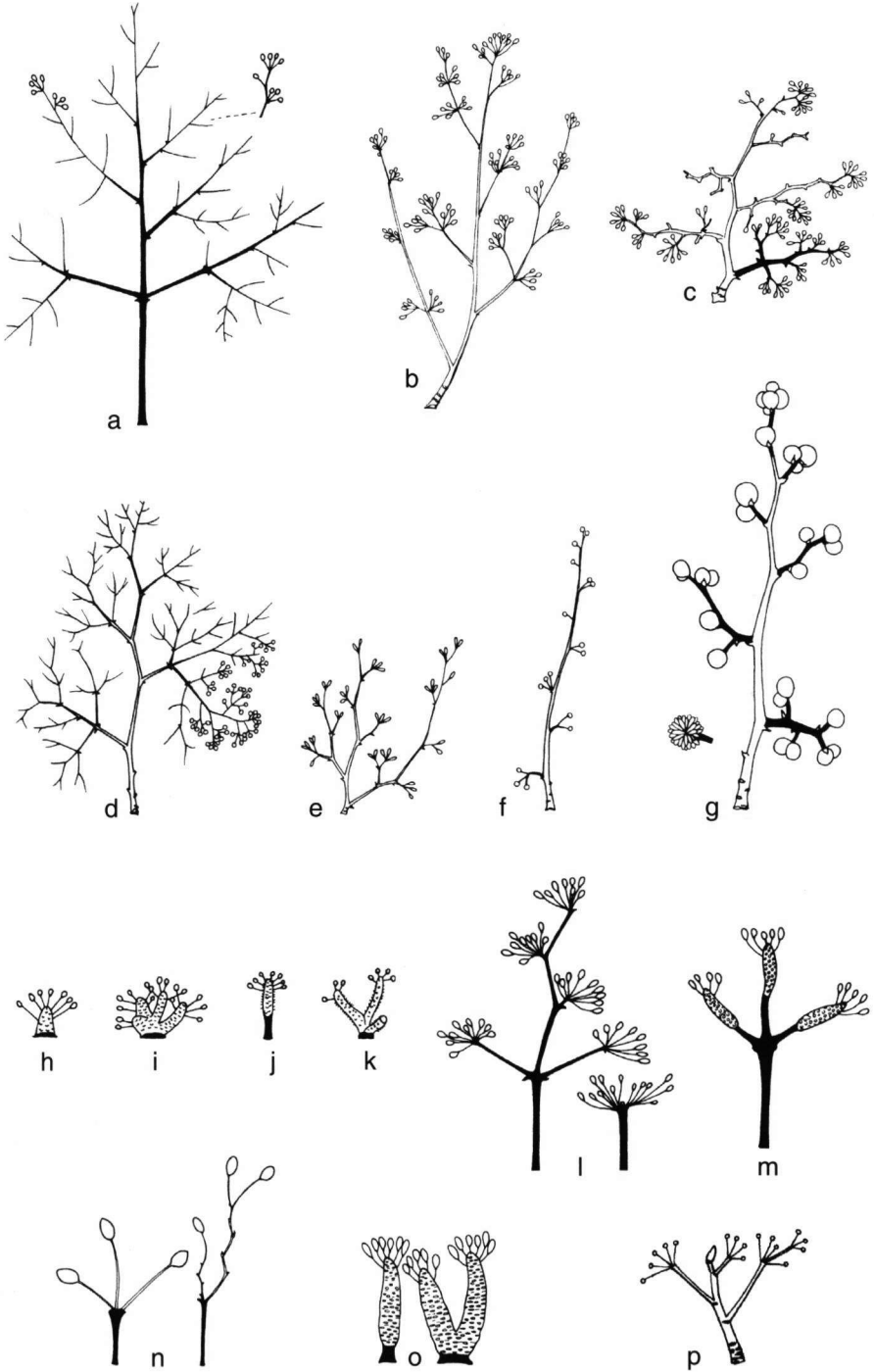
genera; in detail, inflorescences are also characteristic of species (see De Wilde 1992). They are always axillary (rarely somewhat supra-axillary) amongst or below the leaves, and provided with bracts. They are polythetic, which means that their branches are never terminated by a flower. The male inflorescences are often larger and with many more flowers than the female, and show more interspecific differences. *Endocomia*, *Gymnacranthera*, *Horsfieldia*, *Paramyristica*, and part of *Myristica* have non-woody, panicle-like inflorescences of short duration, while *Knema* and *Myristica*, partly, have woody, condensed, knob-like, scar-covered brachyblasts producing at the apex flowers over several seasons. These two types of inflorescence belong to basically different types, a single and a plural (multiple) type (De Wilde 1992).

The architecture of the basic single type of inflorescence corresponds with the typical mode of vegetative branching in the family. This type is axillary, compound, provided with a smooth, non scar-covered, common peduncle; the first lateral branches are opposite, but with branches higher up essentially dispersed. The knob-like inflorescences of *Knema*, and those of *Myristica*, partly, can be regarded as derived from these by reduction of branching and clustering of flowers. The superficially similar paniculate inflorescences of the remaining genera appear to be derived from a number of the basic type inflorescences, arranged in a way again comparable to the mode of vegetative branching.

In the multiple-type inflorescence the common peduncle is always provided with the scars of basal prophylls. Clustering of the flowers into flower heads or (sub)umbels adds to the variation in appearance of the inflorescences, but the presence or absence of scars of prophylls at and towards the base of the main peduncle is an essential and easily seen criterion. *Knema* and *Myristica* (both those with knob-like as well as panicle-like inflorescences) have the single type, *Endocomia* (partly), *Horsfieldia*, and *Gymnacranthera* have the plural type. In *Paramyristica* the inflorescences are essentially as in *Myristica*, but they are panicle-like and arranged in a short-shoot, ending in a vegetative bud.

The two highly distinctive forms of inflorescences in the genus *Myristica*, discriminating the two sections *Myristica* and *Fatua*, both belong to the single type; that of sect. *Fatua*, as that of *Knema*, being a strongly condensed form of the panicle-like inflorescences of sect. *Myristica*. As could be expected, there are quite a number of intermediate forms in *Myristica*.

Fig. 1. Schematic representation of male inflorescences in *Myristicaceae*. — **a**: single type, of *Endocomia rufirachis* — **b**: plural type, distally branched, of *Endocomia macrocoma* subsp. *longipes* — **c**: ditto of *Gymnacranthera forbesii* var. *forbesii* — **d–g**: plural type, generally distally branched, of *Horsfieldia*, **d**: *H. polyspherula*, **e**: *H. clavata*, **f**: *H. spicata*, **g**: *H. iryagedhi* (the latter with a strongly aberrant inflorescence within the genus *Horsfieldia*, the position of the first basal ramifications of the single-type partial inflorescences is often not clear) — **h–k**: a choice of forms of single-type inflorescences in *Knema*, **h**: *K. pseudolaurina*, **i**: *K. furfuracea*, **j**: *K. celebica*, **k**: *K. tridactyla* — **l–o**: a choice of forms of single-type inflorescences as found in *Myristica*: sect. *Myristica*: **l**: *M. iners*, **m**: *M. schleinitzii*, **n**: *M. fragrans*; sect. *Fatua*: **o**: *M. fatua* — **p**: inflorescence of *Paramyristica sepicana*; note that here the single-type inflorescences, which are similar in *Myristica*, are distichously grouped into a short-shoot ending in a vegetative bud.



*Survey of Malesian genera with description of their inflorescences* (Fig. 1)

- 1) *Endocomia* — Inflorescences predominantly of the plural type, panicle-like, resembling those of most *Horsfieldias*; only in one species, *E. rufirachis*, a few single-type inflorescences have been found. Flowers either faintly clustered, or clustered into loose umbels or umbel-like racemes, often with the apical flowers the youngest. — Fig. 1a, b.
- 2) *Gymnacranthera* — Inflorescences of the plural type, panicle-like, resembling those of *Horsfieldia* but branching also from the axils of the lower cataphylls, so that the common peduncle is short or absent. Flowers solitary, or grouped in small few-flowered racemes or small clusters. — Fig. 1c.  
Similar inflorescences with basal branching are prevalent in the *Horsfieldia clavata*-group (New Guinea).
- 3) *Horsfieldia* (with 3 sections) — Inflorescences of the plural type, panicle-like, variable in size and shape. Main peduncle with scars of cataphylls (bracts) and basal (cataphyll-like) prophylls present; ramification into partial inflorescences predominantly higher up in the inflorescence, but mainly basally in the *H. clavata*-group (with deviating androecium, New Guinea); see also under *Gymnacranthera*. Flowers (in most species, sect. *Irya* and *Pyrrosa*) on the ultimate branches, solitary or in few-flowered loose clusters, or in *H. iryagedhi* (sect. *Horsfieldia*, Sri Lanka) flowers numerous, clustered into dense capitula. — Fig. 1d–g.
- 4) *Knema* — Inflorescences of the single type. They consist of persistent scar-covered brachyblasts (of long duration), simple or  $\pm$  digitately 2–4-branched, producing flowers at the apex each flowering season. Flowers each season few to many, closely set, often appearing as an umbel, spirally arranged, axillary to minute caducous bracts. Common peduncle absent, or up to 10 mm long, smooth. The *Knema*-type of inflorescence also occurs in *Myristica* sect. *Fatua* and is thought as having originated by suppression of most of the common peduncle and by contraction of the flower-bearing raceme. — Fig. 1h–k.
- 5) *Myristica* — Inflorescences of the single type. The inflorescences of the two sections as recognized by Sinclair (1968: 30, 41), sect. *Myristica* and sect. *Fatua*, have different designs based on the same plan, taking into account the necessary reductions and corresponding mode of clustering of the flowers. — Fig. 1 l–o.

Sect. *Myristica*: inflorescences branched, panicle-like, generally lasting only one flowering season; peduncle (hypopodium) distinct, often flattened; the proximal pair of main branches and the central branch may be developed variously; sometimes the central branch is lacking, or all three hardly may be developed. Within sect. *Myristica* all kinds of intermediates between the situations of Fig. 4 l–n can be found, sometimes within one species.

Sect. *Fatua*: inflorescences as in *Knema*, i.e., simple or digitately few-branched, with woody scar-covered axes, producing flowers for several seasons; peduncle absent or short, not flattened (Fig. 1o). Also in the *Fatua*-type inflorescences the two opposite basal side branches are generally clearly visible, with the central branch either well developed or represented by only a single flower or the scar of its pedicel, e.g. as in *M. fatua*.

Although Sinclair's sections differ in inflorescence type, it is also true that for many species their assignment to a section is arbitrary. For instance, in sect. *Myristica*, the type species *M. fragrans* has male inflorescences which may be judged as short-lived with a few flowers, but generally they grow quite old and last for many flowering seasons, each season producing one or a few flowers at the ends of one or two slender scar-covered raceme-like partial inflorescences, usually with a single middle-flower; this is the dichasial inflorescence as described by Warburg (1897: 42) and later authors. Recently these inflorescences have been described accurately by Armstrong & Tucker (1986). The *Knema*-like inflorescences of sect. *Fatua* can be related easily to a variant of the single-type inflorescence occurring in sect. *Myristica*.

- 6) *Paramyristica* — Here the inflorescences are truly of a mixed nature. The true (partial) inflorescences are similar to the single-type, condensed inflorescences of *Myristica*, but these are distichously arranged on a lateral short-shoot which ends, significantly, in a small vegetative bud. This arrangement seems also predominant in a few New Guinean species of *Myristica*, for instance *M. markgraviana* (see De Wilde 1995).

*Flowers* — The unisexual flowers are campanulate or urceolate, waxy-creamy or yellow outside, greenish, creamy, yellow, red, or white (*Knema galeata*) inside. They can be glabrous or brownish hairy on both surfaces. Flowers are frequently fragrant (e.g., *Horsfieldia iryaghedhi*, *Myristica fragrans*). The uniseriate perianth is (hard) carnosely, and cleaves at anthesis along previously developed lines of suture into 2–5 lobes, to various depths,  $\pm$  according to the genus. The perianth splits deepest, nearly to the base, in *Endocomia* and part of *Knema*; in some species of *Horsfieldia* it opens only inconspicuously at the very apex. The perianth lobes usually curve back at anthesis (especially or only in female flowers), except for *Horsfieldia* and possibly *Paramyristica*. In the descriptions the size of the dry mature buds is given, and the length of the lobes by stating the depth of the cleft by fractions. In *Knema* the full-sized flower buds remain closed for a long time before opening. According to the genus the short or long pedicels may or may not have one bracteole (rather large in *Myristica*, small in *Knema*). In some species of *Horsfieldia* the pedicel (best to be seen in male flowers) is more or less distinctly jointed at the base; this feature can be used in species delimitation. The female flowers (generally somewhat larger than the male flowers) have a single monocarpellate ovary (hairy or glabrous), with sessile or short-stipitate, usually bilobed stigma, the lobes being simple or variously lobulate again; they are conspicuously many-lobulate especially in species of *Knema*, style and stigma are conspicuously small in *Myristica*. The androecium of the male flowers is most distinctive for the genera, as explained below (Fig. 2).

*Note on the construction of the androecium, and its naming in the six genera*

The male organ in the unisexual flowers is formed by the fusion of a variable number of stamens. Together they form the *androecium*, situated in the centre of the flowers. Each anther consists of a pair of bisporangiate lobes or thecae (which are usually septate when immature). When fully fused, the number of anthers may be difficult to count, but it is half that of the often closely appressed thecae. Genera in which the filaments of the individual stamens have remained partly free (e.g. in the Madagascan genus *Maloutchia*),

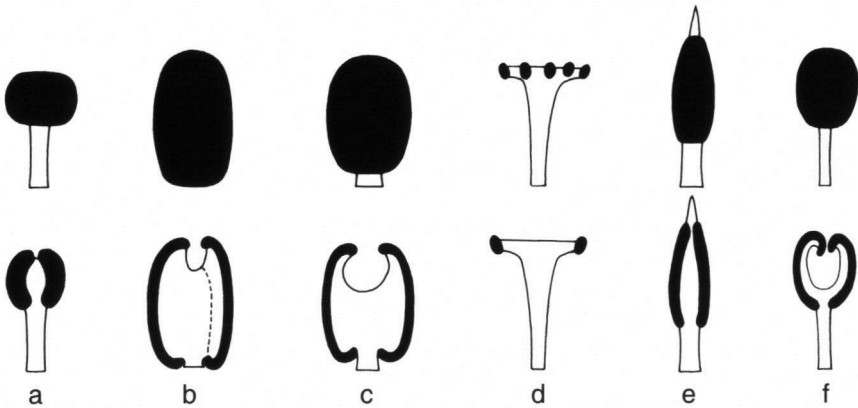


Fig. 2. Schematic drawings of the androecium of *Endocomia* (a), *Gymnacranthera* (b), *Horsfieldia* (c), *Knema* (d), *Myristica* (e), and *Paramyristica* (f).

can be regarded as comparatively primitive in this respect. The Malesian genera all have (almost) completely fused stamens, forming an androecium of which the shape is characteristic for the genus. For convenience's sake, schematic drawings with a brief explanation of the construction of the androecium and the terms used in the taxonomic text are given for each genus. The (partly) connate or free anthers are shown in solid black. In the case of connate anthers these form the *synandrium* and the fused filaments below form a stalk called *androphore*. When the androphore is absent or inconspicuous, the synandrium coincides with the androecium. In *Knema* the anthers are mostly free, and the androecium is described in a different way. In the descriptions the number of thecae is given, but in *Knema* only the number of anthers. In Figure 2 the letters correspond with the explanation below.

- a: *Endocomia* — The synandrium consists of short anthers adnate by their backs to a short slender column, carried on a stalk or androphore. In the descriptions the following terms are used: synandrium, androphore.
- b: *Gymnacranthera* — The androecium practically entirely consists of elongate anthers which are tightly connate into an elongate synandrium by most of their dorsal and lateral sides. The stalk or androphore is so short that the synandrium appears to be sessile. Therefore solely the all-comprising term androecium is used in the descriptions.
- c: *Horsfieldia* — Here the synandrium is formed by elongate anthers which are completely or for a lower part attached by their backs to a swollen, solid or usually hollow column. The synandrium is either sessile (as in *Gymnacranthera*), or carried on a comparatively short stalk or androphore. In the description either only the general term androecium is used when an androphore is practically absent, or the terms androecium and androphore when the latter is obvious.
- d: *Knema* — The androecium is formed by an apical disc-like structure to which the sessile or free anthers are attached radially. Below the disc there is a cylindrical or tapering stalk. In the descriptions the terms staminal disc and staminal column are used.

- e: *Myristica* — Tightly set elongate anthers are completely adnate by their backs to a rather thick central column, together forming the elongate synandrium. Above this, the column is usually produced into a sterile portion, called the sterile apex, whereas the synandrium is carried on a distinct cylindrical stalk or androphore. The terms used in the descriptions are sterile apex, synandrium, and androphore.
- f: *Paramyristica* — The subglobose synandrium is formed by (tightly set) elongate anthers which are completely fused by their backs to a swollen but largely hollow column, as in most species of *Horsfieldia*, and is carried on a comparatively long stalk or androphore. Terms used in the taxonomic descriptions are synandrium and androphore.

*Fruits* — The fruits are ellipsoid or oblong, more rarely (sub)globose, and they vary strongly in size (1–12 cm long); only in *Gymnacranthera* all species have rather small fruits. Fruits are essentially similar in construction in all genera, when fully ripe a firmly fleshy or  $\pm$  coriaceous unilocular capsule, circumferentially opening at ventral and dorsal side, at the latter, though not completely to the base. Usually the fruits are variously rusty pubescent or glabrous, pale yellow or creamy, pinkish, or salmon, or in *Endocomia canarioides* glossy dark purple. The colourful unit of brown or black seed with bright orange or red aril remains attached to the inner base of the pericarp (which often is brightly coloured inside). In *Endocomia* the colour of the aril possibly is not always red, probably in some species yellow, but this needs further observation. The showy open fruits with contrasting colours supposedly attract frugivorous birds.

The fruit (pericarp) usually shrinks considerably on drying, and shape and size information given in the descriptions concerns dried specimens.

*Seeds* — The single seed is generally similar in shape to that of the fruit. The endosperm is ruminant, the embryo small, the seed coat ligneous, (blackish) brown, or grey, and covered by the firm-fleshy aril. According to Corner (1976) the construction of the seed coat is anatomically characteristic for the various Asian genera. The tegmen is massive (Corner 1976; Van Heel 1982) and causes the characteristic rumination of the seed (rumination in *Annonaceae* and some other families is of both testal and tegmic origin). The testa in *Endocomia* is (mostly) variegated, in general an infrequent feature of seeds.

The rather thin (sometimes thick) hard-fleshy aril is a true aril, originating from funicular as well as exostomal tissue. It is always well developed and completely covering the seed in Asian *Myristicaceae* (reduced in *Myristica ingens* from New Guinea) and either entire or shallowly to deeply lacinate, according to the genus. The aril is entire or only shallowly lobed in *Knema* and *Horsfieldia*, in the latter sometimes  $\pm$  elongate above the seed into a short folded tube; the aril is incised to about halfway in *Endocomia* and deeply cleft (nearly) to the base in *Gymnacranthera*, *Myristica*, and *Paramyristica*. The embryo is small and shows variation in the position of the cotyledons and whether or not they are partially connate, according to the genera (Warburg 1897; Sinclair 1958). The endosperm (albumen) is hard and contains fat and/or fixed (not volatile) oil, and some essential (volatile) oil (3–8% in seeds of *M. fragrans*, which contains a narcotic); starch may be present, is abundant in *Myristica*, and absent in *Gymnacranthera* and *Horsfieldia*.

*References:* Armstrong, J.E. & S.C. Tucker, Floral development in *Myristica* (Myristicaceae). *Amer. J. Bot.* 73 (1986) 1131–1143. — Corner, E.J.H., The seeds of Dicotyledons. Cambridge Univ. Press (1976). — De Wilde, W.J.J.O., The genera of Myristicaceae as distinguished by their inflorescences, and the description of a new genus, *Bicuiba*. *Beitr. Biol. der Pflanzen* 66 ('1991', 1992) 95–125; Census of *Myristicca* (Myristicaceae) in New Guinea anno 1994. *Blumea* 40 (1995) 237–344. — Sinclair, J., *Gard. Bull. Sing.* 16 (1958) 205; 33 (1968) 1–540. — Van Heel, W.A., Notes on the structure of developing seeds of *Knema* and *Horsfieldia* (Myristicaceae). *Blumea* 28 (1982) 53–60. — Warburg, O., *Monographie der Myristicaceae*, *Nova Acta Acad. Caes. Leop.-Carol.* 68 (1897) 1–680.

#### FOSSILS

Little is known about fossil *Myristicaceae*. A leaf fragment, *Myristicophyllum*, is described from E Borneo (Geyler 1887); fossil wood, *Myristicoxylon princeps*, has been described from the Cretaceous in the Sahara (Boureau 1950).

*References:* Geyler, H.T., *Über fossile Pflanzen von Labuan aus Vega. Exped. Vetensk., Jakttagelser*, Stockholm 4 (1887) 499, t. 33, f. 3–6. — Boureau, E., *Étude paléoxylologique du Sahara (IX). Sur un Myristicoxylon princeps*, n. gen, n. sp., du Danien d'Asselar. *Bull. Mus. Hist. Nat. Paris II*, 22 (1950) 523–528.

#### CHROMOSOMES

According to the summary presented by Kühn & Kubitzki (1993), based on Marawetz (1986), and Plant Resources of South-East Asia 5 (2, 1995 & 3, 1998)], chromosome numbers are high and interpreted as (paleo)polyploid. Known are for *Knema*:  $2n = 42$  (*K. intermedia*:  $n = 21$ ), *Gymnacranthera*:  $2n = 44$  (*G. farquhariana* var. *zippeliana*:  $n = 21$ ), *Horsfieldia*:  $2n = 50$  (*H. iryagedhi*:  $n = 25$ ), *Myristica*:  $2n = 42$  or  $44$  (*M. elliptica*:  $n = 21$ , *M. fragrans*  $2n = 42$ ). In the New World much higher numbers have been found (*Osteophloeum*:  $2n = c. 280$ ).

*References:* Kühn, U. & K. Kubitzki, in: K. Kubitzki, F.G. Rohrer & V. Bittrich (eds.), *The families and genera of vascular plants*, vol. 2 (1993): Myristicaceae: 461. — Marawetz, W., *Pl. Syst. Evol.* 152 (1986) 49–100.

#### USES

In most myristicaceous species the heartwood is poorly differentiated from the sapwood, and the wood is of minor commercial importance. The timber is suitable for temporary light constructions. The wood, mainly from the blackish-stemmed group (including *Myristica lowiana*), is mostly soft or moderately hard or heavy; perishable, but easily treated with preservatives; it is easy to work, but sometimes splits soon. The sapwood is pale, sometimes not well defined, but often the heartwood is dark reddish brown.

The seeds of some species may be used for their fat content or their fragrance, also as medicine. *Myristica fragrans* is most important, yielding nutmeg (seeds), mace (aril), and the spicy pericarp can be candied. The seeds of *M. argentea* (W New Guinea) is of minor importance.

*Myristicaceae* are rarely used in silviculture. Some data are given in PROSEA 5 (2, 1995 & 3, 1998). Propagation is by seed, and shade should be provided for germination and growth. A few species are ornamental (e.g., *Horsfieldia iryagedhi*), or may be introduced as such (e.g., *H. sylvestris*)

*Kino* — This substance, in the field-notes called exudate or sap, oozes from freshly cut bark in larger or lesser quantities according to individual species. It is also present in the wood, twigs, and to a lesser extent in petioles and inflorescence axis. Its presence is an excellent field test when one suspects a tree to belong to the *Myristicaceae*. The colour varies from dark red to pink; less often it has an orange tint. Kino is not so obvious in very young trees. The amount probably varies within a species with time. It contains tannin and gum and has left many an indelible stain on the clothes of plant collectors. Warburg (1897) stated that the kino of one species has been used in America as a styptic. Its function is not known, but it may help the wounds of a damaged tree to heal. It has been described as bloody and gruesome and Malays have aptly given *Myristicaceae* names including *darah*, the Malay name for blood.

*References:* De Wilde, W.J.J.O., in: M.S.M. Sosef et al. (eds.), PROSEA: Plant Resources of South-East Asia 5 (3) (1998) 214–216 (*Endocomia* W.J. de Wilde), 292–296 (*Horsfieldia* Willd.). — De Wilde, W.J.J.O., et al., *Gymnacranthera* (A. DC.) Warb.; in: R.H.M.J. Lemmens et al. (eds.), PROSEA: Plant Resources of South-East Asia 5 (2) (1995) 255–260. — Sambas, E.N., *Knema* Lour.; in: M.S.M. Sosef et al. (eds.), PROSEA: Plant Resources of South-East Asia 5 (3) (1998) 317–320. — Sangat-Roemantyo, H., et al., *Myristica* Gronov.; in: R.H.M.J. Lemmens et al. (eds.), PROSEA: Plant Resources of South-East Asia 5 (2) (1995) 346–356. — Warburg, O., Monographie der Myristicaceae, Nova Acta Acad. Caes. Leop.-Carol. 68 (1897) 1–680.

#### VEGETATIVE ANATOMY

(J. Koster, leaf anatomy & P. Baas, wood anatomy)

*Leaf anatomy* — A detailed description of the leaf anatomy of the Asian *Myristicaceae* was given by Koster & Baas (1981). For short leaf anatomical accounts see also Schouten (1986) and De Wilde (1994). Metcalfe (1987) summarized the vegetative anatomy of the whole family. For the present survey more specimens were examined, including the two new genera *Endocomia* and *Paramyristica*.

About 65 of the species belonging to the six Asian genera have been examined leaf anatomically. Individual species will not be mentioned in this synopsis, although many of the species examined can be distinguished by their leaf anatomical characters. Genera will be mentioned when a character has diagnostic value on the genus level.

Hairs are present, at least in young leaves, on both surfaces or only on the abaxial surface (in *Gymnacranthera* and some *Myristica* species). A hair is composed of one row of short to tall cells, having one or two arms each, one or two (rarely more) cells nearest the epidermis (the so-called stalk cells) excepted. In *Gymnacranthera*, *Myristica*, and *Paramyristica* the cells have two arms, of unequal length in *Gymnacranthera*; the cells in *Endocomia*, *Horsfieldia*, and *Knema* have one arm. In older leaves the hairs have often been shed, but the upright walls of the most proximal parts remain as cutinized rings on the epidermis. These rings are subtended by one to numerous small cells, arranged in a circle or oval.

Alveolar material, as an irregularly structured cutinaceous layer overlying the cuticle proper, is present on the abaxial side in many species. The thickness of the cuticle proper measures up to 18 µm adaxially and to 11 µm abaxially. The cuticular flanges on the adaxial surface are usually more or less sinuous at high focus and more or less straight at lower focus; thin areas of cuticle are present in the loops of the undulations. The cuticular flanges usually show inconspicuous pitting.



Abaxial papillae sometimes occur. Large empty idioblasts (partially) with a thin cuticle or without a cuticle, probably secretory cells, are often present. Some species abound in regular cork warts; groups of basal cells of hairs are probably the origin of some of these structures.

Stomata are usually confined to the abaxial epidermis; the stomatal type is paracytic. The dimensions of the guard cell pairs range from 8 to 21  $\mu\text{m}$  for the width and from 15 to 39  $\mu\text{m}$  for the length. The guard cells are often embedded in the subsidiary cells, which are dome-shaped in *Gymnacranthera*. In *Knema*, *Myristica*, and *Paramyristica* the stomatal complex is (strongly) sunken; the bordering epidermal cells show papillae. In *Knema* and some species of *Myristica* these papillae are more or less horizontally directed, leaving a star-shaped opening above the stomatal complex. In most species of *Myristica* and in *Paramyristica* the more or less upright papillae form a ring above the stomatal complex.

An adaxial hypodermis is sometimes present, either as a continuous layer or only locally. An inconspicuous abaxial hypodermis has been recorded for a few species.

The mesophyll is dorsiventral (rarely isobilateral), with mostly two or three, sometimes up to four adaxial layers of palisade parenchyma. In the leaf margin the cells adjacent to the epidermis often have sclerified walls.

The midrib is abaxially prominently raised, and adaxially raised in most *Horsfieldia* species, in *Endocomia*, *Knema*, *Myristica*, and *Paramyristica*. There is a more or less straight adaxial vascular bundle (sometimes strongly interrupted) and an arc-shaped abaxial bundle, sometimes joined together. The phloem is arranged in separate strands, often in two layers. One to numerous phloem bundles are interspersed in the ground tissue between the main bundles, often accompanied by xylem elements; in some *Knema* species there is a complete collateral bundle in the pith. In *Gymnacranthera* the adaxial bundle is absent. The whole system is surrounded by groups of sclerenchyma fibres, which also occur in the pith, often even in the centre of the phloem bundles. The ground tissue is from centre to periphery parenchymatous to collenchymatous, often interspersed with cells with sclerified walls; in *Gymnacranthera* and *Knema* there are often several layers of these cells at the periphery of the midrib. Sometimes adaxial chlorenchyma is continuous in the midrib.

The veins are supplied with collateral bundles; the major veins may have a more complex vascular system, not unlike that of the midrib. Sclerenchyma caps are present at the abaxial and adaxial sides; in *Knema* a sclerenchymatous bundle sheath is found. A usually poorly differentiated parenchymatous bundle sheath, in *Knema* sometimes continuous to the epidermides, surrounds the bundle and the sclerenchyma. In *Knema* strands are present, consisting of sclerenchyma fibres only, in position and distribution not unlike the vein bundles.

The petiole at its basal end has a vascular system consisting of three more or less arc-shaped collateral bundles with free phloem bundles adaxially. The sclerenchyma is usually confined for the greater part to the abaxial sides. The vascular system of the distal end is intermediate between that of the basal end and the midrib.

Crystals may be present in various types. Large druses in enlarged mesophyll idioblasts frequently occur, often adjacent to epidermal cells, which may be extremely flattened and have a thin cuticle and thin and short cuticular flanges (in *Myristica* adaxially and in *Endocomia*, *Gymnacranthera*, and *Horsfieldia* adaxially and abaxially). Small druses

have also been found, but not in *Gymnacranthera*. Small spindle-shaped particles often occur, usually grouped in cells of the mesophyll and the ground tissue of the midrib. Other crystal types have been found in one or a few species only.

Large, more or less spherical cells frequently occur in the mesophyll and the ground tissue of the midrib. Usually they contain oil, in some species probably tannin- or mucilage-like substances. The large empty idioblasts in the epidermis have been mentioned above. Fairly thick-walled tubule-shaped cells have sometimes been found, adaxially and abaxially of the sclerenchyma caps of the vein bundles. The content of these cells is probably tannin.

Sclereids are often present as brachy- to astrosclereids in the ground tissue of the midrib. Filiform, rarely branched sclereids have been recorded for *Gymnacranthera*. Astrosclereids and thick filiform, branched sclereids are present in a few species only.

The genera *Gymnacranthera* and *Knema* can be distinguished by a combination of leaf anatomical characters. Leaf anatomy provides no means to discriminate between *Endocomia* and *Horsfieldia* and between *Myristica* and *Paramyristica*.

*Wood anatomy* — The wood anatomy of the *Myristicaceae* is fairly uniform. For a detailed family description and literature survey see Metcalfe (1987). Wood anatomy of the main Malesian genera is summarized in the PROSEA Handbooks 5: 2 & 3 (Lemmens et al. 1995; Sosef et al. 1998) and pictured by Ilic (1991). The wood is diffuse-porous with vessels medium-sized and in low density (usually 3–12/sq.mm), solitary and in radial multiples. Perforations mixed simple and scalariform, but one of the types dominant or (virtually) exclusive in some species. Intervessel pits ranging from scalariform to opposite and alternate. Vessel–ray pits often coarse and with reduced borders to simple. Fibres thin- to medium thick-walled, with minutely bordered to simple pits, often septate around the vessels. Parenchyma scanty paratracheal to narrowly vasicentric and often also in zonate bands. Rays typically 1–2(–3)-seriate, heterocellular and composed of fairly large cells. Crystals present in ray cells or absent. Tanniniferous tubes, usually in very low frequency, present in all species studied, and virtually unique to the family *Myristicaceae* (except sporadic occurrence in some members of the *Ulmaceae*). Oil and/or mucilage cells present among the axial and ray parenchyma in some species.

*References:* De Wilde, W.J.J.O., *Paramyristica*, a new genus of Myristicaceae. *Blumea* 39 (1994) 341–350. — Ilic, J., CSIRO Atlas of Hardwoods (1991) 331–334. — Koster, J. & P. Baas, Comparative leaf anatomy of the Asiatic Myristicaceae. *Blumea* 27 (1981) 115–173. — Lemmens, R.H.M.J., I. Soerianegara & W.C. Wong (eds.), *Plant Resources of South-East Asia* 5 (2). *Timber Trees: Minor commercial timbers* (1995) 255–260. — Metcalfe, C.R., *Anatomy of the Dicotyledons*, Ed. 2, Vol. 3 (1987) 56–71. — Schouten, R.T.A., Revision of the genus *Gymnacranthera* (Myristicaceae). *Blumea* 31 (1986) 451–486. — Sosef, M.S.M., L.T. Hong & S. Prawirohatmadojo (eds.), *Plant Resources of South-East Asia* 5 (3). *Timber Trees: Lesser-known timbers* (1998) 292–296, 317–320, 603–662.

#### PALYNOLOGY

(R.W. J. M. van der Ham)

The pollen morphology of the *Myristicaceae* has been poorly known for a long time. The earliest more extensive account is that by Wodehouse (1937), who dealt with 36 species of the American genera, providing detailed descriptions and drawings. A more

inclusive treatment is the light microscopic study by Agababian (1970) of 10 genera from America, Africa and Asia. Further, pollen of a limited number of species is described in pollen floras, of which Tissot et al. (1994) stands out by informative light and scanning electron micrographs (*Gymnacranthera*, *Knema*, *Myristica*). Generic accounts are those by Siddiqi & Wilson (1975; 8 spp. of *Knema*) and Medeiros Carreira (1985; 36 spp. of *Virola*, incl. *Bicuiba*). A preliminary paper by Walker (1976) contains a short family description based on light and scanning electron microscopic data. Comprehensive descriptions of all American, African and Madagascan genera, including scanning and transmission electron micrographs, are in a series of papers by Walker & Walker (1979, 1980, 1981, 1983). The Asian genera, among which the largest in the family (*Horsfieldia*, *Knema*, *Myristica*), are still in need of elaborate palynological study. To date the pollen of the Asian *Endocomia* (4 spp.) and *Paramyristica* (1 sp.) and the African *Staudtia* (2 spp.) is entirely unknown.

Pollen grains of *Myristicaceae* are usually subspherical to slightly boat-shaped monads with a single, probably always distal aperture. Occasional chance tetrads, observed, for instance, in *Iryanthera*, are tetragonal. The outline in polar view is subspherical to elliptic, or sometimes obtusely rectangular. Outline in equatorial view is subspherical to elliptic, or often obtusely triangular with a straight to slightly convex apertural side and a more or less strongly convex nonapertural side. Pollen grain size (largest equatorial diameter) is mostly between 20 and 40  $\mu\text{m}$ . Pollen of *Brochoneura* is smaller (14–21  $\mu\text{m}$ ). Some other genera have larger pollen grains: *Gymnacranthera* (up to 49  $\mu\text{m}$ ), *Knema* (up to 57  $\mu\text{m}$ ), *Myristica* (up to 59  $\mu\text{m}$ ), and *Mauloutchia* (up to 69  $\mu\text{m}$ ).

Aperture morphology is relatively simple and not much diverse. It ranges from distinctly sulcate via indistinctly sulcate (sulcoidate) to more or less ulcerate or ulceroidate. The aperture margins are often not clearly defined, which in ulceroidate groups may lead to a superficially inaperturate condition (cryptoaperturate). Wodehouse (1937) observed that an apertural area, even in pollen with a hardly recognizable aperture in the exine, shows a distinctly thickened intine. Sometimes such intine parts seem to be acetolysis-resistant (Walker & Walker 1983).

Exine thickness is from 0.5 to 5  $\mu\text{m}$ . Rather thin exines are found in *Brochoneura* (0.5  $\mu\text{m}$ ), *Pycnanthus* (0.5  $\mu\text{m}$ , exclusive echinae) and *Scyphocephalum* (0.8  $\mu\text{m}$ ). Fairly thick exines (3–5  $\mu\text{m}$ ) occur in the coarsely reticulate *Myristica* pollen. Exine stratification is usually distinct, with a thin to thick infratectal layer, which is mostly columellate. In *Brochoneura* the infratectum is thin, so that the granulae observed by Walker & Walker (1979) might actually represent short columellae. In *Mauloutchia* pollen the verrucate/scabrate sexine elements seem to stand directly on the nexine, although irregular columella-like structures occur as well. The allegedly primitive granular infratectum reported by Walker & Walker (1979) seems to be part of a granular sexine structure, which is rather a derived feature. Distinct infratectal granules were found so far only in *Otoba*, more or less adhering to the inner tectum surface and mixed with columellae. In view of the other pollen characters (see below) this is probably also a derived condition. The tectum as well as the nexine can be relatively thin to rather thick. In a few genera most or only the inner part of the nexine may be lamellate. Because of the absence of any contrast in the nexine in transmission electron micrographs, the whole exine is considered to be ectexinous.

Exine ornamentation is the most diverse character in *Myristicaceae* pollen: from psilate/perforate via finely fossulate to coarsely reticulate, with several derivations. Pollen of *Brochoneura* (Madagascar) has a simple massive psilate/perforate tectum. Pollen of the American genus *Otoba* is psilate/imperforate with a proximal,  $\pm$  protruding (coarsely) reticulate area. In *Compsonaura* and *Virola* (both American) the ornamentation is finely fossulate to coarsely reticulate. In both genera reticulate pollen with scabrate ( $\pm$  banded) muri is found. Such ornamentation occurs also in *Iryanthera* (America) and *Coelocaryon* (Africa), while the finely fossulate type with vaguely banded muri of *Haematodendron* (Madagascar) and the crotonoid type of *Scyphocephalum* (Africa) can be easily joined. The finely fossulate type of *Compsonaura* and *Virola* is also known from *Gymnacranthera* (Asia), and the (more) coarsely reticulate type from the American *Bicuiba* and *Osteophloem*, and the Asian *Horsfieldia*, *Knema* and *Myristica*. In *Horsfieldia* the reticulum is sometimes interrupted, so that an intectate condition remains. Ornamentation in the Madagascan genus *Mauloutchia* is diverse: scabrate, verrucate (verrucae scabrate or smooth) or scabrate/echinate. Scabrate verrucae occur also in *Cephalosphaera* (Africa). The pollen of *Pycnanthus* (Africa) is finely reticulate/echinate.

Concluding, the pollen of the *Myristicaceae* is diverse. Virtually every genus in the family is palynologically distinct. A rigid subdivision based on pollen morphology, however, is difficult, but may be attempted after a more extensive study of the Asian genera.

The family has a modest fossil pollen record (Muller 1981). *Pycnanthus* type pollen is known from the Upper Eocene and Lower Miocene of Africa, and pollen grains of the *Virola* type from Pliocene and Quaternary sediments in Guyana.

*References:* Agababian, V.S., Biol. Zh. Armenii 23, 5 (1970) 58–69. — Medeiros Carreira, L.M., Bol. Mus. Paraense E. Goeldi, Bot. 2 (1985) 29–76. — Muller, J., Bot. Rev. 47 (1981) 1–142. — Siddiqi, M.R. & T.K. Wilson, Pak. J. Bot. 7 (1975) 197–200. — Tissot, C., H. Chikhi & T.S. Nayar, Publ. Dép. Écol. Inst. Fr. Pondichéry 35 (1994). — Walker, J.W., Linn. Soc. Symp. Ser. 1 (1976) 251–308. — Walker, J.W. & A.G. Walker, Ann. Missouri Bot. Gard. 66 (1979) 731–755; Amer. J. Bot. 67 (1980) 603–611; Grana 20 (1981) 1–17; Amer. J. Bot. 70 (1983) 315–326. — Wodehouse, R.P., Brittonia 2 (1937) 397–402.

## PHYTOCHEMISTRY AND CHEMOTAXONOMY

(R. Hegnauer)

*General remarks* — Chemical characteristics of the family were discussed in a number of reviews in recent time (Hegnauer 1969, 1989, 1990; Gottlieb 1979). Many references and structural formulae are given in these surveys. Therefore a compact résumé of presently known facts and some references to most recent chemical investigations of myristicaceous plants, with emphasis on Asian taxa, seem to be appropriate here. Most members of the family are locally used in traditional medicine. This is one of the reasons why we are relatively well informed about its secondary metabolites. Moreover, *Myristica fragrans* yields the famous spices nutmeg and mace. There is plenty of literature about this plant, its cultivation and its products (e.g., Brücher 1977, Purselglove et al. 1981, Delaveau 1987, Flach & Tjeenk Willink 1989). Because nutmeg, if taken in large amounts, is toxic and causes among other symptoms hallucinations, pharmacologists and ethnobotanists interested in psychotropic plants became also involved in nutmeg research (Efron 1967).

*Chemistry of the family* — Essential oils, lignans and neolignans, flavonoids in the widest sense and biogenetically related phenolic compounds, peculiar acetogenins based on long-chain fatty acids, and large amounts of a special type of triglycerides in seeds are outstanding myristicaceous features. Moreover, tryptamine-derived alkaloids were reported in several genera, and diterpenoids and triterpenoids were detected only erratically hitherto.

*Essential oils* — Belonging to woody polycarps (i.e. *Magnoliidae–Magnoliana* sensu Takhtajan 1980) *Myristicaceae* have oil cells in most of their parts and usually are aromatic plants. So far only essential oils of nutmeg and mace were investigated thoroughly (Purseglove et al. 1981). There are scarcely qualitative differences between the oils of nutmeg and mace, but rather marked quantitative differences. The same is true between nutmeg oils of different production centres (West India [Grenada], Indonesia and East India) and even between individual trees of the island Grenada. Roughly nutmeg yields 7–16% and mace 4–17% essential oil. Nutmeg oil contains 61–66% monoterpene hydrocarbons (85–93% individual trees of Grenada), mainly pinenes and sabinene, 5–15% (6.6–12%) monoterpene alcohols and their esters, such as geraniol and linalool, and their acetates, and 2–18% (0–3.5%) phenylpropanoid ethers, among which myristicin, elemicin and safrole predominate. These aromatic allylphenolic ethers are assumed to represent the main toxic and psychotropic constituents of nutmeg and mace. The essential oil of leaves of *M. fragrans* also contains mainly pinene and myristicin.

*Lignans and neolignans* — These plant constituents are dimers of phenylpropanoids ( $C_1 \dots C_9 + C_1' \dots C_9'$ ). According to Gottlieb and Yoshida (1989) lignans and neolignans should be defined biogenetically not purely on chemical arguments. They consider lignans as  $C_8-C_8'$ -linked dimers of phenolic derivatives of cinnamyl alcohol ( $C_6H_5-7CH = 8CH-9CH_2OH$ ) or phenolic derivatives of cinnamic acid ( $C_6H_5-7CH = 8CH-9COOH$ ). On the other hand neolignans are dimeric derivatives of allylbenzenes ( $C_6H_5-7CH_2-8CH = 9CH_2$ ; e.g. eugenol) or propenylbenzenes ( $C_6H_5-7CH = 8CH-9CH_3$ ; e.g. isoeugenol), and different types of linkage between the two monomers occur, e.g. 8-8', 8-1', 8-3', 8-5', 8-7', 5-5', 1-5', 8-O-4', 4-O-5' etc. In both, lignans and neolignans, one or two additional linkages between the two units are often present. In lignans  $C_9$  and  $C_9'$  carry oxygen and in neolignans they do not. A botanical argument which favours such a lignan-neolignan distinction is their distribution in seed-plants. Lignans occur everywhere in gymnosperms and angiosperms, and neolignans are mainly (not wholly!) restricted to *Magnoliidae–Magnoliana* (Takhtajan 1980) which correspond with woody *Polycarpicae + Piperales* of Wettstein (1935). In *Myristicaceae* both true lignans and neolignans occur frequently. Conserva et al. (1990) call neolignans "the most conspicuous constituents of *Myristicaceae*." Examples of neolignans occurring in the family are dehydroguaiaretic acid and 1,2-dihydrodehydroguaiaretic acid of the stem bark of *Knema furfuracea* (Pinto et al. 1990), and lignans are represented, e.g. by asarinin, horsfieldin and dihydrocubebin, from leaves, bark, wood and seeds of *Horsfieldia iryagedhi* (Gunatilaka et al. 1982; Tillekeratne et al. 1982). By condensations with chalcones or dihydrochalcones neolignans can give rise to still more complex phenolic compounds such as the lignoflavonoids iryantherin A to J of South American *Iryanthera* taxa (Conserva et al. 1990; Silva et al. 1995). Finally it should be mentioned that not all phytochemists follow the lignan-neolignan-definition of Gottlieb and Yoshida. Many chemists prefer the older definition which considers all 8-8'-linked dimeric

phenylpropanoids as lignans, and dimers with other linkages, e.g. the 5-5'-linked dehydrodieugenol and the 8-5'-linked carinatone of *Virola carinata*, as neolignans.

**Flavonoids and biogenetically related phenolic compounds** — If flavonoids are defined as phytoconstituents derived from a cinnamic acid and three acetates (malonates) which yield the phloroglucinol- or resorcinol-type A-ring, this class of natural products comprises many chemical subclasses. *Myristicaceae* are outstanding producers of flavonoids *sensu lato*. At present the following types of flavonoid phenolics are known from the family: Flavonols (e.g. kaempferol, quercetin), flavones (e.g. apigenin, luteolin, 7,4'-dimethoxyflavone, a 5-desoxyflavonoid), flavanones (pinocembrin), several chalcones and dihydrochalcones, several diarylpropanes, isoflavones (e.g. 2'-hydroxyformononetin [also a 5-desoxyflavonoid]), pterocarpans (demethylhomopterocarpin, maackiain), flavan-3-ols (catechins, e.g. fisetinidol) and flavans. Moreover, the family is rich in condensed tannins which are based on catechins and leucoanthocyanidins (flavan-3,4-diols). Leucoanthocyanidins have not yet and catechins only rarely been isolated from *Myristicaceae*. Nevertheless the production of astringent kino-like exudates by most species and the demonstration of the presence of procyanidins in a few species render possible the conclusion that myristicaceous tannins are of flavanoid nature. Still another type of natural products is represented by stilbenes. In contrast to flavonoids which are C<sub>6</sub>-C<sub>3</sub>-C<sub>6</sub> compounds, stilbenes are C<sub>6</sub>-C<sub>2</sub>-C<sub>6</sub> products, because during the biosynthesis of usual stilbenes one CO<sub>2</sub> is lost. Stilbenes occur in *Myristicaceae*, e.g., as mono-, di- and trimethylethers of resveratrol (= 3,5,4'-trihydroxystilbene).

**Peculiar acetogenins based on long chain fatty acids** — Two main types of such acetogenins or polyketides occur in the family. (a) The anacardic acid-cardol-type of alkyl- or alkenylphenols which is based on ordinary polyketides. If polyketide synthesis starts with a cinnamic acid molecule this pathway yields ω-phenylalkanyl- and -alkenylphenols. The phenolic part of such acetogenins originates from cyclization of the last three or four acetyl units of the polyketide chain and bears one, two or three phenolic hydroxyls (= phenol-, resorcinol- and phloroglucinol-type compounds). Additionally this aromatic ring may carry a carboxyl group (anacardic acids *sensu stricto*) or an acetyl group (acetophenone derivatives). Phenolic alkanones, such as the malabaricones, have an oxo group in the side chain next to the aromatic ring. In some species 3-alkyl- or 3-ω-phenylalkylisocoumarins occur; these metabolites are lactones of an anacardic acid carboxyl with a 2'-hydroxyl in the side chain. Thus this type of biogenetically related phenolic polyketides is extremely diverse in *Myristicaceae*. (b) The second class of acetogenins bears a methyl- or methylene-butanolide or -butenolide structure which is probably formed by a reaction of the carboxyl group terminating the polyketide chain with a pyruvate unit or its enolic form. Examples of this type of acetogenins are iryelliptin, grandinolide and the juruenolides of *Iryanthera elliptica*, *grandis*, *jururensis* and *ulei* and *Virola surinamensis* (Lopes et al. 1994, 1996).

Most recent phytochemical investigations treat mainly lignanoids, flavonoids and acetogenins. Examples are: *Horsfieldia iryaghedhi* (Gunatilaka et al. 1982; Tillekeratne et al. 1982). *Knema austrosiamensis* (Gonzales et al. 1993, 1996), *K. elegans* (Spencer et al. 1980), *K. furfuracea* (Pinto et al. 1990; Zahir et al. 1993), *K. glomerata* (Lu Zeng et al. 1994), *K. laurina* (Kijjoo et al. 1991; Gonzalez et al. 1996), *K. tenuinervia* subsp. *setosa* (Kijjoo et al. 1991). *Myristica dactyloides* (Herath & Priyadarshini 1996, 1997). *Pycnanthus angolensis* (Omobuwajo et al. 1992). For 1,3-diarylpropanes and

1,3-diarylpropan-2-ols and catechins *Virola elongata* and *minutiflora* are noteworthy (Kijjoo et al. 1981). *Virola venosa* (Kato et al. 1992) and *Virola* aff. *pavonis* (Martinez & Torres 1997) represent a notable example for the vicarious occurrence of lignans and neolignans in the family.

*Seed fats* (oils) — *Myristicaceae* store large amounts of triglycerides in seeds; they are accompanied by proteins and in some species by starch. The triglycerides of the family contain saturated fatty acids as main acids, usually 14:0 (myristic) and 12:0 (lauric) and sometimes 16:0 (palmitic) or 18:0 (stearic). The presence of large amounts of 14:0 in several seed fats explains the fact that trimyristin could be isolated from the seeds of a number of species. Often the seed lipids contain a large portion of unsaponifiable matter, i.e. non-triglycerides. The non-triglyceride part consists of essential oils, lignans, acetogenins and other resinous matters.

*Alkaloids* — As already mentioned (Efron 1967) tryptophan-derived protoalkaloids and  $\beta$ -carboline alkaloids occur in several species of *Virola*. Recently 5-methoxy-N,N-dimethyltryptamine, 6-methoxy-2-methyl-1,2,3,4-tetrahydro- $\beta$ -carboline and horsfieldine, C<sub>13</sub>H<sub>16</sub>N<sub>2</sub>O<sub>2</sub>, a new oxindole alkaloid, were isolated from leaves of *Horsfieldia superba* (Jossang et al. 1991). Leaves of *Osteophloeum platyspermum* contain the methylether of N-methyltryptophan. Thus a special metabolism of tryptophan yielding psychotropic tryptamines and simple indolic alkaloids seems to be present in New World (*Virola* and *Osteophloeum* species) and Old World (*Horsfieldia* species) members of the family. Bennett and Alarcón (1994) published recently a remarkable ethnobotanical paper about Amazonian *Myristicaceae* and about hallucinogenic uses of *Osteophloeum platyspermum* and *Virola duckei* in Ecuador.

*Meroterpenoids* (= compounds of partly terpenoid origins) — Fruits (seed kernels, arilli, pericarps) yield lipid fractions which often contain besides triglycerides appreciable amounts of 'resinous matter' of varying composition (essential oils, lignanoids and flavonoids, acetogenins and, in some instances, meroterpenoids). Such a meroterpenoid is komboic acid of seeds of *Pycnanthus kombo*. It amounts to ca. 23% of total seed 'fat' and was characterized as 16(2',5')-dihydroxy-3'-methylphenyl)-2,6,10,14-tetramethyl-2,6,10,14-hexadecatetraenoic acid, i.e. a 2-geranylgeranyl-substituted 6-methylhydroquinone with one of the last methyl groups in the geranylgeranyl side chain oxidated to COOH. Biogenetically related tocotrienols (vitamin E group), of which 2,8-dimethyl-2-(4,8,12-trimethyl-3,7,11-tridecatrienyloxy)-6-chromanol was the main product, were isolated from fruits of *Iryanthera grandis*, and seeds of *Otoba parvifolia* yielded a series of farnesylated aromatic to semiaromatic and ring-constricted compounds which probably all derive from the same biogenetic pathway, i.e. farnesylation of gentisic acid and consequent modifications of the resulting farnesylgentisic acid (Ferreira et al. 1989, 1995). Gentisic acid may also be involved in the biosynthesis of komboic acid and the tocotrienols in which an aliphatic diterpene in place of the sesquiterpene farnesol is combined with an aromatic ring.

*Diterpenes, triterpenes and phytosterols* — Small amounts of phytosterols and tetra- and pentacyclic triterpenes are ubiquitous in unsaponifiable matters of plant lipids. Accumulation of diterpenes and triterpenes seem to be much more restricted and rather rare in the family. The tetracyclic triterpenes cycloeucalenol and 24-methylenecycloartanol were isolated from wood of *Cephalosphaera usambarensis*, and nutmegs yielded a saponin with oleanolic acid as sapogenin. Diterpenoids were isolated from leaves and twigs of

*Osteophloeum platyspermum* (a kaurane and three eperuane derivatives), and recently stem bark of *Staudtia kamerunensis* yielded staudtienic acid, C<sub>20</sub>H<sub>26</sub>O<sub>2</sub> with a rearranged abietane structure (Noumbissie et al. 1992).

*Summary and chemotaxonomic remarks* — *Myristicaceae* are chemically characterized by a number of metabolic features.

1) They store large amounts of triglycerides of buttery or fatty consistency because 12:0 and 14:0 (16:0, 18:0) are their main fatty acids.

2) They deposit variable amounts of essential oil in oil cells which occur in practically all plant parts.

3) They have an extremely diverse flavonoid metabolism which results in the production of rather characteristic compounds in a number of their taxa, e.g. isoflavones, pterocarpanes, 1,3-diarylpropanes and their 2-ols, chalcones and dihydrochalcones, flavanones, flavones and catechins.

4) Lignans and/or neolignans occur in large numbers and often in large amounts in all investigated plant parts of practically every member of the family.

5) Two types of polyketides (acetogenins) occur widely in the family: the anacardic acid-type with several variants and the methylbutanolide-type with a smaller number of variants.

6) *Myristicaceae* are relatively tannin-rich plants, but the precise nature of their tannins is not yet known. All available facts indicate a universal presence of condensed tannins, i.e. oligo- and polymeric proanthocyanidins.

Idioblasts storing essential oils characterize woody polycarps or *Magnolianae* (Takh-tajan 1980). Within this taxon *Myristicaceae* resemble *Lauraceae* mostly in their seed fats and in their secondary metabolism. Both families are virtuous producers of neolignans and lignans and of polyketides of the butanolide-type. The typical alkaloids of *Magnolianae* are benzyltetrahydroisoquinoline-type bases. They are widespread in *Lauraceae*, but seem to be totally absent in *Myristicaceae*, but also in *Winteraceae*, *Calycanthaceae* and some other, mostly small relictic families. *Myristicaceae*, however, are not an alkaloid-free taxon. Some of its members produce tryptamine derivatives including  $\beta$ -carboline and the oxindole horsfiline. The tendency to replace benzylisoquinolines by tryptamine derivatives does also occur in some members of *Lauraceae* (*Aniba* p.p., *Nectandra* p.p. and *Umbellularia* p.p.) and is characteristic of *Calycanthaceae*. *Myristicaceae* could represent a member of *Magnolianae* in which accumulation of benzylisoquinolines was totally replaced by intensifying the production of lignanoids and flavonoids s.l. Finally it should be mentioned that *Myristicaceae* resemble strikingly *Papilionoideae* (many 5-desoxyflavonoids, isoflavones, pterocarpanes, 1,3-diarylpropanes, flavans and fisetinidol-type catechins).

*References:* Bennett, B.C. & R. Alarcón, *Osteophloeum platyspermum* and *Virola duckei* (Myristicaceae): Newly reported as hallucinogens from Amazonian Ecuador, *Econ. Bot.* 48 (1994) 152–158. — Brücher, H., *Tropische Nutzpflanzen* (Ursprung, Evolution und Domestikation) (1977) 426–427: *Myristica fragrans*; Springer-Verlag Berlin. — Conserva, Lucia M., et al., *Phytochemistry* 29 (1990) 3911–3918: Dihydrochalcones and the dihydrochalcone-based flavonolignans iryantherin A to E from fruits and barks of *Iryanthera laevis*, *paraensis* and *ulei*. — Delaveau, P., *Les épices; histoire, description et usage des différents épices, aromates et condiments* (1987), Ed. Albin Michel S.A., Paris: Part IV. Passez muscade (*Myristica fragrans*): 154–164. — Efron, D.H. (Editor-in-chief), *Ethnopharmacologic search for psychoactive drugs*, *Public Health Publ. No.* 1645 (1967),



U.S. Government Printing Office, Washington, D.C.: Part III: 185–229: *Myristica fragrans*, with 3 contributions treating mainly psychoactivity, toxicology, pharmacology and chemistry of nutmeg. Part IV. South American snuffs with 6 contributions of which one treats botanical origins of snuffs known as Yakee and Paricá (prepared by some tribes with barks of *Virola calophylla*, *calophylloidea* and *elongata*), one treats the snuff Epéna prepared from the bark of *Virola calophylloidea*, and one treats the identification of N-methyltryptamines and  $\beta$ -carbolines in Epéna and Paricá-snuff preparations and in the bark of *Virola calophylla*, and an other one treats the psychoactive action of tryptamine derivatives. The harmala alkaloids (=  $\beta$ -carbolines) are treated in part V which is devoted to Malpighiaceae which yield the snuffs Ayahuasca, Caapi and Yagé. — Ferreira, A.G., et al., *Phytochemistry* 28 (1989) 579–583; 40 (1995) 1723–1728. — Flach, M. & M. Tjeenk Willink, in E. Westphal & P.C.M. Jansen (Eds.) PROSEA, A selection (1989) 192–196: *Myristica fragrans*. Pudoc Wageningen. — Gonzalez, M.J.T.G., et al., *Phytochemistry* 32 (1993) 433–438: Two resveratrol methyl ethers, a diarylpropane, a flavan, two resorcinol- and two phloroglucinol-type alkanones and two corresponding alkenones and the two lignans episesamin and xanthoxylol from wood of *Knema austrosiamensis*. — Gonzalez, M.J.T.G., et al., *Phytochemistry* 43 (1996) 1333–1337: Saturated and monounsaturated anacardic acids, alkylphenols and alkanoylphenols from wood of *Knema austrosiamensis* and bark of *K. laurina* and 5-hydroxy-3',4'-methylene-dioxyflavan from bark of *K. laurina*. — Gottlieb, O.R., Chemical studies on medicinal Myristicaceae of Amazonia, *J. Ethnopharmacol.* 1 (1979) 309–323. — Gottlieb, O.R. & M. Yoshida, Lignans, in: J.W. Rowe (Ed.), *Natural products of woody plants* (1989) 439–511. Springer-Verlag, Berlin. — Gunatilaka, A.A.L., et al., *Phytochemistry* 21 (1982) 2719–2723: Lignans asarinin, dihydrocubebin and horsfieldin and trimyristin from seeds of *Horsfieldia iryagedhi*. — Hegnauer, R., *Chemotaxonomie der Pflanzen*, Vol. V (1969) 144–153, 435–437, 457. — Hegnauer, R., *Chemotaxonomie der Pflanzen*, Vol. VIII (1989) 108–118: Comments on the chemistry of Polycarpiceae (= Magnoliidae sensu Cronquist), including fatty acid-derived acetogenins of Myristicaceae. — Hegnauer, R., *Chemotaxonomie der Pflanzen*, Vol. IX (1996) 101–111. — Herath, H.M.T.B. & A.M.A. Priyadarshini, *Phytochemistry* 42 (1996) 1439–1442; 44 (1997) 699–703: Neolignans and arylalkanonones (malabaricones) from bark. — Jossang, A., et al., *J. Org. Chem.* 56 (1991) 6527–6530. — Kato, M.J., et al., *Phytochemistry* 31 (1992) 283–287: Two 5-desoxyflavones from flowers, pericarp and leaf and ten lignans from pericarp, aril, seed and root and a special type of w-phenylalkanoylphenol (1-[11-phenylundecanoyl]-3-hydroxycyclohexan-2,6-dione) which occurs in all parts and was already known from *Virola elongata* and *sebifera*. — Kijjoa, A., et al., *Phytochemistry* 20 (1981) 1385–1388: Virolane and virolaflorine, two 1,3-diarylpropanes from wood of *Virola minutiflora* and virolanol, virolanol-B and -C, three 1,3-diarylpropan-2-ols and (–)-fisetinidol from wood of *V. elongata*. — Kijjoa, A., et al., *Planta Medica* 57 (1991) 575–577: Bark of both species yielded only several acetogenins of type (a). — Lopes, N.P., et al., *Phytochemistry* 35 (1994) 1469–1470; 43 (1996) 1089–1092: 17 Neolignans from leaves and seeds and juruenolide C and D and 3 propiophenones from seeds and a new juruenolide from seedlings. — Lu Zeng et al., *J. Natural Products* 57 (1994) 376–381: Stem bark yielded 10 (a)-type polyketides among which kneglomeratanol and the two acetophenones kneglomeratanone A and B and the isoflavones fromonetin, biochanin-A and 8-O-methylretusin. — Martinez V., J.C. & R. Torres Ch., *Phytochemistry* 44 (1997) 1179–1182: Leaves yielded nine neolignans among which otobaphenol. — Motter Magri, Fatima M., et al., *Phytochemistry* 43 (1996) 669–671: Unripe pericarps yielded an 1,4-dioxane-type neolignan (linkages 7-O-7' and 8-O-4') and 4 butanolide-type polyketides. — Noumbissie, B.E., et al., *J. Natural Products* 55 (1992) 137–139. — Omobuwajo, O.R., et al., *Phytochemistry* 31 (1992) 1013–1014: 2'-Hydroxyformononetin and its 7-methyl ether from wood. — Pinto, Magdalena M.M., et al., *Phytochemistry* 29 (1990) 1985–1988: (a)-Type acetogenins among which an isocoumarin and two neolignans (dehydroguaiaretic acid and its 1,2-dihydro derivative) from bark. — Purselglove, J.W., et al., *Spices*, Vol. 1 (1981), Logman Group Ltd., London: Nutmeg and mace p. 174–228: History - Botany - Ecology - Cultivation - Diseases - Pests - Improvement - Products and end-uses - Processing and manufacture - Chemistry - Standard specifications - Production, trade and markets - 3 pp.

of References. — Silva, Dulce H.S., et al., *Phytochemistry* 38 (1995) 1013–1016: Iryantherin G to J from fruits of *Iryanthera grandis*. — Spencer, G.F., et al., *J. Natural Products* 43 (1980) 724–730: Three neolignans and several anacardic acid- and resorcinol-type acetogenins from seeds. — Takhtajan, A.J., Outline of the classification of flowering plants (Magnoliophyta), *Bot. Rev.* 46 (1980) 225–359. — Tillekeratne, L.M.V., et al., *Phytochemistry* 21 (1982) 467–476: Bark, wood and leaves yielded the lignans asarinin and dihydrocubebin and dodecanoylphloroglucinol. — Wettstein, R., *Handbuch der systematischen Botanik*, 4. Aufl. (1935), Franz Deuticke, Leipzig-Wien. — Zahir, A., et al., *J. Natural Products* 56 (1993) 1634–1637: Leaves yielded two new phenyl-acylphenols, knerachelin A and B.

#### VERNACULAR NAMES

The preferred trade name applicable for *Myristicaceae* in general is *penarahan*. Peninsular Malaysian names are: *chendarah*, *chendarahan*, *darahan*, *penarah*, *penarahan*, *pendarah*, and *pendarahan*; in Sabah: *darah-darah* (preferred name); in Sarawak: *binarah* (Murut), *bindara* (Kelabit), *jela bala* (Kenyah), *kayo bela* (Kayan), *kayo raha* (Berawan), *kumpang* (preferred name), *pang* (Bidayuh), *pendarahan*, *pumpu* (Bidayuh Sadong), *raha meban* (Punan Tutoh); the names *balun ijok*, *darah-darah*, *penarahan*, and *pianggu* are also used in Sarawak; in the Philippines: *duguan* (Filipino language).

The group of *Myristicas* with black, gritty bark is called *penarahan arang* in Malaya and parts of Indonesia. Some *Knema* species in Indonesia are called *ki-mokla* (Sundanese). Specific names are, e.g., *swamp nutmeg* for *Myristica elliptica* (W Malesia) or *mangrove nutmeg* for *M. hollrungii* (New Guinea); the *papua nutmeg* is *M. argentea*, a species locally cultivated in SW Papua Barat. Some other Malay names for *Myristicaceae* may be mentioned here: the nutmeg, *Myristica fragrans*, is called *buah pala*, while wild nutmegs are called *pala bukit* or *pala hutan*. *Horsfieldia irya* is *pianggu* and *H. crassifolia* is *jangkang paya*. *Jangkang* means stilt-roots and *paya* is swamp. In Sarawak and Brunei, *Myristicaceae* are generally called *kumpang*. In New Guinea the family has many different names in the local languages. This information about the vernacular names comes largely from Sinclair (1958).

*Reference:* Sinclair, J., A revision of the Malayan Myristicaceae. *Gard. Bull. Sing.* 16 (1958) 205–472.

#### KEY TO THE GENERA

(based on male flowering specimens)

- 1a. Inflorescence a sessile or to 3(–5) mm peduncled, short, tubercle- or worm-like protuberance, usually woody, with scars of fallen pedicels and bracts. Bracteole present . . . . . 2
- b. Inflorescence branched, panicle-like, short- or long-peduncled, the distal parts of the branches woody and with scars, or not. Bracteole present or absent . . . . . 3
- 2a. Androecium a stalked disc with the anthers sessile, contiguous or largely free, stellately attached by their bases. Bracteole mostly small, at the base of the perianth or lower, to median on the pedicel . . . . . *Knema* (p. 222)
- b. Androecium a stalked elongate column with the anthers completely fused dorsally, apex of the column often a sterile protuberance, or ± flat, very rarely shallowly hollowed (*M. markgraviana*, *M. hooglandii*). Bracteole embracing the perianth, at or near the apex of the pedicel . . . . . *Myristica* (p. 359)

- 3a. Bracteole present, at or towards the apex of the pedicel. [Inflorescences with scar-covered perennial distal parts present or not.] . . . . . **Myristica** (p. 359)
- b. Bracteole absent . . . . . 4
- 4a. Synandrium variable, with the central column solid or excavated, usually considerably broader than the androphore. Perianth inside glabrous, lobes not reflexed at anthesis . . . . . 5
- b. Synandrium elongate or  $\pm$  globose, central column at apex not excavated, narrow, about as wide as or narrower than the androphore. Perianth inside hairy or papillary hairy, lobes erect or reflexed at anthesis. [Inflorescences panicle-like, usually branched from near the base and with some basal cataphyll scars present.] . . . . . 6
- 5a. Male perianth small, less than 4 mm long (6–7 mm in *H. superba*); androphore much shorter than synandrium, glabrous. Inflorescence with peduncle with basal cataphyll scars, not branched from base; apical vegetative bud absent . . . . . **Horsfieldia** (p. 54)
- b. Male perianth 5–6 mm long; androphore nearly as long as synandrium, with minute hairs at base. Inflorescence a brachyblast composed of partial inflorescences of the *Myristica* sect. *Myristica*-type (see also p. 360), ending in a vegetative bud . . . . . **Paramyristica** (p. 619)
- 6a. Synandrium elongate, anthers free in the apical part. Perianth lobes erect at anthesis . . . . . **Gymnacranthera** (p. 40)
- b. Synandrium short, (depressed) globose, anthers completely sessile, without apically free part. Perianth lobes spreading or reflexed at anthesis . . . . . **Endocomia** (p. 29)

#### KEY TO THE GENERA

(based on female flowering and fruiting specimens, also using vegetative characters)

- 1a. Aril divided into segments to or almost to the base . . . . . 2
- b. Aril entire or lacinate up to halfway or less . . . . . 4
- 2a. Inflorescences or infructescences paniculate, with scars of basal cataphylls, without apical vegetative bud. Bark of twigs smooth or very finely striate. Fruits 1.5–3 cm long. [Bracteole absent. Leaves not conspicuously brittle when dry.] . . . . . **Gymnacranthera** (p. 40)
- b. Inflorescences either 1) simple or furcate, short, (sub)sessile, or panicle-like with peduncle, without basal cataphyll scars and without terminal bud, or 2) compound, consisting of those of the foregoing type distichously arranged on short-shoots, with apical vegetative bud. Bark of twigs usually striate, longitudinally cracked, or flaking. Fruits 1.5–8 cm long . . . . . 3
- 3a. Inflorescence a compound synflorescence, with apical vegetative bud. Bracteole (female flowers not seen) absent. Fruits 5 cm long, conspicuously pubescent. Crowded linear basal cataphyll scars usually present on innovations. [Leaves brittle when dry.] . . . . . **Paramyristica** (p. 619)
- b. Inflorescences without apical vegetative bud, rarely present (*M. carrii*, *M. hooglandii*, *M. markgraviana*). Bracteole scar on fruiting pedicel present. Fruits of variable size, pubescent or glabrescent. Crowded basal cataphyll scars on twigs usually not present. [Leaves brittle when dry.] . . . . . **Myristica** (p. 359)

- 4a. Aril at apex convoluted or shallowly laciniate. Seed not variegated, not pointed at one end . . . . . 5
- b. Aril coarsely incised for about the upper 1/3, or  $\pm$  entire in the Philippines. Seeds usually variegated, often bluntly pointed at one end. [Bracteole absent. Stigma narrowly 2- or few-lobed. Inflorescence paniculate. Monoecious. Leaves brittle when dry, not whitish below.] . . . . . **Endocomia** (p. 29)
- 5a. Bracteole absent. Inflorescence paniculate. Stigma minutely 2-lobed (or few-lobed in *H. iryagedhi*, introduced). Leaves brittle when dry, lower surface usually not whitish (papillose and whitish below only in *H. iryagedhi*) . . . . . **Horsfieldia** (p. 54)
- b. Bracteole present. Inflorescences short, wart- or worm-like, simple or forked, scar-covered, (sub)sessile. Stigma few- to many-lobed. Leaves generally not brittle when dry; lower surface usually  $\pm$  whitish [venation on upper surface finely reticulate and usually clearly visible, unlike most other genera.] . . . . . **Knema** (p. 222)

## ENDOCOMIA

*Endocomia* W.J. de Wilde, *Blumea* 30 (1984) 179; *Beitr. Biol. Pflanzen* 66 ('1991', 1992) 95; *Tree Fl. Sabah & Sarawak* 3 (2000) 338. — Type species: *Endocomia macrocoma* (Miq.) W.J. de Wilde.

*Horsfieldia* sect. *Pyrrhosa* subsect. *Papillosae* Warb., *Mon. Myrist.* (1897) 265. — Based on *Horsfieldia papillosa* Warb., *H. prainii* (King) Warb., *H. canarioides* (King) Warb.

Trees, monoecious (always?). *Twigs* never angular or ridged, without lenticels, sometimes flaky. *Leaves* membranous or chartaceous, slightly brittle when dry, lower surface not pale, not papillose, dots absent; reticulation lax, distinct or not. *Inflorescences* with male and female flowers mixed (always?), sometimes pseudoterminal (terminal bud of twig abortive), paniculate, branched from near the base; basal cataphylls caducous; bracts caducous; flowers in small clusters, buds either in the same or in different stages of development. *Flowers* short or long pedicellate, at base not articulated; bracteole absent. *Male flowers*: perianth rotate, thinly leathery, inside pubescent, yellowish or (in New Guinea) bright red; buds small, ellipsoid, ovoid, or subglobose, cleft to c. 3/4 to nearly the base, lobes 3–5, spread or recurved in anthesis; androecium with androphore narrow, glabrous, synandrium small, (depressed) globose or short-ellipsoid, with 2–6 completely fused, short (0.5 mm or less) elliptic anthers. *Female flowers*: similar to male; ovary ovoid, glabrous, stigma sessile, minute, 2-lobed, lobes narrow or broad and 2–5-lobulate. *Infructescences* small or large panicles, to 30 cm long. *Fruits* ellipsoid or (ob)ovoid, glabrous, yellow or purplish; pericarp thin or thick, fleshy-leathery; aril yellowish (?) or red, subentire or to halfway laciniate; seeds usually pointed at apex, variegated; albumen ruminant, without (?) starch; embryo incompletely known. — **Fig. 3, 4.**

**Distribution** — The genus has 4 species, ranging from South China through South-east Asia and *Malesia* east to New Guinea; not in Central & East Java, Lesser Sunda Islands, Solomon Islands or Australia. — Map 1 (see p. 3).

**Note** — In most species female flowers have not been seen; they should be found in the large, paniculate, predominantly male-flowered inflorescences, or in purely female inflorescences.

## KEY TO THE SPECIES

- 1a. Flowers in one cluster or semi-cluster all in about the same stage of development. Synandrium depressed-globose, slightly broader than long. Androphore short, about as long as or shorter than the synandrium. Anthers 4–6. Fruits 4.5–7 cm long . . . 2
- b. Flowers in one cluster usually in different stages of development. Synandrium globose or short-ellipsoid, about as broad as long or longer than broad. Androphore about as long as or longer than the synandrium or, in Java, sometimes shorter than the synandrium. Anthers mostly 3–6. Fruits of variable sizes . . . . . 3
- 2a. All male perianths on a plant (3- or) 4-lobed. Anthers 4–6. Leaf buds, twig apex and inflorescences with grey-brown hairs 0.1–0.2 mm long, sometimes glabrescent. Nerves above flat or but little raised. Pericarp 2–10 mm thick . . . 1. **E. canarioides**
- b. Male perianths more or less evenly mixed 4- and 5-lobed. Anthers 4. Leaf buds, twig apex and inflorescences with rusty hairs 0.5 mm long, sometimes late glabrescent. Nerves raised above. Pericarp 1.5–3(–4) mm thick . . . . . 3. **E. rufirachis**
- 3a. Leaves 8–20 cm long, drying greenish; nerves 7–12 pairs. Inflorescences weak and slender, rather poorly flowered. Fruits 4.5–7 cm long, pericarp 5–8 mm thick, drying brown . . . . . 4. **E. virella**
- b. Leaves larger, 15–35 cm long, usually drying dark brown; nerves 11–24 pairs. Inflorescences variable. Fruits up to 4.5(–5.5) cm long, pericarp less than 5 mm thick, drying blackish . . . . . 2. **E. macrocoma**

**1. Endocomia canarioides (King) W. J. de Wilde**

*Endocomia canarioides* (King) W. J. de Wilde, *Blumea* 30 (1984) 190, f. 3e–h. — *Horsfieldia canarioides* (King) Warb., *Mon. Myrist.* (1897) 294, t. 21; Gamble, *Mat. Fl. Malay Penins.* 5 (1913) 208; Ridl., *Fl. Malay Penins.* 3 (1924) 55. — *Myristica canarioides* King, *Ann. Roy. Bot. Gard. Calc.* 3 (1891) 304, pl. 134. — *Horsfieldia macrocoma* (Miq.) Warb. var. *canarioides* (King) J. Sinclair, *Gard. Bull. Sing.* 16 (1958) 389, f. 55. — Lectotype: *King's coll. 10064*, Peninsular Malaysia.

*Myristica racemosa* King, *Ann. Roy. Bot. Gard. Calc.* 3 (1891) 328, pl. 173. — *Horsfieldia racemosa* (King) Warb., *Mon. Myrist.* (1897) 347; Gamble, *Mat. Fl. Malay Penins.* 5 (1912) 222; Ridl., *Fl. Malay Penins.* 3 (1924) 60. — Type: *Curtis 934*, Peninsular Malaysia.

?*Embelia ridleyi* King & Gamble, *Mat. Fl. Malay Penins.* 4 (1905) 112; J. Sinclair, *Gard. Bull. Sing.* 15 (1956) 31. — Type: *Ridley 6324*, Peninsular Malaysia.

Tree 10–35 m. *Twigs* (grey-)brown, 1.5–4(–10) mm diameter, with minute grey-brown hairs 0.1 mm long, early glabrescent, bark striate, on older twigs sometimes longitudinally cracking, lenticels very inconspicuous. *Leaves* membranous or chartaceous, elliptic to oblong, 8–30 by 4–13.5 cm, base subcordate or rounded to short-cuneate, apex acute-acuminate; upper surface dark brown, glabrous, lower surface early glabrescent; midrib on both surfaces early glabrescent, above flat or slightly raised; nerves 11–19 pairs, lines of interarching distinct or not; venation lax, distinct or not on both surfaces; petiole 8–30 by 1.5–4 mm; leaf bud 6–25 by 1–3 mm, with dense (grey-)brown hairs 0.1–0.2 mm long or less. *Inflorescences* predominantly with male flowers, generally behind the leaves, (sub)glabrescent or with sparse greyish hairs 0.1 mm or less, variable in shape, loose or condensed, many-flowered, 6–25 by 3–15 cm, peduncle 0.5–6 cm long, bracts caducous, not seen. *Flowers* in loose or dense clusters of 3–8, all in about

the same stage of development; perianth outside with  $\pm$  sparse greyish hairs 0.1 (–0.2) mm, or glabrous, lobes inside with pale hairs 0.2–0.3 mm, often in longitudinal rows. *Male flowers*: pedicel 1.5–2.5 mm; bud broadly ellipsoid-obovoid, 1.5–1.6 by 1.3–1.4 mm, apex broadly rounded or somewhat depressed, base  $\pm$  tapering, subcircular in cross section, cleft  $3/4$ – $4/5$ , lobes 3 or 4 (or 5), at sutures 0.2(–0.3) mm thick; synandrium depressed globose, 0.3–0.5 by 0.5–0.6 mm, anthers 4–6, androphore 0.3–0.4 by 0.3 mm. *Female flowers* not seen; ovary in very immature fruits glabrous. *Fruits* (solitary or) 2–6 together in panicles of 15–25 cm long, ellipsoid-oblong, (4.5–)5–7 by 2.5–3.5 cm, apex (narrowly) rounded, base rounded or narrowed for 3–5 mm, glabrous, drying dark brown or blackish, finely granulate; pericarp 2–10 mm thick; fruiting pedicel 15–20 mm long; aril lacinate for c.  $1/3$  to nearly halfway; seeds ellipsoid-oblong, 4–5 cm long, apex subacute or bluntly beaked for up to 3 mm long, testa purplish brownish variegated. — **Fig. 4e–h.**

**Field-notes** — Bark smooth, grey- or dark-brown, flaking in small thin pieces, or finely fissured or cracked; slash inner bark brownish white, yellowish brown, or red, with watery reddish exudate; slash wood white or pale yellow. Leaves glossy on both surfaces. Flowers (pale) green. Fruits green turning yellow (Peninsular Malaysia) or purple brown (N Sumatra), ellipsoid-oblong, very large, to 10–12 cm long, mature aril yellow.

**Distribution** — Peninsular Thailand; *Malesia*: Sumatra, Peninsular Malaysia, Singapore.

**Habitat & Ecology** — Evergreen, open bamboo forest, lowland rain forest, on flat land or hillsides; 0–300 m altitude; fl. Jan.–June; fr. June–Sept.

**Note** — The fruits are very variable in the thickness of the pericarp. When more material becomes available, two varieties may be distinguished through this character. Fruiting specimens with thin pericarp may be difficult to distinguish from large-fruited specimens of *Endocomia macrocoma* subsp. *prainii*.

## 2. *Endocomia macrocoma* (Miq.) W. J. de Wilde

*Endocomia macrocoma* (Miq.) W. J. de Wilde, *Blumea* 30 (1984) 182; *Tree Fl. Sabah & Sarawak* 3 (2000) 339. — *Myristica macrocoma* Miq., *Ann. Mus. Bot. Lugd.-Bat.* 1 (1864) 207; 2 (1865) 49, p.p. (excl. specimens from Sulawesi = *Horsfieldia irya*). — *Horsfieldia macrocoma* (Miq.) Warb., *Mon. Myrist.* (1897) 299, t. 21; J. Sinclair, *Gard. Bull. Sing.* 16 (1958) 392; 23 (1975) 75, p.p. — Lectotype (here designated): *Teijsmann 5553*, Moluccas, Halmahera

For more references and synonyms see the subspecies.

Trees 5–50 m. *Twigs* (pale) grey brown to dark brown, 2–6(–10) mm diameter, with grey-brown to rusty hairs 0.1–0.5 mm, early to late glabrescent, bark (coarsely) striate or longitudinally cracking, sometimes flaking, lenticels absent or inconspicuous. *Leaves* membranous or chartaceous, elliptic or obovate to oblong-oblongeolate, (12–)15–35 (–40) by (4–)5–12 cm, base (narrowly) rounded to attenuate, apex acute-acuminate; upper surface olivaceous to brown, glabrous, lower surface glabrous or (early) glabrescent; midrib above slender, flat or slightly raised; nerves 11–24 pairs, lines of interarching generally indistinct; venation lax or fine, sometimes slightly trabeculate, on both surfaces distinct or not; petiole 10–25 by 1.5–3.5 mm, glabrous to late glabrescent; leaf bud 8–25 by 1.5–3.5 mm, with dense grey brown to rusty hairs 0.1–0.5 mm. *Inflorescences* (see note 1) slender to stout, much or little branched, glabrescent or with persist-

ent greyish or rusty hairs 0.1–0.5 mm long, in male 6–30 by 2–25 cm, moderately to many-flowered, peduncle 0–5 cm long, bracts  $\pm$  elliptic, 1.5–3 mm,  $\pm$  thinly pubescent, caducous. *Flowers* 4–10 together, buds usually in different stages of development, in  $\pm$  umbelliform clusters (3–)5–30 mm spaced along the main branches of the inflorescence; perianth outside early glabrescent or thinly with hairs 0.1–0.5 mm long, lobes inside towards the apex with few to many (pale) brownish red hairs 0.2–0.4 mm long, usually in rows in spaces between the anthers, sometimes only near the lobe sutures. *Male flowers*: pedicel 1.5–7 mm long; buds broadly ellipsoid or broadly ovoid, 1.5–2.3 by 1.3–2 mm, apex rounded to subacute, base rounded to attenuate, in cross section sub-circular or 3- or 4-angular, cleft 2/3–4/5, lobes 3 or 4 (or 5), at sutures 0.2–0.3(–0.5) mm thick; synandrium (depressed) globose to ellipsoid, 0.2–0.5 by 0.3–0.5 mm, anthers 3–6, androphore slender, longer to shorter than the androecium, 0.3–1 mm long. *Female flowers*: pedicel 2–6 mm; buds ovoid-ellipsoid, 2.2–2.6 by 1.7–2 mm, cleft 2/3–5/6, lobes 0.2–0.3 mm thick; ovary (narrowly) ovoid, 1.3–1.8 by 0.8–1.2 mm, glabrous, stigma 0.2–0.3 mm high, narrowly to broadly 2-lipped, in the latter case the lips minutely 2–5-lobulate. *Fruits* 3–12 in a pendent loose panicle (10–)15–30 cm long, ovoid, (narrowly) ellipsoid, or obovoid, 1.5–4.5(–5.5) cm long, glabrous; pericarp 1–3 mm thick, blackish, finely granulate, not or sparingly warted; the aril almost entire to lacinate to about halfway; seeds usually with pointed apex, testa variegated (not always in New Guinea).

Distribution — Widespread, continental Southeast Asia and *Malesia*; see under the subspecies.

Notes — 1. The inflorescences often have mixed male and female flowers, the latter possibly most frequent towards the end of the branches; other species may have separate male and female inflorescences on the same twig.

2. The flowers in a subumbel or cluster are generally in different stages of development, as in *Endocomia virella*, hence open flowers are found together with closed ones and usually with much smaller, still growing flower buds.

#### KEY TO THE SUBSPECIES

- 1a. Synandrium (0.3–)0.4–0.5 mm long, with (3 or) 4–6 anthers, androphore 0.3–0.6 mm long. Stigma broadly 2-lipped and minutely lobulate . . . . . 2  
 b. Synandrium 0.2–0.3 mm long, with 2 or 3 anthers, androphore 0.7–1 mm. Stigma narrowly 2-lipped. [Perianth inside greenish to pale yellowish. Fruits 3–4.5 cm long.]  
 . . . . . **b. subsp. longipes**
- 2a. Plants either early glabrescent or leaf buds, inflorescences and flowers with greyish or pale brown hairs 0.1–0.2 mm long or less. Perianth inside greenish to yellowish (continental Southeast Asia, W Malesia, Philippines) or red (New Guinea). Fruits 2.5–4 cm long . . . . . **c. subsp. prainii**  
 b. Leaf buds, inflorescences and flowers with  $\pm$  conspicuous rusty hairs 0.2–0.5 mm long. Perianth inside greenish yellow. Fruits 1.7–3.5 cm long **a. subsp. macrocoma**

#### **a. subsp. macrocoma**

*Endocomia macrocoma* (Miq.) W.J. de Wilde subsp. *macrocoma*; W.J. de Wilde, Blumea 30 (1984) 184, f. 2i; 3d; 41 (1996) 375. — *Horsfieldia macrocoma* (Miq.) Warb. var. *macrocoma*; J. Sinclair, Gard. Bull. Sing. 16 (1958) 393.

*Myristica nesophila* Miq., Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 206, p.p. — For the syntype *de Vriese s.n.* (L), Bacan I., not the lectotype = *Horsfieldia*.

*Horsfieldia leptocarpa* Warb., Mon. Myrist. (1897) 346, t. 21 (excl. *Forster s.n.*, Sulawesi = *Horsfieldia irya*). — *Horsfieldia leptosperma*, nomen, in obs. sub *Horsfieldia olivaeformis* Warb., Mon. Myrist. (1897) 352. — Type: *de Vriese s.n.*, fr., Sulawesi or Buru.

*Gymnacranthera ibutii* Holthuis, Blumea 5 (1942) 183, f. 4. — Type: *Lam 2976*, Talaud I.

Leaf bud and twigs rusty pubescent, hairs 0.2–0.5 mm long, twig apex sometimes early glabrescent. *Inflorescences* rather condensed, much branched, 6–15 cm long, the flowers densely rusty pubescent, hairs 0.2–0.5 mm long. Pedicels of male and female flowers 3–4 mm long. *Male flowers*: buds 3-lobed, cleft to c. 4/5, inside greenish yellow; synandrium subglobose to ellipsoid, 0.5 by 0.4–0.5 mm, anthers 4, androphore 0.4–0.6 mm long. *Female flowers*: ovary ± narrowly ovoid, stigma rather broadly 2-lipped and very finely lobulate. *Infructescences* 10–16 cm long. *Fruits* fusiform, ellipsoid, ± obovoid, or pear-shaped, 1.7–3.5 by 1.2–1.9 cm, apex acute to broadly rounded, base rounded or narrowed; pericarp 1–3 mm thick; fruiting pedicel 6–12 mm long; aril at apex lacinate 1/3–1/2; seeds ± ellipsoid, 1.5–2 cm long, apex ± acute, testa blotched and variegated. — Fig. 3i, 4d.

Field-notes — No buttresses. Outer bark 0.2–0.7 mm thick, slightly fissured or not, little peeling; inner bark 9–18 mm, pale red to pink-ochre, with some pale reddish watery exudate; sapwood whitish to yellowish tinged red, gradually passing into the darker heartwood. Perianth (inside) greenish yellow. Fruits yellow or orange, aril bright red, at apex incised to 1/3–1/2; seeds mottled brown.

Distribution — *Malesia*: Moluccas (Talaud, Morotai, Halmahera, Bacan, Obi, Buru, Seram, Ambon); possibly Sulawesi (sterile coll.) and Philippines (NE Luzon); see notes.

Habitat & Ecology — Forest with little undergrowth, on alluvial flats locally with stagnant water, or hill slopes; on porous volcanic soil, or loam soil with stones; also in disturbed forest; 0–400 m altitude; fl. & fr. throughout the year.

Notes — 1. Subsp. *macrocoma* is arbitrarily separated from subsp. *prainii*, the latter being very variable in many features, and mainly differing by a much less developed indumentum on leaf buds and inflorescences, and by its generally larger fruits. Subsp. *macrocoma* has a remarkable variation in fruit shapes. Its fruits are generally ± ellipsoid, but fruits from Bacan and Obi are small, 1.7–2.2 cm long and either broad-ellipsoid or obovoid; in Buru fusiform fruits 28 mm long are found.

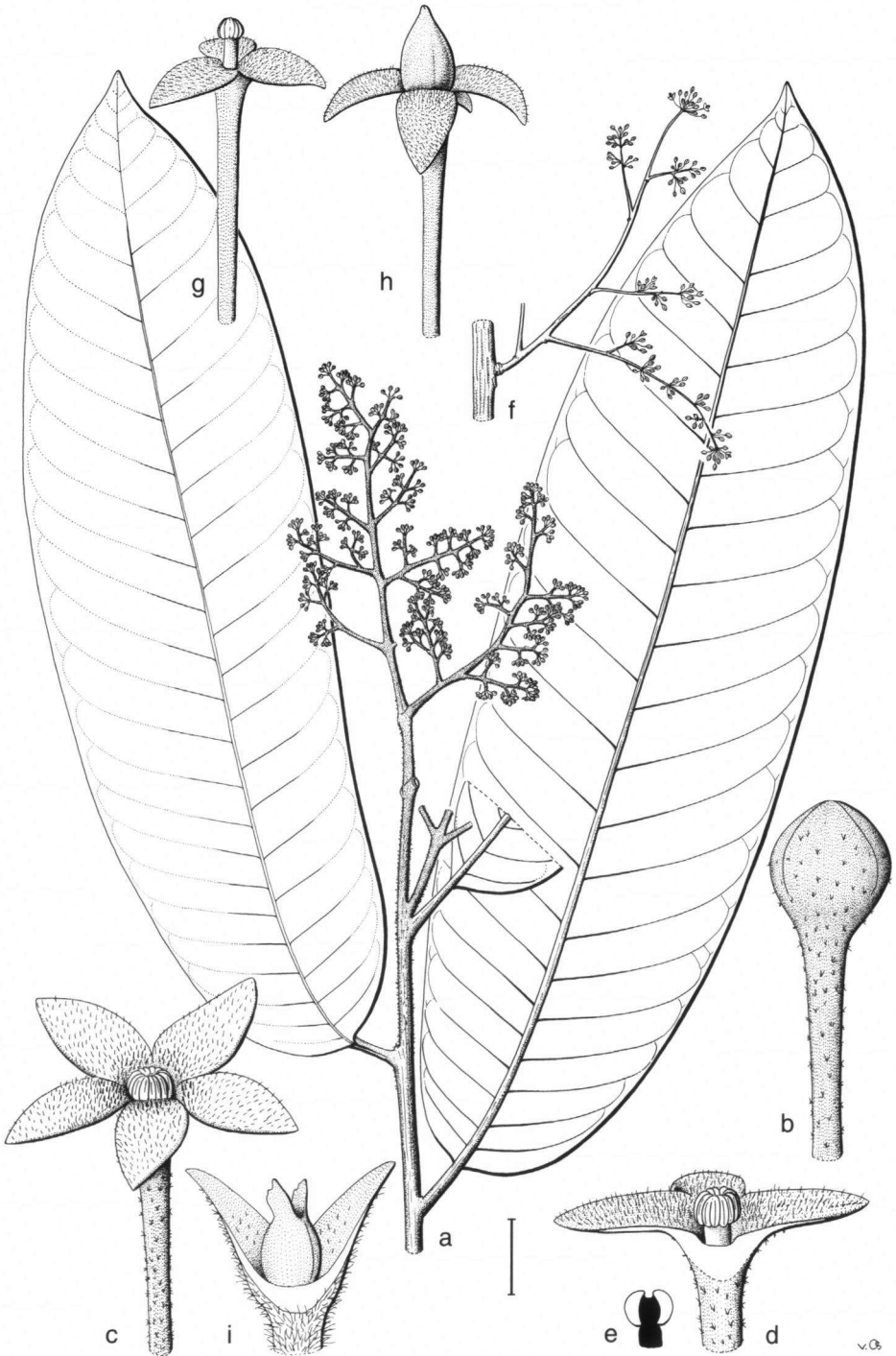
2. *Ridsdale c. s. ISU 317*, from Palanan, NE Luzon, strongly deviates in its very hairy appearance, and may represent a separate taxon.

## b. subsp. *longipes* W.J. de Wilde

*Endocomia macrocoma* (Miq.) W.J. de Wilde subsp. *longipes* W.J. de Wilde, Blumea 30 (1984) 185, f. 2f–h; Tree Fl. Sabah & Sarawak 3 (2000) 339. — Type: *de Vogel 888*, SE Kalimantan.

Leaf bud with hairs dull brown, 0.1 mm long or less, twig apex early glabrescent. *Inflorescences* lax, little to much branched, 6–30 cm long, with the flowers glabrous or sparingly pubescent, hairs grey-brown, 0.1 mm long; male and female flowers with slender pedicels (2–)4–7 mm long. *Male flowers*: buds 3- (or 4-)valved, cleft to 4/5–5/6, inside greenish to yellowish; synandrium (depressed) globose, 0.2–0.3 by 0.2–0.4 mm, anthers 2 or 3, androphore slender, (0.6–)0.7–1 mm long. *Female flowers*: ovary narrowly ovoid,





stigma shortly and narrowly 2-lipped. Infructescences 15–30 cm long. *Fruits* narrowly ovoid-ellipsoid, 3.5–4(–5.5) by 1.4–2 cm, apex blunt or subacute, base rounded or narrowed; pericarp 1–2 mm thick; fruiting pedicel 15 mm long; aril lacinate to 1/5; seeds 3 cm long, the apex slightly acute or to 2 mm beaked, testa variegated with longitudinal blotches. — **Fig. 3f–h.**

**Field-notes** — Bark of trunk greyish or chocolate brown, somewhat fissured or not and little to profusely scaling in small thin pieces; outer bark 2 mm thick, brown; inner bark 7–17 mm, cream, light brown(-red), or yellowish, with pale orange or reddish watery exudate; sapwood pale yellow or pale brown. Perianth inside yellowish or pale green. Fruits hanging from the branches, green.

**Distribution** — *Malesia*: E Sumatra and Borneo (Sarawak, Sabah, E and S Kalimantan).

**Habitat & Ecology** — Primary forest, mixed dipterocarp forest, riverside forest, on stream banks or alluvial flats, on deep clay soil, low ridges with sandy or sedimentary soil; 0–1000 m altitude; fl. & fr. throughout the year.

**Note** — Related to *Endocomia virella*, with similar flowers, but the latter has leaves drying distinctly greenish, and much larger fruits.

### c. subsp. *prainii* (King) W.J. de Wilde

*Endocomia macrocoma* (Miq.) W.J. de Wilde subsp. *prainii* (King) W.J. de Wilde, *Blumea* 30 (1984) 187, f. 3b, c. — *Myristica prainii* King, *Ann. Roy. Bot. Gard. Calc.* 3 (1891) 299, pl. 126. — *Horsfieldia prainii* (King) Warb., *Mon. Myrist.* (1897) 292, t. 21. — Types: *King's coll.* 417, 431; *Carter s.n.*, Andaman.

*Horsfieldia papillosa* Warb., *Mon. Myrist.* (1897) 291, t. 21. — *Myristica papillosa* (Warb.) Boerl., *Handl.* 3 (1900) 85. — Type: male specimen, cultivated in Bogor Botanical Garden., origin unknown.

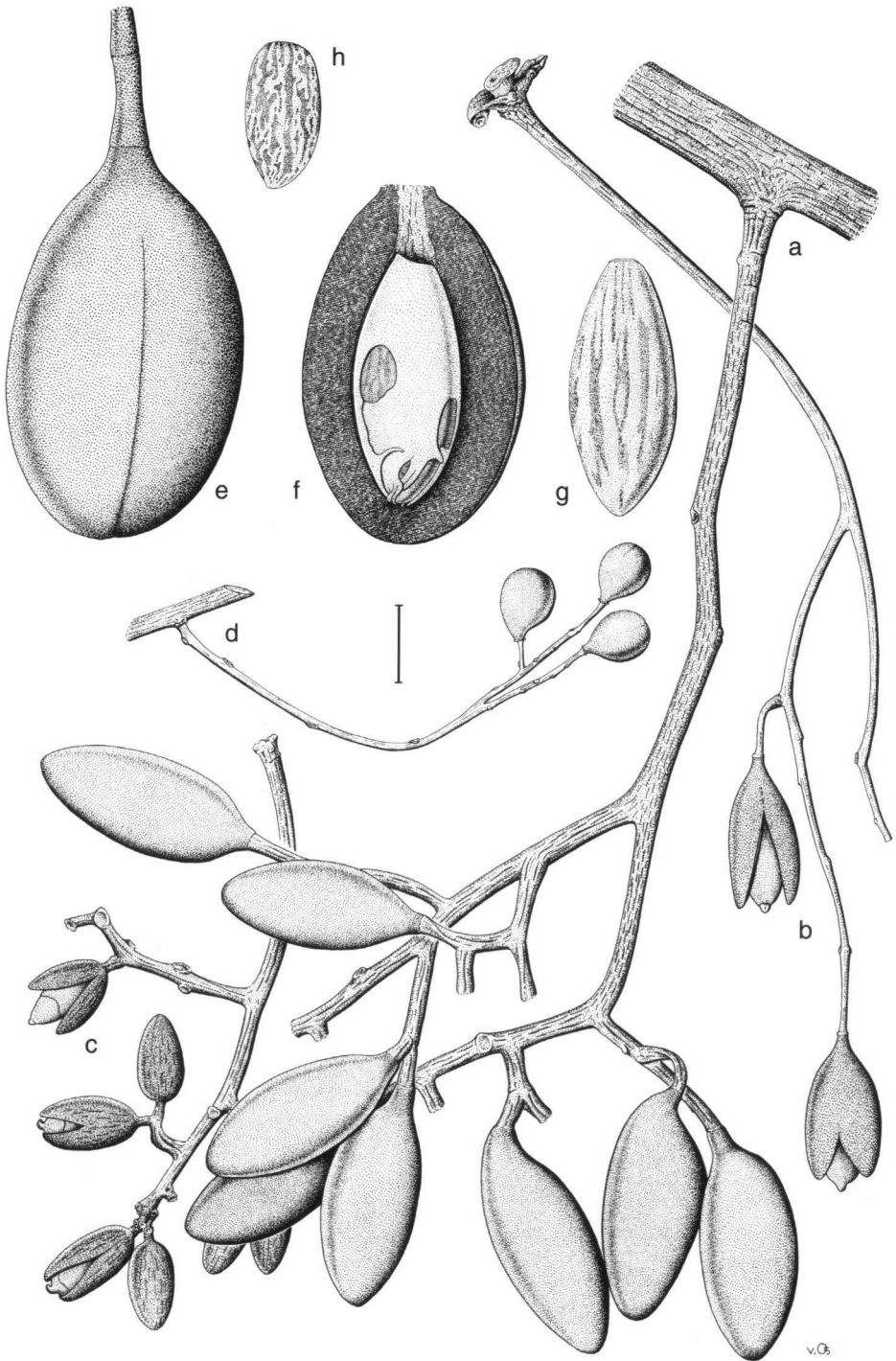
*Horsfieldia merrillii* Warb. in Perkins, *Fragm. Fl. Philipp.* (1904) 49; Merr., *Philipp. J. Sci., Bot.* 2 (1907) 274; *Enum. Philipp. Flow. Pl.* 2 (1923) 182. — Types: *Merrill 2233, 2370*, Mindoro.

*Horsfieldia oblongata* Merr., *Philipp. J. Sci., Bot.* 13 (1918) 286; *Enum. Philipp. Flow. Pl.* 2 (1923) 182; *Markgr., Bot. Jahrb. Syst.* 67 (1935) 148 (for the New Guinean specimens only). — Type: *Ramos Philip. pl. 1393*, Luzon.

*Horsfieldia trifida* A.C. Sm., *J. Arnold Arbor.* 22 (1941) 60. — Type: *Brass & Versteegh 14017*, Irian Jaya.

Leaf bud pubescent, hairs greyish to dull brown, 0.1–0.2 mm long or less, twig apex early glabrescent. *Inflorescences* condensed to lax, usually much-branched, 8–25 cm long, with the pedicels and perianths sparingly to densely short-pubescent, hairs grey

**Fig. 3.** Inflorescences and flowers of *Endocomia*. — *E. rufirachis* (J. Sinclair) W.J. de Wilde. a. Flowering twig; flowers all in about the same stage of development and rachis of inflorescence at base without cataphylls; b. male flower in mature bud stage; c. ditto, at anthesis, note papillose-hairy inner surface of perianth lobes; d. section of male perianth showing stalked androecium; e. longitudinal section of androecium, schematic, androphore and central column drawn solid black. — *E. macrocoma* (Miq.) W.J. de Wilde subsp. *longipes* W.J. de Wilde. f. Inflorescence with female and male flowers, all in different stages of development; g. male flower at anthesis; note reflexed perianth lobes and slender androphore; h. female flower at anthesis. — *E. macrocoma* subsp. *macrocoma*. i. Female flower in section [a–e: *BNB For. Dept.* 1716; f–h: *SAN 66753*, i: *Atasrip 103*]. — Scale bar for a, f = 2 cm; for b–e, g–i = 0.8 mm.



(-brown), 0.1–0.2 mm long; pedicels of male and female flowers slender, 1.5–2.5 mm long. *Male flowers*: buds 3- or 4- (or 5-)lobed, cleft to (2/3–)3/4–5/6, inside greenish to yellowish, or red; synandrium (depressed) globose or ellipsoid, (0.3–)0.4–0.5 by 0.3–0.5 mm, anthers (3 or) 4, or 5 or 6 (New Guinea, see note 1), androphore slender, (0.2–)0.3–0.6 mm long. *Female flowers*: ovary ovoid, with broad 2-lipped stigma. Infructescences 10–30 cm long. *Fruits* narrowly to broadly ellipsoid to ovoid, (2.2–)3–4.5(–5.5) by (1–)1.2–2.5 cm, apex obtuse or often subacute, base rounded, or with an up to 5 mm long narrowed part; pericarp 1–2.5 mm thick; fruiting pedicel 5–15 mm long; aril almost entire (Philippines, New Guinea) or lacinate c. 1/5; seeds ellipsoid, 2–3.2 cm long, apex acute or shortly beaked, testa variegated by longitudinal markings, in New Guinea not or only indistinctly so. — **Fig. 4b, c.**

**Field-notes** — Without or with short buttresses up to 200 × 30 × 4 cm, branches often horizontally spreading, or drooping. Bark grey to blackish brown, smooth, without or with shallow fissures, shallowly irregularly peeling or not; exudate watery, colourless or pale red to brownish, once recorded as slightly milky; blaze pale brown to salmon; wood white or straw or salmon-cream. Perianth inside greenish to yellow (W Malesia), once purple (Thailand) or dark red to deep maroon (New Guinea), anthers creamy to pale yellow, ovary green with brown or blackish stigma; flowers with sweet scent. Fruits glossy green, turning yellow, in the Philippines and New Guinea orange, aril bright red.

**Distribution** — South China (Yunnan), India (Assam, Andaman I.), Bangladesh, Burma, Indochina; *Malesia*: W Sumatra, W Java, Philippines, New Guinea.

**Habitat & Ecology** — Lowland and hillside forest, riverine or swamp forest; by streams, on alluvial or clayey soil, in limestone country, or on copper-rich soil; 0–500 m altitude; fl. & fr. throughout the year, but fl. in W Malesia mainly July, Aug., in the Philippines mainly Mar.–May, in New Guinea throughout the year.

**Uses** — The wood is used for house-building (Sepik area).

**Notes** — 1. A variable subspecies, mainly in the indumentum, some features of the male flowers, the shape and size of the fruits, and the colour of the seeds. This variation is more or less correlated with the geography. Specimens from the Philippines differ in inflorescences and indumentum, especially that of the flowers, composed of grey-white rather long hairs 0.1–0.2 mm. Specimens from New Guinea stand apart. They are characterized by generally shorter inflorescences and infructescences, androecium with 5 or 6 anthers, perianth dark red inside, fruits orange and small, sometimes only 2.2–2.5 cm long, testa non-variegated or only faintly so. Specimens from outside New Guinea have usually only 4 anthers, perianth greenish or yellowish inside, fruits yellow (once orange in the Philippines) and the testa always variegated. In other features the New Guinea specimens agree with those from elsewhere in the range of the species.

**Fig. 4.** Infructescences, fruits, and seeds of *Endocomia*. — *E. rufirachis* (J. Sinclair) W.J. de Wilde. a. Infructescence. — *E. macrocoma* (Miq.) W.J. de Wilde subsp. *prainii* (King) W.J. de Wilde. b. Infructescence; note complete arils and pointed seeds; c. ditto; note arils faintly lacinated, incompletely covering the seeds pointed at apex. — *E. macrocoma* subsp. *macrocoma*. d. Infructescence. — *E. canarioides* (King) W.J. de Wilde. e. Fruit in spirit; f. ditto, opened; note deeply lacinated aril; g & h. seed; note variegated testa [a: *Kostermans* 9579; b: *PNH* 7281 (*Edaño*); c: *Kostermans & Soegeng* 478; d: *Atasrip* 103; e–g: *de Wilde/Duyffes* 18877 (spirit); h: *King's coll.* 10064). — Scale bar for all = 2 cm.

2. In *Endocomia* the seeds are almost always variegated, except in *E. macrocoma* subsp. *prainii* from New Guinea, where the seeds are dull greyish brown, not variegated or only faintly so, possibly because the aril is not laciniate.

### 3. *Endocomia rufirachis* (J. Sinclair) W.J. de Wilde

*Endocomia rufirachis* (J. Sinclair) W.J. de Wilde, *Blumea* 30 (1984) 192, f. 2 a–e, 3a; *Tree Fl. Sabah & Sarawak* 3 (2000) 340. — *Horsfieldia macrocoma* (Miq.) Warb. var. *rufirachis* J. Sinclair, *Gard. Bull. Sing.* 16 (1958) 393. — Type: *Wood SAN A 4770*, Sabah.

Tree 10–40 m. *Twigs* brown, 3.5–5(–14) mm diameter, with rusty hairs 0.5 mm long, early to late glabrescent, bark coarsely striate, tending to flake, lenticels absent or inconspicuous. *Leaves* membranous to thinly chartaceous, elliptic-oblong to oblong-lanceolate, 18–38 by 6–11 cm, base subcordate, broadly rounded, or short-cuneate, apex acute-acuminate; upper surface drying brown, glabrous, lower surface early glabrescent; midrib on both surfaces often late glabrescent, above rather flat to moderately raised; nerves 17–25(–30) pairs, above (partly) raised, sometimes late glabrescent, lines of interarching often distinct and regular; venation lax, distinct or faint above; petioles 8–25 by 1.5–3 mm,  $\pm$  late glabrescent; leaf bud 8–18 by 2–3.5 mm, with dense rusty hairs 0.3–0.5 mm. *Inflorescences* (with male or mixed male and female (?) flowers) between or behind the leaves, sometimes apical, 3–5 times branched, many-flowered, 8–30 by 5–25 cm, peduncle 1.5–5 cm, with dense rusty hairs 0.5–0.7 mm long, bracts elliptic-oblong, 2–6 mm long, caducous. *Flowers* usually in rather dense clusters of 5–10, sometimes flowers more dispersed and only 2 or 3 together, all  $\pm$  in the same stage of development; perianth outside with hairs 0.2–0.5 mm long, lobes inside with dense rusty hairs 0.2–0.3 mm. *Male flowers*: pedicel slender, 2–3.5 mm; buds obovoid to  $\pm$  obconical, 1.5–1.8 by 1.2–1.5 mm, apex rounded to subtruncate, base  $\pm$  tapering, in cross section faintly angular or subcircular, pubescent or glabrescent towards the apex, cleft  $3/4$ – $4/5$ , the lobes (3 or) 4 or 5, oblong, 0.2 mm thick; synandrium depressed-globose, (0.2–)0.3 by 0.5–0.6 mm, anthers 4, sessile, androphore 0.3 by 0.2–0.3 mm. *Female flowers* not seen. *Fruits* 6–18 in large panicles up to 30 cm long, ellipsoid-oblong, 4.5–6.5 by 1.8–2.5 cm, apex narrowly rounded, base subacute or often tapering into a 4–10 mm long narrowed part, glabrous, drying blackish, finely granulate, without lenticels, not warted; pericarp 1.5–3 (–4) mm thick; fruiting pedicel 8–16 mm long; aril laciniate to  $1/5$ – $1/3$ ; seeds ellipsoid-oblong, 3.5–4.5 cm long, apex beaked for 0.2–4 mm, testa with elongate purplish and brownish dapples. — **Fig. 3a–e, 4a.**

*Field-notes* — Buttresses sometimes present, short and rounded. Bark usually blackish, brittle, smooth with superficially longitudinal cracks or with paper-thin flakes; inner bark 10–15 cm thick, pale yellow, (reddish) brown, or orange, cambium yellowish to red; sapwood pale, whitish to brown-yellow, soft; exudate slight, pale red from inner sapwood. Flowers yellow with reddish or brown-red indumentum. Fruits green to yellow, aril bright red.

*Distribution* — *Malesia*: Borneo (Sarawak, Sabah, E Kalimantan).

*Habitat & Ecology* — Primary and logged-over lowland rain forest on flat land and hill slopes or on periodically inundated ground; on leached clays, loam soils, black soil, also on sandstone and limestone; 0–400 m altitude; fl. & fr. throughout the year.

Notes — 1. Characterized by the inflorescences in which all the flowers are in about the same stage of development, by the conspicuous rusty indumentum on leaf buds and inflorescences, and by the large fruits.

2. *Endocomia rufirachis* resembles *Horsfieldia motleyi*, which has similarly pubescent flowers. *Endocomia macrocoma* subsp. *macrocoma* (Moluccas) may have a similar, rather conspicuous yellowish red indumentum, but differs in the one-clustered flowers in various stages of development, the shape of the androecium, and the smaller fruits.

3. In spite of a fairly large number of flowering specimens, only male flowers have been found. Some of the collections have male inflorescences with fruits separately attached to the herbarium sheet; both are apparently collected from one single tree. In the related *Endocomia macrocoma*, the female flowers are usually scattered in between the more numerous male ones in one inflorescence, or can be found on separate female inflorescences of the same tree.

#### 4. *Endocomia virella* W.J. de Wilde

*Endocomia virella* W.J. de Wilde, Blumea 30 (1984) 194; Tree Fl. Sabah & Sarawak 3 (2000) 342.  
— Type: SAN 49546 (*Sadau*), Sabah.

Tree 8–20 m. Twigs pale grey-brown, 1.5–4 mm diameter, with grey hairs 0.1 mm or less, early glabrescent, bark finely irregularly striate, slightly longitudinally cracking, not flaking, lenticels absent. Leaves membranous to thinly chartaceous, elliptic(-oblong), 8–20 by 3.5–8 cm, base cuneate, apex acute-acuminate; upper surface dark olivaceous to dull green, glabrous, lower surface olivaceous to dull pale green, glabrous; midrib above slender, flat; nerves 7–12 pairs, above flat or but little raised, lines of interarching distinct or not; venation lax, generally indistinct on both surfaces; petiole 10–18 by 1.5–2 mm; leaf bud 6–10 by 0.6–1 mm, with rather sparse greyish hairs 0.1 mm or less. Inflorescences slender and lax, 5–15 by 1.5–8(–10) cm, few-flowered, peduncle 0.5–2.5 cm, glabrous or glabrescent, hairs sparse, greyish or pale brown, less than 0.1 mm, early caducous, bracts not seen. Flowers (male) in lax umbel-like clusters of 2–6 flowers, 5–20 mm spaced along the main branches of the inflorescence, the buds in one cluster usually in different stages of development; perianth outside with sparse hairs less than 0.1 mm, soon glabrescent, lobes inside towards the apex with pale hairs 0.2–0.4 mm long in between the anthers. Male flowers: pedicel slender, 4–6 mm long; buds broadly ellipsoid or broadly ovoid, 1.8–2 by 1.5–1.6 mm,  $\pm$  3- (or 4-)angular, apex rounded to subacute, base (broadly) rounded, cleft c. 5/6, lobes 3 or 4, widely spreading or  $\pm$  recurved, 0.2 mm thick; synandrium globose or depressed globose, 0.2–0.3 by 0.3–0.4 mm, anthers 3 or 4, androphore slender, 0.8–1 by 0.2 mm. Female flowers not seen. Fruits 1–4 in little-branched panicles 12–25 cm long, ellipsoid-obovoid to ellipsoid-oblong, (4.5–)5–7 by 2.5–3.5 cm, apex rounded, base subattenuate or with an up to 7 mm long narrowed part, glabrous, drying bright to dark brown, finely granulate; pericarp  $\pm$  woody, 5–8 mm thick; fruiting pedicel 25–30 mm; aril lacinate to 1/4–1/3; seeds ellipsoid-oblong, 4 cm long, apex subacute, testa elongately purple-brown variegated.

Field-notes — Once recorded with buttresses. Bark greenish, brown-yellow, yellowish green, or black, smooth or scaly; inner bark either reddish, orange-yellow, with clear red sap, smelling; sapwood white, soft or medium hard. Perianth greenish to yellowish, anthers yellow. Fruits green.

Distribution — *Malesia*: Borneo (Sarawak: 4th Div.; Brunei; Sabah: Beaufort Hill).

Habitat & Ecology — Primary forest on hillsides, ridges; brown or blackish soil; 0–400 m altitude; fl. Jan., May; fr. Jan., Aug., Oct.

Note — Characterized by the minute indumentum, the rather small leaves drying green, the slender and lax inflorescences, the flowers which are in each cluster in different stages of development and greenish when mature, the long-stalked synandrium of only 3 or 4 anthers, and the large fruits drying brown. Specimens may resemble those of the Bornean subspecies of *Endocomia macrocoma*, but they dry brown and have smaller fruits.

### GYMNACRANTHERA

*Gymnacranthera* (A. DC.) Warb., Ber. Pharm. Ges. 2 (1892) 227; Ber. Deutsch. Bot. Ges. 13 (1895) 82; Mon. Myrist. (1897) 131; Gamble, Mat. Fl. Malay Penins. 5, 23 (1912) 222; Ridl., Fl. Malay Penins. 3 (1924) 61; J. Sinclair, Gard. Bull. Sing. 16 (1958) 434; 17 (1958) 96; R.T.A. Schouten, Blumea 31 (1986) 451; W.J. de Wilde, Tree Fl. Sabah & Sarawak 3 (2000) 343. — *Myristica* sect. *Gymnacranthera* A. DC., Ann. Sc. Nat. 4, 4 (1855) 31; Prodr. 14, 1 (1856) 200; Miq., Fl. Ind. Bat. 1, 2 (1858) 63; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 304. — Type species: *Myristica paniculata* A. DC. = *Gymnacranthera paniculata* (A. DC.) Warb.

Shrubs or trees, dioecious. *Twigs* often somewhat compressed, lenticellate, not flaky. *Leaves* rarely brittle when dry, lower surface pale, not papillose, dots absent; reticulation lax, faint. *Inflorescences* paniculate, branched from near the base (female more condensed); flowers in loose clusters, all in the same stage of development; basal cataphylls caducous; bracts caducous. *Flowers* short-pedicellate, bracteole absent. *Male flowers*: perianth urceolate, membranous or leathery, inside pubescent, yellow; buds ellipsoid, cleft to about 1/2 or less, lobes (2 or) 3 or 4, slightly outcurved (in female ± reflexed); androecium sessile or with short and narrow androphore, synandrium (long-)ellipsoid, with 5–12 linear anthers, dorsally connate to the central column, laterally and at apices free, the connective sometimes slenderly protruding. *Female flowers*: shorter and wider than male, ± ovoid; ovary broadly ovoid, pubescent, stigma small, sessile, 2-lobed, each lobe entire or 3–6-lobulate. *Infructescences* paniculate, several-fruited. *Fruits* ellipsoid (globose in *G. canarica*, S India), 2–3.5 cm long, hairy or glabrescent; pericarp thick-leathery; aril lacinate to near the base (as in *Myristica*); seeds not variegated; albumen ruminant, containing a fixed oil, starch absent; cotyledons divaricate, connate at base. — Fig. 5–7.

Distribution — The genus has 7 species, of which one, *G. canarica* (King) Warb., in S India, and 6 in S Thailand and *Malesia* east to E New Guinea; not known from Java, the Lesser Sunda Islands, and Palawan (Philippines). — Map 2 (see p. 3).

#### KEY TO THE SPECIES

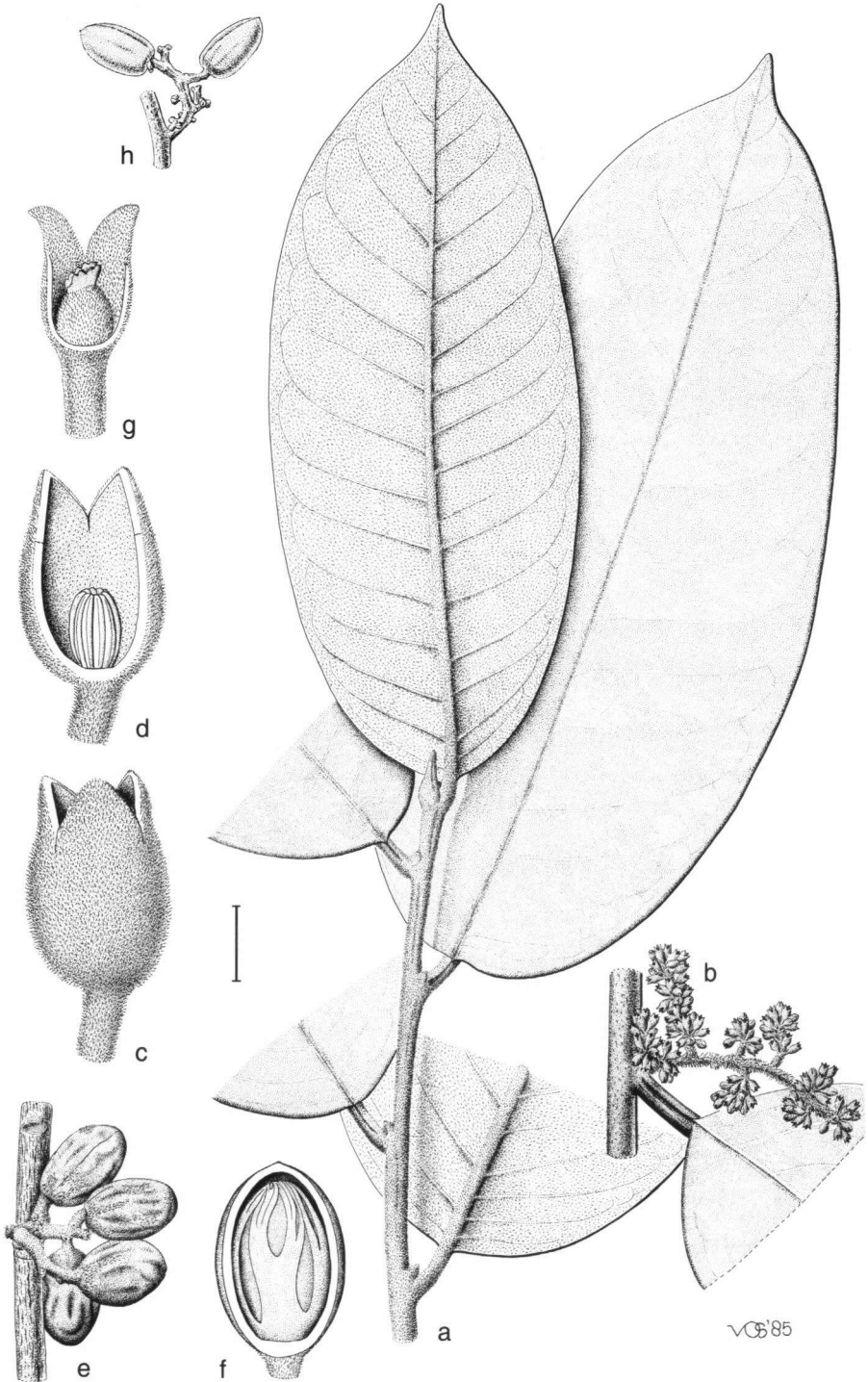
- 1a. Male perianth 4–6 mm long; androecium shorter than the perianth tube. Young twigs and inflorescences with woolly hairs 1(–2) mm long; lower leaf surface with persistent woolly hairs 0.5 mm long. Leaves 18–42 cm long, petiole 3–5 mm thick. Fruits 2.5–3.5 cm long, with hairs 0.3–0.5 mm. — Peninsular Malaysia, Sumatra, Borneo ..... **1. *G. bancana***

- b. Male perianth 2–5 mm; androecium as long as the perianth tube. Young twigs and inflorescences glabrescent, or with hairs less than 0.5 mm; lower leaf surface glabrescent or with appressed hairs, indumentum less than 0.5 mm high. Leaf size variable, petiole 1–3 mm diameter. Fruits 2–3 cm long, pubescent or glabrescent . . . 2
- 2a. Young twigs with ± woolly hairs to 0.5 mm long. Leaves densely pubescent below. Fruits 2.3–3 by 2–2.2 cm, indumentum conspicuous, pericarp 3–5 mm thick. — Central Sulawesi . . . . . **5. *G. maliliensis***
- b. Young twigs glabrescent or variously pubescent by appressed hairs, less than 0.2 mm long. Leaves below glabrescent or with ± scattered hairs. Fruits generally smaller, glabrescent or pubescent, pericarp up to 2 mm thick . . . . . 3
- 3a. Twigs, including the apical part, conspicuously densely set with lenticels. Lower leaf surface with brownish hairs. Midrib flat above; nerves at c. 45° to the midrib in the middle of the leaf. Fruits ellipsoid-ovate with truncate base, 2 cm long, short-pubescent. — Borneo . . . . . **6. *G. ocellata***
- b. Twigs towards the apex without or with but a few lenticels. Lower leaf surface glabrescent or with scattered, inconspicuous, greyish or pale brown hairs. Nerves at more than 45° to the midrib. Fruits globose to ellipsoid-oblong, base not truncate, 1.8–2.8 cm long, glabrescent or pubescent . . . . . 4
- 4a. Twigs at apex 1–2 mm, about 10 cm lower down 2–3.5 mm diameter. Leaves 5–17 (–27) by 1.5–5.5 (–8.5) cm; midrib flat or sunken above. — W & E Malesia (in E Malesia not rarely twigs thicker and leaves larger) . . . . . **3. *G. farquhariana***
- b. Twigs at apex (2–)2.5–4 mm, about 10 cm lower down (3–)3.5–5.5 mm diameter. Leaves larger, 14–33 by (5.5–)6–13 cm; midrib usually sunken . . . . . 5
- 5a. Lateral nerves on lower leaf surface distinct but little prominent, at 60–70° to the midrib in the middle of the leaf; blade drying flat. Anthers 6 (–8), straight. — Borneo . . . . . **2. *G. contracta***
- b. Lateral nerves on lower leaf surface very distinct and prominent, at (35–)40–50 (–55)° to the midrib in the middle of the leaf; blade generally drying irregularly undulate. Anthers 6–10, sometimes twisted. — S Thailand, W Malesia . . . . . **4. *G. forbesii***

### 1. *Gymnacranthera bancana* (Miq.) J. Sinclair

- Gymnacranthera bancana* (Miq.) J. Sinclair, Gard. Bull. Sing. 16 (1958) 436, f. 53, pl. XIII A; 17 (1958) 99; R.T.A. Schouten, Blumea 31 (1986) 463, f. 3a–f. 4; W.J. de Wilde, Tree Fl. Sabah & Sarawak 3 (2000) 345. — *Myristica bancana* Miq., Fl. Ind. Bat., Suppl. (1861) 383; Warb., Mon. Myrist. (1897) 518. — Type: *Teijsmann 3279*, Sumatra, Bangka.
- Myristica murtonii* Hook. f., Fl. Brit. India 5 (1886) 105; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 297, pl. 124 ter. — *Gymnacranthera murtonii* (Hook. f.) Warb., Mon. Myrist. (1897) 357, t. 20; Gamble, Mat. Fl. Malay Penins. 5, 23 (1912) 223; Ridl., Fl. Malay Penins. 3 (1924) 61. — Type: *Murton 13*, Singapore.
- Myristica ferruginea* Wall. ex King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 298, pl. 125. — Type: *Wallich Cat. n. 6803* (lecto), Singapore.
- Myristica amplifolia* Warb., Mon. Myrist. (1897) 517. — Type: *Anonymous n. 16* 'Medang Simpai', Palembang, Sumatra.
- Gymnacranthera murtonii* (Hook. f.) Warb. var. *borneensis* Warb., Mon. Myrist. (1897) 359. — *Myristica murtonii* Hook. f. var. *borneensis* (Warb.) Boerl., Handl. 3 (1900) 88, nom. alt. — *Gymnacranthera bancana* (Miq.) J. Sinclair var. *borneensis* (Warb.) J. Sinclair, Gard. Bull. Sing. 16 (1958) 439; 17 (1958) 100. — Syntypes: *Beccari 1211, 3977*, Kuching, Sarawak.





Tree 15–40 m. *Twigs* 3–6(–8) mm diameter, rusty woolly-tomentose with hairs 0.5–1 mm long, glabrescent, greyish, bark smooth or finely cracked, densely set with lenticels. *Leaves* coriaceous, elliptic to lanceolate, 18–42 by 7.5–19 cm, base short-attenuate to rounded or subcordate, apex acute(–acuminate), margin often revolute; upper surface olivaceous, often glossy, lower surface grey-brown, hairs dense, rusty, 0.5 mm long, glabrescent; midrib above flat, 1–2 mm wide, nerves (13–)15–23 pairs, at 60–70° to the midrib, prominent below, venation indistinct on both surfaces; petiole late glabrescent, 10–20 by 3–5 mm; leaf buds 10–20 by 4–6 mm, with dense brown hairs 0.5–1 mm. *Inflorescences* paniculate, with hairs 1–2 mm long; in male 6–10 cm long, up to 6 cm wide, many-flowered, in female 2–5 cm long, fewer-flowered; bracts triangular, 2–4 mm long, pubescent, caducous. *Flowers* rusty pubescent inside and outside, hairs 0.2–0.3 mm long. *Male flowers*: pedicel 1–3 mm long; buds ellipsoid-oblong, 4–6 by 2–3 mm, cleft 1/4 to nearly 1/2, lobes (long) triangular, slightly spreading, tube 2.5–3.5 mm long; androecium truncately ellipsoid, (sub)sessile, 1.5–2 by 0.8–1.2 mm; anthers (7–)9 or 10, subsessile, free apices ± erect, 0.2–0.3 mm long. *Female flowers* (immature): pedicel 1 mm long; buds coriaceous, ovoid, 4–6 mm long, lobes 3; ovary subglobose, densely pubescent, stigma sessile. *Fruits* 2–8 per infructescence, ellipsoid(–oblong), 2.2–3.5 by 1.5–2.2 cm, with rusty hairs 0.3(–0.5) mm long; pericarp 3 mm thick; fruiting pedicel 3–5 mm long. — **Fig. 5a–f; Photo 1.**

**Field-notes** — A handsome tree, especially when in flower; crown dense or spreading; bole smooth, no buttresses. Bark brown to grey, slightly fissured, finely or thickly flaky, or scaly; slash wood white to yellow. Flowers golden yellow with a brownish tinge, with a spicy odour when crushed.

**Distribution** — *Malaysia*: Sumatra (Aceh, Indragiri, Jambi, Palembang, Bangka, Riau), Peninsular Malaysia (Johore), Singapore, Borneo (Sarawak, Brunei).

**Habitat & Ecology** — Primary and degraded dryland forest, also swamp forest and on hillsides and ridges, on granite, sand and sandy loam soil; up to 250 m altitude; fl. Sept., Oct.; fr. throughout the year.

## 2. *Gymnacranthera contracta* Warb.

*Gymnacranthera contracta* Warb., Mon. Myrist. (1897) 360, t. 20 (excl. *Motley 1284* = *Gymnacranthera forbesii*); J. Sinclair, Gard. Bull. Sing. 16 (1958) 439, f. 54, p.p.; 17 (1958) 100, p.p.; R.T.A. Schouten, Blumea 31 (1986) 471, f. 4; W.J. de Wilde, Tree Fl. Sabah & Sarawak 3 (2000) 347. — *Myristica contracta* (Warb.) Boerl., Handl. 3 (1900) 88. — Type: *Beccari 321* (male, female), Sarawak.

Tree 5–26 m. *Twigs* subterete to angular or ± ridged, 3–4(–5.5) mm diameter, hairs minute, early glabrescent, bark chocolate to greyish brown, finely longitudinally cracked

**Fig. 5.** *Gymnacranthera bancana* (Miq.) J. Sinclair. a. Habit of leafy twig; b. male inflorescence; c. male flower; d. ditto, opened, showing porportionally small androecium; e. fruits; f. fruit, opened, showing thin pericarp and deeply lacinated aril of seed. — *G. ocellata* R.T.A. Schouten. g. Female flower, opened, showing pubescent ovary with obliquely 2-lipped sessile stigma, each lip shallowly lobulate; h. fruits, note truncate bases [a: *SF 39502* (Sinclair), b–d: *SF 40045* (Sinclair); e, f: Sinclair & Kadim 10436; g: Endert 4835; h: *S 39255* (Ilias Paie)]. — Scale bar for a, b, e, h = 2 cm; for c, d, g = 1.65 mm; for f = 1 cm.

with lenticels when older. *Leaves* chartaceous or subcoriaceous, elliptic-oblong to lanceolate, sometimes  $\pm$  parallel-sided, (16–)20–29 by 6–9.5 cm, base short-attenuate to broadly rounded, apex (acute-)acuminate, margin flat; upper surface  $\pm$  brown, often glossy, lower surface greyish to violaceous, with scattered appressed hairs, glabrescent; midrib above slightly sunken (grooved), narrow, 1 mm wide, nerves (11–)13–18 pairs, at 60–70° to the midrib, below slender, distinct but not much prominent, venation indistinct at both surfaces; petiole 10–20(–25) by 2–2.5 mm; leaf buds 4–8 by 2–3 mm, sometimes with scale-like cataphylls, densely minutely appressed-pubescent. *Inflorescences* in male (broadly) paniculate, 3.5–4.5 cm long, up to 4 cm wide, many-flowered, with rusty hairs 0.3–0.5 mm long, in female 1.5–2 by 1 cm, fewer flowers but more dense; bracts broadly triangular, 2.5 by 3 mm, pubescent, caducous. *Flowers* rusty pubescent inside and outside, hairs 0.1–0.2 mm long. *Male flowers*: pedicel 2–2.5 mm long; buds ellipsoid-oblong, 2.5–2.8 by 1.5–2 mm, cleft 1/3 to nearly 2/3, lobes 3 or 4, triangular, slightly spreading, tube 1–1.8 mm long; androecium truncately ellipsoid-oblong, 1.7 by 0.6–0.7 mm, up to 0.2 mm stiped; anthers 6(–8), subsessile, free apices 0.3 mm long, erect. *Female flowers*: pedicel 1–2 mm long; buds narrowly obovoid, 3–3.5 by 2 mm, cleft 2/3–3/4, lobes 3 or 4, long-triangular, curved outward or reflexed, tube 0.7–1 mm long; ovary subglobose, minutely pubescent, 1.2 mm diameter, stigma sessile, minutely 2-lobed. *Fruits* c. 7 per infructescence, ellipsoid, 2–2.2 by 1–1.4 cm, with hairs 0.1 mm, or early glabrescent; pericarp 1.2–1.4 mm thick; fruiting pedicel 3–7 mm long.

Field-notes — Bark reddish brown, nearly smooth, very fine scaly; inside hard, pale reddish brown. Flowers yellow. Fruits dark red.

Distribution — *Malesia*: Borneo (Sarawak, Brunei, Sabah; possibly also W Kalimantan: *Suzuki 9993*).

Habitat & Ecology — Primary lowland forest, 0–580 m altitude; fl. July–Sept.; fr. Oct.–Dec.

### 3. *Gymnacranthera farquhariana* (Hook. f. & Thomson) Warb.

*Gymnacranthera farquhariana* (Hook. f. & Thomson) Warb., *Mon. Myrist.* (1897) 365, t. 20; R. T. A. Schouten, *Blumea* 31 (1986) 476, f. 7; W. J. de Wilde, *Tree Fl. Sabah & Sarawak* 3 (2000) 348. — *Myristica farquhariana* Wall. ex Hook. f. & Thomson, *Fl. Ind.* (1855) 161, p. p. — Lectotype: *Wallich Cat. no 6795* (K), Singapore.

For more references and synonyms see the varieties.

Tree 3–30(–45) m. *Twigs* faintly angular,  $\pm$  ridged or lined when young, 1–2(–3.5) mm diameter, with hairs 0.1 mm, early glabrescent, bark chocolate or grey, later on grey-brown, smooth, lenticellate. *Leaves* thinly chartaceous to coriaceous, elliptic to lanceolate, 5–17 by 1.5–5.5(–6) cm, in E Malesia up to 27 by 8.5 cm, apex acute(-acuminate), base attenuate, margin conspicuously revolute or not, olivaceous or brown, sometimes glossy above; lower surface with sparse appressed hairs 0.1 mm, glabrescent, pale brown to grey-purplish; midrib above flat or sunken (grooved), to 1 mm wide; nerves 7–11 (–15) pairs, flat or raised below, discoloured or not; venation indistinct; petiole 6–15 (–18) by 1–2.5 mm; leaf buds slender, 5–10 by 1–2 mm, with dense appressed greyish hairs 0.1 mm. *Inflorescences* paniculate, with rusty hairs 0.2 mm long; in male 2.5–12 cm long, up to 8 cm wide, many-flowered, in female up to 4 by 2 cm, fewer flowered; bracts broadly triangular, 1 by 2 mm, pubescent, caducous. *Flowers* rusty pubescent inside and outside, hairs 0.1 mm long. *Male flowers*: pedicel 1.5–4 mm long; buds ellip-

soid(-oblong), 2.5–4 by 2–3 mm, cleft 1/3–2/3, lobes 3 or 4, (long-)triangular, slightly spreading, tube 1–2.3 mm long; androecium truncately ellipsoid-oblong, 1–2.5 by 0.8–1 mm, stiped up to 0.3 mm; anthers (6 or) 7–11(–13), subsessile, free apices up to 0.5 mm long, erect or somewhat incurved. *Female flowers*: pedicel 1.5–3 mm long, buds ovoid or obpyriform, 2–3 by 1.5–2 mm, cleft 1/2–3/4, lobes 3 or 4, long-triangular, strongly spreading or recurved, tube short-urceolate, 0.7–1.5 mm long; ovary subglobose, 1 mm diameter, densely minutely pubescent, stigma minute, subsessile. *Fruits* up to 13 per infructescence, subglobose to ellipsoid-oblong, 1.8–2.8 by 1.1–1.9 cm, glabrescent (glabrous) or inconspicuously pubescent, hairs 0.1 mm long; pericarp 1 mm thick; fruiting pedicel 4–15 mm long.

Distribution — A widespread species ranging from Peninsular Malaysia to the Bismarck Archipelago. Four varieties of *Gymnacranthera farquhariana* are recognized to accommodate its particularly complex variation. The varieties are very close to each other, and several specimens are not easily placed within a variety.

#### KEY TO THE VARIETIES

- 1a. Leaves oblong-lanceolate, small, 5–13.5 by 1.5–4.5 cm; nerves below not or hardly raised, i.e. usually they cannot be felt with the finger. Fruits short-ellipsoid to globose. — Sumatra, Peninsular Malaysia, Borneo . . . . . **b. var. eugeniifolia**
- b. Leaves small or large, 6–27 by 2–8.5 cm; nerves below usually clearly visible and contrasting, usually distinctly raised and to be felt with the finger. Fruits various
- 2a. Leaves coriaceous, elliptic(-oblong), 6–15(–17) by 3–5.5(–6) cm, usually with conspicuously revolute edge. [Fruits globose to short-ellipsoid.] — Sumatra, Peninsular Malaysia, Borneo . . . . . **a. var. farquhariana**
- b. Leaves membranous, chartaceous, or sometimes coriaceous, (elliptic-oblong to) lanceolate, 8–27 by 2–8.5 cm, margin flat, rarely revolute . . . . . 3
- 3a. Fruits globose to short-ellipsoid, fruiting pedicel 8–15 mm long. — Philippines . . . . . **c. var. paniculata**
- b. Fruits ellipsoid to oblong, rarely subglobose (Moluccas), fruiting pedicel 4–8 mm long. — W Malesia (nerves on lower surface of blade usually pale yellowish), E Malesia (nerves usually reddish brown and contrasting), rare in the Philippines . . . . . **d. var. zippeliana**

#### **a. var. farquhariana**

*Gymnacranthera farquhariana* (Hook. f. & Thomson) Warb. var. *farquhariana*; R.T.A. Schouten, Blumea 31 (1986) 477; W.J. de Wilde, Tree Fl. Sabah & Sarawak 3 (2000) 349. — *Gymnacranthera farquhariana* (Hook. f. & Thomson) Warb., Mon. Myrist. (1897) 365, t. 20, p.p. — *Myristica farquhariana* Wall. ex Hook. f. & Thomson, Fl. Ind. (1855) 161, p.p.; A.D.C., Prodr. 14, 1 (1856) 200, p.p.; Miq., Fl. Ind. Bat. 1, 2 (1858) 63, p.p.; Hook. f., Fl. Brit. India 5 (1886) 108, p.p.; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 305, pl. 138.

*Myristica griffithii* Hook. f., Fl. Brit. India 5 (1886) 109 (excl. *Maingay 1306A & B* = var. *eugeniifolia*); King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 304, pl. 135 (excl. *Curtis 2406, 2458* = *Horsfieldia penangiana*). — *Gymnacranthera farquhariana* (Hook. f. & Thomson) Warb. var. *griffithii* (Hook. f.) Warb., Mon. Myrist. (1897) 368; Gamble, Mat. Fl. Malay Penins. 5, 23 (1912) 226, p.p.; Ridl., Fl. Malay Penins. 3 (1924) 62. — *Gymnacranthera eugeniifolia* (A.D.C.) J. Sinclair var. *griffithii* (Hook. f.) J. Sinclair, Gard. Bull. Sing. 16 (1958) 447, f. 57; 17 (1958) 113. — Lectotype: *Griffith 4356* (K), Malacca.

*Myristica farquhariana* Wall. ex Hook. f. & Thomson var. *major* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 306, pl. 136, f. 4. — *Gymnacranthera farquhariana* (Hook. f. & Thomson) Warb. var. *major* (King) Gamble, Mat. Fl. Malay Penins. 5, 23 (1912) 226; Ridl., Fl. Malay Penins. 3 (1924) 62. — Lectotype: Griffith 4355 (K), Malacca.

Tree 3–30 m. *Leaves* coriaceous; blade elliptic(-oblong), widest at or above the middle, 6–15(–17) by 3–5.5(–6) cm, usually with a conspicuously revolute margin; nerves 7–11 pairs, on the lower leaf surface distinct and discoloured or not, but always clearly raised and to be felt with the finger; petiole 8–18 by 1.5–2 mm. *Fruits* 1–6 per infructescence, globose to short-ellipsoid; fruiting pedicel 6–15 mm long. — **Photo 3.**

Field-notes — Crown dense or spreading; bole smooth, in peat swamps sometimes with buttresses or with a few stilt-roots. Bark dark brown, brittle; slash wood whitish. Flowers yellow. Fruits yellow to orange, very spicy.

Distribution — Peninsular Thailand; *Malesia*: S Sumatra (Lampung), Peninsular Malaysia, Singapore, Borneo.

Habitat & Ecology — Primary and degraded forest; mostly in peat swamp forest, occasionally on hillsides; 0–1000 m altitude; fl. mainly Apr.–July; fr. Sept.–Mar.

#### b. var. *eugeniifolia* (A. DC.) R.T.A. Schouten

*Gymnacranthera farquhariana* (Hook. f. & Thomson) Warb. var. *eugeniifolia* (A. DC.) R.T.A. Schouten, Blumea 31 (1986) 480; W.J. de Wilde, Tree Fl. Sabah & Sarawak 3 (2000) 349. — *Myristica eugeniifolia* A. DC., Ann. Sc. Nat. 4, 4 (1855) 29; Prodr. 14, 1 (1856) 190; Miq., Fl. Ind. Bat. 1, 2 (1858) 58; Hook. f., Fl. Brit. India 5 (1886) 113. — *Gymnacranthera eugeniifolia* (A. DC.) J. Sinclair, Gard. Bull. Sing. 16 (1958) 444, p. p. — *Gymnacranthera eugeniifolia* (A. DC.) J. Sinclair var. *eugeniifolia*; J. Sinclair, Gard. Bull. Sing. 16 (1958) 444, f. 56, pl. XIV, p. p.; 17 (1958) 112, p. p. — Type: *Gaudichaud 116*, Penang.

*Myristica farquhariana* auct. non Hook. f. & Thomson, p. p.: Hook. f., Fl. Brit. India 5 (1886) 108; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 305. — *Gymnacranthera farquhariana* auct. non (Hook. f. & Thomson) Warb., p. p.: Warb., Mon. Myrist. (1897) 365; Gamble, Mat. Fl. Malay Penins. 5, 23 (1912) 225; Ridl., Fl. Malay Penins. 3 (1924) 62.

*Myristica griffithii* auct. non Hook. f.: Hook. f., Fl. Brit. India 5 (1886) 109 (as for syntype *Maingay 1306* only).

*Gymnacranthera apiculata* Warb., Mon. Myrist. (1897) 359, t. 20. — *Myristica apiculata* (Warb.) Boerl., Handl. 3 (1900) 88. — Type: *Beccari 2246*, Borneo, Sarawak.

Tree 3–30 m. *Leaves* chartaceous or coriaceous; blade oblong-lanceolate, widest at or below the middle, 5–13.5 by 1.5–4.5 cm, margin little or conspicuously revolute or not; nerves 6–10 pairs, on lower leaf surface not or hardly raised, usually concolorous and not to be felt with the finger; petiole 7–14 by 1–1.5 mm. *Fruits* 1–3(–5) per infructescence, subglobose, 1.8–2.2 by 1.3–1.8 cm; fruiting pedicel 4–13 mm long.

Field-notes — Crown small, narrow, dense or not; bole smooth, no buttresses. Bark brown(-grey), finely fissured, with small scales; wood white to pale brown. Flowers bright yellow. Fruits green turning golden yellow to orange, very spicy.

Distribution — *Malesia*: throughout Sumatra, Peninsular Malaysia, Singapore, and Borneo.

Habitat & Ecology — Primary and degraded forest, on dry land (hillsides and ridges) as well as in (periodically) wet places, near streams and rivers, and in kerangas; found on limestone and on sandy soils; 0–1300 m altitude; fl. mainly Mar.–Oct.; fr. July–Feb.

Note — The distribution of var. *eugeniifolia* largely coincides with that of var. *farquhariana*. Specimens from Borneo here referred to var. *eugeniifolia* were formerly sometimes determined as *Gymnacranthera contracta*, a species now accepted in a much more restricted sense. Also specimens intermediate with var. *zippeliana* occur, especially in Sabah and Sarawak.

**c. var. paniculata (A. DC.) R.T.A. Schouten**

*Gymnacranthera farquhariana* (Hook. f. & Thomson) Warb. var. *paniculata* (A. DC.) R.T.A. Schouten, *Blumea* 31 (1986) 481. — *Myristica paniculata* A. DC., *Ann. Sc. Nat.* 4, 4 (1855) 31; *Prodr.* 14, 1 (1856) 200; *Miq., Fl. Ind. Bat.* 1, 2 (1858) 63; *Fern.-Vill., Nov. App.* (1880) 177; *Vidal, Phan. Cuming.* (1885) 139; *Rev. Pl. Vasc. Filip.* (1886) 221. — *Gymnacranthera paniculata* (A. DC.) Warb., *Mon. Myrist.* (1897) 370, t. 20; *Merr., Philipp. J. Sci., Suppl.* 1 (1906) 55; *Enum. Philipp. Flow. Pl.* 2 (1923) 181; *Elmer, Leafl. Philipp. Bot.* 3 (1911) 1059; *J. Sinclair, Gard. Bull. Sing.* 17 (1958) 104. — *Gymnacranthera paniculata* (A. DC.) Warb. var. *paniculata*; *J. Sinclair, Gard. Bull. Sing.* 17 (1958) 104, f. 2. — Type: *Cuming 901*, Luzon.

*Myristica farquhariana* auct. non Hook. f. & Thomson, p. p.: Hook. f., *Fl. Brit. India* 5 (1886) 108 (for the Philippine specimen).

*Gymnacranthera laxa* Elmer, *Leafl. Philipp. Bot.* 8 (1915) 2772. — Type: *Elmer 13715*, Philippines, Mindanao.

*Gymnacranthera acuminata* Merr., *Philipp. J. Sci., Bot.* 12 (1917) 265; *Enum. Philipp. Flow. Pl.* 2 (1923) 181. — Type: *FB 21074 (Cenabre & Cortes)*, Philippines, Samar.

*Gymnacranthera macrobotrys* Merr., *Philipp. J. Sci., Bot.* 13 (1918) 284; *Enum. Philipp. Flow. Pl.* 2 (1923) 181. — Type: *BS 1171 (Ramos)*, Philippines, Leyte.

Tree 8–14 m. *Leaves* chartaceous; blade (oblong-)lanceolate, 9–21 by 3–6 cm, margin not revolute; nerves (8–)9–11 pairs, on lower leaf surface distinct, sometimes discolorous, little raised; petiole 8–15 by 1–2 mm. *Fruits* 1 or 2(–4) per infructescence, subglobose or short-ellipsoid, 1.8–2.3 by 1.5–1.9 cm (when large with marked ridge on the suture); fruiting pedicel 8–15 mm long.

Field-notes — Bark smooth, brittle, pale grey-brown, 1 cm thick. Fruits orange; seeds banded brown and black, with but little spicy taste.

Distribution — *Malesia*: Philippines.

Habitat & Ecology — Forest on ridges as well as by rivers and lakes; up to 1400 m altitude; fl. mainly Apr.–June, Aug.–Oct.; fr. Jan.–July.

Note — This variety is restricted to the Philippines. It is very close to var. *zippeliana* from which it differs only in the fruits; in var. *zippeliana* the fruits are usually ellipsoid-oblong, not subglobose, and have a shorter fruiting pedicel. *FB 21074* (the type of *G. acuminata*) and *Sulit 14603*, from Samar, deviate in rather small leaves with glossy upper surface.

**d. var. zippeliana (Miq.) R.T.A. Schouten**

*Gymnacranthera farquhariana* (Hook. f. & Thomson) Warb. var. *zippeliana* (Miq.) R.T.A. Schouten, *Blumea* 31 (1986) 482; *W.J. de Wilde, Tree Fl. Sabah & Sarawak* 3 (2000) 349. — *Myristica zippeliana* Miq., *Ann. Mus. Bot. Lugd.-Bat.* 2 (1865) 50; *Scheff., Ann. Jard. Bot. Buitenzorg* 1 (1876) 45. — *Gymnacranthera zippeliana* (Miq.) Warb., *Mon. Myrist.* (1897) 373. — *Gymnacranthera paniculata* (A. DC.) Warb. var. *zippeliana* (Miq.) *J. Sinclair, Gard. Bull. Sing.* 17 (1958) 108, f. 3. — Type: *Zippelius s. n.*, Irian Jaya, Bird's Head.

*Gymnacranthera suluensis* Warb., Mon. Myrist. (1897) 373; Elmer, Leaflet Philipp. Bot. 3 (1911) 1058; Merr., Enum. Philipp. Flow. Pl. 2 (1923) 181. — Syntypes: *Vidal 3546, 3561*, Philippines, Sulu I., Basilan.

Tree 3–30(–45) m. *Leaves* thickly membranous or chartaceous, sometimes subcoriaceous; blade (oblong-)lanceolate, widest at or above the middle, 7.5–27 by 3.5–8.5 cm, margin not revolute; nerves 8–11(–15) pairs, on lower leaf surface distinct or not, but always clearly raised, either pale yellowish, concolorous (W Malesia), or reddish or purplish brown, discoloured (generally in E Malesia); petiole 7–15 by 1–2.5(–3) mm. *Fruits* (1 or) 2–13 per infructescence, ellipsoid to oblong, rarely subglobose, (1.5–) 1.8–2.5 by 1.1–1.5 cm; fruiting pedicel 4–8 mm long.

Field-notes — Crown dense, narrow; bole smooth, no buttresses. Bark brown or grey, slightly fissured and finely flaky or scaly; inner bark dark brown, 5–14 mm thick, slash wood white to yellow; heartwood yellow to brown, hard. Flowers golden yellow to brown, odourless or faintly sweet; androecium brownish; pollen whitish. Seeds dark brown.

Distribution — *Malesia*: Peninsular Malaysia, S Philippines, and New Guinea (incl. the Bismarck Archipelago), not in Java or the Lesser Sunda Islands. The most widespread taxon of *Gymnacranthera*.

Habitat & Ecology — Variable; found in primary or in degraded and secondary forest, mostly on hillsides and ridges, in New Guinea usually on foothills and riverbanks, also near the coast; on sandstone, clay, loam, and granite rock; 0–900 m altitude, in Borneo 400–1200 m; fl. mainly Jan.–June, Aug.–Oct. (Borneo mainly July–Nov.); fr. Jan.–June, Aug.–Sept. (Borneo Mar.–May, Oct.–Nov.). Locally abundant, but frequently mentioned as growing in regenerating forest.

Uses — In Papua Barat (Bird's Head) the bark, together with lime, is used to prepare the skins of birds.

Notes — 1. *Gymnacranthera farquhariana* var. *zippeliana* is variable in leaf size. In Sulawesi, Moluccas, and New Guinea in particular, specimens with large leaves up to 27 cm long are found. The fruits also are variable in shape and size. Particularly distinctive fruits are found in *de Vogel 3789, 3795, 3955*, from Bacan I., which have small, almost globose fruits 1.2 cm diameter; the trees are 40–45 m high (other specimens have never been recorded as being taller than 33 m). In all other characters these specimens agree with var. *zippeliana*, but more material may show them to represent a separate taxon.

2. The fruits of some specimens from New Guinea are ± ellipsoid(-oblong), and are intermediate in shape with those of var. *paniculata*; they are placed in var. *zippeliana* because of their short fruiting pedicels.

3. Occasionally specimens are found with particularly brittle leaves when dry, a character not often met with in other *Gymnacranthera* species.

4. Some collections from New Britain have leaves drying dull with the nerves sunken above, and pale, often purplish-whitish below, but intermediate forms exist with the remainder of var. *zippeliana*.

#### 4. *Gymnacranthera forbesii* (King) Warb.

*Gymnacranthera forbesii* (King) Warb., Mon. Myrist. (1897) 363, t. 20; Gamble, Mat. Fl. Malay Penins. 5, 23 (1912) 224; Ridl., Fl. Malay Penins. 3 (1924) 61; J. Sinclair, Gard. Bull. Sing. 16 (1958) 441, f. 55, pl. XIII B; 17 (1958) 101, f. 1A, C; R.T.A. Schouten, Blumea 31 (1986) 472,

474; W.J. de Wilde, *Tree Fl. Sabah & Sarawak* 3 (2000) 350. — *Myristica forbesii* King, *Ann. Roy. Bot. Gard. Calc.* 3 (1891) 306, t. 137. — Lectotype: *Forbes* 2976 (female fl.) (K), Sumatra, Benkulu.

Tree 5–35 m. *Twigs* subterete to angular or ridged, (2–)2.4–4(–5.5) mm diameter, hairs 0.1 mm or less, early glabrescent, bark chocolate, later on brown or grey, finely cracked, with many lenticels. *Leaves* chartaceous or coriaceous, elliptic to oblong-lanceolate, widest at or below the middle, 14–33 by (5.5–)6–13 cm, base (short-)attenuate to broadly rounded, apex (acute-)acuminate, blade coarsely undulate on drying, margin not revolute; upper surface olivaceous to brown, sometimes glossy, lower surface grey (-purple) to brownish, with scattered appressed minute hairs, glabrescent; midrib above somewhat sunken (grooved) above, 1.5 mm wide, nerves 10–18 pairs, at (35–)40–50 (–55)° to the midrib, yellowish, distinct and (very) prominent below, venation sometimes distinct at the lower surface; petiole 8–20 by 1.5–3 mm; leaf buds 5–10 by 1.5–4 mm, with dense greyish hairs 0.1 mm. *Inflorescences* paniculate, with (grey-)rusty ± woolly hairs 0.2–0.4 mm long; in male 4–12 cm long, up to 8 cm wide, many-flowered, in female 1–4 cm long, 1–3 cm wide, generally fewer flowered; bracts triangular, 3 by 3.5 mm, pubescent, caducous. *Flowers* grey-rusty pubescent inside and outside, hairs 0.1–0.2 mm long. *Male flowers*: pedicel 2–3 mm long; buds ellipsoid-oblong, 2.5–4 by 1.5–2 mm, cleft 1/3–nearly 1/2, lobes 3 (or 4), (long-)triangular, only slightly spreading, tube 1.5–2.3 mm long; androecium ± truncately ellipsoid-oblong, stiped to 0.2 mm long, 1.5–2.3 by 1 mm; anthers 6–10, subsessile, often somewhat twisted, free apices 0.3–0.5 mm long, ± erect. *Female flowers*: pedicel 2 mm long; buds ovoid or pyriform, 2–2.5 by 1.7–2 mm, cleft to c. 3/4, lobes (2 or) 3, strongly spreading or recurved, tube short-urceolate, 0.5–0.7 mm long; ovary subglobose, 1–1.3 mm diameter, densely minutely pubescent; stigma sessile, minutely 2-lobed. *Fruits* 4–25 per infructescence, ellipsoid-oblong, 1.8–2.4 by 1–1.4 cm, (early) glabrescent or short-pubescent, hairs 0.1 mm; pericarp 1 mm thick; fruiting pedicel 4–10 mm long. — **Photo 2.**

*Distribution* — S Thailand; *Malesia*: Sumatra, Peninsular Malaysia, Singapore, Borneo. Somewhat arbitrarily two varieties can be distinguished, of which one confined to Borneo.

*Note* — The leaves of *G. forbesii* usually dry coarsely undulate, not flat as in other species.

#### KEY TO THE VARIETIES

- 1a. Leaves chartaceous to coriaceous; nerves on lower surface moderately prominent, 0.3–0.5 mm wide. Infructescences usually not branched at the base, few-fruited. — Peninsular Malaysia, Sumatra, Borneo . . . . . **a. var. forbesii**  
 b. Leaves (very) coriaceous; nerves on lower surface more prominent, 0.5–0.7 mm wide. Infructescences conspicuously branched from the base, many-fruited. — Borneo . . . . . **b. var. crassinervis**

#### **a. var. forbesii**

*Gymnacranthera forbesii* (King) Warb. var. *forbesii*; J. Sinclair, *Gard. Bull. Sing.* 17 (1958) 101, f. 1A, C, p.p.; R.T.A. Schouten, *Blumea* 31 (1986) 474; W.J. de Wilde, *Tree Fl. Sabah & Sarawak* 3 (2000) 350.



*Twigs* (2–)2.5–3(–4) mm diameter. *Leaves* chartaceous or subcoriaceous; blade elliptic to oblong, 14–28 by (5.5–)6–13 cm; nerves on lower surface moderately prominent, 0.3–0.5 mm wide. *Infructescences* not or little branched at base, with 4–10 fruits.

*Field-notes* — Crown irregular, dense; bole usually straight, not buttressed. Bark soft, grey to brown, smooth, finely fissured, or thinly flaky; the inner bark pink to red-brown, laminated, sometimes fibrous; slash wood white to pale yellow. Flowers brown-green in buds, bright yellow at anthesis; pollen whitish. Fruits brown-green turning orange.

*Distribution* — S Thailand (Pattani); *Malesia*: Sumatra, Peninsular Malaysia, Singapore, Borneo.

*Habitat & Ecology* — Primary and degraded forest; hillsides and riverbanks, alluvial forest; on sandy and limestone-derived soils; up to 600 m altitude; fl. Feb.–Apr., Aug.–Sept.; fr. May–July(–Aug.), Dec.–Jan.

#### b. var. *crassinervis* (Warb.) J. Sinclair

*Gymnacranthera forbesii* (King) Warb. var. *crassinervis* (Warb.) J. Sinclair, Gard. Bull. Sing. 17 (1958) 102, f. 1B; R.T.A. Schouten, Blumea 31 (1986) 475; W.J. de Wilde, Tree Fl. Sabah & Sarawak 3 (2000) 350. — *Gymnacranthera crassinervis* Warb., Mon. Myrist. (1897) 362, t. 20. — *Myristica crassinervis* (Warb.) Boerl., Handl. 3 (1900) 88. — *Lectotype*: Beccari 1119 (K), Sarawak.

*Twigs* (2.5–)3–4(–5.5) mm diameter, lower down 3.5–5.5 mm. *Leaves* coriaceous; blade elliptic-oblong to oblong-lanceolate, 16–33 by 6–12 cm; nerves on lower surface strongly prominent, conspicuous, 0.5–0.7 mm wide. *Infructescences* often conspicuously branched from the base, with 8–25 fruits.

*Field-notes* — Bole without buttresses. Bark grey to brown, smooth or sometimes slightly flaky, slash wood white-orange-brown. Flowers bright yellow. Fruits brown green, orange-red when ripe.

*Distribution* — *Malesia*: most of Borneo (according to Sinclair W Kalimantan, but no specimens seen).

*Habitat & Ecology* — Primary and degraded dryland as well as wet forest, alluvial forest; on sandy(-clay) and loamy soils; up to 1250 m altitude; fl. mainly Apr., Aug.–Oct.; fr. Apr., Aug.–Dec.

*Note* — *Gymnacranthera forbesii* var. *crassinervis* usually is easily recognized and distinguished from var. *forbesii* and other species of *Gymnacranthera* by its stout twigs and leaves and usually strong orange-yellowish lateral nerves, which are very distinctly raised on the lower leaf surface. *Gymnacranthera bancana* also is a stout species, but leaves and young twigs are always rusty tomentose, whereas the present variety is almost glabrous.

### 5. *Gymnacranthera maliliensis* R.T.A. Schouten

*Gymnacranthera maliliensis* R.T.A. Schouten, Blumea 31 (1986) 467, f. 5. — *Type*: van Balgooy 3960, eastern Central Sulawesi.

Tree 6–20 m. *Twigs* terete to slightly angular, 1.5–2.5(–4) mm diameter, lower down 3–4 mm, when young rusty pubescent by woolly hairs, not very appressed, hairs woolly, to 0.5 mm long, glabrescent, greyish to brown with the bark smooth or finely longitu-

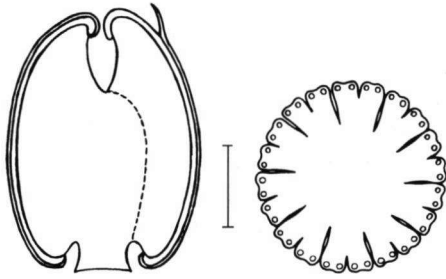


Fig. 6. Schematic drawing, in longitudinal and transverse section, of the androecium of *Gymnacranthera maliliensis* R.T.A. Schouten; note the minute appendix of the connectivum; the broken line indicates the depth of the incision between the anthers. — Scale bar = 1 mm.

*Inflorescences* (broadly) paniculate, with rusty hairs 0.5 mm long; in male 4.5–7 cm long, up to 6 cm wide, many-flowered, in female (from infructescences) little or much branched, rather few- to many-flowered, 3–5 cm long; bracts broadly triangular, 2.5 mm, pubescent, caducous. *Flowers* rusty pubescent inside and outside, hairs 0.1–0.2 mm long. *Male flowers*: pedicel 2.5–4 mm long; buds ellipsoid-oblong, 3.5–4 by 2 mm, cleft to 1/4–1/2, lobes 3 or 4, (long-)triangular, somewhat spreading, tube 2–2.7 mm long; androecium  $\pm$  truncately ellipsoid, 1.8–2.3 by 1.7 mm, stipe 0.2 mm; anthers 8–10, subsessile, the free apices 0.5 mm long, erect or curved slightly inward. *Female flowers* not seen. *Fruits* up to 25 in immature infructescences, 3–6 when mature, ellipsoid, 2.3–3 by 2–2.2 cm, hairs persistent, rusty, 0.2 mm; pericarp 3–5 mm thick; fruiting pedicel stout, 4–8 mm long. — Fig. 6, 7.

*Field-notes* — Tree to 20 m, dbh to 25 cm, with red sap. Flowers dark yellow. Unripe fruits brown.

*Distribution* — *Malesia*: E Central Sulawesi, east of Malili.

*Habitat & Ecology* — Primary and degraded forest on ultrabasic (nickel-containing) soils; 200–500 m altitude; fl. Feb., July; fr. Oct.

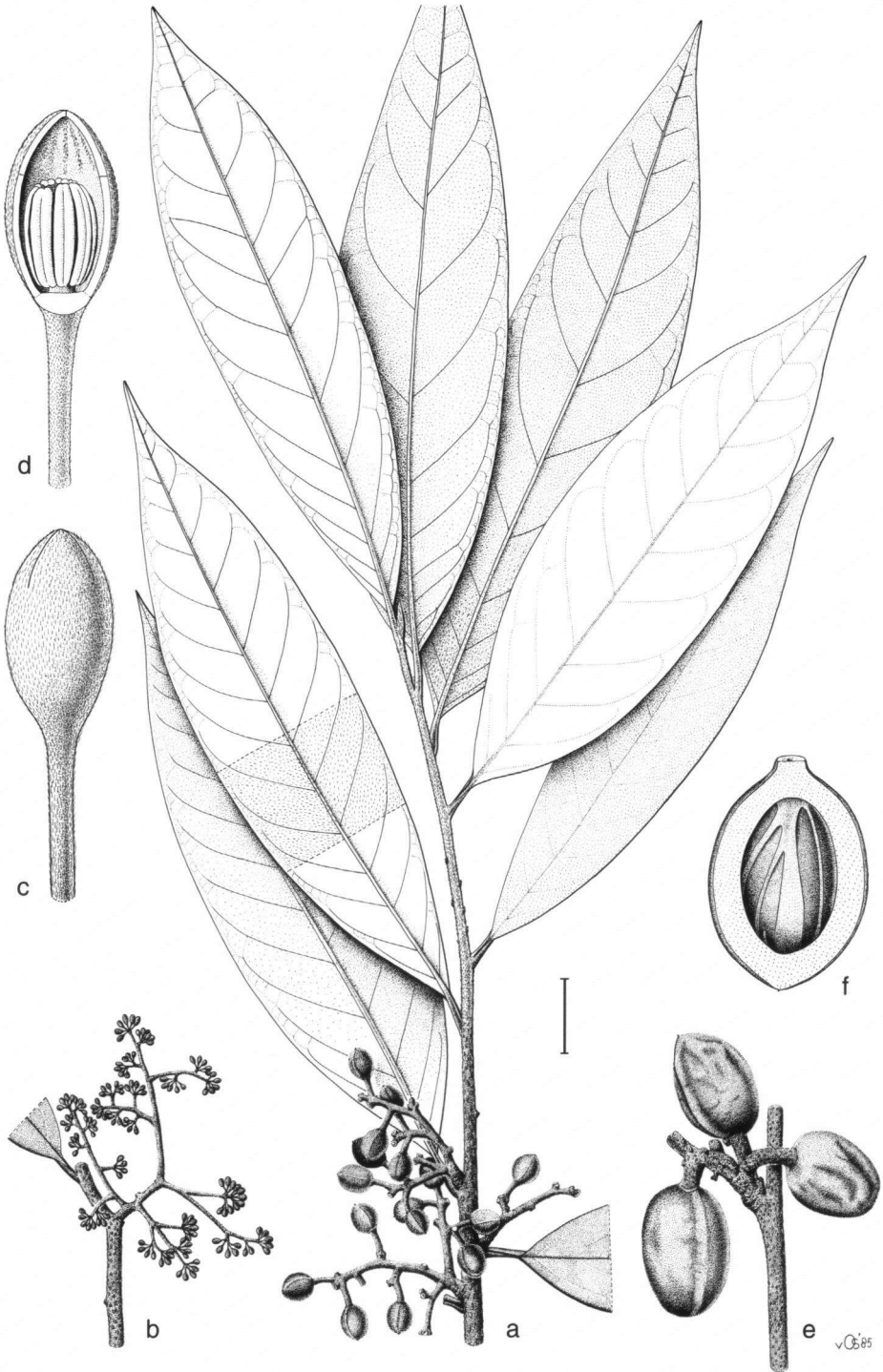
*Note* — Endemic to Central Sulawesi; restricted to soils derived from ultrabasic rock. Distinguished from the only other species occurring in Sulawesi, *G. farquhariana* var. *zippeliana*, by the more conspicuous indumentum of woolly hairs on the young twigs and the large fruits with thick pericarp.

## 6. *Gymnacranthera ocellata* R.T.A. Schouten

*Gymnacranthera ocellata* R.T.A. Schouten, *Blumea* 31 (1986) 469, 3g, h; W.J. de Wilde, *Tree Fl. Sabah & Sarawak* 3 (2000) 351. — Type: SAN 72177 (*Saikeh*), Sabah.

Tree 10–25 m. *Twigs* somewhat angular or  $\pm$  compressed, 2–3.5(–6.5) mm diameter, with appressed hairs 0.2 mm high, glabrescent, the bark brown or grey, smooth or finely cracked, with dense conspicuous lenticels of mixed size, even when young; at the base

dinally cracked, densely set with lenticels. *Leaves* chartaceous or coriaceous, (oblong-)lanceolate, 10–28(–30) by 3–7(–9) cm, base attenuate, apex acute (–acuminate), margin not or but slightly revolute; upper surface olivaceous to brown and often glossy, lower surface brown to purplish grey, with dense appressed hairs 0.2–0.3 mm long, late glabrescent; midrib above flat or slightly sunken, 1 mm wide, nerves 8–17 pairs, at 45–60° to the midrib, distinct but not prominently raised below, venation forming a coarse network  $\pm$  indistinct at both surfaces; petiole 7–14 by 1.5–2(–2.5) mm; the leaf buds 10 by 2 mm, densely appressed-pubescent.



of each innovation a group of scars occurs (see note). *Leaves* chartaceous or thinly coriaceous, ovate-elliptic to oblong-lanceolate, widest at or below the middle, 10–25 by 4–9.5 cm, base short-attenuate to broadly rounded, apex acute, margin not revolute; upper surface olivaceous or brown, often glossy, lower surface grey-brown, with distinct, but not very dense appressed rusty hairs, late glabrescent; midrib above flat, narrow, 1 mm wide; nerves 11–18 pairs, at c. 45° to the midrib, distinct but not prominent below, venation on both surfaces a coarse, rather indistinct network; petiole 9–18 by 2–2.5 mm; leaf buds ± stout, 10 by 3 mm, composed of the unexpanded leaf often with in addition several scale-like cataphylls, densely appressed-pubescent. *Inflorescences* (broadly) paniculate, with rusty hairs 0.3–0.5 mm long; in male 3–8.5 cm long, up to 7 cm wide, many-flowered, in female to 2 by 1.5 cm, few-flowered; bracts broadly triangular, 2.5 by 3 mm, pubescent, caducous. *Flowers* rusty pubescent inside and outside, hairs 0.1(–0.2) mm long. *Male flowers*: pedicel 1.5–3.5 mm long; buds ellipsoid-oblong, 3–4(–5) by 2–3(–3.5) mm, cleft 1/3–1/2, lobes 3 or 4, (long-)triangular, at anthesis somewhat recurved, tube 2–2.5 mm long; androecium truncately ellipsoid, 1.5–2.3 by 0.7–1 mm, stipe to 0.2 mm; anthers 7–10, subsessile, the free apices 0.4–0.5 mm long, ± erect. *Female flowers*: pedicel 1.5–2.5 mm long; buds narrowly ovoid, 2.7–3 by 2 mm, cleft 1/2–3/4, lobes (2 or) 3, long-triangular, ± recurved, tube 0.5–1.3 mm long; ovary subglobose, 1.2–1.5 mm diameter, densely minutely pubescent, stigma sessile, shallowly 2-lobed. *Fruits* 4–10 per infructescence, ovoid-ellipsoid, usually with truncate base, 1.8–2.2 by 1.1–1.3 cm, hairs 0.1–0.2 mm long; pericarp 0.7–1.3 mm thick; fruiting pedicel 3–7 mm long. — **Fig. 5g, h.**

**Field-notes** — Bole smooth, 10–17 m; no buttresses. Bark smooth, fissured, regularly cracked, or flaky, grey or dark red-brown; inner bark 10–15 mm thick, brown; sapwood 4 cm, whitish streaked with pale red; heartwood light brown to blackish brown. Flowers yellow; anthers (pollen) whitish yellow. Fruits green turning orange(-brown).

**Distribution** — *Malesia*: Borneo (Sarawak, Brunei, Sabah, Kalimantan, incl. Nunukan).

**Habitat & Ecology** — Primary dryland forest, kerangas, forest on ridges and low hills; on tuff, sand, and sandy loam; up to c. 1300 m altitude; fl. mainly June–Nov.; fr. July–Dec.

**Note** — The specific epithet refers to the numerous small eye-like pale lenticels on the twigs. *Gymnacranthera ocellata* may also be recognized by the conspicuous and numerous scars of cataphylls at the base of each seasonal shoot, possibly related with a marked seasonal growth.

**Fig. 7.** *Gymnacranthera maliliensis* R.T.A. Schouten. a. Habit of leafy twig with immature fruits; b. twig with male inflorescence; c. male flower; d. ditto, opened, showing androecium; e. infructescence; f. fruit, opened, showing thick pericarp and deeply lacinated aril of seed [a: *van Balgooy* 3884; b–d: *van Balgooy* 3960; e, f: *bb Cel./V* 255]. — Scale bar for a, b, e = 2 cm; for c, d = 1.65 mm; for f = 1 cm.

## HORSFIELDIA

*Horsfieldia* Willd., Sp. Pl. 4 (1806) 872 [non Blume = *Harmsiopanax* Warb. (*Araliaceae*)]; Pers., Symb. 2 (1807) 635; Warb., Mon. Myrist. (1897) 130, 262; J. Sinclair, Gard. Bull. Sing. 16 (1958) 368; 27 (1974) 133–141; 28 (1975) 1–181; W. J. de Wilde, Gard. Bull. Sing. 37, 2 ('1984', 1985) 115–179; 38, 1 (1985) 55–144; 38, 2 ('1985', 1986) 185–225; 39, 1 (1986) 1–65; *Blumea* 32 (1987) 459–472; 41 (1996) 375–381; Tree Fl. Sabah & Sarawak 3 (2000) 352. — *Pyrrhosa* Endl., Gen. Pl. (1839) 830, nom. illeg. — Type species: *Horsfieldia odorata* Willd. [= *Horsfieldia iryagedhi* (Gaertn.) Warb.].

*Myristica* sect. *Pyrrhosa* Blume, Rumphia 1 (1837) 190–192, t. 62–64. — Subsequent authors treated the genus *Horsfieldia* as defined at present partly under *Myristica* sect. *Pyrrhosa* as well as under several other sections of *Myristica*, e.g., sections *Caloneura* p.p., *Eumyristica* p.p., *Horsfieldia*, *Irya* (see Sinclair, 1958: 368), and under the here accepted and discussed sections. — Lectotype species: *Myristica glabra* Blume [= *Horsfieldia glabra* (Blume) Warb.].

Shrubs or usually trees, dioecious. *Twigs* sometimes angular or with two raised lines, lenticellate, not flaky. *Leaves* sometimes dispersed, brittle when dry, lower surface not pale, papillose only in *H. iryagedhi*, dots present or absent; reticulation lax (never forming a close raised network as in *Knema*). *Inflorescences* (on older wood in *H. sabulosa*) paniculate, usually branched several times; flowers numerous, all in about the same stage of development, solitary, or clustered (in *H. iryagedhi* the male with flowers sessile in dense flower heads); basal cataphylls caducous; bracts small or large, caducous. *Flowers* small, mostly short-pedicelled, at base articulated or not, bracteole absent. *Male flowers*: perianth ± globose or cup-shaped, leathery, inside glabrous, yellowish (never red); buds (depressed-)globose, (transversely) ellipsoid, reniform, or clavate, laterally compressed or not, cleft to variable depths, lobes 2 or 3 (or 4), not spread at anthesis; androecium sessile or with short narrow androphore, glabrous, synandrium variously shaped (cup-shaped, globose, ellipsoid, cylindrical, or trigonous), laterally compressed or not; anthers 2–c. 25, largely or entirely connate into a central column hollowed to different depths at apex; anthers straight, curved, or inflexed into the apical cavity to variable depths. *Female flowers*: slightly larger than male, globose to ovoid-ellipsoid; ovary glabrous or pubescent, style absent, stigma small, deeply 2-lobed (more-lobed in *H. iryagedhi*). *Infructescences* branched, few- to many-fruited. *Fruits* globose or ellipsoid, 1–8 cm long, pericarp leathery or somewhat fleshy, with or without lenticel-like tubercles, glabrous or pubescent, perianth sometimes persistent; aril entire or only shallowly lobed; seeds rarely globose, not variegated; albumen ruminant, with fatty oil but no starch; cotyledons connate at base. — Fig. 8–33.

**Distribution** — More than 100 species, ranging from Sri Lanka through NE India to S China (Kwangsi, Hainan) and through *Malesia* and the Caroline Islands east to the Solomon Islands and N Australia. The genus is absent in the Lesser Sunda Islands and 8 species occur exclusively outside the Malesian area. Except for a few widely distributed species, e.g., *H. amygdalina* (extra-Malesian), *H. glabra*, *H. irya*, *H. laevigata*, *H. tuberculata*, most species have a limited distribution. — Map 3 (see p. 4).

Distinct centres of species development are New Guinea and Borneo, and to a lesser extent Sumatra and Peninsular Malaysia. Three sections have been recognized here, and they occupy largely exclusive areas. Section *Horsfieldia*, with only *H. iryagedhi*, is confined to Sri Lanka. Section *Irya* (with c. 40 species) is, except for the widespread

*H. irya*, confined to East Malesia, the Solomons and N Australia. Section *Pyrrhosa* occurs west of Wallace's Line. In distribution, sections *Irya* and *Pyrrhosa* overlap for a narrow area in the Philippines and Sulawesi. They are morphologically segregated mainly by a different number of perianth lobes. Some species with the aberrant number of 3 lobes occur in section *Irya*: *H. angularis*, *H. olens*, and *H. sepikensis*. In section *Pyrrhosa* the deviating number of 2 lobes is found in *H. longiflora*, *H. thorelii*, and *H. amygdalina*, partly (these three species are extra-Malesian), and *H. crassifolia* and *H. sterilis*. For a further explanation, see De Wilde ('1984', 1985).

**Habitat & Ecology** — Trees of primary rain forest, persisting in degraded forest or sometimes in old secondary growths; sometimes in marshy forest (*H. irya*); stilt-roots are present in some species. Some species reach or occur in montane areas, and the wide altitudinal range contrasts with those of the other Malesian genera of the *Myristicaceae*.

According to Sinclair (1958) the bark of species of Peninsular Malaysia is usually reddish brown, smooth or more often striate, or rough with circular or irregular dents, sometimes flaking but mostly not. The flowers are usually waxy yellow, and often sweet scented; those of *H. iryagedhi* have a particularly strong smell.

**Taxonomy** — There is a large morphological diversity in the flowers of the genus *Horsfieldia*. Schematic drawings of the androecia of most species have been depicted here on pages 58–61 as Plates 1–3 [after W. J. de Wilde, Gard. Bull. Sing. 37, 2 ('1984', 1985) 129–137].

Three sections can be recognized and are supposedly of unequal taxonomic weight but with significant different ranges of distribution (see above): 1) sect. *Horsfieldia*, containing one single species, the type species of the genus, rather deviating from all other species, 2) sect. *Irya*, containing most species with predominantly a 2-lobed perianth, and 3) sect. *Pyrrhosa*, most of its species with predominantly a 3- or 4-lobed perianth. The descriptions of the three sections have been given here separately and are not included in the treatment of the species, which are all listed alphabetically. [For an extensive discussion of the subdivision of *Horsfieldia* into the three sections, see W. J. de Wilde ('1984', 1985) 125–136.]

### Section *Horsfieldia*

*Myristica* Gronov. sect. *Horsfieldia* A. DC., Prodr. 14, 1 (1856) 200; Miq., Fl. Ind. Bat. 1, 2 (1858) 63. — *Myristica* Gronov. sect. *Irya* auct. non Hook. f. & Thomson: Benth. & Hook. f., Gen. Pl. 3 (1880) 137, for *Horsfieldia* only. — *Myristica* Gronov. sect. *Eumyristica* Hook. f. & Thomson subsect. *Horsfieldia* (A. DC.) King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 282. — Type species: *Horsfieldia odorata* Willd.

*Myristica* Gronov. sect. *Pyrrhosa* Blume, Rumphia 1 (1835) 190, p.p., for *Myristica horsfieldii* only, not the lectotype species. — *Myristica* Gronov. sect. *Eumyristica* Hook. f. & Thomson, Fl. Ind. (1855) 162, p.p., for *Myristica horsfieldii* only.

*Horsfieldia* Willd. sect. *Orphanthera* Warb., Mon. Myrist. (1897) 268, p.p., for the lectotype species only. — *Horsfieldia* Willd. sect. *Trivalves* J. Sinclair subsect. *Orphanthera* (Warb.) J. Sinclair, Gard. Bull. Sing. 16 (1958) 371, p.p., nom. inval., provisional name only. — Lectotype species: *Horsfieldia iryagedhi* (Gaertn.) Warb.

**Phyllotaxis** of plagiotropic shoots distichous. Lower leaf surface with alveolar tissue, epidermis papillose, stomatal complex sunken; without larger dark-coloured dots (cork

warts). Flowers in male inflorescences sessile, at base not articulated, arranged in many-flowered subglobose dense heads; perianth in buds elongate-obconical,  $\pm$  angled, cleft 1/2–3/4, 3- or 4-(in female: 2- or 3-)lobed. Androecium elongate, subcylindrical, androphore distinct; column narrow, narrowly hollowed for over halfway; anthers 3–5, erect. Stigma sessile, many-lobulate. — One species, Sri Lanka. — Map 3 (p. 4).

Section *Horsfieldia* is monotypic, the species *H. iryagedhi* deviating from all other *Horsfieldias* by some anatomical characters of the leaf, male flowers sessile and arranged in dense heads with a thick receptacle, angular buds, anthers largely connate, but not back to back so that a narrowly hollowed central column is formed; the stigma in the female flowers is many-lobed, not 2-lobed as in the other *Horsfieldia* species.

### Section Irya

*Horsfieldia* Willd. sect. *Irya* (Hook. f. & Thomson) Warb., Mon. Myrist. (1897) 123, 267, p. p.; W.J. de Wilde, Gard. Bull. Sing. 37, 2 ('1984', 1985) 127. — *Myristica* Gronov. sect. *Irya* Hook. f. & Thomson, Fl. Ind. (1855) 159; A. DC., Prodr. 14, 1 (1856) 202; Miq., Fl. Ind. Bat. 1, 2 (1858) 64; Benth. & Hook. f., Gen. Pl. 3 (1880) 137, p. p., excl. sect. *Horsfieldia*; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 284, p. p., for the smaller part only. — *Horsfieldia* Willd. sect. *Irya* (Hook. f. & Thomson) Warb. subsection. *Euirya* Warb., Mon. Myrist. (1897) 123, 267, p. p., for the type species only. — Type species: *Myristica irya* Gaertn. [= *Horsfieldia irya* (Gaertn.) Warb.]. *Myristica* Gronov. sect. *Pyrhosa* Blume, Rumphia 1 (1837) 190, p. p., for *Myristica javanica* and a few other species only, excl. lectotype species *Myristica glabra* (= sect. *Pyrhosa*) and *Myristica horsfieldii* (= *Horsfieldia iryagedhi*, sect. *Horsfieldia*); A. DC., Prodr. 14, 1 (1856) 202, p. p.; Miq., Fl. Ind. Bat. 1, 2 (1858) 64, p. p., excl. *Myristica glabra* (= sect. *Pyrhosa*). *Horsfieldia* Willd. sect. *Pyrhosa* (Blume) Warb. subsection. *Bivalves* Warb., Mon. Myrist. (1897) 262 (incl. series *Smithii* and series *Globularia*). — *Horsfieldia* Willd. sect. *Bivalves* J. Sinclair, Gard. Bull. Sing. 16 (1958) 370, 371, comb. inval., provisional name only. — Type species not indicated, several species listed.

Phyllotaxis in plagiotropic shoots distichous. Lower leaf surface without alveolar tissue, epidermis not papillose, stomatal complex not sunken; rarely (*H. inflexa*) with larger dark-coloured dots. Flowers pedicelled, not articulated at base, solitary or in loose clusters; buds rarely globose or obovoid, usually laterally compressed, in outline circular, elliptic, or pear-shaped, not angular (in young stages of *H. sylvestris* faintly so), cleft to variable depths, perianth mostly predominantly 2-lobed, rarely 3-lobed. Androecium various, often  $\pm$  zygomorphic, laterally compressed, sometimes anthers at apex bi-laterally incurved, or obconical and  $\pm$  actinomorphic; androphore distinct or not, central column broad or narrow, little to much hollowed; anthers few to many, (sub-)erect, or at apex incurved into apical hollow of the column. Stigma minutely 2-lobed. — Mainly E Malesia (including the Philippines), and one species, *H. irya*, distributed over almost the whole area of the genus. — Map 3 (p. 4).

Almost all of the 40 species of this section have predominantly 2-lobed perianths, with a more or less zygomorphic androecium, because it is laterally compressed or with the anthers at apex incurved from two sides into an apical hollow of the column.

Aberrant are *H. olens* and *H. sepikensis* with 3- or 4-lobed perianths, but with the androecium tending to be zygomorphic. *Horsfieldia angularis* has 2–4-lobed perianths.

Also aberrant are the species of the group of *H. clavata*, with a 2-lobed perianth but a club-shaped non-zygomorphic androecium.

A few mutually related species from continental SE Asia, placed in section *Pyrrhosa*, viz. *H. longiflora*, *H. thorelii* and *H. amygdalina*, have (partly) a 2-lobed perianth, and a zygomorphic androecium, especially *H. longiflora*. They blur the distinction between sections *Irya* and *Pyrrhosa*. Section *Irya* occurs mainly in East Malesia, with only *H. irya* extending far beyond the main range of distribution of the section. Within section *Irya*, eight groups of species can be distinguished, a survey of which is given by De Wilde ('1984', 1985: 128).

### Section *Pyrrhosa*

- Horsfieldia* Willd. sect. *Pyrrhosa* (Blume) Warb., Mon. Myrist. (1897) 262, p.p.; W.J. de Wilde, Gard. Bull. Sing. 37, 2 ('1984', 1985) 130. — *Myristica* Gronov. sect. *Pyrrhosa* Blume, Rumphia 1 (1837) 190, t. 62–64, p.p., for the smallest part incl. the lectotype t. 64, f. 1A, B; Hook. f. & Thomson, Fl. Ind. (1855) 160; A. DC., Prodr. 14, 1 (1856) 202, p.p.; Miq., Fl. Ind. Bat. 1, 2 (1859) 64, p.p.; Benth. & Hook. f., Gen. Pl. 3 (1880) 136; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 282. — *Horsfieldia* Willd. sect. *Pyrrhosa* (Blume) Warb. subsect. *Eupyrrhosa* Warb., Mon. Myrist. (1897) 265 (excl. *Horsfieldia macrocoma* = *Endocomia*). — Lectotype species: *Myristica glabra* Blume [= *Horsfieldia glabra* (Blume) Warb.].
- Myristica* Gronov. sect. *Eumyristica* Hook. f. & Thomson, Fl. Ind. (1855) 162, p.p., for *Myristica superba* = *Horsfieldia superba* (Hook. f. & Thomson) Warb. only. — *Myristica* Gronov. sect. *Caloneura* A. DC., Prodr. 14, 1 (1856) 192, p.p., for *Myristica superba* Hook. f. & Thomson only [= *Horsfieldia superba* (Hook. f. & Thomson) Warb.].
- Myristica* Gronov. sect. *Irya* auct. non Hook. f. & Thomson: King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 284, p.p.
- Horsfieldia* Willd. sect. *Irya* (Hook. f. & Thomson) Warb. subsect. *Euirya* Warb., Mon. Myrist. (1897) 267, p.p., excl. *Horsfieldia irya* (type species of sect. *Irya*).
- Horsfieldia* Willd. sect. *Irya* (Hook. f. & Thomson) Warb. subsect. *Trivalves* Warb., Mon. Myrist. (1897) 267. — *Horsfieldia* Willd. sect. *Trivalves* J. Sinclair subsect. *Trivalves*, J. Sinclair, Gard. Bull. Sing. 16 (1958) 370, 371, comb.inval., provisional name only. — Type species not indicated.
- Horsfieldia* Willd. sect. *Orphanthera* Warb., Mon. Myrist. (1897) 268, p.p., for *Horsfieldia ralunensis* and *Horsfieldia sylvestris* only, excl. the lectotype species *Horsfieldia iryagedhi*.

Phyllotaxis of plagiotropic shoots dispersed or distichous. Lower leaf surface without alveolar tissue, epidermis not papillose, stomatal complex not sunken; with or without larger dark-coloured dots (or cork warts). Flowers with a pedicel (short in *H. wallichii*), at base with or without articulation, solitary or in loose clusters; buds (depressed) globose, obovoid, or ellipsoid, not laterally compressed, not angular, cleft c. 2/3 or less; perianths predominantly 3- (or 4-)lobed (rarely 2-lobed, *H. longiflora*, *H. sterilis*). Androecium (sub)circular or more or less triquetrous in cross section, never laterally compressed, depressed-globose, ellipsoid, or obovoid, usually with a broad central column with an apical hollow of variable shape and depth; androphore usually narrow at base; anthers few to many, ± straight or curved, almost entirely connate or free for about the upper half (*H. polyspherula*-group). Stigma minutely 2-lobed. — Continental SE Asia, West Malesia (including the Philippines). — Map 3 (p. 4).

Section *Pyrrhosa* contains c. 60 species, mainly with exclusively or predominantly a 3- (or 4-)lobed perianth; species with a 2-lobed perianth are *H. longiflora* (Vietnam), *H. crassifolia* (Sumatra, Peninsular Malaysia, Borneo) and *H. sterilis* (Sabah). For a brief discussion see De Wilde ('1984', 1985: 132).



**Legends to Plates 1–3:**

Semi-schematic drawings of the androecia of most species of *Horsfieldia*, except *H. ampla* [1], *H. discolor* [21], *H. disticha* [22], *H. perangusta* [59], and *H. sessilifolia* [75], of which no male flowers are available.

Between square brackets the number has been given of the alphabetically arranged species of the present revision.

Lateral view (*left*), longitudinal section (*right*), apical view (*top*); *white*: anthers; *black*: sterile tissue (i. e., androphore and central column).

**Plate 1** — 1: *H. iryagedhi* [36] – 2: *H. irya* [35] – 3: *H. spicata* [79] – 4: *H. inflexa* [33] – 5: *H. moluccana* var. *moluccana* [44a] – 6: *H. parviflora* [56] – 7: *H. obscurinervia* [49] – 8: *H. ardisiifolia* [6] – 9: *H. talaudensis* [88] – 10: *H. samarensis* [72] – 11: *H. smithii* [77] – 12: *H. olens* [51] – 13: *H. sepikensis* [74] – 14: *H. sylvestris* [87] – 15: *H. coryandra* [16] – 16: *H. urceolata* [94] – 17: *H. crux-melitenensis* [19] – 18: *H. clavata* [13] – 19: *H. squamulosa* [81] – 20: *H. ampliformis* [2] – 21: *H. angularis* [5] – 22: *H. iriana* [34] – 23: *H. aruana* [7] – 24: *H. subtilis* var. *subtilis* [84a] – 25: *H. schlechteri* [73] – 26: *H. basifissa* [9] – 27: *H. sinclairii* [76] – 28: *H. psilantha* [62] – 29: *H. laevigata* var. *laevigata* [37a] – 30: *H. pilifera* [60] – 31: *H. lancifolia* [38].

**Plate 2** — 32: *H. decalvata* [20] – 33: *H. tuberculata* [93] – 34: *H. corrugata* [15] – 35: *H. pachycarpa* [53] – 36: *H. pulverulenta* [64] – 37: *H. leptantha* [40] – 38: *H. hellwigii* var. *hellwigii* [31a] – 39: *H. ralunensis* [67] – 40: *H. sabulosa* [71] – 41: *H. atjehensis* [8] – 42: *H. sucosa* subsp. *sucosa* [85a] – 43: *H. pallidicaula* var. *pallidicaula* [55a] – 44: *H. sparsa* [78] – 45: *H. triandra* [91] – 46: *H. tristis* [92] – 47: *H. fulva* [27] – 48: *H. superba* [86] – 49: *H. grandis* [30] – 50: *H. wallichii* [96] – 51: *H. pulcherrima* [63] – 52: *H. flocculosa* [25] – 53: *H. motleyi* [46] – 54: *H. tomentosa* [90] – 55: *H. cf. gracilis* [29] – 56: *H. paucinervis* [57] – 57: *H. splendida* [80] – 58: *H. rufo-lanata* [70] – 59: *H. reticulata* [68] – 60: *H. crassifolia* [18] – 61: *H. carnosa* [12].

**Plate 3** — 62: *H. sterilis* [82] – 63: *H. hirtiflora* [32] – 64: *H. brachiata* [11] – 65: *H. pachyrachis* [54] – 66: *H. ridleyana* [69] – 67: *H. obtusa* [50] – 68: *H. tenuifolia* [89] – 69: *H. macilenta* [41] – 70: *H. laticostata* [39] – 71: *H. nervosa* [47] – 72: *H. polyspherula* var. *polyspherula* [61a] – 73: *H. oligocarpa* [52] – 74: *H. endertii* [24] – 75: *H. valida* [95] – 76: *H. borneensis* [10] – 77: *H. fragillima* [26] – 78: *H. androphora* [4] – 79: *H. amplomontana* [3] – 80: *H. montana* [45] – 81: *H. elongata* [23] – 82: *H. punctata* [65] – 83: *H. costulata* [17] – 84: *H. subalpina* subsp. *subalpina* [83a] – 85: *H. obscura* [48] – 86: *H. xanthina* subsp. *xanthina* [97a] – 87: *H. majuscula* [43] – 88: *H. coriacea* [14] – 89: *H. penangiana* [58] – 90: *H. punctatifolia* [66] – 91: *H. macrothyrsa* [42] – 92a: *H. glabra* var. *glabra* [28a] – 92b: *H. glabra* var. *javanica* [28b].

Magnification for 3–11, 15–19, 21–27, 29–40, 45–48, 50, 52, 74, 75, 81 =  $\times 5$ ;  
Magnification for 1, 2, 12–14, 20, 28, 41–44, 49, 51, 53–73, 76–80, 82–92a, b =  $\times 10$ .

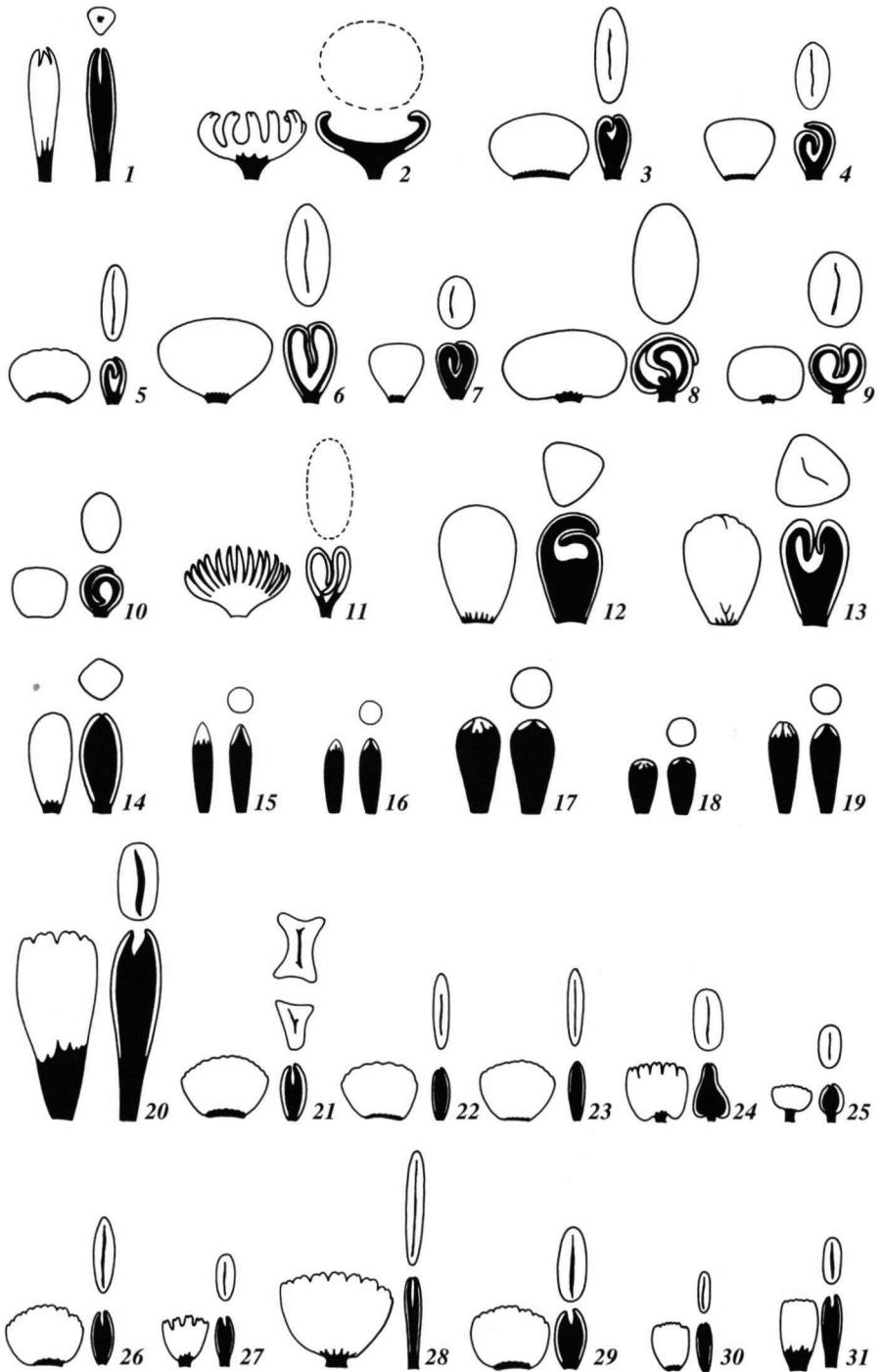


Plate 1 — For legends, see page 58.

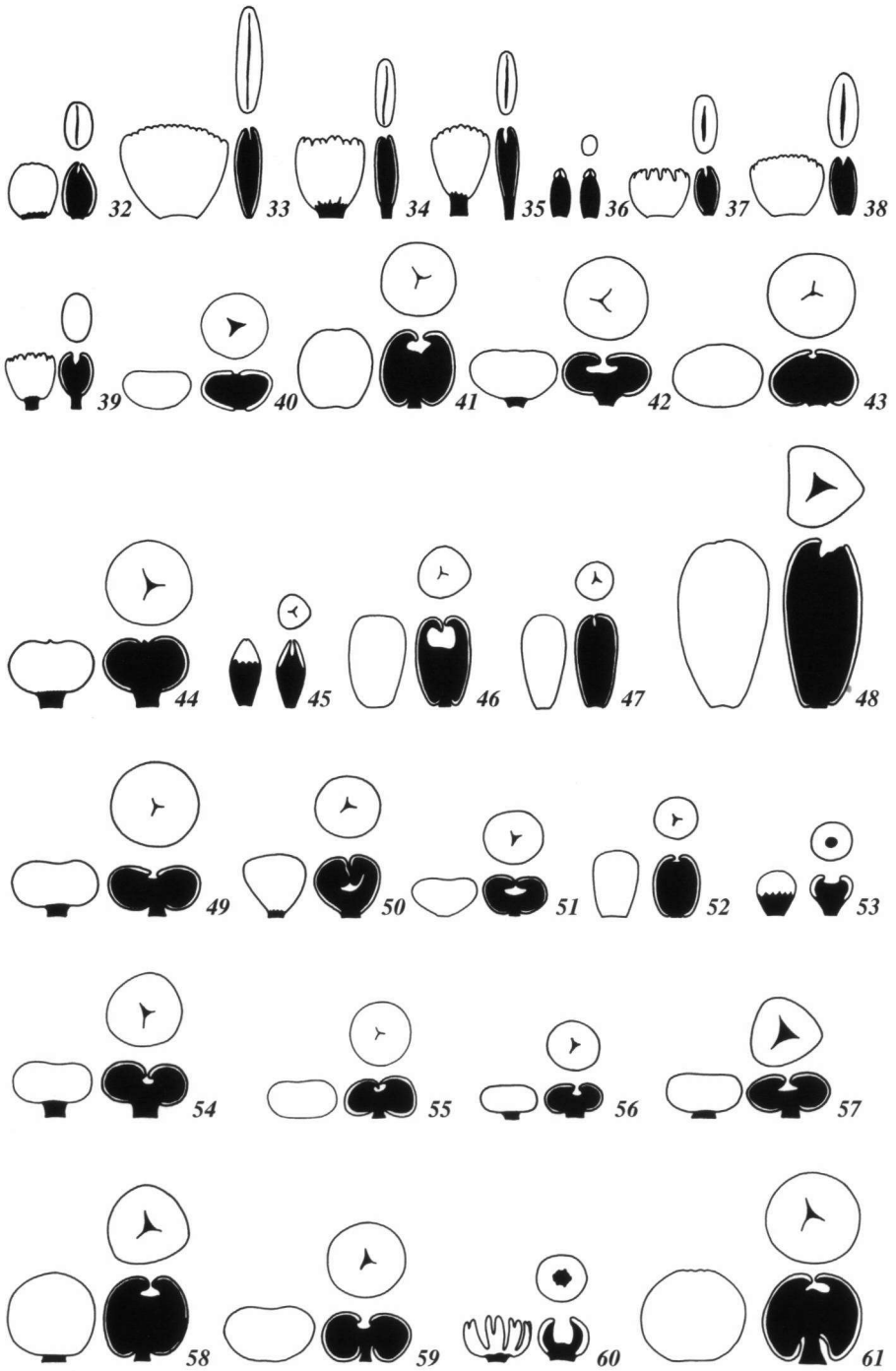


Plate 2 — For legends, see page 58.

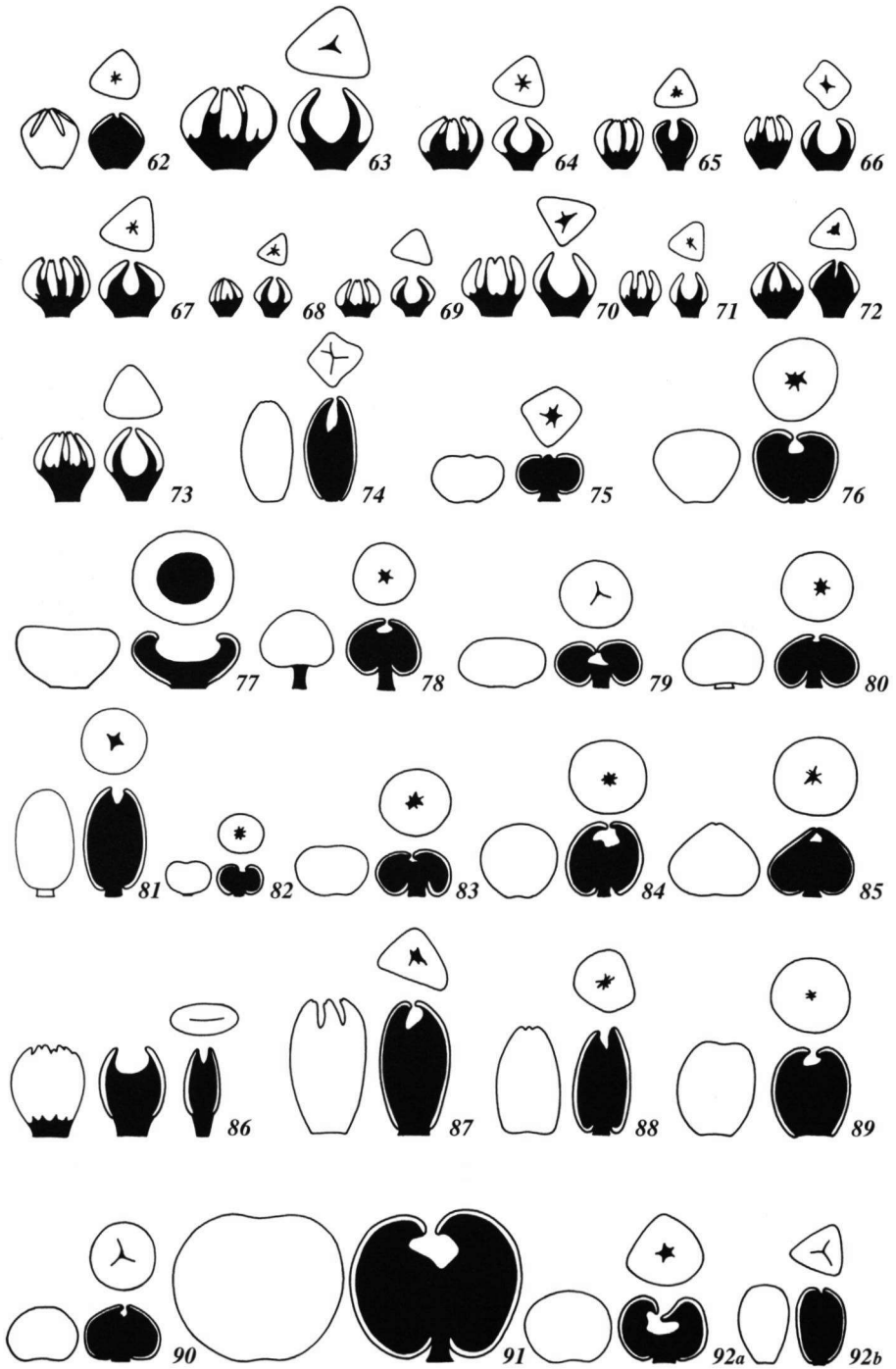


Plate 3 — For legends, see page 58.

**Notes to the Keys:**

Besides a general key to the species (1), based on male flowering specimens, five separate regional keys (2–6) are given, based on female flowering and fruiting specimens and with emphasis on vegetative characters and partly on distribution.

In species with a laterally compressed androecium (generally in flowers with a 2-lobed perianth) the shape and size of the androecium, as given in the keys and descriptions, always concern the outline as seen laterally.

## (1) GENERAL KEY TO THE SPECIES

(based on male flowering specimens)

- 1a. Leaves papillose beneath. Male flowers sessile, packed into dense subglobose capitula; buds  $\pm$  obconical, mutually appressed, angular. Perianth 3-lobed, cleft 1/5–2/3. Androecium stalked, anthers\* 3–5. — Sri Lanka, elsewhere cultivated . . . . . **36. *H. iryagedhi***
- b. Leaves not papillose beneath. Male flowers subsessile or usually pedicelled, mutually free or at least not densely clustered; buds variable, not or only somewhat angular. Perianth densely clustered before anthesis in *H. sylvestris* from E Malesia . . . . . 2
- 2a. Leaves in fertile twigs distichous, membranous, usually with whitish marks of irregular shape and size. Perianths globose, 2-lobed, 1–1.5(–2) mm diam. Androecium not or hardly laterally compressed; anthers 6–10, for the larger part connate, forming a shallow or deep saucer-shaped column, free apices 0.3 mm,  $\pm$  incurved; androphore distinct, tapering. — Sri Lanka to Solomon Is. (throughout Malesia), generally coastal-riverine . . . . . **35. *H. irya***
- b. Leaves in fertile twigs distichous (alternate), or dispersed (spirally), or mixed in the same specimen. Leaf of variable consistency, usually without whitish marks. Perianths 2–4-lobed, variable in shape and size. Androecium various; anthers few to many, connate or mutually for some distance free, column variable; if column deeply cup- or saucer-shaped, then anthers at apex free for at least halfway, or deeply inflexed into the cup; androphore various . . . . . 3
- 3a. Perianth 2-lobed, or sometimes a few flowers in one inflorescence 3- or 4-lobed. — Species mainly from E of Wallace's Line, or the following from W Malesia: *H. crassifolia* (Sumatra, Peninsular Malaysia, Singapore, Borneo), *H. penangiana*, p. p. (Sumatra), *H. sterilis* (Borneo), *H. sucosa* subsp. *bifissa* (Borneo) . . . . . 4
- b. Perianth 3- or 4-lobed, or perianth with both 3 and 4 lobes present; sometimes the odd flower in an inflorescence with 2-lobed perianth. — Species from W Malesia, and the following from New Guinea: *H. angularis*, *H. olens*, *H. sepikensis* . . . . . 43
- 4a. Androecium not laterally compressed (in cross section  $\pm$  circular), not longer than wide. — W Malesia . . . . . 5
- b. Androecium laterally compressed or not; if not or only slightly so then the androecium (including androphore) longer than wide; androecium not or little laterally compressed in odd 3- or 4-lobed flowers. — E Malesia . . . . . 8
- 5a. Leaves coriaceous, lower surface with inconspicuous, subsistent, dense indumentum beneath (in Borneo the hairs often deciduous) [dark dots and dashes present.] — Swamp forest on peat or sand . . . . . **18. *H. crassifolia***

\*) In the species descriptions the number of thecae, twice the number of anthers, is given.

- b. Leaves  $\pm$  membranous, glabrous or early glabrescent beneath. — Not from peat swamp forest . . . . . 6
- 6a. Twigs 2 mm diam.; bark not pale on drying. Leaves 7–12 cm long, with dots beneath. [Lateral nerves flat and inconspicuous above.] . . . . . **58. *H. penangiana***
- b. Twigs 2–5(–10) mm diam.; bark pale on drying, often contrasting with the blackish dried petioles. Leaves 14 cm long or more, without dots beneath . . . . . 7
- 7a. Androecium depressed-globose, largely consisting of anthers; apical hollow flat and shallow . . . . . **85b. *H. sucosa* subsp. *bifissa***
- b. Androecium broadly obovoid, consisting of a large sterile basal part at apex with 3 or 4 small anthers (i.e., c. 6 thecae) . . . . . **82. *H. sterilis***
- 8a. Inflorescences spike-like, unbranched or short-branched, lateral branches to 5 (–10) mm long. Inflorescences, flowers and petioles blackish on drying, usually contrasting with the paler grey-brown twigs. Anthers inflexed. — Moluccas . . . . . **79. *H. spicata***
- b. Inflorescences branched, the side branches at least 5 mm long. Inflorescences, flowers, and petioles brown, not contrasting with the colour of the twigs . . . . . 9
- 9a. Androecium cup- or saucer-shaped, moderately laterally compressed; anthers at one or both sides of the androecium distally distinctly incurved into the central hollow. — E Malesia: Philippines, Sulawesi, Moluccas, NW New Guinea . . . 10
- b. Androecium laterally flattened or not, the column either 1) solid, 2) broadly but shallowly hollowed only up to c. 1/3, or 3) narrowly slit-like channelled to variable depths; anthers straight or only slightly incurved, never inflexed into the central hollow. — E Malesia: Moluccas, whole of New Guinea . . . . . 17
- 10a. Leaves with dots beneath (lens!). Twigs angular or ridged . . . . . **33. *H. inflexa***
- b. Leaves without dots. Twigs terete, angular, or winged . . . . . 11
- 11a. Perianth together with the pedicel  $\pm$  pear-shaped, i.e., pedicel tapering. Petiole comparatively long, 1–2.6 cm. Twigs terete, not angular. [Leaf blade (6–)8–22(–25) cm.] . . . . . **44. *H. moluccana***
- b. Perianth (in lateral view) short-cuneate, rounded, or subtruncate at base; pedicel  $\pm$  abruptly passing into the perianth, not tapered. Petioles comparatively shorter. Twigs terete or angular . . . . . 12
- 12a. Perianth cleft about halfway. Anthers connate; androphore short or absent . . 13
- b. Perianth cleft to  $\pm$  2/3 or more. Anthers mutually free at least in the incurved or inflexed part . . . . . 14
- 13a. Anthers 18–25, inflexed at both sides into thin-walled laterally compressed androecium cup. Perianth 2.5–4 mm wide. Leaves membranous, matt on drying. — Moluccas . . . . . **56. *H. parviflora***
- b. Anthers 11–12, inflexed at only one side of the androecium cup; cup thick- and firm-walled. Perianth 2–2.2 mm wide. Leaves chartaceous,  $\pm$  glossy above. — Philippines (Luzon) . . . . . **49. *H. obscurinervia***
- 14a. Anthers free only in the inflexed distal parts, the basal parts connate into a cup-shaped column. Androphore minute, only c. 1/10 of the androecium length . . 15
- b. Anthers free for at least 2/3. Androphore longer, c. 1/3 of the androecium. [Twigs generally angular or ridged. Perianth 2–3 mm wide; pedicel glabrous. Anthers all inflexed into the centre of the androecium.] — Moluccas . . . . . **77. *H. smithii***

- 15a. Twigs angular or winged. Perianth 4 mm wide, glabrous. — Philippines . . . . . **6. *H. ardisiifolia***  
 b. Twigs terete. Perianth 2.5–3 mm wide . . . . . 16
- 16a. Pedicel pubescent, shorter than the perianth. Inflorescences densely finely pubescent. Anthers inflexed at both sides of the laterally compressed androecium. — Moluccas (Talaud I.) . . . . . **88. *H. talaudensis***  
 b. Pedicel glabrous, longer than the perianth. Inflorescences with sparse hairs less than 0.1 mm long. Anthers inflexed at one side only of the androecium. — Philippines (Samar) . . . . . **72. *H. samarensis***
- 17a. Flower buds ± angular, arranged into dense semi-globose clusters. Androecium much longer than wide, not or slightly laterally compressed. Leaves lanceolate(-linear), usually ± parallel-sided . . . . . **87. *H. sylvestris***  
 b. Buds not angular, not densely clustered . . . . . 18
- 18a. Twigs angular, ridged, or winged, at the apex as well as lower down . . . . . 19  
 b. Twigs not winged, i.e., terete or only somewhat angular or lined at apex . . . . . 21
- 19a. Perianth 2-, 3-, or 4-lobed, subspherical, hardly or not laterally compressed, ± glossy, not collapsing on drying. — Papua Barat (Bird's Head) . . . . . **5. *H. angularis***  
 b. Male perianth predominantly 2-lobed, little or much laterally compressed, matt on drying, slightly or strongly collapsing on drying . . . . . 20
- 20a. Leaves thinly coriaceous. Pedicel about as long as or longer than the perianth. Buds cleft almost to the base. Hairs of inflorescences and pedicel 0.2–0.3 mm. Anthers 10–14; the column hollow for c. 1/4 . . . . . **34. *H. iriana***  
 b. Leaves membranous. Pedicel shorter than the perianth. Buds cleft to 2/3–3/4. Inflorescences and pedicel almost glabrous, hairs 0.1 mm or less. Anthers (12–)14–18; column solid or almost so . . . . . **7. *H. aruana***
- 21a. Inflorescences 25–35 cm long. Buds ± pear-shaped. Androecium longer than broad; androphore 0.5 mm long or more, about half as long as the anthers or longer . . . . . 22  
 b. Inflorescences 20 cm long or less. Buds of variable shapes. Androecium longer or shorter than broad; androphore short or long . . . . . 23
- 22a. Buds glabrous (?), 4 by 2 mm. Anthers 10, androphore nearly as long as the anthers. Inflorescences to 25 cm long, glabrescent . . . . . **1. *H. ampla***  
 b. Buds pubescent, 3 by 3 mm. Anthers 7, androphore about half as long as the anthers. Inflorescences 25–35 cm long, pubescent . . . . . **2. *H. ampliformis***
- 23a. Inflorescences delicate, 2–5(–8) cm long, 1 or 2 (or 3) times branched. — New Guinea, including Aru Is. . . . . 24  
 b. Inflorescences stouter, 5–20 cm long, not or 1–4 times branched (inflorescences of *H. sinclairii* and *H. basifissa* from New Guinea sometimes small). — Whole of E Malesia, including Sulawesi; not in the Philippines . . . . . 30
- 24a. Buds pubescent or late glabrescent, distinctly or only somewhat longer than broad. Anther-bearing part of the androecium much shorter than the elongate club-shaped androphore . . . . . 25  
 b. Buds glabrous or early glabrescent, about as long as or shorter than broad. Androphore much shorter than the anthers . . . . . 29
- 25a. Buds together with tapering pedicel long pear-shaped. Androphore glabrous . . . . . 26  
 b. Buds globose or ellipsoid, distinctly marked-off from the slender pedicel. Androphore glabrous or pubescent . . . . . 27

- 26a. Pedicel and bud together 10–12 mm long . . . . . **19. *H. crux-melitensis***  
 b. Pedicel and bud together 5 mm long . . . . . **13. *H. clavata***
- 27a. Buds subglobose or ellipsoid in outline, lobes 0.5–0.8 mm thick. Twig apex, leaf bud, and inflorescences with hairs 0.1–0.2 mm . . . . . 28  
 b. Buds subglobose in outline, lobes 1–1.5 mm thick. Hairs 0.3(–0.4) mm. [Androphore glabrous. Pedicel 3 mm long.] . . . . . **94. *H. urceolata***
- 28a. Androphore (at least in the lower half) densely pubescent. Pedicel 3–3.5 mm long. Buds cleft c. 1/8 only . . . . . **81. *H. squamulosa***  
 b. Androphore glabrous or with a few scattered hairs. Pedicel (3–)4–6.5 mm long. Buds cleft (1/6–)1/4 . . . . . **16. *H. coryandra***
- 29a. Buds ± laterally compressed, ± obtriangular in lateral view, 1.8–3 mm wide, usually ± collapsing on drying. Androphore 0.2–0.5 mm long, shorter than the anthers . . . . . **84. *H. subtilis***  
 b. Buds subglobose, 1–2 mm wide, not or but slightly compressed, wrinkled on drying but not collapsing. Androphore 0.4–0.5 mm long, about half the length of the anthers . . . . . **73. *H. schlechteri***
- 30a. Bud and pedicel together ± pear-shaped; apex broadly rounded in lateral view, the lower (1/4–)1/3–1/2 tapered and gradually passing into the ± tapered pedicel (these characters not always clear in certain specimens of *H. tuberculata*). Buds glabrous, pubescent, or glabrescent . . . . . 31  
 b. Buds in lateral view circular, ovate, obovate, elliptic, transversely elliptic, or reniform; at base short-attenuate, rounded, or truncate, not tapered; pedicel ± slender. Buds hairy (at least at base) or in *H. basifissa*, *H. psilantha*, and *H. sinclairii* glabrous or glabrescent . . . . . 35
- 31a. Buds glabrous. — A variable species . . . . . **93. *H. tuberculata***  
 b. Buds minutely pubescent, or in *H. corrugata* (at 1200–1900 m altitude) early glabrescent . . . . . 32
- 32a. Leaves ± lanceolate, 5–16 cm long. Buds cleft only c. 1/6. — Sulawesi . . . . . **38. *H. lancifolia***  
 b. Leaves elliptic to lanceolate, 12–30 cm long. Buds cleft about halfway . . . . . 33
- 33a. Pedicel 1.5–2 mm long; buds 2.3 mm long, thinly pubescent. Anthers 6. — Moluccas; at low altitude . . . . . **20. *H. decalvata***  
 b. Pedicel generally longer; buds 2.5–3.5 mm long. [Vegetatively and sometimes in fruit much resembling *H. laevigata*.] — New Guinea; at 450–2000 m . . . . . 34
- 34a. Pedicel stoutish, 2–4 mm long. Buds ± membranous, glabrescent, with or without a few scattered blackish warts. Anthers 8–12 . . . . . **15. *H. corrugata***  
 b. Pedicel stout or slender, 2–5 mm long. Buds ± fleshy, pubescent, blackish warts absent. Anthers 5–10 . . . . . **53. *H. pachycarpa***
- 35a. Inflorescences pubescent to nearly glabrous. Leaf bud and twig at apex with rusty or greyish hairs, 0.1–0.4(–0.5) mm long. Leaves ± glabrescent, or with scattered stellate hairs beneath when younger . . . . . 36  
 b. Inflorescences generally thick-woolly tomentose. Leaf bud and twig at apex with conspicuous, coarse, rusty hairs, (0.3–)0.5–1.5 mm. Leaves with (sub)persistent indumentum, at least on and near the midrib beneath . . . . . 40
- 36a. Buds ± glabrous, subglobose, 2–3 mm diam., cleft to the base, not collapsing on drying . . . . . **9. *H. basifissa***



- b. Buds glabrous or hairy, size and shape variable, cleft c. 1/2 to near the base; collapsing on drying or not . . . . . 37
- 37a. Buds (almost) wholly with  $\pm$  persistent indumentum, hairs may be very minute and scattered. [Leaves olivaceous-brown, without a reddish tinge. Hairs of leaf bud 0.1–0.2 mm, usually greyish.] — Moluccas, New Guinea, incl. New Britain . 38
- b. Buds (and pedicel) glabrous or glabrescent, at least the upper 4/5. — E Papua New Guinea . . . . . 39
- 38a. Buds 1.2–1.9 mm diam. — A variable species . . . . . **60. *H. pilifera***
- b. Buds 2–3.3 mm diam. — A variable species . . . . . **37. *H. laevigata***
- 39a. Buds (2–)2.5–3.5(–4) mm diam., cleft 1/2–2/3. Leaves 20–40 cm long, olivaceous or brown, not reddish tinged. — Papua New Guinea (Bagabag I., Long I., New Britain, New Ireland) . . . . . **62. *H. psilantha***
- b. Buds (1–)1.5–2 mm diam., cleft c. 1/2. Leaves 6–20 cm long, generally with a reddish tinge on drying, especially the midrib and nerves. [Hairs of leaf bud to 0.1 mm long, greyish brown. Buds larger and pedicel pubescent in deviating specimens.] — E Papua New Guinea . . . . . **76. *H. sinclairii***
- 40a. Buds largely pubescent, towards the base thick-walled and coriaceous, the remainder collapsing on drying; both male and female buds opening at apex by small pore-like slit less than 1 mm long. Androecium subellipsoid, mainly consisting of the column with 2 minute anthers at the apex, just below the pore. Leaves coriaceous,  $\pm$  bullate; with harsh hairs leaving rough thickened bases . . . **64. *H. pulverulenta***
- b. Buds glabrous or pubescent, membranous or chartaceous,  $\pm$  not collapsing on drying, cleft at least c. 1/3. Androecium mainly consisting of 10–16 sessile anthers. Hairs not harsh, not leaving rough thickened bases . . . . . 41
- 41a. Buds pubescent, cleft 3/4–5/6. Anthers 10–14. Leaves membranous or chartaceous . . . . . **40. *H. leptantha***
- b. Buds glabrous, except at the very base; cleft c. 1/2 or less. Leaves generally membranous . . . . . 42
- 42a. Buds subglobose. Anthers 12–16. Leaves oblong(-lanceolate), at apex (acute-)acuminate, not caudate (always?) . . . . . **31. *H. hellwigii***
- b. Buds obovoid or ellipsoid. Anthers 10(–12). Leaves oblong-lanceolate, at apex caudate . . . . . **67. *H. ralunensis***
- 43a. Leaves in fertile shoots dispersed, i.e. in 3 or more rows along the twigs. Leaf bud proportionally short and broad (about 4 times longer than broad, or less) . . . . 44
- b. Leaves in fertile shoots distichous (in rare cases a few on the same plant in 3 rows). Leaf bud generally more slender . . . . . 52
- 44a. Leaves  $\pm$  clustered towards the end of the twigs. Leaf bud and inflorescences with hairs 0.5–1 mm long. Bark of older twigs often blackish, flaking. — Borneo (Sarawak, Brunei); sandy soils . . . . . **71. *H. sabulosa***
- b. Leaves clustered or not. Leaf bud and inflorescences with hairs up to 0.2 mm long. Bark of older twigs not or slightly flaking . . . . . 45
- 45a. Leaves with dots beneath (lens!) . . . . . 46
- b. Leaves without dots . . . . . 47
- 46a. Bark of twigs (grey-)brown, not contrasting with the dark colour of the petioles; older bark not flaking. Leaves in 2 or 3 rows. — W, C & S Sumatra, Java . . . . . **28. *H. glabra***

- b. Bark pale, grey or yellowish brown, rather contrasting with the petioles; older bark more or less flaking. Leaves in 3–5 rows. — Sumatra (N Aceh); at c. 1300 m . . . . . **8. *H. atjehensis***
- 47a. Bark of twigs brown, not contrasting with the colour of the petioles . . . . . 48
- b. Bark of twigs pale, greyish or straw, contrasting with the blackish brown colour of the petioles . . . . . 50
- 48a. Twigs ridged or short-winged. — Sumatra . . . . . **32. *H. hirtiflora***
- b. Twigs terete, neither ridged nor winged . . . . . 49
- 49a. Leaf pubescent beneath. — Sumatra, Peninsular Malaysia . . . . . **86. *H. superba***
- b. Leaf glabrous beneath. — Borneo . . . . . **26. *H. fragillima***
- 50a. Pedicel articulated. Androecium with depressed apex, apical hollow broad, either shallow or rather deep, reaching up to nearly halfway the column; androphore largely hidden by the anthers. Leaves mostly distichous, sometimes tristichous. — Sumatra, Peninsular Malaysia, . . . . . **85a. *H. sucosa* subsp. *sucosa***
- b. Pedicel mostly not articulated. Androecium not or but slightly depressed, the apical hollow narrow and inconspicuous. Leaves generally in 3–5 rows . . . . . 51
- 51a. Androphore ± absent. Leaves blackish brown. — Borneo . . . . . **55. *H. pallidicaula***
- b. Androphore 0.3–0.4 mm long. Leaves bright brown. — Peninsular Thailand, Sumatra, Peninsular Malaysia . . . . . **78. *H. sparsa***
- 52a. Buds ± obconical-obovoid, very leathery, cleft 1/6–1/5(–1/4) only. Androecium turbinate, anthers 3. — Sumatra . . . . . **91. *H. triandra***
- b. Buds of variable shapes, cleft 1/5(–1/4) or more. Androecium various, anthers 4 or more (male flowers not known in *H. perangusta*) . . . . . 53
- 53a. Buds ellipsoid or obovoid, 3–8 mm long, cleft 1/5–1/4(–1/3). Leaves ± parchment-like, matt above with finely wrinkled surface (in *H. sessilifolia* male flowers not known and leaves not so distinctly matt) . . . . . 54
- b. Buds either 1) ellipsoid or short pear-shaped, 3.5 mm long or less (though sometimes rather large in *H. endertii*, *H. flocculosa*, *H. majuscula*, and *H. wallichii*), or 2) (depressed) globose; cleft (1/4–)1/3–1/2 or more. Texture of leaves variable including coriaceous, never parchment-like and not typically matt above . . . . . 58
- 54a. Twigs 5–7(–10) mm diam. Leaves 25–70 cm long, indumentum persistent beneath . . . . . 57
- b. Twigs 3–5 mm diam. Leaves up to 30 cm long, (largely) glabrous beneath, or with some hairs persistent on the midrib. [Male perianth 3–5 mm long.] . . . . . 55
- 55a. Apical leaf bud with hairs 0.1–0.3 mm. Leaf midrib broad, margin flat . . . . . 56
- b. Leaf bud with hairs 1 mm long. Leaf midrib above line-shaped, margin (dry) rolled-in . . . . . **59. *H. perangusta***
- 56a. Leaves to 32 cm long, dark olivaceous. Twigs (yellowish) brown, coarsely striate and tending to crack longitudinally. Inflorescences (almost) glabrous. Pedicel not articulated. Anthers 12–20 . . . . . **92. *H. tristis***
- b. Leaves up to 24 cm long, fulvous-brown. Twigs brown, finely striate, not cracking. Inflorescences pubescent. Pedicel articulated. Anthers 10–12 . . . . . **27. *H. fulva***
- 57a. Buds 7–8 mm long, perianth and pedicel glabrous. Petiole 6–15 mm long. — Sumatra, Peninsular Malaysia . . . . . **86. *H. superba***
- b. Male buds not known; female perianth and pedicel pubescent. Petiole almost absent. — Borneo (Sarawak) . . . . . **75. *H. sessilifolia***

- 58a. Leaves with (sub)persistent indumentum beneath; in *H. gracilis* and *H. wallichii* sometimes hairs vestigial on and near midrib and nerves . . . . . 59
- b. Leaves glabrous or early glabrescent beneath; in some species often with vestigial hairs on the lower midrib . . . . . 69
- 59a. Leaves not scabrous above . . . . . 60
- b. Leaves scabrous above . . . . . **30. *H. grandis***
- 60a. Leaves with dots and/or dashes beneath, obscured by hairs or not (lens!) . . . . 61
- b. Leaves without dots or dashes beneath . . . . . 63
- 61a. Buds short pear-shaped, 2–2.5 mm long; pedicel indistinct, 0.3–1 mm long. Leaves thinly pubescent beneath, often  $\pm$  glabrescent . . . . . **96. *H. wallichii***
- b. Buds subglobose, 1–1.5 mm diam., pedicel slender, 0.5–1.5 mm long. Leaves with conspicuous indumentum beneath . . . . . 62
- 62a. Twigs 2–3 mm diam.; leaf blades 7–15 cm long, [lateral nerves 5–9 per side]. — Borneo (Sarawak); sandy soils . . . . . **57. *H. paucinervis***
- b. Twigs 5–8(–14) mm diam.; leaf blades (18–)24–36 cm long. — Sumatra, Peninsular Malaysia . . . . . **63. *H. pulcherrima***
- 63a. Buds broadly ellipsoid or obovoid, 2–3 mm long; androecium longer than broad. Pedicel (1.5–)3–4 mm long. Twigs and lower leaf surface with hairs 1.5–2 mm long . . . . . **25. *H. flocculosa***
- b. Buds (depressed) globose, 2.5 mm diameter or less; androecium as broad as or broader than long. Pedicel 3 mm long or less. Twigs and lower leaf surface with hairs to 1.5 mm long . . . . . 64
- 64a. Buds 1 mm diam., with persistent indumentum or late glabrescent . . . . . **46. *H. motleyi***
- b. Buds 1–2.5 mm diam., glabrous or glabrescent . . . . . 65
- 65a. Pedicel not or indistinctly articulated (this character not quite clear in *H. gracilis* and *H. rufo-lanata*) . . . . . 66
- b. Pedicel articulated . . . . . **68. *H. reticulata***
- 66a. Upper leaf surface dark brown on drying, with venation  $\pm$  indistinct. — S Peninsular Thailand, Peninsular Malaysia . . . . . **90. *H. tomentosa***
- b. Upper leaf surface olivaceous on drying, venation distinct or not. — Borneo 67
- 67a. Twigs 3.5–7(–13) mm diam. Leaves 10–45 cm long; venation distinct above; lateral nerves 11 pairs or more. Buds 1.5–2.3 mm diam.; anthers 8 or more . . . . 68
- b. Twigs 3 mm diam. Leaves 12–21 cm long; venation indistinct above; lateral nerves 14–17 pairs; [lower leaf surface with sparse subpersistent hairs, vestigial mainly on nerves and midrib]. Buds 0.6–1 mm diam.; anthers 16–18 . . . **29. *H. gracilis***
- 68a. Leaves 18–45 cm long; lateral nerves 18–25 pairs, sunken above. Buds 1.5–2 mm diam.; anthers 8–10. — Borneo; lowland . . . . . **80. *H. splendida***
- b. Leaves smaller, 10–23 cm long; lateral nerves 11–16 pairs, raised above. Buds 2–2.3 mm diam.; anthers c. 15. — Borneo (Sarawak, Sabah); montane, 900–1400 m . . . . . **70. *H. rufo-lanata***
- 69a. Twigs at apex pale, greyish or straw, contrasting with the dark brown petiole 70
- b. Twigs at apex (dark) brown, not contrasting with the petiole . . . . . 75
- 70a. Androecium angular in cross section. Anthers free for the upper half or more. — Borneo; heath forest on sand or peat soil . . . . . **52. *H. oligocarpa***
- b. Androecium (sub)circular in cross section. Anthers largely connate . . . . . 71

- 71a. Leaves chartaceous, bright brown. [Pedicel not articulated. Androecium with small apical hollow.] — Borneo; mostly in heath forest on sandy soils . . . **12. *H. carnosa***  
 b. Leaves membranous, (blackish) brown. — Usually growing in forest on richer soils, including sand . . . . . 72
- 72a. Pedicel articulated. Androecium strongly depressed-globose; apical hollow broad with flattish bottom, to nearly halfway into the androecium. — Sumatra, Peninsular Malaysia . . . . . **48. *H. sucosa* subsp. *sucosa***  
 b. Pedicel not articulated. Androecium ellipsoid to slightly depressed-globose; with the apical hollow small and narrow (male flowers not known in *H. discolor*). — Peninsular Malaysia, Borneo . . . . . 73
- 73a. Buds (sub)globose, 1.5–2(–2.2) mm long, androecium subglobose or short-ellipsoid, 1 mm long. Leaves distichous or dispersed. — Borneo; up to 700 m . . . 74  
 b. Buds ellipsoid, 2–2.4 mm long, androecium ellipsoid, 1.8–2 mm long. Leaves distichous. — Peninsular Malaysia; at c. 1300 m . . . . . **23. *H. elongata***
- 74a. Fruits 4(–6) cm long or less . . . . . **55. *H. pallidicaula***  
 b. Fruits 5 cm long or more . . . . . **21. *H. discolor***
- 75a. Twigs ridged or nearly winged, also in the older wood . . . . . 76  
 b. Twigs not ridged; sometimes twigs faintly ridged, lined, or angular in the apical part only . . . . . 79
- 76a. Buds cleft nearly to the base. — New Guinea . . . . . 77  
 b. Buds cleft 1/2–2/3. — West Malesia . . . . . 78
- 77a. Buds slightly broader than long, short-pubescent in the lower half. Androecium slightly broader than long; anthers erect, not incurved . . . . . **5. *H. angularis***  
 b. Buds subglobose to broadly ellipsoid, glabrous. Androecium longer than broad, ± obovoid, the anthers with apex free and incurved, those of one side of the androecium clasping the others . . . . . **51. *H. olens***
- 78a. Buds 2.5 mm diam., pubescent. — N Sumatra . . . . . **32. *H. hirtiflora***  
 b. Buds 1–1.5 mm diam., glabrous. — S Peninsular Thailand, Sumatra, Peninsular Malaysia, Borneo . . . . . **11. *H. brachiata***
- 79a. Buds short pear-shaped, 2(–2.5) mm long, subsessile with the pedicel much shorter than the perianth, 0.3–1 mm long, thickish. Leaves coriaceous, pubescent or glabrescent, with dots and dashes beneath (lens!); lateral nerves flat or sunken above. Twigs hollow . . . . . **96. *H. wallichii***  
 b. Buds variable in shape and size, the pedicel proportionally longer and more slender (buds obovoid with pedicel short in *H. glabra* var. *oviflora*). Leaves variable, nerves raised or sunken, dots present or absent. Twigs solid or faintly hollow . . . . . 80
- 80a. Inflorescences stout, the rachis towards the base 5–8 mm diam. Androecium about as broad as long, triquetrous in cross section, [anthers entirely connate]. — W Borneo . . . . . **54. *H. pachyrachis***  
 b. Inflorescences large or small, the rachis towards base 4(–4.5) mm thick or less. Androecium triquetrous or circular in cross section. — Whole of W Malesia . 81
- 81a. Androecium 3- or 4-angular in cross section. Anthers ± erect, free for about half-way or more. Buds 1.5(–2) mm diameter or less. Pedicel articulated. Leaves with the lateral nerves raised above; dots absent (*H. ridleyana* with leaves small, nerves sunken, male buds 1 mm diam.). — Most of W Malesia, not in Sulawesi, rare in the Philippines . . . . . 82

- b. Androecium in cross section circular, ellipsoid, or subtriangular with rounded angles. Anthers  $\pm$  curved, almost entirely connate, free apices c. 1/3 or less. Buds (1.3–)1.5 mm diameter or more. Pedicel articulated or not. Leaves with the lateral nerves raised, level, or sunken above; dots present or absent (lens!) . . . . . 89
- 82a. Leaves 5–16 cm long; midrib and lateral nerves level or sunken above . . . . . 83
- b. Leaves small or large, 5–28 cm long; midrib and lateral nerves raised above . . . . . 84
- 83a. Twigs and inflorescences rather glabrescent. Leaf apex acute or acute-acuminate; nerves faint above. Anthers 4–6. — Peninsular Malaysia, Borneo . . . . . **69. *H. ridleyana***
- b. Twigs late glabrescent, inflorescences with persistent indumentum. Leaf apex blunt; nerves flat or but little raised above, clearly visible. Anthers 9 or 10. — Borneo (Sarawak) . . . . . **50. *H. obtusa***
- 84a. Leaves early glabrescent beneath, also on the midrib; leaf apex long acute-acuminate. Twigs rather smooth, lower down cracking longitudinally. — Borneo (Brunei) . . . . . **22. *H. disticha***
- b. Leaves early glabrescent beneath, but midrib sometimes late glabrescent; leaf apex acute-acuminate. Twigs striate, lower down coarsely striate or finely cracking . . . . . 85
- 85a. Twigs 1–2(–4) mm diam. Leaves 7–18 cm long, thinly membranous to subchartaceous; petiole slender, 1–1.5(–2) mm diam. Inflorescences delicate, up to 9 cm long; buds 1 mm diam. . . . . 86
- b. Twigs 1–5(–8) mm diam. Leaves of variable sizes, chartaceous or coriaceous; the petiole 1.5–4(–8) mm diam. Inflorescences up to 15(–20) cm long; buds 1–2 mm diam. . . . . 87
- 86a. Leaf bud with hairs (0.1–)0.2 mm long; twigs at apex and leaves glabrous; inflorescences with sparse stellate hairs 0.2 mm long, glabrescent. Leaves drying to a greyish tinge. Male buds short pear-shaped, tapering into the pedicel . . . . . **89. *H. tenuifolia***
- b. Leaf bud, apical part of twig, petiole, midrib beneath and inflorescences with woolly stellate-dendroid hairs (0.2–)0.5 mm long; leaves olivaceous on drying. Male buds globose or depressed-globose . . . . . **41. *H. macilenta***
- 87a. Twigs and leaves stout, the midrib broad above, at the transition to the petiole at least 3 mm wide. Inflorescences 10–20 cm long. — Borneo; forests on poor soil, including sand and peat . . . . . **39. *H. laticostata***
- b. Twigs and leaves less robust; midrib above towards the insertion of the petiole less than 3 mm wide. Inflorescences up to 15–20 cm long. — On poor or rich soil . . . . . 88
- 88a. Leaves 16–28 cm long, leaf base  $\pm$  rounded or short-attenuate; nerves 16–19 pairs, very prominent above. — Borneo (Sarawak) . . . . . **47. *H. nervosa***
- b. Leaves 7–28 cm long, base short- to long-attenuate; nerves 6–16 pairs, raised to variable degrees above. [On drying, colour of leaves above and beneath usually much contrasting, generally more so than in the related species.] — Variable, with 3 varieties (based on fruit size). Sumatra, Peninsular Malaysia, whole of Borneo, Philippines (Mindanao, Palawan) . . . . . **61. *H. polyspherula***
- 89a. Leaf bud, apical part of twig, and inflorescences with hairs 0.2 mm long or more (hairs 0.1–0.4 mm long in *H. punctata*) . . . . . 90
- b. Leaf bud, apical part of twig, and inflorescences with hairs (0.2–)0.1 mm long or less . . . . . 97

- 90a. Buds ellipsoid, 2.5–3.5 mm long; androecium longer than broad. [Leaves thick and brittle, apex bluntish; lower surface usually with conspicuous pale golden hair scars (lens!).] . . . . . **24. H. endertii**
- b. Buds (sub)globose; androecium not longer than broad . . . . . 91
- 91a. Buds 2.5–3 mm diam. (or 1.5 mm in *Hallier 624* from W Borneo, see the notes), cleft c. 4/5. — Sumatra . . . . . **95. H. valida**
- b. Buds (1–)1.2–2.5 mm diam., cleft 1/3–2/3(–3/4). — Peninsular Malaysia, Borneo . . . . . 92
- 92a. Leaves with dots beneath (lens!) . . . . . 93
- b. Leaves without dots beneath. [Pedicel not articulated.] . . . . . 94
- 93a. Pedicel articulated. Lateral nerves flat or sunken above. Lower leaf surface cinnamon or chocolate, contrasting with upper surface. — Borneo . . . . . **10. H. borneensis**
- b. Pedicel not articulated. Lateral nerves largely raised above. Upper and lower leaf surface not much contrasting. — Peninsular Malaysia . . . . . **65. H. punctata**
- 94a. Buds 2–2.5 mm diam.; androecium sessile, broadly saucer-shaped. Leaves 20–45 cm long. — Lowland forest . . . . . **26. H. fragillima**
- b. Buds (1–)1.4–2.2 mm diam.; androecium (depressed-)globose, with the apical hollow small, concealed by the apices of the anthers. Leaves 4–35 cm long. — Montane forest at 800–2000 m . . . . . 95
- 95a. Androecium with slender androphore 0.3–0.8 mm long, not hidden by the anthers. Leaves membranous, 9–18 cm long, dark brown, [apex acute-acuminate] . . . . . **4. H. androphora**
- b. Androecium (sub)sessile, androphore absent or up to 0.5 mm, largely hidden by the anthers . . . . . 96
- 96a. Leaves chartaceous or membranous, to c. 35 cm long, olivaceous-brown; apex acute-acuminate. Inflorescences to 20 cm long. — Borneo (Mt Kinabalu) . . . . . **3. H. amplomontana**
- b. Leaves coriaceous, 4–14 cm long, blackish; apex obtuse to subacute. Inflorescences 4–16 cm long . . . . . **45. H. montana**
- 97a. Leaves with dots beneath . . . . . 104
- b. Leaves without dots beneath (dots should not be confused with smaller, blackish points) . . . . . 98
- 98a. Buds ± ellipsoid; androecium ± obovoid, the apical part of the anthers deeply inflexed into the apical hollow. — New Guinea . . . . . **74. H. sepikensis**
- b. Buds and androecium of variable shapes; the anthers ± straight or curved, at apex not inflexed. — W and E Malesia, not in New Guinea . . . . . 99
- 99a. Perianth coriaceous; lobes thick, towards the base (0.3–)0.4–1 mm thick. Androecium ellipsoid-obovoid, longer than broad . . . . . 102
- b. Perianth thinner, lobes at base 0.2–0.3 mm thick. Androecium subglobose, broadly ellipsoid, or obovoid, not or but little longer than broad. [Androphore narrow, only 0.2 mm long. Leaves membranous to chartaceous.] . . . . . 100
- 100a. Pedicel (1–)1.5–2 mm long, about as long as the perianth. — Peninsular Malaysia, Borneo . . . . . 101
- b. Pedicel shorter than the perianth, 0.5 mm long. — Sulawesi, Philippines . . . . . **17. H. costulata**

- 101a. Buds cleft c. 1/2 . . . . . **83. *H. subalpina***  
 b. Buds cleft 2/3–4/5 . . . . . **48. *H. obscura***
- 102a. Bark of twigs not flaking. Leaves  $\pm$  membranous . . . . . 103  
 b. Bark of twigs flaking or not. Leaves coriaceous. [Pedicel not articulated. Anthers (3–)4–8; androphore rather broad, tapering, (0.1–)0.2–0.3 mm long.] — Borneo (Sarawak, Sabah); kerangas, montane forest; 800–1550 m . . . **97. *H. xanthina***
- 103a. Pedicel articulated. Anthers 7–9; androphore rather broad and tapering, 0.2–0.5 mm long. — Sumatra, Peninsular Malaysia; 0–1000 m . . . . . **43. *H. majuscula***  
 b. Pedicel not articulated. Anthers 5 or 6; androphore narrow, 0.1–0.2 mm long, hidden by the anthers. — C Sulawesi; 100–450 m . . . . . **14. *H. coriacea***
- 104a. Twigs 2.5–3(–4) mm diam. Leaves (8–)12 cm long or more. Male buds (sub-)globose, 1.5–4.2 mm diam. . . . . 105  
 b. Twigs 1.5–2 mm. Leaves 5–12 cm long. Male buds  $\pm$  ellipsoid or globose, 1.2–1.8 mm long . . . . . **58. *H. penangiana***
- 105a. Buds cleft 3/4–4/5; anthers 7–11 . . . . . 106  
 b. Buds cleft 1/3–2/3; anthers 9–20. — Sumatra, Java . . . . . 107
- 106a. Anthers 7–9. Dry fruits 4–5 cm long, pericarp 10–20 mm thick. — N Sumatra, Peninsular Malaysia, Borneo . . . . . **66. *H. punctatifolia***  
 b. Anthers c. 11. Dry fruits 2 cm long, pericarp 1.5 mm thick. — Peninsular Malaysia . . . . . **65. *H. punctata***
- 107a. Buds 3–4.2 mm diam.; anthers 15–20. — N & C Sumatra **42. *H. macrothyrsa***  
 b. Buds 1.5–2.5 mm diam.; anthers 9–15. — Variable, with 3 varieties. Java, W, C & S Sumatra . . . . . **28. *H. glabra***

(2) REGIONAL KEY TO THE SPECIES — PENINSULAR MALAYSIA, SINGAPORE  
 (based on female flowering and fruiting specimens)

- 1a. Flower buds pubescent at base. [Ovary pubescent. Fruits pubescent, ellipsoid, 2.5–4 cm long. Flowers in dense clusters and strongly fragrant in male specimens.] — Originating from Sri Lanka, cultivated in Penang, Singapore and elsewhere . . . . . **36. *H. iryagedhi***  
 b. Buds glabrous or early glabrescent . . . . . 2
- 2a. Perianth 2-lobed. Ovary glabrous . . . . . 3  
 b. Perianth 3- (or 4-)lobed. Ovary glabrous or pubescent . . . . . 5
- 3a. Twigs ridged or lined. Leaves membranous, often with irregular whitish blotches. Fruits and seeds globose. — Plant usually riverine, in coastal areas . . . **35. *H. irya***  
 b. Twigs not lined. Leaves without pale blotches. Fruits and seeds ellipsoid . . . . . 4
- 4a. Leaves membranous, glabrous beneath, dots absent. — Gardens' Jungle, Singapore (originating from E Malesia) . . . . . **56. *H. parviflora***  
 b. Leaves coriaceous, beneath pubescent and with dots (lens!) — Kerangas, peat swamp forest . . . . . **18. *H. crassifolia***
- 5a. Leaves with dots beneath (dots not to be confused with smaller dark punctation) 20  
 b. Leaves without dots beneath . . . . . 6
- 6a. Leaves with persistent indumentum beneath . . . . . 7  
 b. Leaves glabrous or glabrescent beneath . . . . . 11

- 7a. Ovary pubescent. Fruits pubescent or at least with vestigial indumentum near the base; perianth not persistent . . . . . **90. H. tomentosa**
- b. Ovary glabrous or with some incidental minute hairs. Fruits glabrous, perianth (at least at first) persistent . . . . . 8
- 8a. Hairs on lower (and upper) leaf surface harsh, with hardened hair bases, in older leaves rendering the surface scabrous. Fruits 1–1.4 cm long . . . . **30. H. grandis**
- b. Leaves not scabrous. Fruits 2 cm long or more . . . . . 9
- 9a. Twigs 3–5 mm diam. Leaf bud and twig apex with hairs 0.2–0.3 mm long. Leaf blade 13–21 cm long, [matt above on drying. Fruits 2.2–2.4(–3) cm long] . . . . . **27. H. fulva**
- b. Twigs 5–10 mm diam. Leaf bud and twig apex with hairs 0.5 mm long or more. Leaf blade 20–40(–70) cm long . . . . . 10
- 10a. Leaf bud, twig apex and lower leaf surface with rather stiff, rust-coloured hairs 0.5–1 mm long. Fruits 3.8–5.5 cm long . . . . . **86. H. superba**
- b. Leaf bud, twig apex and lower leaf surface with yellow-brown or pale brown woolly hairs 1–2 mm long. Fruits 3 cm long . . . . . **25. H. flocculosa**
- 11a. Twigs pale brown or straw, contrasting with the blackish petiole. Leaves either distichous or in 3–5 rows along the twigs . . . . . 12
- b. Twigs brown, not contrasting with the petiole. Leaves distichous . . . . . 14
- 12a. Leaves distichous or in 3 rows . . . . . 13
- b. Leaves in 3–5 rows along the twigs. [Pedicel not articulated. Fruits 3–5.5 cm long, perianth not persistent.] . . . . . **78. H. sparsa**
- 13a. Leaves distichous. Pedicel not articulated. Male perianth ± ellipsoid, 2–2.4 mm long. Fruits not known . . . . . **23. H. elongata**
- b. Leaves distichous or in 3 rows. Pedicel articulated (this character best seen in male flowers). Male perianth globose, smaller. Fruits 2.5–3.5 cm long, perianth persistent . . . . . **85a. H. sucosa** subsp. *sucosa*
- 14a. Leaf upper surface matt on drying caused by fine wrinkles; nerves flat or sunken. Fruits usually with persistent perianth . . . . . **27. H. fulva**
- b. Leaves above not particularly matt, not finely wrinkled; nerves flat or raised. Perianth not persistent under the fruits . . . . . 15
- 15a. Lateral nerves flat or but faintly raised above . . . . . 16
- b. Lateral nerves distinctly raised above. [Pedicel articulated; this character best seen in male flowers.] . . . . . 18
- 16a. Leaf bud with hairs 1 mm long. [Midrib narrow, line-shaped, sunken above; blade margin rolled-in.] . . . . . **59. H. perangusta**
- b. Leaf bud with hairs much shorter . . . . . 17
- 17a. Leaf bud with hairs 0.1 mm long. Twigs 2.5–5 mm diam. Leaves 15–27 cm long. Pedicel not articulated . . . . . **83a. H. subalpina** subsp. *subalpina*
- b. Leaf bud with hairs 0.2–0.4 mm long. Twigs 1.5–3.5 mm diam. Leaves 5–15 cm long. Pedicel articulated . . . . . **69. H. ridleyana**
- 18a. Leaf bud with hairs 0.1 mm long. Midrib early glabrescent beneath. Fruits 4.5–6.5 cm long, with thick pericarp . . . . . **43. H. majuscula**
- b. Leaf bud with hairs 0.1 mm long or usually much longer. Midrib often late glabrescent beneath. Fruits 2–4 cm long, pericarp 2–5(–7) mm thick . . . . . 19



- 19a. Twigs  $\pm$  angular, lined or low-ridged. [Fruits 2–3(–4) cm long.] **11. *H. brachiata***  
 b. Twigs terete, neither lined nor ridged . . . . . 20
- 20a. Twigs 2–5 mm diam. Leaves usually chartaceous. Fruits 1.9–3.5 cm long . . . . .  
 . . . . . **61. *H. polyspherula***  
 b. Twigs 1–3 mm diam. Leaves membranous. Fruits 2.3–2.4 cm long . . . . .  
 . . . . . **41. *H. macilenta***
- 21a. Leaves usually with persistent indumentum beneath . . . . . 22  
 b. Leaves glabrous or glabrescent beneath . . . . . 23
- 22a. Leaves  $\pm$  pubescent, sometimes late glabrescent, with dots and dashes beneath.  
 Ovary glabrous. Fruits 4–6 cm long, glabrous, perianth usually persistent . . . . .  
 . . . . . **96. *H. wallichii***  
 b. Leaves always pubescent beneath, with dots, not with dashes. Ovary pubescent.  
 Fruits 1.6–1.8 cm long, shaggy-hairy, perianth not persistent **63. *H. pulcherrima***
- 23a. Twigs 1.5–2 mm diam. Fruits 1.1–2 cm long . . . . . **58. *H. penangiana***  
 b. Twigs somewhat stouter, 2.5–5 mm diam. Fruits 2 cm long or more . . . . . 24
- 24a. Leaves coriaceous, apex blunt or subacute. Fruits 2–2.3 cm long, pericarp thin. —  
 Montane species of C Peninsular Malaysia . . . . . **65. *H. punctata***  
 b. Leaves membranous, apex acute-acuminate. Fruits 4.5–8 cm long, pericarp 10–20  
 mm thick. — Widespread in W Malesia; forests up to c. 1100 m . . . . .  
 . . . . . **66. *H. punctatifolia***

(3) REGIONAL KEY TO THE SPECIES — SUMATRA, JAVA

(based on female flowering and fruiting specimens)

- 1a. Flower buds pubescent at base. [Ovary pubescent. Fruits ellipsoid, 2.5–4 cm long,  
 pubescent. In male the flowers in dense clusters, strongly fragrant.] — Cultivated,  
 originating from Sri Lanka . . . . . **36. *H. iryagedhi***  
 b. Buds glabrous (pubescent at base in *H. hirtiflora* and *H. triandra*) . . . . . 2
- 2a. Leaves membranous, often with irregular whitish blotches. Fruits globose, 1.5–2  
 cm diam., glabrous; pericarp 1–2 mm thick; seeds globose. [Perianth 2-lobed; ovary  
 glabrous.] — Riverine or marshy, usually near the coast . . . . . **35. *H. irya***  
 b. Leaves of different consistency, usually not blotched. Fruits and seeds ellipsoid. —  
 Plant not coastal . . . . . 3
- 3a. Perianth 2-lobed. Leaves with dots beneath (dots not to be confused with smaller  
 punctuation of different origin, lens!) . . . . . 4  
 b. Perianth 3- (or 4-)lobed. Leaves with or without dots beneath . . . . . 5
- 4a. Leaves coriaceous, 10–20(–28) cm long, finely pubescent beneath. Twigs 2–6 mm  
 diam. Fruits 1.5–2.2 cm long, with persistent perianth. — Peat swamp or padang  
 forest . . . . . **18. *H. crassifolia***  
 b. Leaves membranous or thinly chartaceous, 5–12 cm long, glabrous beneath. Twigs  
 1.5–2 mm diam. Fruits 1–2 cm long; perianth not persistent. — Mixed forest . . . .  
 . . . . . **58a. *H. penangiana* subsp. *penangiana***
- 5a. Ovary and fruits (at least at base) pubescent. Leaves with persistent indumentum  
 beneath . . . . . 6  
 b. Ovary and fruits glabrous (fruits almost glabrous in *H. triandra*). Leaves glabrous  
 or pubescent beneath . . . . . 7

- 6a. Twigs 2–5 mm diam. Leaves 9–27 cm long, lower surface without dots. Fruits with hairs 0.5 mm long or less. — Thailand, Peninsular Malaysia; specimens from Sumatra not seen . . . . . **90. *H. tomentosa***
- b. Twigs 5–8 mm diam. Leaves 20–36 cm long, with dots beneath (lens!). Fruits with hairs 2 mm long . . . . . **63. *H. pulcherrima***
- 7a. Leaves with dots beneath (lens!). Lateral nerves generally flat or sunken above . . . . . 21
- b. Leaves without dots beneath. Nerves either raised or flat to sunken above . . . . 8
- 8a. Leaves with persistent indumentum beneath. Fruits with persistent perianth . . 9
- b. Leaves glabrous or glabrescent beneath. Fruits with persistent perianth or not 11
- 9a. Hairs harsh, older leaves scabrous beneath. [Fruits 1–1.4 cm long.] . . . . . **30. *H. grandis***
- b. Hairs softer; older leaves not scabrous beneath . . . . . 10
- 10a. Twigs 5–8 mm diam.; leaves 20–40(–70) cm long. Leaf bud with hairs 0.5–1 mm. Fruits 3.8–5.5 cm long . . . . . **86. *H. superba***
- b. Twigs 3–5 mm diam.; leaves 13–21 cm long. Leaf bud with hairs 0.2–0.3 mm long. Fruits 2–3 cm long . . . . . **27. *H. fulva***
- 11a. Lateral nerves flat or sunken or but faintly raised above. Colour of lower leaf surface generally greyish brown, not much contrasting with upper surface . . . . 12
- b. Lateral nerves distinctly raised above. Colour of the lower leaf surface bright brown or chocolate, contrasting with the upper surface . . . . . 16
- 12a. Twigs 1.5–3 mm diam. Leaf bud, twig apex, and young inflorescences with woolly hairs 0.3–0.7 mm. Leaves 5–9 cm long . . . . . **91. *H. triandra***
- b. Twigs (2–)3–10 mm diam. Leaf bud, twig apex, and inflorescences 0.1–0.3 mm long. Leaves more than 10 cm long . . . . . 13
- 13a. Leaves distichous, matt on drying caused by minutely wrinkled upper surface. Bark of twigs straw or brown . . . . . 14
- b. Leaves distichous or in 3–5 rows; not particularly matt, upper surface not finely wrinkled. Bark of twigs pale, grey-brown or straw, contrasting with the blackish petiole . . . . . 15
- 14a. Leaves elliptic-oblong to oblong, olivaceous-brown above. Stem grey-brown, not much contrasting with petiole. Fruits brown on drying, 2.2–3 cm long, perianth persistent . . . . . **27. *H. fulva***
- b. Leaves elliptic-oblong to lanceolate, dark olivaceous above. Stem pale, ± yellowish brown, rather contrasting with the petiole. Fruits blackish on drying, 1.5 cm long, perianth not persistent . . . . . **92. *H. tristis***
- 15a. Leaves distichous or in 3 rows. Fruits 2.5–3.5 cm long, with the perianth persistent. Pedicel articulated (best seen in male flowers) . . . **85a. *H. sucosa* subsp. *sucosa***
- b. Leaves in 3–5 rows. Fruits 3–5.5 cm long, perianth not persistent. Pedicel not articulated . . . . . **78. *H. sparsa***
- 16a. Perianth 4-lobed. Pedicel not articulated. Fruits 8–9 cm long. [Flowers known only from the remnants persistent under the young fruits.] . . . . . **95. *H. valida***
- b. Perianth generally 3-lobed. Pedicel articulated. Fruits up to 6.5 cm long . . . 17
- 17a. Twigs ± angular, with lines or ridges . . . . . 18
- b. Twigs terete or faintly angular, neither lined nor ridged . . . . . 19

- 18a. Buds pubescent (known only in male flowers). Fruits 5–6 cm long. — N Sumatra  
 ..... **32. *H. hirtiflora***  
 b. Buds glabrous. Fruits 2–4 cm long ..... **11. *H. brachiata***
- 19a. Twigs 1–3 mm diam. Leaves membranous, midrib beneath late glabrescent. Fruits  
 2.3–2.4 cm long ..... **41. *H. macilentia***  
 b. Twigs 2–5 mm diam. Leaves chartaceous. Fruits 1.9–6.5 cm long ..... 20
- 20a. Leaf bud and inflorescences with hairs 0.1–0.2 mm long. Midrib beneath early gla-  
 brescent. Fruits 4.5–6.5 cm long ..... **43. *H. majuscula***  
 b. Leaf bud and inflorescences with hairs 0.1–0.6 mm long. Midrib often late gla-  
 brescent. Fruits 1.9–3.5 cm long. — Variable; 3 varieties based on fruit size .....  
 ..... **61. *H. polyspherula***
- 21a. Leaves usually with persistent indumentum beneath (sometimes glabrescent), and  
 with both dots and dashes (lens!). Twigs conspicuously hollow. Fruits 4–7 cm long,  
 the perianth generally persistent ..... **96. *H. wallichii***  
 b. Leaves glabrous or glabrescent beneath, with dots, not with dashes. Twigs not con-  
 spicuously hollow. Fruits variable ..... 22
- 22a. Bark of twigs pale, greyish to straw-coloured, contrasting with blackish petiole.  
 Leaves dispersed in 3–5 rows. [Female flowers and fruits not known.] — Sumatra  
 (N Aceh); at c. 1300 m ..... **8. *H. atjehensis***  
 b. Bark of twigs brown, not contrasting with petiole. Leaves distichous (or in 3 rows  
 in *H. glabra*, p.p.) ..... 23
- 23a. Fruits (4.5–)5–8 cm long, pericarp 10–20 mm thick ..... **66. *H. punctatifolia***  
 b. Fruits 1–2.5 cm long, pericarp much thinner ..... 24
- 24a. Twigs 1.5–2 mm diam. Leaves 5–12 cm long. Fruits 1.1–2 cm long .....  
 ..... **58. *H. penangiana***  
 b. Twigs 2.5–4(–6) mm diam. Leaves (8–)12 cm long or more. Fruits 1.8–2.5 cm long  
 ..... 25
- 25a. Leaves distichous. — C & N Sumatra ..... **42. *H. macrothyrsa***  
 b. Leaves distichous or in 3 rows. — S Sumatra, Mentawai Is., north to Simeuluë I.,  
 Java ..... **28. *H. glabra***

## (4) REGIONAL KEY TO THE SPECIES — BORNEO

(based on female flowering and fruiting specimens)

- 1a. Leaves membranous, usually with irregularly shaped whitish blotches. Fruits glo-  
 bose, 1.5–2 cm diam., glabrous; pericarp 1–2 mm thick; seeds globose. [Perianth  
 2-lobed; ovary glabrous.] — Plants usually growing not too far from the coast ...  
 ..... **35. *H. irya***  
 b. Leaves variable, usually not white-blotched. Fruits subglobose or ellipsoid; seeds  
 ellipsoid. — Plants coastal or not ..... 2
- 2a. Perianth 2-lobed ..... 3  
 b. Perianth predominantly 3- (or 4-)lobed ..... 5
- 3a. Leaves coriaceous, densely short-pubescent and with dots beneath (lens!). Twigs  
 grey-brown, not contrasting with petioles ..... **18. *H. crassifolia***  
 b. Leaves membranous, glabrous and without dots beneath. Twigs greyish or straw-  
 coloured, contrasting with blackish petioles ..... 4

- 4a. Inflorescences ± spike-like, 5–10 cm long. Perianth persistent under the fruits (always?). — Borneo (SE Sabah) . . . . . **82. *H. sterilis***  
 b. Inflorescences branched, 1–2 cm long. Perianth not persistent under the fruits. — Borneo (Sarawak, Sabah, E, C & S Kalimantan) . **85b. *H. sucosa* subsp. *bifissa***
- 5a. Leaves in 3 or more rows along the twigs . . . . . 6  
 b. Leaves distichous . . . . . 8
- 6a. Leaves ± clustered at the apex of the twigs. Petiole proportionally long and slender, 25–50 mm long. — Northern Borneo; sandy soils . . . . . **71. *H. sabulosa***  
 b. Leaves not clustered. Petiole proportionally shorter . . . . . 7
- 7a. Leaves 10–30 cm long. Twigs pale, grey or straw-coloured, contrasting with the blackish petioles. Buds 2.5–3 mm long. Fruits 1.5–6 cm long **55. *H. pallidicaula***  
 b. Leaves 20–45 cm. Twigs brown, not contrasting with the petioles. Buds 4–5 mm long. Fruits 6–8 cm long . . . . . **26. *H. fragillima***
- 8a. Twigs lined or ridged . . . . . **11. *H. brachiata***  
 b. Twigs terete or faintly angular, neither distinctly lined nor ridged . . . . . 9
- 9a. Leaves with (sub)persistent indumentum beneath (sometimes largely glabrescent in *H. wallichii*) . . . . . 10  
 b. Leaves glabrous or early glabrescent beneath (midrib sometimes late glabrescent) . . . . . 18
- 10a. Plant stout; leaves 50 cm long, petiole 3 mm long only. — Borneo (lowland Sarawak) . . . . . **75. *H. sessilifolia***  
 b. Plants variable in habit; leaves large, but petiole proportionally much longer . . 11
- 11a. Older leaves with scabrous hair scars above and beneath. Fruits 1–1.4 cm long . . . . . **30. *H. grandis***  
 b. Leaves not scabrous. Fruits larger . . . . . 12
- 12a. Leaves with dots and/or dashes beneath (lens!) . . . . . **96. *H. wallichii***  
 b. Leaves with or without dots beneath, never with dashes . . . . . 13
- 13a. Flower buds with persistent indumentum; fruits without persistent perianth . . . . . **46. *H. motleyi***  
 b. Buds glabrous or early glabrescent; fruits with persistent perianth or not . . . . 14
- 14a. Ovary pubescent; fruits sometimes pubescent only towards the base . . . . . 15  
 b. Ovary and fruits glabrous . . . . . 16
- 15a. Twigs 3.5–5 mm diam. Leaves 10–23 cm long; nerves 11–16 pairs. Fruits largely glabrescent; perianth not persistent . . . . . **70. *H. rufo-lanata***  
 b. Twigs 4–7 mm diam. Leaves 18–45 cm long, nerves 18–25 pairs. Fruits pubescent, with persistent perianth . . . . . **80. *H. splendida***
- 16a. Twigs 3–6 mm diam. Leaves 18–35 cm long; upper surface sometimes bullate; [nerves 17–20 pairs.] Fruits 2.3–2.7 cm long . . . . . **68. *H. reticulata***  
 b. Twigs 1.5–3 mm diam. Leaves often smaller, not bullate. Fruits 1–1.5 cm long 17
- 17a. Leaves membranous, beneath without dots; nerves 14–17 pairs . **29. *H. gracilis***  
 b. Leaves thinly chartaceous, beneath with dots; nerves 5–9(–11) pairs . . . . . **57. *H. paucinervis***
- 18a. Leaves with dots or with dots and dashes beneath (lens!) (dots not to be confused with smaller, irregularly spaced points, which are usually present) . . . . . 19  
 b. Leaves without dots beneath (enlarged hair scars sometimes present) . . . . . 22

- 19a. Leaf bud, twig apex, and young inflorescences with hairs 0.2 mm long or more ..... 20  
 b. Leaf bud, twig apex, and young inflorescences with hairs 0.1 mm long or less 21
- 20a. Twigs hollow. Leaves often with persistent indumentum beneath. Pedicel not articulated. Fruits with persistent perianth ..... **96. H. wallichii**  
 b. Twigs (almost) solid. Leaves glabrescent beneath. Pedicel articulated. Fruits without persistent perianth ..... **10. H. borneensis**
- 21a. Twigs 1.5–2 mm diam. Leaves 5–12(–17) cm long; nerves 8–11 pairs. Fruits 1.1–2 cm long, pericarp thin ..... **58. H. penangiana**  
 b. Twigs 2.5–4 mm diam. Leaves 9–21 cm long, nerves 11–16 pairs. Fruits 4.5–8 cm long, with thick pericarp ..... **66. H. punctatifolia**
- 22a. Twigs pale, grey-brown or yellowish, contrasting with the dark brown petioles 23  
 b. Twigs brown on drying, ± not contrasting with the petioles ..... 27
- 23a. Leaves membranous, (blackish) brown above, somewhat paler beneath. Perianth persistent under the fruits. — Mixed forest ..... **55. H. pallidicaula**  
 b. Leaves usually chartaceous, bright brown or olivaceous above. Perianth not persistent under the fruits ..... 24
- 24a. Twigs 2–3 mm diam. Leaves 7–16 cm long, bright brown or chocolate beneath, contrasting with the grey-olivaceous upper surface. Fruits 1.8–2.7 cm long. — Kerangas, peat forest ..... **52. H. oligocarpa**  
 b. Twigs 3–10 mm diam. Leaves 13–35 cm long, the lower surface not conspicuously contrasting with upper surface ..... 25
- 25a. Fruits 5 cm long or more. Leaves not conspicuously matt above . **21. H. discolor**  
 b. Fruits 2 cm long or less. Leaves matt, caused by finely wrinkled upper surface . . .  
 ..... 26
- 26a. Leaves (elliptic-)oblong. Fruits 1.6–2 cm long. — Heath forest, peat swamp forest ..... **12. H. carnosa**  
 b. Leaves elliptic-oblong to lanceolate. Fruits 1.5 cm long. — Mixed forest .....  
 ..... **92. H. tristis**
- 27a. Leaf bud and immature inflorescences with hairs 0.1 mm long or less. Lateral nerves flat or sunken, or but little raised above ..... 28  
 b. Leaf bud and immature inflorescences with hairs 0.1 mm long or more; lateral nerves above raised or not; if hairs only 0.1 mm long, then the lateral nerves above distinctly raised, at least in the lower half ..... 30
- 28a. Species from lowland limestone, up to c. 700 m. Leaves membranous. Fruits not known. — Borneo (NE Kalimantan) ..... **48. H. obscura**  
 b. Montane species; 800–1800 m. Leaves membranous or coriaceous. Fruits 5 cm long or less. — Borneo (Sarawak, Sabah) ..... 29
- 29a. Leaves without distinct large hair scars beneath (lens!). Fruits 3–5 cm long .....  
 ..... **83b. H. subalpina** subsp. **kinabaluensis**  
 b. Leaves with (usually) distinct yellowish enlarged hair scars beneath. Fruits 3.5–5 cm long ..... **97. H. xanthina**
- 30a. Pedicel not articulated (best seen in male flowers). Fruits with perianth persistent or not ..... 31  
 b. Pedicel articulated. Perianth not persistent under the fruits ..... 36

- 31a. Leaves 15–45 cm long. Fruits 6 cm long or more; perianth ± persistent. — Lowland or montane forest ..... 32
- b. Leaves 5–20 cm long. Fruits 2–4 cm long; perianth not persistent. — Montane forest at 800–2000 m ..... 34
- 32a. Nerves 11–22 pairs. — Borneo (Sabah: Mt Kinabalu); 1000–1500 m ..... **3. H. amplomontana**
- b. Nerves 20–30 pairs. — Forests up to c. 1000 m ..... 33
- 33a. Female flowers and fruits not known. — *Hallier 624*, Mt Damoes, W Kalimantan; probably an undescribed species close to *H. valida*, see there . **95. aff. H. valida**
- b. Perianth 4–5 mm long. Fruits 6–8 cm long, pericarp 10–20 mm thick ..... **26. H. fragillima**
- 34a. Leaves membranous, apex acute-acuminate. Fruits 2.4–3 cm long ..... **4. H. androphora**
- b. Leaves chartaceous or coriaceous, apex rounded to (sub)acute, not acute-acuminate ..... 35
- 35a. Leaves chartaceous or coriaceous, without large hair scars beneath (lens!). Perianth 2 mm long. Fruits 2–2.7 cm long ..... **45. H. montana**
- b. Leaves usually strongly coriaceous, usually with large hair scars beneath. Perianth 2.5–3 mm long. Fruits 3–4 cm long ..... **24. H. endertii**
- 36a. Male inflorescences very stout, the rachis towards the base 5–8 mm diam. [Female inflorescences, flowers, and fruits not known.] — Borneo (W Kalimantan) ..... **54. H. pachyrachis**
- b. Male inflorescences less stout ..... 37
- 37a. Midrib on upper leaf surface towards the transition to the petiole 3 mm broad or more ..... **39. H. laticostata**
- b. Midrib at base narrower ..... 38
- 38a. Leaves 16–28 cm long, base rounded or short-attenuate; nerves 16–19 pairs. — Borneo (Sarawak) ..... **47. H. nervosa**
- b. Leaves 5–28 cm long, base rounded, short-, or long-attenuate; nerves 5–15(–20) pairs ..... 39
- 39a. Lateral nerves sunken, flattish, or but slightly raised above ..... 40
- b. Lateral nerves raised above ..... 41
- 40a. Leaf apex rounded. Fruits not seen ..... **50. H. obtusa**
- b. Leaf apex acute-acuminate. Fruits 1.5–2 cm long ..... **69. H. ridleyana**
- 41a. Leaf bud and young inflorescences with hairs 0.1–0.2 mm long. Leaves on drying dull, greyish brown, colour of upper and lower surface not much contrasting. Fruits 1.7–2 cm long ..... **89. H. tenuifolia**
- b. Leaf bud and young inflorescences with hairs 0.2 mm long or more; if hairs 0.1 mm long, then the olivaceous to dark-brown upper leaf surface much contrasting with the cinnamon colour beneath ..... 42
- 42a. Twigs 1–3 mm diam. Leaves membranous, 10–18(–27) cm long. Fruits 2.3–2.4 cm long ..... **41. H. macilenta**
- b. Twigs 2–5 mm diam. Leaves chartaceous; leaves and fruits of variable sizes . 43
- 43a. Twigs early glabrescent; bark ± longitudinally cracking. Leaf apex long acute-acuminate. Fruits 2.8–3.2 cm long; pericarp hard-woody, 8–10 mm thick. — Borneo (Brunei) ..... **22. H. disticha**

- b. Twigs late glabrescent; bark striate, not cracking. Leaf apex acute-acuminate, the acumens not conspicuously long. Fruits 1.9–6 cm long. — Variable, with 3 varieties (based on fruit size). Whole of Borneo . . . . . **61. *H. polyspherula***

(5) REGIONAL KEY TO THE SPECIES — PHILIPPINES, SULAWESI, MOLUCCAS  
(based on female flowering and fruiting specimens)

- 1a. Leaves membranous, usually irregularly whitish blotched. Perianth 2-lobed; ovary glabrous. Fruits globose, 1.5–2 cm diam., glabrous; pericarp 1–2 mm thick; seeds globose. — Riverine or marshy, mostly near the coast . . . . . **35. *H. irya***
- b. Leaves variable, usually not whitish blotched. Fruits subglobose or ellipsoid; seeds ellipsoid. — Coastal or not . . . . . 2
- 2a. Perianth 3-lobed. [Ovary and fruits glabrous.] . . . . . 3
- b. Perianth 2-lobed . . . . . 5
- 3a. Leaf bud and inflorescences with hairs 0.2–0.6 mm long. Pedicel articulated. [Fruits 2(–2.5) cm long.] — Philippines (Mindanao, Palawan) . . . . . **61a. *H. polyspherula* var. *polyspherula***
- b. Leaf bud and inflorescences with hairs 0.1–0.2 mm long. Pedicel not articulated . . . . . 4
- 4a. Fruits 3.5–7 cm long; (dry) pericarp (4–)8–15 mm thick. Leaves ± membranous, olivaceous-brown, midrib glabrous above; leaves sometimes with whitish blotches as in *H. irya*. — Philippines, Sulawesi . . . . . **17. *H. costulata***
- b. Fruits 4 cm long, (dry) pericarp 3.5–8 mm thick. Leaves membranous to thinly coriaceous, brown; midrib towards the base pubescent above in younger leaves. — C Sulawesi . . . . . **14. *H. coriacea***
- 5a. Twigs 4–14(–20) mm diam. Leaves 20–45 cm long, petiole 2–7 mm long. Leaf bud and inflorescences with hairs 0.3–1(–1.5) mm long. Buds 3.5–5 mm long, glabrous; ovary glabrous. Fruits 3.5–5.5 cm long, glabrous . . . . . **87. *H. sylvestris***
- b. Twigs more slender. Leaves smaller, petiole comparatively longer. Leaf bud and inflorescences with hairs up to 0.2 mm long. Buds 3(–3.5) mm long or less. Fruits up to 3 cm long (in *H. lancifolia* to 3.5 cm long) . . . . . 6
- 6a. Leaves ± chartaceous, oblong-lanceolate to lanceolate. Buds cleft c. 1/4; ovary pubescent. Fruits often ± pear-shaped, 2.5–3.5 cm long, early glabrescent; (dry) pericarp 4–8 mm thick. — Sulawesi . . . . . **38. *H. lancifolia***
- b. Leaves of different consistency, generally broader, oblong to oblong-lanceolate. Buds cleft c. 1/3 or more. Fruits 1–3 cm long . . . . . 7
- 7a. Ovary and fruits pubescent; hairs on the fruits may be inconspicuous and only remaining at the very base near the insertion of the pedicel (lens!); pericarp thick or thin . . . . . 8
- b. Ovary and fruits glabrous; pericarp 1–2 mm thick. [Female flowers and fruits not known in *H. aruana* and *H. samarensis*.] . . . . . 11
- 8a. Flower buds 2.5–3 mm long, cleft 1/3–1/2. Fruits (1.6–)1.8–3 cm long; pericarp 2–3 mm thick . . . . . **37. *H. laevigata***
- b. Female flowers not known. Fruits smaller, pericarp thinner . . . . . 9

- 9a. Fruits 1.5–1.6 cm long, short-ellipsoid. [Male buds transversely ellipsoid, cleft 2/3–4/5. Leaves 8–30 cm long, membranous or chartaceous; nerves flat, inconspicuous. Twigs terete, not ridged.] — Moluccas (Talaud Is.), possibly Sulawesi . . . . . **88. *H. talaudensis***
- b. Fruits smaller, 1.1–1.3 cm long . . . . . 10
- 10a. Fruits subglobose. Twigs ± flattened, usually lined or low-ridged. Leaves 12–25 cm long, membranous; nerves flat, inconspicuous. Male buds ± pear-shaped, cleft to c. 2/3. — Moluccas . . . . . **20. *H. decalvata***
- b. Fruits short-ellipsoid. Twigs terete, not lined. Leaves 5–14 cm long, chartaceous, nerves inconspicuous on both surfaces. Male buds ± obtriangular, cleft about half-way. — Philippines (Luzon) . . . . . **49. *H. obscurinervia***
- 11a. Twigs angular or ridged. [Species distinctive only in male flowering specimens.] . . . . . 12
- b. Twigs (sub)terete or sometimes faintly angular, or shallowly lined . . . . . 13
- 12a. SW New Guinea, possibly Aru and Tanimbar Is. [Female flowers and fruits not known.] . . . . . **7. *H. aruana***
- b. Moluccas (Seram, Banda, Dammar I., possibly Ternate) . . . . . **77. *H. smithii***
- c. Philippines. [Ovary glabrous or almost so.] . . . . . **6. *H. ardisiifolia***
- 13a. Bark of twigs pale, grey-brown, contrasting with the blackish petioles. [Fruits blackish on drying, 1.5–2 cm long.] — Moluccas . . . . . **79. *H. spicata***
- b. Twigs brown, in colour not contrasting with the petioles . . . . . 14
- 14a. Fruits ± globose to subellipsoid, 0.9–1.2 cm long (to 2 cm in New Guinea); blackish on drying. — Aru Is., New Guinea . . . . . **84a. *H. subtilis* var. *subtilis***
- b. Fruits 1.1–1.6 cm long (fruits not known in *H. samarensis*) . . . . . 15
- 15a. Philippines (Samar) . . . . . **72. *H. samarensis***
- b. Moluccas, Sulawesi . . . . . 16
- 16a. Fruits ellipsoid, 1.5 cm long; blackish on drying. — Moluccas (Morotai, Obi Is.) . . . . . **44a. *H. moluccana* var. *moluccana***
- b. Fruits subglobose or ellipsoid, 1.1–1.6(–2) cm long, brown on drying. — Sulawesi (Kabaena Is.), Moluccas (Seram) . . . . . **56. *H. parviflora***

## (6) REGIONAL KEY TO THE SPECIES — NEW GUINEA

(based on female flowering and fruiting specimens)

- 1a. Leaves membranous, often with irregular whitish blotches. Perianth 2-lobed; ovary glabrous. Fruits glabrous, globose, 1.5–2 cm diam.; pericarp 1–2 mm thick; seeds globose. — Riverine or marshy, usually not far from the coast . . . . . **35. *H. irya***
- b. Leaves of different consistency, generally without whitish blotches. Fruits glabrous or pubescent, globose or ellipsoid; if globose either only 1 cm diam. (*H. subtilis*), or the pericarp more than 2 mm thick, at least at one side; seeds mostly ellipsoid. — Coastal or not . . . . . 2
- 2a. Twigs angled or ridged. — Aru Is., New Guinea . . . . . 3
- b. Twigs terete, sometimes lined in-between the bases of petioles but neither angled nor ridged. — New Guinea to Solomon Is. . . . . 8



- 3a. Leaves with dots beneath (lens!). Perianth 2-lobed. — New Guinea (Bird's Head to W Sepik Prov.) . . . . . **33. *H. inflexa***  
 b. Leaves without dots beneath . . . . . 4
- 4a. Perianth 3- (or 4-)lobed . . . . . 5  
 b. Perianth 2-lobed . . . . . 6
- 5a. Ovary glabrous (?). Fruits 10–16 mm long, glabrous. Leaves chartaceous, 7–14 cm long; petiole comparatively long and slender, 11–20 mm long. — SW & S New Guinea (Digul, Western Prov.) . . . . . **51. *H. olens***  
 b. Ovary pubescent. Fruits 17–20 mm long, pubescent at base. Leaves membranous or thinly chartaceous, 10–27 cm long; petiole 7–15 mm. — Papua Barat (Bird's Head) . . . . . **5. *H. angularis***
- 6a. Flower buds depressed-globose, lobes nearly 1 mm thick; ovary pubescent. Fruits 17–20 mm long, pubescent. Leaves membranous or thinly chartaceous. — Papua Barat (Bird's Head) . . . . . **5. *H. angularis***  
 b. Female flowers and fruits not known . . . . . 7
- 7a. Leaves membranous. — SW New Guinea; possibly Aru and Tanimbar Is. . . . . **7. *H. aruana***  
 b. Leaves thinly coriaceous. — SW New Guinea (a species close to *H. aruana*) . . . . . **34. *H. iriana***
- 8a. Perianth 3- (or 4-)lobed, [cleft almost to the base.] — Papua New Guinea (East Sepik Prov.) . . . . . **74. *H. sepikensis***  
 b. Perianth 2-lobed . . . . . 9
- 9a. Ovary and fruits glabrous . . . . . 10  
 b. Ovary and fruits pubescent. [Hairs on fruits either distinct or small and inconspicuous and usually only to be seen at the base of the fruits near the insertion of the stalk (lens!). Fruits ellipsoid, sometimes globose in *H. sinclairii*.] . . . . . 16
- 10a. Leaf bud, twig apex, and inflorescences with hairs 0.3–1.5 mm long. Leaves 17–45 cm long, often  $\pm$  parallel-sided; nerves 30–40 pairs. [Fruits ellipsoid, 3.4–5.5 cm long, glabrous.] — Moluccas and W & C New Guinea . . . . . **87. *H. sylvestris***  
 b. Leaf bud, twig apex, and inflorescences with hairs 0.2 mm long or less; hairs in *H. moluccana* and *H. tuberculata* 0.1–0.3 mm long. Leaves generally smaller; nerves fewer . . . . . 11
- 11a. Fruits globose or subglobose, [not beaked and without pseudostalk], 1.4 cm diam. or less . . . . . 12  
 b. Fruits ellipsoid, 1.3 cm long or more . . . . . 13
- 12a. Fruits brown on drying; pericarp 1.5–3 mm thick. Buds cleft nearly to the base. — Northern parts of Papua Barat and Papua New Guinea . . . . . **9. *H. basifissa***  
 b. Fruits blackish on drying; pericarp 1 mm thick. Buds cleft c. 1/3. — Aru Is., whole of New Guinea . . . . . **84a. *H. subtilis* var. *subtilis***
- 13a. Fruits to 2 cm long, blackish on drying; apex pointed/beaked or not, base without or with long or short pseudostalk . . . . . 14  
 b. Fruits 1.3–3.7 cm long, (dark) brown on drying; apex rounded, base mostly without pseudostalk . . . . . 15
- 14a. Pseudostalk of fruit (1.5–)2–6 mm long. — Papua Barat (Jayapura), Papua New Guinea (W Sepik Prov.) . . . . . **73. *H. schlechteri***  
 b. Pseudostalk absent or up to 3 mm long. — Whole of New Guinea **84. *H. subtilis***

- 15a. Buds 2 mm long, cleft 1/2–4/5. Fruits 1.3–2.8 cm long, pericarp 1–2 mm thick. — Moluccas, W New Guinea . . . . . **44. *H. moluccana***  
 b. Buds 2–3 mm long, cleft 1/2–2/3. Fruits 1.5–3.7 cm long, pericarp 1–8 mm thick. — Papua New Guinea (Milne Bay Prov., Bismarck Archipelago, Papuan Islands) . . . . . **93. *H. tuberculata***
- 16a. Leaf bud, twig apex, and inflorescences with hairs 0.2 mm long or less (0.1–0.3 mm long in *H. psilantha*) . . . . . 17  
 b. Leaf bud, twig apex, and inflorescences with hairs 0.5–1 mm long (0.2–0.5 mm long in *H. ampliformis*; indumentum not known in *H. ampla*) . . . . . 27
- 17a. Hairs 0.1–0.3 mm long. Infructescences and female inflorescences large, much branched, 10–16 cm long. Fruits 1.7–2.2 cm long, pericarp 1–2 mm thick. — Papua New Guinea (Bismarck Archipelago, Bagabag I., Long I.) . . . . **62. *H. psilantha***  
 b. Hairs 0.1–0.2 mm long, or less. Infructescences and female inflorescences 10 cm long or less. Fruits variable . . . . . 18
- 18a. Fruits 1.6 cm long or less; pericarp 1–3 mm thick. Buds pubescent . . . . . 19  
 b. Fruits 1.5 cm long or more; pericarp 2 mm thick or more; if fruit 1.5 cm long, then almost globose and buds glabrous . . . . . 24
- 19a. Fruits at apex rounded, not apiculate; pseudostalk absent . . . . . **60. *H. pilifera***  
 b. Fruits apiculate; pseudostalk to 5 mm long . . . . . 20
- 20a. Leaves broadly obovate to oblong, 12–20 by 5–11 cm. Pedicel widening to above and gradually passing into the bud. Fruits (including 1 mm long pseudostalk and 2 mm long apiculum) 1.4 by 0.8–0.9 cm, fruiting pedicel 9–14 mm long, distinctly tapering . . . . . **19. *H. crux-melitensis***  
 b. Leaves elliptic to lanceolate, 4.5–20 by 0.7–6 cm. Pedicel clearly marked off from the bud. Pseudostalk of fruits 1.5–5 mm; fruiting pedicel up to 10 mm long, not or but little tapering . . . . . 21
- 21a. Pseudostalk of fruits 5 mm long. [Fruits excluding pseudostalk but including 2–3 mm long apiculum 1.6–1.7 by 0.9–1 cm.] . . . . . **81. *H. squamulosa***  
 b. Pseudostalk of fruits 1.5–3 mm long . . . . . 22
- 22a. Leaf bud, twig apex, and inflorescences with hairs 0.3 mm. Tertiary venation of leaves below coarse and distinct. [Female flowers not known; fruits not known with certainty; male buds subglobose, with thick perianth.] . . **94. *H. urceolata***  
 b. Leaf bud, twig apex, and inflorescences with hairs 0.1–0.2 mm. Tertiary venation generally less distinct. [Male perianth different.] . . . . . 23
- 23a. Fruits excluding the 1.5–2.5 mm long pseudostalk, but including the 0.5–2 mm long apiculum, 1.2–1.5 by 0.8–1 cm. Male buds clearly marked off from the pedicel . . . . . **16. *H. coryandra***  
 b. Fruits excluding the 1.5–2 mm long pseudostalk, but including the 2 mm long apiculum, 1.3 by 1 cm long. Male pedicel broadening to above and gradually passing into the bud . . . . . **13. *H. clavata***
- 24a. Buds 2–2.4 mm long, glabrous. Leaves 6–14 cm long. [Fruits (sub)globose, short-ellipsoid, or obovoid, 1.5–2.5 by 1.5–2 cm; pericarp 4–6 mm thick.] — E Papua New Guinea . . . . . **76. *H. sinclairii***  
 b. Buds 2.5 mm long or more, pubescent or glabrescent. Leaves 10 cm long or more . . . . . 25

- 25a. Fruits 1.6–3 cm long, usually with coarse pale wart-like lenticels; (dry) pericarp 2–6 mm thick (sometimes much resembling small-fruited *H. pachycarpa*). — Moluccas, whole of New Guinea including Bismarck Archipelago; 0–1000 m . . . . . **37. *H. laevigata***
- b. Fruits (3–)3.5–7.5 cm long; pericarp (4–)5 mm thick or more. — New Guinea; (450–)1000–2000 m . . . . . 26
- 26a. Buds pubescent. Fruits 3–4.5 cm long; pericarp 4–10 mm thick . . . . . **53. *H. pachycarpa***
- b. Buds glabrescent. Fruits 6–7.5 cm long; pericarp 10–20 mm thick . . . . . **15. *H. corrugata***
- 27a. Leaf bud and inflorescences with hairs 0.2–0.5 mm long. Fruits not known. [Leaf bud, female flowers, and fruits not known in *H. ampla*.] . . . . . 28
- b. Leaf bud and inflorescences with hairs 0.5–1(–1.5) mm long. Fruits usually conspicuously pubescent . . . . . 29
- 28a. Inflorescences glabrescent. — Papua New Guinea (Sepik Prov.) . . . **1. *H. ampla***
- b. Inflorescences pubescent. — Papua New Guinea (Sepik and Morobe Prov.) . . . . . **2. *H. ampliformis***
- 29a. Leaves coriaceous, beneath with harsh hairs, when shed leaving thickened scars. Buds 4 mm long, opening with narrow pore-like slit. [Fruits 3–5 cm long, pericarp 4–7 mm thick.] — New Guinea . . . . . **64. *H. pulverulenta***
- b. Leaves membranous or chartaceous. Buds cleft 1/4–1/2 . . . . . 30
- 30a. Flowers [only the male known] entirely pubescent. [Fruits 2–2.4 cm long, pericarp 4–7 mm thick.] — New Guinea . . . . . **40. *H. leptantha***
- b. Flowers largely glabrescent . . . . . 31
- 31a. Leaves generally oblong-lanceolate, at apex caudate. Buds 4 mm long. Fruits 2.5–3 cm long. — Papua New Guinea (New Britain) . . . . . **67. *H. ralunensis***
- b. Leaves oblong(-lanceolate), at apex not caudate (always?). Buds 3 mm long. Fruits 1.2–2.8 cm long. — Most of Papua New Guinea (incl. New Britain and New Ireland) . . . . . **31. *H. hellwigii***

### 1. *Horsfieldia ampla* Markgr.

*Horsfieldia ampla* Markgr., Bot. Jahrb. Syst. 67 (1935) 148; W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 95. — Type: *Ledermann 9639* (B, lost), Papua New Guinea, Sepik Prov.

Small tree 4–5 m. *Twigs* terete. *Leaves* cuneate-obovate, up to 40 by 16 cm, base ± attenuate, apex short-acuminate; nerves 16–18 pairs, straight, sharply raised beneath and connected towards the margin; petiole 1 cm long. *Inflorescences* on the older wood, to 25 by 10 cm, glabrescent, loosely flowered. *Male flowers* yellow, clavate, 4 by 2 mm (excluding pedicel?), the perianth 2-lobed, cleft to hardly 1/4. Staminal column thick; thecae to c. 20, the androphore about as long as the anthers or slightly shorter.

Distribution — *Malesia*: NE Papua New Guinea (Sepik Prov., ‘Aprilfluss’; mountain slope near camp 18).

Habitat & Ecology — Dense, very humid forest, on mountain slope at 200–400 m altitude; male fl. Nov. 1912.

Notes — 1. Known only from the type, now destroyed. Keyed out by Markgraf with *H. crux-melitensis*, both having clavate flowers. He mentions in the key that the perianth (not the androecium) is largely hollow, and in a note that the species is peculiar amongst the New Guinea *Horsfieldias* because of its large male flowers, which in other species are smaller and almost always broader than long, and that it is without close relatives.

2. The species is possibly related to or may be identical with *H. ampliformis*.

## 2. *Horsfieldia ampliformis* W.J. de Wilde

*Horsfieldia ampliformis* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 95, f. 14. — Type: *Hoogland & Craven 11085* (male fl.), New Guinea, Sepik Prov.

Tree 5–8 m. *Twigs* when young narrowly ridged, 4–7(–10) mm diameter, early or late glabrescent, with  $\pm$  woolly hairs 0.2–0.5 mm long; bark coarsely striate, lenticellate, not flaking. *Leaves* thickly membranous, (elliptic-)oblong, (18–)25–38 by (6–)7–13 cm, base short to long-attenuate, apex attenuate-acuminate; upper surface drying dark brown, lower surface early or late glabrescent or with rather scattered stellate hairs 0.2–0.5 mm long; dots absent; midrib above  $\pm$  narrow, flattish; nerves 18–22 pairs, above thin, flat or sunken; lines of interarching beneath not very prominent; venation lax, indistinct on both surfaces; petiole 4–6 by 3–4 mm; leaf bud 25–40 mm long, with hairs 0.2–0.5 mm. *Inflorescences* below the leaves; in male: many-flowered, 4 to 5 times branched, 25–35 by 20–30 cm, peduncle 4–5 cm; in female: 9–10 by 6–8 cm; all branches with rather loose hairs 0.2–0.5 mm long; bracts (seen only in female) 5 mm long, caducous. *Flowers* 2–5 together in male and female, with loose hairs (0.1–)0.2–0.3 mm long, in female glabrescent towards apex; perianth 2-lobed; pedicel not articulated. *Male flowers*: pedicel 2–4 mm long, buds largely hollow, broadly obovoid, laterally  $\pm$  flattened, 3–3.3 by 3–3.2 mm, apex obtuse to broadly rounded, base shortly tapering, cleft c. 1/3, lobes 0.3 mm thick; androecium small,  $\pm$  flattened, 2.5 by 1–1.2 mm, apex broadly rounded, synandrium 1.5–1.8 by 1–1.2 mm, narrowly hollowed for 1/5–1/3 at apex (Plate 1: 20); thecae 14, free apices 0.1–0.2 mm; androphore 0.8–1 by 0.5–0.6 mm. *Female flowers*: pedicel 1–2 mm long, buds broadly ovoid, 3 by 2.6–2.8 mm, cleft c. 2/3; ovary broadly ovoid, 2–2.2 by 1.8–2 mm, densely pubescent with hairs 0.1 mm or less, stigma short, not or hardly lobed, 0.1 by 0.4 mm. *Fruits* not seen. — **Fig. 8.**

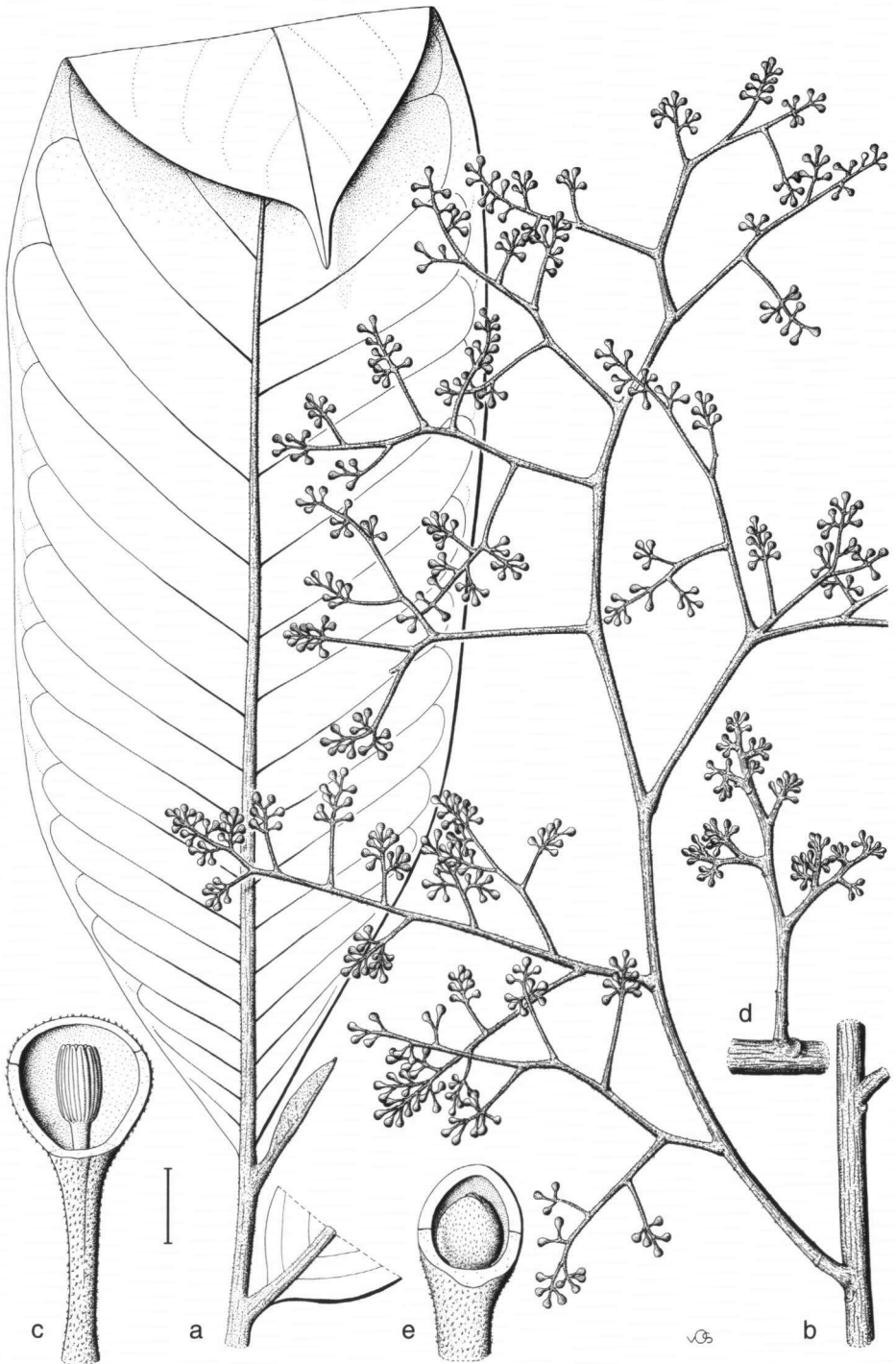
Field-notes — Small tree, 8 m high. Flowers medium green, yellow at anthesis.

Distribution — *Malesia*: northern Papua New Guinea (Sepik, Morobe Prov.).

Habitat & Ecology — Lower montane rain forest; 1200–1300 m altitude; fl. Apr., Aug.

Notes — 1. *Horsfieldia ampliformis* is close to *H. ampla*, of which no material has been seen. According to the description the latter differs by the more elongate, possibly glabrous perianths, 4 by 2 mm, the androecium with 20 thecae, and the glabrescent inflorescences. The two species have a peculiar long-stalked androecium and large, male inflorescences. *Horsfieldia ampla* was collected at only 200–400 m altitude.

2. Known only from a male and a female flowering specimen. The perianths of the female specimen, *Craven & Schodde 1463* (Morobe Prov.), are glabrescent in the upper half; it could be *H. ampla*. Moreover, as the hairs on the leaf buds are slightly shorter than those of the male specimen, this specimen is difficult to distinguish from the variable and widespread *H. laevigata*.



### 3. *Horsfieldia amplomontana* W.J. de Wilde

*Horsfieldia amplomontana* W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 34; Tree Fl. Sabah & Sarawak 3 (2000) 361. — Type: *Clemens 30536*, Sabah.

Tree 10–20 m. Twigs 3.5–6(–10) mm diameter, early to rather late glabrescent, hairs 0.3–1(–1.5) mm long; bark coarsely striate, not flaking, lenticels small, not contrasting in colour and inconspicuous. *Leaves* membranous to chartaceous, elliptic-oblong to oblong-lanceolate, 15–35 by 5–11 cm, base short-attenuate to narrowly rounded, apex acute-acuminate; upper surface glabrescent, except towards the base of the midrib in young leaves, olivaceous to brown, lower surface glabrous (glabrescent), without dots or hair scars, sometimes pale and contrasting with upper surface; midrib slender,  $\pm$  raised above, nerves 11 or 12 pairs, above flattish or raised, lines of interarching not distinct; venation lax,  $\pm$  distinct or not; petiole 8–15 by 2.5–3.5 mm, glabrescent; leaf bud 15–22 by 3–4 mm, with dense rusty hairs 0.5–1(–1.5) mm long. *Inflorescences* behind the leaves, with shaggy rusty hairs 0.5 mm; in male: 3 or 4 times branched, many-flowered, 10–21 by 10–16 cm, peduncle 1.5–4 cm long, in male in loose clusters of 5–10; in female (in fruit): 7–8 cm long; bracts broadly ovate-ellipsoid, 2–7 mm long, finely pubescent, caducous; flowers glabrous, perianth 3- (or 4-)lobed, pedicel sometimes  $\pm$  articulated (see note 2). *Male flowers*: pedicel 0.8–1.5(–2) mm long, buds (depressed-)globose, 1.5–2 by 2–2.3 mm, apex and base (broadly) rounded, glabrous, cleft 1/2–2/3, lobes 0.2 mm thick, not or only slightly collapsing on drying; androecium depressed-globose, 0.6–1 by 1.1–1.8 mm, apex broadly rounded, base rounded or sagged (Plate 3: 79); thecae 20–26, almost completely sessile, 0.8–1.2 mm long, free apices up to 0.1 mm, incurved, concealing a  $\pm$  3-radiate apical slit or cavity 0.2–0.5 mm deep; column broad, solid; androphore rather narrow, (0.1–)0.2–0.4 mm long, completely or partly hidden by the anthers. *Female flowers* (from fruit): 3-lobed, 3 mm long. *Fruits* 1–3 per infructescence, ellipsoid, apex and base rounded, 7–8 by 4.5–5 cm, glabrous, drying dark brown, finely to coarsely tubercled, pericarp 15 mm thick; fruiting pedicel 3 mm long; perianth persistent.

Field-notes — Large tree. Bark grey, fissured; outer bark soft, 5 mm thick; inner bark white, soft, 5 mm; cambium pale; sapwood white; exudate from bark sticky. Flowers golden. Ripe fruits orange.

Distribution — *Malesia*: Borneo (Sabah: Mt Kinabalu).

Habitat & Ecology — Primary and degraded forest, ridge forest; on sandstone; 1000–1500 m altitude; fl. Nov., Dec., Feb.; fr. Nov.

Notes — 1. Close to *H. montana*, both having very similar male flowers, but *H. amplomontana* differs considerably by its stouter twigs, larger leaves, larger male inflorescences, and very much larger fruits with a thick pericarp; in *H. montana* the fruit is only 2–2.7 cm long, and the perianth is not persistent.

2. The pedicels are generally not articulated, although some flowers of *SAN 18843* seem to have an articulation, but this may be an artefact caused by drying.

Fig. 8. *Horsfieldia ampliformis* W.J. de Wilde. a. Twig apex with leaves; b. twig with male inflorescence axillary to fallen leaf; c. mature male flower, perianth opened, showing androecium; d. twig with female inflorescence; e. female flower, opened, showing finely pubescent ovary and minute 2-lobed stigma [a–c: *Hoogland & Craven 11085*; d, e: *Craven & Schodde 1463*]. — Scale bar for a, b, d = 2 cm; for c, e = 1.7 mm.

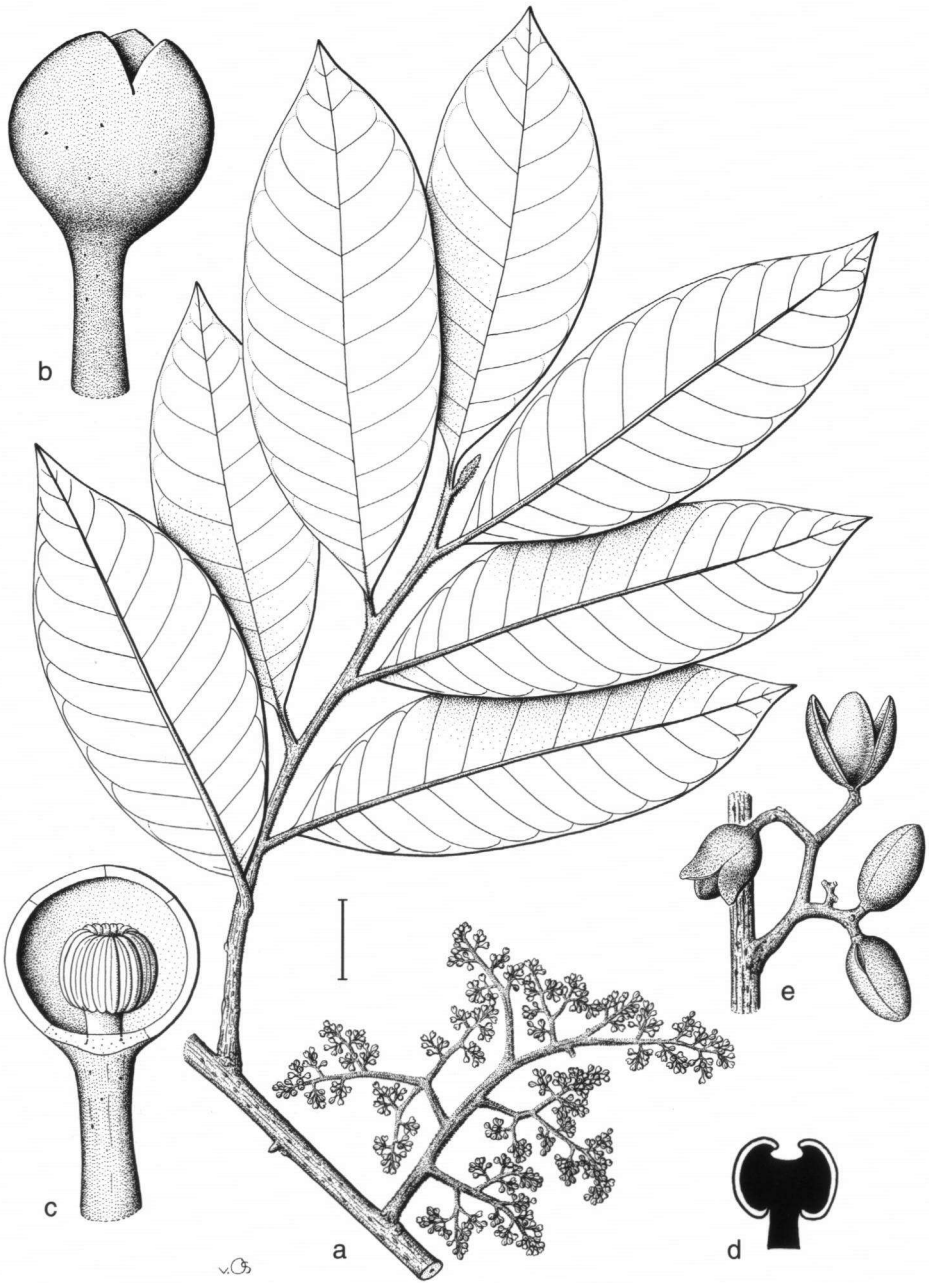


Fig. 9. *Horsfieldia androphora* W.J. de Wilde. a. Branch with leafy twig and male inflorescence; b. mature male flower; c. ditto, longitudinally opened, showing androecium; d. androecium, longitudinal section, schematic; e. twig with infructescence, fruits mature, aril complete [a–d: *Nootenboom & Chai* 01710, type; e: *Sinclair, Kadim & Kapis* 8977]. — Scale bar for a, e = 2 cm; for b–d = 0.85 mm.

#### 4. *Horsfieldia androphora* W.J. de Wilde

*Horsfieldia androphora* W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 32, f. 30; Tree Fl. Sabah & Sarawak 3 (2000) 362. — Type: *Nooteboom & Chai 01710*, Sarawak.

Tree 7–20 m. Twigs 2–4(–5) mm diameter, with rusty hairs 0.3–0.6 mm, rather late glabrescent; bark blackish brown, finely striate, not flaking; lenticels small, inconspicuous. *Leaves* membranous, elliptic to oblong, 9–18 by 3.5–6.5 cm, base attenuate, apex acute-acuminate; upper surface drying dark brown or blackish brown, glabrous, lower surface glabrescent (except midrib); dots absent; midrib above raised, beneath with some vestigial indumentum or late glabrescent; nerves 9–13 pairs, raised above, lines of interarching on the lower surface irregular and not very conspicuous; venation lax, distinct or not; petiole 10–12 by 1.5–2 mm, glabrescent; leaf bud 8–12 by 2–3 mm, with rusty hairs 0.3–0.6 mm. *Inflorescences* with  $\pm$  dense hairs 0.2–0.6 mm; in male: rather many-flowered, 3 (or 4) times branched, 6–14 by 3.5–9 cm, peduncle 1–2 cm long; in female (from infructescences): 3–4 cm long; bracts densely short-pubescent, ovate-elliptic,  $\pm$  acute, 3 mm long, caducous; flowers (male) in clusters of 2–6 each, perianth 3-lobed, glabrous, pedicel glabrous or with a few minute hairs 0.1 mm at the very base, not articulated. *Male flowers*: pedicel 0.5–2 mm, slender; buds globose, 1.4–2(–2.2) mm diameter, cleft 1/3 to nearly 1/2, lobes 0.2 mm thick; synandrium depressed-globose, somewhat flattened or impressed at apex and/or base, in cross section rounded, (0.6–) 0.8–1 by (0.8–)1–1.3 mm, androphore slender, (0.3–)0.4–0.8 mm long (Plate 3: 78); thecae 14–22, almost completely connate, incurved, concealing the apical hollow, 0.2–0.3 mm deep. *Female flowers* not seen. *Fruits* 2–5 per infructescence, ellipsoid, 2.4–3 by 1.4–2 cm, apex subacute to rounded, base rounded or shortly narrowed, glabrous, drying dark brown, finely tuberculate, without lenticels, pericarp 1.5–2 mm thick; fruiting pedicel 2 mm long; perianth not persistent. — Fig. 9.

Field-notes — Bark chocolate to reddish brown, narrowly cracked, longitudinally furrowed, or cut into rectangular blocks; sap watery, more or less colourless (tree in flower), or blood red (tree in fruit). Twigs chocolate, with rusty hairs. Flowers yellow. Fruits smooth, orange, testa whitish grey.

Distribution — *Malesia*: Borneo (Sarawak, Sabah).

Habitat & Ecology — Montane forest, mossy forest, wooded sandstone ridges, 800–1200 m altitude; fl. Mar., Oct.; fr. Mar., June.

Notes — 1. Regarding the general morphology of the androecium, the present species belongs to the *H. grandis* group. It seems closest to *H. tomentosa* from S Thailand and Peninsular Malaysia, the two having a long-stalked synandrium in common. *Horsfieldia tomentosa* has generally larger flowers, a pubescent lower leaf surface, and smaller fruits which are pubescent or glabrescent. *Horsfieldia androphora* grows in mountains; *H. tomentosa* is restricted to lowlands.

2. *Horsfieldia androphora* keys out beside *H. fragillima* (also with non-articulated pedicels), but the latter species differs in many characters including general habit and fruit size; its saucer-shaped androecium is quite different.

#### 5. *Horsfieldia angularis* W.J. de Wilde

*Horsfieldia angularis* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 97. — Type: *BW 5828* (male fl.), New Guinea, Bird's Head.



Tree 15–30 m. *Twigs* 2-angular, lower down subterete, with two ridges, 3–7(–10) mm diameter, early glabrescent, hairs grey-brown, 0.1 mm or less; bark striate, distinctly coarsely lenticellate, not flaking. *Leaves* membranous to thinly chartaceous, oblong (–lanceolate), 10–27 by 3–7.5 cm, base attenuate, apex acute-acuminate; upper surface drying pale to dark brown, often finely paler pustulate, lower surface glabrescent, hairs very minute, grey, stellate, less than 0.1 mm; dots absent; midrib slightly raised above; nerves 12–15 pairs, above thin and flattish or slightly sunken, lines of interarching not distinct; venation lax, faint; petiole 7–15 by 2–3 mm; leaf bud 10–15 by 2–2.5 mm, with hairs 0.1 mm. *Inflorescences* with rather dense hairs 0.2–0.3 mm; in male and female: 2 or 3 times branched, rather few-flowered, 3–4 by 2–2.5 cm, peduncle 0.3–0.6 cm long; bracts not seen, caducous; flowers (male) generally 2–4 together; perianth 2–4-lobed in male, 2(–3)-lobed in female, in the lower half with hairs 0.1(–0.2) mm long; pedicel pubescent, not articulated. *Male flowers*: pedicel not tapering, 1–2 mm long; buds in lateral view circular or slightly transversely ellipsoid, not or only slightly laterally compressed, not collapsing on drying, 1.7–2.3 by 2.2–3.2 mm, cleft c. 9/10, lobes (0.2–)0.3 mm thick; androecium slightly laterally flattened (in 3- or 4-lobed flowers about 3- or 4-angular in cross section), above broadly rounded, 1.2–1.5 by 1.5–2.2 mm (Plate 1: 21); thecae 24 to c. 40 (in 4-lobed flowers),  $\pm$  erect, free parts at apex to 0.1 mm, central column at apex narrowly hollowed for (1/3–)1/2; androphore absent, the androecium  $\pm$  broadly attached. *Female flowers*: pedicel 1–1.5 mm long; buds depressed globose, 2.5 by 3–3.2 mm, cleft c. 3/4; ovary  $\pm$  depressed globose-ovoid, 1.2 by 1.5 mm, densely short-pubescent, style and stigma minutely 2-lobed, 0.1 by 0.3 mm. *Fruits* 5–10 per infructescence, short-ellipsoid, 1.7–2 by 1.4–1.7 cm, pubescent at very base, with coarse paler-coloured lenticel-like tubercles; pericarp thick-woody, 3–5 mm thick; fruiting pedicel 3–5 mm long; perianth not persistent.

*Field-notes* — Sometimes buttressed to 1 by 0.5 m; bark sometimes fissured, or peeling off in small scales; with red exudate; sapwood pale brown or white; heartwood not discernible or pinkish. Flowers greenish. Fruits yellow(–brown), sour and edible.

*Distribution* — *Malesia*: Papua Barat (Bird's Head, subprov. Manokwari).

*Habitat & Ecology* — Primary forest; on clayey soils; locally common on the coastal plain up to 600 m in Kebar Valley; 0–600 m altitude; fl. Feb., Aug.; fr. Feb., Oct.

*Note* — Much related to *H. basifissa*, of which sterile specimens are difficult to identify since their twigs too are rather ridged. *Horsfieldia angularis* is distinguished from *H. basifissa* by 1) the more strongly ridged and somewhat stouter twigs, 2) the more hairy and 2–4-lobed flowers with thicker lobes, 3) the hairy ovary and the thinly pubescent ellipsoid fruits. Both species have thickish, subglobose male buds, which hardly collapse on drying, and which at anthesis are cleft to the base.

## 6. *Horsfieldia ardisiifolia* (A. DC.) Warb.

*Horsfieldia ardisiifolia* (A. DC.) Warb., Mon. Myrist. (1897) 274; J. Sinclair, Gard. Bull. Sing. 28 (1975) 3; W. J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 72, f. 9. — *Myristica ardisiifolia* A. DC., Ann. Sc. Nat. Bot. 4, 4 (1855) 31, t. 4; Prodr. 14, 1 (1856) 203, 'ardisiaefolia'. — Type: *Cuming 1702*, Philippines.

*Horsfieldia warburgiana* Elmer, Leafl. Philipp. Bot. 3 (1911) 1061; Merr., Enum. Philipp. Flow. Pl. 2 (1923) 183. — Type: *Elmer 12297*, Philippines.

*Horsfieldia gigantifolia* Elmer, Leafl. Philipp. Bot. 9 (1925) 3120, 3129; 10 (1939) 3763; nom. nud.

Tree 5–10 m. *Twigs* flattened 2-angular, lower down terete with two ridges, 3–6(–13) mm diameter, at first with bright rusty hairs 0.3–0.5(–0.8) mm long, early glabrescent; bark smooth to striate, distinctly lenticellate, not flaking. *Leaves* membranous, (elliptic-)oblong, 20–40 by 5.5–15 cm, base nearly rounded to attenuate, apex acute-acuminate; upper surface drying olivaceous to blackish brown, finely minutely paler pustulate or not, lower surface early glabrescent except for some indumentum remaining on the midrib, hairs coarse 0.3–0.5 mm; dots absent; midrib fairly broad, flattish above; nerves 18–28 pairs, slender above, flattish, lines of interarching regular and distinct beneath; venation lax, inconspicuous; petiole 13–16 by 3–4.5 mm; leaf bud 10–20 by 3–4 mm, with hairs 0.3–0.8 mm long. *Inflorescences* thinly with stellate-dendroid hairs 0.3 mm; in male: 3 or 4 times branched, rather many-flowered, broadly pyramidal, 7–16 by 6–14 cm, peduncle 0.5–1(–2) cm long; in female: 4–8 cm long; bracts broadly ovate, pubescent, 3–4 mm long, caducous; flowers (male) solitary or 2–4 together, perianth 2-lobed, glabrous, pedicel sometimes at first with sparse hairs, slender, not articulated. *Male flowers*: pedicel 1–2(–4) mm; buds transversely ellipsoid or reniform, moderately laterally compressed, drying dull, more or less collapsed on drying or not, 2.5–3 by 4–4.5 mm, below sometimes with a basal sinus, cleft 4/5–5/6, the lobes 0.2(–0.3) mm thick; androecium broadly transversely ellipsoid, slightly laterally flattened, hollow, 1.5 by 3–3.5 mm (Plate 1: 8); thecae (36–)40–48, connate for about halfway, forming a cup with the anthers from one side deeply inflexed, those from the other side for a large part over-arching the former; anthers sometimes slightly sagged at base, hiding the narrow androphore, 0.2–0.3 mm long. *Female flowers*: pedicel 2(–2.5) mm long; buds subglobose-ovoid, 2.5 mm diameter, cleft c. 1/2; the ovary broadly ovoid-subglobose, 1.5–1.7 mm diameter, glabrous, stigma consisting of 2 minute sessile lobes 0.1–0.2 mm. *Fruits* 2–6 per infructescence, broadly ellipsoid to subglobose, 20–25 by 17–20 mm, glabrous (or possibly with few minute hairs at base), finely rugulose, without marked tubercles, drying (reddish) brown; pericarp 1.5–2 mm thick; fruiting pedicel 3–6 mm long; perianth not persistent. — **Fig. 10.**

Field-notes — Flowers yellow, fragrant. Fruits orange-red.

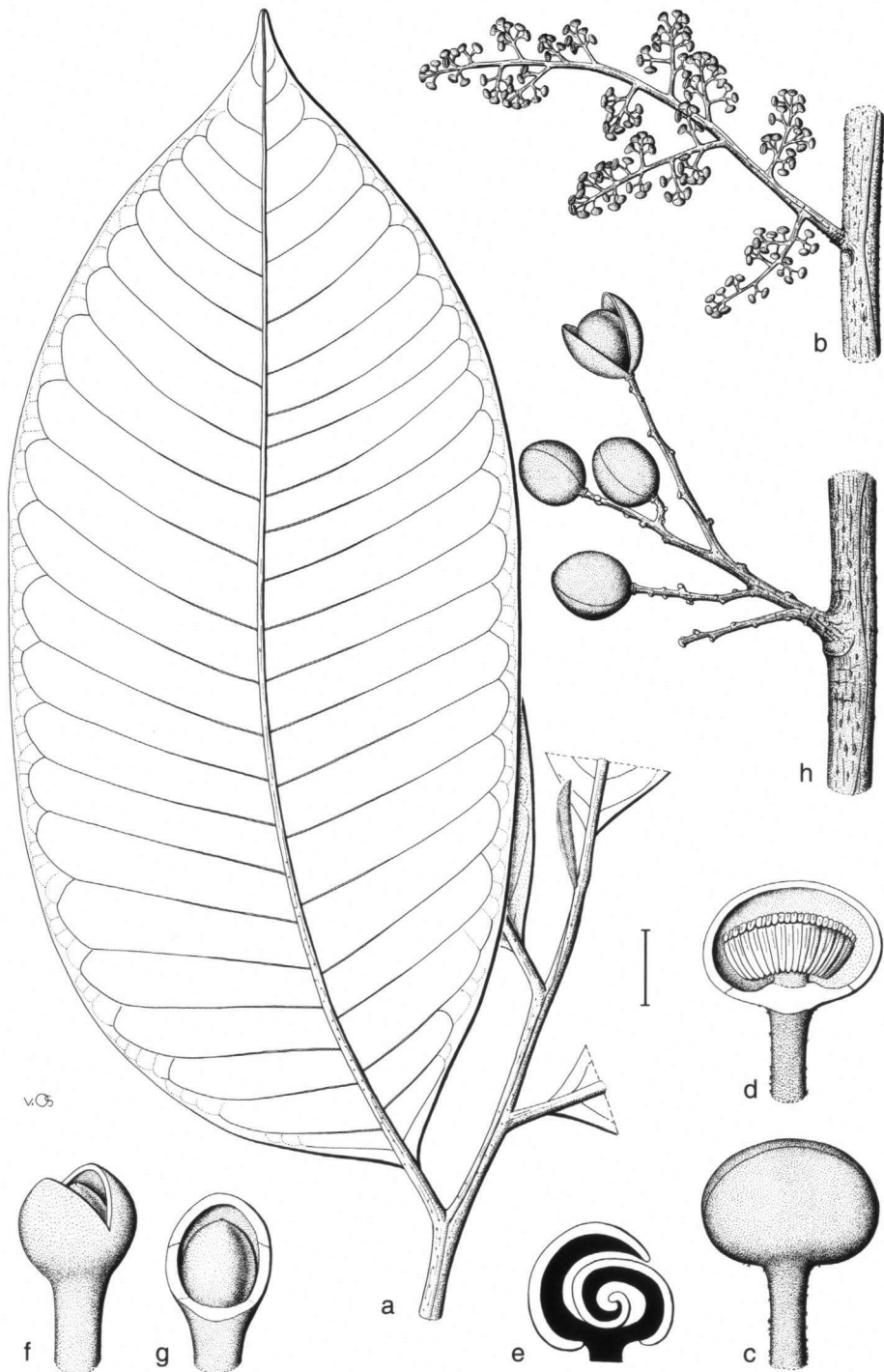
Distribution — *Malesia*: Philippines (Luzon, Mindoro, Sibuyan, Samar, Leyte).

Habitat & Ecology — Lowland forest in moist valleys; 0–400 m altitude; fl. & fr. throughout the year.

Note — *Horsfieldia ardisiifolia* is close to species like *H. parviflora* and *H. smithii*, both from the Moluccas, all of which have anthers strongly incurved or inflexed into the androecium cup. *Horsfieldia ardisiifolia* is distinguished by thick winged or ridged twigs, large leaves, coarse hairs on the leaf buds, male buds 4–4.5 mm wide, and a broad androecium with the anthers deeply incurved and clasping each other.

## 7. *Horsfieldia aruana* (Blume) W. J. de Wilde

*Horsfieldia aruana* (Blume) W. J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 100. — [*Palala aruana* Rumph., Herb. Amb. 7 (1755) t. 24.] — *Myristica aruana* Blume, Rumphia 1 (1837) 191; J. Sinclair, Gard. Bull. Sing. 28 (1975) 112, 118, 119, 122–124, in the synonymy of *Horsfieldia spicata*. — *Horsfieldia novo-guineensis* Warb., Mon. Myrist. (1897) 271, t. 23, nom. nov., p. p., for the lectotype only. — Lectotype: those specimens of *Zippelius s. n.* at L, annotated by Blume, W New Guinea.



Tree c. 15 m. *Twigs* 2-angled, becoming subterete with two ridges, 3–5 mm diameter, early glabrescent, hairs c. 0.1 mm long; bark striate, not flaking; lenticels small, inconspicuous. *Leaves* membranous, elliptic-oblong, 15–29 by 5–9.5 cm, base attenuate, apex acute-acuminate; upper surface drying olivaceous to brown, lower surface early glabrescent; dots absent; midrib slightly raised above; nerves 13–15 pairs, slender, flat-tish; venation lax, indistinct; petiole 10–15 by 1.5–2.5 mm; leaf bud c. 10 by 1.5 mm, hairs c. 0.1 mm long. *Inflorescences* among or below the leaves, with sparse hairs c. 0.1 mm or less; in male: 3 or 4 times branched, 5–8 by 4–5 cm, rather many-flowered, peduncle 0.5–1.5 cm long; bracts not seen, caducous; flowers (male) in loose clusters of 2–5 each, perianth 2-lobed, glabrous; pedicel slender, sparsely pubescent, not articulated. *Male flowers*: pedicel 1–1.5 mm long; buds in lateral view circular to somewhat transversely elliptic, laterally compressed, blackish and collapsing (always?) on drying, 1.5–2 by 2–2.5 mm, cleft 2/3–3/4, lobes c. 0.2 mm thick; androecium much compressed laterally, c. 1.5 by 2 mm, above broadly truncate-rounded (Plate 1: 23); thecae 28–36, distal free parts 0–0.1 mm, column almost completely solid; androphore to 0.1(–0.2) mm. *Female flowers and fruits* not seen.

Distribution — *Malesia*: SW Papua Barat; possibly also Moluccas (Aru and Tanimbar Islands, see note).

Habitat & Ecology — Not known.

Note — Specimens perhaps to be included in *H. aruana* are *Buwalda* 4969 from the Aru Is. and *bb* 24414 from the Tanimbar Is.; the male flowers of both are immature. The synandrium of *Buwalda* 4969 is cleft to c. 1/10 only; however, in *bb* 24414 it appears cleft nearly 1/4 or 1/5; the irregular whitish blotches on the leaves are similar to those usually found in *H. irya* and *H. smithii*.

## 8. *Horsfieldia atjehensis* W.J. de Wilde

*Horsfieldia atjehensis* W.J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 186. — Type: *Bangham* 882, Sumatra, N Aceh.

*Horsfieldia amygdalina* auct. non (Wall.) Warb.: Merr., J. Arnold Arbor. 8 (1934) 61.

Tree c. 10 m. *Twigs* terete, 3.5–5(–8) mm diameter, pale grey to yellowish brown, early glabrescent, with grey-brown hairs less than 0.1 mm; bark coarsely striate and tending to flake; lenticels rather conspicuous towards the apex of the twig. *Leaves* in 3–5 rows, thinly chartaceous, obovate-oblong to oblong-lanceolate, 13–25 by 4.5–9 cm, base long-attenuate, apex acute-acuminate; upper surface drying dark brown, lower surface early glabrescent, with scattered dots (lens!); midrib flat above; nerves 10–12 pairs, flat above, lines of interarching indistinct; venation lax, indistinct or invisible on both surfaces; petiole 12–15 by 2.5–3.5 mm; leaf bud 15 by 3.5–4 mm, with dense grey-brown hairs less than 0.1 mm. *Inflorescences* (female not seen) behind the leaves, glabrescent,

Fig. 10. *Horsfieldia ardisiifolia* (A. DC.) Warb. a. Leafy twig apex, note ridged twig; b. twig with male inflorescence in axil of fallen leaf; c. mature male flower, lateral view; d. ditto, opened, showing androecium; e. androecium, longitudinal section, schematic; f. mature female flower, lateral view; g. ditto, opened, showing glabrous ovary with minute stigma; h. twig with infructescence with ripe fruits [a: *BS* 39770 (*Ramos*), b: *PNH* 6236 (*Sulit*); c–e: *Elmer* 12337; f, g: *Elmer* 17220; h: *PNH* 17461 (*Conklin*)]. — Scale bar for a, b, h = 2 cm; for c, d, f, g = 1.7 mm; for e = 0.85 mm.

or thinly haired, less than 0.1 mm; in male about 3 times branched, rather many-flowered, 7–14 by 4–10 cm, peduncle 1–2 cm long; bracts elliptic-oblong, 2–4 mm, finely pubescent, caducous; flowers in male in loose clusters of 4–8 each, glabrous, perianth 3-lobed, pedicel not articulated. *Male flowers* ( $\pm$  immature): pedicel slender, 1–1.5 mm long; buds globose, 1.5 mm diameter, cleft c. 1/2, lobes 0.2(–0.3) mm thick; androecium subglobose to short-ellipsoid, 1.2 by 1 mm, apex broadly rounded, in cross section sub-circular (Plate 2: 41); thecae 22, almost completely sessile, free apices 0.1(–0.2) mm, curved over and more or less into the rather narrow apical cavity 0.3 mm deep; column broad, androphore narrow, 0.2(–0.3) mm long. *Female flowers* and *fruits* not seen.

Field-notes — Leaves leathery, glabrous. Flower buds green.

Distribution — *Malesia*: Known from only one collection in N Aceh, Sumatra.

Habitat & Ecology — Montane forest, possibly on limestone; 1200–1800 m altitude; male fl. (immature) in Jan.

Note — *Horsfieldia atjehensis* is in many respects closely related to and  $\pm$  intermediate between *H. amygdalina* (Wall.) Warb. (from continental SE Asia), *H. glabra*, *H. macrothyrsa*, and *H. sparsa*, but is still markedly distinct from these species (De Wilde, l.c.: 188).

### 9. *Horsfieldia basifissa* W.J. de Wilde

*Horsfieldia basifissa* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 109. — Type: NGF 10242 (*White*), New Guinea.

*Horsfieldia polyantha* auct. non Warb.: J. Sinclair, Gard. Bull. Sing. 28 (1975) 95, p.p.

Tree 10–25 m. *Twigs* faintly ridged or not, 2–4(–8) mm diameter, with grey-brown hairs 0.1 mm, early glabrescent; bark finely striate, not flaking; lenticels inconspicuous. *Leaves* membranous or thinly chartaceous, elliptic-oblong to oblong-lanceolate, 10–22 by 3–8 cm, base attenuate, apex acute-acuminate; upper surface drying olivaceous to brown, often with paler markings, sometimes faintly pale pustulate, lower surface glabrescent, hairs 0.1 mm; dots absent; midrib above flattish; nerves 10–15 pairs not particularly contrasting, above thin, flattish or sunken, beneath with lines of interarching neither regular nor prominent; venation lax, rather faint; petiole 5–10 by 1.5–2.5 mm; leaf bud 10 by 1.5 mm, with hairs 0.1 mm. *Inflorescences* in male 3 (or 4) times branched, many-flowered, 4–10 by 2.5–6 cm, peduncle 0.2–2 cm long; in female: 5 by 3.5 cm; with dense to sparse stellate hairs 0.1–0.2 mm; bracts elliptic-oblong, acute, 1–2(–4) mm long, caducous; flowers generally 1–3 together; perianth 2-lobed, glabrescent except at the very base, pedicel with hairs 0.1 mm long, not articulated. *Male flowers*: pedicel 1.5–3 mm long; buds as seen laterally  $\pm$  circular, slightly broader than long, slightly laterally compressed, not or but slightly collapsed on drying, 2.2–2.7 by 2.6–3 mm, cleft to the base, lobes 0.1–0.2 mm thick; androecium laterally much flattened, above broadly rounded, 1.5–1.7 by 2 mm (Plate 1: 26); thecae 24–28(–32), erect, at apex free for 0.1 mm long, column at apex narrowly hollowed for 1/3–2/3; androphore to 0.1 mm, broadly attached. *Female flowers* (immature): pedicel 1.5–2 mm long, buds broadly ovoid, 1.5 by 1.4 mm, cleft nearly to the base; ovary ovoid, 1.1 by 0.6 mm, glabrous, style and stigma minutely 2-lobed. *Fruits* 1–20 per infructescence, globose or subglobose, 1.1–1.4 cm diameter, glabrous, drying light to dark brown, with or without coarse, paler coloured lenticels or warts; pericarp 1.5–3 mm thick, woody-granular; fruiting pedicel 3–4 mm; perianth not persistent.

Field-notes — Slender tree, branches horizontal. Flowers yellow. Fruits green, turning orange.

Distribution — *Malesia*: New Guinea (NE Papua Barat, including Memberamo River area; N Papua New Guinea: Sepik, Madang Prov.).

Habitat & Ecology — Primary and degraded forest, marshy forest, locally common; recorded from *Pometia*–*Intsia* forest; on clays and marls; 0–200 m altitude; fl. Sept.; fr. Mar., June, Oct.

Note — Apart from *H. angularis* (see the note under that species) *H. basifissa* is possibly closely related to *H. parviflora*, both have glabrous fruits. The globose fruits are often very similar to those of *H. pilifera* or *H. sinclairii*; in these two species, however, the fruits are always hairy, at least towards the base. *Horsfieldia basifissa* has much in common with *H. laevigata* var. *novobritannica*, which also has the androecium deeply hollowed inside; the latter has a more hairy perianth. The female flowers of var. *novobritannica* are not known, but its globose fruits are larger than those of *H. basifissa* and somewhat hairy at the base. *Horsfieldia basifissa* is characterized by the subglabrous male flowers with a very deeply cleft perianth, glabrous ovary, and glabrous, globose fruits.

#### 10. *Horsfieldia borneensis* W.J. de Wilde

*Horsfieldia borneensis* W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 27; Blumea 32 (1987) 468; Tree Fl. Sabah & Sarawak 3 (2000) 363. — Type: *S 14610 (Bojang)*, Sarawak.

Tree 10–30 m. *Twigs* subterete, (1.5–)2–4(–10) mm diameter, sometimes blackish, early to rather late glabrescent, hairs rusty, 0.2–0.4 mm; bark finely striate, not distinctly lenticellate, sometimes finely cracking or slightly flaking. *Leaves* chartaceous to thinly coriaceous, elliptic-oblong to oblong-lanceolate, 7–18 by 2–6 cm, base (short-)attenuate, apex acute to (short-)acuminate; upper surface drying dull olivaceous to (partially) blackish brown, glabrous, lower surface drying pale brown to chocolate, glabrescent, hairs densely branched dendroid 0.3–0.4 mm (especially on midrib); dots present and obvious; midrib slightly raised above, (late) glabrescent; nerves 10–16 pairs, slender above, flat or sunken (slightly raised only close to the midrib) or in thinner-leaved specimens slightly raised, glabrous, lines of interarching  $\pm$  regularly shaped, not distinct; venation hardly or not visible on both surfaces; petiole 12–25 by 1.5–2.5 mm, sometimes late glabrescent; leaf bud 10–17 by 2–4 mm, with dense hairs 0.3 mm long. *Inflorescences* behind the leaves, with dense short-woolly rusty hairs up to 0.7 mm long; in male: fairly large, many-flowered, about 4 times branched, (8–)13–20 by (5–)10–18 cm, peduncle 1.5–3.5 cm long; in female: 8–10(–13) by 4–5 cm, less branched; bracts elliptic to elliptic-oblong, pubescent as the inflorescences, 1.5–5 mm long, caducous; flowers (male) in loose clusters of 2–6, glabrous; perianth 3-lobed, pedicel distinctly articulated. *Male flowers*: pedicel 1–1.5 mm; buds subglobose to broadly ellipsoid or broadly obovoid, 1.3–1.8 by 1.2–1.7 mm, cleft c. 1/3 (to nearly 1/2), not collapsing on drying, lobes 0.2–0.3 mm thick; androecium broadly ellipsoid to subglobose, 0.7–1.2 by 0.6–1.3 mm, the apex broadly rounded, slightly impressed in the centre with cavity to c. 1/4, base rounded, in cross section circular (Plate 3: 76); thecae 16–20, almost completely sessile and mutually closely appressed, at apex incurved over the cavity, free apices about none; column broad; androphore narrow, at most 0.1 mm long. *Female flowers*:

pedicel thickish, glabrous, 1–1.5 mm long, distinctly articulated; buds subglobose or broadly ellipsoid, 3–3.5 by 3 mm, glabrous, cleft c. 1/3; ovary subglobose to broadly ovoid-ellipsoid, 2(–2.5) by 2 mm, glabrous, stigma 2-lobed, 0.2 mm high, descending 1.5 mm down the ovary. *Fruits* 1–7 per infructescence, ovoid, 4–6 by 3–4.5 cm, glabrous, somewhat laterally flattened and slightly flanged, apex and base rounded, drying brown and often with a glaucous tinge, smooth; pericarp 10–15 mm thick; fruiting pedicel stout, 4–6 mm long; perianth not persistent.

Field-notes — Bark usually dark brown, reddish, or blackish, rough, deeply fissured, flaking in squares, strips or flakes up to 5 cm wide, up to 1 cm thick (strips with rounded edges, appearing smooth); living bark 5–10 mm thick, red-brown, the sap red; sapwood 10 cm, reddish white to pale red; heartwood red-brown. Fruits bluish green, turning green-yellow to yellow or reddish, pericarp pink inside.

Distribution — *Malesia*: Borneo (Sarawak, Sabah, E & NE Kalimantan).

Habitat & Ecology — Primary lowland dipterocarp forest, swamp forest; on sandy soils, flat clayey soil, sandstone, sandy ridges; 0–200 m altitude; fl. Apr., Aug., Sept.; fr. throughout the year.

Notes — 1. *Horsfieldia borneensis* and *H. wallichii* both have characteristic blackish dots on the lower leaf surface, a dull upper leaf surface with largely sunken nerves, and similar fruits (although the perianth in *H. wallichii* is persistent). However, *H. wallichii*, which also occurs in Borneo, is generally stouter and has much larger leaves, often with a persistent indumentum. Above all, it differs in general appearance, shape, and structure of the androecium, and the pedicel which is not articulated.

2. *Horsfieldia borneensis*, with its dotted lower leaf surface, belongs to a group of species including *H. wallichii* and *H. pulcherrima*, while the structure of its androecium links it to species such as *H. flocculosa*, *H. grandis*, and *H. pulcherrima*; compare also *H. punctatifolia*.

## 11. *Horsfieldia brachiata* (King) Warb.

*Horsfieldia brachiata* (King) Warb., Mon. Myrist. (1897) 325; Gamble, Mat. Fl. Malay Penins. 5, 23 (1912) 218; Ridl., Fl. Malay Penins. 3 (1924) 59; W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 3; Tree Fl. Sabah & Sarawak 3 (2000) 363. — *Myristica brachiata* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 311, pl. 144. — *Horsfieldia subglobosa* (Miq.) Warb. var. *brachiata* (King) J. Sinclair, Gard. Bull. Sing. 16 (1958) 431, f. 51E. — *Horsfieldia brachiata* (King) Warb. var. *brachiata*: J. Sinclair, Gard. Bull. Sing. 28 (1975) 9. — Lectotype: *Griffith 4351*, Peninsular Malaysia.

Tree 10–35 m. *Twigs* ± angular or subterete, or more or less flattened, distinctly lined or ridged (sometimes lines evident only in part of the material), 2–7(–18) mm diameter, generally early glabrescent, hairs rusty, (0.1–)0.2–0.4 mm long; bark finely to coarsely striate, not flaking; lenticels present but not much contrasting. *Leaves* membranous, elliptic-oblong to oblong(-lanceolate), 12–26(–30) by 4–9(–11) cm, base cuneate, apex acute-acuminate; upper surface glabrous, drying olivaceous to brown or sometimes blackish, lower surface drying light brown, early glabrescent, midrib sometimes later glabrescent; dots absent; midrib raised above, glabrous; nerves 12–20 pairs, raised above, lines of interarching usually not distinct; venation lax, usually not distinct above; petiole 8–13(–20) by 2–3 mm, glabrescent; leaf bud 8–15 by 3–4 mm, hairs 0.2–0.4 mm long.

*Inflorescences* with sparse to dense dendroid hairs 0.2–0.5 mm, sometimes glabrescent; in male: 3 or 4 times branched, many-flowered, 7–18(–22) by 5–16(–18) cm, peduncle 0.6–1.8 cm long, the flowers in loose clusters of 3–6; in female: many-flowered, 3–8 by 2–6 cm; bracts oblong-lanceolate, acutish, 3–5 mm long, pubescent, caducous; flowers with perianth 3- (or 4-)lobed, glabrous, pedicel pubescent in various degrees, hairs 0.1–0.2 mm long (in female glabrescent), articulated. *Male flowers*: pedicel (1–)1.5–2.5 mm long; buds (depressed-)globose to broadly obovoid, in cross section rounded or slightly angular, 1–1.5 by 1.2–1.8 mm, base rounded to short-cuneate, not or but little collapsing on drying, cleft 1/2–2/3, lobes 0.2–0.4(–0.5) mm thick; androecium depressed-globose to obovoid in outline, (0.5–)0.7–1 by 0.8–1.2 mm, ± rounded or usually ± triangular in cross section (Plate 3: 64); thecae 12–20, anthers 0.5–0.7 mm long, mutually free for about halfway, usually curved towards the centre, column largely hollowed out, at base continuing into the 0.2–0.3 mm long androphore, slightly tapering or not. *Female flowers*: pedicel 1–1.5 mm long; buds broadly ellipsoid, 2.2–2.5 by 1.8–2 mm, cleft c. 1/3; ovary ovoid, 1–1.4 by 0.8–1.2 mm, glabrous, the stigma 2-lobed, 0.2 by 0.4 mm. *Fruits* 4–12(–20) per infructescence, broadly ellipsoid, apex narrowly rounded, base (broadly) rounded, 2–2.8(–3) by 1.8–2.2(–2.6) cm (see note 3), glabrous, drying brown to dark brown, neither warted nor lenticellate, pericarp 1.5–4 mm thick; fruiting pedicel 1.5–3 mm long; perianth not persistent.

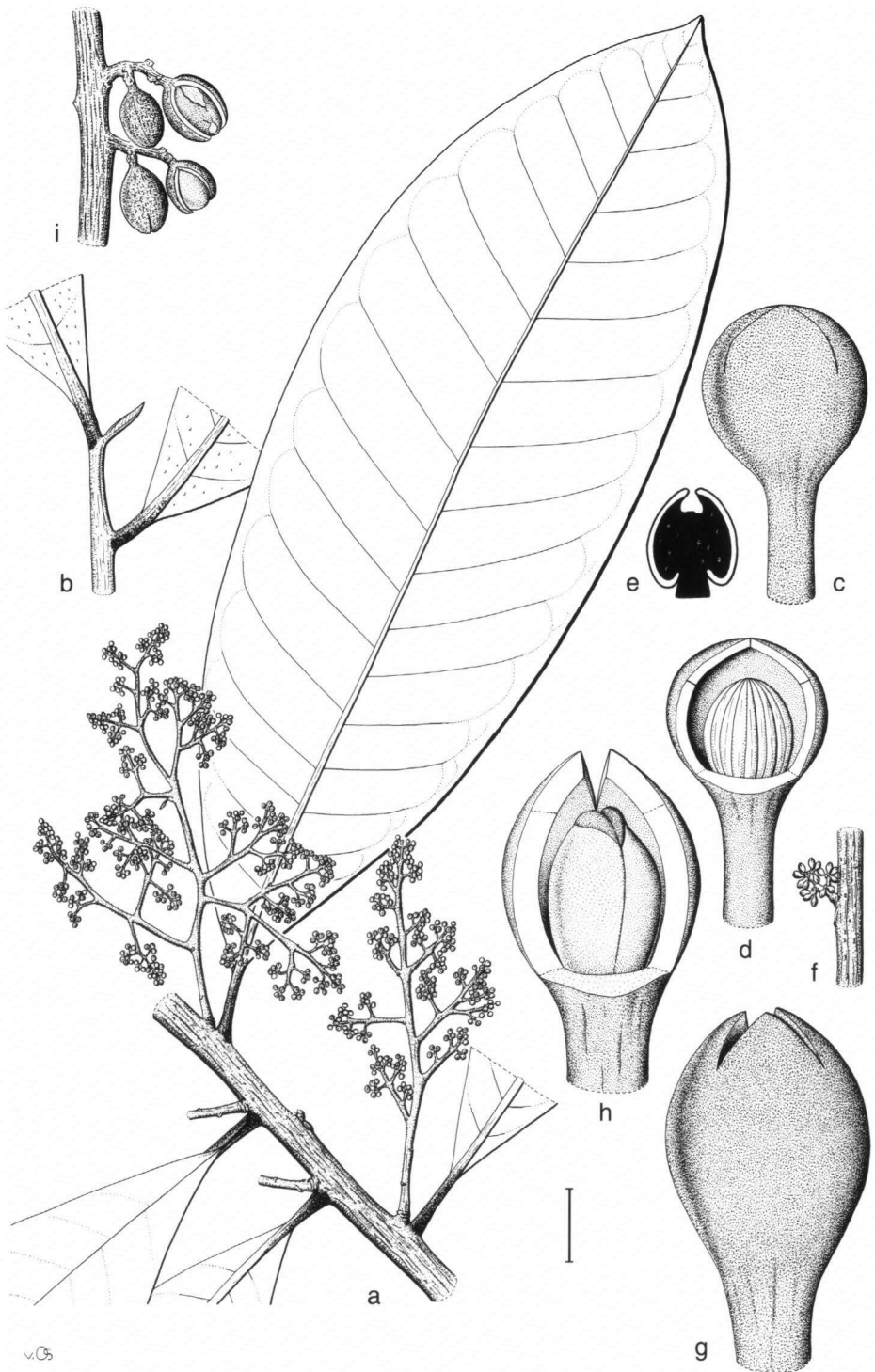
*Field-notes* — Usually a slender tree with straight bole, once recorded as with buttresses to 50 cm high; bark ± smooth, pale to dark brown, generally with shallow vertical fissures 1 cm apart, sometimes ± laminated, scaly, or cracked; living bark 8–10 mm thick, pinkish to reddish brown, exuding reddish sap; wood whitish to pale brown; no heartwood; twigs with raised lines. Flowers greenish yellow to dark yellow, scented. Fruits yellow(-green) or yellow-orange.

*Distribution* — Peninsular Thailand; *Malesia*: Sumatra, Peninsular Malaysia (Kedah, Kelantan, Perak, Trengganu, Pahang, Malacca, Johore), Borneo (Sarawak, including one deviating collection, see note 3; Sabah; C, E & NE Kalimantan; Brunei); not found in Singapore and large parts of Kalimantan.

*Habitat & Ecology* — Primary and degraded lowland rain forest; often near streams in flatland; marshy, riverside, and peaty forests, forest on alluvial plains, poor forest on soil with stagnant water, but also on hillsides; on alluvial soils, brown and sandy soil (in *Tristania* forest, Sabah), sandstone, peaty soils, loam soil with lime; 0–400 m altitude; fl. & fr. throughout the year.

*Notes* — 1. *Horsfieldia brachiata* is close to *H. polyspherula*, and in most cases easily recognized by its weak to strong raised lines on the twigs. Its fruits are rather uniform in shape and size, 20–28 mm long, and thus ± intermediate between those of *H. polyspherula* var. *polyspherula* and var. *sumatrana* (see there). The leaves of *H. brachiata* are rather like those of *H. polyspherula* var. *sumatrana*, namely generally membranous and drying pale, dull olivaceous above and pale cinnamon below. Its flowers are rather uniform, with mature male buds 1.2–1.8 mm in diameter, and the androecium usually ± triquetrous with 6–10 stamens (but see note 2), and they do not differ from those of *H. polyspherula* s.l. Sterile and flowering collections in which the apical and lower twig parts are not sufficiently represented may be difficult to place. *Horsfieldia brachiata* generally has stouter inflorescences than *H. polyspherula* and is quite common in ever-green forests in Peninsular Thailand; *H. polyspherula* has not been found there.





2. The species usually has 12–16 thecae in the androecium, but material from Peninsular Thailand may have 18 or 20 thecae.

3. *S 34908* from Sarawak (Kapit, 5th Div.) is a stout specimen, in bad condition, with female flowers; at L there is a single fruit measuring 40 by 30 mm, with the pericarp  $\pm$  woody, 5–7 mm thick. *Horsfieldia brachiata* is not common in Sarawak and this large-fruited specimen probably represents a separate taxon. It was collected in a kerangas-mossy forest at c. 800 m altitude, higher than any other specimen of the species.

## 12. *Horsfieldia carnos* Warb.

*Horsfieldia carnos* Warb., Mon. Myrist. (1897) 348, 619; Merr., Enum. Born. (1921) 268; J. Sinclair, Gard. Bull. Sing. 28 (1975) 21; W.J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 222, f. 26; Tree Fl. Sabah & Sarawak 3 (2000) 364. — *Myristica carnos* (Warb.) Boerl., Handl. 3 (1900) 87. — Lectotype: *Beccari 1242* (FI acc. 7625), fr.; Sarawak.

Tree 4–10 m. Twigs 3–10(–16) mm diameter, early glabrescent, hairs grey-brown, 0.1 mm; bark coarsely or finely striate, tending to flake, drying somewhat pale, yellow-brown or light grey-brown, generally contrasting with the blackish brown of the petioles; lenticels usually not conspicuous. *Leaves* chartaceous-coriaceous, rarely  $\pm$  membranous, (elliptic-)oblong, 13–35 by 5–11 cm, base long- or sometimes short-attenuate, apex acute-acuminate; upper surface drying bright dark brown, finely wrinkled-granulate, glabrous, lower surface early glabrescent (glabrous); dots absent; midrib above flat; nerves 13–18 pairs, flat above, lines of interarching indistinct; venation lax, faint or invisible on both surfaces; petiole 10–16 by 2–4 mm, glabrous or early glabrescent; leaf bud 9–13 by 2–3 mm, hairs grey-brown, 0.1 mm long. *Inflorescences* with dense to sparse hairs 0.1 mm or less; in male: below the leaves, many-flowered, 3 or 4 times branched, 6–17 by 5–14 cm, peduncle 1–3 cm long; in female: ramiflorous, rather many-flowered, 1–2 cm long; bracts elliptic to oblong, 4–10 mm long, pubescent, caducous; flowers glabrous, in male in loose clusters of 3–9, perianth 3-lobed, pedicel not articulated. *Male flowers*: pedicel 1–1.5 mm long; buds (sub)globose, 1.9–2.1 by 1.8–2 mm, cleft 1/3–1/2, not collapsing on drying, lobes 0.2 mm thick; androecium (sub)globose, 1–1.2 by 1–1.3 mm, circular in cross section (Plate 2: 61); thecae 18–22, completely sessile, without free apices, incurved, concealing a small apical cavity 0.2–0.4 mm deep; column broad,  $\pm$  spongy, androphore rather narrow, 0.2–0.5 mm long, completely hidden by the anthers. *Female flowers*: pedicel 1–1.5 mm long; buds ellipsoid, 3.5 by 2.5 mm, cleft c. 1/3, lobes 0.3–0.4 mm thick; ovary ellipsoid, 2 by 1.5 mm, glabrous, stigma consisting of two broad lips 0.2 mm high. *Fruits* 2–11 per infructescence, ellipsoid, 1.6–2 by 1.2–1.5 cm, glabrous, drying brown, the surface finely granulated; pericarp 1.5 mm thick; fruiting pedicel 1–2 mm long; perianth not persistent. — **Fig. 11.**

Fig. 11. *Horsfieldia carnos* Warb. a. Twig with leaf and male inflorescences; b. apical part of leafy twig; c. mature male flower, lateral view; d. ditto, opened, showing androecium; e. androecium, longitudinal section, schematic; f. twig with female inflorescence axillary to leaf scar; g. female flower at anthesis, lateral view; h. ditto, longitudinally opened, showing glabrous ovary with broad 2-lobed stigmas; i. older twig with infructescences, fruits mature, aril complete but torn on drying [a: *van Niel 5419*; b–e: *S 18011*; f–h: *SAN 63191*; i: *SAN 17438*]. — Scale bar for a, b, f, i = 2 cm; for c–e, g, n = 0.85 mm.

Field-notes — Small tree, trunk slender; the bark often flaking or shallowly fissured; inner bark yellow, thin, sap watery, clear, not reddish; sapwood whitish, twigs light brown. Flowers green-yellow, anthers whitish. Fruits (immature) greenish yellow, aril orange.

Distribution — *Malesia*: Borneo (Sarawak, Brunei, Sabah; W Kalimantan: Mt Klam).

Habitat & Ecology — Heath forest, wet kerangas, peat swamp forest, *Agathis-Casuarina* forest; on white sandy soils; 0–100 m altitude; fl. mainly July–Nov.; fr. throughout the year. An extensive note on the ecology is given by Sinclair, l.c.

Note — *Horsfieldia carnosia* is a well-characterized species, a small tree of kerangas or peat swamp forest, on white sandy soils. It is distantly related to *H. glabra*, which is distinguished by a less stout habit, dark twigs, bark not tending to flake, smaller and usually membranous leaves, globose male flowers, pedicels  $\pm$  articulated, globose or ellipsoid androecium with short androphore, and somewhat longer, not densely clustered fruits, 1.8–2.4 cm long.

### 13. *Horsfieldia clavata* W.J. de Wilde

*Horsfieldia clavata* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 92, f. 13d–f. — Type: *Hoogland 3663*, New Guinea.

Shrub or tree, 3–6 m. Twigs 1.5–3 mm diameter, glabrescent, hairs grey-rusty, 0.1 mm long; bark finely striate, not flaking; lenticels absent or inconspicuous. *Leaves* membranous, elliptic or oblong, 7–18 by 3–6 cm, base short- to long-attenuate, apex acute-acuminate (in *Hoogland 3523* 2 cm caudate); upper surface drying olivaceous, lower surface with persistent, scattered, stellate-dendroid scale-like hairs 0.1–0.2 mm long, especially on midrib, the nerves not much contrasting; dots absent; midrib slender above, raised; nerves 10–20 pairs (including some intersecondary nerves), above thin and flat or slightly raised, beneath much raised (not much contrasting in colour), lines of inter-arching regularly looping, distinct; venation lax, rather indistinct; petiole 7–14 by 1–1.5 mm; leaf bud 7–10 by 1–1.5 mm, hairs 0.1 mm. *Inflorescences* with scale-like hairs 0.1 mm or less, among the leaves, delicate, 1 or 2 (or 3) times branched, lowest branch from near the base; in male 2–3 by 1.5–2 cm, rather many-flowered; in female: 1–2 cm long, 2- or 3-flowered; bracts densely pubescent, 1–1.5 mm long, caducous; flowers solitary or 2 or 3 together; perianth 2-lobed, with stellate-dendroid hairs 0.1 mm; pedicel not articulated. *Male flowers*: pedicel 2.5–3.5 by 1–1.5 mm, pubescent; buds clavate, with tapering pedicel, together 4–5.5 by 1.5–2.2 mm; perianth rounded above, 1.5–2 by 1.5–2.2 mm, cleft c. 1/10, lobes 0.2 mm thick, lower down perianth wall 0.5–0.7 mm thick; androecium clavate, 1.5 by 0.7 mm, anthers 3 (or c. 6 thecae), 0.3 mm long,  $\pm$  stellate, sessile, column not hollowed out; androphore thickish subcylindrical, slightly bullate-striate, glabrous (Plate 1: 18). *Female flowers*: pedicel  $\pm$  slender, 2 mm long; buds ellipsoid, 1.8(–2) by 1.2 mm, cleft c. 1/4; ovary ovoid, 1 by 0.6 mm, with dense stellate scale-like hairs 0.1 mm or less, style 0.4 mm long, stigma 2-lobed, 0.2 mm long. *Fruits* 1 (or 2) per infructescence, broadly ellipsoid-ovoid, 1.3 by 1 cm (excluding pseudostalk), base broadly rounded, apex  $\pm$  acuminate, beak 2 mm, with hairs 0.1 mm long, drying brownish, without lenticels; pericarp 1 mm thick; fruiting pedicel 6–10 mm, the pseudostalk 1.5–2 mm long; perianth not persistent. — **Fig. 14d–f.**

Field-notes — Shrub or treelet. Flowers yellow. Fruits orange or red.

Distribution — *Malesia*: Papua New Guinea (Northern Prov.).

**Habitat & Ecology** — Locally common in regrowth in tall lowland forest on well-drained soil; 0–50 m altitude; fl. & fr. Aug.

**Note** — *Horsfieldia clavata* is related to *H. squamulosa* and *H. crux-melitensis* which have a similar clavate androecium. *Horsfieldia squamulosa* differs in its slender, male pedicels. The pedicel, and hence the whole male flower of *H. crux-melitensis* is similarly club-shaped as in the present species, but about twice as large; its leaves are also larger and darker, and both male and female flowers have much thickened pedicels.

#### 14. *Horsfieldia coriacea* W.J. de Wilde

*Horsfieldia coriacea* W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 50. — Type: *bb Cel. III-27*, Sulawesi.

Tree 8–25 m. Twigs 2.5–4(–10) mm diameter, early glabrescent, hairs greyish brown, 0.1 mm; bark finely striate, not flaking; lenticels conspicuous or not. *Leaves* membranous to thinly chartaceous, (elliptic-)oblong, 14–27 by 5–10 cm, base attenuate, apex acute-acuminate; upper surface glabrous, drying olivaceous brown to blackish brown, the midrib glabrous but towards the base in younger leaves finely pubescent, lower surface glabrous; dots absent; midrib moderately raised above; nerves 13–18 pairs, raised above, lines of interarching not distinct; venation lax, barely visible on either surface; petiole 12–16 by 2.5–3.5 mm; leaf bud 12–17 by 2–3 mm, hairs dense, grey-brown to rusty, 0.1 mm long. *Inflorescences* behind the leaves, with sparse hairs 0.1 mm; in male: 2 or 3 times branched, few-flowered, 4–10 by 3–5 cm, peduncle 1–2 cm long, the flowers in loose clusters of 3–5; in female (from infructescences): 2–5 cm long; bracts not seen, caducous; flowers glabrous, perianth 3- or 4-lobed, pedicel not articulated. *Male flowers*: pedicel 1.5–2 mm long; buds subglobose to broadly ovoid, 2–2.5 by 2–2.3 mm, apex shortly rounded to subacute, not or only slightly collapsing on drying, cleft 1/2–2/3, lobes 0.4–0.5 mm thick, coriaceous; androecium subellipsoid, 1.5–1.6 by 0.8–0.9 mm, in cross section ± blunt-triangular (Plate 3: 88); thecae 10 or 12, at the base curved, and towards the apex erect or somewhat curved, 1.6 mm long, free apices 0.1–0.2(–0.3) mm, apical cavity narrow, 0.2–0.3(–0.5) mm deep, androphore narrow, 0.1–0.2 mm long, hidden by the anthers. *Female flowers* not seen. *Fruits* 1–5 per infructescence, ellipsoid, 4–4.2 by 2.5–3.2 cm, glabrous, drying rust-brown, finely granulate and with at most a few tubercles or lenticels; pericarp rather coriaceous, 3.5–8 mm thick; fruiting pedicel 2–4 mm long; perianth not persistent.

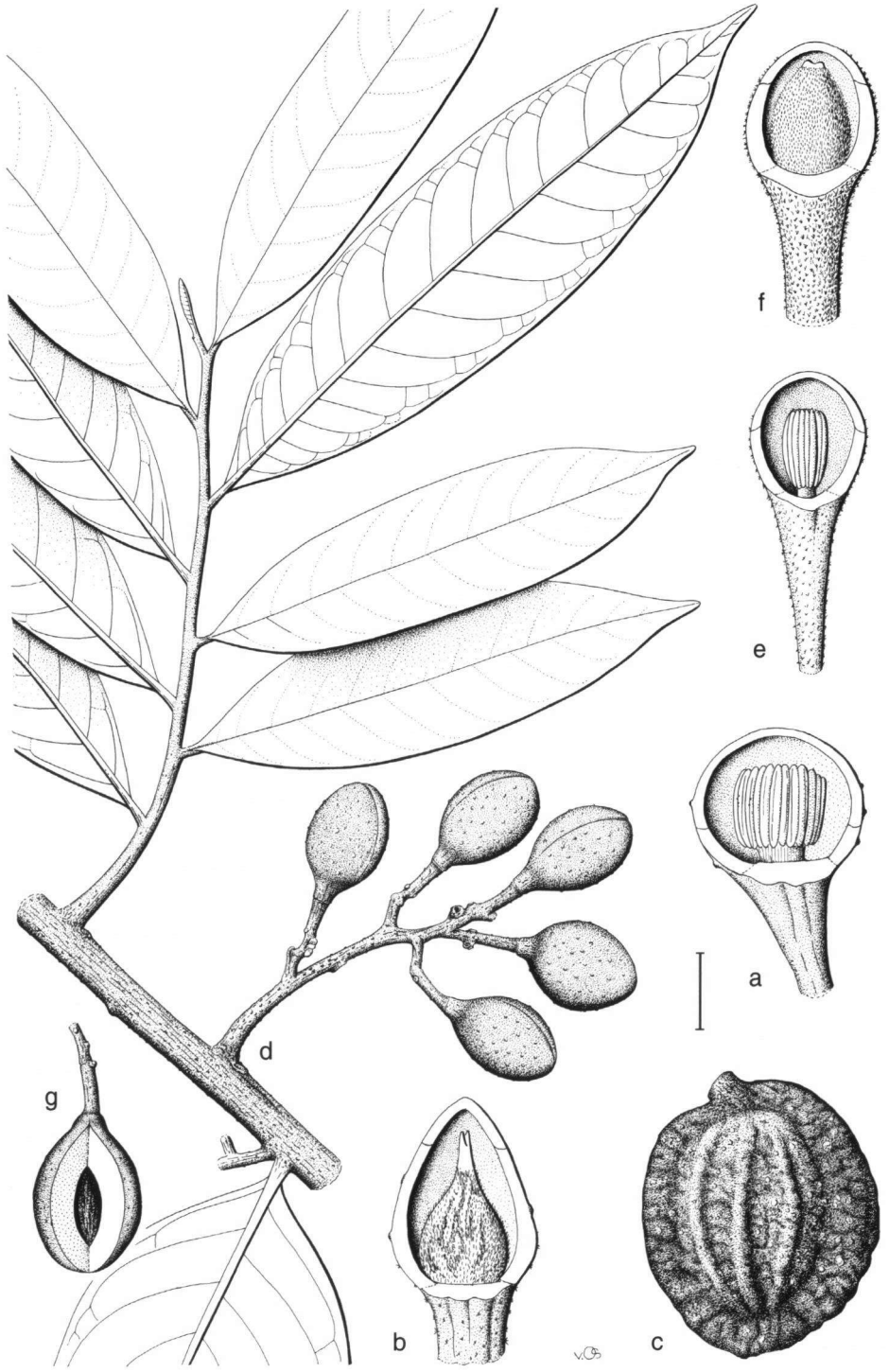
**Field-notes** — Bark and leaves with aromatic scent; branches horizontal; cauliflorous. Flowers yellow, strongly scented; perianth fleshy. Ripe fruits orange.

**Distribution** — *Malesia*: Endemic in C Sulawesi.

**Habitat & Ecology** — Primary and disturbed forest (with *Imperata*, *Gleichenia*, and *Melastoma*) on ultrabasic soil; 100–700 m altitude; fl. Mar., Nov.; fr. Apr., July.

**Notes** — 1. In most flowers there are a few minute wart-like appendages 0.1 mm high around the insertion of the androecium.

2. *Horsfieldia coriacea*, vegetatively and in fruit, resembles *H. costulata*, which has a much larger distribution in Sulawesi and the Philippines. However, the latter differs in thinner membranous leaves, drying generally more olivaceous, with the midrib on the upper surface entirely glabrous, the lateral nerves usually forming a greater angle with the midrib, and less conspicuous lenticels on the twigs. The fruits are generally larger



with a pericarp 8–10(–15) mm thick. Furthermore, the male flowers are quite different, those of *H. costulata* being arranged in rather dense clusters of 5–10.

3. *Horsfieldia coriacea* seems closely related to *H. majuscula* (Sumatra, Peninsular Malaysia) and *H. xanthina* (Borneo), both also having an elongate androecium, but with a broader and tapered androphore, not hidden by the anthers; in *H. majuscula* the pedicel is articulated.

### 15. *Horsfieldia corrugata* Foreman

*Horsfieldia corrugata* Foreman, Contr. Herb. Austral. n. 10 (1974) 45, f. 1; W. J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 130, f. 20a–c. — Type: LAE 52461, Papua New Guinea.

Tree 5–12 m. Twigs (3–)4–5(–12) mm diameter, early glabrescent, hairs greyish to rusty, 0.1 mm; bark striate, not flaking, lenticels large, usually not much contrasting in colour. Leaves thinly coriaceous, elliptic-oblong, 12–29(–32) by 4.5–8.5(–10) cm, base attenuate, apex acute-acuminate; upper surface drying dark brown, minutely pustulate or not, lower surface early glabrescent; dots absent; midrib slender to rather broad, flat-tish above; nerves 12–18 pairs, thin and flat above, beneath lines of interarching with irregular loops, distinct or not, venation lax, indistinct; petiole 6–18 by 2–3.5 mm; leaf bud 10–20 by 1.5–3 mm, hairs 0.1 mm. Inflorescences below the leaves, with rusty stellate hairs 0.1 mm long or less; in male: 2 or 3 times branched, rather slender, (4–)6–14 by 2–9 cm, peduncle 1–2.5 cm long; in female: up to 5 cm long, peduncle 1 cm long; bracts pubescent, 1.5–4 mm long, caducous; flowers (in male) solitary or in loose clusters of 2–5, glabrous or glabrescent, hairs scattered, less than 0.1 mm, perianth 2-lobed, pedicel ± tapering, not articulated. Male flowers: buds in lateral view subcircular, 3–3.5 by 3(–4) mm, apex broadly rounded, the lower half ± tapering into the thickish tapering pedicel, (2–)3–4 mm long; perianth cleft 1/2 to nearly 2/3, lobes 0.2–0.3 mm thick, often with a few coarse blackish brown wart-like dots; androecium thickish, not much laterally compressed, above broadly rounded, (1.5–)2–2.2 by 2–2.2(–3) mm (Plate 2: 34); thecae 16–24, erect, 2 mm long, free apical parts 0.1–0.2 mm, column narrowly hollowed for 1/5–1/4, androphore 0.2–0.3 mm long. Female flowers: pedicel 4–5 mm long, minutely pubescent; buds narrowly ovoid, almost glabrous, with a few coarse, dark brown wart-like dots, 4.5 by 3 mm, cleft 1/4–1/3, lobes 0.3–0.4 mm thick, coriaceous; ovary ovoid, somewhat dented or corrugated, 2.5–3 by 2.5 mm, with dense hairs less than 0.1 mm long, style and 2-lobed stigma glabrous, 0.8–1 mm long. Fruits 1(–4) per infructescence, ramiflorous, broadly ellipsoid to subglobose, somewhat flattened, 6–7.5 by 4.5–6.5 cm, coarsely flanged and corrugated, drying blackish brown, with scattered, coarse, paler coloured tubercles, glabrescent, at base sometimes a short pseudostalk, apex acutish, pericarp ± woody-corky, 10–20 mm thick; fruiting pedicel 5–10 mm long; perianth not persistent. — Fig. 12a–c.

Fig. 12. *Horsfieldia corrugata* Foreman. a. Longitudinally opened male flower showing androecium; b. ditto, female flower, showing pubescent ovary and narrow 2-lobed style; c. fruit. — *H. pachycarpa* A. C. Sm. d. Leafy twig with infructescence; e. longitudinally opened male flower showing androecium; f. ditto, female flower with pubescent ovary with short 2-lobed stigma; g. almost mature fruit [a: Carr 14123; b: LAE 60020; c: Carr 14334; d: LAE 62196; e: LAE 51940; f: Clemens 5378; g: NGF 38895]. — Scale bar for c, d, g = 2 cm; for a, b, e, f = 1.7 mm.

Field-notes — Wood very light brown. Flowers yellow or orange. Fruits green, strongly wrinkled or corrugated, and strongly ridged.

Distribution — *Malesia*: Papua New Guinea (Central, Northern, Milne Bay Prov.).

Habitat & Ecology — Primary and degraded rain forest of mountainous terrain on slopes and ridges, fagaceous forest; 1200–1900 m altitude; fl. & fr. July to Dec.

Note — When in flower, *H. corrugata* may be difficult to distinguish from, e.g., *H. pachycarpa*, *H. tuberculata*, or certain forms of *H. laevigata*. However, the few coarse and conspicuous blackish brown wart-like dots on the perianth, found in male and female flowers, help to characterize *H. corrugata*. The large, corrugated and ridged thick-lobed fruits are also distinctive, those of the other species may be similar but not ridged.

## 16. *Horsfieldia coryandra* W.J. de Wilde

*Horsfieldia coryandra* W.J. de Wilde, Blumea 32 (1987) 464. — *Horsfieldia squamulosa* auct. non W.J. de Wilde: W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 93, p.p. — Type: NGF 46892 (male fl.; fr.), Papua New Guinea.

Shrub or treelet, 1.5–6 m Twigs 1.5–2 mm diameter, with rusty hairs to 0.1 mm long, glabrescent; bark finely striate, neither cracking nor flaking; lenticels few and inconspicuous or absent. *Leaves* membranous, elliptic-oblong to lanceolate, 5–20 by 0.7–5 cm, base (long-)attenuate or acute, apex long-acuminate, acumen often slender, to 3 cm long, or gradually narrowed from slightly above the middle, blade above glabrous, drying dark brown (sometimes slightly olivaceous), beneath glabrescent with scattered hairs 0.1 mm or less remaining on and near the midrib, drying brown or olivaceous brown; dots absent; midrib above slender, flat or raised; nerves 11–19 pairs (usually with some intersecondary nerves not reaching the marginal nerve), above indistinct, flat or sunken, beneath distinct, with lines of interarching usually distinct; venation coarse and distinct; petiole 6–14 by 0.5–1.5 mm, glabrescent; leaf bud 7–12 by 1(–1.5) mm, with dense rusty hairs 0.1 mm or less. *Inflorescences* among the leaves, 2 or 3 times branched, peduncle 0.2–1 cm long, with grey-brown hairs 0.1 mm or less, rather few-flowered; in male: 2–3 by 1.5–3 cm, flowers solitary or 2 or 3 together; in female: 1–1.5 cm long, not or little branched, few-flowered; bracts oblong, 1–2 mm long, caducous; flowers 2-lobed, with sparse hairs 0.1(–0.2) mm or less, glabrescent in the apical part, pedicel not articulated. *Male flowers*: pedicel slender, (2.5–)4–6.5 mm long; buds slightly compressed elliptic(-obovate) to elliptic-oblong, 2–3 by 1.5–2 mm, cleft 1/6 to nearly 1/4; perianth 0.5–0.7 mm thick, towards the apex of the lobes 0.2–0.3 mm; androecium club-shaped, the apex subacute (to bluntish), 1.5–2.5 by 0.6–0.8 mm; anthers 0.5–0.7(–1) mm long, mutually touching, at apex free for c. 0.3 mm (Plate 1: 15); thecae 8, column not hollowed at apex; androphore glabrous or basally with scattered pale brown hairs less than 0.1 mm, the upper part with somewhat warted or wrinkled surface. *Female flowers*: pedicel 2.5–3.5 mm; buds ellipsoid or ± fusiform, 2–2.5 by 1.5–2 mm, cleft c. 1/3; perianth (and lobes) 0.2–0.3 mm thick; ovary ovoid, 1.5 by 1.4 mm, densely minutely pubescent, style erect with 2 ± acute lobes together 0.4 mm long. *Fruits* 1 or 2 per infructescence, broadly ellipsoid-ovoid, including the 0.5–2 mm long apiculum 1.2–1.5 by 0.8–1 cm, pseudostalk 1.5–2.5 mm, all with hairs 0.1 mm or less, pericarp 0.5(–1) mm thick, drying blackish, without lenticels; fruiting pedicel (5–)10–12 mm long, not or hardly broadened towards the apex; perianth not persistent.

Field-notes — Bark smooth, greenish brown or dark green, underbark red; exudate red; inner bark brown; wood cream turning brown on exposure. Flowers yellow or orange. Fruits (yellow-)green to orange; aril complete (orifice very small and folded away), thin, red.

Distribution — *Malesia*: Papua New Guinea (Milne Bay Prov. incl. Normanby I., Northern Prov., Morobe Prov.).

Habitat & Ecology — Understorey shrub or low tree, sometimes gregarious. Lower hill forest; *Castanopsis* forest on steep slopes, *Eucalyptus*-dominated forest, ridge forest, on riverbanks; forest on limestone; 200–500 m altitude; fl. & fr. throughout the year.

Note — Close to *H. squamulosa*, with similar, rather ellipsoid perianth, but differing in some small features in flowers and fruits.

### 17. *Horsfieldia costulata* (Miq.) Warb.

*Horsfieldia costulata* (Miq.) Warb., Mon. Myrist. (1897) 350; W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 38. — *Myristica costulata* Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 48. — Type: *de Vriese & Teijsmann s.n.*, Sulawesi.

*Horsfieldia pachythyrsa* Warb., Mon. Myrist. (1897) 618; Koord., Meded. Lands Pl. Tuin 19 (1898) 70, 'crassithyrsa'. — *Myristica pachythyrsa* (Warb.) Boerl., Handl. 3 (1900) 86; 87, 'crassithyrsa'. — *Horsfieldia minahassae* auct. non (Warb.) Koord.: Koord., Meded. Lands Pl. Tuin 19 (1898) 70, p.p., quoad *Koorders 18158*. — Syntypes: *Koorders 18156* (male, L lecto), *18158* (L), *18170* (female, L), Sulawesi.

*Horsfieldia confertiflora* Merr., Philipp. J. Sci., Bot. 13 (1918) 285. — Type: *FB 3183* (*Ahern's Coll.*), Philippines.

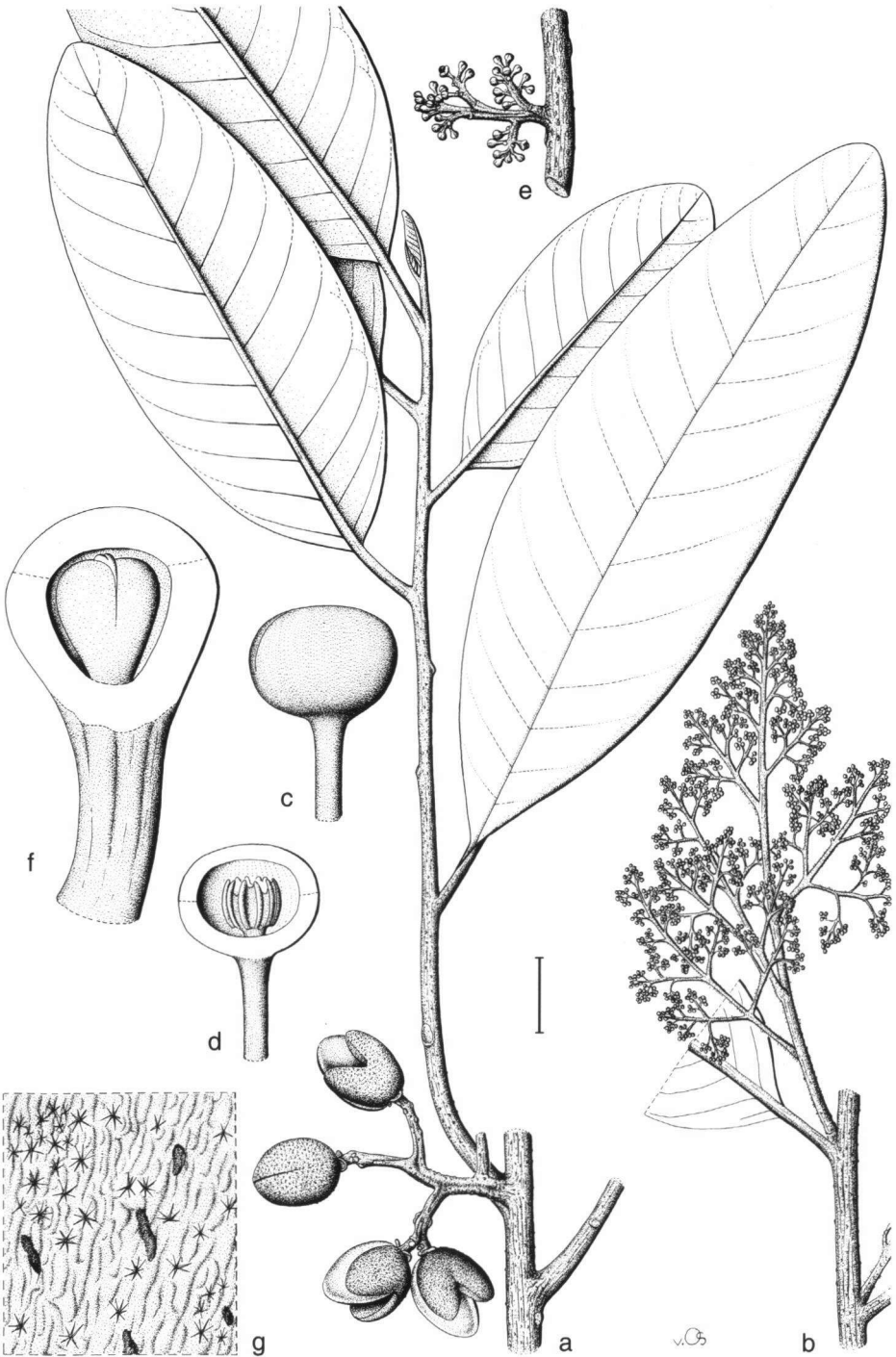
*Horsfieldia megacarpa* Merr., Philipp. J. Sci., Bot. 13 (1918) 286. — Type: *BS 16527* (*Ramos*), Philippines.

*Horsfieldia villamilii* Elmer ex Merr., Enum. Philipp. Flow. Pl. 2 (1923) 182, nom. nud.

*Horsfieldia vulcanica* Elmer ex Merr., Enum. Philipp. Flow. Pl. 2 (1923) 182, nom. nud.

Tree 9–30 m. Twigs 2.5–5(–10) mm diameter, early glabrescent, with grey-brown to light rusty hairs, 0.1(–0.2) mm; bark finely to coarsely striate, not flaking; lenticels small, generally inconspicuous. *Leaves* membranous or subchartaceous, elliptic-oblong to oblong-lanceolate, 15–30 by 5–13 cm, base narrowly rounded to attenuate, apex acute-acuminate; upper surface drying olivaceous to dark brown, sometimes with whitish marks as in *H. irya*; lower surface early glabrescent; dots absent; midrib above flat or slightly raised, early glabrescent; nerves 14–21 pairs, above thin, flat or raised, lines of interarching generally indistinct; venation lax, faint on both surfaces; petiole 7–14 by 2–4 mm; leaf bud 8–14 by 2–2.5 mm, with dense (grey-)rusty hairs 0.1(–0.2) mm. *Inflorescences* mostly behind the leaves, with dense or sparse hairs 0.1–0.2 mm; in male: 3 or 4 times branched, many-flowered, 6–14 by 5–13 cm, peduncle 1–3 cm long; in female: 2–6 cm long, shortly branched; bracts broadly triangular to elliptic-oblong, 2–4(–5) mm long, short-pubescent, caducous; flowers in male in clusters of 5–10 each, in female fewer, glabrous, perianth 3- (or 4-)lobed, pedicel not articulated. *Male flowers*: pedicel slender, 0.4–0.6(–0.7) mm long; buds ( $\pm$  depressed-)globose, 1.5–1.8 by 1.5–2 mm; cleft c. 1/2, lobes 0.2 mm thick; androecium (depressed-)globose or broadly ovoid 0.5–0.8 by 0.7–1.1 mm, circular in cross section (Plate 3: 83); thecae 14–20, completely sessile (free apices to 0.1 mm), incurved, apical cavity narrow, (0.1–)0.2 mm deep; androphore rather stout, 0.2–0.4 mm long, completely or partly hidden by the anthers. *Female flowers*: pedicel





0.5–1 mm long; buds subglobose, 2.3–2.5 mm diameter, cleft 1/3–1/2; ovary ovoid, glabrous, 1.2–1.5 mm diameter, stigma minutely 2-lobed, 0.1–0.2 mm. *Fruits* 1–3 per infructescence, subglobose to broadly ellipsoid or obovoid, 3.5–6 by 3–4 cm, glabrous, finely granulate, drying bright brown to blackish brown; pericarp (4–)8–10 mm thick; fruiting pedicel 2–4 mm long; perianth not persistent.

Field-notes — Tree with or without low buttresses, 30 by 10 cm; bark fissured or with longitudinal grooves, often peeling off, sap first clear, turning red to brown-red; heartwood reddish. Flowers yellow. Fruits yellow to red, on the larger branches.

Distribution — *Malesia*: Philippines (incl. Palawan), Sulawesi.

Habitat & Ecology — Mixed rain forest, primary dipterocarp forest; recorded from alluvial soil and volcanic soil, with *Eucalyptus deglupta* dominance; 250–1200 m altitude; fl. & fr. throughout the year, but fl. mainly July–Sept.

### 18. *Horsfieldia crassifolia* (Hook. f. & Thomson) Warb.

*Horsfieldia crassifolia* (Hook. f. & Thomson) Warb., Mon. Myrist. (1897) 323, p.p.; J. Sinclair, Gard. Bull. Sing. 16 (1958) 386, f. 34, pl. X-A; 28 (1975) 23; J. A. R. Anderson, Gard. Bull. Sing. 20 (1963) 195; W. J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 219, f. 25; Tree Fl. Sabah & Sarawak 3 (2000) 366. — *Myristica crassifolia* Hook. f. & Thomson, Fl. Ind. (1855) 160; A. DC., Prodr. 14, 1 (1856) 204; Miq., Fl. Ind. Bat. 1, 2 (1858) 68; Hook. f., Fl. Brit. India 5 (1886) 108; King, Ann. Roy. Bot. Gard. Calc. (1891) 308, pl. 140. — *Myristica irya* Gaertn. var. *crassifolia* Miq. ex Hook. f., Fl. Brit. India 5 (1886) 108, pro syn. — Type: Griffith 4350 (see notes by Sinclair, 1975: 25), Peninsular Malaysia.

*Myristica horsfieldia* auct. non Blume: Wall., Cat. (1832) n. 6806, p.p. (other parts are *Horsfieldia polyspherula* and *H. wallichii*).

*Myristica subglobosa* Miq., Fl. Ind. Bat., Suppl. 1 (1861) 383, p.p. (other part is *Horsfieldia irya*).

*Myristica paludicola* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 328, pl. 169. — *Horsfieldia fulva* (King) Warb. var. *paludicola* (King) Warb., Mon. Myrist. (1897) 299. — Syntypes: King's coll. 4267, 4706, 6688, Wray 3071, Peninsular Malaysia.

Tree 10–25 m. *Twigs* 2–6(–8) mm diameter, rather early glabrescent, hairs yellow-brown or rusty, woolly, 0.2–0.5 mm; bark coarsely striate, not flaking; lenticels sparse to dense, distinct or not. *Leaves* coriaceous, elliptic to oblong, 10–20(–28) by 3.5–7(–10) cm, base rounded to attenuate, apex rounded to subacute or rarely emarginate; upper surface drying dull greenish brown to dark brown, lower surface ± covered with subpersistent interwoven or spaced stellate scale-like hairs 0.1 mm high (when very young with dendroid emergents), or glabrescent and then showing distinct hair scars, and scattered dots and dashes; midrib above flattish; nerves 11–16 pairs, above thin and flat or sunken; venation faint on both surfaces; petiole 9–20(–30) by 1.5–4.5 mm, leaf bud

Fig. 13. *Horsfieldia crassifolia* (Hook. f. & Thomson) Warb. a. Branch with leafy twig and infructescence with mature fruits; note persistent perianth and completely closed aril; b. twig with male inflorescence; c. mature male flower, lateral view; d. ditto, longitudinally opened, showing androecium; e. older twig with female inflorescence axillary to leaf scar; f. opened mature female flower showing glabrous ovary and 2-lobed stigma; note that the flower is considerably larger than the male flower; g. part of lower leaf surface with persistent indumentum and irregularly shaped dark-coloured dots [a: *Mondi* 51; b–d: *S* 9226; e–g: *SAN* 27183]. — Scale bar for a, b, e = 2 cm; for c, d, f = 0.85 mm; for g = 0.4 mm.

7–12 by 2–3 mm with hairs 0.2–0.5 mm. *Inflorescences* among or behind the leaves, late glabrescent or with persistent, dense, woolly dendroid hairs 0.2–0.5 mm; in male: 3–5 times branched, broadly paniculate, many-flowered, 6–20 by 4–15 cm, peduncle 0.5–2 cm long; in female: 3–14 cm long; bracts elliptic-lanceolate, 2–5(–7) mm long, pubescent, caducous; flowers (male) in loose clusters of 2–7, glabrous; perianth 2-lobed, pedicel slender, not articulated. *Male flowers*: pedicel (0.3–)1 mm long; buds globose or slightly transversely ellipsoid, (0.8–)1–1.3 by 1–1.5 mm, cleft 1/3–1/2(–2/3), lobes 0.2–0.3 mm thick; androecium globose or ± transversely ellipsoid, barely laterally compressed, 0.4–0.5 by 0.5–0.8 mm (Plate 2: 60); thecae (6–)8–12, widely spaced, connectives broad (and androecium angular), the anthers free for almost the upper half or more; androphore 0.2(–0.3) mm long, slender. *Female flowers*: pedicel 1.5–2.5 mm long; buds broadly obovoid, 2–3 by 2–2.5 mm, cleft 1/5–1/3, lobes 0.6–1 mm thick; ovary obovoid, glabrous, 1.5 by 1.2–1.5 mm, stigma of 2 sessile small lobes 0.1–0.2 mm high, running out into a faint ridge at one side of the ovary. *Fruits* (1–)2–10 per infructescence, ovoid to obovoid, 1.5–2.2 by 1.2–1.8 cm, glabrous, drying dark brown, with at most few lenticel-like tubercles; pericarp 1.5–2 mm thick; fruiting pedicel 2–5(–7) mm long; perianth persistent. — **Fig. 13.**

**Field-notes** — A few stilt-roots or low buttresses occasionally recorded; bark greyish, fissured, flaking in small rectangular scales. Flowers yellow, strongly scented.

**Distribution** — S Thailand; *Malesia*: Sumatra (including Indragiri, Riau, Bangka, Belitung), Peninsular Malaysia (Perak, Trengganu, Selangor, Negri Sembilan, Malacca, Johore), Singapore, whole of Borneo.

**Habitat & Ecology** — Mostly in marshy forest, freshwater and peat-swamp forest; on sandy soils, 0–200 m altitude; fl. & fr. throughout the year.

**Notes** — 1. The lower leaf surfaces of Borneo material of *H. crassifolia* are earlier glabrescent as compared to those in Sumatra and Peninsular Malaysia.

2. *Horsfieldia crassifolia* may be confused with *H. fulva*, a species also with more or less coriaceous leaves and a perianth persistent on the fruit, but with a 3-lobed perianth. Sterile specimens of *H. crassifolia* may be recognized by the coriaceous leaves, which have usually persistent scale-like hairs on the lower surface, and sparse to rather dense irregularly shaped dark dots and dashes. Sinclair (1975: 26) remarked that the species can easily be recognized from a distance by the rusty or cinnamon-brown colour of the lower leaf surface. The species is very constant in habit, characters, and habitat.

### 19. *Horsfieldia crux-melitensis* Markgr.

*Horsfieldia crux-melitensis* Markgr., Bot. Jahrb. Syst. 67 (1935) 148, '*crux melitensis*'; J. Sinclair, Gard. Bull. Sing. 28 (1975) 26, '*cruxmelitensis*'; W. J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 90, f. 13a–c; Blumea 32 (1987) 459. — Type: *Schlechter 19246*, Papua New Guinea.

Shrub or treelet 2–7 m. *Twigs* 1.5–3(–4) mm diameter, glabrescent, hairs rusty, 0.1 mm; bark finely striate, not flaking, lenticels absent or inconspicuous. *Leaves* membranous, elliptic to obovate(-oblong), 12–27 by 5.5–11.5 cm, base attenuate, apex acute or broadly rounded, the tip acute-acuminate; upper surface drying dark brown, without or with very minute paler dots, lower surface with hairs rather sparse, 0.1 mm, persistent, especially on the midrib, or late glabrescent, nerves not contrasting in colour; dots absent; nerves 10–15 pairs, sometimes with intersecondary nerves, thin and flat above,

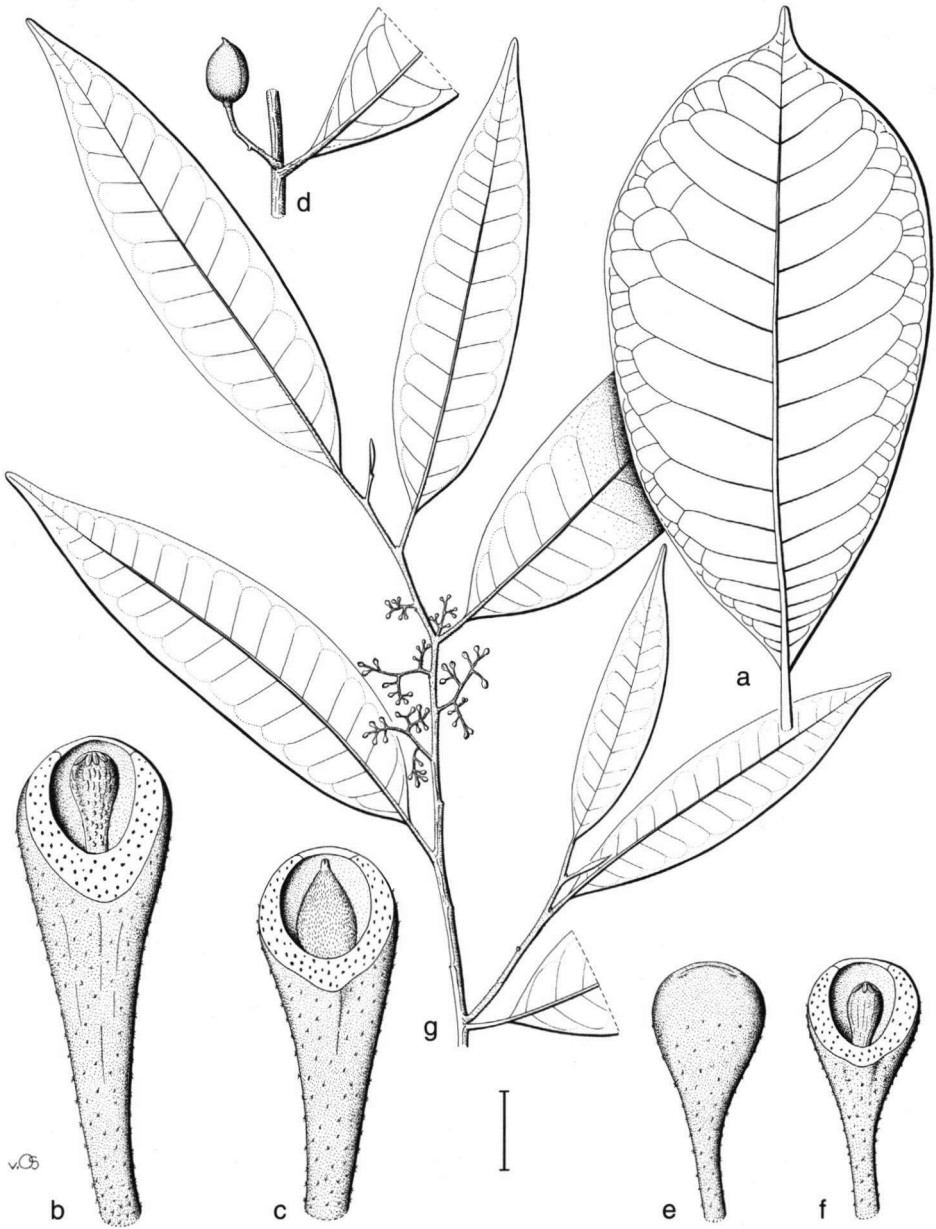


Fig. 14. *Horsfieldia crux-melitensis* Markgr. a. Leaf; b. opened male flower showing club-shaped androecium; c. opened female flower showing pubescent ovary with minute narrow 2-lobed style. — *H. clavata* W.J. de Wilde. d. Twig with infructescence with mature fruit; e. mature male flower, lateral view; f. ditto, opened, showing club-shaped androecium. — *H. squamulosa* W.J. de Wilde. g. Habit of leafy twig with male inflorescences [a, c: LAE 73830; b: Schlechter 19246; d: Hoogland 3623; e, f: Hoogland 3663; g: Brass 7221]. — Scale bar for a, d, g = 2 cm; for b, c, e, f = 1.7 mm.

much raised beneath, lines of interarching distinct, irregular; venation lax, rather indistinct; petiole 10–16 by 1.5–2.5 mm; leaf bud 7–12 by 1–2 mm, hairs 0.1–0.2 mm. *Inflorescences* (male) among the leaves, 1.5–5 by 1.5–4 cm, peduncle 0.6–1.5 cm long, rather few-flowered, with woolly stellate-dendroid hairs 0.1–0.2 mm, 2 (or 3) times branched; female inflorescences smaller; bracts subulate, to 5 mm, pubescent, caducous; flowers solitary or up to 3 together,  $\pm$  clavate; perianth 2-lobed, with scattered stellate hairs 0.1 (–0.2) mm, densest towards base, pedicel tapering, pubescent, not articulated. *Male flowers*: pedicel 7–8 by 2–3 mm, buds subglobose, 2–3 by 2–3.2 mm, gradually passing into the tapered pedicel, forming a long club-shaped flower 9–11 by 2–3.2 mm, apex broadly rounded, somewhat compressed, cleft 1/8–1/5, lobes 0.3–0.6 mm long, 0.2–0.3 mm thick (lower down 0.6–0.8 mm thick); androecium clavate, 1.5–2.5 by 0.7–1.2 mm, apex  $\pm$  rounded, central column solid (Plate 1: 17); thecae 6–10, 0.2–0.3 mm long, radiating, connate, androphore thick, subcylindrical, the surface  $\pm$  wrinkled-bullate, more striate basally, glabrous. *Female flowers*: pedicel 6 by 2.6 mm, buds 2.2 by 3 mm, cleft c. 1/10; ovary obovoid, 2 by 1.5 mm, densely pubescent, hairs 0.1 mm long, style with 2-lobed stigma 0.2–0.3 mm long. *Fruits* 1–4 per infructescence, ellipsoid-ovoid, 1.4 by 0.8–0.9 cm, apex apiculate for 2 mm, base broadly rounded; pericarp 0.5(–1) mm thick, blackish, finely pubescent, partly glabrescent leaving a fine brown punctation, without lenticels; seed ellipsoid; fruiting pedicel elongate, thickened towards the apex; perianth not persistent. — Fig. 14a–c.

Field-notes — Stem 6–8 cm diameter; bark grey or dark green, wood cream or white. Flowers cream or orange. Fruits yellowish or red.

Distribution — *Malesia*: Papua New Guinea (Morobe Prov.).

Habitat & Ecology — Mixed rain forest, lowland forest, common in wet areas; altitude 0–50 m; fl. Jan.–May; fr. Mar.

## 20. *Horsfieldia decalvata* W.J. de Wilde

*Horsfieldia decalvata* W. J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 125. — Type: *Idjan & Mochtar 181*, Halmahera.

Tree 10–15 m. *Twigs*  $\pm$  flattened, sometimes faintly ridged, 1.5–4(–9) mm diameter, early glabrescent, hairs brown, 0.1 mm; bark finely striate, not flaking; lenticels small, not conspicuous. *Leaves* membranous, elliptic-oblong to oblong-lanceolate, 11–25 by 3.5–7 cm, base (long-)attenuate, apex acute-acuminate; upper surface drying dark brown, lower surface early glabrescent, hairs 0.1 mm; dots absent; midrib above flat; nerves 12–16 pairs, above thin and flattish, on lower surface lines of interarching not very distinct; venation on upper surface fine,  $\pm$  distinct or not; petiole 5–10 by 1.5–2.5 mm; leaf bud 6–10 by 1–2 mm, with dense dull brown hairs 0.1 mm long. *Inflorescences*  $\pm$  behind the leaves, 2 (or 3) times branched; in male: 4–6 by (1–)2–4 cm; branches subglabrescent, hairs 0.1 mm; peduncle 1–2 cm; in female: up to 2.5 cm long, caducous; bracts not seen; flowers (in male) solitary or 2 or 3 together, minutely pubescent (hairs 0.1 mm); perianth 2-lobed. *Male flowers*: pedicel 1.5–2 mm long, not articulated; buds subglobose to short pyriform, moderately compressed, 2.3 by 2.3 mm, apex broadly rounded, tapering basally into the pedicel, cleft c. 2/3, lobes 0.2–0.3 mm thick; androecium moderately flattened, 1.6 by 1.4 mm, upper part rounded (Plate 2: 32); thecae c. 12 (anthers c. 6 with  $\pm$  broad connectives), 1.6 mm long, erect, free apical parts to 0.1 mm, androphore up to

0.1 mm long, column cleft 1/5–1/4. *Female flowers* not seen; immature fruits (ovaries) densely finely pubescent. *Fruits* 2–5 per infructescence, short-ellipsoid to subglobose, 1.1–1.2 by 1–1.1 cm, with hairs 0.1 mm or less, drying brown, with scattered small tubercles; pericarp 1 mm thick; fruiting pedicel slender, 4 mm long; perianth not persistent.

Field-notes — Flowers brown. Fruits yellow.

Distribution — *Malesia*: Moluccas.

Habitat & Ecology — Forest at low altitudes, 0–100 m; fl. Sept.; fr. May–Nov.

Note — *Horsfieldia decalvata* superficially resembles several other species, including the widespread *H. laevigata*, *H. moluccana*, and *H. tuberculata*, but is distinguishable by its finely pubescent, pear-shaped male flowers, erect anthers, pubescent ovaries, and small, subglobose, finely pubescent fruits. In *Horsfieldia laevigata* the male bud is more spherical in outline, and the fruit is much larger and pubescent. *Horsfieldia moluccana* has incurved anthers and glabrous fruits. *Horsfieldia tuberculata* also has pear-shaped flowers which are generally glabrous, and it has larger, glabrous fruits.

## 21. *Horsfieldia discolor* W.J. de Wilde

*Horsfieldia discolor* W.J. de Wilde, *Blumea* 32 (1987) 469; *Tree Fl. Sabah & Sarawak* 3 (2000) 367. — Type: *Kostermans 7414*, fr., E Kalimantan.

Tree 10–18 m. *Twigs* grey-brown or straw, (2–)3–4 mm diameter, thinly with dull to dark rusty scaly-stellate hairs 0.1 mm high, soon glabrescent; bark (coarsely) striate, pale to grey-brown, neither cracking nor flaking; lenticels absent to many (see the note), inconspicuous. *Leaves* thinly chartaceous, extremely brittle when dry, oblong(-lanceolate), (9–)13–18 by (3.5–)4–7.5 cm, base attenuate, apex ± short-attenuate or acute-acuminate; upper surface drying olivaceous to dark brown, lower surface early glabrescent (glabrous), drying bright brown; dots absent; midrib above flat, very slender; nerves 10–13 pairs, above flat, inconspicuous, lines of interarching indistinct; venation indistinct on both surfaces; petiole 10–15 by 2–3 mm, drying dark brown, contrasting with the pale twigs; leaf bud 10 by 2 mm, with dense, dull, scale-like hairs to 0.1 mm. *Male and female inflorescences and flowers* not known (but see the note). *Infructescences* rather stout, short, little or not branched, 1.5–3.5 cm long, early glabrescent, with 1 or 2 (or 3) fruits. *Fruits* subglobose or ellipsoid, glabrous, drying (blackish) brown, somewhat wrinkled and at most with few wart-like lenticels, 5.5–8(–9) by 4–6.5 cm; pericarp 10–20 mm thick; fruiting pedicel 2–5 mm long; aril lacinate at apex for 1/4–1/5; perianth not persistent.

Field-notes — Low to medium tree; bark red-brown, light brown, or black, rather smooth with longitudinal surface marks or fissures, strips 1–2 cm wide, 0.5–1 mm thick, once recorded as lenticellate; living bark red-brown or orange-brown, 5–7 mm thick, soft, exuding clear pink (or red) sap; (sap)wood soft, white or yellow, with reddish streaks. Fruits orange-yellow to orange-red, with the inner layer pink; seed (*Sinclair 9278*) 5.5 by 3 cm, brown.

Distribution — *Malesia*: Borneo (E Kalimantan, type; probably Sarawak and Sabah, see specimens discussed by De Wilde, l.c.).

Habitat & Ecology — Forest on loam-soil over sandstone, 700–900 m altitude; fr. July (E Kalimantan), Mar., June, Nov. Doubtful specimens from alluvial forest (riverbank forest) and kerangas on sandy soils.

Note — *Horsfieldia discolor* is known only in fruit, and characterized by the pale colour of the young twigs that contrasts with the dark brown or blackish dry petioles. It is closely related to *H. obscura*, known only from two male flowering specimens which differ in the twigs turning brown on drying, and densely set with rather conspicuous lenticels. In *H. discolor* lenticels are almost absent, or in some tentatively included specimens few to abundant, but they are never conspicuous. Furthermore, *H. obscura* occurs on limestone, whereas *H. discolor* seems associated with sandstone and alluvial soils.

## 22. *Horsfieldia disticha* W.J. de Wilde

*Horsfieldia disticha* W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 10; Blumea 32 (1987) 467; Tree Fl. Sabah & Sarawak 3 (2000) 368. — Type: *Sinclair (& Kadim) 10453*, Brunei.

Tree 20 m. Twigs sometimes faintly angular, 2–3(–4) mm diameter (in fruit-bearing part 11–13 mm diam.), dark grey-brown or reddish brown, very early glabrescent, hairs dull rusty, 0.2–0.3 mm; bark longitudinally cracking; lenticels rather sparse but distinct. Leaves chartaceous, oblong-lanceolate, 8–13.5 by 2.5–3.5 cm, base ± rounded to short-attenuate, apex acuminate (to 15 mm); upper surface drying olivaceous-brown, glabrous, lower surface pale chocolate, glabrous; dots absent; midrib raised above, glabrous; nerves 9–13 pairs, raised above, lines of interarching indistinct; venation faint on both surfaces; petiole 10–15 by 1–1.5 mm; leaf bud 10 by 2 mm, with dense dull rusty hairs 0.2–0.3 mm long. Male and female flowers not seen, but perianth apparently 3-lobed as judged from the perianth scars on the fruits. Infructescences 3–6 by 2–4 cm, borne on the older wood behind the leaves, glabrous (glabrescent), 3–6-fruited. Fruits ovoid-ellipsoid, 2.8–3.2 by 2.1–2.5 cm, glabrous, drying dark brown, not tubercled nor lenticellate; pericarp hard-woody, 8–10 mm thick; fruiting pedicel 10–15 mm long; perianth not persistent.

Field-notes — Bark with longitudinal, shallow furrows. Leaves dark green above, paler beneath, dull on both surfaces. Fruits unripe, pear-shaped.

Distribution — *Malesia*: Borneo (Brunei).

Habitat & Ecology — Lowland forest, at side of new road, Andulau Forest Reserve (West); fr. Aug.

Note — From both the general habit of the specimens, and especially the leaves with the nerves raised above, *H. disticha* belongs to the *H. polyspherula* group. *Horsfieldia disticha* differs from *H. ridleyana* of this group in its general habit, the raised nerves, the longitudinally cracking of the bark on the twigs, and the much larger fruits with a conspicuously thick pericarp. The twigs have remarkably conspicuous, pale, scattered lenticels, contrasting with the dark bark. The available male inflorescences are too immature to describe, but they possibly will not grow longer than 3 cm. They have ovate to elliptic bracts 4(–5) mm long which have, like the inflorescences, dense shaggy rusty-red hairs up to 0.5 mm long. The immature male buds including pedicels hardly reach 1 mm; they are 3-lobed, glabrous, and possibly will resemble those of, e.g., *H. polyspherula*.

## 23. *Horsfieldia elongata* W.J. de Wilde

*Horsfieldia elongata* W.J. de Wilde, Blumea 32 (1987) 465, f. 1. — Type: *Stone 10779*, Peninsular Malaysia.

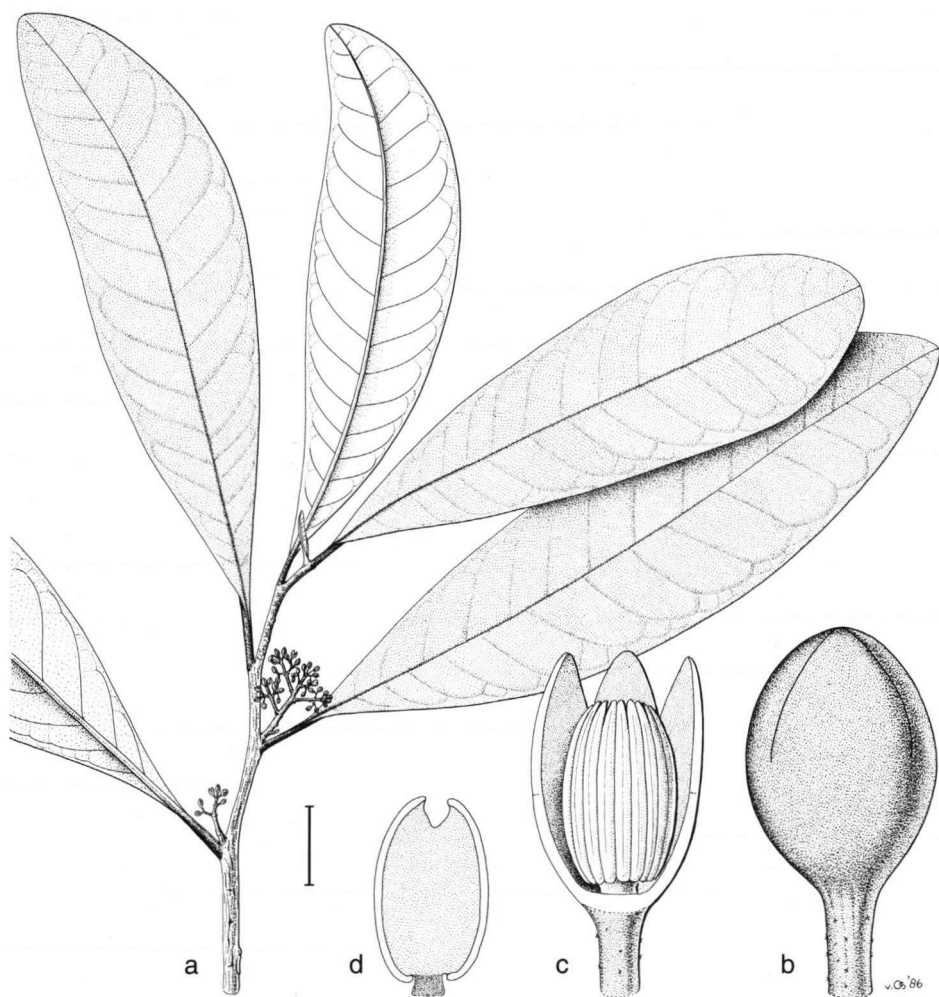


Fig. 15. *Horsfieldia elongata* W.J. de Wilde. a. Habit of branchlet with male inflorescences; b. mature male flower bud; c. ditto, longitudinally opened, showing androecium; d. androecium, longitudinal section, half-schematic [all Stone 10779]. — Scale bar for a = 2 cm; for b–d = 0.85 mm.

Tree c. 8 m. Twigs 1.5–2 mm diameter, hairs pale brown, 0.1 mm, early glabrescent, bark (coarsely) striate, drying greyish, not flaking; lenticels present. Leaves ± membranous, oblong-lanceolate, 13–21 by 3.5–6 cm, base long-attenuate, apex rounded or bluntish to subacute; upper surface glabrous, drying dull, brown-olivaceous, lower surface slightly paler, glabrous (very early glabrescent); dots absent; midrib above slender, flat; nerves 15–18 pairs, sunken or flattish, inconspicuous; venation lax, indistinct; petiole 10–20 by 1.5–2.5 mm, drying blackish; leaf bud 10–12 by 1.5–2 mm, with dense pale brown hairs 0.1 mm long. Inflorescences among the leaves, with pale brown stellate hairs 0.1 mm; in male: small, ± slender, rather few-flowered, once or twice branched,



1.5–2.5 by 1–2 cm, peduncle 0.1–0.5 cm long; bracts  $\pm$  elliptic, densely pale brown villos by hairs 0.1 mm, caducous; flowers solitary or 2 or 3 together, glabrous or glabrescent, hairs scattered, less than 0.1 mm, perianth 3- or 4-lobed, pedicel not articulated. *Male flowers*: pedicel (0.5–)1–2 mm long; buds ( $\pm$  ovoid-)ellipsoid, 2–2.4 by 1.5–1.8 mm, cleft 1/3–1/2(–2/3), lobes 0.1–0.2 mm thick; androecium nearly sessile, ellipsoid, 1.8–2 by (1.3–)1.5 mm, in cross section subcircular (Plate 3: 81); thecae appressed, 16 or 18, almost completely sessile, free apex of anthers 0.1(–0.2) mm; column with narrow excavation 0.2(–0.3) mm deep; androphore narrow, 0.2–0.3 mm long. *Female inflorescences, flowers, and fruits* not seen. — **Fig. 15.**

Field-notes — Small tree, flowers yellowish.

Distribution — *Malesia*: Peninsular Malaysia (Pahang, Fraser's Hill, start of Pine Tree Hill trail).

Habitat & Ecology — Known only from the type. About 1300 m altitude; fl. June 1972.

Note — *Horsfieldia elongata* belongs to the group of species with pallid bark of twigs and often dispersed leaves, like *H. atjehensis*, *H. pallidicaula*, *H. sparsa*, and *H. sucosa*; the present species has distichous leaves. It keys out besides *H. pallidicaula* from Borneo, to which it seems closely related.

#### 24. *Horsfieldia endertii* W.J. de Wilde

*Horsfieldia endertii* W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 24; Tree Fl. Sabah & Sarawak 3 (2000) 368. — Type: *Endert 3996*, E Kalimantan, W Kutei.

Tree 4–25 m. *Twigs* 2.5–4(–8) mm diameter, blackish brown, early or late glabrescent, hairs harsh, deep rust coloured, 0.3–0.6 mm; bark coarsely striate, sometimes tending to flake; lenticels coarse and conspicuously pale. *Leaves* (strongly) coriaceous, elliptic-oblong to oblong-lanceolate, 8–17(–26) by 3–6(–10) cm, base rounded to (short-)attenuate, apex rounded to subacute; upper surface glabrous (glabrescent), but base of midrib late glabrescent, drying olivaceous, yellowish, or dark-brown, lower surface pale brown to chocolate, not much contrasting with the upper surface; dots absent, but usually with conspicuous pale yellowish hair scars (lens!); midrib above relatively broad, raised; nerves 8–15 pairs, above sunken, flattish, or slightly raised, lines of interarching fairly regular, sometimes distinct; venation lax, indistinct on both surfaces; petiole 6–16 by 2–3.5(–4) mm, leaf bud 10–20 by 3–4 mm, with hairs 0.3–0.6 mm. *Inflorescences* below the leaves, with dense, shaggy hairs 0.5–1 mm long; in male: 2 or 3 times branched, not many-flowered, (1.5–)3–10 by (1–)2–5 cm, peduncle 0.5–2 cm long, the flowers in clusters of (1–)2–6; in female:  $\pm$  few-flowered, 2–4 cm long; bracts broadly ovate-ellipsoid, 3–7 mm long, densely pubescent, caducous; flowers with perianth 3- (or 4-)lobed, glabrous (glabrescent), pedicel puberulous in the lower half, not articulated. *Male flowers*: pedicel 2–3 mm long; buds  $\pm$  obovoid (immature) to ellipsoid, 2.5–3.5 by 2–2.5 mm, glabrous, cleft 1/3–1/2, slightly collapsing on drying, lobes 0.3 mm thick; androecium  $\pm$  sessile, obovoid to truncate-ellipsoid, 2–2.8 by 1.4–1.6 mm, in cross section subtriangular (Plate 3: 74); thecae 24–28, 2–2.8 mm long, almost completely sessile (anthers free at apex for only 0.1 mm or less), column with a narrow apical hollow or slit to

1/5–1/3; androphore narrow, (0–)0.1–0.3 mm long, hidden by the anthers. *Female flowers*: pedicel 1.5–2 mm long, basally with hairs 0.2 mm; buds broadly ovoid-ellipsoid, 2.5–3 by 2–2.5 mm, cleft 1/3–1/2; ovary ovoid-ellipsoid, 2 by 1.5 mm, glabrous, stigma 0.2 mm high, minutely 2-lobed. *Fruits* 1–4(–8) per infructescence, ellipsoid, apex rounded to acutish, 3–4.2 by 1.6–2.4 cm, glabrous, drying grey-brown to dark brown, without or with a few tuberculate lenticels; pericarp 2–4 mm thick; fruiting pedicel 3–5 mm long; perianth not persistent.

Field-notes — Tree sometimes dwarfed; bark cracked or finely fissured, brown(-black); inner bark reddish; cambium and sapwood whitish; exudate turning reddish. Flowers yellow. Fruits orange-yellow, pink(-red), or orange-red.

Distribution — *Malesia*: Borneo (Sarawak, Sabah, E Kalimantan).

Habitat & Ecology — Montane; in ridge- or mossy forest, montane dwarfed forest on wind-swept crests; on sandy soil, black or brownish soil; 1200–2100 m altitude; fl. & fr. throughout the year.

Notes — 1. A similar species, *H. xanthina*, differs in the androecium and in a much shorter indumentum; *H. montana* differs in its globose male flowers of only 2 mm long. *Horsfieldia endertii* is characterized by ellipsoid male flowers 1.5–3.5 mm long, with an androecium which is distinctly longer than broad, not articulated pedicels, very coriaceous leaves, harsh-haired leaf buds, and inflorescences; on the lower leaf surface there are practically always pale-yellowish hair scars, visible with a lens. The species usually has ± rounded leaf tips, as in *H. montana*, but the leaves in the latter usually dry blackish and are only 4–14 cm long and thinner.

2. The type, *Endert 3996*, with male flowers, is the only specimen from Kalimantan. The remaining specimens from Sarawak and Sabah somewhat differ in general appearance, their twigs are often less roughly hairy towards the apex, and their leaves are somewhat more coriaceous with the lateral nerves ascending at a slightly sharper angle to the midrib.

## 25. *Horsfieldia flocculosa* (King) Warb.

*Horsfieldia flocculosa* (King) Warb., Mon. Myrist. (1897) 297; J. Sinclair, Gard. Bull. Sing. 16 (1958) 398, f. 38; W.J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 207. — *Myristica flocculosa* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 302, pl. 131. — Type: *King's coll. 8618*, Peninsular Malaysia, Selangor.

Tree 10–28 m. *Twigs* 6–10(–12) mm diameter, with dense felty-woolly yellow-brown or pale brown hairs (1–)1.5–3 mm, late glabrescent; bark coarsely striate, soon longitudinally cracking, eventually transversely cracking and ± flaking; lenticels absent or indistinct. *Leaves* chartaceous, oblong(-lanceolate), 18–40(–45) by 6–13(–18) cm, base broadly or narrowly rounded or subcordate, apex acute-acuminate; upper surface drying olivaceous to (light) brown, finely pustulate and wrinkled, glabrous, lower surface with dense woolly hairs 1.5–2 mm long; dots absent; midrib flat above; nerves 15–20 pairs, above sunken, lines of interarching distinct and regular; venation lax, faint above, obscured by the indumentum on the lower surface; petiole 7–14(–20) by 5–7 mm, densely pubescent; leaf bud stout, 10–15 mm long. *Inflorescences* behind the leaves, densely

woolly-pubescent; in male: stout, many-flowered, 3 or 4 times branched, (8–)12–20 by 5–14 cm, peduncle 3–5 mm diameter, 0.1–1 cm long; in female: little branched, 1.5–3 cm long, few-flowered; bracts ovate to lanceolate, densely pubescent, 5–20 mm long, caducous; flowers (male) solitary or 2–3(–4) together, not densely clustered, glabrous, perianth (3- or) 4-lobed in male, (2- or) 3-lobed in female, pedicel not articulated. *Male flowers*: pedicel slender, (1.5–)3–4 mm long; buds broadly ellipsoid to obovoid, sometimes subglobose, not or slightly compressed, (2–)2.2–3 by 2–2.7 mm, cleft 1/5–1/4, lobes 0.2 mm thick; androecium  $\pm$  ellipsoid or broadly obovoid, subtruncate, 1.2–1.5 (–2) by 1–1.3(–1.5) mm, not or only little compressed, base broadly rounded, often faintly 4-angular in cross section (Plate 2: 52); thecae 20–26, entirely sessile, apically slightly incurved, column broad, with shallow apical hollow 0.2–0.3 mm deep; androphore short, 0.1 by 0.4 mm, usually hidden by the slightly sagged anthers. *Female flowers*: pedicel stoutish, 2 mm long; buds broadly ellipsoid, 3.5 by 3 mm, cleft 1/6–1/5, lobes 0.4–0.5 mm thick; ovary broadly ovoid, 1.8 by 2 mm, glabrous except for a few minute hairs (always?) on the suture below the stigma, stigma minute, faintly 2-lobed, 0.3 mm long. *Fruits* (almost mature, according to Sinclair) subglobose to slightly ellipsoid, glabrous, 3 by 2.5 cm; pericarp 5 mm thick; fruiting pedicel 5 mm long; perianth (at first) persistent.

Field-notes — Buttresses absent; bark superficially fissured, blackish brown; inner bark pinkish brown, laminated; sapwood whitish; exudate watery, red. Young leaves flocculose; lamina somewhat bullate, thickish, glossy medium green above, golden below. Flowers yellow, or waxy light yellow; perianths are described by Sinclair (1958) as “covered with circles which are hyaline in the centre and brown round the circumference.”

Distribution — *Malesia*: E Sumatra (Jambi), Peninsular Malaysia (Selangor, Negri Sembilan, Pahang, and Johore).

Habitat & Ecology — Lowland rain forest, also swampy forest, regenerating forest; 0–300 m altitude; fl. mainly Feb.–June.

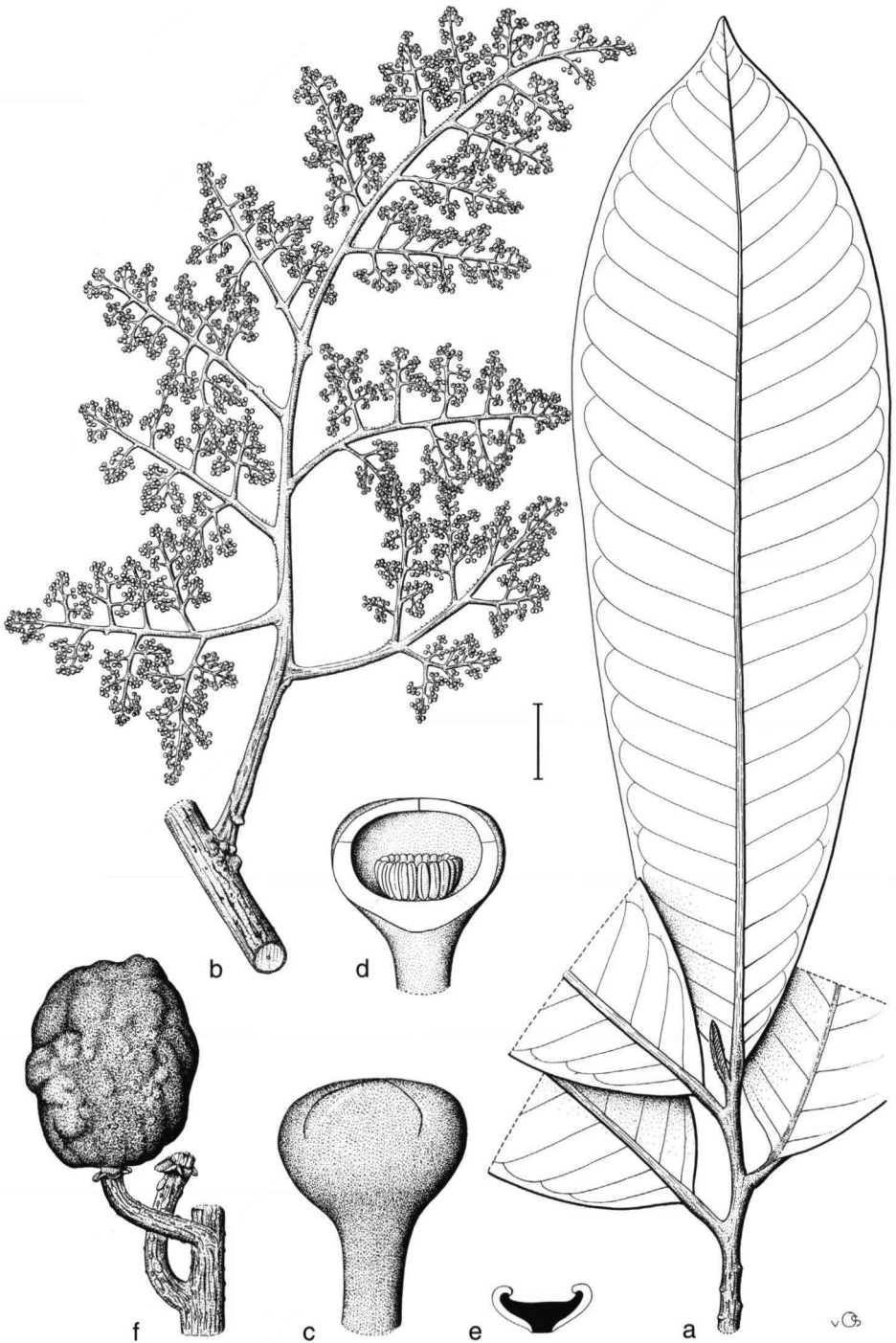
Note — *Horsfieldia flocculosa* is related to *H. superba*, *H. fulva* (there too female and male flowers are  $\pm$  similar in shape), and also to the *H. grandis* group, but it is quite distinguishable by its flocculose indumentum; the margins of the dry leaves are revolute.

## 26. *Horsfieldia fragillima* Airy Shaw

*Horsfieldia fragillima* Airy Shaw, Kew Bull. 1939, n. 10 (1940) 542; W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 29, f. 29; Tree Fl. Sabah & Sarawak 3 (2000) 369. — Type: *Richards 2602*, Sarawak, 4th Div., Mt Dulit.

Tree 10–30 m. *Twigs* sometimes faintly angular, 2.5–7(–15) mm diameter, early glabrescent, hairs 0.3 mm; bark coarsely striate,  $\pm$  flaking; lenticels distinct, on older wood

Fig. 16. *Horsfieldia fragillima* Airy Shaw. a. Leafy twig apex; b. older twig with male inflorescence axillary to leaf scar; c. mature male flower, lateral view; d. ditto, longitudinally opened, showing androecium; e. androecium, longitudinal section; f. twig with infructescences, fruit mature; note persistent perianth [a–e: *S 34358*; f: *S 16985*]. — Scale bar for a, b, f = 2 cm; for c–e = 0.85 mm.



inconspicuous. *Leaves* sometimes (partly) in 3 rows, membranous to thinly (rarely thickly) coriaceous, oblong(-lanceolate), usually  $\pm$  tapering below the middle, 20–45 by 6.5–12(–15.5) cm, base narrowly (rarely broadly) rounded to attenuate, apex acute(-acuminate); upper surface drying olivaceous to brown, lower surface early glabrescent, with some minute indumentum remaining at the base of the midrib; dots absent; midrib raised above, at base broad and flat; nerves 20–30 pairs, raised above, lines of interarching  $\pm$  indistinct; venation lax, faint above; petiole stout, faintly pulvinate, 4–13(–20) by 3–8 mm; leaf bud 12–20 by 3–5 mm, with dense hairs 0.3 mm. *Inflorescences* behind the leaves, with sparse hairs (0.1–)0.2–0.4 mm long; in male: large, very many-flowered, in clusters of 2–6, 4 or 5 times branched, 15–30 by 10–20 cm, peduncle 2.5–6 cm long; in female (from infructescences): 6–13 cm long, stout, rather few-flowered; bracts up to 12 by 5 mm, tomentulose, caducous; flowers glabrous, perianth 3- (or 4-)lobed; pedicel glabrous, not articulated. *Male flowers*: pedicel 1–1.5(–2) mm long; buds (somewhat depressed) globose, 1.4–2 by 2–2.5 mm, cleft c. 1/2, lobes 0.2(–0.3) mm thick; androecium depressed-globose, synandrium almost saucer-shaped, deeply and broadly depressed in the centre, 0.5–1 by 1–1.5 mm (Plate 3: 77); thecae 14–18, almost completely sessile, free apices up to 0.1 mm, incurved; column broadly hollowed to about halfway, androphore narrow, up to 0.1 mm long. *Female flowers* (from fruit): buds 4–5 by 3–4 mm. *Fruits* up to 8 per infructescence, on the older wood, broadly ellipsoid, possibly slightly flattened, 6–8 by 4–6 cm, glabrous, drying dark brown, wrinkled and usually with small or large warts; pericarp 10–20 mm thick; fruiting pedicel 2–4 mm long; perianth persistent. — **Fig. 16.**

**Field-notes** — Trunk without buttresses, and then often with broad gullies, rounded-fluted, or with short and rounded buttresses only; bark chocolate, reddish, or blackish brown, furrowed or not,  $\pm$  fissured, mostly flaky; inner bark 3 mm thick, pale pink or reddish to yellowish; sapwood soft, whitish or (yellow-)pink. Branches somewhat drooping. Flowers yellow. Fruits ramiflorous, to 10 by 7 cm (seed 3 by 2 cm), greenish yellow turning rose-pink to red; pericarp to over 2 cm thick.

**Distribution** — *Malesia*: Borneo (Sarawak, Brunei, Sabah, W & C Kalimantan; possibly E Kalimantan).

**Habitat & Ecology** — Primary lowland dipterocarp forest; hill slopes, and flat land, once found in seasonal swamp; common on leached clayey loam over sandstone, and sandy clay, often along or near streams and in riverine forest; 0–400 m altitude; fl. Feb.–May; fr. throughout the year.

**Uses** — Fruits edible, very acid and resinous.

**Notes** — 1. *Horsfieldia fragillima* may be confused in the sterile state superficially with *H. laticostata*, as the former may have a similar broad basal part of the midrib. *Horsfieldia laticostata* differs in the male flowers, in much smaller fruits, and in different texture and colour of the leaves. *Horsfieldia fragillima* seems related to *H. splendida* and *H. pulcherrima*, which have similar androecia (though with a narrower hollow) and not articulated pedicels, and they differ from the present species in general habit, including their markedly hairy lower leaf surface.

2. *Argent & Sidiyasa et al. 93176*, from C Kalimantan, is an exceedingly stout specimen with large coriaceous leaves, up to 15.5 cm wide. The mature aril is bright yellow (arils are red in almost all *Myristicaceae*).

**27. *Horsfieldia fulva* (King) Warb.**

*Horsfieldia fulva* (King) Warb., Mon. Myrist. (1897) 297; J. Sinclair, Gard. Bull. Sing. 16 (1958) 396, f. 37; 28 (1975) 33; W.J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 199. — *Myristica fulva* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 297, pl. 124. — Syntypes: *Maingay 1304* (2426), *Scortechini 184a* (lecto), Peninsular Malaysia.

Tree 10–20 m. Twigs 3–5(–10) mm diameter, late glabrescent, hairs dense, 0.2–0.3 mm long; bark grey(-brown), finely striate, not flaking; lenticels many, not conspicuous. *Leaves* chartaceous to coriaceous, elliptic-oblong to (obovate-)oblong, 13–21 by 4–9.5 cm, base attenuate, apex acute-acuminate or bluntish; upper surface drying dull olivaceous to brown, lower surface pale brown, glabrous or with persistent hairs 0.2–0.3 mm long on and near the midrib and lateral nerves; dots absent; midrib ± raised above, early glabrescent; nerves 11–14(–18) pairs, above flat or ± sunken, lines of interarching regular, not distinct; venation hardly visible on both surfaces; petiole 8–13 by 2.5–3.5 mm; leaf bud 10–15 by 2.5–3 mm, with dense hairs 0.2–0.3 mm long. *Inflorescences* behind the leaves, with hairs 0.2–0.3 mm; in male: about 3 times branched, many-flowered, 3–10 by 2–6 cm, peduncle 0.2–0.7 cm long; in female: few-flowered, 1–2 cm long; bracts not seen, caducous; flowers solitary or in loose clusters of up to 5, glabrous, perianth 3-lobed, pedicel ± articulated. *Male flowers*: pedicel 1–3 mm long, slender; buds ellipsoid(-obovoid), 3–4(–5) by 2–2.5 mm, apex rounded, base ± attenuate to rounded, cleft 1/5–1/4, lobes 0.2–0.3 mm thick; androecium long-ellipsoid, apex truncate to rounded, subcylindrical to ± triangular, 2–3 by 1.1–3 mm (Plate 2: 47); thecae 20–24, almost entirely sessile, mutually appressed, free apices to 0.1 mm, column at apex narrowly hollowed or cleft to 0.3 mm, androphore narrow, to 0.1 mm long. *Female flowers* (Sinclair 1958): pedicel stout, 3 mm long; buds long-ellipsoid, 5–6 mm long; ovary 2.5–3 mm long, glabrous, stigma sessile, bilobed. *Fruits* up to 3 per infructescence, ovoid-ellipsoid, apex obtuse to acutish, base broadly rounded, 2.2–2.4(–3) by 1.6–2 (–2.5) cm, glabrous, drying bright brown, without lenticels or warts; pericarp 3 mm thick; fruiting pedicel 3–5 mm long; perianth persistent (always?).

Field-notes — Bark yellowish brown, thin, shallowly longitudinally fissured but not flaking; inner bark orange; wood white; sap watery, pale pink, not copious. Flowers orange. Fruits yellow.

Distribution — *Malesia*: Sumatra (Jambi Prov.), Peninsular Malaysia (Perak, including Pulau Rumbia; Selangor, Negri Sembilan, Malacca).

Habitat & Ecology — Lowland rain forest; undulating country, on ridges; 0–200 m altitude; fl. & fr. throughout the year.

Note — *Horsfieldia fulva* is easily recognized by the dull parchment-like leaves when dry; the nerves are flat above or somewhat sunken, and the venation is not or hardly visible; it is one of the few species with a 3-lobed perianth which is elongate and rather large, 3 mm long or more. The species is closely related to *H. superba*, which is larger in size in almost all aspects, and has a persistent indumentum on the lower leaf surface.

**28. *Horsfieldia glabra* (Blume) Warb.**

*Horsfieldia glabra* (Blume) Warb., Mon. Myrist. (1897) 313, t. 21, p. p. — *Myristica glabra* Blume, Bijdr. (1826) 576. — Syntype: *Blume s.n.*, Java.

Tree 6–25 m. *Twigs* 2–4 mm diameter, (blackish) brown, early glabrescent, hairs (grey-)brown, up to 0.2 mm long; bark finely striate, not flaking; lenticels conspicuous. *Leaves* in 2 or 3 rows, membranous to thinly coriaceous (very brittle when dry), elliptic or obovate to oblong-lanceolate, 8–27 by 3–10.5 cm, base usually long-attenuate, apex acute(-acuminate); upper surface drying olivaceous to dark brown; lower surface early glabrescent; dots (not dashes) present (lens!); midrib flat above; nerves 8–16 pairs, thin, flat, or sunken above (in var. *glabra* sometimes  $\pm$  raised), lines of interarching indistinct; venation lax, indistinct on both surfaces; petiole 10–15 by 1.5–2.5 mm; leaf bud 7–12 by 1.5–2.5 mm, slender, in tristichous twigs slightly thicker, with (grey-)brown hairs 0.1–0.2 mm. *Inflorescences* among or behind the leaves, with dense to sparse hairs to 0.1 mm long, sometimes glabrescent; in male: (2 or) 3 (or 4) times branched, many-flowered, 5–10 by 4–7 cm, peduncle 0.4–1.5 cm long; in female: 1 or 2 times branched, 2–4 by 1–3 cm; bracts elliptic-lanceolate, 2–5 mm long, short-pubescent, caducous; flowers in male (2-)3–5 in loose clusters, in female solitary or 2 or 3 together, glabrous; perianth (2-) 3- or 4-lobed, pedicel articulated or not, usually mixed in one inflorescence. *Male flowers*: pedicel slender or thickish; buds globose or broadly ellipsoid or obovoid, 1.5–2.5 mm long, cleft 1/2–2/3, lobes 0.2–0.3 mm thick; androecium (depressed-)globose, or ellipsoid or short-obovoid (Plate 3: 92a, b); thecae 18–30, almost completely sessile; androphore narrow, (0-)1–2 mm long. *Female flowers*: pedicel 0.5–1.5 mm long; buds ellipsoid, 2.5–3 by 2.2–2.5 mm, cleft 1/3 to c. 1/2; ovary ovoid, 1.5–2 by 1.2–1.5 mm, glabrous, the stigma narrowly 2-lobed, 0.1 mm high (var. *glabra*), or broad-lipped, 0.2 (–0.3) mm high (var. *oviflora*). *Fruits* 2–6 per infructescence, ovoid-ellipsoid, base (broadly) rounded, 1.8–2.4 by 1.4–1.9 cm, glabrous, drying blackish brown, without lenticel-like tubercles; pericarp 1–2.5 mm thick; fruiting pedicel 1–2.5 mm long; perianth not persistent.

Distribution — *Malesia*: W, C & S Sumatra, Mentawai I. north to Simeuluë (Simaloer I.), Java (3 varieties), Bali.

Note — In *H. glabra* dots are always present on the lower leaf surface, a character regarded by Sinclair (1958: 413) as exclusive for the related *H. punctatifolia* which it resembles vegetatively.

#### KEY TO THE VARIETIES

- 1a. Male buds globose or subglobose, [1.7–2.5 mm long], cleft 1/2–2/3; androecium globose or depressed-globose, circular or faintly triangular in cross section. [Pedicel  $\pm$  slender. Leaves membranous to chartaceous, nerves flat or slightly raised above. Fruits 18–24 mm long. — Distribution as the species; 0–600(–1500) m altitude.]  
 ..... **a. var. glabra**
- b. Male buds broadly ellipsoid to broadly obovoid, cleft about halfway; androecium ellipsoid to obovoid, blunt-triangular in cross section ..... 2
- 2a. Male buds ellipsoid, 1.5 mm long; androecium ellipsoid. Pedicel slender. Leaves membranous, nerves flat. Fruits not seen. — E Java ..... **b. var. javanica**
- b. Male buds broadly ellipsoid-obovoid, 2–2.5 mm long; androecium broadly ellipsoid-obovoid. Pedicel rather short and thickish. Leaves chartaceous to subcoriaceous, nerves flat or sunken above. Fruits 18–20 mm long. — W & C Java; 600–1500 m altitude ..... **c. var. oviflora**

**a. var. glabra**

*Horsfieldia glabra* (Blume) Warb., Mon. Myrist. (1897) 313, t. 21, p.p.; J. Sinclair, Gard. Bull. Sing. 16 (1958) 411, p.p., for the basionym only; 28 (1975) 35, p.p.; Backer & Bakh. f., Fl. Java 1 (1964) 138; W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 57. — *Myristica glabra* Blume, Bijdr. (1826) 576; Rumphia 1 (1837) 191, t. 64 f. 1; Miq., Pl. Jungh. (1852) 172; Fl. Ind. Bat. 1, 2 (1858) 65 (excl. *Myristica integra* Wall.); Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 49 (excl. var. *sumatrana*). — *Pyrhosa glabra* (Blume) Hassk., Cat. Pl. Hort. Bog. (1844) 174.  
*Myristica glabra* Blume var. *grandifolia* Miq., Fl. Ind. Bat. 1, 2 (1858) 65; Suppl. 1 (1860) 156. — Type: *Teijsmann s. n.*, W Coast Sumatra.

*Leaves* membranous to chartaceous, up to 27 cm long; nerves flat or slightly raised above. *Male flowers*: pedicel slender, clearly marked-off from the perianth; buds globose, 1.7–2.5 mm diameter, cleft 1/2–2/3, perianth 3- or 4-lobed, lobes 0.2–0.3 mm thick; androecium globose or depressed-globose, 0.8–1.3(–1.5) by 1.3–1.6 mm, circular or faintly triangular in cross section (Plate 3: 92a); thecae 20–30, almost completely sessile, free apices to 0.1 mm, curved over towards the apex and more or less into the rather broad, 0.3–0.5 mm deep, apical cavity; column broad; androphore narrow, up to 0.2 mm long. *Female flowers*: stigma minutely 2-lobed, 0.1 mm long. *Fruits* 1.8–2.4 cm long.

Field-notes — Bark smooth to rough, shallowly longitudinally fissured. Flowers yellow, smelling of Peru-balsam. Fruits glossy greenish orange, pericarp to 4 mm thick.

Distribution — As the species.

Habitat & Ecology — Primary and degraded forest, also in coastal forest on limestone; 0–800(–1500) m altitude; fl. & fr. throughout the year.

Notes — 1. Phyllotaxis in Java di- or tristichous, sometimes mixed in one collection; in Sumatra distichous.

2. The male buds of the Sumatra specimens are faintly ellipsoid, strictly globose in Java.

**b. var. javanica** W.J. de Wilde

*Horsfieldia glabra* (Blume) Warb. var. *javanica* W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 59. — Type: *Koorders 5210*, Java.

*Leaves* membranous, 9–12 cm long, nerves above flat. *Male flowers*: pedicel slender; buds ellipsoid, 1.5 by 1.2–1.3 mm, cleft c. 1/2, perianth 3-lobed, lobes 0.1–0.2 mm thick; androecium ellipsoid, apex subtruncate, 1–1.2 by 0.7–0.8 mm, blunt-triangular in cross section (Plate 3: 92b); thecae 18–30, completely sessile, free apices up to 0.1 mm, at apex not or only slightly incurved; apical cavity small and narrow, 0.1–0.2 mm deep; column solid; androphore narrow, up to 0.1 mm long. *Female flowers* and *fruits* not seen.

Distribution — *Malesia*: Java (possibly only in E Java), Bali (collection from submontane area).

Note — According to the flowers this variety seems related to *H. penangiiana*, a species also with dotted leaves and a perianth of similar size and shape (partly), but with the androecium round in cross section and with fewer thecae, 10–18(–20); in *H. penangiiana* the twigs are more slender and the leaves generally smaller.



**c. var. oviflora** W.J. de Wilde

*Horsfieldia glabra* (Blume) Warb. var. *oviflora* W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 59. — Type: *bb Ja.* 3827 (L), Central Java.

*Leaves* chartaceous to subcoriaceous, 8–15 cm long; nerves flat or sunken above. *Male flowers*: pedicel 1 mm long, thickish; buds broadly obovate-ellipsoid, 2–2.5 by 1.7–2.3 mm, cleft c. 1/2, perianth 3-lobed, lobes 0.2–0.3 mm thick; androecium ellipsoid-obovoid, apex subtruncate, 1.2–1.8 by 0.8–1 mm, blunt-triangular in cross section; thecae 20–30, ± completely sessile, free apices 0.1–0.2 mm, at apex little incurved; apical cavity narrow to rather broad and deep, reaching to nearly halfway the central column, 0.4–1 mm deep; androphore narrow, 0.1 mm long. *Female flowers*: stigma broadly 2-lobed, 0.2–0.3 mm high. *Fruits* 1.8–2 by 1.4–1.6 cm.

Field-notes — Bark smooth. Flowers yellow, smelling of Peru-balsam.

Distribution — *Malesia*: W and C Java.

Habitat & Ecology — Forest at 600–1500 m altitude; fl. throughout the year; fr. June.

Note — Phyllotaxis of all specimens seen is tristichous.

**29. Horsfieldia gracilis** W.J. de Wilde

*Horsfieldia gracilis* W.J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 211; *Blumea* 41 (1996) 377, f. 1d–g; *Tree Fl. Sabah & Sarawak* 3 (2000) 371. — Type: *S 16604 (Ilias Paie)*, Sarawak.

Tree c. 5 m. *Twigs* 1.5–2.5 mm diameter, late glabrescent, hairs light brown, 0.3–0.5 mm; bark striate, neither cracking nor flaking; lenticels minute, inconspicuous or absent. *Leaves* membranous, oblong-lanceolate, 12–21 by 4–6(–6.5) cm, base (rounded-) attenuate, apex acute-acuminate; upper surface drying dull olivaceous, lower surface pale, olivaceous brownish, with subpersistent scattered pale hairs 0.3(–0.5) mm, or subglabrous; dots absent; midrib raised above; nerves 12–17 pairs, slightly raised to flat above, lines of interarching regular, slightly impressed, obvious; venation lax, indistinct; petiole 8–14 by 1.5(–2) mm, late glabrescent; leaf bud 6–7 by 1.5 mm, with dense pale brown hairs 0.3–0.5 mm long. *Inflorescences* among the leaves, pubescent, hairs 0.3–0.5 mm long; in male: paniculate, 3–5 cm long, many-flowered; in female: not or only once branched, 2–5-flowered, 1–1.5 cm long; bracts not seen; flowers (male) in clusters of 2–6, glabrous, perianth 3-lobed (female) or 4-lobed (male). *Male flowers*: pedicel 0.5 mm long, articulated; buds depressed-globose, 0.6 by 1 mm, cleft slightly over 1/2; androecium depressed-globose, 0.5 by 0.9–1 mm (Plate 2: 55); thecae 32–36, central column slightly hollowed-out at apex. *Female flowers*: pedicel 1 mm long, not articulated; perianth (from fruit) 2 by 1.5 mm, cleft c. 1/2; pistil not seen. *Fruits* 1–3 per infructescence, ellipsoid, apex and base subobtuse, 1.4–1.5 by 1–1.1 cm, glabrous, drying dark brown, finely granulate, lenticel-like tubercles absent; pericarp 0.5–1 mm thick; fruiting pedicel 1–1.5 mm; perianth persistent. — **Fig. 24d–g.**

Distribution — *Malesia*: Borneo (Sarawak: Miri Dist.; Brunei).

Habitat & Ecology — Primary lowland forest.

Note — Related to *H. paucinervis*, but *H. gracilis* is distinguishable by its more slender habit, thin membranous leaves and (sub)persistent rough indumentum on leaf bud, twig apex and lower leaf surface, especially on the midrib and nerves, and by the small fruits with persistent perianth. Superficially the species may be taken for *H. macilenta* or *H. tenuifolia*. For a more extensive discussion, see De Wilde 1996.

**30. *Horsfieldia grandis* (Hook. f.) Warb.**

*Horsfieldia grandis* (Hook. f.) Warb., Mon. Myrist. (1897) 301; J. Sinclair, Gard. Bull. Sing. 16 (1958) 400, f. 39; 28 (1975) 48; W.J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 203; Tree Fl. Sabah & Sarawak 3 (2000) 372. — *Myristica grandis* Hook. f., Trans. Linn. Soc. 23 (1860) 157. — Type: *Low s.n.*, Sabah.

*Myristica rubiginosa* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 302, pl. 130. — Type: *King's coll.* 1233, Singapore.

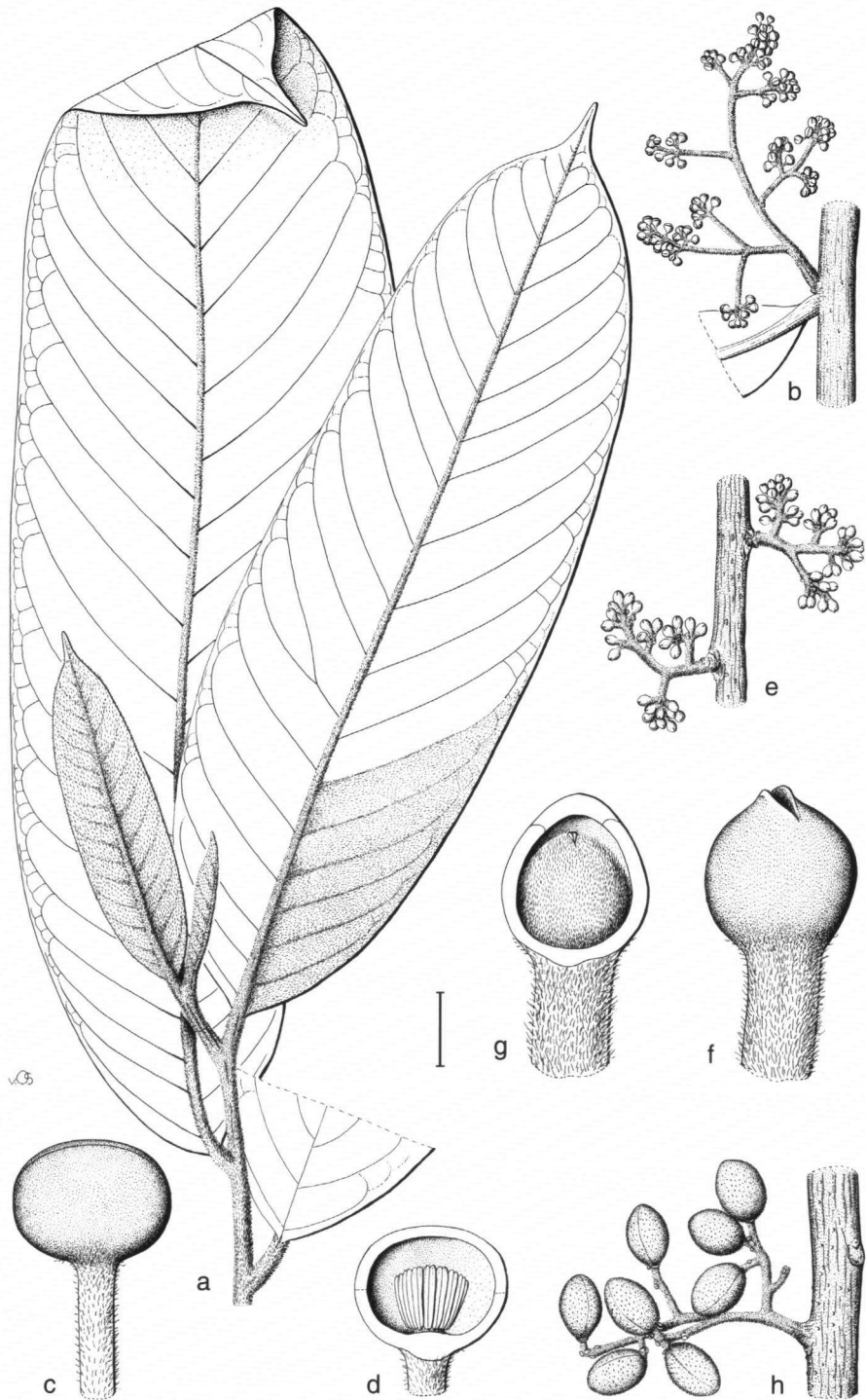
Tree 6–25 m. *Twigs* (3–)4–10 mm diameter, late glabrescent, the hairs dense, harsh, 1–1.5 mm long; bark coarsely striate, sometimes slightly cracking, or flaking; lenticels often present, somewhat elongate, inconspicuous. *Leaves* membranous or chartaceous, ± bullate, elliptic-oblong to oblong-ob lanceolate, 12–40 by 5–20 cm, base ± attenuate to subcordate, apex acute or acute-acuminate; upper surface drying olivaceous, minutely paler pustulate, with harsh, persistent sparse hairs, sometimes glabrescent but always scabrous by harsh hair bases, lower surface with persistent dense to sparse harsh-woolly hairs 1–2 mm long; dots absent; midrib somewhat raised above, harsh-pubescent; nerves (8–)10–16(–19) pairs, flattish or usually sunken above, lines of interarching distinct; venation lax, distinct on both surfaces (especially below); petiole 6–15 by 2.5–6 mm, pubescent; leaf bud short-conical, 7–15 mm long, densely pubescent. *Inflorescences* with dense yellow-rusty hairs, 1.5–3 mm long; in male: many-flowered, 3 or 4 times branched, rather lax, 6–25 by 2.5–10(–15) cm, peduncle up to 1.2 cm long; in female: 1.5–5 cm long, the buds often of different age; bracts oblong to lanceolate-linear, (1–)3–12 mm long, caducous; flowers solitary or usually (in male) in loose clusters, often aggregated into compound clusters corresponding to the main ramifications of the inflorescences, glabrous; perianth 3- or 4-lobed, pedicel slender, not articulated. *Male flowers*: pedicel (0.5–)1–2 mm long; buds globose or depressed-globose, 1.2–1.8(–2) mm diameter, apex (broadly) rounded, base rounded, cleft c. 1/3 to nearly 1/2, lobes 0.2 mm thick; androecium depressed globose, not laterally compressed, 0.5–1 by 0.8–1.5 mm (Plate 2: 49); thecae 16–20, almost completely sessile, incurved towards the apex, column broad, hollow 0.2 mm deep; androphore narrow, 0.2–0.4 mm long. *Female flowers*: pedicel 0.3–0.5 mm long; buds subglobose to broadly ellipsoid, 2–3.2 by 2–2.8 mm, cleft 1/4–1/3; ovary globose to broadly ellipsoid, 1.5–2 by 1.5–1.8 mm, glabrous, stigma sessile, faintly 2-lobed, 0.2 mm high. *Fruits* 2–10 per infructescence, ± clustered, obovoid-ellipsoid, apex rounded, 1–1.4 by 0.8–1.1 cm, glabrous; pericarp 1.5 mm thick, drying dark brown or reddish brown, without lenticels or warts; seed almost globose, 8–10 mm diameter; fruiting pedicel 1 mm long; perianth persistent.

*Field-notes* — Slender tree, without buttresses; branchlets few; bark usually longitudinally fissured, scaly, flaky, or cracked, strips 1 mm thick, 1 cm wide, hard and thin, sometimes smooth, non-flaking; inner bark 2–3 mm thick, slash rich red-brown, with reddish watery exudate; sapwood soft, whitish to yellowish pink, wood pale brown. Flowers yellow, with faint odour. Fruits yellowish or ± orange; pericarp inside pink; seed grey.

*Distribution* — *Malesia*: Sumatra (Palembang; Riau, not seen), Peninsular Malaysia (Pahang, Johore), Singapore, Borneo (Sarawak, Brunei, Sabah, E Kalimantan).

*Habitat & Ecology* — Understorey or middlestorey tree of primary or degraded forest or ridge forest; on clayey soil, sandstone; 0–600 m altitude; fl. & fr. throughout the year.

*Note* — The perianths of *H. grandis* are usually 4-, less frequently 3-lobed. There are 16–20 thecae which are tightly appressed and difficult to count.



**31. *Horsfieldia hellwigii* (Warb.) Warb.**

*Horsfieldia hellwigii* (Warb.) Warb., Mon. Myrist. (1897) 343. — *Myristica hellwigii* Warb., Bot Jahrb. Syst. 18 (1893) 192. — Type: *Hellwig 416* (B lost), Finschhafen, Papua New Guinea.

Tree 5–30 m. *Twigs* subterete or  $\pm$  ridged, often hollow, (4–)5–15 mm diameter, with rusty woolly or felty hairs 0.5–1(–1.5) mm long, early to late glabrescent; bark striate, not flaking; lenticels usually distinct. *Leaves* membranous or chartaceous, elliptic-oblong to oblong-lanceolate, sometimes  $\pm$  parallel-sided, 17–40(–50) by 5–14 cm, base  $\pm$  rounded or (short-)attenuate, apex acute-acuminate (in New Britain rarely short-caudate); upper surface drying dull olivaceous, minutely pustulate, lower surface late glabrescent or with hairs of mixed or subequal size 0.3–1 mm long, when shed not leaving thickened hair bases; dots absent; midrib flat or slightly sunken above, usually with persistent indumentum towards base; nerves 12–33 pairs,  $\pm$  flat above (generally at c. 45° to the midrib), lines of interarching thin,  $\pm$  irregular beneath; venation lax, faint above; petiole (2–)5–8 by 2.5–5 mm, not or hardly winged; leaf bud stout, 3–7 cm long, with dense hairs 0.5–1.5 mm long. *Inflorescences* among the lower leaves, woolly-pubescent, hairs 0.5–1 mm; in male: 2 or 3 times branched, 3.5–15 by 2–10 cm; peduncle up to 3 cm; flowers (male) in clusters of 3–6; in female: up to 8 by 5 cm, flowers in clusters of up to 4; bracts elliptic to broadly ovate, acute, 3–7 mm long, caducous; flowers with perianth 2-lobed (not known in var. *lignosa*), glabrous or glabrescent except at base, pedicel with hairs 0.2–0.5 mm, not articulated. *Male flowers*: pedicel slender, 1–3(–4) mm; buds somewhat laterally compressed, subcircular, 1.8–3.2 by 2.3–3.5 mm, apex and base broadly rounded, cleft (1/3–)1/2–2/3, lobes 0.2 mm thick; androecium: synandrium laterally compressed, (1.2–)1.5–2 by (1.3–)1.7–2 mm, 0.8–1 mm thick, apex  $\pm$  broadly rounded-truncate, column narrowly hollowed for the upper 1/4(–1/5), anthers (10–)12–18 (i.e., with 12–18 thecae at each side), erect, 1.2–2 mm long, completely sessile, mutually touching, free apices up to 0.1 mm, not incurved (Plate 2: 38); androphore  $\pm$  broad, up to 0.1 mm long. *Female flowers*: pedicel 1–2 mm long; buds subglobose or broadly ovoid, 2.8–3.5 by 3 mm, cleft 1/3–1/2; ovary subglobose, 2 mm diameter, with dense hairs 0.2–0.4 mm long, stigma subsessile, faintly 2-lobed, 0.1 mm high. *Fruits* 3–15 per infructescence, subglobose or broadly ellipsoid to fusiform, apex rounded or acutish, 1.2–2.8 by 1–1.8 cm, densely pubescent or partly glabrescent, hairs 0.5 mm, usually finely lenticellate-tuberculate; pericarp 1–3 mm (in var. *lignosa* 4–8 mm) thick; fruiting pedicel 1–4 mm long; perianth not persistent. — **Fig. 17.**

Field-notes — Bole straight, not buttressed; bark finely longitudinally fissured; wood rather soft and light, whitish or straw, heartwood pinkish. Crown narrow, dense; branches often tending to be whorled, horizontal, later on drooping; leaves drooping. Flowers yellow. Fruits green turning yellow or orange.

Fig. 17. *Horsfieldia hellwigii* (Warb.) Warb. var. *hellwigii*. a. Apical part of leafy twig; b. twig with male inflorescence; c. mature male flower, lateral view; d. ditto, longitudinally opened, showing androecium; e. twig with female inflorescences axillary to leaf scars; f. female flower at anthesis; g. ditto, longitudinally opened, showing pubescent ovary and small 2-lobed stigma; h. infructescence with mature fruits [a: NGF 26412; b–d: NGF 4019; e–g: Hoogland 3431; h: LAE 67101]. — Scale bar for a, b, e, h = 2 cm; for c, d, f, g = 1.7 mm.

Distribution — *Malesia*: Papua New Guinea (including New Britain and New Ireland); not yet found in Papua Barat.

Habitat & Ecology — Primary, degraded, and secondary forest, including ridge, gallery, and monsoon forest; in primary forest an understorey or second storey tree, in secondary forest occasionally common; on alluvial soils, also limestone; 0–1200 m altitude; fl. throughout the year; fr. predominantly July–Dec.

Uses — Fruits sometimes recorded as edible.

#### KEY TO THE VARIETIES

- 1a. Fruits slightly asymmetrically subglobose; pericarp woody, 4–8 mm thick, the surface not wrinkled on drying . . . . . **c. var. lignosa**  
 b. Fruits subglobose, ellipsoid, or fusiform; pericarp 2 mm thick, the surface usually somewhat wrinkled on drying . . . . . 2  
 2a. Fruits broadly ellipsoid to nearly globose, 12–15 mm long . . **b. var. brachycarpa**  
 b. Fruits broadly ellipsoid to fusiform, 16–28 mm long . . . . . **a. var. hellwigii**

#### **a. var. hellwigii**

*Horsfieldia hellwigii* (Warb.) Warb., Mon. Myrist. (1897) 343; Markgr., Bot. Jahrb. Syst. 67 (1935) 150; A.C. Sm., J. Arnold Arbor. 22 (1941) 61; J. Sinclair, Gard. Bull. Sing. 28 (1975) 49 (for the type variety only); W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 138, 141, f. 21. — *Myristica hellwigii* Warb., Bot. Jahrb. Syst. 18 (1893) 192.

*Horsfieldia glabrescens* Warb. in K. Schum. & Lauterb., Fl. Schutzgeb. Südsee (1900) 325. — Type: *Tappenbeck 74*, Papua New Guinea, Madang.

Lower leaf surface usually rather densely pubescent with hairs 0.3–1 mm. *Male flowers*: buds 2.2–3.2 by 2.4–3.5 mm, cleft 1/2–2/3; thecae (24–)28–36. *Fruits* broadly ellipsoid to fusiform, 1.6–2.8 by 1–1.8 cm; pericarp 2–3 mm thick, usually somewhat wrinkled on drying.

Distribution — As for the species.

Note — *NGF 40599* from W New Britain, and *LAE 66008* from nearby Umboi I. slightly differ one from the other, the first is much more hairy. Both deviate from normal *H. hellwigii* var. *hellwigii* by more pear-shaped, i.e., at base more tapering male buds. Possibly the specimens are hybrids, e.g., with *H. tuberculata*, or they may represent a separate taxon.

#### **b. var. brachycarpa** W.J. de Wilde

*Horsfieldia hellwigii* (Warb.) Warb. var. *brachycarpa* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 142. — Type: *Lauterbach 1191*, Papua New Guinea.

Lower leaf surface rather sparsely hairy, the hairs 0.3 mm long. *Male flowers*: buds 2 mm diameter (1.9 by 2.3 mm), cleft c. 1/3; thecae 20–24. *Fruits* subglobose to broadly ellipsoid, 1.2–1.5(–1.7) by 1–1.3 cm; pericarp 1–2 mm thick, usually somewhat wrinkled on drying.

Distribution — *Malesia*: Papua New Guinea (Sepik, Madang, Morobe Prov.).

Habitat & Ecology — Twice collected in levee-forest; 0–100 m altitude.

**c. var. lignosa** W.J. de Wilde

*Horsfieldia hellwigii* (Warb.) Warb. var. *lignosa* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 142.  
— Type: LAE 56060 (Leach), Papua New Guinea, Milne Bay Prov.

Lower leaf surface rather sparsely hairy, the hairs 0.2–0.3 mm long (on leaf bud 0.5 mm long); flowers unknown. Fruits somewhat asymmetrically subglobose, slightly flattened or not, 1.6–1.9 cm diameter (immature); pericarp very woody, 4–8 mm thick, the surface not wrinkled on drying, with dense rusty hairs 0.3(–0.5) mm long.

Distribution — *Malesia*: SE Papua New Guinea (Central and Milne Bay Prov.).

Habitat & Ecology — Lowland and montane forest; 300–1150 m altitude; fr. June, Sept.

**32. Horsfieldia hirtiflora** W.J. de Wilde

*Horsfieldia hirtiflora* W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 1, f. 27. — Type: Rahmat si Boeea 9257, northern Sumatra.

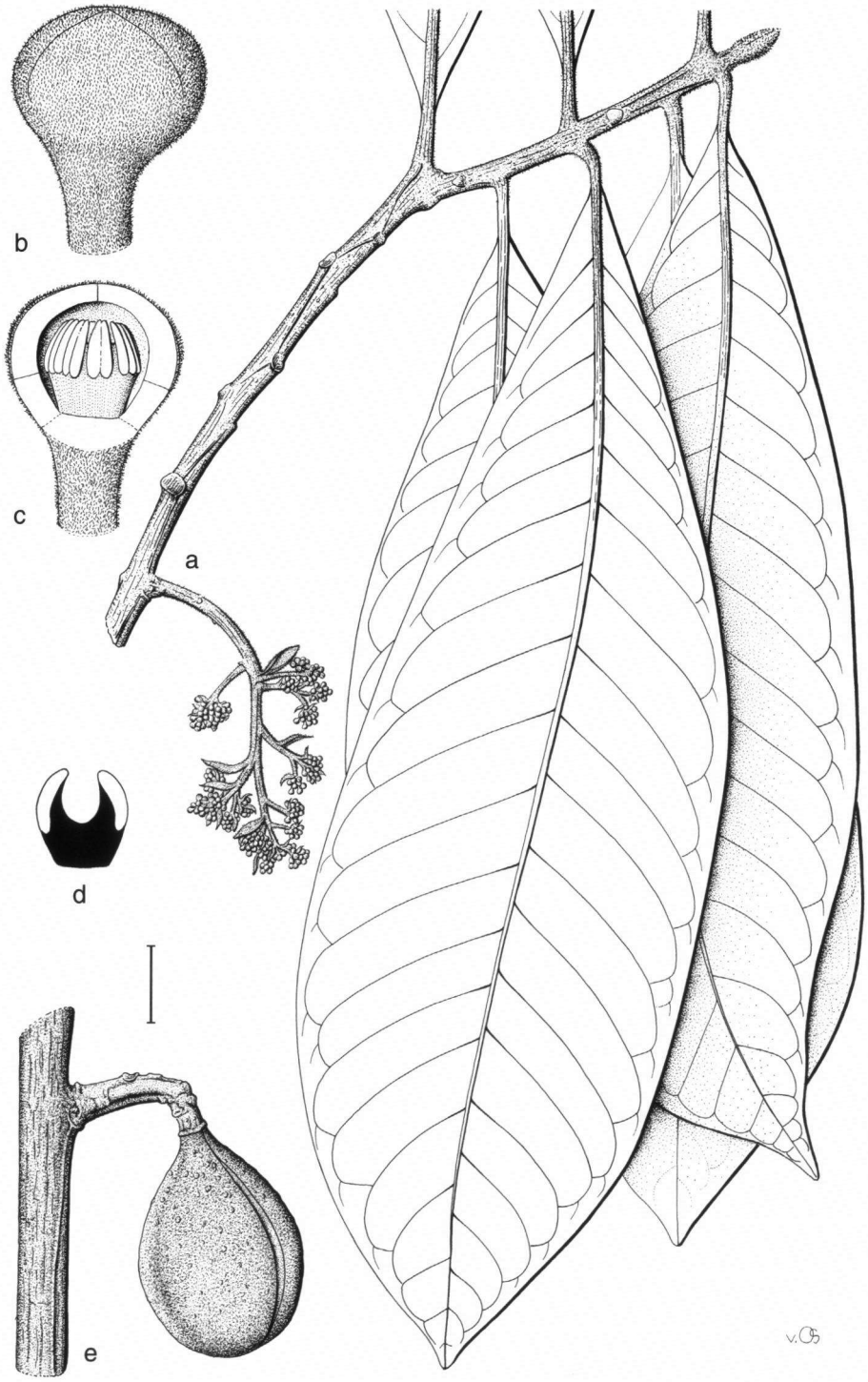
Tree 10 m. Twigs subterete, in the apical part  $\pm$  angular and ridged, lower down lined or ridged, 4–6(–15) mm diameter, glabrescent, hairs 0.3–0.4 mm; bark finely to coarsely striate, not flaking; lenticels not conspicuous. Leaves in 2 or 3 rows, membranous, (obovoid-)oblong, 17–30 by 6–11 cm, base  $\pm$  long-cuneate, apex shortly acute-acuminate; upper surface drying brown-olivaceous, lower surface brown, glabrous but midrib  $\pm$  late glabrescent; dots absent; midrib raised or flattish above, glabrescent; nerves 15–20 pairs, above slender, raised, glabrous, lines of interarching  $\pm$  sunken, distinct; venation lax, indistinct; petiole 15–25 by 2.5–3.5 mm, late glabrescent; leaf bud 8–10 by 4–5 mm, with hairs 0.3–0.4 mm. Inflorescences behind the leaves, with dense rusty hairs 0.3–0.6 mm; in male: 3 or 4 times branched, rather many-flowered, 10–12 by 5–6 cm, peduncle 3.5–4 cm, flowers in clusters of 3–5; in female: few-flowered, 4 cm long; bracts elliptic-oblong, acute, 5–10 mm long, densely pubescent, caducous; flowers with hairs 0.1–0.3 mm long, perianth 3- or 4-lobed, pedicel articulated. Male flowers: pedicel 1.5–2.5 mm long; buds subglobose-obovoid,  $\pm$  collapsing on drying, 2.2–2.5 by 2–2.5 mm, apex broadly rounded, base  $\pm$  rounded, cleft c. 1/2 to nearly 2/3, lobes 0.3–0.4 mm thick; androecium globose to obovoid, (1.2–)1.5 mm diameter, subcircular or blunt-angular in cross section (Plate 3: 63); thecae 12 or 14, acutish, 0.7–0.8 mm long, free for about halfway, somewhat curved towards the centre, column largely hollowed out, the basal part of the androecium consisting of a tapering androphore 0.5–0.7 mm long. Female flowers not seen. Fruits 1–3 per infructescence, broadly ellipsoid-obovoid, apex broadly rounded, base narrowly rounded and short-attenuate, 5–5.7 by 3.8–4.5 cm, glabrous, drying dark brown, sparsely coarsely tubercled; pericarp 10(–15) mm thick; fruiting pedicel 2–3 mm long, pubescent; perianth not persistent. — **Fig. 18.**

Field-notes — Tree 10 m tall, diameter 12 cm; bark rough, hard, black. Fruits yellow, subglobose, 8 cm diameter.

Distribution — *Malesia*: N Sumatra (Tapanuli, E Coast).

Habitat & Ecology — Rain forest; on sandstone; 100–500 m altitude; fl. June–July; fr. Dec.

Notes — 1. *Horsfieldia hirtiflora* is related to *H. brachiata* with which it has the distinctly ridged twigs in common, but *H. hirtiflora* differs from *H. brachiata* in the coarser habit, larger and hairy flowers, and large fruits.



2. In some specimens the leaves towards the apex of the twigs are not distichous, but  $\pm$  arranged in three rows.

### 33. *Horsfieldia inflexa* W.J. de Wilde

*Horsfieldia inflexa* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 63, f. 8. — Type: LAE 52866 (*Streimann & Martin*), Papua New Guinea.

Tree 10–21 m. *Twigs* ridged and angular, especially in the apical part, 2–5(–7) mm diameter, early glabrescent, hairs grey-brown to 0.1 mm; bark faintly striate, not flaking; lenticels abundant, inconspicuous. *Leaves* thinly chartaceous, (elliptic-)oblong, 8–20 by 2.5–7.5 cm, base attenuate, apex bluntish to acute-acuminate; upper surface drying olivaceous to blackish brown, sometimes indistinctly pale-pustulate, lower surface early glabrescent; dots present (lens!); midrib slender, slightly raised above; nerves 8–13 pairs, thin, flat, indistinct, lines of interarching beneath fairly regular but indistinct; venation lax, indistinct on both surfaces; petiole 14–30 by 1.5–2.5 mm; leaf bud 10–14 by 1.5–2 mm, with hairs 0.1 mm long or less. *Inflorescences* glabrescent or with scattered scale-like hairs less than 0.1 mm; in male: 2 (or 3) times branched, 3–10 by 1.5–4.5 cm, the primary branches  $\pm$  spike-like; in female: 3–5 cm long; peduncle 0.1–1.2 cm long; bracts elliptic, 1–3 mm long, with fimbriate margin, caducous; flowers solitary or up to 4 together, glabrous; perianth 2-lobed, pedicel not articulated. *Male flowers*: pedicel 1–2 mm long; buds subglobose, slightly broader than long, not or but little laterally compressed, together with the pedicel sometimes slightly pear-shaped, 2.2–2.5 by 2.5–3 mm, apex broadly rounded, basal part rounded or shortly tapering, cleft 9/10, lobes 0.2–0.5 mm thick, not collapsing on drying; androecium blunt-quadrangular in outline, sometimes broader than long, laterally compressed, 1.5 by 1.5–2 mm, apex broadly rounded (Plate 1: 4); thecae 20–24(–28?), 1.5–2 mm long, free apices long, 0.7–1 mm, at one side of the androecium strongly incurved into the central hollow, almost reaching the base; androphore up to 0.1 mm long. *Female flowers*: pedicel 1–1.5 mm long; buds ovoid-ellipsoid, 2–2.5 by 2 mm, cleft c. 2/3; ovary ovoid, 1.5 by 1.2 mm, glabrous, stigma sessile, minutely 2-lobed, 0.2 mm. *Fruits* solitary or up to 6 per infructescence, ellipsoid, apex rounded to subacute, base  $\pm$  rounded, 2 by 1.4–1.5 cm, glabrous, drying dark brown, without or with only small tubercles or lenticels; pericarp 1.5 mm thick; fruiting pedicel 2–6 mm long; perianth not persistent. — **Fig. 19.**

**Field-notes** — Slender tree, buttresses absent; bark shallowly longitudinally fissured, not or slightly peeling off; slash reddish brown, sapwood whitish red or cream, heartwood not differentiated. Flowers green, turning yellow, fragrant. Fruits yellowish orange.

**Distribution** — *Malesia*: northern part of New Guinea: Papua Barat (Bird's Head, Geelvink Bay, Jayapura); northern Papua New Guinea (West Sepik Prov.).

**Fig. 18.** *Horsfieldia hirtiflora* W.J. de Wilde. a. Leafy twig with immature male inflorescence; note lined twig, dispersed leaves, and bracts present in inflorescence; b. submature male flower, lateral view; c. ditto, opened, showing androecium; d. immature androecium, longitudinal section, schematic; e. twig with infructescence, fruit mature [a–d: *Rahmat si Boeea* 9257; e: *Kostermans* 22048]. — Scale bar for a, e = 2 cm; for b–d = 0.85 mm.



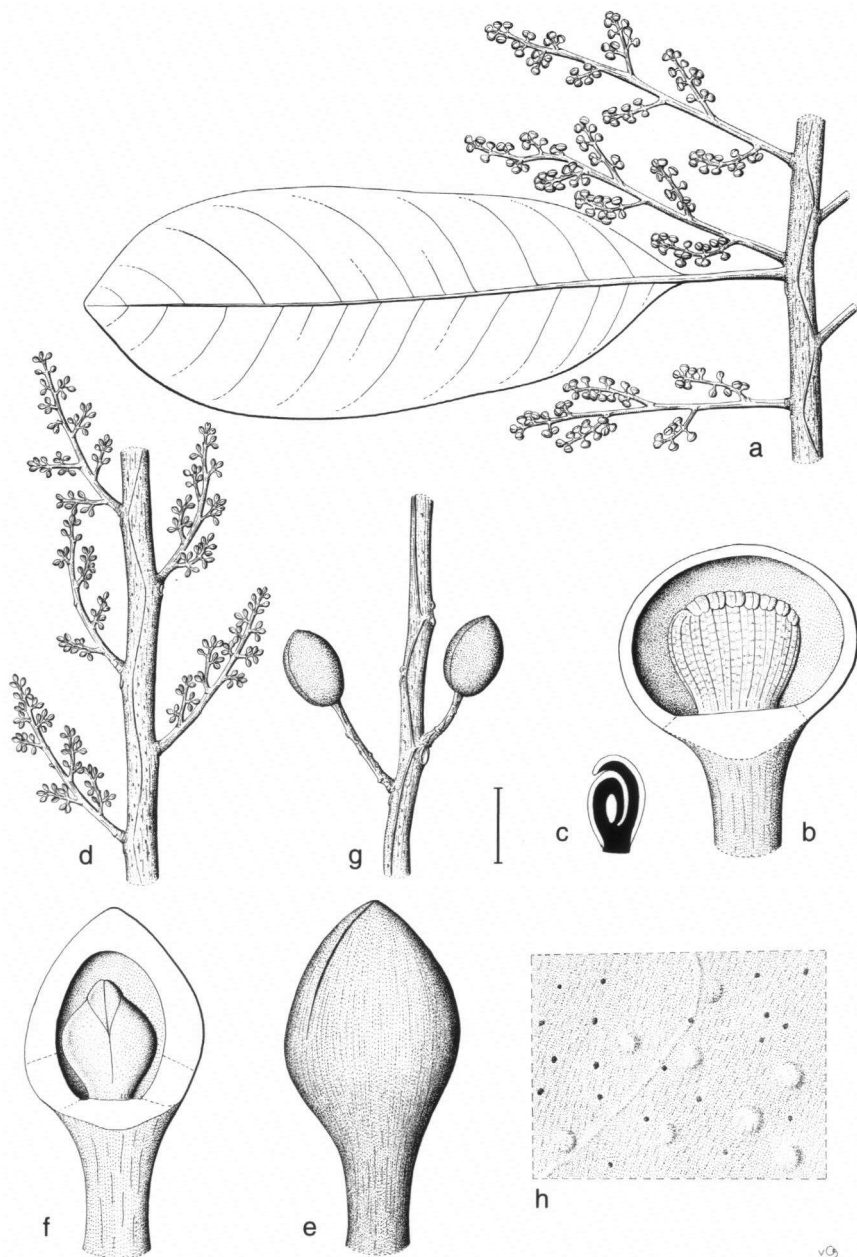


Fig. 19. *Horsfieldia inflexa* W.J. de Wilde. a. Twig with male inflorescences; note lined twig; b. opened mature male flower showing androecium; c. androecium, longitudinal section, schematic; d. twig with female inflorescences axillary to fallen leaves; e. mature female flower, lateral view; f. ditto, opened, showing glabrous ovary with broad-lipped stigma; g. twig with infructescences; h. part of lower leaf surface with scattered dark-coloured non-traumatic cork warts as blackish dots [a–c: LAE 52866; d–f: van Royen 3166; g, h: LAE 52862]. — Scale bar for a, d, g = 2 cm; for b, c, e, f = 0.85 mm; for h = 1.8 mm.

**Habitat & Ecology** — Primary and old degraded forest on alluvial soils, e.g., sandy clay; also in hilly forest and swamp forest; 0–400 m altitude; fl. throughout the year; fr. Sept.–Nov.

**Notes** — 1. This is the only *Horsfieldia* in New Guinea with dark dots on the lower leaf surface.

2. *Horsfieldia inflexa* resembles *H. moluccana* in general shape and texture of the leaves, and the relatively long petioles. It can also be confused with the related species *H. angularis* and *H. basifissa*. *Horsfieldia moluccana* generally has more pear-shaped male buds and differs from *H. inflexa* in terete or faintly lined twigs and not dotted leaves. *Horsfieldia angularis* is distinguishable by not dotted leaves, hairy flowers, an androecium with a narrow central crevice and straight anthers. *Horsfieldia basifissa* has, in contrast, terete or only faintly ridged twigs, and differs further in various characters of the male flower including the androecium.

3. Some specimens of *H. inflexa* from Japen I. resemble *H. parviflora* by rather unbranched spike-like inflorescences; *H. parviflora* has more pronounced pear-shaped flowers and paler, not angular twigs. In most of the specimens of *H. inflexa*, the male inflorescences are distinctly branched with the lateral branches almost unbranched and spike-like.

### 34. *Horsfieldia iriana* W.J. de Wilde

*Horsfieldia iriana* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 99. — Type: *Zippelius (139d)*, West New Guinea.

*Horsfieldia novo-guineensis* Warb., Mon. Myrist. (1897) 271, p.p., only the type of *Horsfieldia iriana*, not the lectotype, which is *H. aruana*.

*Myristica nesophila* auct. non Miq.: Miq., Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 206; 2 (1865) 49, p.p., as based on *Zippelius (139d)*, not the lectotype of *Myristica aruana* Blume = *Horsfieldia aruana*.

Tree c. 10 m. *Twigs* 2-angular, lower down ridged, 3–5 mm diameter, early glabrescent, hairs grey-rusty, 0.2 mm long; bark rather smooth, not flaking; lenticels small, distinct. *Leaves* thinly coriaceous, oblong-lanceolate, 17–28 by 4.5–8 cm, base long-attenuate, apex acute-acuminate; upper surface drying olivaceous, lower surface early glabrescent, at first with stellate-scaly hairs 0.1–0.2 mm long; dots absent; midrib broad and flat above; nerves 13–16 pairs, thin, flat above, lines of interarching indistinct; venation lax, slightly raised, indistinct above; petiole 6–11 by 2–3.5 mm; leaf bud 10–15 by 1.5–2 mm, with hairs 0.1–0.2 mm long. *Inflorescences* in male: among the leaves, with sparse stellate hairs 0.2(–0.3) mm long, (2 or) 3 (or 4) times branched, rather many-flowered, 6–8 by 4–6 cm, peduncle 0.5–1 cm long; bracts not seen, caducous; flowers in loose clusters of 2–5, perianth 2-lobed, glabrous except some minute hairs towards the base; pedicel sparsely pubescent, not articulated. *Male flowers*: pedicel not tapered, slender, 2.5–3 mm long; buds in lateral view circular to slightly longitudinally ellipsoid, not or slightly laterally compressed, blackish brown, not collapsing on drying, 2.3–2.8 by 2.2–2.8 mm, apex subacute or narrowly rounded, base rounded, cleft 3/4–5/6, lobes 0.2 mm thick; androecium laterally compressed, 1.5 by 1.5–2 mm, apex (broadly) rounded (Plate 1: 22); thecae 20–28, erect, free apices 0.1(–0.2) mm long, column narrowly hollowed for c. 1/4; androphore absent. *Female flowers* and *fruits* not seen.

Distribution — *Malesia*: SW Papua Barat, known only from the type.

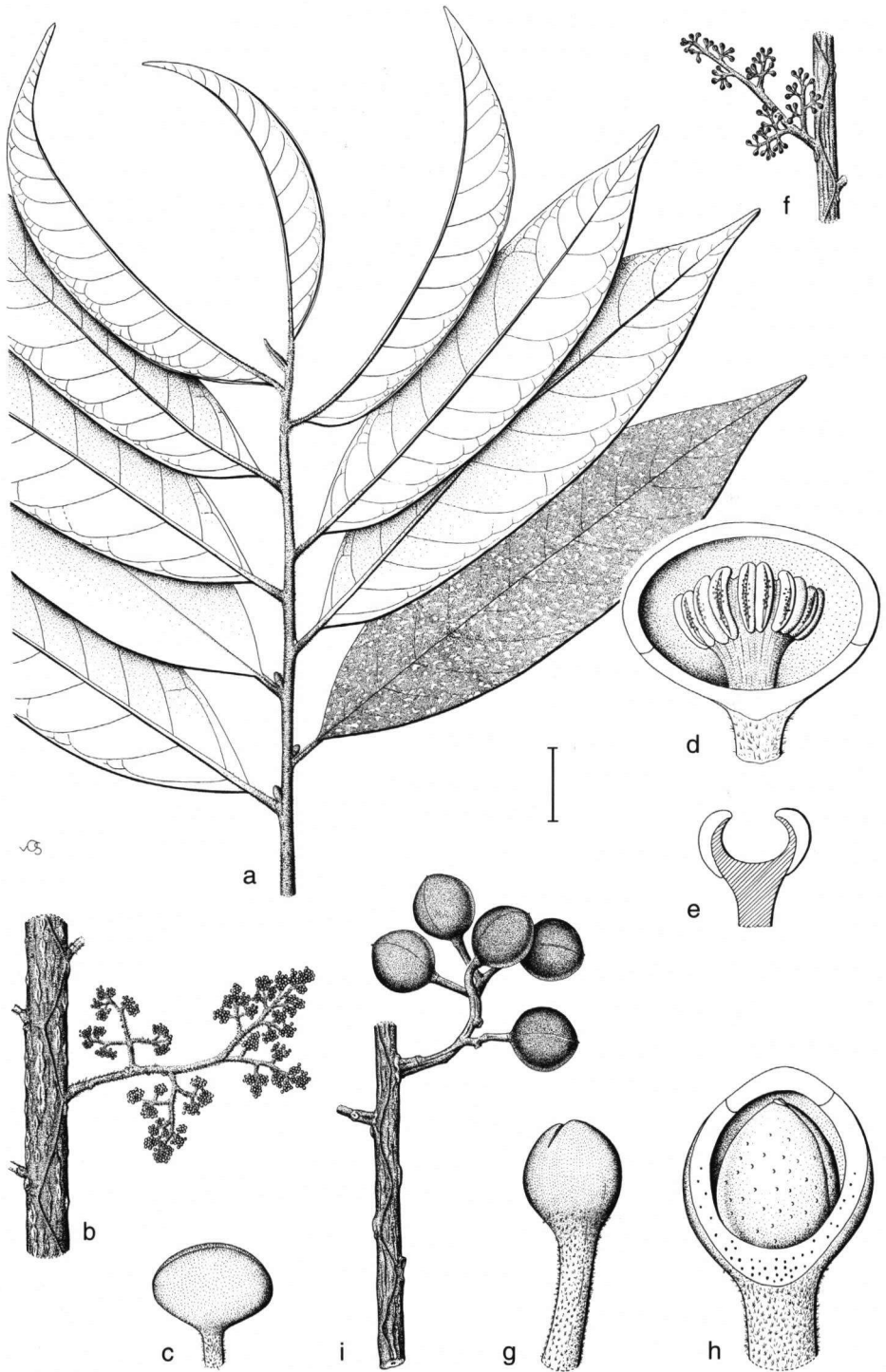
Habitat & Ecology — Possibly from coastal lowland forest.

Note — The only specimen known, *Zippelius* (139d), is part of the heterogeneous *Zippelius* material which served for the description of *Myristica aruana* Blume and *Horsfieldia novo-guineensis* Warb. For details see de Wilde (1985).

### 35. *Horsfieldia irya* (Gaertn.) Warb.

- Horsfieldia irya* (Gaertn.) Warb., Mon. Myrist. (1897) 317 (incl. var. or forma *ceylanica*, *javanica*, *malayana*, *moluccana*, *siamensis*, *wallichii*), t. 22; J. Sinclair, Gard. Bull. Sing. 16 (1958) 382, f. 33, pl. IX-A; 28 (1975) 61; Backer & Bakh. f., Fl. Java 1 (1964) 138; W. J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 55, f. 6; Tree Fl. Sabah & Sarawak 3 (2000) 373. — *Myristica irya* Gaertn., Fruct. 1 (1788) 195, t. 41; Hook. f. & Thomson, Fl. Ind. (1855) 159; A. DC., Prodr. 14, 1 (1856) 202 (excl. *M. exaltata*, p.p., see under *Endocomia*, Blumea 30 (1984) 173); King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 308, pl. 141, 141-bis. — Type: Gaertner's drawing, Sri Lanka.
- Myristica javanica* Blume, Bijdr. (1826) 576; Rumphia 1 (1835) 190, t. 62. — Type: Blume's authentic specimens not found in L [Rumphia, t. 62, male fl., fr.].
- Myristica spherocarpa* Wall., Pl. As. Rar. (1830) 79, t. 89. — *Myristica irya* Gaertn. var. *wallichii* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 309, pl. 141-bis 3–5. — Type: *Wallich Cat. n. 6796*.
- Myristica micrantha* Wall., Cat. (1832) n. 6807, nom. nud. — Type: *Wallich Cat. n. 6807*.
- Myristica lemanningiana* A. DC., Ann. Sc. Nat. Bot. 4, 4 (1855) 31, t. 4; Prodr. 14, 1 (1856) 203. — *Horsfieldia lemanningiana* (A. DC.) Warb., Mon. Myrist. (1897) 326. — Type: *Lemann s. n.*, Peninsular Malaysia, Malacca.
- Myristica subglobosa* Miq., Fl. Ind. Bat., Suppl. 1 (1861) 383. — *Myristica globularia* Blume var. *subglobosa* (Miq.) Miq., Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 206. — *Horsfieldia subglobosa* (Miq.) Warb., Mon. Myrist. (1897) 328 (for the original syntype only). — Syntypes: *Diepenhorst HB 2148*, *Teijsmann HB 3189*, both Sumatra.
- Myristica vrieseana* Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 49. — *Myristica irya* Gaertn. var. *longifolia* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 309, pl. 141-bis 1 & 2. — Type: *de Vriese s. n.* (L).
- Horsfieldia labillardieri* Warb., Mon. Myrist. (1897) 283, t. 21. — *Myristica labillardieri* (Warb.) Boerl., Handl. 3 (1900) 85. — Type: *Labillardière s. n.*, male fl. (B lost; iso FI, see note by Sinclair 1975: 89), Java.
- Horsfieldia acuminata* Merr., Philipp. J. Sci. 17 ('1920', 1921) 253; Enum. Philipp. Flow. Pl. 2 (1923) 181. — Type: *FB 27507 (de Mesa)*, Philippines.
- Horsfieldia nunu* Kaneh., Trop. Woods 29 (1932) 5, nom. nud.; Bot. Mag. Tokyo 46 (1932) 451; Fl. Micr. (1933) f. 32; Enum. Micron. Plants, in J. Dept. Kyushu Imp. Univ. 4, 6 (1935) 319. — Syntypes: *Kanehira 1303*, *1304*, Pacific area.
- Horsfieldia amklaal* Kaneh., Bot. Mag. Tokyo 47 (1933) 670; Fl. Micr. (1933) 109, f. 31, pl. 16. — Syntypes: *Kanehira 1944*, *1978*, *2058*, *2059*, Pacific area.
- Horsfieldia congestiflora* A. C. Sm., J. Arnold Arbor. 22 (1941) 64. — Type: *Brass 8010*, New Guinea.

Fig. 20. *Horsfieldia irya* (Gaertn.) Warb. a. Leafy twig apex; note whitish blotched leaves; b. twig, ridged, with male inflorescence; c. mature male flower bud, lateral view; d. male flower, longitudinal section, showing androecium; e. androecium, longitudinal section, schematic; f. twig with female inflorescence; g. mature female flower; h. ditto, opened, showing glabrous ovary with minute 2-lobed stigma; i. twig with infructescence; note spherical fruits [a, b: *NGF 22319*; c–e: *Kostermans 24385*; f–i: *FRI 3044*]. — Scale bar for a, b, f, i = 2 cm; for g = 1.7 mm; for c, h = 0.85 mm; d, e = 0.4 mm



Tree 10–25(–40) m. *Twigs* towards apex often drying flattened, usually thinly ridged, (2–)3–10 mm diameter, glabrescent, indumentum minute to conspicuous (New Guinea and Pacific Islands), grey to rusty, dendroid hairs of mixed size, 0.1–0.5(–1) mm long; bark (coarsely) striate,  $\pm$  blackish, not flaking; lenticels conspicuous. *Leaves* often  $\pm$  curved towards the apex, membranous, elliptic-oblong to lanceolate, 10–30(–35) by 3–7(–9) cm, base rounded to attenuate, apex acute-acuminate; upper surface drying dull, greenish to blackish, almost always with irregular whitish marks of unknown origin, lower surface early glabrescent; dots absent; midrib flattish above; nerves 10–20 pairs, thin and flattish above, lines of interarching usually indistinct; venation lax, faint above, thin though distinct beneath; petiole 7–16 by 1.5–3(–4) mm; leaf bud 10(–15) by 2–3 mm, with hairs 0.1–0.5(–1) mm. *Inflorescences* with dense hairs 0.1–0.5(–1) mm long, persistent or glabrescent; in male: 3 or 4 times branched, many-flowered, 4–18 by 3–7(–10) cm; in female: 2–6(–8) cm long, 2 (or 3) times branched; peduncle 0.5–4.5 cm long; bracts  $\pm$  acute, 1.5–4 mm long (sometimes larger, leaf-like), caducous; flowers in male in clusters of 3–10, in female fewer; perianth 2-lobed, glabrous, at base glabrescent; pedicel pubescent or glabrescent, not articulated. *Male flowers*: pedicel slender, 0.1–1.5 mm; buds subglobose or  $\pm$  transversely ellipsoid, somewhat laterally compressed or not, 1–1.5 by 1–1.5 mm (largest in Indochina), apical part broadly rounded, base rounded or short-tapering, cleft 1/2–2/3, lobes 0.2 mm thick; androecium  $\pm$  broadly obovoid, 0.8–1.2 by 1–1.5 mm (Plate 1: 2); thecae 12–18(–20, Indochina), not closely touching, 0.5–0.8(–1) mm long, free apical part 0.2–0.3 mm, incurved, column and androphore broadly concave, more or less saucer- or cup-shaped, 0.4–0.5 by (0.5–)0.6–1 mm, tapered towards the base. *Female flowers*: pedicel 1–4 mm long; buds obovoid or ellipsoid, 1.5–2.3 by 1.3–2 mm, cleft 1/4–1/3; ovary broadly obovoid, glabrous, 1.2–1.5 by 1–1.3 mm, stigma minute, 0.1 mm. *Fruits* 2–8 per infructescence, globose, 1.5–2.2 cm diameter, glabrous, finely granular, without tubercles or lenticels, drying dark brown to blackish; pericarp 1–2 mm thick; seeds globose; fruiting pedicel 5–10 mm long; perianth not persistent. — **Fig. 20.**

*Field-notes* — Tall tree with straight bole; crown with several big limbs, or narrow and with slender drooping branches near the apex; bole often fluted or with prop-roots, or usually with buttresses up to 3 m high, 2 m out, and up to 10 cm thick, sometimes without buttresses; the bark often fissured, cracked, or mostly flaking or peeling off in small pieces, sometimes smooth; inner bark whitish, to 7 mm thick; sapwood whitish or pinkish; heartwood absent or only slightly darker; the wood rather soft. Flowers (dark) (orange-)yellow, once reddish; strongly sweet-scented, or without scent. Fruits yellowish or red; up to nearly 3 cm diameter.

*Distribution* — Sri Lanka, Burma, Andaman and Nicobar Islands, S Indochina (Cochinchina), Cambodia, Thailand, Caroline Is., Solomon Is.; in *Malesia*: Sumatra, Peninsular Malaysia, Singapore, Borneo, Java, Sulawesi, Moluccas, C(?) & S Philippines, New Guinea; no collections seen from the Lesser Sunda Islands and N Philippines.

*Habitat & Ecology* — Primary and (old) secondary forest; most frequent in (periodically) swampy coastal or riverine areas, on alluvial (sandy, loamy, or clayey) soils, but also found more inland; 0–450 m altitude; fl. & fr. apparently throughout the year, but probably this is correlated with regional and local climatic conditions. The seeds contain an air chamber, facilitating dispersal by floating.

*Uses* — Rarely recorded that fruits are edible; fruits eaten by monkeys in Sri Lanka.

Note — *Horsfieldia irya* is a homogeneous species, well characterized by its small subglobose male flowers of 1 mm diameter (in Indochina up to 1.6 mm diam.), with typical broad and deeply concave androecium with tapered, relatively large androphore. The fruits (and seeds) are globose, glabrous (ovary glabrous). The twigs are usually thinly ridged. Characteristic are the irregular whitish marks of unknown origin, almost always present on the older leaves in dried specimens. The indumentum is variable: short-haired, sometimes seemingly glabrous specimens are predominant in Sri Lanka, SE Asia, W Malasia, and Moluccas; in New Guinea and the Solomons most specimens have conspicuous, often woolly hairs to 1 mm long on twig apex, leaf bud, and inflorescences.

### 36. *Horsfieldia iryagedhi* (Gaertn.) Warb.

*Horsfieldia iryagedhi* (Gaertn.) Warb., Mon. Myrist. (1897) 332, t. 21 f. 1–4; J. Sinclair, Gard.

Bull. Sing. 28 (1975) 68; W. J. de Wilde, Gard. Bull. Sing. 37, 2 ('1984', 1985) 167, f. 1A-1, 2-I, 3. — *Myristica iryagedhi* Gaertn., Fruct. 1 (1788) 196, t. 41, f. 4. — Type: Gaertner's drawing.

*Myristica glomerata* Thunb., Act. Holm. sive Kongl. Vet. Acad. Nya Handl. (1799) 88, t. 2 f. 1 [non Miq. (1852)]. — Type: *Herb. Thunberg*, fragment of male inflorescence.

*Horsfieldia odorata* Willd., Sp. Pl. 4 (1805) 872. — Type: not known (see Sinclair 1975).

*Myristica horsfieldii* Blume, Bijdr. (1826) 577, '*horsfieldia*'; Rumphia 1 (1837) 192, t. 63; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 296, pl. 122, 123. — *Pyrrhosa horsfieldii* (Blume) Hassk., Cat. Pl. Hort. Bog. (1844) 174. — Type: *Blume s. n.*, Java.

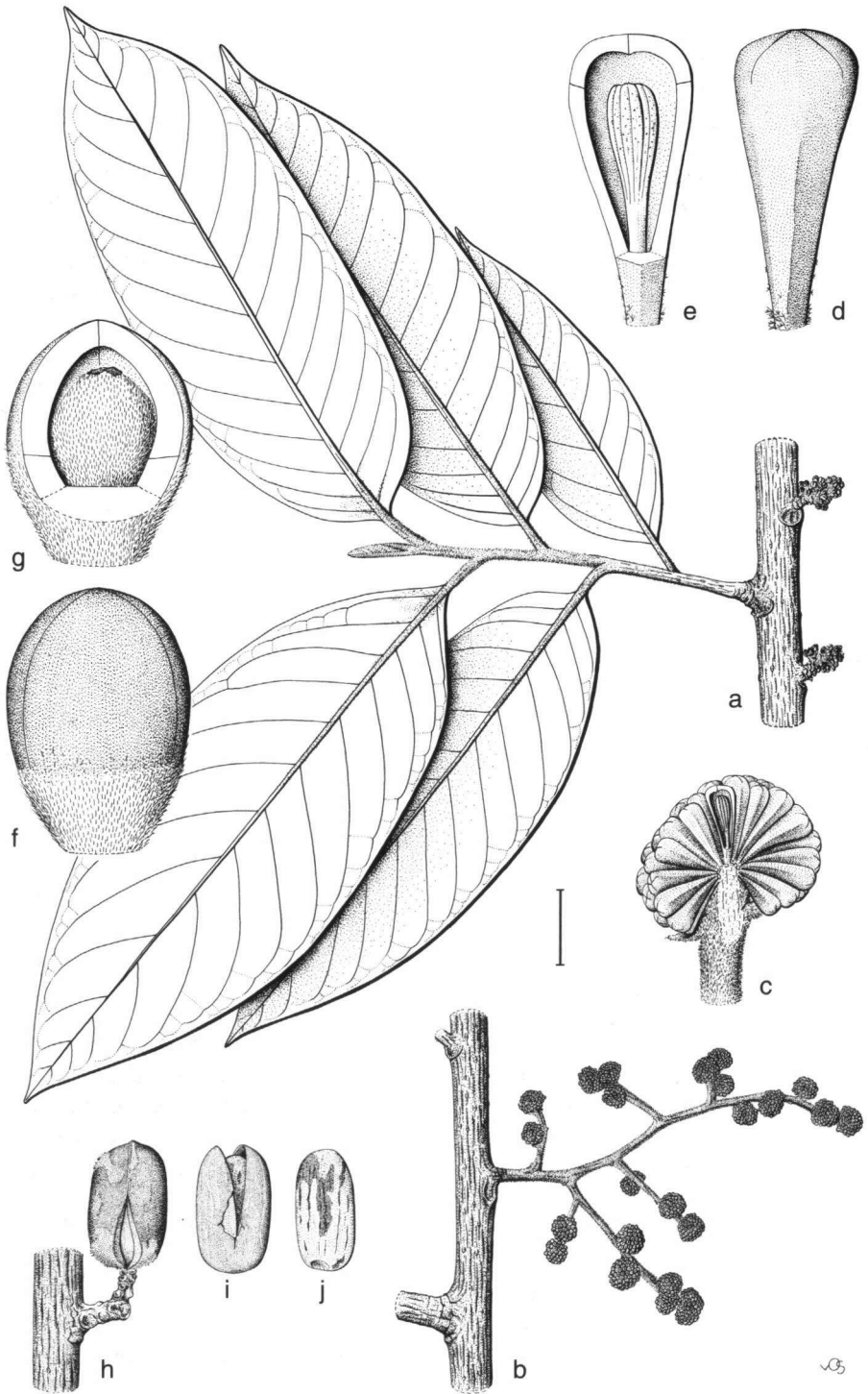
*Myristica notha* auct. non Wall.: Koenig ex Blume, Rumphia 1 (1837) 192, nom. nud. pro syn.

*Myristica* ('*Cnema*') *glomerata* Miq., Pl. Jungh. (1852) 170 [non Thunb. (1799)]. — Type: *Junghuhn s. n.*, Java.

*Myristica odorata* Reinw. ex de Vriese, Pl. Ind. Bat. Or. 2 (1857) 95 [non Willd. (1805)], nom. nud. pro syn.

For more references, see J. Sinclair, l.c..

Tree 5–25 m. Twigs 2–5 mm diameter, early or late glabrescent, at first with woolly rust-yellow hairs 0.5 mm; bark coarsely striate or longitudinally cracking, rarely somewhat flaking; lenticels present, sometimes inconspicuous. *Leaves* chartaceous, ovate-elliptic to oblong-lanceolate, 10–28 by 4–12 cm, base rounded to attenuate, apex acute-acuminate, upper surface glabrous, drying dark brown or olivaceous, lower surface early or late glabrescent, papillose; dots absent; midrib late glabrescent, slightly raised above; nerves 9–16 pairs, flat or sunken above, lines of interarching fairly distinct; venation ± trabeculate, distinct to hardly visible above; petiole late glabrescent, 15–20(–25) by 2–3 mm; leaf bud 10–15 by 3–4 mm, with dense hairs 0.5 mm long. *Inflorescences* with dense woolly hairs 0.3–0.5 mm; in male: 6–15 by 4–10 cm, usually twice branched, the branches few, thickish, peduncle 0.3–2 cm; flowers in 10–25 subglobose dense clusters 5–10 mm diameter, spaced along the branches, each cluster with 80–100 (sub)sessile flowers; in female: smaller, little-branched, 1.5–4 by 1.5–2 cm, the flowers solitary or few together; bracts subtriangular to elliptic, the larger ones with distinct midnerve, 1–3 mm long, pubescent, caducous; flowers subsessile, perianth in male 3- (or 4-)lobed, in female 3- (or 2-)lobed, glabrous except at the base (hairs 0.2–0.5 mm), pedicel pubescent, not articulated. *Male flowers*: pedicel 0.2–0.3 mm long; buds narrowly ± obovoid-oblong or obconical, 3–5- (or 6-)angular, 2–2.5 by 1–1.6 mm, apex broadly rounded, gradually tapering to the base, cleft (1/4–)3/4, lobes 0.2(–0.3) mm thick; androecium elongate, narrowly obconical or ellipsoid-oblong, apex ± truncate, base tapering, 1–1.2



by 0.4–0.5 mm (Plate 1: *I*); thecae 6–10, largely sessile, erect, free apices 0.2 mm, column narrow, hollow to halfway, androphore narrow, 0.2–0.5 mm long. *Female flowers*: pedicel up to 0.2 mm long; buds broadly ellipsoid, 3 by 2 mm, cleft c. 1/2; ovary broadly ellipsoid, 2 by 1.5 mm, densely short-pubescent, stigma minutely 2–4 (or more-)lobulate. *Fruits* 3–8 in a cluster, ellipsoid or ellipsoid-oblong, 2.5–4.2 by 1.7–2.4 cm, with dense rust-yellowish stellate-dendroid hairs 0.5 mm, sometimes partly glabrescent; pericarp 1.5–2(–3) mm thick, not tuberculate; fruiting pedicel 0.5–2 mm long; perianth not persistent. — Fig. 21.

*Field-notes* — Tree at base to 50 cm diameter, branches drooping, sometimes branched from the base; stilt-roots sometimes present when growing in wet soil; bark hard, outer bark light- or black-brown, or greyish red, fissured, gritty, or peeling off in large pieces, or smooth; living bark 5–10 mm, beefy red or red brown, with white lines, exuding a clear light reddish brown sap; wood white to light yellow with red streaks. Leaves grey-green beneath. Perianth (dark) yellow, or orange-brown; pistil with brown hairs. Male flowers 3 mm long, strongly scented, reminiscent of *Michelia champaca*. Fruits yellow(-brown) with rusty indumentum.

*Distribution* — Sri Lanka; in *Malesia* introduced in gardens in Peninsular Malaysia (Penang I.), Singapore, and Java.

*Habitat & Ecology* — In Sri Lanka in lowland rain forest, wet evergreen or intermediate forest; also in disturbed forest; 0–500 m altitude; fl. & fr. throughout the year.

*Uses* — Formerly in Java a wax was obtained after cooking the fruits. The wood is moderately heavy and even-grained (see Sinclair 1975: 72).

*Note* — *Horsfieldia iryagedhi* deviates from all other *Horsfieldias*, and can be placed in a separate section. It is distinguishable by the leaves being papillate beneath, the male flowers arranged in compact heads, and a many-lobulate stigma; according to Warburg (l.c.: 334) the seeds contain some starch, possibly unique for this species.

### 37. *Horsfieldia laevigata* (Blume) Warb.

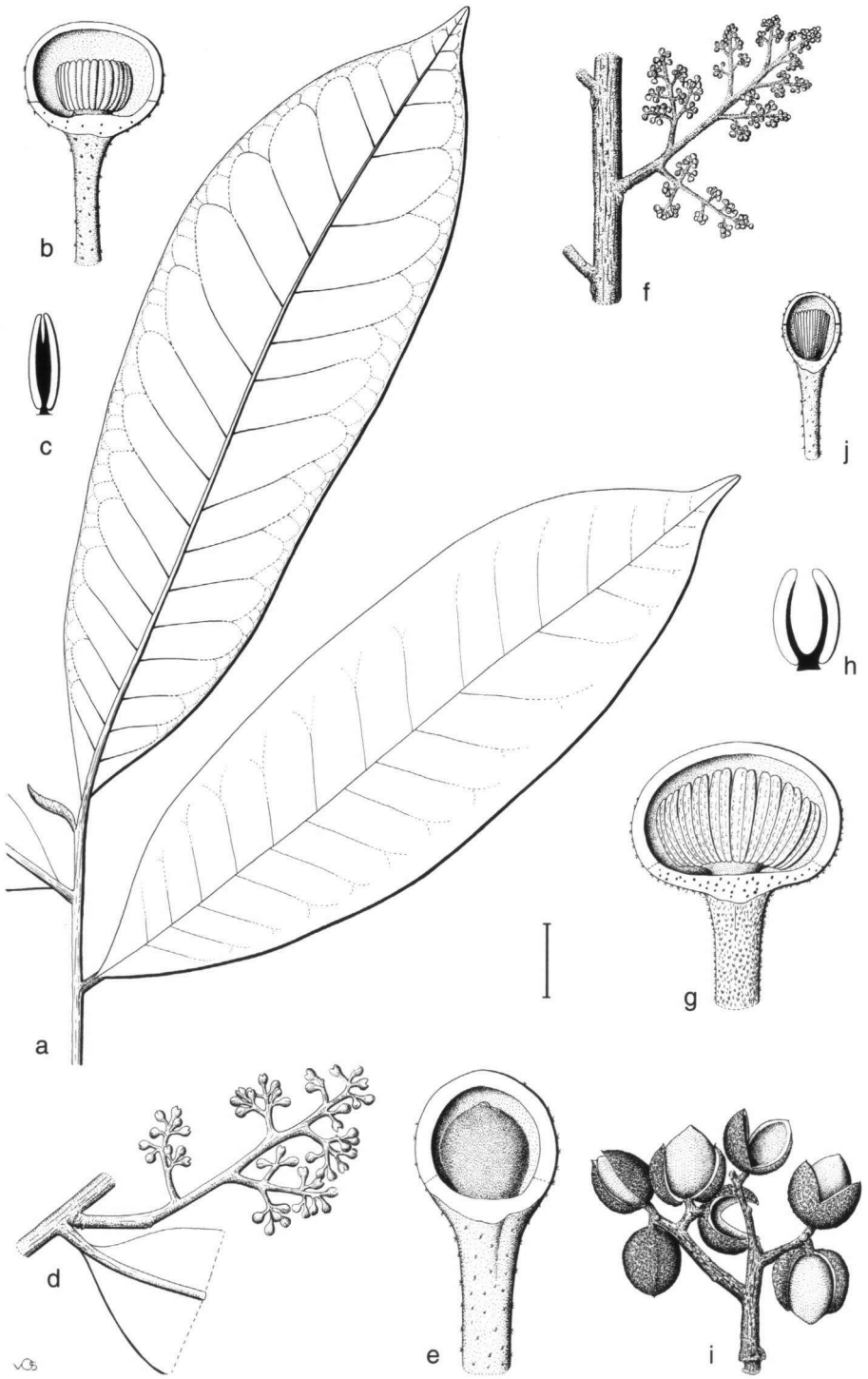
*Horsfieldia laevigata* (Blume) Warb., Mon. Myrist. (1897) 351, t. 21 (excl. specimens from Java); W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 115, f. 17 a–i. — *Myristica laevigata* Blume, Rumphia 1 (1837) 191, t. 64 f. 3, anal. 1–4; A. DC., Prodr. 14, 1 (1856) 202; Miq., Fl. Ind. Bat. 1, 2 (1858) 65, p.p. — Type: *Commerçon (s.n.)* 238, female, cult., Mauritius.

For more references and synonyms see the varieties.

Tree 4–25 m. *Twigs* faintly ridged or not, 1.5–5 mm diameter, early glabrescent, hairs grey to brown, 0.1–0.2 mm; bark striate, not flaking; lenticels conspicuous or not. *Leaves* membranous or thin-chartaceous, elliptic to oblong-lanceolate, 10–30 by (3–)4–12 cm, base attenuate, apex acute-acuminate; upper surface drying dull olivaceous to brown,

Fig. 21. *Horsfieldia iryagedhi* (Gaertn.) Warb. a. Habit of twig with leafy shoot and female inflorescences; b. twig with male inflorescence; c. subspherical male flowerhead, flowers partly removed, one flower opened; d. mature male flower bud, lateral view; e. ditto, longitudinal section showing androecium; f. mature female flower bud; g. ditto, opened, showing pubescent ovary and sessile, minutely lobulate stigma; h. infructescence; i & j. seeds with and without seed coat [a, f, g: *Anonymous*, Hort. Bot. sub XIII-E-9; b–e: *Jayasurya & Bandaranaike* 1869; h–j: *Koster-mans* 26670]. — Scale bar for a, b, h–j = 2 cm; for c = 3.3 mm; for d–g = 0.85 mm.





usually minutely pale pustulate or irregularly blotched (as in *H. irya*), lower surface (largely) glabrescent, hairs 0.1–0.2 mm; dots absent; midrib  $\pm$  flat above; nerves (10–) 12–30 pairs, slightly raised above, lines of interarching irregular, faint beneath; venation lax, faint or distinct on both surfaces; petiole 5–15 by 1.5–3 mm; leaf bud 10–15 by 1.5–2 mm, with hairs 0.1–0.2 mm. *Inflorescences* subglabrescent or with dense or sparse scale-like stellate hairs 0.1–0.2(–0.5) mm; in male: 2–4 times branched, many-flowered, 5–20 by 3–10 cm, peduncle 1–4 cm; in female: 2–10 cm long; bracts 2–3 mm long, caducous; flowers (male) in loose clusters of 2–5; perianth 2-lobed, with sparse or dense hairs 0.1–0.2 mm long, pedicel not tapering, generally pubescent, not articulated. *Male flowers*: pedicel slender, 1.5–3(–4) mm long; buds flattened, subcircular (sometimes slightly longer than broad, or broader than long, e.g., in some specimens from the Papuan Islands; see note 2), 1.7–2.8(–3) by 1.7–3(–3.3) mm, cleft 1/2–3/4(–4/5), lobes (0.1–) 0.2–0.3 mm thick; androecium flattened, quadrangular to  $\pm$  reniform in outline, apex rounded or subtruncate, 1.1–1.5 by 1.1–1.8(–2.2) mm (Plate 1: 29); thecae 18–32, erect, free apex up to 0.2 or 0.4–0.6 (var. *novobritannica*) mm long, column narrowly hollowed for 1/4(–1/2) or in var. *novobritannica* for c. 9/10; androphore to 0.1(–0.2) mm, broadly attached. *Female flowers*: pedicel 2–2.5 mm long; buds broadly ellipsoid to globose, 2.5–3.1 by 2.8–3.1 mm, cleft 1/3–2/3; ovary ovoid or subglobose, 2–2.3 by 1.7–2.2 mm, hairs 0.1 mm, style to 0.3 mm long, stigma hardly 2-lobed, 0.1–0.2 mm. *Fruits* (1–) 2–15 per infructescence, ellipsoid or nearly globose, apex rounded to acutish, base rounded, (1.6–) 1.8–2.8(–3) by 1.4–2(–2.2) cm, glabrescent but always with minute hairs (0.1 mm) remaining at least at base (lens!), usually with coarse pale tubercles or lenticels; pericarp 2–3 mm thick (or 4–6 mm in some forms from SW New Guinea and New Britain); seeds ellipsoid; fruiting pedicel 3–6 mm long; perianth not persistent. — **Fig. 22.**

**Distribution** — *Malesia*: Moluccas, New Guinea (including Papuan Islands and Bismarck Archipelago); see further under the varieties.

**Note** — A variable, complex species; one prominent form is segregated as a variety.

#### KEY TO THE VARIETIES

- 1a. Hairs on inflorescences 0.1–0.2(–0.3) mm long, sometimes almost absent. Anthers at apex free for only 0.1–0.2 mm; the column hollowed for 1/4(–1/2, or slightly deeper). Fruits generally ellipsoid, pericarp 2–3 mm, rarely (SW New Guinea) 4–6 mm thick. — Moluccas, New Guinea, including New Britain . . . **a. var. laevigata**
- b. Hairs of inflorescences more woolly, 0.3–0.5 mm long. Anthers at apex free for 0.4–0.6 mm; the column hollowed for c. 9/10. Fruits generally subglobose or short-ellipsoid, pericarp 2–5 mm thick. — New Britain . . . . . **b. var. novobritannica**

**Fig. 22.** *Horsfieldia laevigata* (Blume) Warb. var. *laevigata*. a. Twig apex with leaves; b. opened mature male flower, showing androecium; c. androecium, longitudinal section, schematic; d. twig with female inflorescence; e. opened female flower, with finely pubescent ovary and minute 2-lobed stigma. — *H. laevigata* var. *novobritannica* (J. Sinclair) W.J. de Wilde. f. Twig with male inflorescence; g. opened mature male flower, showing androecium; h. androecium, longitudinal section, schematic; i. infructescence with mature fruits. — *H. pilifera* Markgr. j. Opened male flower, showing androecium [a–c: LAE 52086; d, e: Commerson (s.n.) 238; f–h: Floyd 6430; i: NGF 10811 (White); j: Ledermann 6675]. — Scale bar for a, d, f, i = 2 cm; for b, e, j = 1.7 mm; for c, g, h = 0.85 mm.

**a. var. laevigata**

*Myristica nesophila* Miq., Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 206, p.p. (excluding specimens from Batjan). — *Horsfieldia nesophila* (Miq.) Warb., Mon. Myrist. (1897) 281, t. 21. — Lectotype: *de Vriese s.n.* (male) (L), Seram.

*Horsfieldia polyantha* Warb., Mon. Myrist. (1897) 281, t. 23; J. Sinclair, Gard. Bull. Sing. 28 (1975) 95 (for the greater part, incl. type). — *Myristica polyantha* (Warb.) Boerl., Handl. 3 (1900) 85. — Type: *Beccari s.n.* (Acc. Nos. 7619, 7619-A), Aru Is., Wokam.

Twigs 2–5(–9) mm diameter. Leaves 10–30 by 4–12 cm. Inflorescences with dense to sparse hairs 0.1–0.2(–0.3) mm, sometimes almost glabrous. Male flowers: buds 1.7–3.3 mm diameter, cleft 1/2–3/4(–5/6); thecae (18–)20–32, free apex (0–)0.1–0.2 mm; column hollowed for 1/4(–1/2, or slightly deeper). Infructescences up to 10 cm long. Fruits ellipsoid, 18–28 mm long, drying blackish or brown, usually with coarse wart-like lenticels; pericarp 2–3(–6) mm thick. — Fig. 22a–e.

Field-notes — Bole straight, without buttresses; bark often shallowly vertically fissured, not peeling off; branches horizontal, or drooping; wood whitish. Flowers greenish or brownish yellow. Fruits yellow to orange.

Distribution — As the species.

Habitat & Ecology — Primary and degraded rain forest on ridges and plains, riverine forest, swampy scrub and forest, edges of sago-swamps; on a great variety of soils, including black volcanic soil (Moluccas); 0–1000(–1300) m altitude; fl. & fr. throughout the year.

Uses — Fruits edible; wood of medium weight and hardness; used for house construction.

Notes — 1. After the separation of var. *novobritannica* the remaining type variety is still very variable, especially in the leaf texture and the length of hairs on the leaf buds, and in the shape of the male buds.

2. The width of the male bud varies between 1.7 and 3.3 mm. Specimens with smaller flowers have been placed in *H. pilifera*. The shape of the bud in lateral view is generally subcircular. Certain specimens, e.g. from the Papuan Islands and Gulf Prov., may have a bud which is rather markedly broader than long, and these flowers may resemble those of, e.g., *H. spicata*. In specimens from the Moluccas the bud is often slightly longer than broad. The degree to which the male bud opens is in most specimens halfway to 2/3; specimens from the Papuan Islands and the Bismarck Archipelago may have male buds cleft as deep as 4/5–5/6, a feature reminiscent of *H. spicata*. In these broad, deeply cleft male flowers, the androecium is broad, rather reniform as seen laterally.

3. The fruits of some specimens from SW New Guinea have thick corky pericarps, 4–6 mm thick, but the leaves agree with those of var. *laevigata*. Forms with larger and thick-walled fruits appear difficult to separate from *H. pachycarpa*; see the notes under that species.

**b. var. novobritannica** (J. Sinclair) W.J. de Wilde

*Horsfieldia laevigata* (Blume) Warb. var. *novobritannica* (J. Sinclair) W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 120, f. 17 f–i. — *Horsfieldia hellwigii* (Warb.) Warb. var. *novobritannica* J. Sinclair, Gard. Bull. Sing. 28 (1975) 54. — Type: NGF 6430 (Floyd), Papua New Guinea.

*Horsfieldia novae-lauenburgiae* Warb., Mon. Myrist. (1897) 278; K. Schum., Notizbl. Bot. Gart. Berlin 2 (1898) 117; K. Schum. & Lauterb., Fl. Schutzgeb. Südsee (1900) 324; Markgr., Bot. Jahrb. Syst. 67 (1935) 151. — Type: *Warburg 20713* (B lost; G iso, n.v.; identity not sure), Bismarck Archipelago, Neu Lauenburg Group, Ulu Is.

*Horsfieldia ralunensis* auct. non Warb.: Kaneh. & Hatus., Bot. Mag. Tokyo 52 (1938) 355 (specimen *Kanehira 3969*, n.v.).

*Twigs* 2–6(–8) mm diameter. *Leaves* (12–)17–30 by (3–)5–8 cm. *Inflorescences* with rather dense woolly indumentum of hairs 0.3–0.5 mm long. *Male flowers*: buds 1.8–2 by 2.2 mm, cleft c. 4/5; thecae c. 28, almost completely filling the perianth, free apices 0.4–0.6 mm; column hollow for c. 9/10. *Infructescences* up to 8 cm long. *Fruits* broadly ellipsoid to almost globose, 18–22 by 16–20 mm, drying grey-brown, with coarse wart-like lenticels; pericarp rather hard, 2–3(–5) mm thick. — **Fig. 22 f–i.**

Field-notes — Fruits globose, golden brown, yellow, or orange when mature.

Distribution — *Malesia*: Papua New Guinea (Bismarck Archipelago: New Britain).

Habitat & Ecology — Primary and disturbed rain forest; 0–1000 m altitude; fl. Aug., fr. throughout the year.

Note — The staminal column is reminiscent of that in *H. irya*, and probably the variety originated by hybridization with the latter. *Inflorescences* of *H. irya* from this region may be similarly woolly hairy. The leaves of var. *novobritannica* may show whitish markings, similar to those found in *H. irya*.

### 38. *Horsfieldia lancifolia* W.J. de Wilde

*Horsfieldia lancifolia* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 123, f. 18. — Type: *bb Cel.III-464*, Sulawesi.

Tree 10–30 m. *Twigs* 1–2.5(–5) mm diameter, sometimes faintly lined, with hairs 0.1 mm or less, glabrescent; bark finely striate, not flaking; lenticels small, inconspicuous. *Leaves* (thinly) chartaceous, oblong or oblong-lanceolate, 5–16 by 1.5–3.5(–4.5) cm, base (long-)cuneate, apex acute-acuminate; upper surface drying olivaceous-brown, sometimes with small whitish marks, lower surface early or late glabrescent, hairs 0.1 mm or less; with or without dots of mixed size; midrib slightly raised above; nerves 9–17 pairs, flat, inconspicuous above, lines of interarching  $\pm$  regular, indistinct; venation lax, inconspicuous; petiole 10–20 by 1–1.5 mm; leaf bud 10–20 by 1.5–2 mm, with hairs 0.1 mm. *Inflorescences* with sparse hairs 0.1–0.2 mm long; in male: 2 or 3 times branched, not many-flowered, 5 by 3.5 cm, peduncle 1 cm long, flowers solitary or 2 or 3 together; in female: 1–3 cm long, little branched, 4–10-flowered; flowers with sparse hairs 0.1–0.2 mm or less, perianth 2-lobed; pedicel not articulated. *Male flowers*: pedicel 1.5–2 mm long, tapered; buds obovoid to pear-shaped, somewhat laterally compressed, drying blackish, not or little collapsing on drying, 2.5–3 by 2–2.3 mm, apex broadly rounded, base tapering into the pedicel, cleft c. 1/6, lobes (at the base) 0.4–0.5 mm thick; androecium (synandrium) long-obovoid, laterally flattened, 1.5–1.8 by 1–1.2 mm, subtruncate (Plate 1: 31); thecae 12–16, erect, free apices 0.3–0.4 mm; column solid, except for the apical part between the free apices of the anthers; androphore slender, 0.6–0.8 mm long. *Female flowers*: pedicel 1–2 or 3–4 mm long; buds subglobose to obovoid, variable in size, 2–3 by (1.8–)2–3.5 mm, cleft 1/4–1/6; ovary ovoid, 1.4–2.2 by 1–2 mm, densely minutely pubescent; style and stigma(s) minute, 0.1 mm. *Fruits* per infructescence, ellipsoid

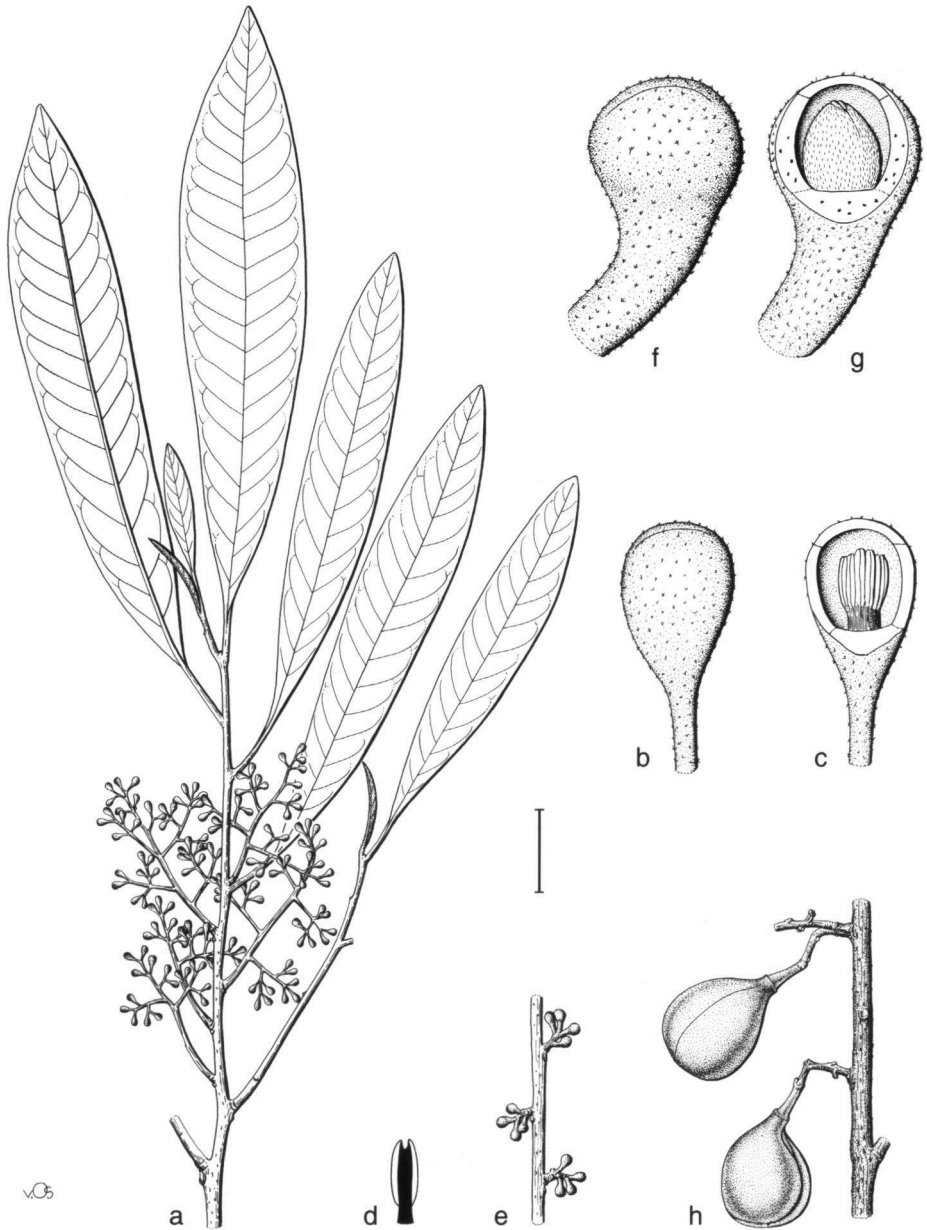


Fig. 23. *Horsfieldia lancifolia* W.J. de Wilde. a. Habit of leafy twig with male inflorescences; b. mature male flower, lateral view; c. ditto, opened, showing androecium; d. androecium, longitudinal section, schematic; e. twig with female axillary inflorescences, leaves fallen; f. mature female flower, lateral view; g. ditto, opened, showing finely pubescent ovary; h. twig with infructescences with mature fruits [a–d: *bb Cel./II-464*; e–g: *de Vogel 5267*; h: *van Balgooy 3973*]. — Scale bar for a, e, h = 2 cm; for b–d, f, g = 1.7 mm.

(and  $\pm$  contracted at base) or pear-shaped, 2.5–3.5 by 1.8–2.4 cm, glabrescent, granulate or with small lenticels or tubercles, drying brown; pericarp thick-woody, 4–8 mm thick; seeds broadly ellipsoid, 17 by 14 mm; fruiting pedicel 3–10 mm long; perianth not persistent. — Fig. 23.

Field-notes — Flower buds brown; fruits glossy green, turning yellow-green to orange.

Distribution — *Malesia*: C & S Sulawesi.

Habitat & Ecology — Forest on ultrabasic rock (iron, nickel), laterite, also limestone ridges; 200–1200 m altitude; fl. throughout the year, fr. May–July.

Note — *Horsfieldia lancifolia* can be easily recognized among the *Horsfieldias* from Sulawesi and the Moluccas by the pear-shaped male buds, rather large fruits with thick pericarp, and small, narrow leaves. The androphore is proportionally long as compared to other species.

### 39. *Horsfieldia laticostata* (J. Sinclair) W.J. de Wilde

*Horsfieldia laticostata* (J. Sinclair) W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 15; Tree Fl. Sabah & Sarawak 3 (2000) 374. — *Horsfieldia brachiata* (King) Warb. var. *laticostata* J. Sinclair, Gard. Bull. Sing. 28 (1975) 12. — Type: *Sinclair 10265*, Sarawak.

Tree 12–35 m. Twigs 3–8 mm diameter, early glabrescent, hairs grey-brown or rusty, 0.1–0.4 mm; bark coarsely striate, when older almost flaking; lenticels usually distinct. Leaves thinly to thickly coriaceous, (obovate-)oblong, (15–)20–33 by 6–12 cm, base attenuate, apex (short-)acute-acuminate; upper surface drying dull olivaceous-brown, glabrous, lower surface chocolate to rusty, contrasting with the upper surface, early glabrescent; dots absent; midrib raised above, towards the base  $\pm$  flat and conspicuously broad, 3–4(–5) mm wide at transition to petiole, sometimes with remnants of indumentum towards the base; nerves 11–20(–24) pairs, raised but towards the blade margin sunken, lines of interarching  $\pm$  distinct, sunken; venation lax, flat or sunken, distinct or not; petiole stout, 6–15 by 5–8 mm; leaf bud 15–23 by 3–5 mm, with dense grey-brown or rusty hairs 0.1–0.4 mm long. Inflorescences below the leaves, with sparse hairs 0.2–0.4 mm long; in male: stout, 4 or 5 times branched, many-flowered, 10–25 by 8–22 cm, main axis towards base 3–4 mm diameter, peduncle 0.5–3.5 cm long; in female: 3–7 cm long, 2 or 3 times branched, rather few-flowered; bracts elliptic, acute, 2–8 by 1–4 mm, with hairs 0.3 mm,  $\pm$  glabrescent, caducous; flowers (male) in clusters of up to 10, perianth 3-lobed, glabrous, pedicel glabrous except few hairs 0.1–0.2 mm long towards the base, distinctly articulated. Male flowers: pedicel 1–2 mm long, slender; buds broadly obovoid to subglobose, 1.3–1.5 mm diameter, apex broadly rounded, base rounded or sometimes  $\pm$  attenuate, glabrous, cleft c. 1/2, not collapsing on drying, lobes 0.2–0.3 mm, towards base of perianth 0.5 mm thick; androecium including androphore broadly obovoid in outline, 0.7 mm diameter, triangular in cross section (Plate 3: 70); thecae 12, suberect,  $\pm$  acute, mutually largely free, 0.3(–0.4) mm long; androphore tapering, 0.3(–0.4) mm long. Female flowers: pedicel 0.5–1 mm long; buds broadly ellipsoid-globose, 2.5 mm diameter, glabrous or with a few minute hairs 0.1 mm long, cleft c. 1/3; ovary broadly ovoid, 1.5 mm long, glabrous, stigma 0.1 mm long, shallowly 2(–4)-lobed. Fruits 1–4 per infructescence, ellipsoid, 2.8–4 by 2.2–2.5 cm, glabrous, with or without warts or lenticels; pericarp 4–5 mm thick; fruiting pedicel 2–4 mm long; perianth not persistent.

Field-notes — Tree without buttresses. Branches predominantly horizontal. Bark hard, fissured or flaky, (reddish) brown; inner bark reddish, laminated, sapwood whitish. Flowers yellow, smelling of Peru balsam. Fruits yellow, orange, or red; fruiting abundantly throughout the crown along the smaller branches. Seeds glossy white, spotted.

Distribution — *Malesia*: Borneo (Sarawak, Sabah, C & NE Kalimantan).

Habitat & Ecology — Primary peat swamp forest, forest on sandy acid soils, waterlogged sand soils, kerangas; 0–400 m altitude; fl. & fr. throughout the year.

Note — *Horsfieldia laticostata* is closely related to the variable *H. polyspherula*, especially to the varieties *sumatrana* and *maxima*. The species seems confined to forests on poor soils, peaty and sandy grounds. It is characterized by stout twigs, large coriaceous leaves with the midrib very broad and flat at the transition to the petiole, the usually stout, broad petioles, fruits of moderate size (30–40 mm long), and large, stout, male inflorescences. The male flowers (perianth and androecium) are very similar to those of *H. polyspherula*.

#### 40. *Horsfieldia leptantha* W.J. de Wilde

*Horsfieldia leptantha* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 137. — Type: *BW 12194* (Vink), Papua Barat, Fak-Fak.

Tree 8–30 m. Twigs 4–8 mm diameter, early to late glabrescent, hairs rusty, 0.5–1 mm long; bark finely or coarsely striate, not flaking; lenticels usually present. Leaves membranous to chartaceous, elliptic to oblong-lanceolate, 13–35 by 5–13.5 cm, base (short-) attenuate, apex acute-acuminate; upper surface drying dull olivaceous, smooth or finely pustulate, lower surface early or late glabrescent, or with persistent stellate-dendroid woolly or mealy hairs of mixed size, 0.5–1 mm long, when shed not leaving rough hair bases; dots absent; midrib above flattish, glabrescent except towards base; nerves 10–20(–30?) pairs, at 45–50° to the midrib, 5–20 mm apart, thin and sunken above, lines of interarching irregular, prominent or not below; venation lax, distinct or not; petiole 5–12 by 2.5–4 mm; leaf bud 2.5–5 cm long, with dense hairs 0.5–1 mm long. Inflorescences with woolly hairs 0.5–1 mm long; in male: rather many-flowered, 2 or 3 times branched, 11 by 7 cm, peduncle 0.5–2 cm long; bracts broadly elliptic, obtuse, 2–3 mm long; flowers in loose clusters of 2–6, with hairs 0.2–0.3(–0.5) mm long; perianth 2-lobed, pedicel slender, not articulated. Male flowers: pedicel 1–1.5 mm long; buds somewhat compressed, in lateral view subcircular, 2.5 by 2.7–3 mm, membranous, not collapsing on drying, cleft 3/4–5/6, lobes 0.2 mm thick; androecium compressed, 1–1.3 by 1.3–1.6 mm, apex broadly rounded-truncate (Plate 2: 37); thecae 20–28, erect, touching each other, 1–1.1 mm long, free apices 0.2–0.3 mm, not or faintly incurved, column narrowly hollowed for 0.3 mm; androphore ± absent. Female flowers not seen. Infructescences 6–12 cm long, branched. Fruits 2–8 per infructescence, broadly ellipsoid to subglobose (seeds ellipsoid), 2–2.4 by 1.6–2 cm, largely glabrescent but with minute vestigial hairs towards the base, tubercles coarse, pale, lenticel-like, pericarp woody-coriaceous, 4–7 mm thick; fruiting pedicel 5–10 mm long; perianth not persistent.

Field-notes — Bark greenish black; blaze with pinkish red serous sap.

Distribution — *Malesia*: Papua Barat (Bird's Head); Papua New Guinea (West Sepik Prov.).

Habitat & Ecology — Degraded and primary forest, ridge forest, on clay soil over limestone; 0–600 m altitude; flowering and fruiting apparently not seasonal.

Note — The male buds are deeply cleft, to 3/4–5/6, much deeper than in the other members of the group of species with *H. hellwigii*, to which *H. leptantha* belongs. The fruits with coarse lenticels and tubercles are reminiscent of those in *H. laevigata*, and possibly there is a close relationship with this species.

#### 41. *Horsfieldia macilenta* W.J. de Wilde

*Horsfieldia macilenta* W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 13; Tree Fl. Sabah & Sarawak 3 (2000) 375. — Type: SAN 37103 (*Aban*), Sabah.

Tree 4–17 m. *Twigs* 1–3 mm diameter, rather late glabrescent, hairs pale rusty, stellate-dendroid, (0.2–)0.5 mm long; rather bark finely striate, not cracking; lenticels small, inconspicuous. *Leaves* membranous, oblong(-lanceolate), 10–18(–27) by 3–6.5 cm, base (rounded to short-)attenuate, apex acute-acuminate; upper surface drying dull olivaceous, glabrous, lower surface light brown, glabrous except midrib and the very base; dots absent; midrib raised above, on lower surface late glabrescent; nerves 10–15(–18) pairs, raised, lines of interarching fairly regular, distinct or not; venation lax, ± indistinct; petiole 10–15 by 1.5–2 mm, late glabrescent; leaf bud 6–8 by 1.5 mm, with dense hairs (0.2–)0.5 mm. *Inflorescences* with sparse woolly hairs (0.2–)0.5 mm; in male: many-flowered, 2 or 3(–4) times branched, 4–10 by 3–5(–7) cm, peduncle 0.3–1.2 cm long; in female: similar to male, or shorter; bracts oblong to lanceolate, 2–5 mm, pubescent, caducous; flowers in male in clusters of 5–8, in female fewer, glabrous or sometimes a few hairs less than 0.1 mm towards the base of the pedicel; perianth 3-lobed, pedicel articulated. *Male flowers*: pedicel 0.8–1.3 mm long; buds globose to depressed globose, 0.7–1.2 by 1–1.2 mm, cleft c. 1/2, lobes 0.2–0.3 mm thick; androecium subglobose (including androphore) 0.4–0.5 by 0.5–0.7 mm, ± triangular in cross section (Plate 3: 69); thecae 10–14, suberect, 0.3–0.4 mm long, free for at least the upper half, column largely hollow, passing into the broad tapering androphore 0.2–0.3 mm long. *Female flowers*: pedicel 1.5 mm; buds subglobose, 1.5 mm diameter, cleft c. 1/2; ovary globose, glabrous, 1–1.2 mm diameter, stigma minutely 2-lipped, 0.1–0.2 mm long. *Fruits* (in Sumatra) 2 or 3 together in a short infructescence 2–3 cm long, glabrous, ellipsoid, 2.2–2.4 by 1.5–1.6 cm, apex rounded, base contracted into a 2–4 mm long narrowed part; pericarp 2 mm thick, not or sparingly tubercled; fruiting pedicel 5 mm long; perianth not persistent.

Field-notes — Outer bark whitish or green-yellow, inner bark red with red sap; cambium yellowish. Flowers (greenish) yellow.

Distribution — *Malesia*: Sumatra, Peninsular Malaysia, Borneo (Sarawak, Sabah).

Habitat & Ecology — Primary lowland mixed dipterocarp forest, swamp forest; up to 200 m altitude; fl. June–Nov.

Note — According the structure of the male flowers, the present species is related to *H. polyspherula*, especially the slender specimens of var. *polyspherula*. *Horsfieldia macilenta* differs from *H. polyspherula* in the more slender twigs, thinly membranous leaves, and slender and tiny inflorescences.



#### 42. *Horsfieldia macrothyrsa* (Miq.) Warb.

*Horsfieldia macrothyrsa* (Miq.) Warb., Mon. Myrist. (1897) 307; K. Heyne, Nutt. Pl. Ned. Indië (1927) 637; W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 55. — *Myristica macrothyrsa* Miq., Pl. Jungh. (1852) 172; A. DC., Prodr. 14, 1 (1856) 203; Miq., Fl. Ind. Bat. 1, 2 (1858) 66; Suppl. 1 (1860) 156. — Type: *Junghuhn* (559), Sumatra, Tapanuli.

Tree 4–15 m. *Twigs* (2–)2.5–6 mm diameter, (blackish) brown, early glabrescent, hairs (grey-)brown, 0.1 mm long; bark finely striate, not flaking; lenticels usually distinct. *Leaves* membranous, (elliptic-)oblong, 12–28 by 4–12 cm, base attenuate, apex acute-acuminate; upper surface drying olivaceous to brown; lower surface early glabrescent; dots (no dashes) present (lens!); midrib  $\pm$  flat above; nerves 9–17 pairs, thin, flat or  $\pm$  raised above (see note 2), lines of interarching indistinct; venation lax, indistinct on both surfaces; petiole 12–20 by 2–4 mm; leaf bud 10–15 by 1.5–3 mm, with dense (grey-)brown hairs 0.1 mm. *Inflorescences* with sparse hairs 0.1 mm or less; in male: about 3 times branched,  $\pm$  few-flowered, 7–20 by 5–12 cm, peduncle 0.5–4.5 cm long; in female (according to infructescences): about twice branched, 3–6 cm long; bracts elliptic-oblong, 2–4 mm long, short-pubescent, caducous; flowers in male in loose clusters of 2–4, in female 1–3 together, glabrous; the perianth 3- (or 4-) lobed, pedicel not or but faintly articulated. *Male flowers*: pedicel 1–2 mm long, usually slender, clearly marked-off from the perianth; buds globose to (depressed-)broadly obovoid, 3–4.3 by 3–4 mm, cleft c. 1/2, lobes 0.2–0.4 mm thick; androecium (depressed) globose or depressed broadly obovoid, 1.8–2.2 by 1.8–2.5 mm, in cross section circular to bluntly 3- or 4-angled (Plate 3: 91); thecae 30–44, completely sessile, free apices up to 0.1 mm long, towards the apex somewhat curved into the rather broad, 0.4–1.2 mm deep, apical cavity of the column; androphore narrow, 0.1–0.4 mm long, hidden by the anthers. *Female flowers* not seen. *Fruits* 2–6 per infructescence, glabrous, ovoid-ellipsoid, 2.2–2.5 by 1.6–1.8 cm, with or without a few small lenticel-like tubercles; pericarp 1.5–3 mm thick; fruiting pedicel 2–5(–7) mm long; the perianth not persistent.

*Field-notes* — Small tree; bark fissured or somewhat peeling; sap dark red-brown; wood white to yellowish with red veins. Flowers greenish to yellow, aromatic. Fruits 2.5–3.5 cm long, ellipsoid, greenish to light yellow, pericarp light yellow inside; aril green (almost mature, *Lörzing* 11703); seeds pale yellow.

*Distribution* — *Malesia*: northern and Central Sumatra.

*Habitat & Ecology* — Lower and mid-montane forest, riverine forest; 400–1600 m altitude; fl. & fr. throughout the year.

*Notes* — 1. Related to *H. glabra*, with similar fruits and flowers. *Horsfieldia macrothyrsa* has markedly larger male flowers, and about twice as many anthers. It has a different distributional area; *H. glabra* is not found in C and N Sumatra.

2. The specimens of *H. macrothyrsa* rather differ from each other in various aspects. Plants from Mt Sago (= Mt Malintang), C Sumatra, are less robust in general habit, the leaves and inflorescences are smaller, the male buds 3–3.5 mm diameter. Specimens from Sibolangit Botanic Garden jungle are stout, with large leaves (to 28 cm long), large male buds (4.3 by 4 mm), and deviate furthermore by the slightly raised nerves on the upper leaf surface.

**43. *Horsfieldia majuscula* (King) Warb.**

*Horsfieldia majuscula* (King) Warb., Mon. Myrist. (1897) 315; Gamble, Mat. Fl. Malay Penins. 5, 23 (1912) 215; Ridl., Fl. Malay Penins. 3 (1924) 57; W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 48. — *Myristica majuscula* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 310, pl. 143. — Lectotype: *King's coll. 5039*, Peninsular Malaysia.

*Horsfieldia bartlettii* Merr., Papers Mich. Acad. Sc. Arts & Letters 24, 1 for 1938 (1939) 71. — Type: *Rahmat si Boeea 8772*, Sumatra.

Tree 6–25 m. *Twigs* 2.5–5 mm diameter, grey-brown, early glabrescent, hairs greyish brown, 0.1(–0.2) mm; bark coarsely longitudinally striate, not flaking; lenticels small, rather inconspicuous. *Leaves* membranous or thinly chartaceous, (elliptic-)oblong, 15–27 by 5.5–9.5 cm, base attenuate, apex acute-acuminate; upper surface glabrous, drying olivaceous-brown, lower surface brown, not conspicuously contrasting in colour with upper surface, early glabrescent; dots absent; midrib raised above; nerves 11–19 pairs, raised above; venation lax, indistinct on both surfaces; petiole 10–20 by 2–2.5 mm, leaf bud 10–15 by 2–3 mm, with grey brown hairs 0.1(–0.2) mm. *Inflorescences* with rather dense stellate hairs 0.1 mm long; in male: 2 or 3 times branched, not very many-flowered, 8 by 4–5 cm, peduncle 1–1.5 cm; flowers in clusters of 2–5; in female: 2–5 cm long, twice branched, fewer-flowered; bracts ovate-oblong, 4 by 2 mm, with dense hairs 0.2 mm long, caducous; flowers with perianth 3- (or 4-)lobed, glabrous, pedicel glabrous or sparsely pubescent (hairs 0.1 mm), articulated. *Male flowers*: pedicel 2–3 mm long; buds broadly ellipsoid or obovoid, 2–3 by 1.8–2.5 mm, apex rounded, base short-attenuate, slightly tapering, cleft 1/3 to 1/2, not or slightly collapsing on drying, lobes thick, 0.3 mm, towards the base to 0.8(–1) mm thick; androecium (including the broad, shortly tapering, 0.2–0.5 mm long androphore) ellipsoid to ellipsoid-oblong, (1.4–) 1.7–2 by 0.8–1 mm, in cross section subtriangular to subelliptic (Plate 3: 87); thecae 14–18, slightly curved, 1.2–1.8 mm long, free apices (0.2–)0.3–0.5 mm. *Female flowers*: pedicel 2–3 mm long; buds broadly obovoid, 2.5 by 2.5 mm, cleft c. 1/3; ovary ellipsoid, 1.8–2 by 1.3–1.5 mm, glabrous, stigma 2-lipped, 0.3 mm high. *Fruits* 1–5 per infructescence, ellipsoid, 4.3–6.5 by 3–4.5 cm, glabrous, drying rusty-brown, finely granulate, not or inconspicuously warted or lenticellate; pericarp 4–11 mm thick; fruiting pedicel 2–7 mm long; perianth not persistent.

Field-notes — Tree without buttresses; bark shallowly fissured or forming shallow, rectangular flakes; slash wood whitish, red-flecked. Flowers yellow. Fruits up to 5 per infructescence, up to 7 by 6 cm, yellow to bright red; pericarp 1.5 cm thick.

Distribution — *Malesia*: Sumatra (W & E Coast, Palembang, Jambi, Aceh), Peninsular Malaysia (Perak, Pahang, Kelantan).

Habitat & Ecology — Dry-land forest and freshwater swamp-forest of lowland and montane areas; rocky stream banks, river valleys; up to 1200 m altitude; fl. & fr. throughout the year.

Note — *Horsfieldia majuscula* can be confused with *H. polyspherula* var. *sumatrana* and var. *maxima*. Variety *sumatrana* differs in usually coarser hairs on the leaf buds, more contrasting colour of the two surfaces of dry leaves, smaller globose male perianths, essentially different androecium, and smaller fruits, up to 35 mm long. Variety *maxima*, known only from Borneo, differs in the same characters, but has fruits of a similar size as those of *H. majuscula*, with the pericarp up to 15 mm thick.

#### 44. *Horsfieldia moluccana* W.J. de Wilde

*Horsfieldia moluccana* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 65. — Type: *Kostermans 673a*, Morotai.

Tree 8–20(–30) m. *Twigs* sometimes slightly angular, 2–5 mm diameter, early glabrescent; hairs 0.1–0.3 mm; bark striate, not flaking, lenticels conspicuous or inconspicuous. *Leaves* thinly chartaceous, (elliptic-)oblong, (6–)8–25 by 2.5–8.5 cm, base attenuate, apex acute-acuminate; upper surface drying olivaceous to brown, usually minutely pale-pustulate, lower surface early glabrescent; dots absent; midrib slender, flat above; nerves 6–15 pairs, thin, flat, indistinct above, lines of interarching indistinct; venation ± fine, indistinct on both surfaces; petiole 10–26 by 1–2 mm; leaf bud 6–12 by 1–2 mm, with hairs 0.1–0.3 mm. *Inflorescences* with sparse stellate hairs 0.1 mm or less; in male: (1–)2–3 times branched (sometimes hardly branched, spike-like, see note 1), 5–11 by 2–5 cm; in female: up to 5 cm long; peduncle 0.5–2 cm; bracts ± oblong, 1.5–4 mm long, thinly pubescent, caducous; flowers solitary or to 4 together, glabrous; perianth 2-lobed, pedicel not articulated. *Male flowers*: buds (including pedicel) pear-shaped, little to much compressed, about as broad as or slightly broader than long, 1.5–2.5(–3) by 2.2–3.8 mm, apex broadly rounded, the lower 1/3 tapering into the pedicel 2–3(–3.5) mm, cleft 2/3–4/5, lobes 0.2–0.3 mm thick; androecium compressed, broadly transversely ellipsoid or kidney-shaped, broadly rounded above, 1.1–1.5 by 1.4–2.8 mm (Plate 1: 5); thecae (14–)20–36, contiguous, 1.5–2 mm long, free apices 0.1–0.5 mm, only at one side of the androecium strongly incurved; column hollow for at least 2/3; androphore to 0.1 mm long. *Female flowers*: pedicel 2–2.5 mm long; buds broadly ovoid-ellipsoid, 1.8–2.2 by 2–2.2 mm, cleft 1/2–4/5; ovary ovoid, glabrous, 1–1.5 by 1 mm, stigma minutely 2-lobed, 0.1 mm high. *Fruits* solitary or 2–6 per infructescence, ellipsoid, apex rounded to subacute, 1.3–2.8 by 1.1–1.7 cm, glabrous, without or with sparse tubercles; pericarp 1–2 mm thick; fruiting pedicel 2–5 mm long; perianth not persistent.

Distribution — *Malesia*: northern Moluccas, West New Guinea.

Note — A species with 4 varieties, closely related to *H. spicata* and *H. tuberculata*. *Horsfieldia spicata* has the generally deeply asymmetrically incurved anthers in common with *H. moluccana*, but the former differs in pale twigs and (almost) spike-like male inflorescences. *Horsfieldia tuberculata* has the staminal column hollowed at the apex for 1/5–1/3.

#### KEY TO THE VARIETIES

- 1a. Hairs of leaf buds woolly-rusty, 0.2–0.3 mm long. — Bird's Head: Fak-Fak . . . . .  
 . . . . . c. var. **pubescens**
- b. Hairs of leaf buds up to 0.1 mm . . . . . 2
- 2a. Petiole 10–15 mm long. [Male buds 3 mm wide.] — Morotai, Obi Is. . . . .  
 . . . . . a. var. **moluccana**
- b. Petiole (10–)15–25 mm long, generally longer in proportion to the smaller blade. —  
 West New Guinea . . . . . 3
- 3a. Leaf blades 7–15 cm long. Fruits 1.3–1.8 cm long. Male buds 2–2.5 mm wide . . . . .  
 . . . . . b. var. **petiolaris**
- b. Leaf blades 13–23 cm long. Fruits 2.2–3 cm long. Male buds (3–)3.5–3.8 mm wide  
 . . . . . d. var. **robusta**

**a. var. moluccana**

?*Horsfieldia olivaeformis* Warb., Mon. Myrist. (1897) 352, t. 23; Markgr., Bot. Jahrb. Syst. 67 (1935) 152, p. p.; W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 66. — *Myristica olivaeformis* (Warb.) Boerl., Handl. 3 (1900) 87. — Type: *Beccari 171* (Fl, n.v., see note 2), Papua Barat, Sorong, Bird's Head.

Leaf blades 9–22 by 4–8 cm; petiole (8–)10–20 mm. Indumentum of leaf bud composed of hairs 0.1 mm long or less. *Male flowers*: buds 2–3 by 2.7–3.3 mm, pedicel 2–3 mm long. *Fruits* 1.5 cm long.

Field-notes — Straight tall tree, to 30 m, once with prop-roots up to 1.5 m; bark peeling off or not, exudate watery, turning pink, later brownish. Flowers yellow, once red.

Distribution — *Malesia*: northern Moluccas (Morotai, Obi).

Habitat & Ecology — Well-drained forests on clayey soil, volcanic soil, alluvial soil rich in humus, also flat land behind the mangrove; also found on limestone, at the base of serpentine-rock, or on porous nickel-containing soil; 0–600 m altitude; fl. & fr. throughout the year.

Notes — 1. Can be confused with *H. parviflora* which has more roundish (not pear-shaped) male buds and shorter petioles. *Horsfieldia spicata* is closely related but differs in the paler colour of the dried twigs, the generally spike-like male inflorescences, and the more membranous leaves.

2. I have not seen the type of *H. olivaeformis*, a name which may have priority but is not accepted here (De Wilde, l.c.).

**b. var. petiolaris W.J. de Wilde**

*Horsfieldia moluccana* W.J. de Wilde var. *petiolaris* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 67. — Type: *van Royen 5388*, West New Guinea.

Leaf blades 6–15(–19) by 2.5–6.5(–7) cm; petiole proportionally long, 10–20 mm. Indumentum of leaf bud composed of hairs up to 0.1 mm long. *Male flowers*: buds 1.5–2.2 by 2.2–2.5 mm, pedicel 2–3.5 mm long. *Fruits* 1.5–1.8 cm long.

Field-notes — Bark flaking. Flowers greenish. Fruits yellow or orange-yellow.

Distribution — *Malesia*: Papua Barat (Bird's Head; islands in the Geelvink Bay; Noemfoer, Meos Waar, Japen I.; Waigeo I.).

Habitat & Ecology — Locally common in forests on sandy or stony-clayey soils; *Calophyllum*–*Ficus* forest; 0–100 m altitude; fl. & fr. throughout the year.

Uses — Fruits once reported as edible and sour.

**c. var. pubescens W.J. de Wilde**

*Horsfieldia moluccana* W.J. de Wilde var. *pubescens* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 68. — Type: *BW 15370 (Vink)*, West New Guinea, Bird's Head.

Leaf blades (6–)8–14 by (2.5–)3–5 cm; petiole (9–)11–18 mm long. Indumentum of leaf bud ± woolly, composed of hairs 0.2–0.3 mm long. *Flowers* not seen. *Fruits* 1.3 cm long.

Field-notes — Tree to 16 m; buttresses up to 1 m high, 0.5 m wide; the bark little or strongly peeling; inner bark with much red and clear exudate; wood white. Fruits light green.

Distribution — *Malesia*: Papua Barat (Bird's Head).

Habitat & Ecology — Common in primary and degraded forest on clayey soil or sandy clay over limestone; most collections from limestone; 50–300 m altitude; fr. Mar., May.

Note — This variety appears to be almost identical with var. *petiolaris*, except for the more woolly indumentum. In *Horsfieldia*, the nature of the indumentum is usually of taxonomic significance.

**d. var. robusta** W.J. de Wilde

*Horsfieldia moluccana* W.J. de Wilde var. *robusta* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 68. — Type: *van Royen & Sleumer 6682*, West New Guinea.

Leaf blades 12–22(–25) by 3.5–8(–9) cm; petiole 12–26 mm. Indumentum of leaf bud consisting of hairs 0.1 mm long. *Male flowers*: buds 2.5–3 by (3–)3.5–3.8 mm, pedicel 3 mm. *Fruits* 2.2–3 cm long.

Field-notes — Bark flaking. Flowers yellow, fragrant. Fruits yellow.

Distribution — *Malesia*: Papua Barat (Bird's Head, Batanta I.).

Habitat & Ecology — Degraded and coastal forest, on limestone; 0–15 m altitude; fl. & fr. throughout the year.

Note — Var. *robusta* is a form similar to var. *petiolaris* but coarser in all aspects: leaves, flowers, and fruits are larger. It superficially resembles *H. tuberculata*, which differs in the generally shorter petioles, and the androecium with the anthers not strongly inflexed into the cavity

**45. *Horsfieldia montana*** Airy Shaw

*Horsfieldia montana* Airy Shaw, Kew Bull. 1939, n. 10 (1940) 542; W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 35; Tree Fl. Sabah & Sarawak 3 (2000) 375. — Type: *Richards (Native Coll.) 2509*, Sarawak, Dulit Range.

Tree (3–)7–24 m. *Twigs* terete or faintly angular, 1.5–4(–7) mm diameter, early to late glabrescent, hairs short or long-shaggy, 0.2–1 mm long; bark coarsely striate, flaking or not, lenticels inconspicuous or absent. *Leaves* chartaceous or coriaceous, elliptic (–oblong), 4–14 by 2–6 cm, base (short-)attenuate, apex rounded or (sub)acute; upper surface glabrous (base of midrib late glabrescent), drying olivaceous to blackish, lower surface glabrous but very base and midrib late glabrescent, drying chocolate, not much contrasting with upper surface; dots absent; midrib raised above, nerves 6–11 pairs, flattish to raised above, lines of interarching indistinct; venation lax, faint on both surfaces; petiole 5–16 by 1.5–2.5 mm, late glabrescent; leaf bud 5–10 by 1.5–4 mm with hairs 0.2–1 mm long. *Inflorescences* behind the leaves, sparsely or densely pubescent, hairs 0.2–1 mm long (see note); in male: 3 or 4 times branched, sometimes many-flowered, 4–12(–16) by 3–10 cm, peduncle 0.5–2 cm long, the flowers in loose clusters of 3–10 each; in female: few-flowered, 2–6 cm long; bracts ovate to ellipsoid, 2.5–6 mm long, pubescent, caducous; flowers glabrous, perianth 3- or 4-lobed, pedicel in male not articulated, in female ± articulated (always?). *Male flowers*: pedicel 1–1.5 mm; buds (sub)globose, (1.2–)1.4–2 mm diameter, cleft c. 1/3 to nearly 1/2, not or slightly collapsing on drying, lobes (0.2–)0.3 mm thick; androecium (depressed) globose, apex rounded,

base rounded,  $\pm$  truncate, or sagged, (0.5–)0.6–1.1 by 0.8–1.1 mm, subcircular in cross section (Plate 3: 80); thecae (16–)18–26, almost completely sessile, 0.8–1.2 mm long,  $\pm$  curved, free apices to 0.1 mm; column broad, with shallow apical cavity or slit 0.1–0.2 mm deep; androphore narrow, 0.3–0.5 mm long, hidden by the anthers, thus making the androecium look sessile. *Female flowers*: pedicel 1.5 mm long; buds ellipsoid-obovoid, 2 by 1.8 mm, cleft c. 1/3; ovary ellipsoid, 1.5 by 1.3 mm, glabrous, stigma minutely 2-lobed, 0.1–0.2 mm high. *Fruits* 2–9 per infructescence, ellipsoid, base rounded, slightly contracted towards the fruiting pedicel, apex rounded or  $\pm$  acute, 2–2.7 by 1.3–1.7 cm, glabrous, with or without few small lenticel-like tubercles, pericarp 1.5–2 mm thick; fruiting pedicel 2–4 mm long, at base  $\pm$  articulated; perianth not persistent.

Field-notes — Low or medium-sized tree, without buttresses; bark (slightly) longitudinally, shallowly fissured, or sometimes flaky, chocolate, red-brown, or dark grey; inner bark pale yellowish, reddish, or brownish, with red watery exudate or not; sapwood pale orange or whitish. Flowers yellow, sweet-scented; androecium orange. Fruits yellow or red.

Distribution — *Malesia*: Borneo (Sarawak, Brunei, Sabah).

Habitat & Ecology — Crest forest, kerangas on ridges, montane forest, moss forest, *Agathis* forest; on black soil or sandy soil; (800–)1300–2000 m altitude; fl. & fr. throughout the year.

Note — Specimens from Kinabalu and vicinity differ markedly from those from Sarawak and Brunei in the nature of the indumentum. Specimens from the latter two areas (including the type) have compact hairs 0.2(–0.5) mm long; the Kinabalu specimens have shaggy hairs 0.5–1 mm long, sometimes with longer emergents.

#### 46. *Horsfieldia motleyi* Warb.

*Horsfieldia motleyi* Warb., Mon. Myrist. (1897) 304; Merr., Enum. Born. (1921) 268; J. Sinclair, Gard. Bull. Sing. 28 (1975) 81; W.J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 209; Tree Fl. Sabah & Sarawak 3 (2000) 376. — *Myristica motleyi* (Warb.) Boerl., Handl. 3 (1900) 85. — Type: *Motley 355*, SE Kalimantan, Banjarmasin.

*Horsfieldia macrobotrys* Merr., Univ. Calif. Publ. Bot. 15 (1929) 76. — Type: *Elmer 21882*, Sabah, Tawau.

Tree 12–35 m. *Twigs* (2.5–)3–5 mm diameter, at first with dense rusty hairs 0.5(–1) mm, late glabrescent; bark finely striate, not flaking; lenticels inconspicuous. *Leaves* membranous, elliptic to oblong, 9–27 by 4–12 cm, base rounded to attenuate, apex  $\pm$  obtuse to acute-acuminate; upper surface drying olivaceous(-brown), glabrous, lower surface with persistent rather dense stellate-dendroid hairs of mixed size, 0.3–1 mm long; dots absent; midrib flattish above, sometimes late glabrescent; nerves 9–21 pairs, flat or sunken, often late glabrescent above; lines of interarching  $\pm$  indistinct; venation lax, faint above; petiole 13–22 by 1.5–4 mm, late glabrescent; leaf bud 15–20 by 3–4 mm, with dense hairs 0.5 mm long. *Inflorescences* with dense stellate-dendroid yellow-brown to rusty hairs 0.5–1 mm long; in male: 4 or 5 times branched, many-flowered, 12–20 by 10–14 cm, peduncle 2–4 cm, flowers  $\pm$  densely clustered (immature buds  $\pm$  angular); in female: much branched, rather many-flowered, 3–6(–10) cm long; bracts broadly ellipsoid, acutish, 2–5 mm long, densely pubescent, caducous; flowers (male) in clusters of 5–20, with hairs 0.1–0.3 mm long, perianth 3-lobed, pedicel not articulated.

*Male flowers*: pedicel slender, 1–1.5 mm long; buds subglobose or broadly obovoid, 0.8–1 by 0.7–1(–1.1) mm, pubescent or late glabrescent, cleft c. 1/2, lobes 0.1 mm thick; androecium broadly obovoid, 0.5–0.7 by (0.3–)0.5–0.6 mm, synandrium at apex somewhat flattish, depressed in the centre, subcircular in cross section (Plate 2: 53); thecae 10, completely sessile, towards the apex not or hardly incurved, 0.25–0.4 mm long, column broad, with broad, apical hollow to c. 1/10, androphore conspicuous, continuous with the anthers,  $\pm$  tapering, 0.2–0.3 mm long. *Female flowers*: pedicel 1.5 mm long; buds ellipsoid, 2.4 by 1.8–2 mm, pubescent, cleft 1/4–1/3; ovary broadly ellipsoid, 1.5 by 1.2 mm, grooved at one side, glabrous, stigma broad, shallowly 2-lobed, 0.2 mm high. *Fruits* 5–15 per infructescence, broadly ellipsoid, 1.9–2.3 by 1.6–1.8 cm, glabrous, smooth; pericarp 2 mm thick; fruiting pedicel 2–4 mm long; perianth not persistent.

Field-notes — Bole sometimes with steep buttresses to 5 m high, 30 cm out, 9 cm thick, merging into the stem; bark fissured, often scaly, strips 3–4 cm wide, to 10 mm thick, black-brown, chocolate, or red-brown; living bark 10–12 mm thick, undulate in cross section, dark brown, brown-red, or red-laminated; cambium pinkish; sapwood (reddish) white, heartwood pinkish or brown; exudate of bark a red watery sap, sometimes sticky, appearing fast. Flowers (dark) yellow. Fruits orange-red, with sticky exudate.

Distribution — *Malesia*: Borneo (Sarawak, Sabah, W, S, SE and E Kalimantan).

Habitat & Ecology — Primary forest, disturbed or poor forest, *Dryobalanops* forest, hill dipterocarp forest, usually on dry sandy soils, sandy clay, also loam with lime; often on ridge tops; 0–750 m altitude; fl. & fr. throughout the year.

Note — *Horsfieldia motleyi*, especially in a young stage, may be confused with *Endocomia rufirachis*, a species also with pubescent flowers.

#### 47. *Horsfieldia nervosa* W.J. de Wilde

*Horsfieldia nervosa* W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 16; Tree Fl. Sabah & Sarawak 3 (2000) 377. — Type: S 16652 (*Ilias Paie & Ashton*), Sarawak.

Tree 13–16 m. *Twigs* 3.5–6 mm diameter, grey-brown, late glabrescent, hairs rusty, 0.3–0.6 mm long; bark coarsely striate, slightly flaking or not; lenticels  $\pm$  inconspicuous. *Leaves* thinly coriaceous, oblong, 16–28 by 5.5–9 cm, base short-attenuate to rounded, apex acute-acuminate; upper surface drying olivaceous, largely glabrous but midrib and nerves late glabrescent; lower surface chocolate, contrasting in colour with upper surface, glabrescent but hairs 0.5 mm long, often (partly) persistent on midrib and nerves; dots absent; midrib slender (at transition of petiole 1.5 mm wide), raised above; nerves 16–19 pairs, raised above, glabrescent, lines of interarching flattish, indistinct; venation lax, indistinct, petiole 15–22 by 3.5–4.5 mm, late glabrescent; leaf bud 16–20 by 3.5–4.5 mm, with dense rusty hairs 0.5 mm long. *Inflorescences* behind the leaves, with dense woolly-shaggy hairs up to 0.6 mm long; in male: about 4 times branched, many-flowered, 10 by 10 cm, peduncle 1–2 cm long, the flowers in clusters of 2–6; in female: fewer-flowered, 4 by 3.5 cm; bracts pubescent, caducous; flowers with perianth 3-lobed, glabrous, pedicel towards base with hairs 0.1–0.2 mm, articulated. *Male flowers*: pedicel 1.5 mm long; buds globose, 1.2 mm diameter, cleft nearly 1/2, not collapsing on drying, lobes 0.2 mm thick, at base of perianth  $\pm$  fleshy-coriaceous, 0.5–0.6 mm thick; androecium including androphore  $\pm$  broadly obovoid, 0.6–0.7 by 0.6 mm, triquetrous in cross section (Plate 3: 71); thecae 10 or 12, at least the upper half free,  $\pm$  erect, 0.3–0.4

mm long; column deeply hollowed; androphore  $\pm$  tapering to the base, 0.3 mm long. *Female flowers*: pedicel 1.5(–2) mm long,  $\pm$  pubescent with hairs 0.1–0.2 mm; buds subglobose, 2.5 mm diameter, subglabrous, cleft slightly over 1/3; ovary broadly ovoid, 1.5 mm diameter, glabrous, stigma 0.3 by 0.6 mm, 2-lobed, the lobes shallowly 5- or 6-lobulate. *Fruits* not seen.

Field-notes — Buttresses thin, small, to 35 cm tall; bark pale ochre and brown-mottled, smooth. Flowers pale yellow.

Distribution — *Malesia*: Borneo (Sarawak: 1st Div.; two collections only).

Habitat & Ecology — Primary forest on yellow podzolic soil; c. 70 m altitude; fl. Nov.

Note — This species is close to *H. polyspherula*, which has smaller leaves with fewer lateral nerves and attenuate base. In *H. nervosa* the nerves on the upper leaf surface are strong and markedly raised, and midrib and nerves on both surfaces remain covered with indumentum for a long time.

#### 48. *Horsfieldia obscura* W.J. de Wilde

*Horsfieldia obscura* W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 44; Blumea 32 (1987) 468; Tree Fl. Sabah & Sarawak 3 (2000) 378. — Type: *Kostermans 13773*, E Kalimantan.

Tree c. 20 m. *Twigs* 2–3(–4) mm diameter, early glabrescent, hairs greyish brown to rusty, 0.1–0.2 mm long; bark finely striate, not flaking; lenticels not much contrasting. *Leaves* membranous, (elliptic-)oblong, 10–15 by 4–7 cm, base short-attenuate, apex short acute-acuminate; upper surface dark brown, lower surface pale or bright brown, glabrous; dots absent; midrib  $\pm$  flat above; nerves 10–13 pairs, thin and flat above, lines of interarching invisible; venation lax, very faint on both surfaces; petiole 11–15 by 1.5–2.5 mm, glabrous; leaf bud slender, 7–10 by 1.5–2 mm, with dense (grey-)rusty hairs 0.1–0.2 mm. *Inflorescences* behind the leaves, with  $\pm$  sparse hairs 0.1 mm; in male: 3 (or 4) times branched,  $\pm$  many-flowered, 7–10 by 5–8 cm, peduncle (0.2–)0.6–1.2 cm long; in female: 3.5 cm long (stout, as seen in infructescences); bracts caducous, not seen; flowers in male in clusters of 3–5, perianth 3- (or 4-)lobed, glabrous, pedicel glabrous or with some minute hairs towards the base, not or faintly articulated. *Male flowers*: pedicel 1–2 mm long, slender; buds subglobose, 2–2.2 by 2–2.3 mm, cleft 2/3–4/5, lobes 0.2–0.3 mm thick; androecium (depressed) globose-ovate, apex narrowly, base broadly rounded, 1 by 1–1.2 mm, in cross section (sub)circular (Plate 3: 85); thecae 16–20, almost completely sessile, free apices sometimes  $\pm$  sterile, up to 0.1(–0.2) mm long, concealing the narrow, 0.1–0.2 mm deep apical cavity of the column; androphore narrow, to 0.2 mm long, hidden by the anthers. *Female flowers* not seen. *Fruits* (of *S 36305*, see note 2) 2 or 3 in a short, stout infructescence, broadly ellipsoid, 5–5.5 by 3.5–4 cm, glabrous, with a few, small tubercles, pericarp 7–10 mm thick, perianth not persistent.

Field-notes — Trunk irregular; bark red-brown, rough, 5 mm thick, peeling off irregularly in strips; living bark 10 mm, red to brown-red; sap red; wood reddish to brown-red. Flowers (dark) yellow, smelling of Peru-balsam. Fruits bright orange.

Distribution — *Malesia*: Borneo (E Kalimantan, possibly Sarawak, see note 2), Philippines (Palawan).

Habitat & Ecology — Ridge forest on limestone, coral limestone, yellow sandy soil in lowland dipterocarp forest; 150–730 m altitude; fl. (E Kalimantan) Aug., Nov.; fr. (Sarawak) May.



Notes — 1. *Horsfieldia obscura* keys out beside *H. subalpina* (accepted for Borneo as subsp. *kinabaluensis* and restricted to the montane forest in the Kinabalu area). The latter differs from *H. obscura* in the more elongate male buds, cleft to nearly halfway, short-ellipsoid androecium, more rigid leaves, and smaller fruits with less thick pericarp. *Horsfieldia obscura* appears to be closely related to typical *H. subalpina*, from Peninsular Malaysia, which differs in habit (larger leaves, more distinct lenticels on twigs, larger inflorescences), in male flowers cleft to about halfway, and smaller fruits.

2. Some doubtful specimens in fruit, all from Borneo, key out beside *H. subalpina*, *H. obscura*, or *H. discolor*. These specimens are discussed by De Wilde (l.c.), and may represent new species.

#### 49. *Horsfieldia obscurinervia* Merr.

*Horsfieldia obscurinervia* Merr., Philipp. J. Sci., Bot. 12 (1917) 265; Enum. Philipp. Flow. Pl. 2 (1923) 182; W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 71. — Type: *FB 26503 (de Mesa & Magistrado)*, Philippines.

*Horsfieldia ramosii* Merr., Philipp. J. Sci. 17 ('1920', 1921) 254; Enum. Philipp. Flow. Pl. 2 (1923) 182. — Type: *BS 35047 (Ramos)*, Philippines.

Tree c. 11 m. Twigs 1.5–4 mm diameter, at first with greyish hairs less than 0.1 mm long, glabrescent; bark finely striate, not flaking; lenticels rather distinct. Leaves chartaceous, (oblong-)lanceolate, 5–14 by 2–4 cm, base attenuate, apex acute-acuminate; upper surface drying olivaceous to brown,  $\pm$  glossy, lower surface early glabrescent; dots absent; midrib flat or slightly raised above; nerves 7–15 pairs, slender, inconspicuous on both surfaces, lines of interarching inconspicuous; venation hardly visible; petiole 6–15 by 1–1.5 mm; leaf bud 6–10 by 1.5–2 mm, with hairs 0.1 mm long or less. Inflorescences subglabrous or with sparse hairs 0.1–0.3 mm long; in male: 2 or 3 times branched, rather few-flowered, 3–4 by 2–3 cm, peduncle 0.5–1 cm; bracts and bracteoles not seen, caducous; female not seen; flowers solitary or 2 or 3 together, glabrous, perianth 2-lobed, pedicel not articulated. Male flowers: pedicel slender, 1 mm long; buds slightly compressed, subobtriangular, 2 by 2.2 mm, apex rounded, base  $\pm$  cuneate, rather firm, not collapsing on drying, bright brown, cleft c. 1/2, lobes 0.2–0.3 mm thick; androecium  $\pm$  obtriangular or obovoid, narrowed to the base, slightly laterally compressed, thickish, 1.5 by 1.2 mm, column largely hollow; anthers 11 or 12 (i. e., 11 or 12 thecae on each side), almost completely connate (the free apices 0.1 mm), forming a deep thick-walled cup, the anthers on one side deeply inflexed and almost completely filling the cup (Plate 1: 7); androphore narrow, 0.1 mm long. Female flowers: not seen. Infructescences 2–3 cm long, once or twice branched, with 2–5 fruits. Fruits short-ellipsoid, 1.1–1.3 by 0.9–1.1 cm, glabrescent except for minute dendroid hairs at base (hence ovary pubescent), finely granulate, not tuberculate, drying (reddish) brown; pericarp 1–1.5 mm thick; fruiting pedicel 2–5 mm long; perianth not persistent.

Field-notes — Small tree. Flowers yellow.

Distribution — *Malesia*: Philippines (Luzon).

Habitat & Ecology — On low hills at c. 20 m altitude; fl. July; fr. Nov., Dec.

Note — Related to *H. parviflora* from the Moluccas, with an almost similar flower structure but differing in the larger membranous leaves, larger male perianths (2.5–4 mm width), 36–50 thecae, thinner-walled and deeper androecium cup, with the anthers usually inflexed at both sides of the androecium, and glabrous ovary and fruit.

**50. *Horsfieldia obtusa* W.J. de Wilde**

*Horsfieldia obtusa* W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 9; Tree Fl. Sabah & Sarawak 3 (2000) 379. — Type: BS 821 (Native Coll.), Sarawak.

Tree, height not recorded. *Twigs* terete or faintly angular, 2.5–4(–6) mm diameter, grey-brown, rather late glabrescent, hairs dark rusty, 0.2–0.4 mm long; bark coarsely striate, finely longitudinally cracking; lenticels small and inconspicuous. *Leaves* thinly coriaceous, oblong, 8–10 by 3–3.5 cm, base attenuate, apex rounded; upper surface glabrous (except midrib), dark olivaceous on drying, lower surface early glabrescent, purplish brown on drying, with pale yellowish enlarged hair scars, but dots absent; midrib moderately raised, late glabrescent above; nerves c. 10 pairs, ± flat above, lines of interarching regular, clearly visible; venation lax, hardly visible; petiole 10 by 2 mm, late glabrescent; leaf bud 12 by 3 mm, with dense dark rusty hairs 0.2–0.4 mm. *Inflorescences* behind the leaves, densely pubescent, hairs rusty, 0.2–0.4(–0.5) mm long; in male: about 3 times branched, many-flowered, 5–9 by 3–5 cm, peduncle 0.3–1 cm long, with flowers in clusters of 3–6; female not seen; bracts caducous; flowers glabrous, perianth 3- (or 4-)lobed, pedicel articulated. *Male flowers*: pedicel 1–1.5 mm long, slender; buds subglobose, 1.3–1.5 by 1.5–1.6 mm, cleft nearly 1/2, firm, not collapsing on drying, lobes at the apex 0.2 mm, at base 0.4 mm thick; androecium (including androphore) broadly obovoid, 0.8 by 1 mm, in cross section 3- (or 4-)quetrous (Plate 3: 67); thecae 18 or 20, suberect, 0.5 mm long, free in the upper half, acutish; androphore ± tapering to base, 0.3 mm long; column hollowed to about the base of the anthers. *Female flowers* and *fruits* not known.

Distribution — *Malesia*: Borneo (Sarawak; known only from the type, precise locality not indicated).

Habitat & Ecology — Not known.

Note — *Horsfieldia obtusa* obviously belongs in the group of species with *H. polyspherula* on account of the articulated pedicel and angular androecium with the distally free anthers. The species is distinguishable by generally flat nerves and rather large male flowers with 18 or 20 thecae. By the rather small coriaceous leaves with rounded apex it is reminiscent of *H. montana* which has quite different male flowers. *Horsfieldia xanthina* has similar large, pale yellowish hair scars on the leaves, but differs in other ways.

**51. *Horsfieldia olens* W.J. de Wilde**

*Horsfieldia olens* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 80. — Type: NGF 31966, Papua New Guinea.

Tree 10–35 m. *Twigs* 2–4 mm diameter, quadrangular by ridges from both sides of the petiole bases (lower down ridged or lined), early glabrescent, hairs greyish or brown 0.1 mm; bark striate, not flaking; lenticels usually distinct. *Leaves* chartaceous, oblong (–lanceolate), 7–14 by 2.5–6 cm, base attenuate, apex rounded, obtuse, or bluntly short-acute-acuminate, upper surface brown to blackish on drying, sometimes with few minute whitish dots or pustules; lower surface early glabrescent, hairs minute, 0.1 mm or less; dots absent but irregularly shaped pustules of a different nature present; midrib raised above; nerves 7–10 pairs, above and below thin, flattish, inconspicuous, lines of interarching regular, thin; venation lax, faint on both surfaces; petiole 12–20 by 1.5–2 mm;

leaf bud 6–10 by 1.5 mm, with hairs 0.1 mm long. *Inflorescences* glabrescent or with sparse hairs 0.1–0.2 mm, short and stout, 2 or 3 times branched, peduncle 0.1–1 cm long, rather many-flowered; in male and female (according to the infructescence): 2–6 by 1.5–4 cm, bracts not seen, caducous; flowers (male) in loose clusters of 3–5(–7), glabrous; perianth 3- (or 4-)lobed, pedicel slender,  $\pm$  articulated or not. *Male flowers*: pedicel 2.5–4 mm long; buds broadly ellipsoid to globose, not angular, 1.8–2.3 mm diameter, cleft c. 5/6 or nearly to the base, lobes 0.2 mm thick; androecium  $\pm$  obovoid, blunt-triangular in cross section, 1.5 by 1 mm (hence not filling the perianth) (Plate 1: 12); thecae 20–24, free apices 0.3–0.8 mm, incurved, those of one side clasping the others; column broad, hollowed for 1/4 to 1/3; androphore broad, up to 0.1 mm long. *Female flowers* not known. *Fruits* 2–6 per infructescence, ellipsoid, 1–1.6 by 0.8–1.2 cm, apex minutely pointed, base subattenuate, glabrous, without or with sparse small tubercles or lenticels; pericarp 1–1.5 mm thick; fruiting pedicel 1–4 mm long; perianth not persistent.

*Field-notes* — Sometimes with small stilt-roots; bark longitudinally fissured, (red-) brown or blackish brown, inside reddish, with some reddish exudate, with a very offensive smell or a strong disinfectant smell; wood whitish to yellow. Leaves  $\pm$  leathery, bluish green above (once recorded). Flowers yellow. Fruits orange(-yellow).

*Distribution* — *Malesia*: New Guinea (Papua Barat, Digul; Papua New Guinea, Western Prov.).

*Habitat & Ecology* — Swamp edges, in fringes (with *Acacia*) of savanna and rain forest; ridge forest; primary forest on level land inundated in the wet season, swampy forest on peaty soil; *Myrtaceae-Vatica-Campnosperma* forest on well-drained podzolic ground; 0–200 m altitude; fl. June; fr. Feb.–Aug.

*Note* — Apparently related to *H. sepikensis*, one of the few other New Guinean species with 3-lobed perianths. That species differs in non-angular twig apices, more elongate perianth, more slender inflorescences, membranous leaves, and apparently a different ecology. *Horsfieldia olens* is mostly found in dry or wet habitats on poor peaty or podzolic soils.

## 52. *Horsfieldia oligocarpa* Warb.

*Horsfieldia oligocarpa* Warb., Mon. Myrist. (1897) 354, t. 22; W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 22; Tree Fl. Sabah & Sarawak 3 (2000) 379. — *Myristica oligocarpa* (Warb.) Boerl., Handl. 3 (1900) 87. — *Horsfieldia polyspherula* (Hook. f.) J. Sinclair var. *oligocarpa* (Warb.) J. Sinclair, Gard. Bull. Sing. 28 (1975) 104. — Lectotype: *Beccari 2066* (FI acc. 7620), fr., Sarawak.

Tree 4–20 m. *Twigs* 2–3(–4) mm diameter, grey-brown, later on pale yellowish or whitish brown, contrasting with the dark colour of the dry petioles, early glabrescent, hairs 0.1 mm long; bark striate, not flaking; lenticels small, at first distinct. *Leaves* chartaceous, (elliptic-)oblong, 7–16 by 2.5–6 cm, base attenuate, apex acute-acuminate, upper surface glabrous, drying dull, olivaceous greenish, lower surface bright rusty or chocolate, much contrasting with the upper surface, glabrous; dots absent; midrib raised above, glabrous; nerves 8–11(–15) pairs, slender, raised above, lines of interarching and venation indistinct at both surfaces; petiole 6–12 by 1.5–2.5 mm, drying blackish brown; leaf bud 7–10 by 2–3 mm, with dense grey-rusty hairs 0.2 mm long, the indumentum

early shed in the form of small crust-like pieces. *Inflorescences* with sparse stellate hairs 0.2–0.3 mm long,  $\pm$  glabrescent; in male: 2 or 3 times branched, 3–6 by 1.5–4 cm, peduncle 0.5–1 cm long, few-flowered, the flowers in clusters of 3–8; in female (according to infructescences): 1.5–4 cm long; bracts not seen, caducous; flowers glabrous, perianth 3-lobed, pedicel articulated. *Male flowers*: pedicel 1–1.5 mm long, slightly tapering; buds globose to broadly obovoid, 1–1.7 mm diameter, base  $\pm$  rounded, coriaceous, not collapsing on drying, cleft nearly 1/2, lobes towards base to 0.5 mm thick; androecium (including androphore)  $\pm$  obovoid, 1 by 1 mm, triangular in cross section (Plate 3: 73); thecae 12 or 14, largely free, 0.5 mm long, apex acutish, at base attached to a short column continuous with tapering androphore 0.5 mm long. *Female flowers*: not seen. *Fruits* 1–4 per infructescence, ellipsoid, 1.8–2.7 by 1.4–1.9 cm, glabrous, drying (dark) brown, hardly lenticellate, pericarp 2–3 mm thick; fruiting pedicel 2–5 mm long; perianth not persistent.

Field-notes — Shrub or tree, buttresses absent; bark grey and dark brown, or reddish brown, fissures 0.8–1.3 cm wide, 22 cm long; inner bark pink brown, soft, 1 cm thick, sap red; sapwood pink-yellow, soft. Timber firm. Leaves pale green, dull, not glaucous beneath. Flowers light brown. Fruits pale yellow to orange, pear-shaped,  $\pm$  pointed at apex.

Distribution — *Malesia*: Borneo (Sarawak, Brunei).

Habitat & Ecology — Heath forest and forest on poor soils: white (podzolic) sand, yellow sand, sandstone, terraces, sand and peat, once recorded from a ridge; altitude 0–50(–100) m; fl. June, Aug.; fr. Aug.–Oct.

Note — Close to *H. polyspherula*, especially var. *polyspherula*, with fruits of about the same size. *Horsfieldia oligocarpa* stands out by the overall pale colour, the pale twigs, the leaves above a dull pale green on drying, contrasting strongly with the bright brown or copper lower leaf surface (more contrasting than usually in *H. polyspherula*), the small, not many-flowered,  $\pm$  glabrescent inflorescences, and the markedly coriaceous (? always) flowers.

### 53. *Horsfieldia pachycarpa* A. C. Sm.

*Horsfieldia pachycarpa* A. C. Sm., J. Arnold Arbor. 22 (1941) 64; W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 133, f. 20d–g. — Type: *Brass 610*, West New Guinea.

*Horsfieldia praetermissa* J. Sinclair, in sched. (*Carr 13262*, etc.).

Tree 5–25 m. *Twigs* faintly ridged or not, 3–5 mm diameter, early glabrescent, hairs 0.1 mm; bark coarsely striate, not flaking; lenticels usually coarse and distinct. *Leaves* membranous or thinly coriaceous, elliptic-oblong to lanceolate, 17–30 by 4–11 cm, base attenuate, apex acute-acuminate; upper surface usually minutely pustulate, lower surface early glabrescent; dots absent; midrib flattish above; nerves 14–18 pairs, flat above, inconspicuous, lines of interarching below not very regular, distinct or not; venation lax, indistinct; petiole 6–12 by 2–5 mm, leaf bud 10–15 by 2–3 mm, with hairs 0.1 mm. *Inflorescences* subglabrous or with sparse stellate hairs 0.1–0.2(–0.3) mm, 2–4 times branched; in male: 7–15 by 6–10 cm; in female up to 10 by 4 cm, peduncle 0.5–2.5 cm; bracts caducous, not seen; flowers in loose clusters up to 5, with sparse hairs 0.1 mm, sometimes glabrescent towards the apex, perianth 2-lobed, pedicel not articulated. *Male flowers*: buds short-pear-shaped, somewhat compressed, about as broad as long or slightly longer than broad, 2.5–3.2 by 2.8–3.2 mm, apex bluntish to broadly rounded, the lower

$2/3 \pm$  gradually passing into the thickish tapering pedicel 2–5 mm long, cleft c.  $1/2$ , lobes towards apex 0.2 mm thick, the perianth towards base thicker, firm-fleshy or coriaceous, 0.3–0.8 mm thick; androecium  $\pm$  flattened, 1.8–2.1 by 1.1–1.8 mm, apex broadly rounded (Plate 2: 35); thecae 10 or 12, (or 18 or 20?), erect, 1.5–2 mm long, free apical parts 0.1–0.2 mm; androphore rather slender, 0.2–0.5 mm long; column narrowly hollowed for  $1/6$ – $1/3$ . *Female flowers*: pedicel 2–4 mm long; buds ovoid-ellipsoid, 2.5–4 by 2.5–3.2 mm, cleft c.  $1/3$ ; ovary ovoid, densely minutely pubescent, 2.5–3 by 1.8–2.5 mm, stigma sessile, minutely 2-lobed, 0.1 mm. *Fruits* 1–6 per infructescence, (broadly) ellipsoid, often  $\pm$  ridged towards the base, rounded or tapering into a short pseudostalk, apex rounded, 3.5–4.5 by 2–3 cm, minutely pubescent towards the base, or glabrescent, drying blackish (brown), usually with conspicuous coarse, paler coloured lenticel-like tubercles; pericarp  $\pm$  woody, (4–)5–10 mm thick; fruiting pedicel 5–10 mm; perianth not persistent. — Fig. 12d–g.

*Field-notes* — Branches often horizontal; bark shallowly vertically fissured; exudate watery, clear or  $\pm$  reddish; wood pink, cream, or whitish. Flowers yellow, fragrant. Fruits ramiflorous, glossy green turning yellow to orange, eaten by cuscus.

*Distribution* — *Malesia*: New Guinea (W Papua Barat: Snow Mountains, Idenburg River.; Papua New Guinea: West Sepik, Western, Eastern, and Southern Highlands, Madang, Morobe, Central Provinces).

*Habitat & Ecology* — Primary and degraded montane forest, fagaceous (*Castanopsis-Lithocarpus*) forest; forest clearings; often on ridges; (450–)1000–2000 m altitude; fl. & fr. throughout the year.

*Notes* — 1. *Horsfieldia pachycarpa* differs from the resembling *H. tuberculata* in the thick woody-fleshy, largely pubescent perianth, and the pubescent ovary and fruit. Fruiting specimens may also resemble *H. laevigata*, a species obviously closely related. The male flowers of *H. pachycarpa* are  $\pm$  pear-shaped, and of a more fleshy-woody consistency; those of *H. laevigata* are much more globose, of a more membranous-herbaceous consistency, with the pedicel more slender.

On account of the somewhat resembling male flowers, *H. pachycarpa* seems related to *H. corrugata*, a species from similar montane habitats, differing in the much larger corrugated fruits and the flowers which probably always have large, thickened, blackish dots, absent in *H. pachycarpa*.

*Horsfieldia tuberculata* var. *crassivalva* (from the Louisiade Archipelago), known only from fruit with also a thick pericarp, is similar as well.

2. Some deviating specimens (almost all collected above 1000 m altitude) have been discussed by De Wilde (l.c.: 134); the female perianths measure 2–2.8 by 1.8–2.3 mm, the fruits 2.5–3.5 by 1.7–2 cm, and they have a thick woody pericarp. In appearance and size of the fruits these specimens seem intermediate with the widespread and common *H. laevigata*.

#### 54. *Horsfieldia pachyrachis* W.J. de Wilde

*Horsfieldia pachyrachis* W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 5. — Type: bb 28128, West Kalimantan.

Tree. *Twigs* 5–7 mm diameter, blackish brown, glabrescent, hairs rusty to grey-brown, 0.2 mm; bark of older twigs not seen; lenticels conspicuous. *Leaves* thinly chartaceous,

(obovate-)oblong, 16–26 by 6.5–9 cm, base (long-)attenuate, apex broadly acutish; upper surface drying olivaceous to blackish brown, glabrous, lower surface drying dark brown, early glabrescent but on the midrib towards the base vestigial hairs 0.2–0.3 mm; dots absent; midrib raised above, near the transition of the petiole 2.5–3 mm wide; nerves 14–17 pairs, raised above, lines of interarching not very distinct; venation lax,  $\pm$  flat, indistinct; petiole 7–11 by 3.5–4.5 mm; leaf bud 15 by 4 mm, with hairs 0.2 mm. *Inflorescences* behind the leaves, with dense or sparse dendroid hairs 0.2–0.3 mm, glabrescent; in male: stout and compact, 4 or 5 times branched, many-flowered, 14 by 10 cm (not fully expanded), the main axis stout, towards the base 5–8 mm diameter, length of peduncle not known (broken off); bracts caducous, those of uppermost ramifications  $\pm$  elliptic, subacute, densely pubescent, 3–5 by 2–4 mm; flowers in clusters of 4–10, perianth 3-lobed, glabrous, pedicel with sparse hairs 0.1–0.2 mm long towards base, articulated. *Male flowers* (submature): pedicel 1.5–2 mm long; buds broadly globose to broadly obovoid, 1.5 by 2 mm, apex broadly rounded, slightly depressed, base  $\pm$  narrowly rounded, glabrous, cleft nearly 1/2, hard-fleshy, not collapsing on drying, lobes 0.2–0.3 mm thick, perianth towards the base 0.5–0.7 mm thick; androecium subglobose-obovoid, 0.6 by 0.6 mm,  $\pm$  sharp-triangular in cross section (Plate 3: 65); thecae 10–14, slightly incurved, connate, concealing the apical cavity reaching to 1/4–1/2 of the column; androphore slightly tapering, 0.1–0.2 mm long. *Female flowers* and *fruits* not seen.

*Distribution* — *Malesia*: Borneo (W Kalimantan: Melawi, Bukit Kelawai, known only from the type).

*Habitat & Ecology* — Altitude 80 m; fl. May; no further ecological data known.

*Note* — The male flowers resemble those of the group of species with *H. polyspherula* (especially var. *sumatrana*) or *H. laticostata*, particularly the distinctly triquetrous androecium. However, in the *H. polyspherula*-group the (sub)erect anthers are mutually free for at least about halfway, whereas in *H. pachyrachis* the anthers are (almost) completely connate. In general habit and the colour of the leafy twig, *H. pachyrachis* somewhat resembles the *H. polyspherula*-group. The connate anthers (and the appearance of the leaves) point to the group of species keyed out around *H. fragillima*.

### 55. *Horsfieldia pallidicaula* W.J. de Wilde

*Horsfieldia pallidicaula* W.J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 191; Tree Fl. Sabah & Sarawak 3 (2000) 380. — Type: *Jacobs 5413*, Sarawak.

Tree 7–20 m. *Twigs* 2–10 mm diameter, pale, whitish or greyish brown, contrasting with the blackish drying colour of the petioles (which often are greyish and sometimes flaky in the lower half), early glabrescent, hairs grey-brown, 0.1–0.3 mm long; bark finely striate, slightly flaking or not; lenticels inconspicuous or absent. *Leaves* either in 2, 3, or 5 rows, membranous, oblong(-lanceolate), 10–30 by 4–9.5 cm, base long-attenuate, apex acute-acuminate; upper surface drying (blackish) brown, lower surface drying (grey-)brown, early glabrescent; dots absent; midrib slightly raised above, glabrous; nerves 10–18 pairs, slender, flat or slightly raised above, lines of interarching indistinct; venation lax, indistinct; petiole 10–25 by 1.5–3 mm; leaf bud stout or slender, 7–10 by 2–4 mm, with brown-grey or rusty hairs (0.1–)0.2(–0.3) mm long. *Inflorescences* generally behind the leaves, glabrescent, hairs sparse, 0.1–0.2 mm; in male: (2 or) 3 times

branched, many-flowered, 3–9 by 2.5–7 cm, peduncle up to 0.7 cm long (inflorescences often branched from near the base), the flowers in loose clusters of 2–4; in female: rather few-flowered, 1–3 cm long; bracts lanceolate, acute, finely pubescent, 1–3 mm long, caducous; flowers glabrous, perianth 3- or 4-lobed, in female sometimes 2-lobed, pedicel not articulated. *Male flowers*: pedicel 1–2 mm, slender; buds globose or broadly obovoid, 1.5–2(–2.2) mm diameter, base rounded to short-attenuate, cleft c. 1/3 to nearly 1/2, not or but slightly collapsing on drying, lobes 0.2–0.3 mm thick; androecium short-ellipsoid or depressed-globose, 0.8–1.2 by 0.8–1.2 mm, circular in cross section (Plate 2: 43); thecae 16–20, completely sessile (free apices 0.1 mm long), incurved towards the apex of the androecium; column broad with narrow apical cavity, 0.1–0.2 mm deep; androphore narrow, 0–0.2 mm long. *Female flowers*: pedicel 1–1.5 mm long; buds broadly ellipsoid or subglobose, 2.5–3 by 2.5 mm, cleft 1/4–1/3; ovary broadly ovoid, 1.7–2 by 1.5–2 mm, glabrous, stigma lobes 0.1–0.2 mm long. *Fruits* 1–5 per infructescence, broadly ellipsoid, 1.5–6 by 1–3 cm, glabrous, drying blackish, finely granulate and sometimes tubercled; pericarp variable; fruiting pedicel 1–3 mm long; perianth persistent under the fruits (always?) (see under the varieties).

Distribution — *Malesia*: Borneo (Sabah and Sarawak).

Note — The three varieties are sympatric and similar in the vegetative characters. They are mainly distinguished by the remarkable differences in fruit size, and hence flowering material cannot be named with certainty.

#### KEY TO THE VARIETIES

- 1a. Fruits 1.5–1.7 by 1–1.2 cm; pericarp 1–1.5 mm thick. Leaves up to 23 cm long . . . . . **c. var. microcarya**  
 b. Fruits larger, 2–6 by 1.8–3 cm . . . . . 2  
 2a. Fruits 2–2.2 by 1.8 cm; pericarp 2–3 mm thick. Leaves up to 25 cm long . . . . . **a. var. pallidicaula**  
 b. Fruits 3.7–6 by 2.7–3 cm; pericarp 6–8(–10) mm thick. Leaves 25–30 cm long . . . . . **b. var. macrocarya**

#### **a. var. pallidicaula**

*Leaves* 10–25 cm long, up to 7.5 cm wide. *Fruits* 2–2.2 by 1.8 cm; pericarp 2–3 mm thick; fruiting pedicel and perianth not seen.

Field-notes — Bark smooth, dark grey; sapwood white-red. Perianth yellow or yellow-green, androecium pale pink-yellow, pollen white.

Distribution — *Malesia*: Borneo (Sarawak, West Sabah; West Kalimantan, doubtful, see note 2).

Habitat & Ecology — Primary lowland and lower montane forest; sandstone; 0–700 m altitude; fl. throughout the year; fr. June.

Notes — 1. *Horsfieldia pallidicaula* vegetatively resembles the related species *H. sucosa* and *H. sterilis*, both essentially differing in the male flowers.

2. *Winkler 1435*, from West Kalimantan, deviates in the very thin membranous leaves which dry greenish; the flowers are smaller and differ in details (see De Wilde, l.c.: 193). The specimen was collected in a marshy forest at c. 50 m altitude.

**b. var. macrocarya** W.J. de Wilde

*Horsfieldia pallidicaula* W.J. de Wilde var. *macrocarya* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 193; Tree Fl. Sabah & Sarawak 3 (2000) 381. — Type: *Ding Hou 474*, Sarawak.

*Leaves* 23–30 by 6–9.5 cm. *Fruits* 3.5–6 by 2.5–3 cm; pericarp 6–8(–10) mm thick; fruiting pedicel 1–2 mm long, persistent perianth 2- or 3-lobed.

Field-notes — Bark smooth to ± flaky, or longitudinally fissured. Fruits and aril pink.

Distribution — *Malesia*: Borneo (Sarawak: 4th and 5th Div.).

Habitat & Ecology — Lowland mixed dipterocarp forest; yellow sandy clay soil; altitude 30–200 m; fr. July, Oct.

**c. var. microcarya** (J. Sinclair) W.J. de Wilde

*Horsfieldia pallidicaula* W.J. de Wilde var. *microcarya* (J. Sinclair) W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 193; Tree Fl. Sabah & Sarawak 3 (2000) 381. — *Horsfieldia bracteosa* Henderson var. *microcarya* J. Sinclair, Gard. Bull. Sing. 28 (1975) 20. — Type: *SAN 16971*, Sabah.

*Leaves* to 20 cm long, up to 7.5 cm wide. *Fruits* 1.5–1.7 by 1–1.2 cm; pericarp 1–1.5 mm thick; fruiting pedicel 2 mm long, persistent perianth 3-lobed.

Distribution — *Malesia*: Borneo (West Sabah, E Kalimantan).

Habitat & Ecology — Lowland forest at c. 100 m altitude; fr. July.

**56. *Horsfieldia parviflora* (Roxb.) J. Sinclair**

*Horsfieldia parviflora* (Roxb.) J. Sinclair, Gard. Bull. Sing. 28 (1975) 82; W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 69. — *Myristica parviflora* Roxb., Fl. Ind. 3 (1832) 847; (ed. 1874) 744; Icones 2574. — Type: Roxburgh's description and figure; Calcutta, culta.

*Myristica tingens* Blume, Rumphia 1 (1837) 190. — *Horsfieldia* sp. Merr., Int. Rumph. (1917) 231. — Based on *Palala minima*, *P. tertia*, *P. tingens* Rumph., Herb. Amb. 2, 10 (1741) 27, t. 7 f. A, B; see Sinclair, 1975: 161.

*Myristica globularia* Blume, Rumphia 1 (1837) 191, t. 64 f. 2 (non Lamarck). — *Pyrrhosa globularia* (Blume) Hassk., Cat. Pl. Hort. Bog. (1844) 174. — *Horsfieldia globularia* (Blume) Warb., Mon. Myrist. (1897) 288, t. 21 1–4. — *Palala globularia* (= *P. quinta*) Rumph., Herb. Amb. 2, 10 (1741) 28, t. 9 f. a–b; see Sinclair, 1975: 165. — Type: Blume's figure, and *Zippel s.n.* (Ambon, 'mas'), a sterile specimen.

*Myristica bivalvis* Hook. f., Fl. Brit. India 5 (1886) 107; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 307, pl. 139. — *Horsfieldia bivalvis* (Hook. f.) Merr., Philipp. J. Sci., Bot. 2 ('1916', 1917) 271; J. Sinclair, Gard. Bull. Sing. 16 (1958) 379, f. 32, pl. VIII-B. — Type: *Murton 149*, Java, culta.

*Horsfieldia globularia* (Blume) Warb. var. *minahassae* Warb., Mon. Myrist. (1897) 617. — *Horsfieldia minahassae* (Warb.) Koord., Meded. Lands Pl. Tuin 19 (1898) 70. — Syntypes: *Koorders 18123, 18124, 18146, 18164* (lecto), Sulawesi.

Tree 10–20 m. *Twigs* somewhat flattened but not angular, 2–5 mm diameter, glabrescent, hairs 0.1 mm; bark finely striate, not flaking; lenticels abundant, small, not conspicuous. *Leaves* membranous, (oblong-)lanceolate, 8–23 by 2.5–7.5 cm, base attenuate, apex acute-acuminate; upper surface drying olivaceous or brown, dull (sometimes with fine pale pustules or larger irregularly shaped marks), lower surface early glabrescent; dots absent; midrib flat above; nerves 10–15 pairs, flat, inconspicuous above, lines of interarching indistinct; venation fine, indistinct; petiole 6–16 by 1.5–2.5 mm; leaf bud 6–13 by 1–2 mm, with hairs 0.1 mm long. *Inflorescences* with sparse or dense hairs 0.1–0.3 mm; in both male and female: 3 or 4 times branched, many-flowered, 4–10



by 4–8 cm, peduncle 1–2 cm long; bracts pubescent, elliptic to oblong, 2–5 mm long, caducous; flowers in loose clusters of 2–4, perianth 2-lobed, glabrous or in female sometimes minutely pubescent at base, pedicel with sparse hairs 0.1 mm long or less, not articulated. *Male flowers*: pedicel slender, 1–2 mm long; buds somewhat laterally compressed, obtriangular to transversely ellipsoid, 2.2–3 by 2.5–4 mm, apex broadly rounded, at base short-attenuate, firm, not collapsing on drying, bright brown or with a grey-blue tinge, cleft c. 1/2, lobes (0.1–)0.2–0.3 mm thick; androecium transversely ellipsoid or  $\pm$  obtriangular, not or slightly laterally compressed, largely hollow, (1–)1.6–2.2 by 1.6–3 mm (Plate 1: 6); thecae 36–50, completely connate, forming a thin-walled cup, the anthers (sometimes only on one side of the androecium) completely inflexed from the middle and reaching nearly the bottom of the cup, free apices 0.1 mm; androphore narrow, 0.1–0.3 mm long. *Female flowers*: pedicel 1–2 mm, with sparse hairs 0.1 mm; buds ellipsoid, (2.5–)3–3.5 by 2.5 mm, cleft c. 1/3; ovary ovoid-ellipsoid, 2–2.3 by 1.5 mm, glabrous, style and stigma 2- (or 3-)lobed, 0.1–0.2 mm long. *Fruits* 2–10 per infructescence, ellipsoid to nearly globose, 1.1–1.6(–2) by 1–1.3 cm, glabrous, finely granulate, not or hardly tuberculate; pericarp 1–1.5 mm thick; fruiting pedicel 2–4 mm long; perianth not persistent.

Field-notes — Tree without buttresses; bark smooth or fissured; wood whitish. Flowers yellow, fragrant; anthers yellowish white. Fruits behind the leaves, yellow or light brown; aril bright red, once recorded as yellow (unripe?).

Distribution — *Malesia*: Sulawesi (including Kabaena I.), Moluccas (Seram, Ambon), Singapore (running wild in the Garden's Jungle of the Botanic Garden).

Habitat & Ecology — Forests; once on sandy loam; 0–600 m altitude; fl. & fr. throughout the year.

Notes — 1. *Elbert 3457* (Kabaena I., limestone; S Sulawesi) has rather large fruits, 1.6 cm long, with a distinct pseudostalk 1.5–2 mm long; fruit of *Darnaedi 2287* (S Central Sulawesi) is 2 cm long.

2. *Horsfieldia parviflora* is easily distinguishable by the smooth, rather inflated male buds,  $\pm$  obtriangular to transversely ellipsoid in lateral view, not collapsing on drying, usually of a bluish or reddish brown tinge.

### 57. *Horsfieldia paucinervis* Warb.

*Horsfieldia paucinervis* Warb, Mon. Myrist. (1897) 345, t. 22; Merr., Enum. Born. (1921) 268; J. Sinclair, Gard. Bull. Sing. 28 (1975) 93; W.J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 212; Blumea 41 (1996) 379, f. 1a–c; Tree Fl. Sabah & Sarawak 3 (2000) 381. — *Myristica paucinervis* (Warb.) Boerl., Handl. 3 (1900) 87. — Type: *Beccari 3279* (female fl.), Sarawak.

Fig. 24. Some taxonomically related *Horsfieldia* species. — *H. paucinervis* Warb. a. Habit of male flowering twig; b. longitudinally opened male flower and schematic section of androecium; c. twig with fruit. — *H. aff. gracilis* W.J. de Wilde. d. Twig with male inflorescence; e. male flower and section of androecium. — *H. gracilis* W.J. de Wilde. f. Twig with mature fruit; note persistent perianth. — *H. cf. gracilis* W.J. de Wilde. g. Male flower and section of androecium. — *H. reticulata* Warb. h. Male flower and section of androecium; i. fruit; note persistent perianth [a, b: *Purse-glove P 4403*; c: *Keßler 319*; d, e: *S 50154 (Paie)*; f: *S 16604 (Paie)*; g: *Wong KMW 1494*; h: *BRUN 5654*; i: *S 36018 (Chai)*]. — Scale bar for a, d, f, i = 2 cm; for b, e, g, h = 1 mm; for c = 1.2 cm.



Tree 3–8 m. *Twigs* 2–3 mm diameter, late glabrescent, hairs reddish to yellow-rusty, shaggy, 1.5–2 mm long; bark dark grey, striate, not cracking; lenticels inconspicuous. *Leaves* thinly chartaceous, elliptic(-oblong), 7–15 by 3–6.5 cm, base rounded to attenuate, apex acute(-acuminate); upper surface drying olivaceous or brown, glabrous, lower surface dull brown with persistent  $\pm$  sparse dendroid hairs of mixed size, 0.5–1 mm long; dots (or dashes) present (always?); midrib flat above, with persistent indumentum or late glabrescent; nerves 5–9(–11) pairs, flat or sunken, lines of interarching indistinct; venation hardly visible; petiole 6–12 by 1.5–2.5 mm, pubescent; leaf buds 8–10 by 3–4 mm, hairs 1(–2) mm long. *Inflorescences* with dense woolly hairs (0.7–)1–2 mm long; in male: many-flowered, 3 or 4 times branched, 5–9 by 3–5 cm, peduncle to 1.5 cm long; in female: 4–6 cm long; bracts caducous; flowers (in male several in loose clusters) glabrous, perianth 3-lobed, pedicel not articulated. *Male flowers*: pedicel slender, 0.5–1 mm long; buds subglobose, 0.8–1 by 1–1.4 mm, cleft c. 1/3 to nearly 1/2, lobes 0.1 mm thick; androecium small,  $\pm$  depressed-globose, 0.3–0.5 by 0.4–0.8 mm,  $\pm$  circular in cross section (Plate 2: 56); thecae 8 or 10, almost completely sessile, the tips incurved; column broad, with a minute apical hollow c. 1/5 deep, androphore narrow, somewhat tapering, 0.1–0.2 mm long. *Female flowers* (Warburg, l.c. & Sinclair, l.c.): pedicel 2 mm long, glabrous; buds ovoid-globose, 2 mm diameter, cleft slightly over 1/2; ovary subglobose, glabrous, stigma minute. *Fruits* (immature) oblong, obtuse at both ends, glabrous, 1 by 0.7 cm; fruiting pedicel 2 mm long; perianth persistent. — **Fig. 24a–c.**

Field-notes — Shrubs or slender trees; sap pale pink, watery. Flowers yellow.

Distribution — *Malesia*: Borneo (Sarawak: 1st, 2nd, 4th Div.; W Kalimantan).

Habitat & Ecology — Coastal kerangas and degraded forest on eroded white sand; 0–100 m altitude; fl. throughout the year.

Note — *Horsfieldia paucinervis* belongs to the group of species with pubescent leaves to which also belong *H. gracilis*, *H. reticulata*, *H. rufo-lanata*, *H. splendida*, and *H. tomentosa*; it seems especially related to *H. gracilis*.

### 58. *Horsfieldia penangiana* J. Sinclair

*Horsfieldia penangiana* J. Sinclair, Gard. Bull. Sing. 16 (1958) 408, f. 42; 28 (1975) 94; W. J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 52; Blumea 41 (1996) 379; Tree Fl. Sabah & Sarawak 3 (2000) 382. — Type: *Curtis 2406*, Peninsular Malaysia, Penang.

Tree 4–25 m. *Twigs* 1.5–2(–4) mm diameter, early glabrescent, hairs grey-brown, to 0.1 mm long; bark finely striate, not flaking; lenticels small, conspicuous or not. *Leaves* membranous to (thinly) coriaceous, (elliptic-)oblong, 5–12(–17) by 2–4 cm, base attenuate, apex acute-acuminate or rounded, upper surface drying olivaceous to blackish brown, lower surface early glabrescent; dots present (lens!); midrib flattish or raised above; nerves 8–11 pairs, flat, inconspicuous above, lines of interarching indistinct; venation lax, hardly visible; petiole 8–13 by 1–2 mm; leaf bud 6–9 by 1–1.5 mm, with dense greyish brown hairs 0.1 mm. *Inflorescences* with sparse hairs 0.1 mm; in male: 3 or 4 times branched, moderately to many-flowered, 2–7 by 1.5–4.5 cm, peduncle 0.2–2 cm long; in female (from infructescences): 2–5 cm long; bracts ovate-oblong, short-pubescent, 1.5–2.5 mm long, caducous; flowers in male in loose clusters of 2–5, glabrous, perianth 2–4-lobed, pedicel  $\pm$  articulated or not. *Male flowers*: pedicel 0.8–2 mm, slender, buds variable in shape, subglobose or ellipsoid,  $\pm$  circular to faintly triangular in

cross section, 1.2–1.8 by 1–1.5 mm, cleft c. 1/3–1/2, lobes 0.2 mm thick; androecium either broadly ellipsoid, globose, or depressed-globose, 0.6–0.7 by 1 mm, or mostly ellipsoid, 0.7–1.5 by 0.6–1.2 mm (Plate 3: 89); thecae 10–18(–20) or 24(–30), almost completely sessile, free apices to 0.3 mm, erect or slightly incurved, column with narrow shallow hollow, androphore up to 0.1 mm long. *Female flowers* not seen. *Fruits* 2–6 per infructescence, ovoid-ellipsoid, 1.1–2 by 0.9–1.6 cm, apex (narrowly) rounded, base rounded, glabrous, finely wrinkled or granulate, without tubercles; pericarp 1.5 mm thick; fruiting pedicel 3–4 mm long, articulated; perianth not persistent.

Distribution — *Malesia*: Sumatra, Peninsular Malaysia, Borneo (Sarawak, E Kalimantan); 2 subspecies.

Note — *Horsfieldia penangiana* can be recognized by the slender twigs with ± small, dotted leaves, very short hairs on leaf buds and inflorescences, globose or ellipsoid male buds, and by an ellipsoid androecium which is (sub)circular in cross section. In habit it resembles *Gymnacranthera eugeniifolia*. Sterile specimens may also recall *H. ridleyana*. Taxonomically *H. penangiana* seems close to *H. glabra*, especially its var. *javanica*.

#### KEY TO THE SUBSPECIES

- 1a. Leaf apex acute or acute-acuminate. — Sumatra, Peninsular Malaysia . . . . .  
 . . . . . a. subsp. **penangiana**  
 b. Leaf apex blunt or rounded. — Borneo . . . . . b. subsp. **obtusifolia**

#### a. subsp. **penangiana**

*Myristica griffithii* auct. non Hook. f.: King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 31, p.p., quoad Curtis 2406, 2458. — *Gymnacranthera farquhariana* (Hook. f. & Thomson) Warb. var. *griffithii* auct. non (Hook. f.) Warb.: Gamble, Mat. Fl. Malay Penins. 5, 23 (1912) 226, p.p.

*Leaf blades* elliptic-oblong, 6–12 cm long, apex acute or acute-acuminate. *Male buds* (2- or) 3- or 4-lobed, broadly ellipsoid or (sub)globose, 1.2–1.8 mm long, thecae 10–18(–20). *Fruits* 2 by 1.6 cm.

Distribution — *Malesia*: Sumatra, Peninsular Malaysia.

Habitat & Ecology — Primary dryland forest, ridge-top or montane forest; 0–1300 m altitude; fl. June; fr. Aug.

Note — Perianths are generally 3- (or 4-)lobed, but occasionally 2-lobed; the shape of the mature male bud is also variable, and the pedicel is articulated or not.

#### b. subsp. **obtusifolia** W.J. de Wilde

*Horsfieldia penangiana* J. Sinclair subsp. *obtusifolia* W.J. de Wilde, Blumea 41 (1996) 379; Tree Fl. Sabah & Sarawak 3 (2000) 382. — Type: S 47061 (*Awa & Othman*), Sarawak.

*Leaf blade* (elliptic-)oblong, 6–14(–17) cm long, apex blunt or rounded. *Male buds* 3-lobed, globose, (1.5–)2 mm diameter, thecae 24(–30). *Fruits* 1.5 by 1 cm.

Field-note — Almost mature male flower buds green; mature fruits dark green.

Distribution — *Malesia*: Borneo (Sarawak, E Kalimantan).

Habitat — Forest of ridge tops, hills; (50–)300–800 m altitude.

Note — Fruiting pedicels are articulated at the base, the male flower pedicels are partly articulated.

**59. *Horsfieldia perangusta* W.J. de Wilde**

*Horsfieldia perangusta* W.J. de Wilde, *Blumea* 41 (1996) 379. — Type: *KEP FRI 7934* (*Cockburn*), Peninsular Malaysia.

Slender tree, 10–12 m. *Twigs* 3(–4) mm diameter, at first with sparse, shaggy, dark rusty-red hairs 1 mm long, ± early glabrescent; bark dark brown, coarsely striate, not cracking, not or inconspicuously lenticellate. *Leaves* chartaceous or thinly coriaceous, elliptic-oblong, 20–25 by 7–10 cm, base cuneate, apex acute-acuminate; upper surface drying olivaceous, nearly glossy, below ± pale cinnamon, at first with ± sparse, ± appressed, shaggy pale hairs 0.5–1 mm, glabrescent except on and near the midrib and blade base, margin conspicuously rolled-in; dots absent; midrib sunken above, slender (appearing as a thin line); nerves 10–12 pairs, inconspicuous above, lines of interarching visible only below; venation ± invisible on both surfaces; petiole 17–20 by 3–4 mm, glabrescent; leaf bud 10 by 3 mm, with dense red-rusty hairs 1 mm long. *Inflorescences* (from infructescences) on the older twigs below the leaves (twig diameter 5–8 mm), sparsely branched, glabrous (glabrescent), 1–2 cm long. *Flowers* not known. *Fruits* 1–3 per infructescence, ellipsoid, 25–30 by 18–20 mm, apex blunt, base rounded; pericarp 2–3(–4) mm thick, ± glabrous, (possibly) with remnants of minute, rusty, scurfy hairs at very base (hence, ovary minutely pubescent); fruiting pedicel at first with sparse minute indumentum, 2 by 3 mm; seed ellipsoid, 20 by 14–15 mm, light brown; perianth not persistent.

Field-notes — Slender tree to 12 m, girth c. 35 cm; bark dark chocolate brown, smooth, rugose; slash inner bark red-orange, fibrous, laminated; slash wood white. Fruits orange, seed with a deep orange-red leathery aril.

Distribution — *Malesia*: Peninsular Malaysia (Pahang, Udu Endau Forest Reserve, compt. 285), known only from the type.

Habitat & Ecology — Ridge-top forest dominated by palms; 400 m altitude; fr. Mar.

Note — The present species possibly is close to *H. fulva*, which differs in its leaves becoming dull and finely wrinkled above on drying. *Horsfieldia perangusta* has conspicuously incurved blade margins, and a narrow line-shaped midnerve above. Flowers are not known. Male buds of *H. fulva* are conspicuously elongate, a feature uncommon in *Horsfieldia*.

**60. *Horsfieldia pilifera* Markgr.**

*Horsfieldia pilifera* Markgr., *Bot. Jahrb. Syst.* 67 (1935) 154; W.J. de Wilde, *Gard. Bull. Sing.* 38, 1 (1985) 121, f. 17j. — Type: *Ledermann 10450*, Papua New Guinea.

*Horsfieldia novo-guineensis* Warb., *Mon. Myrist.* (1897) 271, p. p. (*Hollrung 657*, syntype; lectotype = *Horsfieldia aruana*).

Tree (5–)10–20 m. *Twigs* lined or faintly ridged or not, 1.5–4(–10) mm diameter, early glabrescent, hairs grey to brown, 0.1 mm; bark striate, not flaking; lenticels mostly inconspicuous. *Leaves* membranous, elliptic to oblong-lanceolate, 7–27 by 2.5–8.5 cm, base attenuate, apex acute-acuminate; upper surface usually minutely whitish pustulate, lower surface glabrescent, hairs stellate, 0.1 mm long; dots absent; midrib hardly raised above; nerves 7–16 pairs, above thin, flat, lines of interarching faint; venation lax, faint on both surfaces; petiole 6–12 by 1.5–2.5 mm; leaf buds 10 by 1–2 mm, with hairs 0.1

mm long. *Inflorescences* with sparse or dense rather woolly hairs 0.1–0.3 mm; in male: 2–4 times branched, many-flowered, 5–12 by 4–8 cm, peduncle 1–2.5 cm; female 4–12 cm long; bracts 1–2(–3) mm long, caducous; flowers (male) in clusters of 2–5; perianth 2-lobed, with sparse or dense stellate hairs 0.1 mm long; pedicel slender, finely pubescent, not articulated. *Male flowers*: pedicel 1–2 mm long; buds little to much flattened, subcircular or slightly transversely or longitudinally elliptic, (1–)1.2–1.8 by 1.2–1.9 mm, apex broadly rounded, base rounded or short-attenuate, cleft 1/3–1/2, lobes 0.1 mm thick; androecium flattened, subquadrangular in outline, 0.7–1.2 by 0.6–1.1 mm, apex broadly rounded (Plate 1: 30); thecae 16–20, (sub)erect, sessile, free apices to 0.1 mm long, column narrowly hollowed for 1/5–1/4; androphore up to 0.1 mm, broadly attached. *Female flowers*: pedicel 2 mm long; buds broadly ellipsoid, 2.8 by 2.5 mm, cleft 1/2–2/3; ovary globose to ovoid, 1.5 by 1.3 mm, with hairs 0.1 mm or less, style and stigmas 0.1 mm long. *Fruits* (2–)5–20 per infructescence, globose or short-ellipsoid, 1.1–1.6 by 1.1–1.6 cm, glabrescent but with minute persistent hairs towards the base (lens!), without or with few tubercles; pericarp often ± woody, thickest at one side, 1–3 mm thick; seed ellipsoid; fruiting pedicel 1–5 mm long; perianth not persistent. — Fig. 22j.

Field-notes — Bark longitudinally fissured; sap watery, turning pink or red; wood straw to brown, of moderate weight and hardness. Flowers yellow. Fruits hard, glossy green, turning dark yellow, orange or red.

Distribution — *Malesia*: northern half of New Guinea (Papua Barat: Bird's Head, Japen I., Jayapura; Papua New Guinea: Sepik, Madang, Morobe Prov.).

Habitat & Ecology — Primary and degraded forest, on sandy loam soil, mixed forest with *Anisoptera* at c. 100 m; 0–1000 m altitude; fl. & fr. throughout the year. Fruiting once reported as very prolific.

Note — Close to *H. laevigata*, but noticeable for the smaller male buds and the smaller (sub)globose fruits without or with few (coarser and paler coloured) lenticel-like tubercles. The male buds are accepted as variable in outline, varying from lengthwise to ± transversely ellipsoid. The only known female flowers (*Schlechter 16933*) are somewhat smaller than those of *H. laevigata*, but they probably do not differ significantly in the two species. In fruit (sometimes globose) *H. pilifera* may be confused with *H. basifissa*, a species with quite different male flowers.

### 61. *Horsfieldia polyspherula* (Hook. f. emend. King) J. Sinclair

*Horsfieldia polyspherula* (Hook. f. emend. King) J. Sinclair, Gard. Bull. Sing. 16 (1958) 422, f. 47, pl. XII-B; W.J. de Wilde, Tree Fl. Sabah & Sarawak 3 (2000) 383. — *Myristica polyspherula* Hook. f., Fl. Brit. India 5 (1886) 108, p.p. (see notes by Sinclair, 1958: 425; 1975: 103). — Lectotype (Sinclair, 1975: 103): *Griffith 4354*, Peninsular Malaysia.

For more references and synonyms see the varieties.

Tree 4–35(–40) m. *Twigs* terete or subterete, 2–5 mm diameter, never lined or ridged, early or late glabrescent, hairs rusty, mealy, 0.1–0.6 mm long; bark finely or coarsely striate, neither cracking nor flaking, lenticels distinct or not. *Leaves* thickly membranous to chartaceous, very brittle, (elliptic-)ovate-oblong to oblong-lanceolate, 7–28 by 2.5–9 cm, base ± rounded or usually attenuate, apex acute-acuminate; upper surface drying olivaceous or (greenish) brown, lower surface light brown or chocolate-brown, usually much contrasting with the upper surface, early glabrescent but midrib often late

glabrescent; dots absent; midrib slender; nerves 6–15(–20) pairs, distinctly raised above, lines of interarching usually not distinct; venation lax, faint; petiole 6–15 by 1.5–3 mm, sometimes late glabrescent; leaf bud 6–17 by 1.5–3 mm, with rusty dendroid hairs 0.1–0.6 mm long. *Inflorescences* with sparse to dense woolly hairs 0.6 mm long, sometimes glabrescent; in male: 3–5 times branched, many-flowered, 4–15(–20) by 3–12 cm, peduncle 0.3–1.5 cm long, the flowers in clusters of up to 8 each; in female: few- to many-flowered, up to 8 cm long; bracts oblong to lanceolate, 1.5–7 mm long, densely pubescent, caducous; flowers with perianth 3-lobed, glabrous or glabrescent, pedicel glabrous or minutely pubescent towards the base, articulated. *Male flowers*: pedicel slender, sometimes tapering, 0.8–1.5(–2) mm long; buds globose or broadly obovoid, 1–1.8 mm diameter, apex (broadly) rounded, base rounded or  $\pm$  tapering into the pedicel, cleft  $1/2$ – $2/3$ , not collapsing on drying, lobes 0.2–0.4 mm thick, at base up to 0.6 mm thick; androecium (including androphore)  $\pm$  broadly obovoid in outline, 0.5–0.8 by 0.6–1 mm, triangular in cross section (Plate 3: 72); thecae (6 or) 8–14, free for at least halfway,  $\pm$  curved or suberect, 0.3–0.5 mm long, apex acutish, at base column short bowl-shaped, narrowed into  $\pm$  tapering androphore, (0.2–)0.3–0.4 mm long. *Female flowers*: pedicel 1–1.8 mm long, minutely pubescent; buds broadly ellipsoid-obovoid, 2–3 by 1.8–2.8 mm, glabrous or with sparse hairs 0.1 mm, cleft  $1/3$ – $2/3$ ; ovary ovoid-ellipsoid, 1.2–1.5 by 1–1.5 mm, glabrous, the stigma shallowly 2-lobed, 0.2–0.3 by 0.5 mm. *Fruits* 1–6 per infructescence, subglobose or ellipsoid, apex rounded, base rounded or slightly attenuate, 1.9–6 by 1.4–5 cm, glabrous, not lenticel-like tuberculate; pericarp 2–15 mm thick; fruiting pedicel 1–4 mm long; perianth not persistent.

Distribution — *Malesia*: Sumatra, Peninsular Malaysia, Borneo, Philippines (Luzon, Mindanao, Palawan; only var. *polyspherula*); 0–1100 m altitude.

Note — *Horsfieldia polyspherula* is a variable species of a complex to which belong closely related species such as *H. laticostata*, *H. oligocarpa*, and *H. tenuifolia* (all from Borneo), *H. brachiata* (Sumatra to Borneo), and *H. majuscula* (Peninsular Malaysia). Variability is found in the thickness of twigs, size and texture of leaves, density of indumentum on leaf buds and twig apex, and especially in fruit size and thickness of the pericarp. On the basis of mainly fruit characters, arbitrarily three rather heterogeneous varieties can be recognized. There are slight differences in the size of the male perianth, mainly on account of the varying thickness of its lobes; the number of thecae is possibly the same in all three varieties.

The anthers have two rather widely separated, almost mutually free thecae, giving the impression as if there are twice as many anthers than actually are present.

#### KEY TO THE VARIETIES

- 1a. Fruits (when dry) (3.5–)4–6 cm long, pericarp 5–15 mm thick. Male flowers not known. Leaves 9–20 cm long, nerves 9–15 pairs . . . . . **b. var. maxima**  
 b. Fruits up to 3.5 cm long, pericarp 2–5 mm thick . . . . . 2  
 2a. Fruits (2.5–)2.8–3.5 cm long. Male buds 1.2–1.8 mm diameter; thecae 12 or 14. Leaves 13–28 cm long, nerves 11–15(–20) pairs . . . . . **c. var. sumatrana**  
 b. Fruits (1.7–)1.9–2.5(–2.8) cm long. Male buds 1–1.5 mm diameter; thecae (6 or) 8–14. Leaves 7–19 cm long, nerves 6–15 pairs . . . . . **a. var. polyspherula**

**a. var. polyspherula**

*Horsfieldia polyspherula* (Hook. f. emend. King) J. Sinclair, Gard. Bull. Sing. 16 (1958) 422, f. 47, pl. XII-B; 28 (1975) 101, p.p., for the type variety only; W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 17; Blumea 41 (1996) 381; Tree Fl. Sabah & Sarawak 3 (2000) 384. — *Myristica polyspherula* Hook. f., Fl. Brit. India 5 (1886) 108, p.p. (see notes by Sinclair, 1958: 425; 1975: 103); King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 312, pl. 146, emend.

*Myristica globularia* auct. non Blume: Hook. f. & Thomson, Fl. Ind. (1855) 160; A. DC., Prodr. 14, 1 (1856) 202, p.p., for the specimens from Malacca.

*Horsfieldia lemnniana* auct. non (A. DC.) Warb.: Warb., Mon. Myrist. (1897) 326, p.p. (type of basionym *Myristica lemnniana* excluded).

*Twigs* 2–3 mm diameter; leaf buds covered with hairs (0.2–)0.3–0.6 mm long. *Leaves* 7–19 by 2.5–6 cm, lateral nerves 6–15 pairs. *Male buds* 1–1.5 mm diameter; thecae (6 or) 8–14. *Female perianth* 2–2.5 mm long. *Fruits* (1.7–)1.9–2.5(–2.8) by 1.4–2 cm, pericarp 2–4 mm thick.

*Field-notes* — Slender tree with narrow crown, the branches often almost in whorls; bark fissured, rarely flaky; inner bark yellow or reddish, fibrous; wood whitish to ochre-brown. Flowers at first jade-green, at anthesis (orange-)yellow with faint sweet odour when crushed. Fruits greenish yellow to orange.

*Distribution* — *Malesia*: Sumatra, Peninsular Malaysia, Singapore, Borneo (Sarawak, rare; Sabah, E Kalimantan), Philippines (Luzon, Mindanao, rare; Palawan).

*Habitat & Ecology* — Lowland forest, usually on sandy soils; also *Casuarina* forest (E Borneo), fresh-water swamp forest, ridge-top forest, kerangas (Sarawak, rare); altitude 0–900 m; fl. & fr. throughout the year, but most fl. collections June–Sept..

*Notes* — 1. The leaves, as in var. *sumatrana*, are usually brittle when dry and often fragmented in herbaria; they are usually greenish above and contrast well with the light to chocolate-brown colour of the lower surface. The hairs of the leaf buds and young twig apex are rather long, 0.2–0.6 mm, slightly longer than in the other varieties.

2. Because var. *polyspherula* is mainly characterized by its smaller fruits, it is often difficult to tell whether specimens with fruits just over 25 mm long belong to var. *sumatrana* or to var. *polyspherula*.

3. Specimens from kerangas in Sarawak may deviate by a stouter habit and less contrasting colour of the dry leaves.

**b. var. maxima** W.J. de Wilde

*Horsfieldia polyspherula* (Hook. f. emend. King) J. Sinclair var. *maxima* W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 22; Tree Fl. Sabah & Sarawak 3 (2000) 383. — Type: S 36228 (*Chai*), Sarawak, 7th Div.

*Twigs* 2–4 mm diameter; leaf buds covered with hairs 0.2–0.5 mm long. *Leaves* 9–20 by 3.5–7 cm, lateral nerves (6–)9–16 pairs. *Flowers* not seen. *Fruits* (3.5–)4–6 by 3–5 cm, pericarp (5–)8–15 mm thick.

*Field-notes* — Buttresses present or absent; bark with shallow boat-shaped fissures; inner bark pinkish; wood medium soft, whitish yellow. Fruits yellow to red.

*Distribution* — *Malesia*: Borneo (Sarawak, Brunei, Sabah, E Kalimantan).

*Habitat & Ecology* — Mixed forest, *Agathis* forest, kerangas; on sandy water-logged soil, sandy loam or yellow clay-loam; 50–500(–1000) m altitude; fr. throughout the year.



Note — This variety differs mainly in its conspicuously large and almost globose fruits with a very thick pericarp. It may be confused with *H. majuscula* from Peninsular Malaysia, which differs from *H. polyspherula* in the size of the male flowers (flowers of var. *maxima* are unknown), a different androecium, leaf colour, and somewhat in the fruits with a thinner pericarp.

Fruiting specimens of *H. polyspherula* var. *maxima* may also be confused with *H. punctatifolia*, which differs in its dotted leaves.

**c. var. *sumatrana* (Miq.) W.J. de Wilde**

*Horsfieldia polyspherula* (Hook. f. emend. King) J. Sinclair var. *sumatrana* (Miq.) W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 20; Tree Fl. Sabah & Sarawak 3 (2000) 384. — *Myristica glabra* Blume var. *sumatrana* Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 49. — *Horsfieldia brachiata* (King) Warb. var. *sumatrana* (Miq.) [J. Sinclair ex Whitmore, Tree Fl. Malaya 1 (1972) 325, nom. inval., basionym wrongly cited and without literature ref.] J. Sinclair, Gard. Bull. Sing. 28 (1975) 13, p.p. (excl. syn. *Horsfieldia majuscula* and *bartlettii*). — Type: *Korthals s.n.*, W Sumatra.

*Myristica integra* Wall., Cat. (1832) n. 6799, nom. nud.

*Myristica colletiana* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 312, pl. 147. — Syntypes: *King 3620, 3899* (lecto), *6672, 6737*, Peninsular Malaysia.

*Horsfieldia subglobosa* auct. non (Miq.) Warb.: Warb., Mon. Myrist. (1897) 328; Gamble, Mat. Fl. Malay Penins. 5, 23 (1912) 220; Ridl., Fl. Malay Penins. 3 (1924) 60; J. Sinclair, Gard. Bull. Sing. 16 (1958) 425, 426, f. 48–50, 51A–D, p.p. (excl. syn. *Horsfieldia majuscula*).

Twigs 2–4 mm diameter; leaf buds covered with hairs 0.1–0.4 mm long. Leaves 13–28 by 4.5–9 cm, lateral nerves 11–15(–20) pairs. Male buds 1.2–1.8 mm diameter, thecae 12 or 14. Female buds 3 mm long. Fruits (2.5–)2.8–3.5 by 2.2–2.7 cm, pericarp 3–5 mm thick.

Field-notes — Tree usually slender, bole straight, without buttresses; bark dark brown, smooth, shallowly to fairly fissured, sometimes flaky (strips 10–20 mm wide); inner bark reddish, fibrous, laminated, kino profuse, colourless then deep red; slash wood (sapwood) and cambium pale; heartwood pinkish. Flowers (waxy) yellow. Fruits glossy green turning (greenish) yellow, or orange.

Distribution — *Malesia*: Sumatra, Peninsular Malaysia, Singapore, Borneo.

Habitat & Ecology — Lowland mixed dipterocarp forest, ridge and montane forest, (peat) swamp forest, and kerangas; on sandy(-loamy) soils, red or yellow clayey soil; 0–1100 m altitude; fl. & fr. throughout the year.

Notes — 1. The hairs of the leaf buds in specimens from Sumatra (including the type of var. *sumatrana*) are quite short, 0.1 mm long; in specimens from Peninsular Malaysia and Borneo they are usually longer and rough, 0.4 mm long.

2. Specimens with fruits less than 30 mm long, smallish leaves, and rather slender twigs may be difficult to distinguish from var. *polyspherula*.

3. Specimens from East Kalimantan may deviate in habit by thinner, membranous leaves, which dry to a paler brownish colour; the flowers and fruits are not different, although Kostermans (*12613*) noted that the fruit is wine-red, a colour as yet unrecorded for other fruiting collections.

4. *King's collector (Goping) 6004* (syntype of *H. majuscula*, not the lectotype) and *Nur 34117* (both from Peninsular Malaysia, with male flowers) belong to the *H. polyspherula*-complex on account of the subglobose male buds and details of the androecium.

They agree with var. *sumatrana*, but differ by the larger buds, 1.8–2 mm diameter, with larger androecium, 1 by 0.8 mm; there are 10 or 12 thecae.

## 62. *Horsfieldia psilantha* W.J. de Wilde

*Horsfieldia psilantha* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 112. — Type: NGF 43642 (Womersley), male fl., Papua New Guinea, Long Island.

Tree 5–25 m. Twigs 3–6(–15, in fruiting twigs) mm diameter, glabrescent, hairs reddish or grey-brown, 0.1–0.3 mm; bark finely striate, not flaking, lenticellate. Leaves membranous, (oblong-)lanceolate, 20–40 by 4.5–12.5 cm, base attenuate, apex acute-acuminate; upper surface drying olivaceous, usually minutely pale-punctate; lower surface (late) glabrescent, hairs scattered, 0.1–0.3 mm, on and near the midrib; dots absent; midrib  $\pm$  flat above; nerves 14–24 pairs, thin,  $\pm$  flat above, lines of interarching  $\pm$  irregular but distinct; venation lax, indistinct; petiole 5–20 by 2–3.5 mm; leaf bud 20–25 by 2.5–3.5 mm, with hairs 0.1–0.3 mm. Inflorescences with sparse woolly stellate-dendroid hairs 0.2–0.4 mm; in male and female (from infructescences): 3 or 4 times branched, many-flowered, 10–16 by 8–12 cm, peduncle 1–4 cm; bracts not seen, caducous; flowers in loose clusters of 2–5, glabrous, perianth 2-lobed, pedicel slender, not articulated. Male flowers: pedicel 2–4.5 mm long; buds somewhat laterally compressed, subcircular, (2–)2.5–3 by (2.5–)3–3.5(–4) mm, apex broadly rounded, base rounded to short-attenuate, cleft 1/2–2/3; lobes 0.2–0.3 mm thick; androecium laterally much compressed, apex rounded-truncate, 1.4–1.8 by 1.5–2.2 mm (Plate 1: 28); thecae 24–28, mutually appressed, erect, free apices 0.1 mm; androphore up to 0.2 mm; column narrowly hollowed for 1/4–1/2. Female flowers not seen. Fruits up to 10 per infructescence, ellipsoid, 1.7–2.2 by 1.2–1.7 cm, with rusty hairs 0.2 mm long, sometimes only remaining at the very base; pericarp 1–2 mm thick, without or with scattered small lenticels or wartlets; fruiting pedicel 2–8 mm long; perianth not persistent.

Field-notes — Slender tree, branches often drooping, without or with a few buttress-roots; bark blackish or dark grey-brown, longitudinally fissured; inner bark cream or pink, exudate pink or colourless; sapwood straw- or cream-coloured. Flowers orange-yellow. Fruits yellow to orange.

Distribution — *Malesia*: NE Papua New Guinea (Madang Prov.: Bagabag I., Long I.; New Britain; New Ireland).

Habitat & Ecology — Forest, including beach forest, shaded degraded forest; altitude 0–200 m; fl. May & Oct.; fr. throughout the year.

Note — *Horsfieldia psilantha* is related to and resembles *H. laevigata*, *H. tuberculata*, and *H. whitmorei*. *Horsfieldia laevigata*, a variable and widespread species as well, always has hairy perianths, though sometimes only scattered hairs are present; it usually has smaller leaves, and the fruits usually have many more and coarser lenticel-like tubercles. *Horsfieldia tuberculata*, variable and widespread, has similarly glabrous flowers, but the shape of the perianth is more tapered at the base, while in the present species it is more circular in lateral view, with the base not or but slightly tapered; *H. tuberculata* furthermore has glabrous fruits and ovaries. The leaves of *H. whitmorei*, a species from the Solomon Islands, sometimes have similar, rather regularly looping, submarginal veins, and similar fruits, but the male perianth is smaller, only 2 mm diameter or less, cleft to c. 9/10, with the base and pedicel hairy.

### 63. *Horsfieldia pulcherrima* W.J. de Wilde

*Horsfieldia pulcherrima* W.J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 206. — Type: *FRI 8008* (Cockburn), Peninsular Malaysia.

Tree 7–27 m. Twigs 5–8 mm diameter, with dense felty to woolly rusty or reddish brown hairs 1–1.5 mm, late glabrescent; bark coarsely striate,  $\pm$  cracking and flaking; lenticels only in the older wood, large, not contrasting in colour. *Leaves* chartaceous, (elliptic-)oblong, (18–)24–36 by 8–14 cm, base rounded to attenuate, apex acute-acuminate; upper surface drying dull olivaceous to blackish brown, early glabrescent, lower surface with dense rusty or red-brown hairs 1–1.5 mm long; dots present; midrib slender, flat above, late glabrescent; nerves 18–23 pairs, slender, flat or sunken, lines of interarching not very distinct; venation lax, faint; petiole 15–25 by 5–7 mm, pubescent; leaf bud 25–30 by 7–9 mm, with hairs 1–1.5 mm long. *Inflorescences* behind the leaves, with dense  $\pm$  shaggy hairs 0.5–1.5 mm long; in male: 5–8 by 5 cm, many-flowered, 3 or 4 times branched, peduncle 0.2–1 cm long; in female: a short, irregularly shaped, woody knob (as in some *Knemas*), 1 cm long; flowers (male) solitary or in loose clusters of up to 15, glabrous, perianth 3- (or 4-)lobed, pedicel not articulated; bracts ovate-oblong, acute, densely pubescent outside, 3–7 mm long, caducous. *Male flowers*: pedicel 1–1.5 mm long, slender; buds somewhat depressed-globose, 1 by 1.2–1.3(–1.4) mm, cleft c. 1/3 to nearly 1/2, lobes 0.2 mm thick; androecium depressed-globose, at apex with a 3- (or 4-)radiate crack, 0.5–0.6 by 0.8–1 mm (Plate 2: 51); thecae 24 or 26, closely pressed, completely sessile, the apical parts overarching the apical hollow; column broadly saucer-shaped, with a broad hollow to  $\pm$  halfway; androphore narrow, 0.1–0.2(–0.3) mm long, largely hidden by the anthers. *Female flowers* (from remnants under fruits): 3 mm long, with sparse hairs 0.3 mm long, cleft nearly 1/2, lobes 0.3 mm thick; ovary pubescent. *Fruits* 1–3(–15) per infructescence, broadly ellipsoid to globose, 1.6–1.8 by 1.5–1.7 cm, with dense shaggy rusty hairs 2 mm long; pericarp  $\pm$  woody, 1.5 mm thick; seeds broadly ellipsoid, 10 mm long; fruiting pedicel to 1 mm long; perianth not persistent.

Field-notes — Slender tree, bole straight; bark grey-brown to blackish, shallowly fissured, occasionally flaking. Inner bark red, laminated, with some red exudate. Slash wood pale (yellow), wood brown. Fruits yellowish brown hairy.

Distribution — *Malesia*: Sumatra (Jambi), Peninsular Malaysia (Pahang, Johore).

Habitat & Ecology — Lowland primary forest, swamp forest; 50–600 m altitude; apparently a rare species; fl. Mar.; fr. June, Sept.

Notes — 1. When sterile, *H. pulcherrima* may be confused with *H. flocculosa*, *H. superba*, or *H. wallichii*, but the male flowers are quite different, similar to those of *H. grandis*. The species is peculiar because of its rather small, subglobose, densely tomentose fruits; in related species the fruits (and ovary) are glabrous.

2. *Horsfieldia pulcherrima* may superficially resemble and may be confused with the stout-leaved *Gymnacranthera bancana*, but the latter has a different indumentum, and lacks the blackish dots on the lower leaf surface.

### 64. *Horsfieldia pulverulenta* Warb.

*Horsfieldia pulverulenta* Warb., Mon. Myrist. (1897) 342, t. 23; Markgr., Bot. Jahrb. Syst. 67 (1935) 150 (sub *H. ralunensis*); W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 135. — *Myristica pulverulenta* (Warb.) Boerl., Handl. 3 (1900) 87. — *Horsfieldia hellwigii* (Warb.) Warb. var.

*pulverulenta* (Warb.) J. Sinclair, Gard. Bull. Sing. 28 (1975) 56, p.p., excl. *BW 12194* (Vink) = *Horsfieldia leptantha*. — Syntypes: *Beccari 759, 925*, Papua Barat, Bird's Head, Andai, Mt Arfak.

*Horsfieldia hellwigii* (Warb.) Warb. var. *hellwigii* × var. *pulverulenta* (Warb.) J. Sinclair, Gard. Bull. Sing. 28 (1975) 58. — Syntypes: *Saunders 202* (L lecto), *358, 398, 483*, Papua New Guinea.

Tree 15–25 m. Twigs 4–10 mm diameter, early to rather late glabrescent, hairs dark rusty, 0.5–1.2 mm; bark finely striate or not, not flaking, lenticels usually present. Leaves coriaceous, elliptic to oblong-lanceolate, 14–35(–40) by 4–10.5(–13) cm, base rounded or short-attenuate, apex acute-acuminate, often to 2(–3, in sapling shoots) cm caudate; upper surface drying dull olivaceous-brown, minutely rugose-pustulate, lower surface late glabrescent or with persistent ± evenly sized, spaced, rather harsh, dark brown hairs 1–1.5 mm long, when shed rough with thickened hair bases; dots absent; midrib ± flat above, late glabrescent, but indumentum usually persistent towards base; nerves 11–30 pairs, ± straight, 50–70° to the midrib, 5–15 mm apart, thin and sunken above, lines of interarching regular and prominent; venation lax, sunken and clearly visible above, giving the blade a ± bullate appearance; petiole 2–12 by 2.5–4.5 mm, not or hardly winged; leaf bud stout, 3–6 cm long, with harsh hairs 1–1.5 mm long. Inflorescences with woolly hairs 1–1.5 mm long, 2 or 3 times branched, rather many-flowered; in male and female: 4–10 by 2–9 cm, peduncle up to 1.5 cm long; bracts (broadly) ovate, acutish, 3–5 mm long, caducous; flowers ± solitary (in female) or in loose clusters of 2–6, perianth 2-lobed, with stellate(–dendroid) hairs 0.1–0.3 mm, pedicel slender, with coarse hairs 0.4–0.7 mm, not articulated. Male flowers: pedicel 2–3.5 mm long; buds somewhat compressed, in lateral view subcircular, 1.5–3 by 3–4 mm, the basal part thick and coriaceous, the remainder collapsed when dry and perianth then often saucer-shaped or wrinkled, above the anthers opening by a minute pore-like slit less than 1 mm wide; lobes and apical part of perianth 0.2(–0.4) mm thick; androecium consisting of a coriaceous ± ellipsoid column 0.8–1.1 mm long, with 2 small anthers, each 0.2(–0.3) mm at the apex (Plate 2: 36). Female flowers: pedicel (1.5–)3–5 mm long; buds broadly ellipsoid-ovoid, 3.8–4 by 3.5–4 mm, cleft 1/5–1/10, with a minute pore-like slit above the stigmas; ovary ovoid-subglobose, 2.5–3 by 2.5 mm, with dense hairs 0.1–0.3 mm; style erect, glabrous, 0.2–0.8 mm long; stigma 2-lobed, 0.2–0.3 mm long. Fruits 3–10 per infructescence, ellipsoid, apex acute, sometimes acuminate, 3–5 by 2–3 cm, minutely pubescent at least at the base, pericarp woody-coriaceous, 4–7 mm thick, usually with paler, small or coarse lenticels or tubercles; fruiting pedicel 2–7 mm long; perianth not persistent.

Field-notes — Bole with slight buttresses or not buttressed. Bark often strongly peeling in small, oblong, thin scales, black-brown. Wood whitish or straw, moderately hard and heavy. Flowers (greenish) yellow or orange-yellow. Fruits (greenish) yellow or yellow-brown.

Distribution — *Malesia*: New Guinea (Papua Barat: Bird's Head, Jayapura, Geelvink Bay, Mimika; Papua New Guinea: West & East Sepik, Madang, Western Prov.; also a deviating specimen from Gulf Prov.).

Habitat & Ecology — Lowland primary and (old) degraded rain forest, ridge-side or swamp forest; on clay, stony-sandy soil; 0–500 m altitude; fl. & fr. throughout the year.

Notes — 1. *Horsfieldia pulverulenta* belongs to the group with *H. hellwigii*, which has stout twigs, and conspicuous coarse hairs on the leaf buds and apex of twigs, (0.5–) 1–1.5 mm long. It is distinguished by its woody perianths, in male usually collapsed

around the small androecium. The androecium is deviating in shape within *Horsfieldia* and consists of an ellipsoid woody body, at the apex with only 2 apparently much reduced anthers (or thecae?) just below the apical pore-like slit of the perianth.

The female flowers of *H. pulverulenta* are larger than those of *H. hellwigii*.

2. *Schodde & Craven 4662* (Gulf Province, male flowers) deviates in non-coriaceous, woolly (not harsh) hairy leaves, and densely hairy perianths. The perianth is light brown on drying, not blackish brown as is usual in *H. pulverulenta*, and collapses only slightly; it has an androecium comparable to that of *H. pulverulenta*. The marginal nerve of the leaves loops very regularly, as in *H. pulverulenta*. The specimen may represent a separate taxon.

### 65. *Horsfieldia punctata* W.J. de Wilde

*Horsfieldia punctata* W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 37. — Type: *FRI 9014* (*Bur-gess*), Peninsular Malaysia.

Tree 10–25 m. *Twigs* 2.5–5 mm diameter, early or late glabrescent, hairs rusty, 0.1–0.4 mm long; bark coarsely striate, with a tendency to crack longitudinally and to flake; lenticels ± absent. *Leaves* coriaceous, (elliptic-)oblong, 4.5–12 by 2–5 cm, base (short-)attenuate, apex rounded to subacute; upper surface drying olivaceous-brown, lower surface rufous, glabrous, but midrib remaining pubescent for some time; dense dots present; midrib somewhat raised above; nerves 5–12 pairs, thin and almost flat above, late glabrescent, lines of interarching indistinct; venation invisible on both surfaces; petiole 6–12 by 1.5–2.5 mm, late glabrescent; leaf bud 7–13 by 2–3.5 mm, with dense grey-brown to rusty hairs 0.1–0.4 mm. *Inflorescences* with dense rusty hairs 0.2–0.3 mm; in male: usually twice branched, not many-flowered, 2–3 by 0.5–1 cm, peduncle 1 cm long; in female: once branched, 2–3 cm long, glabrescent; bracts elliptic-oblong, 1–3 mm, pubescent, caducous; flowers in male in clusters of 3–5, perianth 3-lobed, glabrous, pedicel towards the base with hairs 0.1 mm or less, not articulated. *Male flowers* (submature): pedicel 1 mm long, slender; buds globose, 0.8 by 0.8–1 mm, cleft (2/3–) 3/4, lobes 0.2 mm thick; androecium (depressed-)globose, 0.4–0.5 by 0.5 mm, ± circular in cross section (Plate 3: 82); thecae 10 or 12 (see note 1), sessile, towards the apex incurved and concealing a shallow, narrow, apical cavity in the column, 0.2(–0.3) mm deep; androphore narrow, 0.1 mm long. *Female flowers* not seen. *Fruits* 2–4 per infructescence, ovoid, 2–2.3 by 1.7–1.9 cm, glabrous, finely granulate; pericarp 1.5 mm thick; fruiting pedicel 2 mm long; perianth not persistent.

*Field-notes* — Bole straight, buttresses absent; bark deep- to mid-brown, grid-cracked with rather chunky scales or finely fissured with firm ridges, or bark thick and corky, finely longitudinally fissured; outer cut of slash bark brown, inner bark bright red, layered, separated by blade line; slash wood white to fawn, speckled red; exudate red, blood-like. Fruits greenish yellow, slightly glaucous.

*Distribution* — *Malesia*: Peninsular Malaysia (Cameron Highlands; Fraser's Hill, Genting, Gunung Bunga Bua).

*Habitat & Ecology* — Lower montane forest on granite, ridge forest; at c. 1000 m altitude; fl. Mar.; fr. Nov.

*Notes* — 1. The available flowers are clearly immature and hence the anthers are difficult to count; possibly there are c. 11 thecae and in reality only 5 or 6 anthers.

2. *Horsfieldia punctata* is obviously closely related to *H. glabra* from S Sumatra and Java, and to *H. montana*, *H. punctatifolia* and *H. subalpina*. *Horsfieldia montana* (from Borneo) is very similar in general habit as well as in male flowers and fruit shape, but lacks the characteristic dots on the leaves; *H. punctatifolia*, a species with a wider distribution in Sumatra, Peninsular Malaysia, and Borneo, differs in membranous leaves and larger fruits with a very thick-leathery pericarp. *Horsfieldia subalpina* also seems related, but lacks the leaf dots, has larger and less coriaceous leaves, and larger fruits. *Horsfieldia punctatifolia* has glabrous pedicels and in *H. subalpina* the pedicels are finely puberulous in the lower part, similar as in the present species. Generally *H. glabra* has a much shorter indumentum.

## 66. *Horsfieldia punctatifolia* J. Sinclair

*Horsfieldia punctatifolia* J. Sinclair, Gard. Bull. Sing. 16 (1958) 413, f. 44, pl. XI-B; 28 (1975) 105; W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 54; Tree Fl. Sabah & Sarawak 3 (2000) 384. — Type: SF 42211 (*Sinclair*) (= *Sinclair* 7987), fr., Singapore.

Tree 7–30 m. Twigs 2.5–4 mm diameter, early glabrescent, hairs grey-brown, up to 0.1 mm long; bark finely to coarsely striate, not flaking; lenticels conspicuous or inconspicuous. Leaves membranous, (elliptic-)oblong, 9–21 by 3–9 cm, base attenuate, apex acute-acuminate; upper surface drying dull olivaceous or dark brown, lower surface glabrous; scattered dots (0.1 mm diameter) present; midrib ± flat above; nerves 11–16 pairs, thin, flat above, lines of interarching not distinct; venation lax, hardly visible on both surfaces; petiole 10–17 by 1.5–3 mm, glabrous; leaf bud 8–12 by 1.5–2 mm, with dense grey-brown hairs up to 0.1 mm long. Inflorescences with sparse hairs up to 0.1 mm, or glabrescent; in male: about 3 times branched, rather many-flowered, 4–10 by 2–8 cm, peduncle 0.5–2 cm long; in female: about twice branched, 3–6 by 1.5–4 cm, fewer-flowered than in male; bracts ± oblong, 2–4 mm, short-pubescent, caducous; flowers in male in loose clusters of 2–5, glabrous, perianth 3- or 4-lobed, pedicel not articulated. Male flowers: pedicel 1–4 mm, slender; buds depressed-globose, 1.4–2 by 1.6–2.2 mm, cleft 3/4–4/5, lobes 0.2–0.3 mm thick; androecium depressed-globose to depressed broadly ovoid, 0.6–0.7 by 1–1.5 mm, nearly circular in cross section (Plate 3: 90); thecae 14–18, completely sessile (free apices up to 0.1 mm), the apices of anthers concealing the apical hollow, column broad with narrow hollow up to 0.2 mm deep, in Sumatra up to 0.4 mm deep; androphore narrow, 0.1–0.2 mm long. Female flowers: pedicel 1–2 mm long; buds ellipsoid, 2.8–3.5 by 2.5–3 mm, cleft c. 1/2; ovary broadly ovoid, 1.5–2 by 1.3–2 mm, glabrous, stigma irregularly 2-lipped, 0.2–0.3 mm high. Fruits 1–3 per infructescence, (broadly) ellipsoid, glabrous, 4.5–8 by 3–4.5 cm, drying blackish brown, without or with few small warts; pericarp 10–20 mm thick; fruiting pedicel 4–6 mm long; perianth not persistent.

Field-notes — With or without low-rounded or steep thick buttresses; bark ± smooth, shallowly fissured or cracked, or brittle-scaly; inner bark pinkish to red, with reddish watery exudate; cambium white; slash wood white, yellowish, or pinkish; heartwood dark brown. Perianth (bright) yellow, with a turpentine odour. Fruits yellow to red, apricot, orange(-brown) flushed pink; pericarp pink inside.

Distribution — *Malesia*: Sumatra (North, and E Coast Prov.), Peninsular Malaysia, Singapore, Borneo (Sarawak, Sabah; W, C & E Kalimantan).

**Habitat & Ecology** — Primary forest, including hillside, ridge-top, and pole marshy forest, and kerangas; on a variety of soil types including grey and brown soil, sandy clay, tertiary sandstone, dacite hill; 0–1100 m altitude; fl. & fr. throughout the year.

**Note** — *Horsfieldia punctatifolia* is characterized by the dots on the leaves, deeply cleft male buds, few anthers, and large fruits with thick pericarp.

### 67. *Horsfieldia ralunensis* Warb.

*Horsfieldia ralunensis* Warb, Mon. Myrist. (1897) 336; K. Schum., Notizbl. Bot. Gart. Berlin 2 (1898) 117; K. Schum. & Lauterb., Fl. Schutzgeb. Südsee (1900) 324; Markgr., Bot. Jahrb. Syst. 67 (1935) 150; W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 143. — Type: *Warburg 20709* (B lost, n.v.), New Britain (Neu Pommern), Gazelle Peninsula, Ralun.

Tree 5–18 m. *Twigs* 5–10 mm diameter, early or late glabrescent, hairs light rusty or yellow-brown, 0.5–1 mm long; bark finely striate, not flaking; lenticels present but not distinct. *Leaves* membranous, (oblong-)lanceolate, 30–60 by 7–11 cm, base nearly rounded or (short-)attenuate, apex long acute-acuminate, usually 1–2 cm caudate; upper surface drying dull olivaceous, minutely pale punctate-pustulate, lower surface with persistent pale brown rather soft dendroid hairs of variable size 0.5–1 mm, when shed not leaving thickened rough hair bases; dots absent; midrib flat above, glabrescent except at the very base; nerves 30–40 pairs, generally  $\pm$  straight, 8–15(–20) mm apart, thin and flat above, lines of interarching rather distinct,  $\pm$  irregularly looping; venation lax, indistinct; petiole 5–16 by 3–4 mm, not or hardly winged; leaf bud 4–6 cm long, with dense velvety hairs (0.5–)1 mm. *Inflorescences* with woolly hairs 1–1.5 mm long; in male and female: 2 or 3 times branched, rather many-flowered, 4–20 by 3–10(–12) cm, peduncle 0.5–5 cm long; bracts broadly ellipsoid, subacute, 5–10 mm long; flowers in loose clusters of 3–6, perianth 2-lobed, glabrous except at the very base, pedicel with hairs 0.3–0.8 mm long, not articulated. *Male flowers*: pedicel 1(–2) mm long; buds obovoid-ellipsoid, at apex  $\pm$  acute, 2–2.3 by 1.5–1.7 mm, cleft c. 1/4, lobes 0.2 mm thick. Androecium 1–1.1 by 1.2–1.3 mm, somewhat flattened, apex broadly rounded, column narrowly hollowed for c. 1/4 (Plate 2: 39); thecae 20–24, almost completely sessile, erect, mutually touching, 1–1.2 mm long, free apices c. 0.2 mm; androphore slender, 0.3–0.4 mm long. *Female flowers*: pedicel 1–1.5 mm; buds obovoid, 4 by 2.5–3 mm, cleft c. 1/4; ovary ovoid, 2 by 1.5 mm, with dense hairs 0.5 mm, style and stigmas minutely 2-lobed,  $\pm$  elongate, 0.2 mm long. *Fruits* 2–10 per infructescence, sub-ellipsoid, apex  $\pm$  obtuse, base broadly rounded, 2.5–3 by 1.5–1.9 cm, with hairs 0.5 mm long, and with lenticel-like tubercles; pericarp 3–5 mm thick; fruiting pedicel 1–3 mm long; perianth not persistent.

**Field-notes** — Small or medium-sized tapered understory or subcanopy tree, bole straight, sometimes slightly buttressed; branches horizontal but drooping apically; bark dark, mottled, or with short vertical fissures; wood straw, moderately soft. Inflorescences erect, flowers yellow. Mature fruits green or brown-green.

**Distribution** — *Malesia*: Papua New Guinea (W & E New Britain, Gazelle Peninsula; New Ireland).

**Habitat & Ecology** — Lowland rain forest; well-drained pumice terrain, sandy soil, ridge forest, at edge of swamp; 0–100 m altitude; fl. & fr. apparently not seasonal.

Note — Related to *H. hellwigii*, *H. leptantha*, and *H. pulverulenta*, the first also occurring in New Britain; *H. ralunensis* can be distinguished from *H. hellwigii* by the larger fruits, smaller and narrower male flowers (with a somewhat different androecium), and generally more elongate leaves.

### 68. *Horsfieldia reticulata* Warb.

*Horsfieldia reticulata* Warb., Mon. Myrist. (1897) 304, t. 22; Merr., Enum. Born. (1921) 268; J. Sinclair, Gard. Bull. Sing. 28 (1975) 107; W.J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 218; Blumea 41 (1996) 381, f. 1h, i; Tree Fl. Sabah & Sarawak 3 (2000) 385. — *Myristica reticulata* (Warb.) Boerl., Handl. 3 (1900) 85. — Type: *Beccari 3475*, Sarawak.

*Horsfieldia affinis* W.J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 217. — Type: *S 24718* (Wright), Sarawak.

Tree 7–20 m. Twigs 2.5–6 mm diameter, late glabrescent, hairs rusty, 0.5–1 mm long; bark striate, when old cracked but not flaking; lenticels absent or small and inconspicuous. Leaves membranous or chartaceous, rarely bullate, elliptic-oblong to lanceolate, 8–35 by 4–11 cm, base rounded to attenuate, apex acute-acuminate; upper surface drying (blackish) brown, glabrous, lower surface with (sub)persistent rather sparse (stellate or) dendroid hairs 0.5–1 mm long; dots absent; midrib ± flat above, often late glabrescent; nerves 9–20 pairs, slender, (sunken or) raised, lines of interarching regular, distinct; venation lax, faint or distinct; petiole (7–)12–20 by 2–4 mm, pubescent; leaf bud 10–15 by 3–4 mm, with dense hairs 0.5–1 mm. Inflorescences with dense shaggy hairs 0.5–2 mm long; in male: many-flowered, 4 or 5 times branched, 12–25 by 8–14 cm, peduncle 1.5–6 cm long; in female: fewer flowered than in males, 5–6 cm long; bracts triangular to oblong, acute, 3–9 mm long, densely pubescent, caducous; flowers in male in loose clusters of 2–6, glabrous, perianth 3- or 4- (or 5-)lobed, pedicel articulated. Male flowers: pedicel slender, 0.5–2 mm long; buds depressed-globose, 1.2–2 by 1.5–2 (–2.5) mm, cleft 1/4–1/3, lobes 0.1–0.2 mm thick; androecium (depressed) globose, slightly impressed at the centre, 0.6–0.8 by 1–1.5 mm (Plate 2: 59); thecae 20–24 (–30), completely sessile, incurved towards the apex; column broad, with hollow up to ± half-way; androphore slender or broad, 0.2–0.4 mm long, sometimes hidden by the anthers. Female flowers (from remnants under the fruits): buds 2.5–3 by 2–2.5 mm, cleft over half-way, lobes 3, probably with very weak indumentum. Fruits 4–7 per infructescence, ellipsoid, 2.3–2.7 by 1.7–2.1 cm, glabrous, with some paler wart-like tubercles; pericarp 1.5–2 mm thick; fruiting pedicel 3–4 mm long; perianth persistent. — Fig. 24h, i.

Field-notes — Small tree, crown pyramidal, buttresses absent; bark rough, dark brown, lenticellate; outer bark 1–2 mm thick, brown-red, inside red. Flowers dark or golden yellow, fragrant or with strong sweet smell of balsam of Peru. Fruits ramiflorous, in bunches behind the leaves, pinkish orange, ± sour, eaten by the Dayaks.

Distribution — *Malesia*: Borneo (Sarawak; Brunei; W, C, E & SE Kalimantan).

Habitat & Ecology — Forest on alluvial soils, riverbanks; sandy clay soil or ridges, sandstone; 0–600 m altitude; fl. May–Nov.; fr. July.

Notes — 1. *Horsfieldia reticulata* may be confused with *H. motleyi*, which differs in its inarticulated pedicels, much smaller pubescent flowers with a quite different androecium, the leaves dull olivaceous brown on drying, and sunken lateral nerves.

2. In *H. reticulata* the male flower, including the androecium, is very similar to that of *H. flocculosa*, *H. grandis*, and *H. tomentosa*, obviously all related species.



**69. *Horsfieldia ridleyana* (King) Warb.**

*Horsfieldia ridleyana* (King) Warb., Mon. Myrist. (1897) 331; Gamble, Mat. Fl. Malay Penins. 5, 23 (1912) 221; Ridl., Fl. Malay Penins. 3 (1924) 60; Burkill, Dict. Econ. Prod. Malay Penins. (1935) 1199; J. Sinclair, Gard. Bull. Sing. 16 (1958) 432, f. 52; 28 (1975) 108; W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 7; Tree Fl. Sabah & Sarawak 3 (2000) 386. — *Myristica ridleyana* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 311, pl. 145. — Syntypes: *Cantley 1798*; *King's coll. 10917*; *Scortechini 862* (male fl., lecto), Peninsular Malaysia.

*Horsfieldia kerangasicola* J. Sinclair, in sched. (Borneo material).

Tree 5–25 m. Twigs sometimes  $\pm$  angular, 1.5–3.5(–5) mm diameter, early glabrescent, with rusty hairs 0.2–0.4 mm long; bark finely to coarsely striate, not flaking; lenticels either small and distinct, or absent. Leaves thinly chartaceous to coriaceous, elliptic-oblong to lanceolate, 5–15(–16) by 2–4.5 cm, base attenuate, apex (acute-)acuminate; upper surface glabrous, drying olivaceous-brown, lower surface glabrous, light brown or reddish brown, sometimes contrasting with upper surface; dots absent; midrib flat, sunken or slightly raised above, inconspicuous; nerves 7–15 pairs, sunken or  $\pm$  flat above, inconspicuous; venation lax, faint; petiole 7–15 by 1.5–2.5 mm, early glabrescent; leaf bud 6–14 by 1–2 mm, with dense hairs 0.2–0.5 mm long. Inflorescences with sparse hairs 0.1–0.3 mm, sometimes glabrescent; in male: 3 (or 4) times branched, rather many-flowered, 2–6 by 2–4 cm, peduncle (0.2–)0.5–1.5 cm long, the flowers in loose clusters of 3–6; in female: fewer-flowered, 1.5–4 cm long; bracts oblong-lanceolate, 2–4 mm long, caducous; flowers glabrous, perianth 3- or 4- (rarely 2-)lobed, pedicel slender, articulated. Male flowers: pedicel 1–2 mm long; buds subglobose or short-ellipsoid, 1–1.2 by 0.8–1.3 mm, base rounded or short-attenuate, cleft c. 1/3 to nearly 1/2, not or slightly collapsing on drying, lobes 0.2–0.4 mm thick; androecium (including androphore) broadly obovoid, 0.6–0.8 by 0.4–0.7 mm, in cross section 3- or 4-angular (or  $\pm$  ellipsoid in 2-lobed flowers) (Plate 3: 66); thecae 8–12, mutually almost entirely free (Peninsular Malaysia, Borneo), or free only for nearly the upper half (part of the material from Peninsular Malaysia), suberect,  $\pm$  acute, 0.3–0.4 mm long; androphore  $\pm$  tapering, nearly as long as the anthers, 0.2–0.4 mm long. Female flowers: pedicel 1–2 mm long; buds ellipsoid, 1.5–1.8 by 1.5 mm, cleft 1/3 to nearly 1/2; ovary ellipsoid, 1.2–1.3 by 0.6–0.7 mm,  $\pm$  grooved at one side, glabrous, stigma shallowly 2-lipped, 0.1–0.2 by 0.6 mm. Fruits 1–6 per infructescence, ellipsoid, 1.5–2 by 1–1.4 cm, glabrous, without lenticel-like tubercles; pericarp 1.5 mm thick; fruiting pedicel 2–5 mm long; perianth not persistent.

Field-notes — Slender or crooked trees, once with many buttresses; bark dark brown to red brown, shallowly (rectangular) fissured, cracked, flaky, or dippled; slash bark reddish, fibrous, laminated; sapwood pale, creamy pink. Flowers yellow; stamens pink; ovary pale green. Fruits glossy, green turning yellow-green.

Distribution — *Malesia*: Peninsular Malaysia (Perak, Kelantan, Trengganu, Pahang, Selangor, Malacca), Borneo (Sarawak, Brunei, Sabah); apparently not in Sumatra (see note 3).

Habitat & Ecology — Forest on poor soils: heath forest (with *Dacrydium beccarii*), *Gymnostoma*-forest, kerangas, ridge-forest, quartzite conglomerate-ridges; sandstone with very shallow soil, with *Gymnostoma*, *Tristania*, *Cotylelobium*; sandstone ridges with *Dipteris*; sandstone summits with *Dacrydium*; 0–1100 m altitude; fl. throughout the year, in Borneo most collections June–Oct.; fr. throughout the year.

Notes — 1. Some collections from Pahang have proportionally many 2-lobed flowers in the inflorescences. Such flowers slightly differ in a shorter androecium which is not conspicuously triquetrous but rather subellipsoid in cross section, with shorter androphore.

2. Specimens from Peninsular Malaysia generally have less coriaceous leaves and a thicker indumentum on the leaf buds (0.4 mm) as compared with most of the specimens from Sarawak, Brunei, and Sabah. Specimens from Borneo generally occur in heath forest or kerangas, those from Peninsular Malaysia grow on ridges and hill slopes.

3. The only (sterile) specimen (*bb 6479*) from Sumatra may represent *H. ridleyana*, but it also may be *H. triandra*.

4. Vegetatively *H. ridleyana* may be confused with *H. penangiiana*. In Borneo *H. ridleyana* may resemble *H. oligocarpa*, but the latter has distinctly raised nerves on the upper leaf surface.

## 70. *Horsfieldia rufo-lanata* Airy Shaw

*Horsfieldia rufo-lanata* Airy Shaw, Kew Bull. 1939, n. 10 (1940) 440; J. Sinclair, Gard. Bull. Sing. 28 (1975) 111; W.J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 216; Tree Fl. Sabah & Sarawak 3 (2000) 387. — Type: *Richards 1667*, Sarawak.

Tree 8–17 m. Twigs 3.5–5 mm diameter, late glabrescent, hairs dark rusty to reddish brown, 1–1.5 mm long; bark coarsely striate, later on  $\pm$  longitudinally cracking, not flaking; lenticels indistinct. *Leaves* chartaceous, sometimes slightly bullate, elliptic to oblong, 10–23 by 5–10(–12) cm, base nearly rounded to subattenuate, apex (acute-)acuminate; upper surface drying olivaceous-brown, glabrous except for the nerves, lower surface with dense to sparse, rather harsh hairs of variable size (ranging from sessile-stellate, 0.3 mm, to short-armed dendroid emerging hairs up to 1.5 mm long); dots absent; midrib  $\pm$  raised above, late glabrescent; nerves 11–16 pairs, raised, pubescent or late glabrescent, lines of interarching distinct, regular; venation lax, sunken, distinct or not; petiole 10–16 by 3–4.5 mm, pubescent; leaf bud 15–20 by 3–5 mm with hairs 1–1.5 mm. *Inflorescences* with dense woolly-shaggy hairs 2–3 mm long; in male: many-flowered, 3 or 4 times branched, 8–12 by 5–7 cm, peduncle 1.5–3 cm; in female: few-flowered, 3 cm long; bracts densely shaggy pubescent, oblong-triangular to lanceolate, 3–8 mm long; flowers in male rather few-flowered in loose clusters, glabrous, perianth 3- or 4-lobed, pedicel indistinctly articulated. *Male flowers*: pedicel rather stout, 0.5–1 by 0.5 mm; buds subglobose, 2 by 2.3 mm, rather firm, cleft nearly 1/2, lobes 0.2(–0.3) mm thick; androecium globose, 1.2 mm diameter (Plate 2: 58); thecae c. 30 (closely appressed), completely sessile, incurved towards apex; column broad, with small apical hollow to c. 1/5; androphore slender, 0.2 mm long. *Female flowers* not known. *Fruits* 2–4 per infructescence, broadly ovoid-ellipsoid, 2–2.2 by 1.5–1.6 cm, glabrescent, with remnants of minute hairs 0.1 mm at the base, without distinct lenticels or tubercles, pericarp 2 mm thick; fruiting pedicel 1–3 mm long; perianth not persistent.

Distribution — *Malesia*: Borneo (Sarawak: 4th & 5th Div.; Sabah).

Habitat & Ecology — Montane forest, upper dipterocarp forest on sandstone; altitude 900–1400 m; fl. June, Sept.; fr. Sept.

Note — A montane species closely related to *H. splendida* and especially to *H. reticulata*. *Horsfieldia rufo-lanata* differs in the longer woolly hairs of the inflorescences,

the almost globose (not depressed-globose) male perianth, the near-globose androecium, more thecae, 26–30(–40) as against 20–24 and 16–20 in *H. reticulata* and *H. splendida*, respectively. The nerves on the upper leaf surface of *H. rufo-lanata* apparently remain pubescent for a much longer time, and are generally raised; in contrast with *H. splendida*, the blades are usually smaller and more elliptic and have stiffer hairs on the lower surface; *H. reticulata* has a much less conspicuous indumentum on the lower leaf surface.

### 71. *Horsfieldia sabulosa* J. Sinclair

*Horsfieldia sabulosa* J. Sinclair, Gard. Bull. Sing. 27 (1974) 133; W.J. de Wilde, Gard. Bull. Sing. 38 ('1985', 1986) 185, f. 22; Tree Fl. Sabah & Sarawak 3 (2000) 387. — Type: *Sinclair & Kadim 10491*, Brunei.

Tree 10–37 m. *Twigs* stout, with wart-like thickenings marking the leaf scars, (3–)5–10(–20) mm diameter, rather late glabrescent, hairs grey-brown to rusty 0.5–1(–1.5) mm long; bark grey-brown, lower down grey-blackish, rough, longitudinally cracking and often  $\pm$  flaking; lenticels inconspicuous. *Leaves* in 3–5 rows, generally clustered towards the apex of the twigs, coriaceous, elliptic-oblong to (sub)lanceolate, 9–21 by 2–6 cm, base attenuate, apex acute(–acuminate); upper surface of mature leaves glabrous,  $\pm$  glossy or not, olivaceous-brown, lower surface pale brown, early glabrescent;  $\pm$  round to line-shaped dark brown or blackish dots present; midrib flat, glabrous above; nerves 12–20 pairs, flat above and below, lines of interarching invisible; petiole long in proportion to the blades, 25–50 by 2–4 mm, late glabrescent, hairs 0.5–1.5 mm; leaf bud stout, 10–15 by (3–)4–5 mm, with dense grey-brown to rusty hairs 0.5–1.5 mm long. *Inflorescences* behind the leaves, with dense hairs 1–1.5 mm long; in male: 2 or 3 times branched, many-flowered, 10–13 by 5–6 cm, the peduncle 1.5–2.5 cm long; in female:  $\pm$  fewer-flowered, 3–5 cm long; bracts elliptic to lanceolate,  $\pm$  boat-shaped, 4–15 mm long, with dense hairs 0.5–1.5 mm, glabrous inside, late caducous; flowers in loose clusters of 5–10, glabrous; perianth 3- (or 4-)lobed, pedicel articulated. *Male flowers*: pedicel 1.5 (–2) mm long; buds (depressed-)globose, 2 by 2–2.3 mm, cleft (1/2–)1/3, not collapsing on drying, the lobes 0.2 mm thick; androecium  $\pm$  globose, 1–1.2 by 1.7–1.8 mm (Plate 2: 40); thecae 24(–30),  $\pm$  completely sessile, column broad with shallow apical cavity; androphore narrow, 0.2 mm long. *Female flowers* (Sinclair, l.c.: 134): immature ovary glabrous. *Fruits* 1–6 per infructescence, ovoid, 3–5 by 2.5–4 cm, glabrous, drying dark brown or somewhat bluish black, not warted; pericarp hard, 5–8(–10) mm thick; fruiting pedicel 2–8 mm long; perianth not persistent. — **Fig. 25.**

*Field-notes* — Tall tree, buttresses absent; bark dark grey, longitudinally fissured; sap red, copious; inner bark reddish brown, laminated, fibrous; sapwood soft, pinkish, with a hollow centre 2.5 cm wide. Leaves glossy above, very glaucous beneath, midrib greenish yellow. Fruits yellow, inside apricot; ramiflorous with many fruits on each branch.

*Distribution* — *Malesia*: Borneo (Sarawak: Serian and Bintulu District, Mulu National Park; Brunei; Sabah: Sipitang).

*Habitat & Ecology* — Mixed forest on sandy or peaty soil, deep yellow sands, sandy loam, or heavy yellow clay soil; in *Agathis* forest, ridge forest; 0–100 m altitude; fl. May–July; fr. May–Dec.

Notes — 1. A very characteristic species on account of its thick twigs with bunched leaves, the latter with long petioles in (3–)5 rows, ramiflorous. *Horsfieldia wallichii* has similar fruits, and almost similar dark brown dots on the lower leaf surface.

2. According to Koster & Baas (Blumea 27, 1981, 152) the leaves are unique in having an iso-bilateral mesophyll.

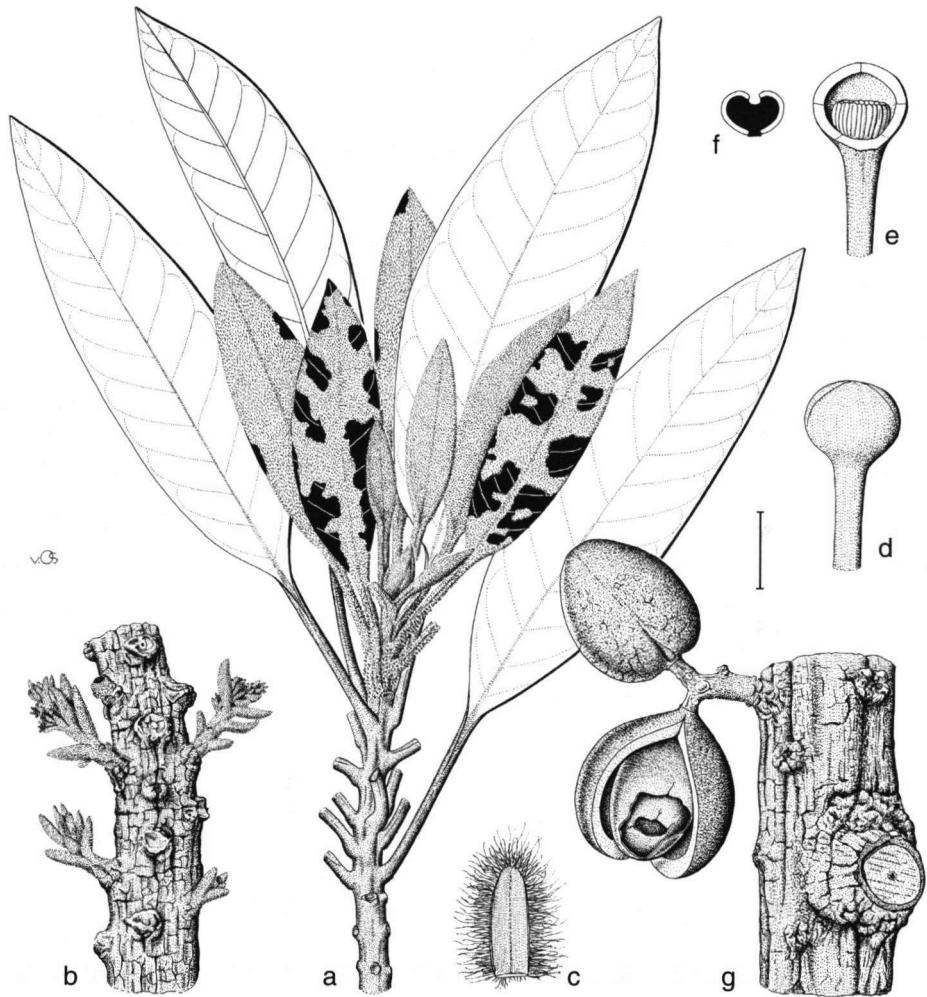


Fig. 25. *Horsfieldia sabulosa* J. Sinclair. a. Shoot apex with densely bunched leaves with dispersed phyllotaxis; indumentum of young leaves partly fallen; b. older wood with leaf scars in dispersed phyllotaxis and immature male inflorescences; note bracts; c. smaller bract; d. immature male flower, lateral view; e. ditto, longitudinally opened, showing androecium; f. longitudinal section of androecium, schematic; g. old wood with infructescence, fruits mature, seeds completely covered by aril [a–f: SAN 15146; g: BRUN 0828]. — Scale bar for a, b, g = 2 cm; for c–f = 0.85 mm.

**72. *Horsfieldia samarensis* W.J. de Wilde**

*Horsfieldia samarensis* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 76. — Type: *PNH 147374* (Gutierrez), Philippines, Samar I.

Tree 5 m. *Twigs* 1.5–3.5 mm diameter, early glabrescent, hairs greyish, less than 0.1 mm; bark finely striate, not flaking; lenticels rather inconspicuous. *Leaves* membranous, (oblong-)lanceolate, 7–11 by 2–3 cm, base attenuate, apex acute-acuminate, upper surface drying dull olivaceous, lower surface bright brown, early glabrescent, hairs sparse, less than 0.1 mm; dots absent; midrib slightly raised above; nerves 10–13 pairs, above slender, flat; lines of interarching faint though regularly looping; venation inconspicuous on both surfaces; petiole 8–10 by 1–1.5 mm, leaf bud 10 by 1 mm, with hairs less than 0.1 mm. *Inflorescences* glabrescent or thinly set with stellate hairs 0.1 mm or less, slender; in male: 2 or 3 times branched, 3–4 by 1.5–2.5 cm, rather few-flowered, peduncle 1–1.5 cm; flowers solitary or in loose clusters of 2 or 3, glabrous, perianth 2-lobed, pedicel not articulated, bracts not seen, caducous. *Male flowers*: pedicel slender, 1.5–3 mm long; buds slightly laterally compressed, transversely ellipsoid, 2–2.2 by 2.5–2.7 mm, above and below broadly rounded, drying brown, not collapsing on drying, cleft 2/3–4/5, lobes firm, 0.2(–0.3) mm thick; androecium ± flattened, broadly obovoid to transversely short-ellipsoid, 1.2–1.3 by 1.4–1.5 mm, 0.8–0.9 mm thick (Plate 1: 10); thecae 28 or 30, closely set, basally connate and forming a saucer-shaped cup into which the anthers at one side inflect deeply nearly to the base, clasped and covered by the other anthers, the inflexed parts of the anthers mutually free; androphore narrow, (0–)0.1 mm long. *Female flowers* and *fruits* not seen.

Field-notes — Tree c. 5 m tall, dbh c. 6 cm. Flowers green.

Distribution — *Malesia*: Philippines (Samar I.; known only from the type).

Habitat & Ecology — North slope, 200–270 m altitude; fl. May.

Note — According to the male flower structure related to *H. talaudensis*, but differing in several points. *Horsfieldia talaudensis* is more robust, has stouter and more densely hairy male inflorescences, shorter (than the perianth) and densely hairy pedicels, somewhat larger buds and the androecium with anthers inflexed into the cavity at both sides.

**73. *Horsfieldia schlechteri* Warb.**

*Horsfieldia schlechteri* Warb. in K. Schum. & Lauterb., Nachtr. Fl. Schutzgeb. Südsee (1905) 267; Markgr., Bot. Jahrb. Syst. 67 (1935) 153; W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 106, f. 15a–f. — *Horsfieldia subtilis* (Miq.) Warb. var. *schlechteri* (Warb.) J. Sinclair, Gard. Bull. Sing. 28 (1975) 137. — Type: *Schlechter 14500*, Papua New Guinea, Torricelli Mts.

Tree or shrub, 3–15 m. *Twigs* 1–4 mm diameter, hairs rusty-grey, 0.1 mm long, early glabrescent; bark finely striate, not flaking; without or with few lenticels. *Leaves* membranous or thinly chartaceous, elliptic-oblong to oblong-lanceolate, 6–19 by 1–6.5 cm, base attenuate, apex acute-acuminate; upper surface drying (dark) olivaceous-brown, finely pale pustulate or not, lower surface early glabrescent, hairs 0.1 mm or less; dots absent; midrib slender, raised above; nerves 6–14 pairs, raised or ± flat above, indistinct; venation lax, hardly distinct on both surfaces; petiole 5–12 by 0.7–1.5 mm; leaf bud 8 by 1 mm, with hairs 0.1 mm long. *Inflorescences* glabrescent or with sparse to dense stellate hairs 0.1 mm long or less; in male: (1 or) 2 (or 3) times branched, 1.5–7 by 1–4 cm,

peduncle 0.3–1.5 cm, slender; in female: few-flowered, 1–4 cm long; bracts 0.5–1 mm long, densely woolly pubescent, caducous; flowers solitary or 2 or 3 together, perianth 2-lobed, (almost) glabrous; pedicel slender, sometimes with minute hairs, not articulated. *Male flowers*: pedicel slender, (1–)2–3.5 mm long, slightly broadened towards the perianth, glabrous or with some scattered minute hairs at base; buds broadly obovoid or

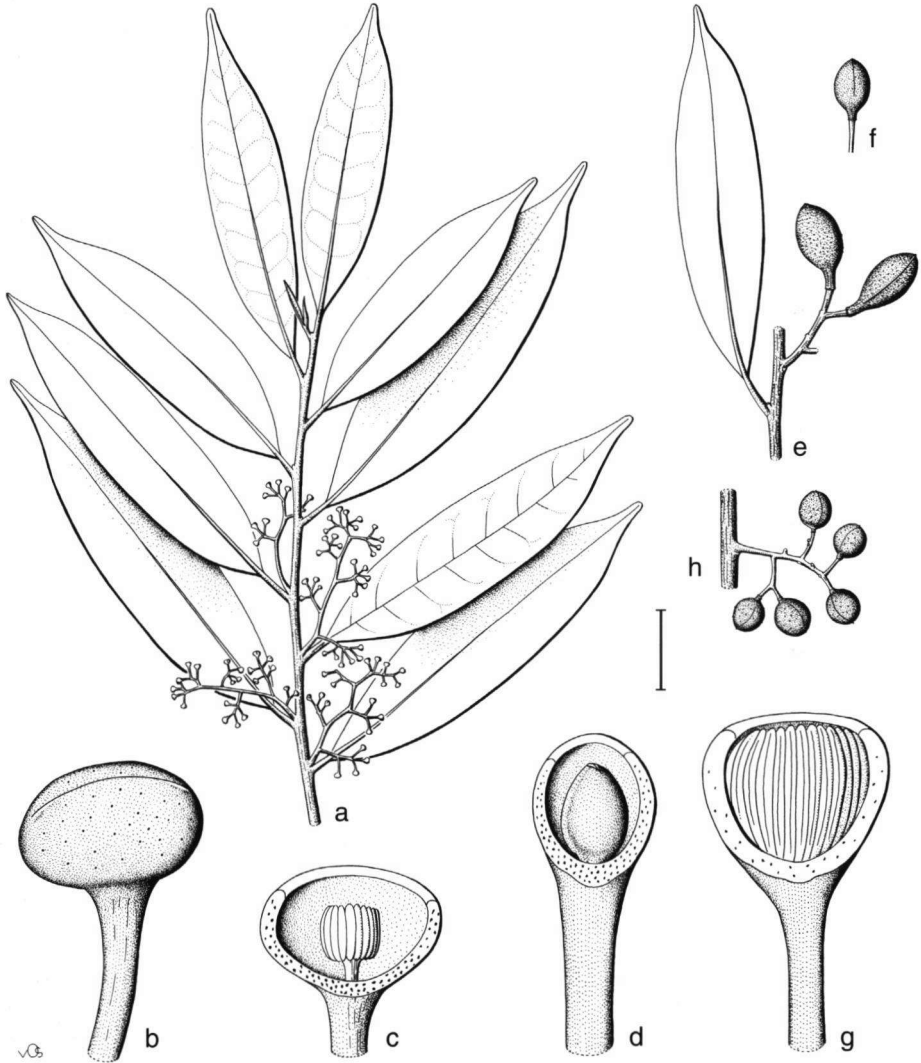


Fig. 26. *Horsfieldia schlechteri* Warb. a. Leafy twig with male inflorescences; b. mature male flower; c. ditto, opened, showing stiped androecium; d. opened mature female flower showing glabrous ovary; e. twig with infructescence, fruits mature; f. mature fruit. — *H. subtilis* (Miq.) Warb. var. *subtilis*. g. Opened male flower showing androecium, androphore hidden by the anthers; h. twig with mature infructescence [a–c: *Kostermans & Soegeng 359*; d & e: *BW 4307*; f: *BW 2900*; g: *LAE 70256*; h: *Hoogland 3503*]. — Scale bar for a, e, f, h = 2 cm; for b–d, g = 0.85 mm.

mostly subglobose, not or only somewhat compressed laterally, 1–1.5 by (1–)1.5–2 mm, when dry wrinkled but not or slightly collapsed, apex rounded, base shortly tapered, cleft 1/3(–1/2), lobes 0.1–0.2 mm thick; androecium  $\pm$  flattened especially in the upper part, rather thick at base, broadly ellipsoid in outline, apex and base broadly rounded, 0.6–0.8 by 0.9–1 mm (Plate 1: 25); thecae 16, mutually appressed, the free apices up to 0.1 mm; androphore 0.4–0.5 mm; column hollow for c. 1/5. *Female flowers*: pedicel 1.5–2 mm long; buds ellipsoid-obovoid, 1.5–2 by 1.5 mm, cleft to c. 1/4; ovary ellipsoid, 1–1.2 by 0.8 mm, glabrous or with a few minute hairs at apex, stigma minutely 2-lobulate, 0.1 mm long. *Fruits* 1 (or 2) per infructescence, ellipsoid, apex rounded, not pointed or for only 1 mm, base rounded or attenuate into a pseudostalk (1.5–)2–6 mm long, excluding pseudostalk 1.3–2(–2.5) by 0.9–1.2 cm, glabrous, drying blackish, with or without paler pustules (or lenticels); pericarp 1–2 mm thick; fruiting pedicel 5–10 mm long; perianth not persistent. — Fig. 26a–f.

Field-notes — Bark dark brown or blackish, with longitudinal fissures. Perianths (orange-)yellow. Fruits green-yellow or (yellow-)orange.

Distribution — *Malesia*: New Guinea (Papua Barat: Jayapura District; N Papua New Guinea: W Sepik Prov.).

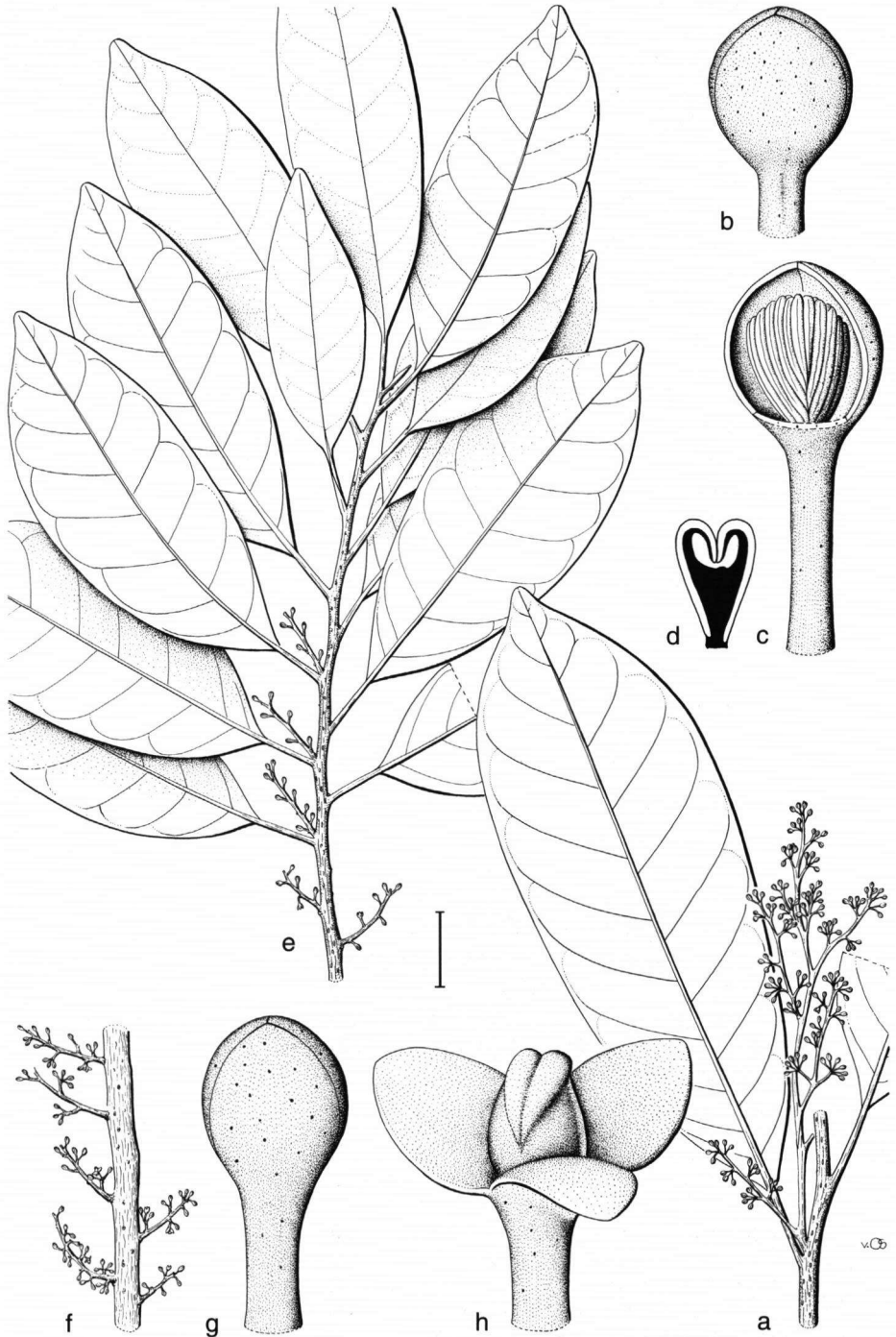
Habitat & Ecology — Forest on stony slopes, foothills, ridges; mossy forest, lowland and lower montane forest; on stony clay, sandy soil, and limestone; 20–500(–1500) m altitude; fl. & fr. throughout the year.

#### 74. *Horsfieldia sepikensis* Markgr.

*Horsfieldia sepikensis* Markgr., Bot. Jahrb. Syst. 67 (1935) 147; W. J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 81, f. 10. — *Horsfieldia spicata* (Roxb.) J. Sinclair var. *sepikensis* (Markgr.) J. Sinclair, Gard. Bull. Sing. 28 (1975) 125, p. p. — Type: *Ledermann 8016*, Papua New Guinea.

Tree 10–25 m. *Twigs* faintly ridged or not, 2–4 mm diameter, early glabrescent, hairs greyish brown, 0.1 mm long or less; bark striate, not flaking; lenticels small but distinct. *Leaves* membranous, oblong(-lanceolate), 8–17 by 3.5–6 cm, base attenuate, apex acute-acuminate with the very tip usually  $\pm$  blunt; upper surface drying dark brown, lower surface early glabrescent, hairs less than 0.1 mm; dots absent; midrib slightly raised above; nerves 8–12 pairs, above thin and flat; venation lax, very faint on both surfaces; petiole relatively long, 15–24 by 1–2 mm, leaf bud 10 by 1 mm, with hairs less than 0.1 mm. *Inflorescences* glabrescent or with sparse hairs 0.1 mm, 2 or 3 times branched, many-flowered; in male: 7–12 by 4–6 cm, peduncle 0.5–1.5 cm long; in female: 2–4 by 1.5–2 cm; bracts not seen, caducous; flowers (male) in loose clusters of 2–7, glabrous, perianth 3- (or 4-)lobed, finely punctate, pedicel not articulated. *Male flowers*: pedicel slender, 2–3 mm long; buds broadly ellipsoid-obovoid,  $\pm$  triangular, 1.5–2 by 1.4–1.6

Fig. 27. *Horsfieldia sepikensis* Markgr. a. Twig with male inflorescence; b. mature male flower, lateral view; c. ditto, opened, showing androecium; d. androecium, longitudinal section, schematic; e & f. female flowering twigs, inflorescences axillary to leaves; g. mature female flower bud; h. ditto, at full anthesis, showing glabrous ovary and large broadly 2-lobed stigma [a–d: *Hoogland & Craven 10255*; e–h: *Hoogland & Craven 10237*]. — Scale bar for a, e, f = 2 cm; for b–d, g, h = 0.85 mm.





mm, apex  $\pm$  acute, base  $\pm$  attenuate, cleft c.  $5/6$ , lobes 0.1 mm thick; androecium  $\pm$  obovoid,  $\pm$  blunt-triangular, 1.5 by 1–1.2 mm (Plate 1: 13); thecae 24–28, tightly appressed (sometimes touching each other in a fish-bone pattern), free apices 0.2–0.5 mm long,  $\pm$  curved into the apical hollow, column broad with hollow to c.  $1/3$ , androphore up to 0.1 mm long, narrow. *Female flowers*: pedicel 1.5–2 mm long; buds ellipsoid, 2 by 1.6–1.8 mm, 3- or 4-lobed, cleft almost to the base; ovary ovoid, 1.5–1.8 by 1.2–1.5 mm, glabrous, style absent, stigmas relatively very large, consisting of two broad fleshy lobes 1 by 0.2 mm, only 0.1 mm high. *Fruits* not seen. — **Fig. 27.**

Field-note — Flowers yellow.

Distribution — *Malesia*: Papua New Guinea (East Sepik Prov.).

Habitat & Ecology — Primary and degraded forest, riverine forest; ridge forest; altitude 0–50 m; fl. & fr. throughout the year.

Notes — 1. A noteworthy species because of its predominantly 3-lobed flowers. The only other species with 3- or 4-lobed flowers in New Guinea is the  $\pm$  related *H. olens*. *Horsfieldia sepikensis* is reminiscent of *Gymnacranthera paniculata* var. *zippeiana*, which differs in the nature of the hairs (on leaf buds and flowers), in hairy perianths cleft to only about halfway, in a hairy ovary, and a different texture and colour of the leaves (whitish below).

2. Markgraf (l.c.) described the fruits as globose, 13–15 cm diameter; pericarp 2 mm thick; seed globose, 1 cm diameter. The fruiting *Ledermann*-specimens, formerly in the Berlin herbarium, have been destroyed.

3. The male flowers have been described by Markgraf (l.c., and probably erroneously) as cleft to about halfway.

## 75. *Horsfieldia sessilifolia* W.J. de Wilde

*Horsfieldia sessilifolia* W.J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 201; Tree Fl. Sabah & Sarawak 3 (2000) 389. — Type: S 27808 (*Turkey bin Tran*), Sarawak.

Tree c. 30 m. Twigs 8–10 mm diameter, twig apex (or leaf buds) not seen; bark glabrous, finely striate and rather densely set with conspicuous lenticels. *Leaves* chartaceous, oblong-lanceolate,  $\pm$  parallel-sided, 50 by 14 cm, base broadly rounded to subcordate, apex acute-acuminate; upper surface drying dark brown, glabrous, lower surface with densely interwoven bright-brown hairs 0.1(–0.3) mm; dots absent; midrib  $\pm$  flat above; nerves 30(–35) pairs, flat or slightly sunken above, lines of interarching distinct; venation lax, indistinct, on the lower leaf surface hidden by the indumentum; petiole absent or short, 2–3 by 8 mm; leaf bud not seen. *Inflorescences* (female) with woolly hairs 0.3–0.5 mm long, about 3 times branched, 4–5 by 3.5 cm, rather many-flowered; peduncle 1 by 0.8 cm; bracts oblong-lanceolate, 10 mm long, inside subglabrous, outside pubescent as the inflorescences, caducous; flowers (female) in clusters of 2–5; perianths 3-lobed, minutely pubescent in the lower half. *Male flowers*: not seen. *Female flowers*: pedicel stout, 1 mm long, minutely pubescent; buds obovoid-ellipsoid, stout, 4.5–5 by 4–4.5 mm, coriaceous, with hairs 0.1 mm in the lower half, cleft  $1/8$ – $1/10$ , lobes 0.5 mm thick; ovary ovoid, 2.5 by 2.5 mm, subglabrous, with few minute whitish hairs less than 0.1 mm on and near the base of the suture; stigma broadly 2-lipped, 0.2–0.3 by 1.5 mm, the lips not or only faintly lobed. *Fruits* not seen.

Field-notes — Tree c. 30 m tall, c. 1 m girth, with stilt-roots.

Distribution — *Malesia*: Borneo (Sarawak: Sibiu District, 3rd Div., Sg. Tutus, Loba Kabang P.F.); known only from the type.

Habitat & Ecology — Lowland mixed swamp forest, at apparently not more than 100 m altitude; fl. June.

Note — The only specimen known is reminiscent of some other stout-leaved *Horsfieldias*, such as *H. sylvestris* from SE Malesia, and to a lesser extent *H. pulcherrima* (Sumatra), *H. splendida* (Borneo), and *H. superba* (Peninsular Malaysia, Sumatra), but *H. sessilifolia* is distinguishable in almost sessile leaves and the densely short-pubescent lower leaf surface. *Horsfieldia sylvestris* is generally less stout; and has similarly subsessile (but narrower) leaves and 2-lobed perianths. The other stout-leaved species mentioned here all have distinctly petioled leaves.

## 76. *Horsfieldia sinclairii* W.J. de Wilde

*Horsfieldia sinclairii* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 110. — Type: NGF 28886 (*Streimann & Katik*), Papua New Guinea.

*Horsfieldia erubescens* J. Sinclair, Gard. Bull. Sing. 28 (1975) 6, in sched.

*Horsfieldia australiana* auct. non S.T. Blake: J. Sinclair, Gard. Bull. Sing. 28 (1975) 6, p.p. — Type in sched.: NGF 8664 (*Womersley & Brass*), Papua New Guinea.

Tree 4–25 m. Twigs not or but faintly ridged, 1.5–3 mm diameter, early glabrescent, with brown hairs 0.1 mm; bark finely striate, not flaking; lenticels mostly inconspicuous. Leaves membranous, elliptic-oblong to oblong-lanceolate, 6–14 by 1.7–4.5 cm, base attenuate, apex acute-acuminate, upper surface drying brown, sometimes with paler pustules or blotches; lower surface glabrescent, hairs 0.1 mm; dots absent; midrib slender, flat above, often reddish tinged, contrasting below; nerves 6–14 pairs, thin and flat above, inconspicuous beneath, lines of interarching faint; venation lax, inconspicuous; petiole 6–15 by 0.8–1.5 mm; leaf bud 8–15 by 1–2 mm with hairs 0.1 mm long. Inflorescences subglabrous or with sparse hairs 0.1 mm; in male: many-flowered, 2–4 times branched, 2.5–8 by 1.5–6 cm, peduncle 0.2–1 cm long; in female: up to 5(–10) by 4 cm; bracts 0.5–2.5 mm long, caducous; flowers (male) in loose clusters of 2–5, glabrous; perianth 2-lobed (in some specimens mixed with 3-lobed perianths), pedicel slender, not articulated. Male flowers: pedicel 0.6–1.5 mm long; buds slightly laterally compressed, subcircular (rarely slightly broader than long), not or somewhat collapsed on drying, 1.1–2 by 1.5–1.8 mm, cleft c. 1/2, lobes 0.1–0.2 mm thick; androecium ± flattened, in lateral view broadly circular to obtriangular, apex broadly rounded, 0.6–1.4 by 1–1.3 mm (Plate 1: 27); thecae 12–20, free apices 0.1–0.3 mm long, the column solid or hollowed to c. 1/3; androphore narrow, up to 0.3 mm long. Female flowers much larger than male, pedicel 1 mm long; buds ellipsoid-ovoid, 2–2.4 by 1.8–2.2 mm, cleft c. 1/3; ovary globose, 1.6 mm diameter, densely minutely pubescent, style ± absent, stigma distinctly 2-lobed, 0.2 mm long. Fruits 1–5(–10?) per infructescence, globose to short-ellipsoid, or obovoid, base rounded or contracted into a pseudostalk up to 2 mm, ridged or not, drying brown or blackish, 1.5–2.5 by 1.5–2 cm, glabrescent but often with remnants of indumentum towards base (lens!), without or with few coarse lenticels or tubercles; pericarp 4–6 mm thick, woody; fruiting pedicel 1–4 mm long; perianth not persistent.

Field-notes — Once reported with buttresses 1 by 1 ft.; bark rough, fissured or peeling off in irregular flakes leaving concave depressions, exudate reddish; wood cream,

straw, or brown. Flowers creamy or yellow(-orange); fragrant. Fruits glossy green, turning yellow to orange.

Distribution — *Malesia*: Papua New Guinea (Madang, Morobe, Northern, and Milne Bay Prov., including Fergusson and Normanby I., Central and Gulf Prov.).

Habitat & Ecology — Understorey tree in primary and disturbed lowland and montane rain forest, flood-plain forest, along creeks, on slopes, on *Castanopsis*-dominated ridges, and in *Anisoptera-Hopea*-dominated forest; stony places; 0–950(–1100) m altitude; fl. mainly Mar., Apr., June; fr. mainly July, Oct.

Notes — 1. Characterized by slender twigs, small thin leaves with often reddish-tinged midrib beneath, small subglobose glabrous male perianths, much larger female flowers with pubescent ovary, and short-ellipsoid, dark brown or blackish, dry fruits, with 4–6 mm thick woody pericarp.

2. A few deviating specimens which key out near *H. sinclairii* possibly represent separate, as yet undescribed taxa and are discussed by De Wilde (1985: 112).

### 77. *Horsfieldia smithii* Warb.

*Horsfieldia smithii* Warb., Mon. Myrist. (1897) 270, t. 21; W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 77. — *Myristica smithii* (Warb.) Boerl., Handl. 3 (1900) 87. — Type: *Smith s.n.*, May 1797 (in BM sheet 296), Banda.

Tree 10–20 m. Twigs 2.5–5 mm diameter, in apical part flat and 2-angled, somewhat yellowish, lower down subterete, with two (faint) ridges or lines, glabrescent, hairs 0.1 mm long or less; bark finely striate, not flaking; lenticels rather small and inconspicuous. Leaves membranous, oblong-lanceolate, 10–30 by 4–10 cm, base attenuate, apex acute-acuminate; upper surface drying olivaceous-brown, with small paler pustules or not, almost always with larger irregular whitish marks, lower surface early glabrescent, hairs 0.1 mm long or less; dots absent; midrib above slender, flat; nerves 10–18 pairs, flat or slightly raised above, inconspicuous, lines of interarching not distinct; venation lax, indistinct; petiole 10–16 by 1.5–2.5 mm; leaf bud 10 by 2 mm with hairs 0.1 mm or less. Inflorescences with sparse or dense hairs 0.1 mm or less; in male: (2–)3–4 times branched, many-flowered, 5–8 by 4–8 cm; in female: 2–3 cm long; peduncle 0.5–1.5 cm; bracts not seen, caducous; flowers (male) 2–4 together, glabrous, perianth 2-lobed, pedicel not articulated. Male flowers: pedicel slender, 1.5–2 mm; buds laterally compressed, subcircular or transversely ellipsoid, or slightly reniform, dull and usually ± collapsed on drying, 2.5–3 by 3–4 mm, apex broadly rounded, base rounded or subtruncate, or shortly tapering, cleft 2/3–3/4, lobes 0.1–0.2 mm thick; androecium inflated, somewhat compressed, transversely ellipsoid, 1–1.5(–2) by 2.5–3.5 mm; anthers 12–15 (i.e., 12–15 thecae at both sides of the androecium) (Plate 1: 11); thecae slender, almost free, at base attached to the rim of the androphore, 1.5–2 mm long, their upper halves deeply incurved almost to the base of the androecium, androphore ± tapering, 0.5–0.8 mm long. Female flowers: pedicel 2 mm long, thinly pubescent; buds ovoid-ellipsoid, 2–3 mm long, cleft c. 1/2; ovary globose-ovoid, 2 by 1.7 mm, glabrous, stigma 0.1 mm long or less. Fruits 1–3 per infructescence, ellipsoid, 1.5–2(–3) by 1.4–1.6 cm, glabrous, with scattered small tubercles or lenticels; pericarp 1.5–2 mm thick; fruiting pedicel 3–5 mm long; perianth not persistent.

Field-notes — Flowers yellow, fruits yellow with whitish dots.

Distribution — *Malesia*: Moluccas (Seram, Banda, Damar Is.; possibly Ternate).

Habitat & Ecology — Altitude 0–100 m; fl. May, Oct.; fr. Oct.

Notes — 1. *Horsfieldia smithii* is closely related to *H. palauensis* Kaneh. (Pacific Islands), *H. ardisiifolia* and *H. parviflora*, with which it shares the largely free thecae curved into the hollowed  $\pm$  cup- or saucer-shaped androphore; the more or less incurved anthers of *H. irya* are reminiscent, but here the buds are much smaller and the anthers shorter and free at the apex for only 0.2 mm; in *H. moluccana* (also with incurved anthers) the male buds are  $\pm$  pear-shaped and the anthers largely interconnate.

2. *Horsfieldia smithii* and related species like *H. ardisiifolia*, *H. irya*, *H. moluccana*, and *H. parviflora* often have (somewhat) ridged or angular twigs, and in sterile or fruiting stages may be confused with species with typically ridged or winged twigs, for instance *H. angularis*, or a few species confined to West Malesia.

### 78. *Horsfieldia sparsa* W.J. de Wilde

*Horsfieldia sparsa* W.J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 194. — Type: *KEP 110406* (*Ogata*), Peninsular Malaysia.

*Horsfieldia sucosa* auct. non (King) Warb.: J. Sinclair, Gard. Bull. Sing. 16 (1958) 416, f. 45, pl. XII-A; 28 (1975) 139.

Tree 15–40 m. Twigs 4–11 mm diameter, pale whitish brown or grey-brown, contrasting with the brown-black colour of the dried petioles, early glabrescent, at first with grey-brown hairs 0.1–0.2 mm; bark rather smooth or coarsely striate, sometimes with a tendency to flake; lenticels conspicuous only towards the apex. Leaves crowded towards the apex or not, in 3–5 rows, thickly membranous to chartaceous, oblong(-lanceolate), (10–)18–24 by 3.5–7 cm, base long-attenuate, apex acute-acuminate; upper surface drying (dark) brown, lower surface drying bright brown, glabrous (early glabrescent); dots absent; midrib flat or slightly raised above, glabrous; nerves 12–16 pairs,  $\pm$  flat above, lines of interarching not distinct; venation lax, hardly visible above; petiole 12–34 by 1.5–3 mm; leaf bud relatively short and broad, 8–12 by 3–5 mm, with dense hairs 0.1–0.2 mm long. Inflorescences behind the leaves, subglabrous or glabrescent, with weak hairs 0.1–0.2 mm; in male: 2 or 3 times branched, many-flowered, 6–12 by 4–6 cm, peduncle (0.2–)0.5–1.5 cm long, the flowers in clusters of 4–10; in female (from infructescences): few-flowered, 1.5–3 cm long; bracts minute, very early caducous; flowers glabrous, perianth 3- or 4- (or 5-)lobed, pedicel not or incidentally articulated. Male flowers: pedicel slender, 2–4 mm long; buds (slightly depressed-)globose, 1.5–2 by 2–2.5 mm, cleft 1/3–1/2, not or but slightly collapsing on drying; lobes 0.1–0.2 mm thick, androecium (depressed-)globose, 0.8–1 by 1–1.2 mm (Plate 2: 44); thecae 14–18, almost completely sessile, incurved at the apex; column broad and solid without or with minute apical cavity (this rarely in S Thailand); androphore  $\pm$  slender, 0.3–0.4 mm long. Female flowers (from young fruits): 3 mm long, 3- or 4-lobed; ovary glabrous. Fruits 2–4 per infructescence, ovoid-ellipsoid, 3–5.5 by 2.5–4.5 cm, glabrous, drying blackish, finely granulate, sometimes  $\pm$  tuberculate; pericarp 4–20 mm thick; fruiting pedicel 5–7 mm long; perianth not persistent.

Field-notes — Erect tree with clear bole, once recorded as  $\pm$  tapering, once with buttresses to 1 ft; bark (blackish) brown, shallowly fissured or thinly flaking; inner bark fibrous, pale red; copious watery or sticky pink-red sap; slash wood cream or pale pink-

brown, red-flecked. Fruits large, up to 11 cm long; pericarp thick fleshy, yellow or orange red, often flushed pink, smooth, waxy, glossy; seeds rather small, up to 5 cm long.

Distribution — Peninsular Thailand; in *Malesia*: Sumatra, Peninsular Malaysia, Singapore.

Habitat & Ecology — Primary and degraded dryland forest, periodically inundated forest; mainly on sandy (loam) soil, sandstone; 0–500 m altitude; fl. Mar., Aug.; fr. mainly May–July.

Note — *Horsfieldia sparsa* is distinguishable from similar species with pale twigs as, e.g., *H. pallidicaula* and *H. sucosa*, by stoutness of the twigs, dispersed and  $\pm$  chartaceous leaves, sometimes crowded towards the thickish, short, apical leaf bud, and relatively long petioles; also by the nearly glabrous inflorescences, the 3- or 4-lobed flowers, the not or only indistinctly articulated male pedicels, and the rather distinctly stalked androecium (androphore), generally without an apical cavity. Dry fruits reach 5.5 cm; according to the field labels fresh fruits may reach up to 11 cm, with thick fleshy-juicy pericarps, which obviously shrink considerably on drying. *Horsfieldia pallidicaula* differs in a sessile androecium; *H. sucosa* has articulated pedicels.

### 79. *Horsfieldia spicata* (Roxb.) J. Sinclair

*Horsfieldia spicata* (Roxb.) J. Sinclair, Gard. Bull. Sing. 28 (1975) 112, 113 (var. *spicata*), p.p.; W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 59, f. 7. — *Myristica spicata* Roxb., Fl. Ind. 3 (1832) 847; (ed. 1874) 744; Warb., Mon. Myrist. (1897) 271, in obs. sub *Horsfieldia smithii* Warb. — Type: Roxburgh's description (see Sinclair, 1975: 122).

*Myristica canariformis* Blume, Rumphia 1 (1837) 190. — *Horsfieldia canariformis* (Blume) Merr., Int. Rumph. (1917) 230. — Based on *Palala quarta*, *P. canariformis*, *P. dentaria* Rumph., Herb. Amb. 2, 10 (1741) 27 t. 8 (see Sinclair, 1975: 162).

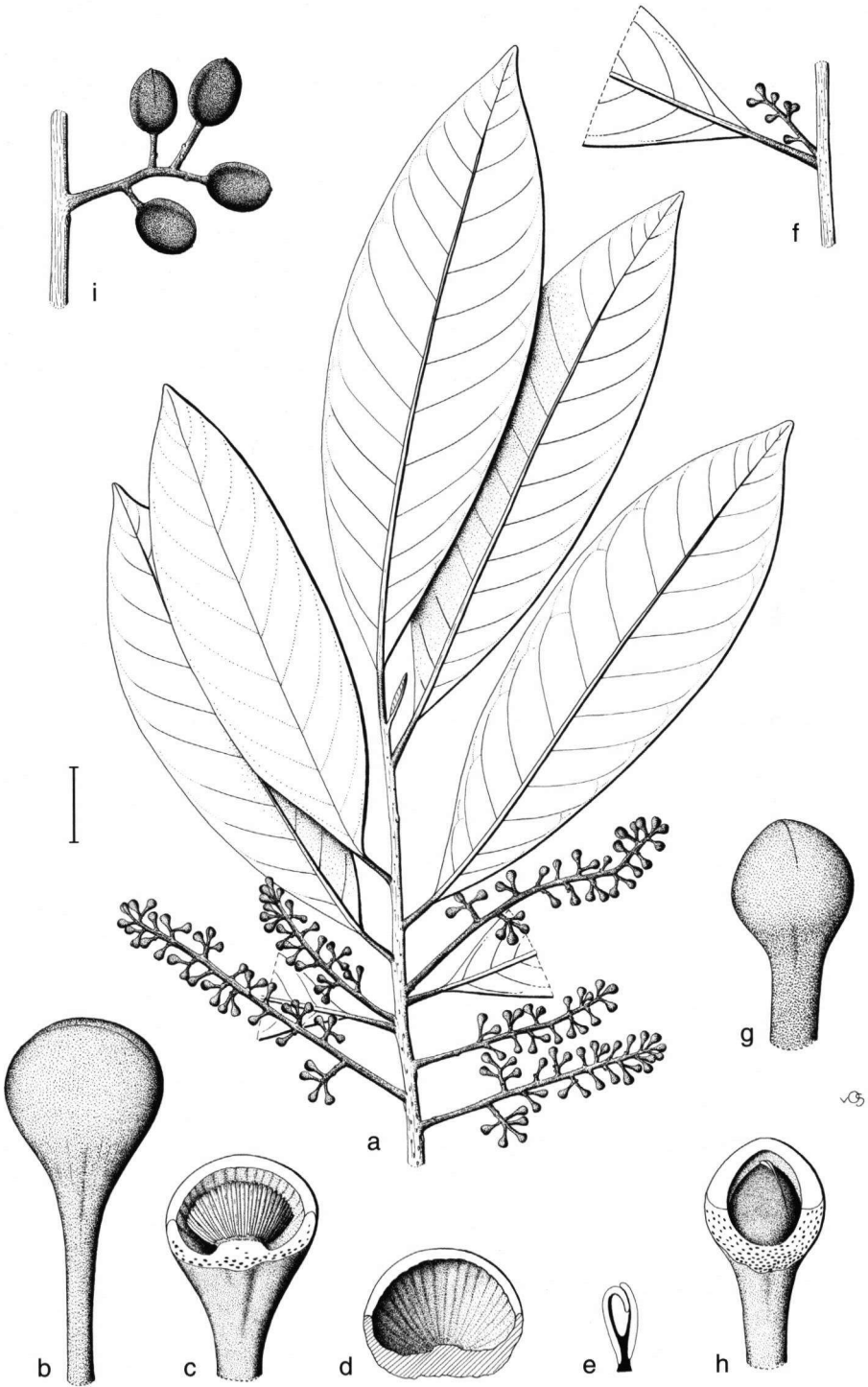
*Horsfieldia batjanica* Warb., Mon. Myrist. (1897) 275, t. 21. — *Myristica batjanica* (Warb.) Boerl., Handl. 3 (1900) 85. — Type: introduced by Teijsmann in Hort. Bog.; original tree still cultivated in Bogor, and collected sub *Kostermans 11186*, *Rastini (220)*, *Sinclair 10035*.

*Horsfieldia roxburghii* Warb., Mon. Myrist. (1897) 277, t. 21. — *Myristica roxburghii* (Warb.) Boerl., Handl. 3 (1900) 85. — Type: *Smith* in Hb. Roxburgh (orig. Ternate); culta in Hort. Bog. (male fl., orig. Ambon) (still in cultivation in Bogor sub no. IV.G.90, collected under *Sinclair 10037*).

*Horsfieldia parviflora* auct. non (Roxb.) J. Sinclair: J. Sinclair, Gard. Bull. Sing. 28 (1975) 82, p.p.

Tree 2.5–20 m. Twigs 2–4 mm diameter, early glabrescent, hairs greyish, 0.1 mm or less; bark pale to whitish brown, contrasting with the blackish colour of dried petioles and inflorescences, striate, not flaking; lenticels few, coarse. *Leaves* membranous, (elliptic-)oblong, 8–30 by 2.5–10 cm, base attenuate, apex acute-acuminate, often densely speckled with pale irregular pustules of unknown origin; upper surface drying dull olivaceous-brown, lower surface early glabrescent, at first with minute scale-like hairs;

Fig. 28. *Horsfieldia spicata* (Roxb.) J. Sinclair. a. Leafy twig with male inflorescences; b. mature male flower, lateral view; c. male flower, opened, showing androecium; d. male perianth, inner side, showing impression of androecium; e. androecium, longitudinal section, schematic; f. twig with female inflorescence; g. mature female flower, lateral view; h. ditto, opened, showing glabrous ovary and 2-lobed stigma; i. twig with infructescence [a–d: *Beguin 1407*; e: *Teijsmann s. n.*; f–h: *Kostermans s. n.* (Hort. Bog. sub IV-H-13); i: *de Vogel 3206*]. — Scale bar for a, f, i = 2 cm; for b–e, g, h = 1.65 mm.



dots absent (very minute blackish points often present); midrib flattish above; nerves 11–17 pairs, thin and flat above, lines of interarching  $\pm$  indistinct; venation lax, thin, distinct or not; petiole 10–20 by 1.5–3 mm, blackish on drying; leaf bud 10 by 1.5–2 mm, with dense grey-brown hairs 0.1 mm long or less. *Inflorescences* early glabrescent, blackish on drying, slender, spike-like, the lateral branches up to 2(–5) mm, peduncle 1–3 cm, not many-flowered; in male 4–10 by 1 cm; in female 2–3 cm long; bracts  $\pm$  blunt, 0.5–1 mm, caducous; flowers up to 3 together in male, solitary or 2 together in female; perianth 2-lobed, early glabrescent; pedicel glabrous, not articulated. *Male flowers*: pedicel tapered, 1.5–3 mm long; buds  $\pm$  obovoid or short pear-shaped, rather compressed, the upper part subcircular to reniform, about as long as broad or slightly broader than long, 2.3–3 by 3–3.5 mm, base  $\pm$  tapering into the pedicel; buds cleft (nearly) to the base, lobes 0.2 mm thick; androecium laterally compressed, reniform, apex broadly rounded, base broadly attached, 1.5–1.8 by 2.5 mm, androphore  $\pm$  absent (Plate 1: 3); thecae (24–)32–44, closely set, free apices 0.1–0.4 mm, at one side weakly to strongly incurved into the apical cavity to 1/4–1/2(–3/4, see note 2) of the column. *Female flowers*: buds subglobose, 2–2.5 by 2.2–2.8 mm, at base passing into the tapered pedicel 1.5–2.5 mm, cleft 1/2–2/3; ovary broadly ovoid, glabrous, 1.5 by 1.5 mm, stigma minute, faintly 2-lobed, 0.1 mm high. *Fruits* 1–5 per infructescence, short-ellipsoid, 1.5–2(–2.5) by 1.2–1.8 cm, glabrous, drying blackish, without pustules; pericarp 1.5 mm thick; fruiting pedicel 4–10 mm long; perianth not persistent. — **Fig. 28.**

*Field-notes* — Buttresses up to 50 cm out and high, or absent; bark often not fissured, peeling off; exudate watery, not or only slightly reddish; sapwood usually cream, gradually passing into the darker heartwood. Flowers greenish or ochre-yellow. Fruits orange.

*Distribution* — *Malesia*: Moluccas (Morotai, Halmahera, Ternate, Bacan, Ambon, Seram, Buru).

*Habitat & Ecology* — Forest on alluvial soils, deep clay, soil rich in humus, and porous volcanic soil over schists; 0–1000 m altitude; fl. & fr. throughout the year.

*Uses* — According to *de Vogel 3206*, the outer bark, mixed with ‘Kuleman’ (a different species of *Horsfieldia*), is used for curing hepatitis.

*Notes* — 1. *Horsfieldia spicata* is recognizable at first glance by its spike-like inflorescences drying blackish, and by the pale twigs contrasting with the blackish dried petioles and the inflorescences.

2. Possibly its most closely related species is *H. moluccana*. Apart from the characters as used in the key, *H. spicata* differs from *H. moluccana* in the more membranous leaves. *Teijsmann s. n.* (L), from Ambon, seems intermediate between *H. spicata* and *H. moluccana*, as explained by De Wilde (l. c.: 63).

## 80. *Horsfieldia splendida* W.J. de Wilde

*Horsfieldia splendida* W.J. de Wilde, Gard. Bull. Sing. 38, 2 (‘1985’, 1986) 213, f. 24; Tree Fl. Sabah & Sarawak 3 (2000) 390. — Type: *S 33723 (Othman)*, Sarawak.

Tree 10–20(–30) m. *Twigs* 4–7 mm diameter, late glabrescent, at first with dense woolly, yellow-brown to rusty hairs 1–1.5 mm; bark dark brown or blackish, coarsely longitudinally striate and fissured, later on cracking and  $\pm$  flaking; lenticels few, indistinct. *Leaves* membranous to chartaceous, elliptic-oblong to oblong-oblongeolate, 18–45 by 6.5–17 cm, base almost rounded to attenuate, apex acute-acuminate; upper surface

drying dull olivaceous-brown, early glabrescent, lower surface with conspicuous rather dense, flossy, stalked-dendroid hairs,  $\pm$  evenly spaced and of about the same size, hairs 0.5–1.5 mm long; dots absent; midrib late glabrescent above, rather flat; nerves 18–25 pairs, sunken above, lines of interarching distinct, regular; venation lax, distinct; petiole 12–17 by 3.5–5 mm, pubescent; leaf bud 15(–20) by 5 mm, with hairs 1–1.5 mm long. *Inflorescences* with dense woolly dendroid hairs 1–1.5 mm; in male: many-flowered, 4 (or 5) times branched, 6–16 by 3–12(–16) cm, peduncle 0.5–2 cm; in female: rather few-flowered, 3–5 cm long; bracts  $\pm$  ovate-triangular, acuminate, 0.4–1 cm long, densely pubescent, caducous; flowers in male 3–8 in loose clusters, perianth 3- (or 4-)lobed, glabrous or thinly pubescent, pedicel slender, glabrous or subglabrescent, hairs 0.3–0.5 mm long, not articulated. *Male flowers*: pedicel 1–1.5 mm long; buds (depressed) subglobose, 1.4–2 by 1.6–2 mm, cleft 1/3 to nearly 1/2, lobes 0.2 mm thick; androecium depressed-subglobose,  $\pm$  impressed in the centre, circular or faintly triangular in cross section, 0.5–0.6 by 1–1.3 mm (Plate 2: 57); thecae 16–20, completely sessile, incurved towards the apex; column broad, solid, with small apical hollow to 1/3(–1/2); androphore  $\pm$  slender, 0.3(–0.5) mm long. *Female flowers* (from remnants under fruits): pedicel 0.5–1 mm long, pubescent; buds 3 by 2.5 mm, 3- or 4-lobed, pubescent; ovary ovoid-ellipsoid, pubescent; stigma minutely 2-lobed, 0.1 mm high. *Fruits* 2–7 per infructescence, broadly ovoid-ellipsoid, 2–3 by 1.5–2 cm, pubescent (hairs 0.5 mm), without lenticles or tubercles; pericarp 3 mm thick; fruiting pedicel 1 mm long; perianth persistent. — Fig. 29.

*Field-notes* — Bark of trunk usually blackish, (red-)brown, fissured or flaking; inner bark soft, light brown or reddish, laminated, exudate reddish; wood yellowish or pale, soft or medium hard. Flowers yellow, with odour of balsam of Peru. Fruits red or orange.

*Distribution* — *Malesia*: Borneo (Sarawak, Brunei, Sabah, W and E Kalimantan).

*Habitat & Ecology* — Lowland mixed dipterocarp forest, edges of swamp forest, kerangas (with *Dryobalanops fusca* dominant), montane forest; brown or yellowish soil, tuff-plateau; 0–600(–1500) m altitude; fl. & fr. throughout the year.

*Notes* — 1. Material of this species was formerly mixed up with *H. reticulata*, a species with smaller leaves but with almost similar flowers.

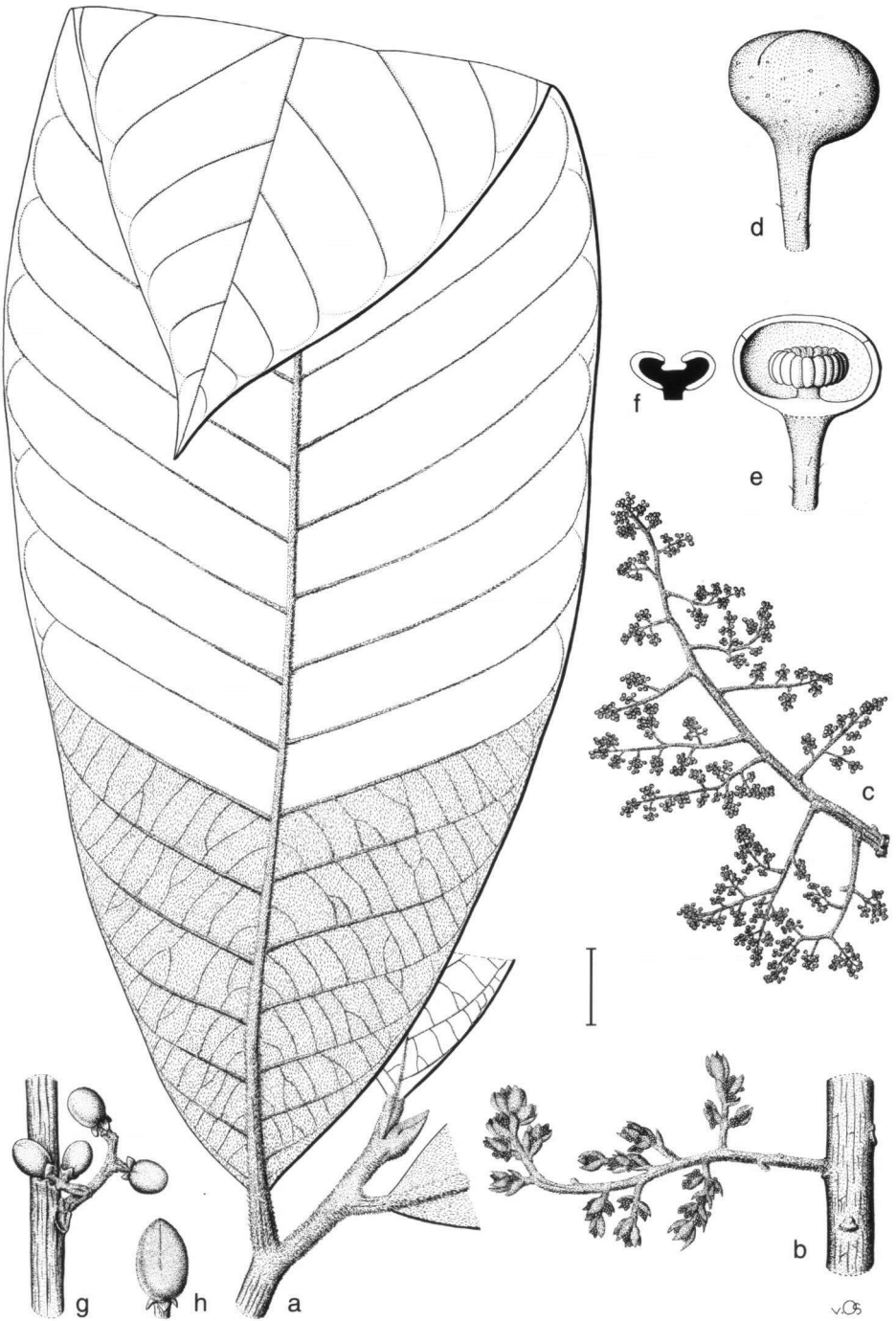
2. *Horsfieldia splendida* is closely related to *H. grandis*, *H. reticulata*, *H. rufo-lanata*, and *H. tomentosa*, and less so to *H. flocculosa*, all having similar male flowers. The perianth remains persistent under the fruits in these species, except for *H. rufo-lanata* and *H. tomentosa*.

### 81. *Horsfieldia squamulosa* W.J. de Wilde

*Horsfieldia squamulosa* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 93. f. 13g (excl. specimens now in *H. coryandra*); Blumea 32 (1987) 460. — Type: NGF 42995 (*Henty & Barlow*), Papua New Guinea.

Shrub or slender treelet, 2–10 m. *Twigs* 1–2 mm diameter, with rusty hairs 0.1(–0.2) mm, late glabrescent; bark finely striate, not cracked nor flaking; lenticles absent or few and inconspicuous. *Leaves* membranous or thinly chartaceous, oblong to lanceolate, 7–15 by 1.5–4 cm, base acute or attenuate, apex acute-acuminate to long-tapering; blade drying blackish brown, glabrous above, beneath glabrescent (with few minute hairs remaining on midrib); dots absent; midrib very slender, slightly raised above; nerves





12–25 pairs, indistinct, flat or slightly raised above, lines of interarching distinct or indistinct; venation indistinct; petiole 7–12 by (0.5–)1 mm, glabrescent; leaf bud 5–7(–10) by 0.5–1 mm, with dense minute rusty hairs 0.1 mm. *Inflorescences* among the leaves, small, twice branched (lowest branch 2–5 mm from the base), with hairs 0.1 mm or less; bracts ellipsoid, 0.5–1 mm long, caducous; in male: 2 by 2 cm, few-branched, few-flowered; in female: 1–1.5 cm long, not or somewhat branched, 1–3-flowered; flowers solitary or up to 3 together, perianth 2-lobed, thinly with stellate-dendroid hairs 0.1–0.2 mm long, pedicel thinly pubescent, not articulated. *Male flowers*: pedicel 3–3.5 mm long; buds slightly flattened, subglobose or broadly ellipsoid or obovoid, 2.2–2.4 mm diameter; cleft c. 1/8, perianth 0.7–0.8 mm thick, the lobes at apex 0.2 mm thick; androecium club-shaped, apex subacute to broadly rounded, 1.7–1.8 by 0.6–0.7 mm (Plate 1: 19); thecae 8, apical, mutually appressed, 0.4 mm long, consolidated with the androphore, apex slightly free or not; androphore in the lower 2/3 with dense minute pale brown hairs less than 0.1 mm, the apical part coarsely irregularly warted or wrinkled-bullate, glabrous; column not hollow at apex. *Female flowers*: pedicel 2–2.5 mm long; buds subglobose, 1.8 mm diameter, lobes 2, cleft c. 1/8; ovary ellipsoid-ovoid, 1.5 by 1(–1.1) mm, densely minutely pubescent; stigma minute, of two suberect lobes 0.1–0.2 mm. *Fruits* 1(–3) per infructescence, ovoid-ellipsoid, including the 2–3 mm long rostrum 1.6–1.7 by 0.9–1 cm, base contracted into pseudostalk 4–5 mm; all thinly with pale brown stellate hairs 0.1 mm or less, drying blackish, without lenticels; pericarp 0.5(–1) mm thick; fruiting pedicel slender, slightly broadened to the apex or not, 8–12 mm long; perianth not persistent. — Fig. 14g.

*Field-notes* — Shrub or small, slender tree, 2–10 m tall, dbh to 10 cm diameter; numerous excurrent horizontal branches, or branches  $\pm$  whorled, drooping; bark brown, wood white, exudate red. Flowers yellow. Fruits conical, orange(-yellow); aril not aromatic.

*Distribution* — *Malesia*: Papua New Guinea (Western Prov., about 5–6° S, 141° E).

*Habitat & Ecology* — Primary and disturbed forest; on ridge-crests, undulating land, forest bordering sago-swamp; locally plentiful in forest undergrowth; 100–200 m altitude; fl. & fr. July–Aug.

*Notes* — 1. *Horsfieldia squamulosa* is related to *H. coryandra*, which generally has similar leaves (though usually with coarser venation), but differs in a more elongate male bud, (almost) glabrous androphore, and fruits with a pseudostalk of only 2 mm long. Vegetatively both species much resemble *H. schlechteri* from the same region, especially in the foliage.

2. *Horsfieldia squamulosa* forms a coherent group with *H. clavata*, *H. coryandra*, *H. crux-melitensis*, and *H. clavata* (the *clavata*-group), species of small trees or shrubs with club-shaped androecium consisting of a relatively large androphore and small ses-

Fig. 29. *Horsfieldia splendida* W.J. de Wilde. a. Apical part of leafy twig; b. twig with immature male inflorescence axillary to leaf scar; note bracts; c. mature male inflorescence; d. mature male flower, lateral view; e. ditto, longitudinally opened, showing androecium; f. androecium, longitudinal section, schematic; g. twig with infructescence, fruits immature; h. mature fruit; note persistent perianth [a, b: *Anderson 12916*; c–f: *BNB For. Dept. 4782*; g: *SAN 16927*; h: *SFN 35606*]. — Scale bar for a–c, g, h = 2 cm; for d–f = 0.85 mm.

sile anthers at the apex. The remote species *H. pulverulenta*, *H. sterilis*, and *H. triandra* have somewhat similar androecia.

## 82. *Horsfieldia sterilis* W. J. de Wilde

*Horsfieldia sterilis* W. J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 224; Tree Fl. Sabah & Sarawak 3 (2000) 390. — Type: SAN 30597 (*Aban Gibot*), Sabah.

Tree or shrub, 3–12 m. Twigs 2.5–4 mm diameter, sometimes grey-brown and contrasting with the blackish colour of the dry petioles, early glabrescent, hairs rusty to grey-brown, 0.1–0.2 mm; bark finely striate, not tending to crack or flake; lenticels conspicuous or not. Leaves membranous, elliptic-oblong to oblong(-lanceolate), 13–37 by 4.5–11 cm, base attenuate, apex acute-acuminate; upper surface glabrous, drying dark brown or blackish, lower surface glabrous; dots absent; midrib flat above, glabrous; nerves 11–18 pairs,  $\pm$  flat above, lines of interarching not particularly distinct; venation lax, faint on both surfaces; petiole 7–20 by 2–3.5 mm; leaf bud 7–12 by 2–2.5 mm, with dense pale-rusty hairs 0.1–0.2 mm long. Inflorescences subglabrescent, hairs  $\pm$  sparse, 0.1–0.2 mm long; in male: lax, 10–20 by 5–8 cm with few side-branches, 2 or 3 times branched, not densely flowered, peduncle 3–13 cm long, with several bract scars, or branched from the base; in female: elongate, slightly branched, almost spike-like, 5–10 cm long; bracts oblong-lanceolate, 3–8 mm long, acute, with hairs 0.1–0.3 mm especially at the margins, caducous; flowers (male) in loose clusters of 2–6, glabrous, perianth 2-lobed, pedicel not articulated. Male flowers: pedicel slender, 1–1.5 mm long; buds broadly obovoid-subglobose, 1.5–1.7 mm diameter, apex broadly rounded or somewhat depressed, base subattenuate, cleft c. 1/4, lobes thick-fleshy, 0.3–0.4 mm thick, shrinking, not collapsing on drying; androecium broadly obovoid, 0.8 by 0.6–0.7 mm, apex  $\pm$  rounded, subcircular in cross section; anthers 3 or 4 or 6–8 (or with 6–8 thecae?), completely sessile at apex of the androecium, 0.4 mm long, connectives broad,  $\pm$  triangular, with narrow thecae (Plate 3: 62); column broad, solid, apical hollow absent or inconspicuous; androphore broad, tapering to below, 0.4 mm long. Female flowers: buds obovoid, 2–2.5 mm long, cleft c. 1/4, ovary subglobose, 1.5 mm diameter, glabrous, stigma lobes minute. Fruits (immature) 4–10 per spike-like infructescence, ellipsoid, 2.2 by 1.8 cm, glabrous, drying blackish, not tubercled; pericarp 2 mm thick; fruiting pedicel 3–4 mm long; perianth persistent under immature fruits.

Field-notes — Small trees or shrubs; bark grey-brown, not fissured; inner bark with orange-red sap; sapwood pale yellow.

Distribution — *Malesia*: Borneo (C & NE Kalimantan and C & SE Sabah).

Habitat & Ecology — Forest on hillsides and riverbanks; 80–500 m altitude; fl. Apr.–July.

Note — *Horsfieldia sterilis* is noticeable by its 2-lobed perianth and the subconical broadly obovoid androecium of which only the apical half bears apparently reduced anthers; the basal part of the androecium or androphore is sterile, broad and tapering.

The structure of the androecium is reminiscent of that of species as *H. crux-melitensis* and *H. clavata* from New Guinea, but in these species the androecium is much more elongate. In general habit *H. sterilis* resembles, e.g., *H. pallidicaula* or *H. sucosa*, because of its pale twigs and blackish drying leaves, but *H. sterilis* differs in more elongate inflorescences.

**83. *Horsfieldia subalpina* J. Sinclair**

*Horsfieldia subalpina* J. Sinclair, Gard. Bull. Sing. 16 (1958) 410; 28 (1975) 131; W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 40; Tree Fl. Sabah & Sarawak 3 (2000) 392. — Type: *Wray 467*, Peninsular Malaysia.

Tree 6–30 m. *Twigs* 2.5–5 mm diameter, early glabrescent, hairs greyish brown, 0.1 mm long or less; bark finely to coarsely striate, not flaking; lenticels usually conspicuous. *Leaves* membranous or chartaceous, (elliptic-)oblong, 15–27 by 5–10 cm, base attenuate, apex acute(-acuminate), sometimes ± blunt; upper surface drying olivaceous to dark brown, lower surface glabrous; dots absent; midrib ± flat above; nerves 9–18(–20) pairs, thin, flat or slightly raised above, lines of interarching indistinct; venation lax, faint on both surfaces; petiole 5–15 by 2–3 mm; leaf bud 12–20 by 2–3 mm, with dense grey-brown to rusty hairs 0.1 mm long or less. *Inflorescences* behind the leaves, with sparse (subsp. *kinabaluensis*) or dense hairs 0.1 mm long; in male: rather stout, about 3 (or 4) times branched, many-flowered, 5–14 by 3–10 cm, peduncle (0.6–)1–3 cm long; female 2 (or 3) times branched, 2–7 by 1.5–4 cm, fewer flowered than male; bracts ellipsoid to oblong, acutish, densely short-pubescent, 2–5 mm long, caducous; flowers in male in loose clusters of 2–5, perianth 3- (or 4-)lobed, glabrous, pedicel glabrous (subsp. *kinabaluensis*) or partly thinly pubescent (subsp. *subalpina*), not articulated. *Male flowers*: pedicel 1.5–2 mm, slender; buds broad-ellipsoid or subglobose, 1.6–2.3 mm long, cleft c. 1/2, lobes 0.2(–0.3) mm thick; androecium globose or broadly ellipsoid, 1–1.5 mm long, cross section circular (Plate 3: 84); thecae 16–24, almost completely sessile, free apices 0.1 mm, curving towards the apex and concealing the narrow apical hollow, 0.3–0.5 mm deep, of the broad column; androphore narrow, 0.2–0.3 mm long, largely hidden by the anthers. *Female flowers*: pedicel 1.5 mm long; buds ellipsoid, 2–2.5 by 1.8–2.1 mm, glabrous (subsp. *kinabaluensis*), cleft (1/3–)1/2; ovary subglobose to broadly ellipsoid, 1.2–1.5 mm long, glabrous, stigma minutely 2-lobed, 0.1 mm high. *Fruits* 2–6 per infructescence, subglobose, broadly ellipsoid, or ellipsoid-oblong, 2.5–5 cm long, glabrous; fruiting pedicel 3–7 mm long; perianth not persistent.

Distribution — *Malesia*: two subspecies, one in montane Peninsular Malaysia, one in the Kinabalu area in Sabah.

Note — In the group of species with *H. obscura* and *H. subalpina*, a number of fruiting specimens could not be assigned satisfactorily to any of the known taxa. More information on their affinities can only be obtained from male flowering specimens which have vegetative characters closely matching those of the fruiting material. These fruiting collections have been discussed under *H. obscura* by De Wilde (l.c., 1986: 44 & *Blumea* 32, 1987: 469).

## KEY TO THE SUBSPECIES

- 1a. Pedicel of male flowers pubescent, at least in the lower half. Male buds subglobose; androecium subglobose, thecae 18–24. Fruits subglobose to broadly ellipsoid, 2.5–4 cm long . . . . . **a. subsp. *subalpina***  
 b. Pedicel of male flowers glabrous. Male buds (broadly) ellipsoid; androecium (broadly) ellipsoid, thecae 16 or 18. Fruits ellipsoid, 3–5 cm long . . . . .  
 . . . . . **b. subsp. *kinabaluensis***

**a. subsp. subalpina**

*Inflorescences* rather densely pubescent. Male pedicel, at least in the lower half thinly pubescent with hairs 0.1 mm. *Male flowers*: buds subglobose to broadly ellipsoid, 1.6–2.3 by 1.6–2.2 mm; androecium subglobose, 1–1.5 by 1–1.2 mm; thecae 18–24. *Female flowers* not seen. *Fruits* subglobose to broadly ellipsoid, 2.5–4 by 2–2.3 cm, apex and base rounded, drying brown-blackish, without or with a few tubercles; pericarp 3–4 mm thick.

Field-notes — Bark smooth or with shallow widely spaced fissures; slash reddish, with red sap; slash wood whitish. Flowers yellow. Fruits greenish yellow and glaucous, or yellow; seed white. Fresh fruits may reach 4.5–5 cm length, the dry fruits are only 2.5–4 cm long.

Distribution — *Malesia*: Peninsular Malaysia (Perak, Pahang, Selangor; Fraser's Hill, Genting Highlands).

Habitat & Ecology — Mountain forest, 800–1500 m altitude; fl. Apr., June; fr. Jan., Aug.–Dec.

**b. subsp. kinabaluensis** W.J. de Wilde

*Horsfieldia subalpina* J. Sinclair subsp. *kinabaluensis* W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 41; Tree Fl. Sabah & Sarawak 3 (2000) 392. — Type: *Clemens 33136*, Sabah.

*Inflorescences* very sparsely pubescent. Male pedicel glabrous. *Male flowers*: buds (broadly) ellipsoid, 1.7–2 by 1.5–1.8 mm; androecium broadly ellipsoid, 1.1–1.2 by 0.8–1 mm; thecae 16 or 18. *Female flowers* as described under the species. *Fruits* ellipsoid to broadly ellipsoid, 3–5.1 by 1.7–2.5 cm, apex  $\pm$  narrowly rounded, base rounded, drying bright brown to blackish brown, without tubercles; pericarp 4–5 mm thick.

Field-notes — Buttresses absent; bark slightly fissured, reddish brown; inner bark fibrous, whitish turning brown, or soft, and then yellowish; cambium pale yellow; wood white to yellowish, medium hard, heartwood not differentiated. Flowers bright yellow. Fruits yellow-red.

Distribution — *Malesia*: Borneo (Sabah: Mt Kinabalu and vicinity; one doubtful collection from E Sarawak).

Habitat & Ecology — Montane (oak) forest; clayish soil; 1400–2000 m altitude; fl. & fr. throughout the year.

**84. *Horsfieldia subtilis* (Miq.) Warb.**

*Horsfieldia subtilis* (Miq.) Warb., Mon. Myrist. (1897) 286, t. 23. — *Myristica subtilis* Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 50. — Type: *Zippelius (78)*, West New Guinea.

For more references and synonyms see the varieties.

Tree 2–10(–20) m. *Twigs* 1–3(–8) mm diameter, early glabrescent, at first with grey-brown hairs 0.1 mm long or less; bark finely striate, not flaking; lenticels fine, usually present. *Leaves* membranous or in var. *calcareae*  $\pm$  chartaceous, elliptic to oblong-lanceolate, 6–28 by 2–9.5 cm, base attenuate, apex acute-acuminate; upper surface drying dull olivaceous to brown, with or without fine paler dots, lower surface early glabrescent, hairs 0.1 mm or less; dots absent; midrib slightly raised above; nerves 6–16 pairs, above thin, flat or raised above, lines of interarching faint or distinct; venation lax, usually in-

distinct; petiole 5–13 by 1–2.5 mm; leaf bud 6–12 by 1.5–2 mm, with hairs 0.1 mm. *Inflorescences* glabrescent or with sparse stellate scale-like hairs 0.1–0.2 mm long; in male: 1–2(–3) times branched, few- to many-flowered, 2–8(–9) by 1.5–6 cm, peduncle up to 1 cm long; female 2–5(–8) cm long; bracts 0.5–2 mm long, glabrescent, with fimbriate margins, caducous; flowers in male in loose clusters of 1–8(–10), glabrous, perianth 2-lobed, pedicel slender, not articulated. *Male flowers*: pedicel 1–3 mm long; buds compressed, in lateral view circular,  $\pm$  broadly transversely subellipsoid, or broadly obtriangular (rarely slightly longer than broad), collapsing on drying, 1.3–2.4 by 1.8–3 mm, apex subtruncate or (broadly) rounded, base subtruncate to short-cuneate, cleft 1/5–1/3(–1/2), lobes 0.1–0.2 (in var. *aucta* up to 0.5) mm thick; androecium flattened towards the apex, base broad and usually almost cylindrical, in lateral view subquadrangular, apex broadly rounded or subtruncate, nearly filling the perianth, (0.7–)1–1.7 by 1.4–1.6 mm (Plate 1: 24); thecae 18–24,  $\pm$  erect, free apices to 0.1 mm long, column narrowly hollowed for 1/4–1/3; androphore  $\pm$  slender, 0.2–0.5 mm long, sometimes  $\pm$  hidden by sagged anthers. *Female flowers*: pedicel 1–5 mm long; buds broadly ellipsoid, ovoid, or subglobose, 1.8–2.5 by 2–2.5 mm, cleft c. 1/3; ovary ovoid, 1.1–1.5 by 0.8–1.1 mm, glabrous, style with minutely bilobed stigma, 0.2 mm long. *Fruits* (1–) 5–15 per infructescence, globose or subglobose, 0.9–1.3 by 0.8–1.3 cm (pseudostalk up to 1 mm), or in varieties larger, rather ellipsoid, 1.4–2 by 1.1–1.4 cm, with the apex rounded to acutish, base rounded, without or with pseudostalk up to 3 mm; glabrous, drying blackish, without or with minute paler tubercles or lenticels; pericarp 1(–2) mm thick; seeds subglobose to ellipsoid; fruiting pedicel 1–7 mm; perianth not persistent. — **Fig. 26g, h.**

Distribution — *Malesia*: Moluccas (Aru Is.), whole of New Guinea.

#### KEY TO THE VARIETIES

- 1a. Male perianth buds 2–3 mm wide. Fruits globose or short-ellipsoid, 0.9–1.3 cm long including pseudostalk 0–1 mm long ..... **a. var. subtilis**
- b. Male perianth buds 2.5–3 mm wide (always?). Fruits larger, short-ellipsoid, 1.4–2 cm long including pseudostalk 3 mm long ..... 2
- 2a. Leaves chartaceous, elliptic, 6–9 cm long. Pseudostalk of fruits 2–3 mm long. — Limestone area, Papua Barat, SW Bird's Head; 200–300 m ..... **c. var. calcarea**
- b. Leaves coriaceous or membranous, elliptic-oblong, 10–22(–26) cm long. Pseudostalk of fruits 0–3 mm long. — Papua New Guinea, possibly also Papua Barat (Bird's Head); 600–1000 m ..... 3
- 3a. Leaves membranous. Perianth (female) glabrous inside ..... **b. var. aucta**
- b. Leaves coriaceous. Perianth (female) hairy inside ..... **d. var. rostrata**

#### **a. var. subtilis**

*Horsfieldia subtilis* (Miq.) Warb., Mon. Myrist. (1897) 286, t. 23; Markgr., Bot. Jahrb. Syst. 67 (1935) 152; J. Sinclair, Gard. Bull. Sing. 28 (1975) 132; W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 102, f. 15g, h. — *Myristica subtilis* Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 50.

*Horsfieldia aruensis* Warb., Mon. Myrist. (1897) 284, t. 23; Markgr., Bot. Jahrb. Syst. 67 (1935) 154. — *Myristica aruensis* (Warb.) Boerl., Handl. 3 (1900) 85. — Type: *Beccari s.n.* (FI 7622, A–C, 7623, n.v.), Aru Is.

*Horsfieldia lauterbachii* Warb., Mon. Myrist. (1897) 285, t. 23; K. Schum. & Lauterb., Fl. Schutzgeb. Südsee (1900) 324; Pulle, Nova Guinea 8 (1912) 635; Markgr., J. Arnold Arbor. 10 (1929) 213; Bot. Jahrb. Syst. 67 (1935) 153. — Type: *Lauterbach 805* (B lost; BRSL, n.v.), New Guinea.

*Horsfieldia ramuensis* Warb. in K. Schum. & Lauterb., Nachtr. Fl. Schutzgeb. Südsee (1905) 266. — Syntypes: *Rodatz & Klink 20, 24* (both B lost), New Guinea.

*Horsfieldia globularia* auct. non (Blume) Warb.: K. Schum. & Lauterb., Fl. Schutzgeb. Südsee (1900) 324.

*Horsfieldia nesophila* auct. non (Miq.) Warb.: Pulle, Nova Guinea 8 (1912) 635.

*Leaves* membranous, elliptic to oblong. *Male flowers*: buds 1.8–3 mm wide. *Fruits* (sub)globose, 0.9–1.3 by 0.8–1.1(–1.3) cm, including the pseudostalk up to 1 mm long.

— **Fig. 26g, h.**

*Field-notes* — Low trees, usually 3–5 m tall; bole straight; bark greyish black or grey-brown, finely longitudinally fissured, with broadened lenticels; branches often horizontal or drooping; exudate pinkish, or colourless and turning reddish; wood straw, usually mottled with ± red streaks. Flowers (orange-)yellow. Fruits (greenish) yellow or orange.

*Distribution* — As for the species.

*Habitat & Ecology* — Understorey tree of primary and degraded forest, dry or marshy forest, often tidal (fresh water) or riverine forest; on alluvial, clayey, and sandy clayey soils, limestone, or coral soils; 0–800 m altitude; fl. & fr. throughout the year. Stems once reported as inhabited by ants.

*Uses* — Leaves and twigs burnt as a mosquito repellent.

#### **b. var. *aucta* W.J. de Wilde**

*Horsfieldia subtilis* (Miq.) Warb. var. *aucta* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 105. — Type: *Jacobs 8972*, Papua New Guinea.

*Leaves* membranous, elliptic-oblong, 11–20(–26, see note 2) by 3–7.5(–9) cm, apex for 1–1.5 cm acute-acuminate. *Male flowers*: buds obtriangular, 2.5–3 mm wide (always?). *Fruits* short-ellipsoid, 1.5–2 by 1.1–1.5 cm including pseudostalk up to 2.5 mm long.

*Field-notes* — Shrub or low tree, 3–8 m. Male flowers fleshy, dark yellow. Fruits glossy orange, hard; aril dark orange, or red, at the base black.

*Distribution* — *Malesia*: New Guinea (possibly W Papua Barat: Bird's Head, near Manokwari, cf. De Wilde, l.c.: 106; Papua New Guinea).

*Habitat & Ecology* — Montane primary and degraded rain forest, on well-drained volcanic soil, or peaty soil; 600–1000 m altitude; fl. Sept., Oct.; fr. July–Oct.

*Notes* — 1. The male flowers are stouter and have a thicker perianth as compared with those of var. *subtilis*. The inflorescences are 8–9 cm long, stouter than generally found in the type variety.

2. *Sands et al. 6165*, from Bird's Head, with leaves to 26 by 9 cm and fruits 2 by 1.5 cm, is like a giant form of var. *calcarea*; its twigs measure 4(–5) mm in diameter at the apex. Possibly it should be recognized as still another, new variety.

#### **c. var. *calcarea* W.J. de Wilde**

*Horsfieldia subtilis* (Miq.) Warb. var. *calcarea* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 104. — Type: *BW 15270 (Vink)*, New Guinea, Bird's Head.

*Leaves* thinly chartaceous, elliptic, 6–9 by 2.5–4 cm, at the apex proportionally long-acute-acuminate for 1–1.5 cm. *Male flowers* not seen. *Fruits* ellipsoid, 1.7–1.9 by 1.2–1.4 cm, including pseudostalk 2–3 mm long.

Field-notes — Shrub, 5 m tall; rather common. Ripe fruits orange.

Distribution — *Malesia*: W Papua Barat (SW Bird's Head).

Habitat & Ecology — Secondary forest on limestone rock with thin clay cover; 220–300 m altitude; female fl. May; fr. Mar., May.

Note — The dry pericarp in *BW 15270* (*Vink*) suggests that the fruits were rather fleshy in the fresh state and drying left the pseudostalks distinct, 3 mm long.

#### d. var. *rostrata* (Markgr.) J. Sinclair

*Horsfieldia subtilis* (Miq.) Warb. var. *rostrata* (Markgr.) J. Sinclair, Gard. Bull. Sing. 28 (1975) 136; W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 106. — *Horsfieldia rostrata* Markgr., Bot. Jahrb. Syst. 67 (1935) 152. — Type: *Ledermann 8916* (B lost; iso SING, n.v.), Papua New Guinea.

*Leaves* chartaceous to coriaceous, cuneate-obovate, 9–13 by 2–4.5 cm, apex shortly acute-acuminate. *Male flowers* not known. *Female perianth* pilose inside (see note). *Fruits* ellipsoid, (apex 2 mm rostrate) 2 by 1.2 cm, including the 2–4 mm long pseudostalk.

Distribution — *Malesia*: NE Papua New Guinea (Sepik Prov., 'Etappenberg'; known only from the type).

Habitat & Ecology — Mossy montane forest with much *Agathis*, c. 850 m altitude; female fl. & fr. Oct.

Note — Markgraf, l.c., described the perianth of the female flowers (*Ledermann 8916*, lost) as pilose inside, which is highly remarkable, and the ovary and fruits as glabrous.

#### 85. *Horsfieldia sucosa* (King) Warb.

*Horsfieldia sucosa* (King) Warb., Mon. Myrist. (1897) 322; W.J. de Wilde, Gard. Bull. Sing. 38 ('1985', 1986) 188; Tree Fl. Sabah & Sarawak 3 (2000) 393. — *Myristica sucosa* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 301, pl. 172. — Lectotype: *King's coll. 4647* (fr., K), Peninsular Malaysia.

Tree 6–20 m. *Twigs* 2–10 mm diameter, (whitish) grey-brown or straw-coloured, contrasting with the blackish colour of the dried petioles, early glabrescent, at first with rusty or greyish hairs 0.1–0.3 mm long; bark coarsely striate or not, with a tendency to flake; lenticels conspicuous only on the very young parts. *Leaves* in 2 or 3 rows, membranous to thin-chartaceous, elliptic-oblong to oblong-(ob)lanceolate, 14–28 by 4.5–8.5 cm, base (long-)attenuate, apex acute-acuminate; upper surface glabrous, drying greenish to blackish brown, lower surface early glabrescent, drying light brown; dots absent, but scattered smaller blackish points often present; midrib ± flat above, glabrous; nerves 13–17 pairs, slender, flat or slightly raised above, lines of interarching indistinct; venation lax, faint; petiole 10–20 by 2–3 mm; leaf bud 10–15 by 2–3 mm, with rusty to greyish brown hairs 0.1–0.3 mm long. *Inflorescences* behind the leaves, thinly pubescent or late glabrescent, hairs 0.1–0.2 mm long; in male: 3 or 4 times branched, many-flowered, lax or condensed, 7–19 by 5–16 cm, peduncle 1–2 cm long, flowers in clusters of 3–7; in female rather few-flowered, 1–2 cm long; bracts ± ovate-elliptic to lanceolate,



acutish, pubescent, 1.5–4 mm long, late caducous; flowers with perianth either mostly 2-lobed (Borneo, see under the subspecies) or mostly 3-lobed (Sumatra, Peninsular Malaysia), glabrous, pedicel slender, usually glabrous (see under subsp. *sucosa*), articulated, contrasting with the pubescent branches of the inflorescence. *Male flowers*: pedicel 1–2 mm long; buds (depressed) globose, apex  $\pm$  flat to broadly rounded, 1.2–1.5 by 1.5–2 mm, cleft 1/3–1/2, when dry not or slightly collapsed at the apex, lobes 0.2–0.3 mm thick; androecium depressed globose, 0.3–0.6 by 0.8–1.2 mm, circular or (in Borneo) broadly ellipsoid in cross section (Plate 2: 42); thecae 14–22, completely sessile with  $\pm$  incurved apex, column broad,  $\pm$  saucer-shaped, with broad, flattish, apical hollow to nearly halfway; androphore rather narrow, 0.1–0.3 mm long. *Female flowers* (subsp. *bifissa*): pedicel 1–1.5 mm long, when young with minute hairs 0.1 mm long or less towards the base; buds broadly ellipsoid, 2.8–3.5 by 2.2–3 mm, 2-lobed, cleft c. 1/4; ovary 1.5 mm diameter, glabrous, stigma shallowly 2-lobed, 0.1 mm high. *Fruits* 1–4 per infructescence, broadly ovoid-ellipsoid, apex  $\pm$  narrowly rounded, 2.3–3.5 by 2–2.5 cm, glabrous, drying blackish, finely granulate, sometimes  $\pm$  tuberculate; pericarp 4 mm thick; fruiting pedicel 1–2 mm long; perianth in Peninsular Malaysia persistent (see further under the subspecies).

Distribution — *Malesia*: Sumatra, Peninsular Malaysia, Borneo.

Note — Divided into two geographically separated taxa, mainly based on the number of lobes of the perianth. It is noteworthy that this character, which can be used for the division of the genus into sections (see p. 55), occurs here within a group of species with mainly 3-lobed perianths.

#### KEY TO THE SUBSPECIES

- 1a. Perianths predominantly 3-lobed. — Sumatra, Peninsular Malaysia . . . . .  
 . . . . . a. subsp. *sucosa*  
 b. Perianths predominantly 2-lobed. — Borneo . . . . . b. subsp. *bifissa*

#### a. subsp. *sucosa*

*Horsfieldia sucosa* (King) Warb., Mon. Myrist. (1897) 322; J. Sinclair, Gard. Bull. Sing. 16 (1958) 416, p.p. (incl. lectotype, excl. f. 45 = *Horsfieldia sparsa*), pl. XII-A; 28 (1975) 139, p.p.; W.J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 188; Tree Fl. Sabah & Sarawak 3 (2000) 393. — *Myristica sucosa* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 301, pl. 172.

*Horsfieldia bracteosa* Henderson, Gard. Bull. Str. Settl. 7, 2 (1933) 120, pl. 30; J. Sinclair, Gard. Bull. Sing. 16 (1958) 419, f. 46. — *Horsfieldia bracteosa* Henderson var. *bracteosa*: J. Sinclair, Gard. Bull. Sing. 28 (1975) 18. — Type: SF 24521 (Henderson), Peninsular Malaysia.

Perianths predominantly 3-lobed, rarely a few 2- or 4-lobed; mature male buds 1.2–1.5 by 1.5–2 mm; androecium 0.4–0.6 by 0.8–1.2 mm; thecae 14–18 (Peninsular Malaysia) or 18–22 (Sumatra). *Fruits* 2.5–3.5 by 2–2.5 cm with persistent 3-lobed perianth.

Field-notes — Bark smooth, shallowly fissured, or thin-scaly; slash bark laminated, reddish, with sticky reddish exudate; wood yellowish or pink. Flowers yellow(-green), scentless. Fruits glossy green, turning yellow or pink.

Distribution — *Malesia*: Sumatra, Peninsular Malaysia.

Habitat & Ecology — Primary or disturbed dry land and seasonal swamp forest; sandy soils or sandstone; 0–500 m altitude; fl. & fr. throughout the year.

Notes — 1. Dry fruits are at most 3.5 cm long, but fresh fruits 5–7.5 cm long, with a thick pericarp.

2. *Horsfieldia sucosa* is vegetatively very similar to *H. pallidicaula* and *H. sterilis*, the latter two being markedly different in the male flowers; they have a different androecium, and the pedicels are not articulated.

3. It seems that the distributional area excludes that of the related and resembling species *H. pallidicaula*.

#### b. subsp. *bifissa* W.J. de Wilde

*Horsfieldia sucosa* (King) Warb. subsp. *bifissa* W.J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 190; Tree Fl. Sabah & Sarawak 3 (2000) 393. — Type: *Soegeng* 58, Kutei.

Perianths predominantly 2-lobed, the odd 3-lobed perianth present; mature male buds 1.2–1.4 by 1.5–1.7 mm; androecium 0.3–0.4 by 0.8–0.9 mm; thecae 14. Fruits 2–2.5 (–4) by 2 cm, the 2-lobed perianth ± caducous.

Field-notes — Bark smooth, undulately fissured; inner bark 10 mm thick, laminated, reddish or yellow brown; wood whitish, pale brown, or reddish. Flowers yellow, the males very fragrant.

Distribution — *Malesia*: Borneo (Sarawak, E Sabah, C, E & S Kalimantan).

Habitat & Ecology — Lowland forest; on sandy loam soil, sandy ridge in *Shorea laevifolia* forest, also in forest over limestone; 0–800 m altitude; fl. & fr. throughout the year.

Note — Fruiting material may be difficult to separate from that of *H. pallidicaula* var. *macrocarpa* in which the perianth is 3- or 4-lobed.

#### 86. *Horsfieldia superba* (Hook. f. & Thomson) Warb.

*Horsfieldia superba* (Hook. f. & Thomson) Warb., Mon. Myrist. (1897) 295; Corner, Wayside Trees (1940 & 1952) 476; J. Sinclair, Gard. Bull. Sing. 16 (1958) 393, f. 36, pl. X-B; 28 (1975) 141; W.J. de Wilde, Gard. Bull. Sing. 38 ('1985', 1986) 200. — *Myristica superba* Hook. f. & Thomson, Fl. Ind. (1855) 162; A.DC., Prodr. 14, 1 (1856) 194; Miq., Fl. Ind. Bat. 1, 2 (1858) 62; Hook. f., Fl. Brit. India 5 (1886) 105; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 298, pl. 124bis, 125bis. — Type: *Phillips s. n.*, Peninsular Malaysia.

Tree 10–30 m. Twigs sometimes faintly angular, 5–8 mm diameter, late glabrescent, at first with dense, rusty, dendroid hairs 0.5–1 mm long, bark dark grey, striate, sometimes slightly cracking and flaking; lenticels usually many and conspicuous. Leaves usually in 2, sometimes in 3 rows (see note 2), coriaceous, (elliptic-)oblong, (17–)25–40(–70) by (7.5–)10–18(–22) cm, base narrowly subcordate to short-attenuate, apex ± blunt to acute-acuminate; upper surface drying dull olivaceous-brown with finely wrinkled structure, glabrescent (except sometimes midrib), lower surface with (bright) brown rather sparse to dense mealy indumentum of dendroid hairs of mixed size, (0.3–) 0.5–1 mm long, usually with many or few emerged hairs to 1.5 mm long; dots absent; midrib rather broad, flat above, pubescent or glabrescent; nerves 15–25(–30) pairs, flat or sunken above, lines of interarching fairly regular, not very distinct; venation faint on both surfaces; petiole 6–15 by 5–7 mm, late glabrescent; leaf bud 20–30 by 5–10 mm, with dense hairs 0.5–1.5 mm long. Inflorescences behind the leaves, with ± dense, woolly,

long-branched yellowish brown dendroid hairs 0.5–1 mm long; in male: rather many-flowered, 2 or 3 times branched, 7–15 by 2.5–10 cm, peduncle 1–1.5 cm; in female:  $\pm$  few-flowered, somewhat branched, 2–5 cm long; bracts broadly ellipsoid, subacute-acuminate, up to 12 by 10 mm, densely pale brownish pubescent, caducous; flowers in male up to 5 in a cluster, glabrous, perianth 3- or 4-lobed, drying often with a grey bluish tinge, pedicel not articulated. *Male flowers*: pedicel slender, 1.5–3.5(–5) mm; buds ellipsoid to obovoid-ellipsoid, 6–7(–8) by 4–5 mm, base rounded to short-attenuate, cleft 1/5–1/4, lobes 0.4 mm thick; androecium elongate-ellipsoid, subcylindrical to triangular in cross section, (4–)4.5–5 by 2.2–2.5 mm, apex subtruncate, with a shallow 3-radiate crack, base subtruncate (Plate 2: 48); thecae 32–40, completely sessile; androphore rather narrow, 0.1–0.4 mm long. *Female flowers*: pedicel stout, 2–3.5 mm long; buds ellipsoid, 7–8 by 4.5 mm, cleft c. 1/5, lobes rather coriaceous; ovary ovoid, slightly compressed, 4–4.5 by 3 mm, glabrous, stigma shallowly 2-lobed, broad, 0.5 by 1.5 mm. *Fruits* 1–3 per infructescence, broadly ovoid-ellipsoid, 3.8–5.5 by 2.8–4.5 cm, glabrous,  $\pm$  coarsely warty and wrinkled, pericarp 8–12 mm thick; fruiting pedicel stout, 3–6 mm long; perianth persistent.

Field-notes — Bole straight; bark longitudinally fissured, dippled or cracked; bark slash brittle, gritty; slash wood soft, whitish or yellowish. Leaves glossy above, becoming dull on drying. Flowers bright yellow, smell unpleasant or of ripe pears, visited by bees. Fruits globose, (greenish) yellow, or orange.

Distribution — *Malesia*: Sumatra (Central, West), Peninsular Malaysia (almost all states), Singapore.

Habitat & Ecology — Forest on alluvial soils, undulating country, also in swampy forest; 0–400 m altitude; fl. Aug.–Oct.; most fruits collected May–Aug.

Notes — 1. Related to *H. fulva* on account of the oblong or obovoid male perianth and oblong staminal column.

2. By way of exception the leaves, also in fertile twigs, are arranged in three rows.

3. Sterile *H. superba* may be confused with *Gymnacranthera bancana*, also with a stout habit and remaining indumentum on the twig apex and the lower leaf surface, but its hairs are much more interwoven forming a thin felty mat; in *H. superba* the lower leaf surface is covered with harsh, stellate-dendroid hairs.

### 87. *Horsfieldia sylvestris* (Houtt.) Warb.

*Horsfieldia sylvestris* (Houtt.) Warb., Mon. Myrist. (1897) 337, t. 22; J. Sinclair, Gard. Bull. Sing. 28 (1975) 142; W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 84, f. 11. — *Myristica sylvestris* Houtt., Nat. Hist. Pl. 2, 3 (1774) 340. — Type: not indicated; see discussion by J. Sinclair, l.c.: 147, 148.

*Myristica salicifolia* Willd. in Roem. & Usteri, Mag. Bot. 3, 9 (1790) 26; Sp. Pl. 4 (1806) 871; Roxb., Fl. Ind. 3 (1832) 846. — Type: not known, see above.

*Myristica pinnaeformis* Zipp. (msc.) ex Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 49. — Type: *Zippelius s.n.* (180), West New Guinea.

*Myristica pendulina* Hook. f., Fl. Brit. India 5 (1890) 859; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 329, pl. 170. — Type: *Cantley s.n.*, culta.

*Horsfieldia sylvestris* (Houtt.) Warb. var. *villosa* Warb., Mon. Myrist. (1897) 341. — Syntypes: *Beccari 696*, *Warburg 20708*, New Guinea.

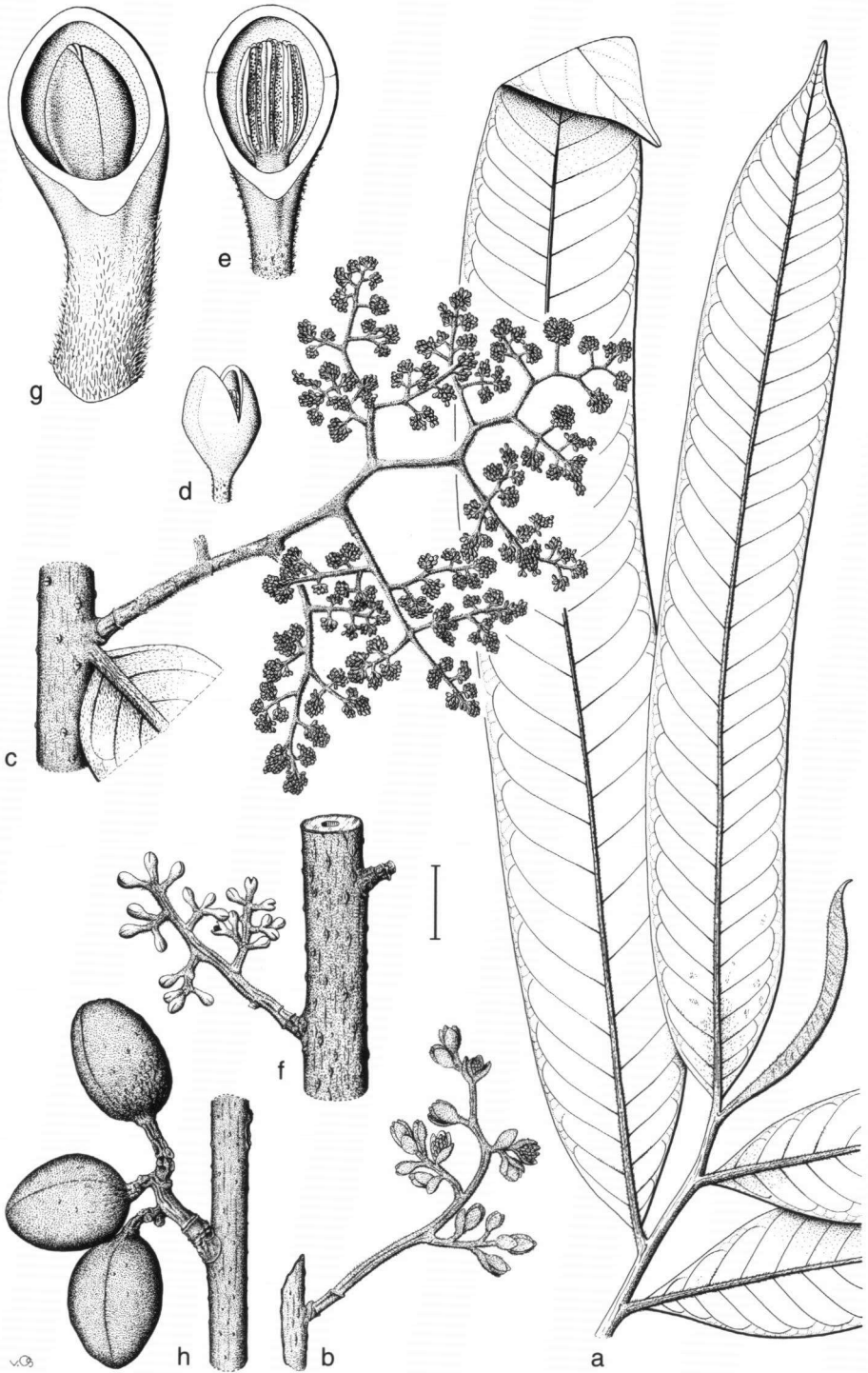
*Myristica edulis* F. Muell. in sched. (*Hb. von Müller, d'Albertis 11*, MEL, not seen).

Tree 7–40(–60) m. *Twigs* hollow, in innovations when dry  $\pm$  angular, flattish, or ridged, 4–14 mm diameter, glabrescent, at first with rusty,  $\pm$  woolly hairs 0.3–1(–1.5) mm; bark faintly striate, not flaking; lenticels coarse. *Leaves* (thinly) chartaceous, lanceolate(-linear), (17–)20–45 by 3–7(–9) cm, base rounded to short-attenuate, apex long acute-acuminate; upper surface drying dull, greenish brown to dark brown, minutely pustulate or not, lower surface late glabrescent or with (partially) persistent hairs of mixed size, 0.1–1(–1.5) mm; dots absent; midrib  $\pm$  flat above, late glabrescent; nerves 30–42 pairs, thin, flat or sunken above, lines of interarching distinct; venation lax, distinct (leaves frequently  $\pm$  bullate) or indistinct; petiole (0–)2–7 by (2–)3–5 mm, usually shortly winged by decurrent lamina; leaf bud up to 8 cm long, densely woolly-pubescent. *Inflorescences* with woolly hairs 0.5–1 mm, or late glabrescent; in male: large, paniculate, many-flowered, 3–5 times branched, 7–30 by 4–14 cm; female 4–10(–15) cm long; peduncle 2–7 cm, at base with a few persistent rather blunt cataphylls 2–4 mm long; bracts  $\pm$  concave, (2–)4–8(–16) mm long, rather late caducous; flowers in male in loose clusters of 4–10, in female up to 5; perianth 2- (or 3-)lobed, often somewhat angular, glabrous or at base glabrescent, pedicel slender, glabrescent or with hairs 0.3 mm, not articulated; flowers before anthesis, especially in male, densely packed into subglobose or ellipsoid glomerules 4–7 mm diameter wrapped in bracts. *Male flowers*: pedicel 0.2–2 by 0.3 mm; buds (narrow-)obovoid or clavate, irregularly shaped and angular by being closely packed, 1.5–2.1 by 0.5–1.3(–1.5) mm, apex obliquely obtuse, towards base  $\pm$  tapering into pedicel, cleft 1/3–1/2, lobes 0.1–0.3 mm thick, sometimes with a few pale dots; androecium ellipsoid-oblong, 1–1.2 by 0.5–0.6 mm, apex broadly rounded (Plate 1: 14); thecae 8–16, completely sessile, 0.8–1.5 mm long, column solid; androphore rather broad, 0.1–0.4 mm long. *Female flowers*: pedicel stout, 1.5–5.5 mm long; buds ellipsoid to broadly ovoid,  $\pm$  coriaceous, 3.5–5 by 3–4.5 mm, cleft c. 1/3; ovary broadly ovoid-ellipsoid, 2.5–3 by 2.5 mm, glabrous, stigma sessile, unlobed, 0.1 by 0.5 mm. *Fruits* 2–10 per infructescence, ellipsoid, base and apex sometimes  $\pm$  acute on drying, 3.4–5.5 by 2.5–3.5 cm, glabrous, without or with few coarse tubercles; pericarp 2–4(–5) mm thick; fruiting pedicel 5–13 mm; perianth not persistent. — Fig. 30.

Field-notes — Striking solitary emergent tree, with pendulous branches (twigs up to 2 m), bole often very straight, in old specimens with rotten core; buttresses present or absent, low or up to 1.5(–2.5) m high, up to 1.5 m out, up to 8(–20) cm thick, sometimes with small stilt-roots; bark brownish, smooth or usually shallowly fissured, or slightly to strongly peeling off in small scales; exudate pale red-brown, watery; sapwood pale yellowish or straw, usually gradually passing into the slightly darker reddish heartwood. Leaves drooping and distichous (twigs resembling compound pinnate leaves), glossy above. Flowers bright or dark yellow, slightly fragrant or not; pollen pale yellow or whitish. Fruits pinkish, orange, red-brown, or deep red.

Distribution — *Malesia*: Moluccas (Morotai to Kai Is.), Aru Is., New Guinea (not known from Morobe and Milne Bay Prov. of Papua New Guinea).

Habitat & Ecology — Primary, degraded, and secondary forest, on alluvial soils (sandy and clayey), especially common in the coastal plains of Bird's Head; also in swampy forest (with *Pometia*), in forest inundated by heavy rains or in stagnant water; also on well-drained porous volcanic soils, or close to limestone outcrops, in ridge forest, or in *Castanopsis* forest (at 530 m, in Bird's Head); 0–700 m altitude; fl. & fr. throughout the year. The trees may bear flowers and fruits simultaneously.



Uses — The wood is heavy, easily worked, not very durable. Fruits (sour taste) edible (Sepik Prov.). The fruit wall is used in rodjak, and in manisan (a sweet pickle) (Moluccas). Extract of bark is used as a drug against 'penyakit keputihan' by pregnant women, also against hepatitis (Moluccas). The fruits are gathered and eaten by the Gogodala tribe (Papua New Guinea, Western Prov.); also planted near villages. Fruits eaten by birds (e. g., pigeons, parrots), apparently swallowed whole. The tree is recorded as beautiful, and recommended as an ornamental. The many vernacular names indicate that the tree is widely known by local people.

Notes — 1. *Horsfieldia sylvestris* is a homogeneous species, and only varies in hairiness. Very hairy specimens were described as var. *villosa* by Warburg.

Sterile specimens may be confused with *H. hellwigii*, a species usually with narrower leaves, subglobose (not clavate) male buds, and smaller and hairy fruits; in *H. sylvestris* the fruits generally are larger, and always glabrous.

2. Warburg placed *H. sylvestris* and *H. ralunensis* in his section *Orthanthera*, which also included *H. iryagedhi* from Sri Lanka, on account of the elongate angular male buds clustered into flower heads. The first two species, however, have the flowers clustered only in immature inflorescences, and are not closely related to *H. iryagedhi*.

### 88. *Horsfieldia talaudensis* W.J. de Wilde

*Horsfieldia talaudensis* W.J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 75. — Type: Lam 2628, Moluccas, Talaud I.

Tree 15–35 m. Twigs 2–4(–7) mm diameter, early glabrescent, at first with scarce hairs 0.1 mm or less; bark striate, not flaking; lenticels ± inconspicuous. Leaves membranous or chartaceous, oblong-lanceolate, 8–30 by 2.5–10 cm, base attenuate, apex acute-acuminate, finely pale-pustulate on both surfaces; upper surface drying greenish to brown, lower surface bright brown, early glabrescent, hairs stellate-scaly, 0.1 mm long or less; dots absent; midrib flat above; nerves 12–20 pairs, flat and inconspicuous above, lines of interarching not distinct; venation thin, indistinct on both surfaces; petiole 10–18 by 1.5–3 mm, leaf bud 10 by 2 mm, with hairs 0.1 mm. Inflorescences with dense hairs 0.1–0.2 mm long, about 3 times branched; in male and female 4–8 by 3–4 cm, rather many-flowered, peduncle 1.5–2 cm; bracts broadly ovoid-ellipsoid, pubescent, 1.5–3 mm long, caducous; flowers in male in clusters of 2 or 3, perianth 2-lobed, glabrous; pedicel pubescent, not articulated. Male flowers: pedicel slender, 1–1.5 mm, with grey or pale brown hairs 0.1 mm; buds transversely ellipsoid, somewhat compressed laterally, 2–2.2 by 2.5–3 mm, drying brown, not collapsing on drying, cleft 2/3–4/5, lobes firm, 0.2–0.3 mm thick; androecium transversely ellipsoid to reniform, not much

Fig. 30. *Horsfieldia sylvestris* (Houtt.) Warb. a. Leafy twig apex; b & c. twigs with immature and full-grown male inflorescences, respectively; note bracts in b; d. male flower; e. ditto, opened, showing androecium; f. twig with female inflorescence axillary to fallen leaf; g. opened female flower, lateral view, showing glabrous ovary; note much larger size as compared with the male flowers; h. twig with infructescence, fruits mature [a, f, g: de Vogel 3069; b: de Vogel 3094; c–e: Craven 739; h: de Vogel 3370]. — Scale bar for a–c, f, h = 2 cm; for d, g = 1.65 mm; for e = 0.85 mm.

compressed, 1.5 by 2 mm (Plate 1: 9); thecae c. 36, connate for basal half and forming a  $\pm$  saucer- or cup-shaped column into which the free apical halves of the anthers are inflexed; androphore slender, 0.2–0.3 mm long. *Female flowers* not seen. *Fruits* 3–10 per infructescence, short-ellipsoid, 1.5–1.6 by 1.3–1.4 cm, glabrescent, at first with stellate hairs 0.1 mm or less (hence ovary pubescent), without conspicuous tubercles; pericarp 1.5 mm thick, fruiting pedicel 3–4 mm long; perianth not persistent.

Field-notes — Tree to 35 m. Ripe fruits orange or brownish yellow.

Distribution — *Malesia*: Moluccas (Talaud Is.: Karakelong), possibly Sulawesi (Minahassa, see note 2).

Habitat & Ecology — Old forest on mountain slopes; 70–200 m altitude; fl. Apr.; fr. Apr., May.

Notes — 1. *Horsfieldia talaudensis* possibly is endemic on the Talaud Islands. It belongs to the group of species with firm, transversely ellipsoid to subglobose male buds, the androecium with strongly inflexed anthers, connate to about halfway, with slender hairy pedicels, and pubescent ovary (thinly pubescent young fruits).

2. *Koorders 18136* (Sulawesi) is sterile but agrees in leaf colour and texture with the specimens from the Talaud Islands.

### 89. *Horsfieldia tenuifolia* (J. Sinclair) W.J. de Wilde

*Horsfieldia tenuifolia* (J. Sinclair) W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 11, f. 28; Tree Fl. Sabah & Sarawak 3 (2000) 394. — *Horsfieldia polyspherula* (Hook. f. emend. King) J. Sinclair var. *tenuifolia* J. Sinclair, Gard. Bull. Sing. 28 (1975) 105. — Type: *S 13686* (*Bujang*), Sarawak.

Tree 5–15 m. *Twigs* 1–3 mm diameter, early glabrescent, hairs greyish rusty, (0.1–) 0.2 mm; bark striate, neither cracking nor flaking; lenticels inconspicuous or absent. *Leaves* membranous or thinly chartaceous, elliptic to oblong-lanceolate, 6.5–16.5 by 3–6.5 cm, base attenuate, apex acute-acuminate; upper surface drying olivaceous to greyish brown, glabrous, lower surface dull greyish brown, glabrous; dots absent; midrib raised above, glabrous; nerves 5–11 pairs, raised above, lines of interarching regular but faint; venation lax, faint; petiole 8–16 by 1.5–2 mm; leaf bud 5–8 by 1–1.5 mm, with dense hairs 0.2(–0.3) mm. *Inflorescences* with (sparse) stellate hairs 0.1–0.2 mm long; in male: rather many-flowered, about 3 times branched, 3–5 by 2–4 cm, peduncle 0.2–1 cm; in female: rather slender, few-flowered, 2–3.5 by 1 cm; bracts elliptic to oblong, 2–3 mm, pubescent, caducous; flowers in male in loose clusters of 3–8, perianth 3- (or 4-)lobed, glabrous, pedicel glabrescent or with few scattered hairs 0.2 mm in the lower half, not or indistinctly articulated. *Male flowers*: pedicel 1–2 mm long, somewhat tapering; buds globose to broadly obovoid, 0.8–1.3 by 1–1.5 mm, apex broadly rounded, base rounded to subattenuate, cleft c. 1/3 to nearly 1/2, lobes 0.2–0.3 mm thick, at base to 0.4 mm thick; androecium  $\pm$  obovoid or ellipsoid, 0.5–0.7 by 0.5–0.8 mm, in cross section triquetrous (Plate 3: 68); thecae 8–12, suberect, 0.3–0.4 mm long, free for at least halfway, column largely hollow, the base continued into the somewhat tapering androphore 0.2–0.3 mm long. *Female flowers*: pedicel 1.5 mm long; buds ellipsoid, 2 by 1.5 mm, cleft c. 1/3 or slightly over; ovary ellipsoid, 1.3 by 0.8–0.9 mm, glabrous, stigma 2-lobed, 0.2 mm high. *Fruits* 1–3 per infructescence, ellipsoid, base sometimes shortly tapered, 1.7–2 by 1.4–1.5 cm, glabrous, without lenticel-like tubercles; pericarp 1–1.5 mm thick; fruiting pedicel 3–5 mm long; perianth not persistent. — **Fig. 31.**

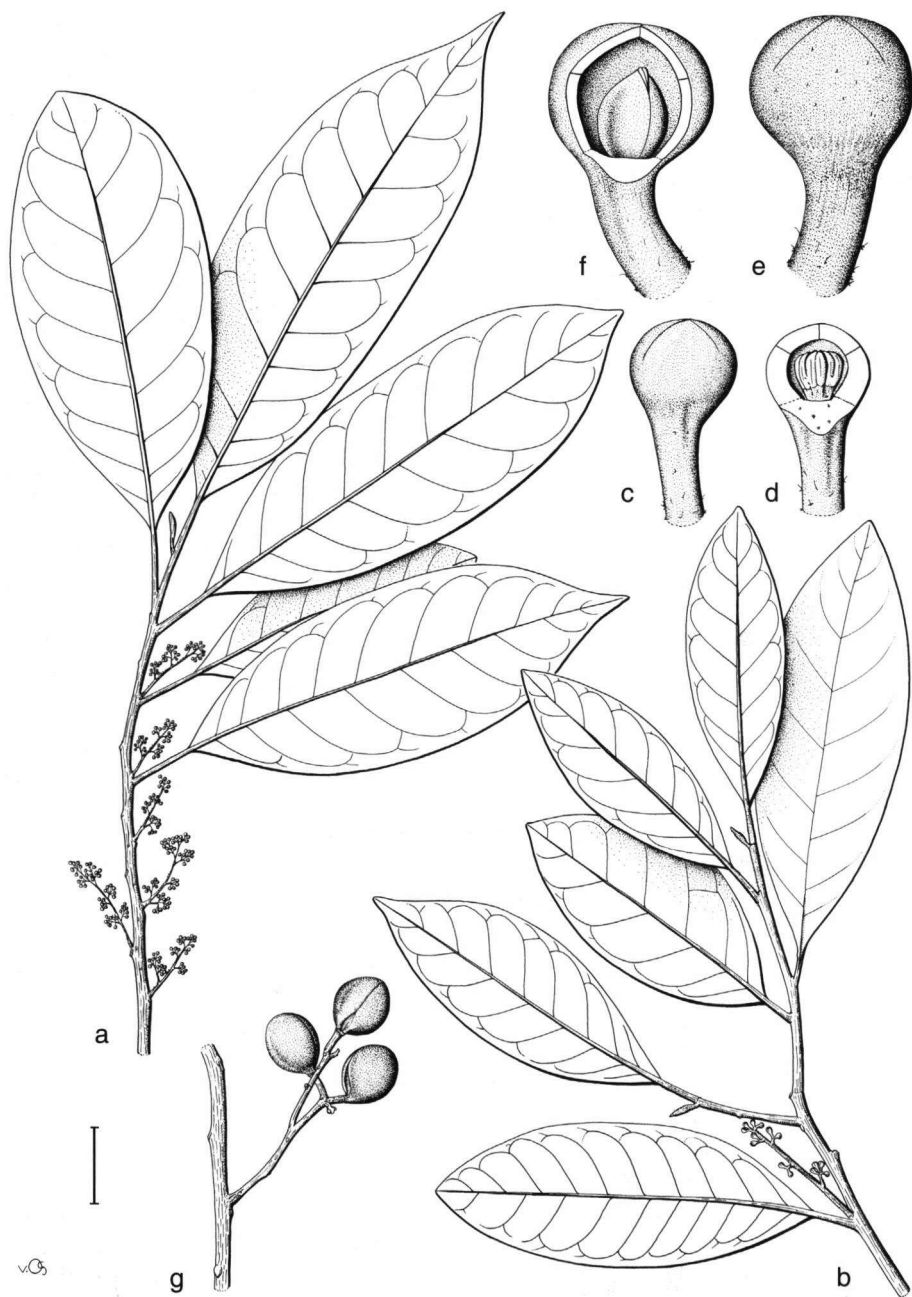


Fig. 31. *Horsfieldia tenuifolia* (J. Sinclair) W.J. de Wilde. a. Habit of twig with leaves and male inflorescences; b. ditto, with female inflorescence; c. mature male flower, lateral view; d. ditto, opened, showing androecium; e. mature female flower; f. ditto, opened, showing glabrous ovary and minute 2-lobed stigma; g. twig with infructescence, fruits mature [a, c, d: S 24945; b, e, f: S 34528; g: S 24914]. — Scale bar for a, b, g = 2 cm; for c–f = 0.85 mm.



Field-notes — Slender tree, once recorded with buttresses; bark (greenish) brown, narrowly fissured, not flaking; inner bark dark red, with red sap; sapwood whitish. Flowers greenish yellow. Fruits yellowish.

Distribution — *Malesia*: Borneo (Sarawak: 1st Div.; Sabah: Beaufort Hill, Jesselton; Brunei, E Kalimantan).

Habitat & Ecology — Understorey tree of lowland dipterocarp forest on richer soils; on yellow (sandy) clay or loam, or brownish soil; on ridges and slopes; 0–300 m altitude; fl. & fr. May–Sept.

Note — *Horsfieldia tenuifolia* is characterized by twigs which are glabrous to the apex, small and slender leaf buds, with hairs only 0.2 mm long, by leaves membranous to thinly coriaceous, not very brittle, drying to a greyish tinge, and the not markedly different colour of upper and lower surfaces, relatively long and slender petioles, and by comparatively small inflorescences and flowers. According to the male flowers the species is close to *H. polyspherula*. Another closely related species is *H. macilenta*, also with thin membranous leaves, but with much more pubescent twigs and inflorescences.

## 90. *Horsfieldia tomentosa* Warb.

*Horsfieldia tomentosa* Warb., Mon. Myrist. (1897) 302; J. Sinclair, Gard. Bull. Sing. 16 (1958) 403, f. 40; 28 (1975) 149; W.J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 210. — *Myristica tomentosa* Hook. f. & Thomson, Fl. Ind. (1855) 161, nom. illeg. [non Thunb. (1782)]; A. DC., Prodr. 14, 1 (1856) 204; Miq., Fl. Ind. Bat. 1, 2 (1858) 68; Hook. f., Fl. Brit. India 5 (1886) 105; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 301, pl. 129. — Type: *Wallich Cat. n. 9025* ('*Myristicea?*'), Peninsular Malaysia.

Tree 5–20(–40) m. Twigs 2–5 mm diameter, late glabrescent, hairs dense, rusty, woolly, 1–1.5 mm; bark striate, not flaking; lenticels abundant, conspicuous. Leaves membranous, elliptic or obovate to oblong-lanceolate, 9–27 by 4–10(–12) cm, base nearly rounded to attenuate, apex acute-acuminate; upper surface drying brown, faintly minutely pustulate or not, glabrous (glabrescent), lower surface with persistent dense dendroid hairs all of about the same size, (0.1–)0.5–0.8 mm long; dots absent; midrib  $\pm$  flat, glabrescent above; nerves 7–15 pairs, flat or sunken above, lines of interarching  $\pm$  regular, distinct; venation lax, faint; petiole 10–18 by 1.5–3 mm, pubescent; leaf bud ovoid-ellipsoid, 10–15 by 2–3 mm, with dense hairs 1.5 mm. Inflorescences with dense woolly hairs 1.5–2 mm long; in male: rather many-flowered, 3 or 4 times branched, 3–12 by 1.5–7 cm, peduncle 0.3–2.3 cm; in female:  $\pm$  few-flowered, 2–6 cm long; bracts elliptic, densely woolly pubescent, 2–4 mm long, caducous; flowers (male) in small fascicles, perianth 3(–4- or 5-)lobed, glabrous; pedicel slender, in male glabrous, in female late glabrescent, not articulated, hairs 0.2 mm. Male flowers: pedicel 1–3 mm long; buds globose, 1.4–2.5 mm diameter, cleft nearly 1/2, lobes 0.1 mm thick; androecium much depressed-globose, above flattish or impressed, circular to blunt-triangular in cross section, 0.6–0.9 by 1.2–1.7 mm (Plate 2: 54); thecae 18–24(–30?), almost completely sessile, incurved towards the apex; column broad, with apical hollow 0.2 mm deep; androphore narrow, 0.4–0.5 mm long. Female flowers: pedicel 1–2 mm long; buds broadly ellipsoid, 2.5 by 2.3 mm, cleft c. 1/3; ovary subglobose, 1.5 mm diameter, with appressed hairs 0.1–0.2 mm, style and stigma minute, faintly 2-lobed, 0.1 mm long. Fruits 1–5 per infructescence, ellipsoid, 1.5–2 by 1.3–1.6 cm, glabrescent, usually with minute indumentum remaining

towards the base, usually minutely pustulate; pericarp 1.5 mm thick; fruiting pedicel 2–6 mm long; perianth not (or for a short period) persistent.

Field-notes — Bark fissured, not flaky nor scaly, brown to blackish, soft; inner bark pale reddish or pale yellowish, laminated, fibrous; exudate pink-red; sapwood whitish or pink. Flowers yellow, with a fine perfume. Fruits yellow to orange.

Distribution — S Peninsular Thailand; in *Malesia*: Sumatra (E Coast, see Sinclair 1975: 149; no specimens seen), Peninsular Malaysia (Kedah, Penang, Perak, Trengganu, Pahang, Selangor, Malacca, Johore, Kelantan), Singapore (doubtful; Sinclair 1975: 150).

Habitat & Ecology — Lowland and foothill forest, old secondary forest; 0–300 m altitude; fl. mostly Mar.; fr. mostly July.

Notes — 1. The lobes of the male perianth in fully mature flowers are often somewhat recurved outward.

2. *Horsfieldia tomentosa* belongs in the alliance with *H. flocculosa*, *H. grandis*, and *H. motleyi*, all with a hairy lower leaf surface.

### 91. *Horsfieldia triandra* W.J. de Wilde

*Horsfieldia triandra* W.J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 195, f. 23. — Type: *Forbes 2465*, Sumatra.

Low tree. *Twigs* sometimes faintly ridged, 1.5–3(–4) mm diameter, early glabrescent, hairs rusty, 0.3–0.7 mm long; bark finely, lower down coarsely striate, not flaking; lenticels small but conspicuous. *Leaves* membranous to thinly chartaceous, (elliptic-)oblong, 5–9 by 2–3.5 cm, base (short-)attenuate, apex acute-acuminate with acumen 8–12 mm long; upper surface glabrous, drying dark olivaceous to dark brown, lower surface brown, early glabrescent; dots absent; midrib raised above, glabrous; nerves 6–10 pairs, flat or ± sunken above; venation lax, faint on both surfaces; petiole 7–13 by 1–1.5 mm; leaf bud 6–8 by 2 mm, with dense rusty hairs 0.3–0.7 mm long. *Inflorescences* with dense rusty hairs 0.3–0.4 mm; in male: 1 or 2 times branched, 3–5 by 1–2 cm, peduncle 0.3–1 cm long, not many-flowered, (10–20 flowers per inflorescence and in different stages of development), solitary or in loose clusters of 2–4; in female (from infructescences): 0.5–1 cm long, few-flowered; bracts ellipsoid-oblong, pubescent, 2–3 mm long, caducous, and each inflorescence usually with one (rarely two) persistent subapical enlarged bract, resembling a small foliage leaf, 5–12 mm long (see note 1); flowers with 3-lobed perianth, towards the base with fine hairs 0.2–0.4 mm, pedicel pubescent, not articulated. *Male flowers*: pedicel 3–4 mm long, slender; buds ± obconical-obovoid, apex broadly rounded or blunt, base tapering, 2.5 by 2.5 mm, cleft 1/5–1/6, not collapsing on drying, lobes at apex 0.2, towards base 0.4 mm thick, ± clasping the anthers, at anthesis hardly opening, the basal part of perianth thick-walled, 0.8–1 mm thick; androecium including androphore ± turbinate, 1.5–1.7 by 0.6–0.8 mm, circular in cross section (Plate 2: 45); thecae 6, acutish, erect, subsessile, 0.6–0.7 mm long, the apical 0.3 mm free; column solid, below proceeding into ± obconical androphore, 1 by 0.6–0.8 mm. *Female flowers* not seen. *Fruits* 1 or 2 per infructescence, broadly ellipsoid, 23–25 by 19–20 mm, drying blackish, glabrescent with remnants of minute indumentum of scattered hairs 0.1 mm or less towards the base; pericarp 1–1.5 mm thick; perianth not persistent. — **Fig. 32.**

Distribution — *Malesia*: C & S Sumatra.

Habitat & Ecology — Forest at 800–1000 m altitude.

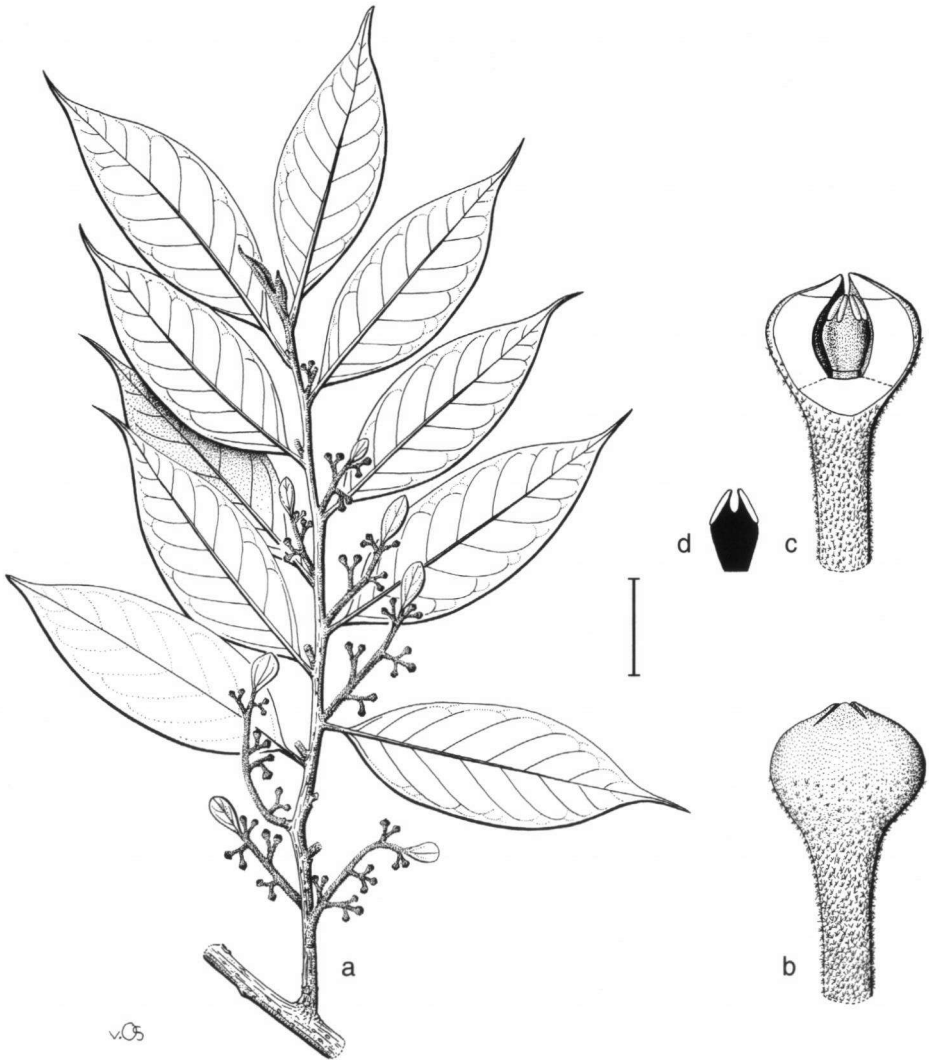


Fig. 32. *Horsfieldia triandra* W. J. de Wilde. a. Habit of leafy twig with male inflorescences; note leaf-like bracts; b. mature male flower; c. ditto, longitudinally opened, thick-walled perianth, and androecium; d. androecium, longitudinal section, schematic [all Forbes 2465]. — Scale bar for a = 2 cm; for b–d = 1.7 mm.

Notes — 1. The male bud deviates from most *Horsfieldias* by the obconical shape and the thick-leathery texture; it opens slightly only at the very apex, and the turbinate androecium, with at apex only 3 anthers, is clasped by the perianth lobes before anthesis.

The flowers look as if diseased, but on opening one finds the perianth and androecium normal. The few-flowered inflorescences, with some leaf-like enlarged bracts in the apical part, also look aberrant. Enlarged leaf-like bracts in the inflorescences are occasionally found in the inflorescences of some other species, e.g., in *H. irya*.

2. *Horsfieldia sterilis* from Borneo, *H. pulverulenta* and *H. crux-melitensis* (to a lesser extent), both from New Guinea, and related species from New Guinea have somewhat resembling male flowers, with thick-leathery perianth, similarly opening only at the apex, and a reduced number of anthers; however, all these species have a 2-lobed perianth.

## 92. *Horsfieldia tristis* W.J. de Wilde

*Horsfieldia tristis* W.J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 197; Tree Fl. Sabah & Sarawak 3 (2000) 396. — Type: S 37470 (*Lai Shak Teck*), Sarawak.

Tree 10–15 m. Twigs 3–5(–7) mm diameter, early glabrescent, with greyish to rusty hairs 0.1 mm long or less; bark bright brown to yellowish, coarsely striate with a tendency to cracking longitudinally, or flaking; lenticels  $\pm$  small, conspicuous or not. Leaves membranous to thinly chartaceous, elliptic-oblong to lanceolate, 14–32 by 4–8.5 cm, base attenuate, apex acute-acuminate; above drying dull with a finely wrinkled or granulate structure, olivaceous-brown, lower surface glabrous, almost concolorous; dots absent; midrib flat or slightly raised, glabrous above; nerves 11–17 pairs, sunken, flat, or slightly raised above, lines of interarching  $\pm$  invisible; venation  $\pm$  lax,  $\pm$  invisible; petiole 6–12 by 2–5 mm; leaf bud 10–15 by 1.5–2.5 mm, with dense greyish to dull-brown hairs up to 0.1 mm long. Inflorescences glabrous or with few scattered hairs up to 0.1 mm; in male: about 3 times branched, rather many-flowered, 5–12 by 3.5–7 cm, peduncle 0.7–2.5 cm long; in female (in fruit): 2–3 cm long, once or twice branched; bracts not seen, caducous; flowers in male in loose clusters of 2–5, glabrous, perianth 3- (or 4-)lobed, pedicel not articulated. Male flowers: pedicel 1.5–5 mm long, slender, well marked off from the perianth; buds obovoid to broadly ellipsoid, 2.8–3.7 by 2–3 mm, base rounded to short-tapering, cleft 1/5–1/4 (to nearly 1/3), lobes 0.2–0.4 mm thick, androecium obovoid-ellipsoid, apex broadly rounded or  $\pm$  depressed, in cross section subcircular or bluntly 3- or 4-angular, 2–2.7 by 1.5–2 mm (Plate 2: 46); thecae 24–40, mutually appressed, almost completely sessile with free apices 0.1(–0.2) mm long, column broad and solid with a broad apical hollow, 0.5–0.8 mm deep, concealed by the overcurved anthers; androphore narrow, 0.2–0.3 mm long, largely hidden by the anther bases. Female flowers not seen. Fruits 4–8 per infructescence, ellipsoid, apex subacute, 1.5 by 1.2 cm, glabrous, drying blackish, without lenticels or tubercles; pericarp 1.5 mm thick; fruiting pedicel 1–2 mm long; perianth not persistent.

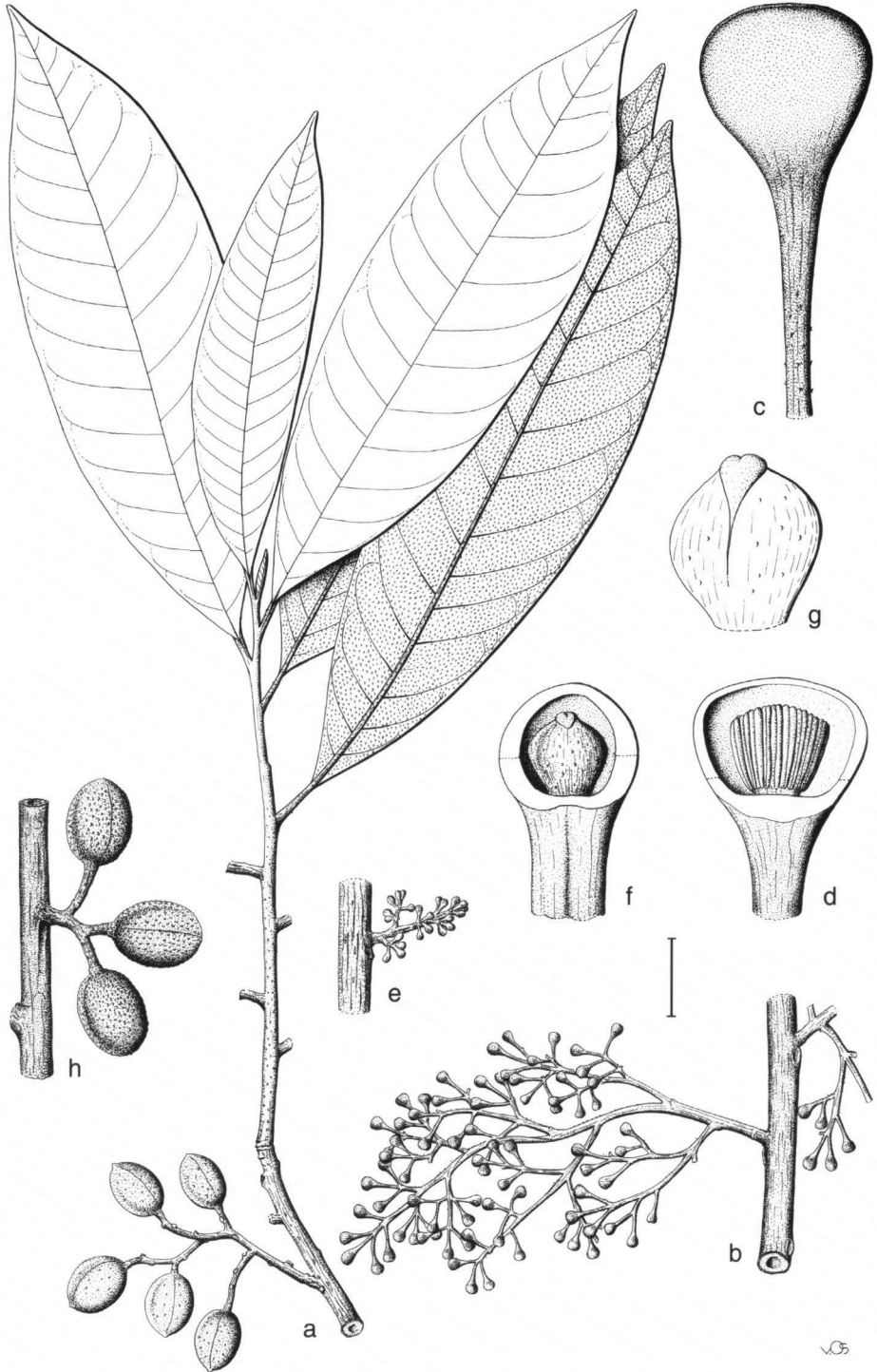
Field-notes — Flowers yellowish, fragrant.

Distribution — *Malesia*: Sumatra (E Coast of Tapanuli), Lingga Arch. (Singkep I.), Borneo (Sarawak, S Kalimantan).

Habitat & Ecology — Forest on flat land; 0–100 m altitude; fl. Aug., Nov.; fr. Sept.

Notes — 1. *Horsfieldia tristis* seems related to *H. fulva*, with similarly elongate male flowers; in *H. fulva* the leaves dry brown instead of olivaceous, the twigs brown (not pale brown), bark not cracking, inflorescences pubescent, and pedicels articulated. Dried specimens of *H. tristis* have yellowish twigs and pale, olivaceous leaves; twigs, leaves and inflorescences are almost completely glabrous.

2. *Bünnemeijer 7100* (Singkep I.) differs in its thin leaves, not distinctly dull and wrinkled on upper surface, and in the broadly ellipsoid, almost globose, male buds; its androecium has a very broad apical cavity with a broad, almost flat base.



**93. *Horsfieldia tuberculata* (K. Schum.) Warb.**

*Horsfieldia tuberculata* (K. Schum.) Warb., Mon. Myrist. (1897) 279, t. 23. — *Myristica tuberculata* K. Schum. in K. Schum. & Hollr., Fl. Kaiser Wilhelmsland (1899) 46. — Syntypes: *Hollrung 848* (K, lecto), Kaiser Wilhelmsland; *Kärnbach s. n.*, lost, Bat I.

Tree 5–20 m. Twigs faintly ridged or not, 2–4(–6) mm diameter, early glabrescent, hairs (rarely ± woolly) 0.1–0.3 mm; bark striate, not flaking; lenticels sparse and small, sometimes almost absent. Leaves membranous (or on higher altitudes subchartaceous), elliptic to oblong-lanceolate, 12–25(–40) by 3–10(–16) cm, base short- to long-attenuate, rarely rounded, apex acute-acuminate; upper surface drying dull (greenish) brown, often minutely pustulate, lower surface early glabrescent, hairs 0.1(–0.3) mm; dots absent; midrib flat or ± sunken above; nerves 11–22 pairs, above thin, flattish or sunken above, lines of interarching not very distinct; venation fine, distinct or not on both surfaces; petiole 8–18 by 1.5–3(–5) mm; leaf bud 10–15 by 2–3 mm, with hairs 0.1–0.3 mm long. Inflorescences with sparse stellate-dendroid hairs 0.1–0.3 mm long, sometimes ± glabrescent; in male 1–3 times branched, 3–15(–22) by 2–10 cm, peduncle 0.5–2.5 cm long; female to 7 cm long; bracts 0.5–3 mm long, caducous; flowers solitary or in loose clusters of 2–4, perianths 2- (or 3-)lobed, glabrous (early glabrescent), pedicels glabrous or rarely sparingly pubescent, sometimes ± articulated. Male flowers: pedicel (somewhat) tapering, 2–5(–6) mm; buds laterally compressed, short-pear-shaped, about as long as broad to slightly broader than long, (1.5–)2–3.5 by 2–4 mm, apex broadly rounded, the lower 1/3–1/2 narrowed into the pedicel, cleft 1/2–3/4, lobes 0.2 mm thick; androecium ± flattened, apex broadly rounded to subtruncate, 1.5–2.5 by 2–3 mm (Plate 2: 33); thecae 24–40, erect, not inflexed, free apical parts up to 0.2 mm long; column narrowly hollowed for 1/5–1/3; androphore up to 0.2 mm long. Female flowers: pedicel 1.5–2.5 mm long; buds subglobose, 2–3 by 2–3.5 mm, cleft 1/2–2/3; ovary subglobose, glabrous, 1.5–2 by 1.5–2 mm; stigma sessile, faintly 2-lobed, 0.2 by 0.5–1 mm. Fruits 5–15 per infructescence, ellipsoid, apex rounded or slightly pointed, 1.5–3.7 by 1.1–2.5(–3) cm, glabrous, drying blackish brown, with sparse, small to coarse, paler lenticel-like tubercles; pericarp 1–8 mm thick; fruiting pedicel 3–10 mm; perianth not persistent. — Fig. 33.

Distribution — Solomon & Caroline Islands; in *Malesia*: Papua New Guinea. Two varieties.

## KEY TO THE VARIETIES

- 1a. Fruits 1.5–2.5 by 1–1.5 cm; dry pericarp 1–2(–3) mm thick . . . **a. var. tuberculata**  
 b. Fruits 2.7–3.7 by 1.7–2.5 cm; dry pericarp 3–8 mm thick . . . . **b. var. crassivalva**

Fig. 33. *Horsfieldia tuberculata* (K. Schum.) Warb. var. *tuberculata*. a. Habit of leafy twig with infructescence; b. twig with male inflorescences; c. mature male flower, lateral view; d. ditto, opened, showing androecium; e. twig with female inflorescence; f & g. opened female flower and glabrous ovary with shallowly 2-lobed stigma; h. twig with infructescence and mature fruits [a: *BSIP 14035*; b–d: *Waterhouse 820-B*; e–g: *BSIP 9628*; h: *BSIP 10611*]. — Scale bar for a, b, e, h = 2 cm; for c, d, f = 1.65 mm; for g = 0.85 mm.

**a. var. tuberculata**

*Horsfieldia tuberculata* (K. Schum.) Warb., Mon. Myrist. (1897) 279, t. 23; K. Schum., Notizbl. Bot. Gart. Berlin 2 (1898) 117; K. Schum. & Lauterb., Fl. Schutzgeb. Südsee (1900) 324; Markgr., Bot. Jahrb. Syst. 67 (1935) 151, p. p.; A. C. Sm., J. Arnold Arbor. 22 (1941) 62; W. J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 126, f. 19. — *Myristica tuberculata* K. Schum. in K. Schum. & Hollr., Fl. Kaiser Wilhelmsland (1899) 46; Warb., Bot. Jahrb. Syst. 13 (1891) 308.

*Horsfieldia novo-guineensis* Warb. var. *moseleyana* Warb., Mon. Myrist. (1897) 273; K. Schum. & Lauterb., Fl. Schutzgeb. Südsee (1900) 324. — Type: *Moseley s.n.*, Admiralty Is.

*Horsfieldia solomonensis* A. C. Sm., J. Arnold Arbor. 22 (1941) 64. — Type: *Kajewski 1549*, Solomon Is.

*Twigs* 2–4(–6) mm diameter. *Leaf blades* 12–25(–40) by 3–10(–16) cm. *Male flowers*: pedicel 2–5(–6) mm; buds (1.5–)2–3(–5) by 2–4 mm; androecium ± flattened, 1.5–2.5 by 2–3 mm, thecae 28–40, free apices up to 0.2 mm; androphore up to 0.2 mm long. *Fruits* 1.5–2.5 by 1–1.5 cm; dry pericarp 1–2(–3) mm thick.

*Field-notes* — Exudate of bark red, watery; slash wood white or brownish white, soft; slash bark soft, pale brown or reddish brown. Flowers yellow, sweet scented. Fruits yellow, or orange(-brown).

*Distribution* — Solomon and possibly Caroline Islands (Palau I.); in *Malesia*: Papua New Guinea (Admiralty Is., Bismarck Arch., Papuan Is., Cape Vogel Peninsula).

*Habitat & Ecology* — Primary, degraded, and secondary forest, low mossy montane forest; on coral rock, seashores, limestone, swamp forest; 0–700 m altitude; fl. & fr. throughout the year.

*Notes* — 1. The size of flowers and fruits is variable, especially on the Solomon Islands.

2. In some collections (e.g. from Cape Vogel Peninsula) the pedicels of the male flowers are slender, and only slightly tapering; such specimens may easily key out wrongly. They probably represent a separate taxon as yet insufficiently defined. In general, the male buds of *H. tuberculata* approach those of *H. laevigata*.

**b. var. crassivalva** W. J. de Wilde

*Horsfieldia tuberculata* (K. Schum.) Warb. var. *crassivalva* W. J. de Wilde, Gard. Bull. Sing. 38, 1 (1985) 130. — Type: *Brass 28352*, Louisiade Arch.

*Twigs* (3–)4–5 mm diameter. *Leaf blades* 25–35 by 10–12.5 cm. *Male flowers*: pedicel 3–6 mm; buds 3 by 3.3 mm; androecium much flattened, 1.8 by 1.8 mm, thecae c. 24, free apices 0.1 mm long; androphore 0.1 mm long. *Fruits* 2.7–3.7 by 1.7–2.5(–3) cm; pericarp 3–8 mm thick.

*Field-notes* — Subcanopy tree. Flowers yellow, very fragrant. Fruits to 5 cm diameter, orange, ovoid or subglobose, keeled; aril pink.

*Distribution* — Solomon Islands (San Cristobal, doubtful); in *Malesia*: Papua New Guinea (Louisiade Arch.: Misima, Tagula, and Rossel I.).

*Habitat & Ecology* — Riverine rain forest at low altitudes, creek alluvial soil; 0–20 m altitude.

*Notes* — 1. Specimens of var. *crassivalva* generally have a stout habit with coarse twigs and large leaves, and relatively large perianths; these sizes fall, however, within those accepted for the type variety.

2. Specimens in fruit may be confused with *H. pachycarpa*, which has minutely pubescent fruits (and pubescent ovaries), at least at the base towards the insertion of the stipe.

#### 94. *Horsfieldia urceolata* W.J. de Wilde

*Horsfieldia urceolata* W.J. de Wilde, *Blumea* 32 (1987) 462. — Type: LAE 77053 (*Gideon*), Papua New Guinea.

Shrub or treelet, 1–5 m. *Twigs* 1.5 mm diameter, with dark rusty-brown hairs (0.2–) 0.3 mm, glabrescent; bark finely striate, neither cracked nor flaking; without or with few inconspicuous lenticels. *Leaves* membranous, oblong to lanceolate, 6–18 by 1.5–7 cm, base attenuate to nearly rounded, apex acute-acuminate; blade above glabrous, drying dark brown above, beneath somewhat paler, glabrescent with some scattered scaly-stellate hairs remaining for some time; dots absent; midrib very slender, raised above; nerves 12–15 pairs, sunken above, lines of interarching  $\pm$  distinct; venation lax, distinct beneath; petiole 6–10 by 1–2 mm; leaf bud 7 by 1.5 mm, with dense rusty woolly hairs 0.2–0.3 mm. *Inflorescences* (male) among the leaves, with dense rusty hairs (0.2–) 0.3 mm, small, twice branched, the lowest branch 2–3 mm from the base, rather few-flowered; in male: 2–3 by 2 cm, with few branches; in female (from infructescences, see note 2): few-flowered, 2.5 cm long; bracts oblong-lanceolate, 1.5–2 mm, pubescent, caducous; flowers solitary or 2 or 3 together, perianth 2-lobed, at base with hairs 0.2–0.3 mm (the remainder of the perianth early glabrescent), drying dark brown or blackish, pedicel pubescent, slender, not articulated. *Male flowers*: pedicel 1.5–3 mm long; buds subglobose or broadly ovoid, 2.5–3 mm diameter, cleft 1/6(–1/8), lobes (perianth) 1–1.5 mm, at apex 0.2 mm thick; androecium club-shaped, 1.5–2 by 0.6–0.7 mm, the anther-bearing apex  $\pm$  acute (Plate 1: 16); thecae 8, sessile, 0.3–0.4 mm long, not or hardly projecting, column solid; androphore glabrous, with scattered tannin-dots, not or but indistinctly warty. *Female flowers* not seen. *Fruits* (doubtful, see note 2) 2 or 3 per infructescence, drying dark brown to blackish, subglobose (to broadly ellipsoid), including the minute, slender, bifid, 1 mm long rostrum (persistent style and stigmas) 1 cm long, pseudostalk 1.5–2 mm; all thinly pubescent, hairs 0.1–0.2 mm; pericarp 0.5 mm thick; fruiting pedicel slender, 7–8 mm long; perianth not persistent.

*Field-notes* — Shrub or low treelet. Leaves dull green above, pale or somewhat olive below, with olive-brown midvein. Flowers yellow. Fruits red, brilliant scarlet inside.

*Distribution* — *Malesia*: Papua New Guinea (Milne Bay Prov., and, possibly, Northern Prov.); restricted to a limited area of distribution.

*Habitat & Ecology* — Primary rain forest on sloping ground; *Lithocarpus*, *Anisoptera*, *Hopea*-dominated forest on ridges and slopes; 25–120 m altitude; fl. Mar., Nov.; fr. May.

*Notes* — 1. Part of the material of *H. urceolata* had been included formerly in *H. squamulosa*. *Horsfieldia urceolata* differs from that species and from the related *H. coryandra* in the subglobose thick-walled male perianth.

2. The fruiting specimen NGF 31751 (*Ridsdale*) differs markedly from the type in foliage, with the blades rather conspicuously tapering in the lower half, less distinct and less projecting tertiary venation, and rather more persistent indumentum on the lower surface. Possibly it represents a separate undescribed taxon, but more material is needed to decide on this.



3. Fruiting specimens of *H. urceolata*, and related species (*H. clavata*-group), may resemble *H. schlechteri* and *H. subtilis*, but the latter two have glabrous ovaries and fruits.

### 95. *Horsfieldia valida* (Miq.) Warb.

*Horsfieldia valida* (Miq.) Warb., Mon. Myrist. (1897) 349; K. Heyne, Nutt. Pl. Ned. Indië (1927) 638; W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 25. — *Myristica valida* Miq., Fl. Ind. Bat. 1, 2 (1858) 67; Suppl. 1 (1860) 156. — Type: *Teijsmann 479* (sterile, the fruits said to be as large as a goose egg), Sumatra, West Coast.

Tree 10–15 m. Twigs 2.5–5 mm diameter, at insertion of inflorescences up to 10 mm diameter, (grey-)brown, glabrescent, hairs rusty, woolly, 0.4–0.7 mm long; bark coarsely striate, not flaking, lenticels  $\pm$  dense, conspicuous, pustulate. Leaves chartaceous, (ob)ovate-oblong, 20–35 by 8–13 cm, base short- to long-attenuate, apex subobtuse to acutish; upper surface glabrous, drying dark olivaceous-brown, lower surface bright brown, early glabrescent but midrib late glabrescent; dots absent; midrib broad towards the base, slightly raised above; nerves 20–25 pairs, raised, lines of interarching indistinct; venation rather lax, flat, faint on both surfaces; petiole 7–12 by 3–4.5 mm; leaf bud 15–20 by 4 mm, with dense ferruginous hairs 0.4–0.7 mm. Inflorescences just behind the leaves, with woolly hairs 0.3–0.5 mm, subglabrescent; in male: 2 or 3 times branched, not many-flowered, 5–6 by 3–4 cm, peduncle 1–1.5 cm long; in female (from infructescences): 5 cm long; bracts not seen, caducous; flowers in male in loose clusters of 3–6, glabrous, perianth 4- (or 3-)lobed, pedicel not articulated. Male flowers: pedicel 1.5 mm long; buds globose, 2.5–3 by 3–3.5 mm, cleft c. 4/5, slightly collapsing on drying, lobes 0.3–0.4 mm thick; androecium  $\pm$  depressed globose, 0.8–1.2 by 1.4–1.6 mm (much smaller than the perianth), in cross section  $\pm$  rounded or faintly 4-angular (Plate 3: 75); thecae 24–28, curved and largely sessile, free apices 0.2 mm; column not or hardly hollowed; androphore narrow, 0.1–0.2 mm long. Female flowers not seen (but see under fruits). Fruits 2–9 per infructescence, ellipsoid, 8(–9) by 5(–6) cm, glabrous, drying brown with surface wrinkled and  $\pm$  warted; pericarp 15 mm thick; fruiting pedicel 5 mm long; perianth persistent under young fruits in *Maradjo 449*, 4-lobed, 3 mm long.

Field-notes — Erect tree, branches wide spreading and arching. Flowers brown, tinged yellow, sweet smelling.

Distribution — *Malesia*: Sumatra (E & W Coast; possibly Palembang, see note 1), probably W Borneo (see note 2).

Habitat & Ecology — Primary forest, ravine forest; (?200 m, see note 1) 900–1100 m altitude; fl. Mar., Aug.; fr. Aug.

Notes — 1. The sterile specimen *Dumas 1649* (Palembang, 200 m alt.) deviates from the other specimens (all from 900–1100 m alt.) by the shorter indumentum on the leaf bud (hairs only 0.3 mm long).

2. *Hallier 624* (with male fl., Mt Damoes, W Kalimantan) is obviously close to *H. valida*, but markedly differs, and apparently represents a new, yet undescribed species. The specimen is discussed further by De Wilde, l.c. Female flowering specimens which match *Hallier 624* have not been found as yet, but *Afriastini* (& *Burley*) 579 (in fruit, from Kalimantan) is possibly identical; it has the perianth not persistent under the fruits.

**96. *Horsfieldia wallichii* (Hook. f. & Thomson) Warb.**

*Horsfieldia wallichii* (Hook. f. & Thomson) Warb., Mon. Myrist. (1897) 305; J. Sinclair, Gard. Bull. Sing. 16 (1958) 405, f. 41, pl. XI-A; 28 (1975) 156, p.p. (excl. part of the Borneo material = *Horsfieldia borneensis*); W.J. de Wilde, Gard. Bull. Sing. 38, 2 ('1985', 1986) 204; Tree Fl. Sabah & Sarawak 3 (2000) 396. — *Myristica wallichii* Hook. f. & Thomson, Fl. Ind. (1855) 161, p.p. (Wall., Cat. n. 6806 being a mixture, see note by Sinclair, 1975: 158); A. DC., Prodr. 14, 1 (1856) 230; Miq., Fl. Ind. Bat. 1, 2 (1858) 67; Hook. f., Fl. Brit. India 5 (1886) 105; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 303, pl. 132 & 133, excl. syn. *Myristica crassifolia* Hook. f. & Thomson. — *Myristica horsfieldia* auct. non Blume: Wall., Cat. (1832) n. 6806, p.p. — Lectotype: *Griffith s. n.*, Malacca.

Tree 10–30 m. *Twigs* sometimes drying somewhat flattened, usually conspicuously hollow, 3–6 mm diameter, early to late glabrescent, hairs 0.3–0.6 mm; bark dark brown or blackish, coarsely striate, later on fissured, sometimes flaking, lenticels inconspicuous. *Leaves* membranous to coriaceous, ovate-oblong to oblong-lanceolate, (14–)19–40 by (4–)4.5–12 cm, base rounded to short-attenuate, apex subobtuse to acute-acuminate; upper surface drying olivaceous to blackish brown, glabrous (with minute indumentum sometimes remaining on midrib); lower surface late glabrescent or indumentum locally persistent, hairs sparse or dense, dendroid, (0.3–)0.5–0.8 mm long; dark dots and/or dashes present; midrib slightly raised above, late glabrescent; nerves (12–)15–28 pairs, slender, flat or sunken above, lines of interarching and venation indistinct; petioles 15–35 by 2.5–4.5 mm; leaf bud 20–30 by 4–6 mm, with dense hairs 0.3–0.6 mm. *Inflorescences* usually behind the leaves, with sparse or dense stellate-dendroid hairs 0.5–1 mm long; in male: large, many-flowered, 3 or 4 times branched, 10–33 by 6–22 cm, peduncle 3–7 cm; in female: rather stout, fewer-flowered, 3–7 cm long; bracts broadly ovate, 3–10 mm long, densely woolly-pubescent, caducous; flowers in male in clusters of 5–12, perianth 3- (or 4-)lobed, glabrous (in female glabrescent), pedicel with hairs 0.2–0.3 mm long, not articulated. *Male flowers*: pedicel 0.3–0.6(–1) mm; buds broadly obovoid, 2–2.5(–3) by 2.4–2.5(–3) mm, apex broadly rounded, base ± attenuate, cleft 1/3–2/3, lobes 0.2–0.3 mm thick; androecium broadly obovoid to subglobose, apex ± depressed with a 3-radiate crack, base rounded to attenuate, faintly triangular in cross section, 1.3–2 by 1.5–2 mm (Plate 2: 50); thecae (24?–)30–46, completely connate, sessile, closely appressed, at apex incurved into apical hollow; column broad with broad hollow to c. 1/2; androphore narrow, up to 0.3 mm long. *Female flowers*: pedicel stout, 0.5–1.5 mm long; buds ovoid-ellipsoid, 2.5–4 by 2–3.5 mm, glabrescent, hairs 0.1 mm, cleft c. 1/3; ovary ovoid to subglobose, 2 by 2–2.5 mm, glabrous, stigma broad, faintly 2-lobed, 0.3 by 0.8 mm. *Fruits* 2–9 per infructescence, ovoid-ellipsoid, 4–7 by 3–4.5 cm, glabrous, smooth or wrinkled, not or only faintly warted; pericarp 10–15 mm thick; fruiting pedicel stout, 4–6 mm long; perianth generally persistent. — **Photo 8.**

*Field-notes* — Bole straight; crown dense; bark shallowly or deeply longitudinally fissured, dark grey, not flaking; bark 1 cm thick, slash underbark bright to deep red, pink, or reddish brown; slash wood whitish, pale or yellowish, light brown, or (red-)brown. Flower buds blue-green or yellow at anthesis. Fruits glaucous, maturing (green-)yellow, orange(-yellow), or red.

*Distribution* — *Malesia*: Sumatra (Aceh, Tapanuli, W & E Coast, Indragiri, Palembang, Simeuluë, Morsala, Mentawai I., Bangka), Peninsular Malaysia (all provinces except Perlis and Negri Sembilan), Singapore, Borneo (Sarawak, Brunei, Sabah, Kalimantan).

Habitat & Ecology — Lowland and ridge-top forest; on red soil, granitic sand, loam soil with coral limestone; 0–470 m altitude; fl. & fr. throughout the year.

Note — *Horsfieldia wallichii* is vegetatively recognizable by the blackish dots and stripes (dashes) on the lower leaf surface, and the hollow twigs. Similar dots are only found in a few other species, including *H. borneensis*, with similar fruits, but differing in general habit, and in the male flowers.

### 97. *Horsfieldia xanthina* Airy Shaw

*Horsfieldia xanthina* Airy Shaw, Kew Bull. 1939, n. 10 (1940) 541 (441); W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 45; Blumea 41 (1996) 381; Tree Fl. Sabah & Sarawak 3 (2000) 397. — Type: Richards 1927, Sarawak, Mt Dulit.

Tree 10–30 m. Twigs sometimes faintly angular at apex, 2.5–6 mm diameter, early glabrescent, hairs 0.1 mm; bark coarsely striate, with a tendency to flake; lenticels conspicuous or not. Leaves coriaceous, elliptic to oblong-lanceolate, 8–35 by 3.5–13 cm, base attenuate to rounded, apex subacute to acute-acuminate; upper surface drying olivaceous to (dark) brown, usually with rather distinct hair scars, lower surface early glabrescent, drying with a reddish tinge; dots absent; midrib slightly raised above; nerves 8–20 pairs, slender, flat or slightly raised, lines of interarching faint; venation lax, faint on both surfaces; petiole 7–12 by 2.5–3 mm; leaf bud 8–13 by 2–3.5 mm, with hairs 0.1 (–0.2) mm long. Inflorescences behind the leaves, with  $\pm$  dense hairs 0.1 mm; in male: sometimes short, robust, (2–)4–20 cm long, (2 or) 3 times branched, not many-flowered, peduncle 0.5–0.8 or 1.5–2 cm (subsp. *macrophylla*) long; in female (from infructescences): 1–1.5 or 5–7 cm (subsp. *macrophylla*) long, few-flowered; bracts not seen, caducous; flowers in male in loose clusters of 3–5(–8), perianth 3- or 4-lobed, glabrous, pedicel glabrescent or with few hairs 0.1 mm towards the base, not articulated. Male flowers: pedicel thickish, somewhat tapering or not, straight or  $\pm$  curved (flowers reflexed), 1–2.5 mm long; buds broadly ellipsoid to ovoid-subglobose, 2.5–2.8 mm long, apex rounded, base shortly rounded and somewhat tapering into the pedicel, cleft 1/2(–2/3), slightly wrinkled but not collapsing on drying, lobes 0.4–0.8(–1) mm thick; androecium  $\pm$  laterally flattened,  $\pm$  broadly obovoid 1–1.3 mm long (Plate 3: 86); thecae 6–16, erect, 0.9–1.1 mm long, largely sessile with free apices 0.1–0.3 mm; column broad, with apical hollow 0.1–0.3 mm; androphore  $\pm$  tapering, broad, (0.1–)0.2–0.3 mm long. Female inflorescences and flowers known only in subsp. *macrophylla*: ovary glabrous. Fruits (1–)2–6 per infructescence, ellipsoid-obovoid or broadly ovoid, (3.5–)5 by 3–3.5 cm, glabrous; pericarp 5(–10) mm thick,  $\pm$  woody towards inside; fruiting pedicel stout, 3 mm long; perianth not persistent.

Distribution — *Malesia*: Borneo (Sarawak, Sabah); two subspecies, both montane.

#### KEY TO THE SUBSPECIES

- 1a. Twigs towards the apex 2.5–4.5 mm diam. Leaf blades 8–18 by 3.5–7 cm. Male inflorescences 2–5 cm long, the flowers often with  $\pm$  reflexed pedicel; thecae 6–12 ..... **a.** subsp. *xanthina*
- b. Twigs stouter, towards apex 3.5–6 mm diam. Leaf blades 22–35 by 7–13 cm. Male inflorescences 10–20 cm, flowers erect; thecae 14 or 16 ... **b.** subsp. *macrophylla*

**a. subsp. xanthina**

Tree 10–17 m. *Twigs* 2.5–4.5 mm diameter; bark with a tendency to flaking. *Leaf blades* 8–18 by 3.5–7 cm. *Male inflorescences* (2–)4–5 by 2–3.5 cm, the rachis at base 2–3 mm diameter; flowers often  $\pm$  reflexed. *Male flowers*: pedicel 2–2.5 mm long; buds subglobose or broadly ellipsoid, 2.5 by 2.2–2.5 mm, cleft 1/2–2/3; androecium slightly laterally compressed, 1–1.2 by 0.8–1 by 0.4–0.5 mm, thecae 6–12. *Female flowers* not seen.

Field-notes — Flowers yellow. Fruits (glaucous) green, glossy, maturing reddish orange.

Distribution — *Malesia*: Borneo (Sarawak).

Habitat & Ecology — Montane, kerangas, heath forest, submontane forest; on (yellow) sandy soils, sandstone, or “on higher flanks of limestone mountain among huge limestone boulders with vegetation and organic layer entwined between boulders”; 800–1800 m altitude; fl. Aug., Sept.; fr. Sept., Nov.

Note — Subspecies *xanthina* is characterized by the usually flaking bark of the twigs, coriaceous and often  $\pm$  reddish brown tinged leaves, and coriaceous rather large male flowers with a typical androecium of only 6–12 thecae and a marked androphore. Possibly it is confined to kerangas at higher altitudes. It is close to *H. majuscula*, from Peninsular Malaysia and Sumatra, which differs by non-flaking bark of twigs, membranous leaves, 14–18 thecae, pedicel articulated at base, and possibly by larger fruits.

**b. subsp. macrophylla W.J. de Wilde**

*Horsfieldia xanthina* Airy Shaw subsp. *macrophylla* W.J. de Wilde, Gard. Bull. Sing. 39, 1 (1986) 47; Blumea 41 (1996) 381; Tree Fl. Sabah & Sarawak 3 (2000) 398. — Type: *Clemens 50050*, Mt Kinabalu.

Tree 25–30 m. *Twigs* 3.5–6 mm diameter; bark not flaking. *Leaf blades* 25–35 by 7–13 cm. *Male inflorescences* 10–20 by 7–11 cm, the rachis at base 3.5–4.5(–5) mm diameter; flowers erect. *Male flowers*: pedicel 1–1.5 mm long; buds broadly ellipsoid, 2.6–2.8 by 2.5–2.7 mm; lobes 3, cleft nearly halfway; androecium 1.3 by 0.8 mm, subtriquetrous in cross section; thecae 14 or 16. *Female inflorescences* (0.5–)1–8 cm long, once (or twice) branched. *Female flowers*: pedicel 1.5–2 mm, glabrous or with some minute hairs towards the base; buds ovoid-ellipsoid, 4–4.5 by 3–3.5 mm, lobes 3, cleft to nearly halfway, lobes 0.8(–1) mm thick; ovary ovoid, 2.2 by 2 mm, glabrous, stigma broadly 2-lipped, 0.3 by 1 mm.

Field-notes — Poorly developed low buttresses (once); bark brown and grey, fissures boat-shaped; exudate light red, watery. Flowers yellow or orange; ovary pale purple. Young fruits green, when mature orange.

Distribution — *Malesia*: Borneo (E Sarawak; Sabah: Mt Kinabalu).

Habitat & Ecology — Mountain forest, ridge forest; on igneous derived (andesitic) soils; 1100–1550 m altitude; fl. July, Nov.; fr. Nov.

Note — May be confused with *H. subalpina* subsp. *kinabaluensis* which has a different androecium and generally smaller fruits.

## KNEMA

*Knema* Lour., Fl. Cochinch. (1790) 604; Warb., Mon. Myrist. (1897) 132, 543; J. Sinclair, Gard. Bull. Sing. 16 (1958) 254; 18 (1961) 102; W.J. de Wilde, Blumea 25 (1979) 321; 27 (1981) 223; 32 (1987) 115; Tree Fl. Sabah & Sarawak 3 (2000) 399. — *Myristica* sect. *Knema* Blume, Rumphia 1 (1836) 187; A. DC., Prodr. 14, 1 (1856) 204; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 284. — Type species: *Knema corticosa* Lour. [= *Knema globularia* (Lam.) Warb.].

Trees, dioecious; stilt-roots sometimes present. *Twigs* without lenticels, flaky or not. *Leaves* not breaking easily when dry (veins with sclerenchym sheaths), lower surface pale, not papillose, dots present or absent; reticulation dense, distinct. *Inflorescences* rarely supra-axillary; a sessile or to 5(–10) mm long pedunculate, simple or 2- (or 4-)fid, wart-like or worm-like densely scar-covered brachyblast, 1–17 mm long, with a slow unlimited growth; basal cataphylls absent; bracts minute, caducous; flowers in apical subumbels (few-flowered in female). *Flowers* pedicellate, not fragrant, bracteole minute, often at a distance below the perianth, usually persistent. *Male flowers*: perianth ± rotate, (thinly) carnose, inside glabrous or pubescent (rare), greenish creamy, pink or red; buds (sub)globose or (ob)ovoid, cleft to c. 1/2 to nearly to the base, lobes 3(–5), spreading at anthesis; androecium stalked, androphore cylindrical or tapering, rarely with few hairs, androecium (or staminal disc) flat or convex (or mammillate) with at the margin 3–25 stellately attached ellipsoid anthers, (half-)sessile or shortly stiped (see also Fig. 34). *Female flowers*: buds (ob)ovoid or ellipsoid, ovary pubescent, style short or absent, stigma ± 2-lobed and each lobe again 2–many-lobulate. *Infructescences* sessile, with one or few fruits. *Fruits* ± ellipsoid, 2–5 cm long, tomentose or early glabrescent (never glabrous as in some species of *Horsfieldia* and *Myristica*); pericarp leathery; aril entire or lacinate at the apex only. *Seeds* ellipsoid, not variegated; albumen ruminant with a fixed oil and starch; cotyledons divaricate or suberect, scarcely or only very slightly connate at the base. — Fig. 34–58.

Distribution — About 93 species in continental Southeast Asia and Malesia, from the Deccan Peninsula (*K. attenuata*) to S China (Yunnan) and East to the Philippines, Moluccas, and western New Guinea (*K. tomentella* in Bird's Head Peninsula); in *Malesia* 75 species, the majority occurring in Borneo. — Map 4 (see p. 4).

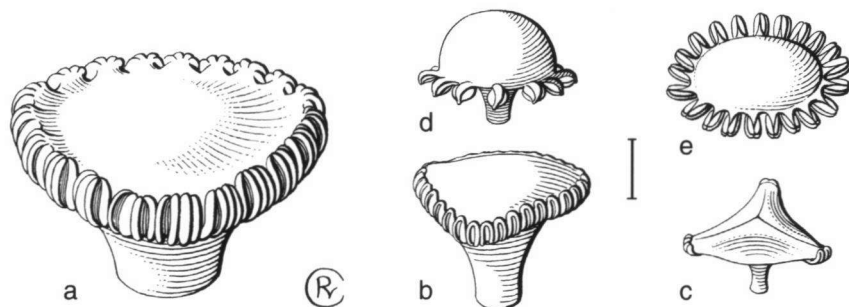


Fig. 34. Androecia of *Knema*. — a. *K. woodii* J. Sinclair; b. *K. curtisii* (King) Warb. var. *amoena* J. Sinclair; c. *K. latifolia* Warb.; d. *K. elmeri* Merr.; e. *K. membranifolia* H.J.P. Winkler [a: Sinclair et al. 9298; b: Sinclair & Kadim bin Tassim 10442; c: Kostermans 9121; d: Sinclair et al. 9311; e: Kostermans 4382]. — Scale bar for all = 1 mm.

Habitat & Ecology — Usually under- and middle-storey trees of primary, often ever-wet forest, in continental SE Asia also in seasonal forest; up to 1800(–2000) m altitude.

Notes — 1. De Wilde (1979) distinguished in the genus *Knema* 12 series for 83 species accepted at that time. This division into series has been based mainly on characters regarding the general shape of male buds, androecium and position of the anthers, and the shape of the stigma lobes, with in addition characters derived from the indumentum and the nature of the bark of the twigs. The series, which were fully described and discussed, at most represent possibly natural groupings of species, presumably close to each other. However, more ample recent material and newly described species rendered the formal distinction of the series more and more doubtful, and so, in the present Flora Malesiana treatment, the author refrained from any formal subdivision. The series are here indicated only in the general key to the species (Key 1), from which the main set of characters can be inferred, and for details the reader is referred to the literature mentioned above. Sinclair (1958, 1961) proposed a subdivision into groups mainly based on female flower characters. This subdivision is for the most part not in accordance with the series distinguished by De Wilde and cannot be used satisfactorily either.

2. Besides a general key to the species (1), mainly based on male flowering specimens, four separate regional keys are given, based on female flowering and/or fruiting specimens and with emphasis on vegetative characters. These keys cover the following areas: (2) Peninsular Malaysia, Singapore, (3) Sumatra, Java, (4) Borneo, (5) Philippines, Sulawesi, Moluccas, Lesser Sunda Islands, and New Guinea (Bird's Head).

(1) GENERAL KEY TO THE SERIES AND SPECIES OF KNEMA  
(mainly based on male flowering specimens)

- 1a. Buds longer than broad (in general resembling female buds: obconical, pear-shaped, ovoid, obovoid, or ellipsoid-oblong); base rounded to attenuate, cleft 1/2–2/3; androphore about as long as or usually longer than the diameter of the staminal disc including anthers (these characters sometimes less obvious in *K. andamanica*). Anthers 6–12, generally ± erect, sometimes almost horizontal. SERIES LAURINAE . . . 2
- b. Buds ± as broad as long, or broader than long (globose, pear-shaped, obovoid, rarely ellipsoid), at base rounded, truncate, saccate, or ± attenuate, cleft c. 2/3 to much deeper; androphore shorter than diameter of staminal disc including anthers. Anthers 3–25, suberect to horizontal. (In *K. piriformis* and *K. pulchra* the buds sometimes short pear-shaped and cleft 1/2–2/3, androphore comparatively long.) . . . 6
- 2a. Lower leaf surface either early glabrescent, or with persistent sessile or mixed sessile and stalked hairs, those on flowers 0.1–0.3 mm long (in *K. laurina* var. *heteropilis* 0.5–1.5 mm long). Anthers half-sessile to stiped, suberect to almost horizontal. Pedicel (0.5–)1–10 mm long . . . . . 3
- b. Lower leaf surface with conspicuous persistent indumentum of evenly spaced, more or less equally long stalked dendroid hairs, those on flowers 0.5–1.5 mm long. Anthers completely sessile, (sub)erect. Pedicel 2–5 mm long. — Sumatra, Peninsular Malaysia, Java, Borneo . . . . . 29. *K. laurina*
- 3a. Twigs ± flattened. Pedicel 1–3 mm long. Leaves faintly reticulate, finely pitted above (visible with a lens!). Fruit apex acute or beaked. — Peninsular Malaysia . . . . . 44. *K. oblongifolia*

- b. Twigs (sub)terete. Pedicel 0.5–10 mm. Leaves faintly or distinctly reticulate above, not finely pitted. Fruit apex blunt or subacute . . . . . 4
- 4a. Inflorescences (partly) 1–5 mm pedunculate. Twigs 1.5–3 mm diam., with minute hairs, glabrescent. Leaves inconspicuously tomentose beneath, glabrescent. — N Sumatra, N Peninsular Malaysia . . . . . **2. K. andamanica**
- b. Male inflorescences sessile or rarely up to 1 mm pedunculate. Twigs (2–)3–5 mm diam., usually short-tomentose, rarely glabrescent. Leaves with conspicuous (sub)-persistent indumentum beneath . . . . . 5
- 5a. Hairs on twig and lower leaf surface 0.1–0.5 mm long, mainly stellate; those on flowers 0.2 mm long. Pedicel 4–9 mm long. — Sumatra, Peninsular Malaysia . . . . . **52. K. pseudolaurina**
- b. Hairs on twig and lower leaf surface 0.5–1 mm long, mainly stellate-dendroid; those on flowers 1–1.5 mm long. Pedicel 0.5–2.5 mm long. — Sumatra, Peninsular Malaysia, Java . . . . . **29b. K. laurina var. heteropilis**
- 6a. Lower leaf surface with persistent very short and dense indumentum, silky to the touch, of densely interwoven scale-like hairs which are only visible with a lens. SERIES SERICEAE . . . . . 7
- b. Lower leaf surface either glabrescent, or hairs longer, or sparse . . . . . 10
- 7a. Twigs 4–6 mm diam.; bark not longitudinally cracking nor flaking. Leaves 25–60 cm long . . . . . 8
- b. Twigs 2–4 mm diam.; bark cracking, lower down flaking. Leaves 12–32 cm long. [Indumentum on lower leaf surface grey or pale brown. Staminal disc convex or mammillate; anthers 10–14.] — Borneo . . . . . **9. K. elmeri**
- 8a. Buds globose, at base rounded, with dense scale-like hairs 0.1 mm long. Staminal disc convex to mammillate. [Anthers 11–15. Indumentum on lower leaf surface pale cinnamon.] — Borneo . . . . . **63. K. sericea**
- b. Buds broadly obovate, at base short-attenuate. Staminal disc flat . . . . . 9
- 9a. Leaf apex obtuse or retuse, base rounded or cordate. Indumentum on lower leaf surface greyish. Buds short-tomentose. Anthers c. 15. — Peninsular Malaysia . . . . . **56. K. retusa**
- b. Leaf apex acuminate, base attenuate, obtuse, rounded, or rarely subcordate. Indumentum on lower leaf surface cinnamon, rarely greyish. Buds with scale-like hairs less than 0.1 mm long, seemingly glabrous. Anthers 22–24. — Borneo . . . . . **3b. K. ashtonii var. cinnamomea**
- 10a. Bark of twigs at most coarsely striate, only occasionally cracking (bark of older wood sometimes finely flaking in *K. galeata*, *K. korthalsii*, *K. mandaharan*, *K. membranifolia*, *K. pedicellata*, ?*K. uliginosa*) . . . . . 22
- b. Bark of twigs soon longitudinally cracked, lower down flaking . . . . . 11
- 11a. Twigs (1–)1.5–4(–6) mm diam.; older bark ± cracking or thinly flaking. Leaves 8–30(–40) cm long, membranous to chartaceous. Buds depressed globose or depressed short-obovoid; staminal disc (flat or) convex or low-mammillate . . . 20
- b. Twigs (3–)4–12 mm diam.; older bark cracking and flaking. Leaves 15–60 cm long, chartaceous to coriaceous. Buds of variable shapes, if only 3–3.5 mm wide then ellipsoid. Staminal disc ± concave or flat. [Pedicel up to 20 mm long.] SERIES LAMELLARIAE . . . . . 12

- 12a. Leaf blades, petioles, and twigs glabrescent, at first with a very conspicuous lanose indumentum consisting of hairs 3–8 mm long; hairs on flowers 1–3 mm long 13
- b. Leaf blades, petioles, and twigs glabrescent, at first with hairs 0.2–2.5 mm long; hairs on flowers up to 1 mm long . . . . . 14
- 13a. Twigs 5 mm diam. or more; hairs to 8 mm. — Sumatra, Peninsular Malaysia . . . . . **18. K. hookeriana**
- b. Twigs less than 5 mm diam.; hairs 3–4 mm. — Borneo . . . . . **31. K. longepilosa**
- 14a. Leaf base (sub)cordate, rarely rounded; basal nerves  $\pm$  crowded. Twigs early coarsely cracking and flaking. Pedicel 3–20 mm long . . . . . 15
- b. Leaf base attenuate, obtuse, (broadly) rounded, or occasionally cordate; basal nerves not or but faintly crowded. Twigs striate, ridged, or cracked, lower down coarsely or finely flaking. Pedicel 2–4.5 mm long . . . . . 18
- 15a. Buds 4–5 mm wide, glabrescent or the indumentum easily rubbed off. Pedicel 3–15 mm long. Anthers 10–14. Disc at base of perianth absent or inconspicuous. Bark of twigs dark brown or blackish; hairs 1 mm long. Female pedicel 1.5–2 mm long; fruits (1.9–)2.5–3.5 cm long, sessile or but shortly pedicelled, hairs up to 2 mm long. — N Sumatra, Peninsular Malaysia, Singapore . . . **11. K. furfuracea**
- b. Buds (5–)6–10 mm wide, either glabrescent or with persistent indumentum. Pedicel 7–20 mm long. Anthers 14–23. Disc at base of perianth present. Bark of twigs pale brown to blackish; hairs 0.2–2.5 mm long. Female pedicel and fruiting pedicel 8–20 mm long; fruits larger, with hairs up to 5 mm long . . . . . 16
- 16a. Buds 5–6.5 mm wide, with persistent indumentum. Pedicel 7–9 mm long. Anthers 13 or 14. Disc at base of perianth consisting of separate pads or ridges, or perianth base thickened and coarsely transversely ridged. Bark of twigs dark brown to blackish; hairs 1–2.5 mm long. Female flowers not known; fruits (immature) with hairs 2–3 mm long, fruiting pedicel 8–10 mm long. — C and S Sumatra, Borneo (Anambas Is.) . . . . . **26. K. lampongensis**
- b. Buds 6.5–10 mm wide, either glabrescent or with persistent indumentum. Pedicel 12–20 mm long. Anthers (15–)17–23. Disc at base of perianth conspicuous, entire or interrupted. Bark of twigs pale or dark brown, or blackish; hairs up to 2 mm long. Female flowers and fruits with pedicel 14–20 mm long; hairs on fruits 1–5 mm long . . . . . 17
- 17a. Buds largely glabrescent. Disc at base of perianth coarsely ridged. Bark of twigs brown to blackish; hairs 1–2 mm long. Fruits velvety-felty with hairs 3–5 mm long. — Peninsular Malaysia . . . . . **25. K. lamellaria**
- b. Buds with persistent indumentum. Disc at base of perianth conspicuous,  $\pm$  entire or ridged. Bark of twigs pale brown or greyish brown; hairs 0.2–1(–2) mm long. Hairs on fruits 1–1.5(–2) mm long. — Borneo . . . . . **45. K. pallens**
- 18a. Buds depressed globose or more or less obovoid, with persistent indumentum. Anthers 10–18 . . . . . 19
- b. Buds  $\pm$  ellipsoid, glabrescent in the upper part. Anthers 6 or 7. — Borneo . . . . . **53. K. psilantha**
- 19a. Buds  $\pm$  obovoid, at base tapering, 3.5–5.5 by 3.5–5.5 mm; anthers curved upwards. Leaves coriaceous, drying olivaceous above. (A variable species; the flaking of the bark of the twigs not obvious in part of the material.) — Borneo . . . . . **49. K. percoriacea**



- b. Buds depressed globose or obovoid, 3–7 by 4–6 mm; anthers horizontal. Leaves chartaceous to coriaceous, drying dark brown above. — Borneo . . . . . **33. *K. lunduensis***
- 20a. Buds 5–8 mm diam., early glabrescent; pedicel 6–9 mm long. Twigs early glabrescent, often yellowish. — Borneo . . . . . **39. *K. membranifolia***
- b. Buds 3–6 mm diam., with persistent indumentum; pedicel (1–)2–10 mm long. Twigs late glabrescent, brown . . . . . 21
- 21a. Buds globose, 3–4.5 mm diam., pedicel (1–)2–3 mm long, bracteole situated towards the apex. Staminal disc flat or faintly convex; anthers  $\pm$  obtuse, opening somewhat towards the outside. SERIES GLOMERATAE p. p. — Sumatra, Peninsular Malaysia, Singapore, Borneo, Philippines . . . . . **27. *K. latericia***
- b. Buds depressed globose, 4–6 mm wide; pedicel (4–)5–10 mm long, bracteole about median. Staminal disc mammillate; the anthers  $\pm$  acute, opening  $\pm$  downwards. — Borneo . . . . . **21b. *K. korthalsii* subsp. *rimosa***
- 22a. Buds (sub)globose, or broadly (ob)ovoid, base rounded, truncate, saccate, or short attenuate; buds cleft to over 2/3. Anthers horizontal, sometimes suberect; androphore tapering or cylindrical . . . . . 32
- b. Buds obovoid or pear-shaped, in the lower half  $\pm$  narrowed; buds cleft 1/2–3/4 (to c. 5/6 in *K. steenisii*). Anthers (half) erect; androphore tapering. SERIES OBOVOIDAE . . . . . 23
- 23a. Hairs on flowers more than 0.2 mm long . . . . . 29
- b. Hairs on flowers less than 0.2 mm long (0.2 mm long in *K. rigidifolia*) . . . . 24
- 24a. Leaves coriaceous. Fruits sessile. — Peninsular Malaysia . . . . . **59b. *K. rigidifolia* subsp. *camerona***
- b. Leaves chartaceous to thinly coriaceous. Fruits stalked . . . . . 25
- 25a. Twigs 3–6(–8) mm diam. Leaf base cordate or broadly rounded. Pedicel 4–8 mm long; anthers 12–25. — Sumatra?, Peninsular Malaysia, Borneo **55. *K. pulchra***
- b. Twigs 1–3 mm diam. Leaf base rounded to attenuate. Pedicel 2–5 mm long . 26
- 26a. Buds cleft c. 5/6; pedicel 2–3 mm long; anthers 4 or 5. — Lesser Sunda Islands (Flores) . . . . . **64. *K. steenisii***
- b. Buds cleft 1/2–3/4; pedicel 2–5 mm long; anthers 8 or more. — Borneo . . . . 27
- 27a. Buds 2.5–4 mm long. Anthers 8–15, just stiped. [Lower leaf surface with persistent sparse hairs 0.1–0.2(–0.3) mm.] — Lowland forest; Borneo . **69. *K. subhirtella***
- b. Buds 4–5 mm long. Anthers 11 or 12 . . . . . 28
- 28a. Anthers 11 or 12, just stiped,  $\pm$  horizontal. Lower leaf surface with subsistent sparse minute hairs. — Montane forest at (400?–)1000–2000 m; Borneo (Sabah) . . . . . **50. *K. piriformis***
- b. Anthers 11, half sessile, suberect. Lower leaf surface early glabrescent, at first with very weak indumentum. — Lowland forest up to 500 m; Borneo **68. *K. stylosa***
- 29a. Leaves beneath with persistent coarse stellate and stalked hairs; old leaves partially glabrescent. — Borneo . . . . . **43. *K. oblongata***
- b. Leaves beneath either glabrescent, or hairs easily rubbed off, or very inconspicuous, minute, sparse . . . . . 30
- 30a. Twigs 4–8(–10) mm diam. Leaves chartaceous or coriaceous, 15–55 cm long, base usually rounded or cordate. Pedicel 2–6 mm long. — Sumatra, Peninsular Malaysia . . . . . **37. *K. mandaharan***

- b. Twigs 1–3(–4) mm diam. Leaves membranous to thinly coriaceous, 6–30 cm long, base attenuate to rounded. Pedicel 3–15 mm long . . . . . 31
- 31a. Leaves ± lanceolate, 15–30 by 1.5–4(–5.5) cm. Buds 6–7 mm long; pedicel 10–15 mm long. — Borneo . . . . . **61. K. rufa**
- b. Leaves oblong to lanceolate, 6–18(–24) cm long [often drying with a blackish metallic lustre]. Buds 3–5 mm long; pedicel 3–11 mm long. — Sumatra, Peninsular Malaysia, W Java . . . . . **15. K. globularia**
- 32a. Anthers 3 (or 4). Flowers subglabrescent. SERIES LATIFOLIAE. — Sumatra, Borneo . . . . . **28. K. latifolia**
- b. Anthers (5 or) 6–25. Flowers with persistent indumentum or glabrescent . . . 33
- 33a. Anthers (5 or) 6–23(–25), mutually free, i.e., not or at least not completely and not tightly touching each other; anthers either half sessile or just sessile, or stiped 37
- b. Anthers 9–25, completely sessile, tightly set, touching, the thecae appearing as if representing twice as many, i.e., 18–50 sessile anthers; anthers completely hidden under the rim of the staminal disc. Twigs usually slender, often yellowish. SERIES CURTISIANAE . . . . . 34
- 34a. Staminal disc circular, anthers 14 or 15. — NE Borneo . . . . . **10. K. emmae**
- b. Staminal disc (blunt-)triangular. — Sumatra, Peninsular Malaysia, Borneo . . 35
- 35a. Leaves chartaceous to thinly coriaceous, drying greenish; venation distinct at both surfaces; base cuneate to rounded, apex acute (subacuminate) to obtuse. Buds subtriangular with rounded angles . . . . . 36
- b. Leaves membranous to chartaceous, base usually cuneate to attenuate; when leaves membranous these drying greenish, with the venation distinct or not, and apex acute or acuminate; when leaves chartaceous these drying brown, with the venation very fine or faint, and apex acute, obtuse, or rounded. Buds (sub)triangular with rounded or sharp angles. — Sumatra, Peninsular Malaysia, Borneo . . . . . **8. K. curtisii**
- 36a. Leaves up to 15 by 5 cm, lateral nerves 8–20 pairs. Buds 3.5–6 mm diam., with short-woolly hairs 0.3–0.4 mm; lobes 0.5–1 mm thick; pedicel slender. — Borneo . . . . . **30. K. linguiformis**
- b. Leaves 17–30 by 5–10.5 cm, nerves 14–23 pairs. Buds 6 mm diam., hairs 0.1 mm long, lobes 1–2 mm thick; pedicel stout. — Borneo (Sarawak) . . . **74. K. viridis**
- 37a. Buds generally with persistent indumentum; sometimes seemingly glabrous because of very minute appressed scale-like hairs only (lens!). Lower leaf surface glabrescent or not . . . . . 41
- b. Buds glabrescent. Lower leaf surface early glabrescent . . . . . 38
- 38a. (Male) inflorescences conspicuously pedunculate. SERIES GLOMERATAE, p. p. — Philippines (Luzon) . . . . . **58. K. ridsdaleana**
- b. Inflorescences (sub)sessile . . . . . 39
- 39a. Buds mitriform, with sharp angles, (8–)9–15 mm diam. Twigs 4–10 mm diam., grey-brown. Leaves rigidly coriaceous. SERIES GALEATAE. — Borneo . . . . . **12. K. galeata**
- b. Buds (depressed-)globose, in cross section circular or obtusely triangular, 2.5–7 (–8) mm diam. Twigs 1.5–3 mm diam., often ± yellowish. Leaves chartaceous to thinly coriaceous . . . . . 40

- 40a. Inflorescences on the older branches, below the leaves. Buds 5–7(–8) mm diam., glabrescent, at first with short hairs 0.2 mm long. Staminal disc flat to convex, not with a mammilla. Anthers 19–23. SERIES MEMBRANIFOLIAE. – Borneo . . . . . **39. *K. membranifolia***
- b. Inflorescences among the leaves. Buds 2.5–4.5 mm diam., glabrescent, at first with woolly hairs 0.5–0.7 mm long. Staminal disc with conspicuous mammilla. Anthers 9–12. SERIES MAMILLATAE p.p. — Borneo (S Kalimantan) . . . **36. *K. mamillata***
- 41a. Leaves on lower surface with scattered brown dots, especially on the finer nerves (lens!). SERIES PUNCTATAE . . . . . 79
- b. Leaves on lower surface without dots (sometimes a few stray dots when leaves glabrescent) . . . . . 42
- 42a. Buds of variable consistency and size. Staminal disc concave, ( $\pm$ ) flat, or but slightly convex (sometimes low-mammillate in *K. glomerata*, *K. latericia*, *K. rubens*, *K. stenocarpa*, and *K. subhirtella*) . . . . . 46
- b. Buds rather robust, 4–7 mm diam. Staminal disc convex or with a mammilla (in dry specimens the latter sometimes shrivelled and indistinct). (Staminal disc sometimes  $\pm$  flat in *K. korthalsii* from the Philippines). SERIES MAMILLATAE p.p. . 43
- 43a. Leaves rigidly coriaceous. Twig apex and young petioles with hairs 2–4 mm long; buds with hairs 1–2 mm long. A ring-shaped disc present at base of perianth around the androphore. — Peninsular Malaysia . . . . . **51. *K. plumulosa***
- b. Leaves chartaceous to coriaceous. Twig apex and young petioles with hairs up to 1 mm long; buds with hairs up to 0.5 mm long. Perianth at base somewhat thickened or not, without a distinct ring-shaped disc . . . . . 44
- 44a. Leaves coriaceous. Mammilla longer than broad. — Sumatra, Peninsular Malaysia, Singapore, W Java, Borneo . . . . . **19. *K. intermedia***
- b. Leaves chartaceous. Mammilla about as long as broad, or shorter . . . . . 45
- 45a. Lateral nerves 8–15 pairs, much raised above. Twigs 1.5–3 mm diam., (sub)terete, smooth or finely striate. Bracteole subapical. Anthers 10–13. — Borneo . . . . . **73. *K. uliginosa***
- b. Lateral nerves 14–40 pairs, not or but slightly raised above. Twigs 3–5 mm diam., rather coarsely ridged or  $\pm$  2- or 3-angled. Bracteole about median. Anthers 10–20. (Compare also *K. glomerata*.) — Borneo, S Philippines . . . . . **21. *K. korthalsii***
- 46a. Buds small or medium-sized, rarely large, 1.5–7 mm diam. Lobes 0.3–1 mm thick. Hairs 0.1–1 mm long. Anthers (5–)6–17. (Compare also *K. pectinata* from the second lead.) . . . . . 50
- b. Buds generally robust, (3.5–)4–8 mm diam. Lobes (0.7–)1–2 mm thick. Hairs finely farinose or scurfy, 0.1(–0.2) mm long or less. Anthers 11–24. (Buds in *K. pectinata* 3.5–7 mm diam., with 11–15 anthers; in *K. scortechinii* 3.5–5 mm diam., with 11–16 anthers.) . . . . . 47
- 47a. Twigs seemingly glabrous, though actually with minute appressed scale-like hairs, chocolate, dark brown, or cinnamon. [Twigs 4–6 mm diam., angular or coarsely striate. Leaves chartaceous to thinly coriaceous; lateral nerves 20–35 pairs.] SERIES SERICEAE p.p. — Borneo . . . . . **3a. *K. ashtonii* var. *ashtonii***
- b. Twigs usually early glabrescent; hairs mealy, minute, pale brown to yellowish brown; indumentum not consisting of appressed scale-like hairs only. SERIES GLOMERATAE p.p. . . . . 48

- 48a. Anthers 18–23, completely sessile. Twigs  $\pm$  angular, dark brown or blackish, 2.5–4 mm diam. Leaves chartaceous or thinly coriaceous; lateral nerves 20–30 pairs. — Borneo . . . . . **75. *K. woodii***
- b. Anthers 11–16, half sessile or stiped. Twigs terete, striate, greyish brown, rarely blackish. Leaves coriaceous . . . . . 49
- 49a. Leaves to 45 cm long; lateral nerves 25–50 pairs, venation coarse or fine. Buds (3.5–)4–7 mm diam.; anthers 11–15, half sessile or nearly stiped. Perianth inside pinkish. Twigs 3–6 mm diam. — Borneo . . . . . **47. *K. pectinata***
- b. Leaves to 30 cm long; lateral nerves 18–30 pairs, venation fine. Buds 3.5–5 mm diam.; anthers 11–16, usually shortly stiped. Perianth inside greenish to yellowish. Twigs 2–4 mm diam. — Sumatra, Peninsular Malaysia . . . . . **62. *K. scortechinii***
- 50a. Indumentum of flowers and twigs apices inconspicuous, scurfy or felty, with scale-like (in *K. rigidifolia* and *K. rubens* with stellate-dendroid) hairs 0.1–0.2 mm long or less. SERIES GLAUCAE (excl. *K. rigidifolia*, *K. tridactyla*) . . . . . 58
- b. Indumentum of flowers and twigs more conspicuous, with farinose or woolly hairs more than (0.1–)0.2 mm long (hairs sometimes short in *K. glomerata* from the Philippines). SERIES GLOMERATAE p. p. . . . . 51
- 51a. Lower leaf surface either 1) completely glabrescent, or with sparse indumentum persistent near midrib and nerves towards the base of the blade; hairs soft and inconspicuous, or 2) indumentum persistent, with minute sparse soft stellate hairs. Inflorescences sessile or pedunculate. Twigs 1–3 mm diam. . . . . 54
- b. Lower leaf surface late glabrescent or with dense persistent indumentum. Inflorescences (partly) pedunculate. Twigs 1–2 mm diam. [Buds 1.5–3 mm diam.; anthers (5–)6–9(–18?).] . . . . . 52
- 52a. Leaves (oblong-)lanceolate; upper surface with hair scars (lens!). Buds 1.5–2 mm diam. — Borneo . . . . . **72. *K. tridactyla***
- b. Leaves ovate to oblong; upper surface without distinct hair scars. Buds 2–3 mm diam. . . . . 53
- 53a. Buds 2–2.5 mm diam. Twigs 1–1.5 mm diam., not or hardly striate. — Philippines (Sulu., Mindanao) . . . . . **66. *K. stenocarpa***
- b. Buds 3 mm diam. Twigs 2–2.5 mm diam., coarsely striate or angled. — Philippines (Luzon) . . . . . **1. *K. alvarezii***
- 54a. Twigs 1.5–2.5(–3) mm diam., smooth, lower down sometimes striate. Buds 3–5 mm diam. Anthers 9–13(–15). Staminal disc  $\pm$  flat, convex, or low-mammillate. Inflorescences sessile. (Compare also *K. korthalsii* and *K. tomentella*.) — Borneo (Sarawak), Philippines . . . . . **16. *K. glomerata***
- b. Twigs slender or rather stout, 1–3 mm diam., striate or ridged, lower down as well as right up to the apex; if striations faint, then twigs 2–3 mm diam. (Twigs in *K. tomentella* from Sulawesi and Seram often hardly striate) . . . . . 55
- 55a. Inflorescences all or partly up to 5 mm pedunculate. [Pedicel 3–11 mm.] Leaves 6–18(–24) by 1.5–4(–6) cm, drying with a blackish metallic lustre above. [Twigs 1–2(–2.5) mm diam.] SERIES OBOVOIDEAE. — Often coastal; Sumatra, Peninsular Malaysia, W Java . . . . . **15. *K. globularia***
- b. Inflorescences all sessile. Leaves drying without a blackish metallic lustre. — C & E Malesia . . . . . 56
- 56a. Buds 1.5–2 mm diam. — Low tree, 2–5 m; Borneo (S Brunei) . . . . . **40. *K. minima***
- b. Buds 2.5 mm diam. or more . . . . . 57

- 57a. Pedicel 2–5 mm long. Buds subglobose, 2.5–3 mm diam., with hairs 0.3–0.5 mm long; anthers (6–)8–11, each 0.3(–0.5) mm long. — Sulawesi, Moluccas, Papua Barat (Bird's Head) . . . . . **71. *K. tomentella***
- b. Pedicel 1–2 mm long. Buds ± pear-shaped, 3.5 mm diam., with coarse hairs 0.7 mm long; anthers 7–9, each 0.5 mm long. — Philippines (Palawan) (see also subsp. *ridleyi* forma *nana*, from Borneo) . . . . . **27a. *K. latericia* subsp. *latericia***
- 58a. Leaf upper surface drying without blackish metallic lustre. Buds with hairs 0.1–0.2 mm long or less . . . . . 59
- b. Leaf upper surface drying usually with a blackish metallic lustre. Buds with hairs more than 0.2 mm long. [Pedicel 3–11 mm long.] (SERIES OBOVOIDEAE). — Sumatra, Peninsular Malaysia, W Java . . . . . **15. *K. globularia***
- 59a. Leaves membranous or chartaceous, lower surface early glabrescent except for the basal part of the midrib with minute hairs. Twigs usually flattened or blunt-triangular, at first with farinose orange-red or orange yellowish hairs 0.2 mm long. — Sumatra, Peninsular Malaysia, Singapore . . . . . **60. *K. rubens***
- b. Leaves membranous, chartaceous, or coriaceous; lower surface completely glabrescent or with a variable (sub)persistent indumentum. Twigs (sub)terete (in *K. luteola* ± flattened), glabrescent, at first with hairs 0.1–0.2 mm long or less . . . . 60
- 60a. Lower leaf surface with either 1) (sub)persistent, though usually inconspicuous, scale-like hairs 0.1 mm long or less (lens!) or 2) (late) glabrescent, at first with more conspicuous dense stellate-dendroid hairs 0.2 mm long. [Fruits with (sub)-persistent indumentum.] . . . . . 66
- b. Lower leaf surface (early) glabrescent; at first with sparse or dense, weak and inconspicuous, minute hairs. [Venation on upper leaf surface usually distinct.] . 61
- 61a. Leaves coriaceous, drying brown above; venation on upper surface distinct and prominent. Twigs drying dark brown to blackish. Fruits with persistent very short indumentum . . . . . 62
- b. Leaves membranous or thinly coriaceous, drying greenish, brown, or blackish above; venation distinct or not. Twigs drying grey or brown. Fruits early glabrescent, finely warty or in *K. luteola* with sparse minute scale-like hairs . . . . . 63
- 62a. Twigs 1.5–2.5 mm diam. Leaves 9–21 by 2.5–5 cm, drying brown above. Bracteole caducous. Perianth inside red. Anthers subsessile. — Borneo (Sabah: Mt. Kinabalu and vicinity) . . . . . **20. *K. kinabaluensis***
- b. Twigs 3–4 mm diam. Leaves generally larger, 14–31 by 4.5–10.5 cm, drying olivaceous(-brown) above. Bracteole persistent. Perianth inside creamy-yellow. Anthers stiped. — Central Sulawesi (Lake Matano area) . . . . . **38. *K. matanensis***
- 63a. Twigs somewhat flattened. Venation on upper leaf surface very fine, areoles less than 0.5 mm diam. Bracteole caducous. Perianth inside yellowish **34. *K. luteola***
- b. Twigs terete. Venation on upper leaf surface with areoles 0.5 mm diam. or more. Bracteole persistent or caducous. Perianth inside reddish (or in Java, Bali, and Borneo reddish or yellowish) . . . . . 64
- 64a. Lateral nerves ± flat or sunken above; venation in older leaves usually distinct. Bracteole apical, caducous. [Leaves 5.5–12 cm wide, base cordate or rounded, not attenuate. Anthers 8–10.] — Borneo . . . . . **22. *K. kostermansiana***
- b. Lateral nerves raised above; venation distinct. Bracteole below the apex, usually persistent . . . . . 65

- 65a. Leaves 6–20(–25) cm long. Buds 2.5–3.5 mm diam. Anthers 8–10, or in E Java and Bali frequently and in Borneo sometimes 11–15. Fruits 1.8–3(–4?) cm long. — Sumatra, Peninsular Malaysia, Borneo, Java, Bali . . . . . **13. *K. glauca***
- b. Leaves 12–30 cm long. Buds 3–4 mm diam. Anthers 12–18. Fruits 3–4 cm long. — Sumatra, Peninsular Malaysia . . . . . **70. *K. sumatrana***
- 66a. Leaves (when submature) on lower surface with  $\pm$  dense hairs of 0.2 mm long, of  $\pm$  mixed size; mature leaves often glabrescent. Venation on upper surface distinct, fine, areoles 0.5 mm diam. or less. [Bracteole caducous or rudimentary.] . . . . 76
- b. Lower leaf surface either with hairs 1) sparse, uniform, scale-like, 0.2 mm long or less, or 2) dense, minute, scale-like, 0.1 mm only. Venation on upper surface distinct or not . . . . . 67
- 67a. Leaves very coriaceous; venation prominent. Bracteole caducous. Buds pear-shaped, at base tapering or not (recheck also fork 21). Fruits globose, 3–3.5 cm diam.; fruiting pedicel 1–3 mm long. (SERIES OBOVOIDEAE). — Peninsular Malaysia . . . . . **59a. *K. rigidifolia* subsp. *rigidifolia***
- b. Leaves membranous or chartaceous; venation not so very prominent, distinct or not. Fruits ellipsoid or obovoid, up to 2.5(–4) cm long; fruiting pedicel to 15(–20) mm long . . . . . 68
- 68a. Buds 2–3.5 mm diam.; pedicel 2–7 mm long, in Borneo to 10 mm long. Anthers 5–9, in Sumatra up to 11, in Borneo up to 15. Bracteole persistent or caducous. — Mainly Borneo . . . . . 71
- b. Buds 3–5 mm diam.; pedicel 6–15 mm long. Anthers 9–15(–17). Bracteole caducous. — Not in Borneo . . . . . 69
- 69a. Buds truncate or  $\pm$  saccate at base. Lateral nerves and venation flat or sunken above, indistinct. Perianth inside yellowish (always?). — Sumatra, Peninsular Malaysia . . . . . **46. *K. patentinervia***
- b. Buds rounded, subtruncate, or short attenuate at base. Lateral nerves and venation raised and distinct above . . . . . 70
- 70a. Twigs 1–2 mm diam., smooth. Anthers opening almost laterally. Perianth pale yellowish inside (always?). Fruits often narrowed at base, with woolly hairs 0.2–0.4 mm long. — Peninsular Malaysia, Singapore . . . . . **35. *K. malayana***
- b. Twigs 1.5–3.5 mm diam., striate. Anthers opening  $\pm$  downwards. Perianth red inside. Fruits  $\pm$  rounded at base, with scurfy hairs 0.1–0.2 mm long. — Lesser Sunda Islands (E of Bali), Philippines . . . . . **5. *K. cinerea***
- 71a. Venation on upper leaf surface very fine, distinct; areoles less than 0.5 mm diam. Buds 2 mm diam.; pedicel 2–3 mm long. Anthers 5 or 6 (or 10–12?). Perianth inside reddish (?). (SERIES GLOMERATAE). — Borneo (Sarawak) . . . . . **72b. *K. tridactyla* subsp. *sublaevis***
- b. Venation on upper leaf surface distinct or indistinct; diam. of the areoles 0.5 mm or more. Buds 2–3.5(–4?) mm diam.; pedicel 3–10 mm long. Anthers 6–13(–15). Perianth inside creamy or yellowish (always?) . . . . . 72
- 72a. Twigs 1 mm diam. Leaves to 15 cm long, beneath with sparse scale-like hairs less than 0.1 mm long. Buds globose or broadly obovoid, 2.5–3 mm diameter; anthers 6–11; androphore glabrous. — Sumatra, Peninsular Malaysia, Borneo . . . . . **67. *K. stenophylla***
- b. Twigs 1–3 mm diam. Leaves to 30 cm long, beneath with hairs more dense, or hairs longer, 0.1–0.3 mm long. Androphore glabrous or finely pubescent at base . . 73

- 73a. Buds (broadly obovate, 2 mm diam.) cleft to the base. Anthers 9, subsessile, half-erect; androphore  $\pm$  tapering, glabrous or with a few minute hairs at base. Leaves to 25 cm long, base short-attenuate or rounded, lower surface with  $\pm$  dense, greyish, equal-sized hairs 0.2 mm long. — Borneo . . . . . **57. *K. riangensis***
- b. Buds cleft 3/4–4/5. Anthers 6–15, subsessile or stiped,  $\pm$  horizontal; androphore little tapering, glabrous or finely pubescent towards the base. Leaves variable, at base attenuate; hairs sparse, of mixed sizes . . . . . 74
- 74a. Twigs 2–3 mm diam. Leaves to 25 cm long. Buds subglobose or broadly obovoid, 3–4 mm long. [Anthers 11–13; androphore pubescent towards the base, not seen in var. *pilocarpa*. Fruits 2.5–3.5 cm long.] — Borneo (Sabah) . . . . **17. *K. hirtella***
- b. Twigs 1–2 mm diam. Leaves generally smaller. Buds obovoid, 2.5–3 mm long . . . . . 75
- 75a. Buds 2.5–3 mm long, anthers 8–15, androphore glabrous or with minute hairs at base. Leaves with distinct venation above. Fruits 2 cm long. — Borneo (Sarawak, Brunei, Sabah) . . . . . **69. *K. subhirtella***
- b. Buds 2.5 mm long, anthers 6–8, androphore glabrous. Leaves with  $\pm$  faint venation above. Fruits 1.5–2 cm long. — Borneo . . . . . **41. *K. mogaena***
- 76a. Twigs (1.5–)2–4 mm diam. Buds 3.5–5 mm diam. [Perianth inside greenish to yellowish.] . . . . . 78
- b. Twigs 1–2(–3) mm diam. Buds smaller, 2.5–3.5 mm diam. . . . . 77
- 77a. Pedicel 2–5 mm long. Leaves (oblong-)lanceolate, broadest at the middle; the base cuneate. Perianth inside reddish (?). — Peninsular Malaysia, Singapore . . . . . **6. *K. communis***
- b. Pedicel 5–11 mm long. Leaves oblong to lanceolate, broadest usually below the middle; base rounded to cuneate. Perianth inside greenish creamy or yellowish. — Sumatra, Peninsular Malaysia, Singapore, Borneo . . . . . **14. *K. glaucescens***
- 78a. Leaves chartaceous, lower surface with  $\pm$  sparse greyish hairs. Pedicel 3–10 mm long. — Sumatra . . . . . **32. *K. losirensis***
- b. Leaves (sub)coriaceous, the lower surface with dense, yellowish or rusty hairs, or glabrescent. Pedicel 7–16 mm long (in series *Glomeratae*). — Sumatra, Peninsular Malaysia . . . . . **62. *K. scortechinii***
- 79a. Leaves with persistent indumentum beneath, or hairs shed late and then leaving hair scars (lens!); sometimes sparse minute scale-like hairs only. Twigs striate (striations sometimes not distinct in *K. kunstleri* subsp. *coriacea* and subsp. *alpina* . . . . . 81
- b. Leaves early glabrescent beneath. Twigs (indumentum removed) not striate . . . . . 80
- 80a. Twigs 1.5–4 mm diam. Leaves coriaceous, 10–20 cm long, apex truncate. Bracteole apical. Anthers long-stiped. — Sulawesi . . . . . **4. *K. celebica***
- b. Twigs 1–1.5 mm diam. Leaves chartaceous, 5.5–15 cm long, apex acute-acuminate. Bracteole about median. Anthers just stiped. — Borneo (Sarawak) . . . . . **42. *K. muscosa***
- 81a. Leaves 10–35 cm long; lower surface with coarse, stiff, sessile and stalked hairs. Buds (3.5–)4–5 mm diam. . . . . 84
- b. Leaves generally smaller, 5–20(–27) cm long; lower surface with mainly sessile stellate hairs. Buds 2–3(–4) mm diam. . . . . 82
- 82a. Perianth inside pubescent. Staminal disc convex. — Borneo . . . **54. *K. pubiflora***
- b. Perianth inside glabrous. Staminal disc flat or shallowly convex . . . . . 83

- 83a. Lower leaf surface with stellate and/or scale-like hairs. Flowers with hairs 0.1–0.2 mm long or less. — Sumatra, Peninsular Malaysia, Borneo, Philippines . . . . . **24. K. kunstleri**
- b. Lower leaf surface with sessile hairs mixed with dendroid hairs, the latter sometimes shed early and leaving hair scars. Flowers with dense woolly hairs 0.2–0.3 mm long, mixed with emergent dendroid hairs. — N Sulawesi, Philippines . . . . . **65. K. stellata**
- 84a. Twigs 2–5 mm diam. Pedicel 7–15 mm long. Perianth 3-lobed, disc at base absent. Staminal disc subtriangular, flat or slightly convex. Anthers 10–17. Fruits ellipsoid to subglobose; fruiting pedicel 5–10 mm long . . . . . **85**
- b. Twigs 4–6 mm diam. Pedicel 20–30 mm long. Perianth 4- or 5-lobed, at base with conspicuous disc. Staminal disc circular, distinctly mammillate. Anthers 14–18. Fruits globose or depressed globose; fruiting pedicel 18–30 mm long. — Borneo . . . . . **48. K. pedicellata**
- 85a. Buds 2(–2.5) mm diam.; anthers 8, each 4-sporangiate. — Borneo (Central Kalimantan) . . . . . **23. K. krusemaniana**
- b. Buds 4–4.5 mm diam., anthers (10–)12–17, each 2-sporangiate. — Sumatra, Peninsular Malaysia, Singapore, Borneo . . . . . **7. K. conferta**

## (2) REGIONAL KEY TO THE SPECIES — PENINSULAR MALAYSIA, SINGAPORE

(based on female flowering and fruiting specimens)

- 1a. Lower leaf surface seemingly glabrous, though actually with (sub)persistent, dense, ± flat, tightly interwoven hairs, silky to the touch. Leaves stout . . **56. K. retusa**
- b. Lower leaf surface either glabrous (glabrescent), or with indumentum not silky to the touch. Leaves large or small . . . . . **2**
- 2a. Bark of twigs longitudinally cracking, when older flaking . . . . . **3**
- b. Bark of twigs neither cracking nor flaking . . . . . **6**
- 3a. Twigs 4–12 mm diam. Buds 6–10 mm long. Fruits 2.5–8 cm long . . . . . **4**
- b. Twigs 2–4 mm diam. Buds 5–8 mm long. Fruits 1.5–2.5(–3) cm long . . . . . **27. K. latericia**
- 4a. Hairs on twigs (3–)5–8 mm long, those of flowers 1–3 mm long, of fruits 5–13 mm long . . . . . **18. K. hookeriana**
- b. Hairs shorter . . . . . **5**
- 5a. Pedicel 1.5–2 mm long. Fruits 2.5–3.5 cm long, fruiting pedicel 2–5 mm long . . . . . **11. K. furfuracea**
- b. Flowers not known. Fruits 4–4.5 cm long, fruiting pedicel 18–25 mm long . . . . . **25. K. lamellaria**
- 6a. Lower leaf surface with dark dots, usually on the smaller veins . . . . . **7**
- b. Lower leaf surface without dots . . . . . **8**
- 7a. Lower leaf surface with sparse scale-like hairs 0.1 mm long . . . . . **24a. K. kunstleri** subsp. **kunstleri**
- b. Lower leaf surface with hairs (0.2–)0.3–1 mm long . . . . . **7. K. conferta**
- 8a. Leaves 3.5–15(–20) cm long, membranous or chartaceous, drying greenish or brown. Twigs (0.5–)1–2 mm diam., early glabrescent, often yellowish. Fruits often glabrescent, 2–5 cm long. Anthers 9–25(–30), closely appressed . . **8. K. curtisii**



- b. Leaves small or large, membranous or coriaceous, greenish or brown. Twigs slender or stout, drying brown or blackish. Fruits variable. Anthers not tightly appressed ..... 9
- 9a. Hairs on twigs and flowers (0.1–)0.2 mm long or more; hairs often comparatively short in *K. globularia* and *K. pseudolaurina*, both with striate twigs ..... 10
- b. Hairs on twigs and (usually) flowers, 0.1–0.2 mm long or less; hairs comparatively long in *K. rubens*, a species with twigs  $\pm$  flattened ..... 16
- 10a. Buds 8 mm long, inside with a conspicuous disc at base; perianth persistent in fruits ..... **51. *K. plumulosa***
- b. Buds 4–10 mm long, without disc at base; perianth not persistent in fruits ... 11
- 11a. Twigs striate, 1–2(–2.5) mm diam. Leaves 6–18(–24) cm long, drying with a blackish metallic lustre above; lower surface late glabrescent, at first with hairs 0.1 mm long ..... **15. *K. globularia***
- b. Twigs striate or not, 1.5–6(–10) mm diam. Leaves 9–40(–55) cm long, without a blackish metallic lustre; lower surface glabrescent or with persistent hairs 0.2 mm long or more ..... 12
- 12a. Twigs flattened or bluntly 2- or 3-angular. Leaves (lens!) pitted above (like the surface of the peel of an orange). Fruits usually beaked at apex **44. *K. oblongifolia***
- b. Twigs  $\pm$  terete. Leaves not pitted. Fruits not beaked ..... 13
- 13a. Leaves early glabrescent beneath ..... 14
- b. Leaves with persistent indumentum beneath ..... 15
- 14a. Twigs (4–)5–8 mm diam. Leaves 15–55 cm long. Buds 8–10 mm long. Fruits 3–6 cm long, with hairs (0.5–)1–2 mm long ..... **37. *K. mandaharan***
- b. Twigs 1.5–4 mm diam. Leaves 9–35 cm long. Buds 5(–6) mm long. Fruits 2.5–4 cm long, rather glabrescent, hairs 0.3–0.5 mm long ..... **19. *K. intermedia***
- 15a. Buds 6–8 mm long, with hairs 0.1–0.5 mm long. Fruits (2.5–)3–4(–5) cm long. Hairs on lower leaf surface stellate-dendroid, of mixed sizes **52. *K. pseudolaurina***
- b. Buds 4–6 mm long, with hairs 0.5–1(–2) mm long. Fruits 1.5–2.5 cm long. Hairs on lower leaf surface  $\pm$  equal, stalked-dendroid (of mixed sizes in var. *heteropilis*) ..... **29. *K. laurina***
- 16a. Twigs flattened, with hairs 0.1–0.2 mm long. Leaves early glabrescent beneath, except the basal part of the midrib ..... **60. *K. rubens***
- b. Twigs terete, with hairs 0.1–0.2 mm long or less. Leaves glabrescent or with persistent indumentum beneath ..... 17
- 17a. Leaf base rounded or cordate. Lower leaf surface glabrescent, or with weak hairs 0.1–0.2 mm long. Fruits ellipsoid, (3–)4–6 cm long; fruiting pedicel (2–)5–12 mm long ..... **55. *K. pulchra***
- b. Leaf base rounded or attenuate (rarely (sub)cordate in *K. rigidifolia* with coriaceous leaves and *K. scortechinii* with coriaceous leaves and with subsistent indumentum beneath). Lower leaf surface glabrescent or with a variable indumentum. Fruits to 4 cm long; fruiting pedicel variable ..... 18
- 18a. Lower leaf surface glabrescent, at first with weak greyish hairs 0.1 mm long or less ..... 19
- b. Lower leaf surface late glabrescent or with (sub)persistent hairs 0.1–0.4 mm long, sometimes remaining on and near midrib and nerves (completely glabrescent, with distinct hair scars, in *K. rigidifolia*) ..... 20

- 19a. Leaves 6–20(–25) by 2–5.5(–11) cm. Fruits 1.8–3(–4?) cm long . . . . . **13. K. glauca**  
 b. Leaves 12–30 by 4.5–12 cm. Fruits 3–4 cm long . . . . . **70. K. sumatrana**
- 20a. Leaves coriaceous. Fruits (sub)globose, 3–4 cm diam.; fruiting pedicel 1–3 mm long . . . . . **59. K. rigidifolia**  
 b. Leaves membranous or chartaceous, or ± coriaceous in *K. scortechinii* and *K. patentinervia*. Fruits ellipsoid, of variable sizes; fruiting pedicel (3–)4–20 mm, in *K. andamanica* 0.5–7 mm long . . . . . 21
- 21a. Lower leaf surface largely glabrescent, hairs 0.1–0.4 mm long, persistent on and near midrib and nerves. Style slender, stigma lobes erect, together 1.5(–2) mm long. Male buds ellipsoid or pear-shaped. Anthers 6 or 7 . . . . . **2. K. andamanica** subsp. **nicobarica**  
 b. Lower leaf surface with conspicuous or inconspicuous (sub)persistent indumentum. Style shorter or absent, stigma lobes ± spreading. Male buds subglobose. Anthers 6–18; 6–11 in *K. stenophylla*, 7–9 in *K. communis* . . . . . 22
- 22a. Leaves with ± conspicuous rather dense stellate-dendroid hairs 0.2 mm long beneath (old leaves glabrescent). Venation distinct above, with areoles 0.5 mm diam. or less . . . . . 23  
 b. Leaves either with sparse hairs 0.2 mm long or less, or with sparse or dense scale-like hairs 0.1 mm long or less. Venation distinct or indistinct above; areoles 0.5 mm diam. or more . . . . . 25
- 23a. Twigs 1–2(–3) mm diam., smooth, not wrinkled. Fruits 1.5–2.2 cm long . . . . . 24  
 b. Twigs (1.5–)2–4 mm diam., often wrinkled. Fruits 2–2.5 cm long . . . . . **62. K. scortechinii**
- 24a. Fruits 1.5–1.8 cm long. Buds 4 mm long; inside reddish (?). Leaves (oblong-)lanceolate, broadest usually at the middle; base cuneate . . . . . **6. K. communis**  
 b. Fruits 1.8–2.2 cm long. Buds 4–5.5 mm long; inside greenish creamy to yellowish. Leaves oblong to lanceolate, broadest usually below the middle; base rounded or cuneate . . . . . **14. K. glaucescens**
- 25a. Leaves thinly coriaceous, glossy above. Lateral nerves ± patent; nerves and venation on upper surface flat or sunken, indistinct. [Perianth inside yellowish (always?)] . . . . . **46. K. patentinervia**  
 b. Leaves membranous or chartaceous, usually dull above. Lateral nerves less patent; nerves and venation distinct or not above . . . . . 26
- 26a. Lateral nerves and venation sunken, flat, or raised, distinct or indistinct above. Perianth inside creamy or yellowish (always?). Fruits at base rounded or sometimes attenuate; hairs scale-like, 0.1 mm long or less . . . . . **67. K. stenophylla**  
 b. Lateral nerves and venation raised and distinct above. Perianth inside creamy. Fruits narrowed at base; hairs 0.2–0.4 mm long . . . . . **35. K. malayana**

## (3) REGIONAL KEY TO THE SPECIES — SUMATRA, JAVA

(based on female flowering and fruiting specimens)

- 1a. Bark of twigs longitudinally cracking, when older flaking . . . . . 2  
 b. Bark of twigs neither cracking nor flaking . . . . . 5

- 2a. Twigs 5–10 mm diam. Buds (6–)8–10 mm long . . . . . 3  
 b. Twigs 2–4 mm diam. [with hairs 0.5–2 mm long]. Buds 5–8 mm long. [Fruits 1.5–2.5(–3) cm long, with hairs 1–2 mm long.] — Northern Sumatra and Bangka . . . . .  
 . . . . . **27b. *K. latericia* subsp. *ridleyi***
- 3a. Hairs on twigs (3–)5–8 mm long, on flowers 1–3 mm long. Fruits 4.5–8 cm long, with hairs 5–13 mm long . . . . . **18. *K. hookeriana***  
 b. Hairs on twigs 1–2.5 mm long, on flowers 0.7–1.2 mm long. Fruits 3 cm long, with hairs 0.6–2 mm long . . . . . 4
- 4a. Fruiting pedicel 10 mm . . . . . **26. *K. lampongensis***  
 b. Fruiting pedicel 2–5 mm long . . . . . **11. *K. furfuracea***
- 5a. Leaves on lower surface with dark dots, especially on the veinlets . . . . . 6  
 b. Leaves on lower surface without dots . . . . . 7
- 6a. Lower leaf surface with persistent, sparse, scale-like hairs 0.1 mm long . . . . .  
 . . . . . **24e. *K. kunstleri* subsp. *macrophylla***  
 b. Lower leaf surface with persistent stellate-dendroid hairs (0.2–)0.3–1 mm long . . . . .  
 . . . . . **7. *K. conferta***
- 7a. Twigs (0.5–)1–2 mm diam., early glabrescent, yellowish. Leaves olivaceous above, early glabrescent beneath. [Fruits 2–5 cm long, often glabrescent, often ± beaked at apex.] . . . . . **8a. *K. curtisii* var. *curtisii***  
 b. Twigs slender or stout, drying brown or blackish. Leaves olivaceous or (dark) brown above, with a variable persistent indumentum, or glabrescent beneath . . . . . 8
- 8a. Hairs on twigs and flowers (0.1–)0.2 mm long or more (hairs comparatively short in *K. globularia* and *K. pseudolaurina*, both with striate twigs) . . . . . 9  
 b. Hairs on twigs and flowers 0.1–0.2 mm long or less (hairs comparatively long in *K. rubens*, with twigs ± flattened and fruits usually with acute apex) . . . . . 13
- 9a. Twigs striate, 1–2(–2.5) mm diam. Leaves 6–18(–24) cm long, drying with a blackish metallic lustre; lower surface late glabrescent, hairs 0.1 mm long . . . . .  
 . . . . . **15. *K. globularia***  
 b. Twigs striate or not, 1.5–6(–10) mm diam. Leaves 9–40(–55) cm long, without blackish metallic lustre; on lower surface glabrescent or with persistent hairs 0.2 mm long or more . . . . . 10
- 10a. Leaves early glabrescent beneath . . . . . 11  
 b. Leaves with persistent indumentum beneath . . . . . 12
- 11a. Twigs (4–)5–8(–10) mm diam. Leaves 15–55 cm long. Buds 8–10 mm long. Fruits 3–6 cm long, with hairs (0.5–)1–2 mm long . . . . . **37. *K. mandaharan***  
 b. Twigs 1.5–4(–5) mm diam. Leaves 9–35 cm long. Buds 5(–6) mm long. Fruits 2.5–4 cm long, rather glabrescent, at first with hairs 0.3–0.5 mm long . . . . .  
 . . . . . **19. *K. intermedia***
- 12a. Buds 6–8 mm long, with hairs 0.1–0.5 mm long. Fruits (2.5–)3–4(–5) cm long. Hairs on lower leaf surface of mixed sizes . . . . . **52. *K. pseudolaurina***  
 b. Buds 4–6 mm long, with hairs 0.5–1(–2) mm long. Fruits 1.5–2.5 cm long. Hairs on lower leaf surface all ± equally long (strongly unequal in var. *heteropilis*) . . . . .  
 . . . . . **29. *K. laurina***
- 13a. Leaves (obovate-)oblong, (7–)10–30 by (2.5–)4.5–12.5 cm, drying brown or blackish above, often ± glossy. Fruits 2–3.5 cm long, often ridged, at base somewhat saccate, hairs minute. Anthers 3 or 4 . . . . . **28. *K. latifolia***

- b. Leaves variable in shape and size. Fruits various, not saccate at base. Anthers 6 or more ..... 14
- 14a. Twigs somewhat flattened, with hairs 0.1–0.2 mm long. Leaves early glabrescent beneath, except for the basal part of the midrib ..... **60. K. rubens**
- b. Twigs terete; hairs 0.1 mm long or less. Leaves glabrescent or with persistent indumentum beneath ..... 15
- 15a. Style slender, stigma erect, 3–8-lobed, together 1.5(–2) mm long. [Male buds  $\pm$  ellipsoid or pear-shaped; anthers 6 or 7.] — Sumatra (Aceh) ..... **2. K. andamanica** subsp. **nicobarica**
- b. Style up to 0.5 mm long; stigma broader, 6–12-lobulate ..... 16
- 16a. Leaves early glabrescent beneath, at first with weak hairs 0.1 mm long. Fruits  $\pm$  glabrescent ..... 17
- b. Leaves with persistent indumentum or rather late glabrescent beneath, at first with hairs 0.1–0.2 mm long, mixed with (sometimes caducous) hairs to 0.5 mm long or not. Fruits with persistent indumentum ..... 18
- 17a. Leaves 12–30 by 4.5–12 cm. Fruits 3–4 cm long ..... **70. K. sumatrana**
- b. Leaves 6–20(–25) by 2–5.5(–11) cm. Fruits 1.8–3(–4?) cm long ..... **13. K. glauca**
- 18a. Lower leaf surface with stellate scale-like hairs 0.2 mm long or less. Lateral nerves and venation above distinct or not ..... 19
- b. Lower leaf surface with hairs 0.1–0.2 mm long, mixed with (sometimes caducous) hairs to 0.5 mm long. Lateral nerves and venation above distinct ..... 20
- 19a. Leaves thinly coriaceous, glossy above. Lateral nerves 12–24 pairs, rather patent, flat, indistinct above; venation indistinct above. Male buds 3.5–5 mm diam.; anthers 11–17 ..... **46. K. patentinervia**
- b. Leaves membranous or chartaceous, not glossy. Lateral nerves 10–21 pairs, less patent, flat or raised, usually indistinct above; venation distinct or indistinct above. Male buds (1.5–)2–3(–4?) mm diam.; anthers 6–11 ..... **67. K. stenophylla**
- 20a. Twigs 1–2(–3) mm diam. Leaves 6–20(–23) cm long; lateral nerves 13–20 pairs. Fruits 1.8–2.2 cm long ..... **14. K. glaucescens**
- b. Twigs 1.5–4 mm diam. Leaves 10–30 cm long; nerves 18–30 pairs. Fruits 2–2.7 cm long ..... 21
- 21a. Twigs 1.5–2.5 mm diam., bark striate. Leaves  $\pm$  membranous ..... **32. K. losirensis**
- b. Twigs 2–4 mm diam., bark usually wrinkled on drying. Leaves coriaceous ..... **62. K. scortechinii**

## (4) REGIONAL KEY TO THE SPECIES — BORNEO

(based on female flowering and fruiting specimens)

- 1a. Lower leaf surface seemingly glabrous, but actually with persistent, dense,  $\pm$  flat, interwoven hairs, silky to the touch ..... 2
- b. Lower leaf surface either glabrous (glabrescent), or with variable indumentum not silky to the touch ..... 4
- 2a. Bark of twigs longitudinally cracking and flaking ..... **9. K. elmeri**
- b. Bark of twigs neither cracking nor flaking ..... 3

- 3a. Leaf apex  $\pm$  rounded or acute-acuminate. Hairs on flowers 0.1 mm long. Fruits subglobose to broadly ovoid, 4.5–5 cm long. [Staminal disc conspicuously convex.] ..... **63. *K. sericea***
- b. Leaf apex acute-acuminate. Hairs on flowers inconspicuous, scale-like, 0.1 mm long or less. Fruits (obovoid-)oblong, 5–8 cm long. [Venation on upper leaf surface finer than in *K. sericea*.] ..... **3b. *K. ashtonii* var. *cinnamomea***
- 4a. Bark of twigs longitudinally cracking, when older flaking (sometimes not apparent in *K. percoriacea*) ..... 5
- b. Bark of twigs neither cracking nor flaking ..... 13
- 5a. Flowers wholly or largely glabrescent ..... 6
- b. Flowers with persistent indumentum (but sometimes easily rubbed off in *K. percoriacea*) ..... 8
- 6a. Fruits with persistent hairs 1 mm long (rarely partly glabrescent) ..... **53. *K. psilantha***
- b. Fruits glabrescent ..... 7
- 7a. Buds  $\pm$  mitriform, sharp-angled, 7–9 mm long. Twigs 4–10 mm diam., brown ..... **12. *K. galeata***
- b. Buds not sharp-angled, 4 mm long. Twigs 1.5–3 mm diam., often yellowish ..... **39. *K. membranifolia***
- 8a. Twigs (1–)2–4 mm diam. Flowers sessile or pedicel to 1.5 mm long (see also *K. korthalsii* subsp. *rimosa*) ..... **27. *K. latericia***
- b. Twigs 3–6(–12) mm diam. Pedicel 2–20 mm long (up to 2 mm in *K. lunduensis*; flowers and fruits not known in *K. longepilosa*, but pedicel presumably comparatively short) ..... 9
- 9a. Buds 6–9 mm long. Fruiting pedicel up to 3(–5) mm long ..... 10
- b. Buds 9–11 mm long. Fruiting pedicel (7–)10–30 mm long ..... 12
- 10a. Leaves chartaceous or thinly coriaceous, drying brown above; leaf base obtuse or subcordate (rarely  $\pm$  narrowed) ..... **33. *K. lunduensis***
- b. Leaves coriaceous, drying greenish or brown above; leaf base attenuate to rounded ..... 11
- 11a. Hairs on flowers and fruits 1 mm long. Anthers 10–15, shortly stiped ..... **49. *K. percoriacea***
- b. Hairs on flowers and fruits (2–)3–4 mm long. Anthers 15–18, sessile ..... **31. *K. longepilosa***
- 12a. Hairs on twigs 1–2.5 mm long; on flowers 0.7–1.2 mm long. Fruits 2.5 cm long. — Sumatra and Anambas Is. .... **26. *K. lampongensis***
- b. Hairs on twigs 0.2–1(–2) mm long; on flowers 0.1–0.8 mm long. Fruits 3.5–7 cm long ..... **45. *K. pallens***
- 13a. Lower leaf surface with dark dots, predominantly on the smaller veins ..... 14
- b. Lower leaf surface without dots ..... 19
- 14a. Twigs 1–1.5 mm diam. Leaves glabrescent beneath. Fruits obovoid-oblong, 1.7–1.8 cm long ..... **42. *K. muscosa***
- b. Twigs 1.5–6 mm diam. Lower leaf surface with (sub)persistent indumentum. Fruits of various shapes, 1.5–4 cm long ..... 15
- 15a. Lower leaf surface with sparse hairs 0.1 mm long, sometimes with a few larger ones in-between. (Older leaves sometimes glabrescent in subsp. *alpina*.) ..... **24. *K. kunstleri***
- b. Lower leaf surface with hairs 0.2–1.2 mm long ..... 16

- 16a. Leaves 4–15 cm long, drying brown above. Perianth inside hairy. [Fruits subglobose or short-ellipsoid, 1.5–2.5 cm long.] . . . . . **54. *K. pubiflora***  
 b. Leaves 10–36 cm long, drying olivaceous or brown above. Perianth inside glabrous . . . . . 17
- 17a. Female pedicel 5–8(–10) mm long. Perianth lobes 3 or 4. No disc at base of perianth. Fruits subglobose or usually ellipsoid or obovoid, (1.5–)2–4 cm long; fruiting pedicel 5–10 mm long . . . . . 18  
 b. Female pedicel 10–12 mm long. Perianth lobes 4 or 5. Perianth with disc at base. Fruits subglobose, usually somewhat broader than long, 2–3 by 2.5–2.8 cm; fruiting pedicel 18–30 mm long . . . . . **48. *K. pedicellata***
- 18a. Male bud 4–4.5 mm diam., lobes usually 3; anthers (10–)12–17, each 2-sporangiate. — Sumatra, Peninsular Malaysia, Singapore, Borneo . . . . . **7. *K. conferta***  
 b. Male buds 2(–2.5) mm diam., lobes 4; anthers 8, each 4-sporangiate. — Borneo (Central Kalimantan) . . . . . **23. *K. krusemaniana***
- 19a. Fruits glabrescent. Perianth glabrescent, except in *K. linguiformis*, *K. viridis*, and *K. curtisii* p.p. Bark of twigs frequently smooth, glabrous, yellowish or purplish (but compare *K. woodii*) . . . . . 20  
 b. Fruits pubescent or glabrescent. Perianth with persistent indumentum. Bark of twigs brown or blackish . . . . . 25
- 20a. Twigs 4–8 mm diam. Buds 8–9 mm long, ± mitriform, sharp-angled . . . . . **12. *K. galeata***  
 b. Twigs 1–3 mm diam. Buds 4–6 mm long, not mitriform . . . . . 21
- 21a. Twigs glabrescent, at first with hairs 1 mm long . . . . . 22  
 b. Twigs glabrescent, at first with hairs 0.1–0.5 mm long . . . . . 23
- 22a. Flowers glabrescent, at first with hairs 0.5–1 mm long. Fruits not seen . . . . . **36. *K. mamillata***  
 b. Flowers glabrescent, at first with hairs 0.1 mm long. Fruiting pedicel 1–5 mm long . . . . . **39. *K. membranifolia***
- 23a. Leaves 17–30 cm long. Pedicel stout, 15 mm long. Fruits 5–6 cm long, pericarp 10 mm thick . . . . . **74. *K. viridis***  
 b. Leaves to 20(–25) cm long. Pedicel (2–)5–10 mm long. Fruits 2–5 cm long, pericarp 1–2.5 mm thick . . . . . 24
- 24a. Twigs with hairs 0.2–0.5 mm long. Fruiting pedicel (2–)5–8(–16) mm long . . . . . **30. *K. linguiformis***  
 b. Twigs with hairs 0.1 mm long or less. Fruiting pedicel 8–16 mm long . . . . . **8. *K. curtisii***
- 25a. Twigs with hairs 0.2 mm long or more . . . . . 26  
 b. Twigs with hairs 0.1 mm long or less . . . . . 35
- 26a. Lower leaf surface with persistent indumentum or (late) glabrescent . . . . . 27  
 b. Lower leaf surface glabrescent, sometimes with some indumentum persistent on midrib and nerves in *K. glomerata* . . . . . 29
- 27a. Lower leaf surface with ± uniformly long stalked dendroid hairs. Fruits 1.5–3(–4) cm long, with hairs 1–3 mm long; fruiting pedicel up to 1(–5) mm long . . . . . **29. *K. laurina***  
 b. Lower leaf surface with hairs of variable sizes, sessile and stellate-dendroid . . . . . 28

- 28a. Buds 6–7.5 mm long. Fruits 2–3.8 cm long, with hairs 1–1.5 mm long; fruiting pedicel 3–10 mm long. [Female flowers and fruits not known of subsp. *parviflora*] ..... **43. *K. oblongata***
- b. Buds 2–2.5 mm long. Fruits 1.4–2 cm long, with hairs 0.2–0.5(–1) mm long; fruiting pedicel 2–3 mm long ..... **72. *K. tridactyla***
- 29a. Leaves drying greenish brown or blackish above. Fruits with hairs 3 mm long .... **61. *K. rufa***
- b. Leaves drying olivaceous brown above. Fruits with hairs 0.1–1 mm long ... 30
- 30a. Buds 2.5 mm long. Fruits 1.5–2 cm long. Tree 2–5 m.—S Brunei **40. *K. minima***
- b. Buds and fruits larger. Trees generally larger ..... 31
- 31a. Leaves coriaceous; midrib, nerves, and venation much raised and distinct above ..... 32
- b. Leaves chartaceous; midrib and nerves flat or little raised above, venation (little) raised, (less) distinct above ..... 33
- 32a. Bracteole median on the pedicel. Staminal disc long-mammillate ..... **19. *K. intermedia***
- b. Bracteole (sub)apical. Staminal disc convex or low-mammillate **73. *K. uliginosa***
- 33a. Twigs 3–5 mm diam. Fruits 1.5–4 cm long, with hairs 0.3–0.5(–1) mm long; fruiting pedicel 2–6 mm long ..... **21. *K. korthalsii***
- b. Twigs 1.5–2.5(–3) mm diam. Fruits 1.5–2.5(–3) cm long, with hairs 0.1–0.2(–0.5) mm long; fruiting pedicel 4–10 mm long ..... 34
- 34a. Fruiting pedicel 4–6(–10) mm long; fruits with scurfy hairs 0.1–0.2 mm. Leaves drying green or brown, venation ± distinct. —Borneo (rare) .. **16. *K. glomerata***
- b. Fruiting pedicel 7–10 mm long, more slender; fruits with mealy hairs to 0.5 mm long. Leaves drying conspicuously green, venation distinct ..... **10. *K. emmae***
- 35a. Fruits largely glabrescent, somewhat flattened, often ridged, at base usually somewhat saccate. Leaves (obovate-)oblong; drying dark brown above, paler, often tinged reddish brown or purplish beneath. Anthers 3 or 4 ..... **28. *K. latifolia***
- b. Fruits either with persistent indumentum or glabrescent and then not saccate at the base. Leaves variable in shape; drying olivaceous or brown above, greyish beneath. Anthers 5–25 ..... 36
- 36a. Buds 2–2.5 mm long. Fruits 1.4–2 cm long; fruiting pedicel 2–3 mm long. Anthers 5 or 6 ..... **72b. *K. tridactyla* subsp. *sublaevis***
- b. Buds 3.5–7 mm long. Fruits variable in size; fruiting pedicel usually more than 3 mm long. Anthers 6 or more ..... 37
- 37a. Twigs 4–6 mm diam. Fruits 6–8 cm long with blunt or rounded apex. Venation of upper surface of leaf fine, areoles 0.5 mm diam. or less (compare also *K. luteola*) ..... **3a. *K. ashtonii* var. *ashtonii***
- b. Twigs variable, 1–6(–8) mm diam. Fruits to 8 cm long; if over 6 cm, then the apex acute, not rounded. Venation of upper leaf surface variable ..... 38
- 38a. Lobes of perianth 1–2 mm thick. (Female flowers not seen in *K. pectinata*.) . 39
- b. Lobes of perianth to 1 mm thick ..... 40
- 39a. Twigs blackish brown, ± angled by ridges down from the base of the petioles. Leaves thinly coriaceous; lateral nerves 20–30 pairs ..... **75. *K. woodii***
- b. Twigs (greyish) brown, not angled. Leaves (rigidly) coriaceous; the lateral nerves 25–50 pairs ..... **47. *K. pectinata***

- 40a. Leaves 12–50 cm long, base broadly rounded to cordate. Twigs rather stout, 2–8 mm diam. . . . . 41
- b. Leaves generally smaller, to 25 cm long, base attenuate to rounded (casually subcordate or broadly rounded in *K. glauca*, *K. hirtella*, *K. riangensis*, and *K. stylosa*). Twigs 1–3.5 mm diam. . . . . 42
- 41a. Twigs 3–6(–8) mm diam. Leaves (20–)30–50 by (6–)10–17 cm, nerves flat or little raised above. Fruits subellipsoid, (3–)4–6 cm long, apex rounded. Male buds pear-shaped . . . . . **55. *K. pulchra***
- b. Twigs 2–4 mm diam. Leaves 12–30 by 5.5–12 cm; nerves sunken to  $\pm$  flat above. Fruits  $\pm$  slender, (5–)7–8 by 2 cm, apex long-acute. Male buds globose . . . . . **22. *K. kostermansiana***
- 42a. Leaves (rigidly) coriaceous, venation on upper surface raised, very distinct. — Altitude 1000–2300 m; Sabah (Mt Kinabalu and vicinity) . . . . . **20. *K. kinabaluensis***
- b. Leaves membranous to thinly coriaceous; venation on upper surface distinct or not. — Altitude 0–2000 m; some species also on Mt Kinabalu . . . . . 43
- 43a. Twigs somewhat flattened, light brown. Venation on upper leaf surface distinct, very fine, the areoles less than 0.5 mm diam. . . . . **34. *K. luteola***
- b. Twigs terete or somewhat angular, drying brown or blackish. Venation on upper leaf surface coarser, distinct or not . . . . . 44
- 44a. Fruits glabrescent. Bracteole usually persistent. Leaves beneath early glabrescent (at first with very weak greyish hairs beneath) . . . . . **13. *K. glauca***
- b. Fruits with persistent indumentum (hairs may be very short). Bracteole persistent or caducous. Leaves with persistent indumentum, glabrescent beneath . . . . . 45
- 45a. Male buds pear-shaped, much tapered in the lower half. — A (sub)montane species at (400?–)1000–2000 m altitude . . . . . **50. *K. piriformis***
- b. Male buds obovoid or globose. — Mainly in lowland forest, 0–1000(–1200) m altitude . . . . . 46
- 46a. Lower leaf surface early glabrescent, at first with very weak indumentum. Style 0.5–1 mm long. Male buds obovoid . . . . . **68. *K. stylosa***
- b. Lower leaf surface with persistent indumentum or late glabrescent. Style to 0.5 mm long (stigma lobes sessile). Male buds obovoid or globose . . . . . 47
- 47a. Hairs on lower leaf surface dense, touching or interwoven . . . . . 48
- b. Hairs sparse, not touching each other . . . . . 49
- 48a. Hairs brown. Lateral nerves usually raised above. Fruits 1.8–2.2 cm long . . . . . **14. *K. glaucescens***
- b. Hairs yellowish or greyish white, weak and inconspicuous. Lateral nerves flat or only partially raised above. Fruits (3–)4 cm long . . . . . **57. *K. riangensis***
- 49a. Twigs 1 mm diam. Leaves to 15 cm long, membranous, on lower surface with sparse scale-like hairs less than 0.1 mm. [Fruits 1–1.5 cm long, fruiting pedicel 10–20 mm long.] . . . . . **67b. *K. stenophylla* subsp. *longipedicellata***
- b. Twigs 1–3.5 mm diam. Leaves to 25 cm long, on lower surface with hairs of mixed sizes, 0.1–0.3 mm long . . . . . 50
- 50a. Twigs 1–1.5(–2) mm diam. Venation on upper leaf surface rather faint. Fruits 1.5–2 cm long, fruiting pedicel 4–10 mm long. Anthers 6–8 . . . . . **41. *K. mogeana***
- b. Twigs 1.5–3 mm diam. Venation on upper leaf surface distinct. Fruits 2–3.5 cm long. Anthers 8–13(–15) . . . . . 51



- 51a. Twigs 1.5 mm diam. Leaves 9–20 cm long. Fruits 2–2.7 cm long ..... **69. *K. subhirtella***  
 b. Twigs 3 mm diam. Leaves 16–25(–27) cm long. Fruits 2.5–3.5 cm long ..... **17. *K. hirtella***

(5) REGIONAL KEY TO THE SPECIES — PHILIPPINES, SULAWESI, MOLUCCAS,  
 LESSER SUNDA ISLANDS, NEW GUINEA (Bird's Head)  
 (based on female flowering and fruiting specimens)

- 1a. Leaves not dotted beneath (lens!) ..... 2  
 b. Leaves with dark dots beneath (present mainly on the nerves) ..... 13  
 2a. Twigs and lower surface of young leaves with hairs 0.2 mm long or more (usually short in *K. glomerata*) ..... 3  
 b. Twigs and lower leaf surface with hairs 0.1 mm long or less ..... 10  
 3a. Male inflorescences distinctly pedunculate. Perianth glabrescent. — Philippines (NE Luzon) ..... **58. *K. ridsdaleana***  
 b. Male inflorescences (sub)sessile. Perianth with persistent indumentum ..... 4  
 4a. Twigs 3–5 mm diam. [Fruits with hairs 0.5 mm long.] — S Philippines (incl. Palawan) ..... **21. *K. korthalsii***  
 b. Twigs 3 mm diam. or less ..... 5  
 5a. Twigs 1–2 mm diam. Female buds 4 mm long. Fruits 1–2 cm long ..... 6  
 b. Twigs (1.5–)2–3(–4) mm diam. Female buds 4.5–6 mm long. Fruits (1–)1.5–2.5 (–3) cm long ..... 7  
 6a. Leaves on lower surface late glabrescent or with subsistent minute sparse hairs. Fruits 1.3–1.5 cm long, with hairs 0.1 mm long. — S Philippines (Sulu I., Mindanao) ..... **66. *K. stenocarpa***  
 b. Leaves on lower surface early glabrescent, hairs shed as pieces of a matted indumentum. Fruits 1.5–2 cm long, with hairs 0.5(–1) mm long. — S Philippines (Palawan) ..... **27a. *K. latericia* subsp. *latericia* var. *subtilis***  
 7a. Twigs terete, smooth or very finely striate. Fruits with hairs 0.1–0.2 mm long. — Philippines ..... **16. *K. glomerata***  
 b. Twigs striate or angled. Fruits with hairs 0.5–1 mm long ..... 8  
 8a. Leaves on lower surface partly glabrescent or with subsistent indumentum beneath. Fruits with soft hairs 0.5 mm long ..... 9  
 b. Leaves early glabrescent beneath. Fruits with rigid hairs 1 mm long. — Philippines (Palawan) ..... **27a. *K. latericia* subsp. *latericia***  
 9a. Lower leaf surface with subsistent indumentum. — Philippines (Luzon) ..... **1. *K. Alvarezii***  
 b. Lower leaf surface largely glabrescent. — Sulawesi, Moluccas, Papua Barat (Bird's Head) ..... **71. *K. tomentella***  
 10a. Twigs 3–4 mm diam. Leaves coriaceous. [Perianth inside creamy-yellow. Fruits with persistent short hairs. Male buds 2.5–3 mm diam.; anthers 7 or 8.] — Central Sulawesi ..... **38. *K. matanensis***  
 b. Twigs 1–3.5 mm diam. Leaves membranous or chartaceous ..... 11  
 11a. Lower leaf surface early glabrescent, at first with weak stellate hairs. Fruits 1.8–3 (–4) cm long, glabrescent. [Male buds globose, 2.5–3.5 mm diam.; anthers 11–15.] — Lesser Sunda Islands (Bali) (compare also *K. glomerata*) ..... **13. *K. glauca***

- b. Lower leaf surface with persistent indumentum. Fruits 1.2–2.4 cm long, with (sub)persistent minute indumentum . . . . . 12
- 12a. Lower leaf surface with minute scale-like hairs. Style 0.5 mm long. Fruits 1.2–1.8 (–2) by 1–1.6 cm. Male buds globose, 3.5–4.5 mm diam.; anthers 9–14. — Lesser Sunda Islands (except Bali), Sulawesi, Moluccas, S Philippines (Mindanao) . . . . . **5. *K. cinerea***
- b. Lower leaf surface with mixed minute scale-like and stellate-dendroid hairs. Style 1 mm long. Fruits 2.2–2.4 by 1 cm. Male buds pear-shaped, 2 mm wide; anthers 4 or 5. — Lesser Sunda Islands (W Flores, at 780 m) . . . . . **64. *K. steenisii***
- 13a. Leaves with truncate apex, lower surface early glabrescent. — Central Sulawesi . . . . . **4. *K. celebica***
- b. Leaves not truncate at apex, lower surface with persistent indumentum or late glabrescent . . . . . 14
- 14a. Lower leaf surface with hairs 0.1 mm long. — Philippines . . . . . **24f. *K. kunstleri* subsp. *parvifolia***
- b. Lower leaf surface with hairs of mixed sizes, 0.2–0.7 mm long. — Philippines, N & C Sulawesi . . . . . **65. *K. stellata***

### 1. *Knema alvarezii* Merr.

*Knema alvarezii* Merr., Philipp. J. Sci., Bot. 13 (1918) 288; Enum. Philipp. Flow. Pl. 2 (1923) 183; W.J. de Wilde, Blumea 25 (1979) 437. — Lectotype: BS 22395 (*Alvarez*), Luzon.

Tree 10–15 m. *Twigs* somewhat angular, 2–2.5 mm in diameter, glabrescent, at first with dense rusty dendroid hairs 0.5 mm long; bark striate, not tending to crack or flake. *Leaves* chartaceous, oblong to lanceolate, 8–14 by 2.5–3.5 cm, base rounded or short-attenuate, apex longly acute(-acuminate); upper surface olivaceous-brown, lower surface greyish, with subsistent grey-brown hairs 0.2–0.3 mm long, when shed leaving minute hair scars; dots absent; midrib raised above; nerves 12–15 pairs, somewhat raised above; venation fine and distinct above; petiole 8–15 by 1–2 mm, late glabrescent. *Inflorescences*: peduncle 1–3 mm, the brachyblast simple or indistinctly forked, 2–4 mm in diameter, in male 5–15-flowered; flowers with persistent rusty hairs 0.5(–0.7) mm long, perianth 3-lobed, reddish? inside. *Male flowers*: pedicel 4–6 mm long, bracteole about the middle, caducous; buds subglobose or depressed broadly obovoid, 3 by 3 mm, cleft c. 4/5, lobes 0.6–0.7 mm thick; staminal disc flat to faintly concave, subcircular, 1.5 mm in diameter; anthers 6 or 7, just stiped, horizontal, 0.5 mm long, not touching; androphore slender, 1 mm long. *Female flowers* not seen. *Fruits* 1 or 2 per infructescence ( $\pm$  immature), ellipsoid, 1.5–2 cm long, with dense ferruginous hairs 0.5(–1) mm long; dry pericarp 1.5 mm thick; fruiting pedicel 5 mm long, scar of bracteole median.

Distribution — *Malesia*: Philippines (Luzon: Prov. of Nueva Ecija & Zambales).

Habitat & Ecology — Lowland and montane forest; possibly on ultrabasic; up to c. 850 m altitude; fl. Feb.; fr. May.

Note — *Knema alvarezii* is known from only a few collections. It seems related to the East Malesian *K. tomentella*, in which it was included by Sinclair (Gard. Bull. Sing. 18, 1961, 277). The latter species differs in its earlier glabrescent lower leaf surface, the somewhat smaller male flowers with 8–11 anthers, and the subapical bracteole.

## 2. *Knema andamanica* (Warb.) W.J. de Wilde

*Knema andamanica* (Warb.) W.J. de Wilde, Blumea 25 (1979) 370. — *Knema glauca* Blume var. *andamanica* Warb., Mon. Myrist. (1897) 596. — *Knema cinerea* (Poir.) Warb. var. *andamanica* (Warb.) J. Sinclair, Gard. Bull. Sing. 18 (1961) 174, f. 4, p.p. — Lectotype: *King's coll. s.n.* (K), Andaman I.

### subsp. *nicobarica* (Warb.) W.J. de Wilde

*Knema andamanica* (Warb.) W.J. de Wilde subsp. *nicobarica* (Warb.) W.J. de Wilde, Blumea 25 (1979) 372. — *Knema glauca* Blume var. *nicobarica* Warb., Mon. Myrist. (1897) 596. — Lectotype: *King's coll. 536* (L), Nicobar I.

Tree 6–16 m. *Twigs* 1.5–3(–5) mm in diameter, early glabrescent, at first with dense grey or yellowish brown hairs 0.1 mm long or less; bark finely striate, not tending to crack or flake. *Leaves* chartaceous, oblong to lanceolate, 8–30 by 2–8.5 cm, base attenuate to rounded, apex subobtuse or acute(-acuminate); upper surface greenish brown, lower surface faintly papillate, with  $\pm$  dense stellate hairs 0.1–0.4 mm (in subsp. *andamanica*, not in Malesia, mixed with longer dendroid hairs or not), subpersistent or late glabrescent, the coarser hairs early shed and leaving minute scars; dots absent; midrib flat or slightly raised above; nerves 12–24 pairs, thin and faint; venation (very) fine, areoles 0.5 mm diameter or less, distinct above; petiole 8–20 by 1.5–3 mm. *Inflorescences*: sessile or pedunculate up to 5 mm, brachyblast wart-like, simple or forked, 2–8 mm in diameter, in male 3–15(–30)-flowered, in female 2–6-flowered; flowers with dull yellowish or (grey-)brown scurfy hairs 0.1–0.2(–0.3) mm or less, perianth 3-lobed, reddish inside. *Male flowers*: pedicel 3–6 mm long, bracteole subapical, subpersistent or caducous; buds obovoid, 2.5–4.5 by 2–3 mm, cleft 1/2–2/3, lobes 0.5–0.7 mm thick; staminal disc  $\pm$  flat or convex, circular, 0.8–1.2 mm in diameter; anthers 6 or 7, half-sessile, suberect, 0.3–0.5 mm, nearly touching; androphore slender, 1–2 mm long. *Female flowers*: pedicel 5–6 mm long, bracteole subapical; buds ovoid-oblong, 6 by 2.5 mm, cleft about halfway, lobes 0.4 mm thick; ovary ovoid, 2 by 1.5 mm; style including stigma slender, 1.5 mm long, stigma  $\pm$  deeply 2-lobed and each lobe shallowly 2–4-lobulate at the apex. *Fruits* 1 or 2 per infructescence, ellipsoid, apex rounded to faintly pointed, 1.8–2 by 1.2–1.6 cm, with rusty or rufous hairs 0.2–0.5 mm long; dry pericarp 1.5 mm thick; fruiting pedicel 7 mm long.

Distribution — India (Nicobar I.), Peninsular Thailand; in *Malesia*: Sumatra (Aceh); Peninsular Malaysia (Penang I.).

Habitat & Ecology — Lowland and lower montane forest; 0–1200 m altitude; fl. & fr. Jan.–Dec.

Notes — 1. Besides *K. andamanica* subsp. *nicobarica* there are two more subspecies, occurring outside Malesia: subsp. *andamanica* and subsp. *peninsularis* W.J. de Wilde, both with somewhat larger male flower buds, 4.5–6 by 3–4.5 mm; subsp. *andamanica* has 10–12 anthers, just stiped, and fruiting pedicels 0.5–4 mm long; subsp. *peninsularis* has 9–11 anthers, half-sessile, its fruits unknown.

2. Perianth in S Thailand once recorded as light yellow inside, in Nicobar I. and N Sumatra as red or reddish.

### 3. *Knema ashtonii* J. Sinclair

*Knema ashtonii* J. Sinclair, Gard. Bull. Sing. 18 (1961) 162, f. 1, p.p., excl. *Jaheri 611*, f. 1A, C–E, I, and description of male flowers; W.J. de Wilde, Blumea 25 (1979) 384; 41 (1996) 382; Tree Fl. Sabah & Sarawak 3 (2000) 405. — Type: *SAN 17386* (*Smythies, Wood & Ashton*), Sabah.

Tree 10–25 m. *Twigs* ridged or ± angled, 4–6 mm in diameter, with dense chocolate, rusty, or grey-brown scale-like hairs 0.1 mm long, glabrescent; bark striate, not tending to crack or flake. *Leaves* chartaceous to thinly coriaceous, obovate-oblong to oblong-lanceolate, 25–55 by 7–15 cm, apex acute-acuminate, base broadly or narrowly rounded, subcordate, or (sub)attenuate; upper surface greenish brown, lower surface either glabrous or with sparse, minute greyish sessile stellate hairs (var. *ashtonii*) or with persistent densely interwoven greyish, pale brown, or cinnamon stellate hairs 0.1–0.2 mm long, silky to the touch (var. *cinnamomea*); dots absent; midrib slightly raised above; nerves 20–40 pairs, flat or ± depressed above; venation (very) fine, often ± trabeculate; petiole late glabrescent, 10–30 by 4–7 mm. *Inflorescences*: sessile, brachyblast simple, up to 10 by 5 mm; in male 4–10-flowered, in female 1–5-flowered; flowers seemingly glabrous, but with minute scale-like hairs less than 0.1 mm long (lens!); perianth 3-lobed, colour inside not known. *Male flowers*: pedicel distinct, bracteole apical, caducous; buds (broadly) obovoid, 5.5–8 mm long, cleft about 4/5, lobes hard-carnose, 1–1.5(–2) mm thick; see further under the varieties. *Female flower* (Sinclair l.c.): pedicel 5–6 mm long, bracteole apical; buds oblong, 5–6 by 4 mm; ovary ovoid, 3 by 2 mm; style 1 mm long, stigma 2-lobed and each lobe again minutely 2-lobulate. *Fruits* 1–3 per infructescence, obovoid-oblong or long-ellipsoid, obtuse to acute at both ends, apex often up to 5 mm beaked, 5–8 by 3–4 cm, with dense chocolate hairs 0.2 mm long; dry pericarp 4 mm thick; fruiting pedicel stout, (5–)10–30 mm long, bracteole scar median to apical, and in addition a distinct collar-like scar of the perianth at the base of the fruit.

Distribution — *Malesia*: Borneo (Sarawak, Brunei, Sabah, Central E Kalimantan).

Habitat & Ecology — Primary forest; often along streams; 0–600 m altitude; fl. Mar.–Apr.; fr. Jan.–Dec.

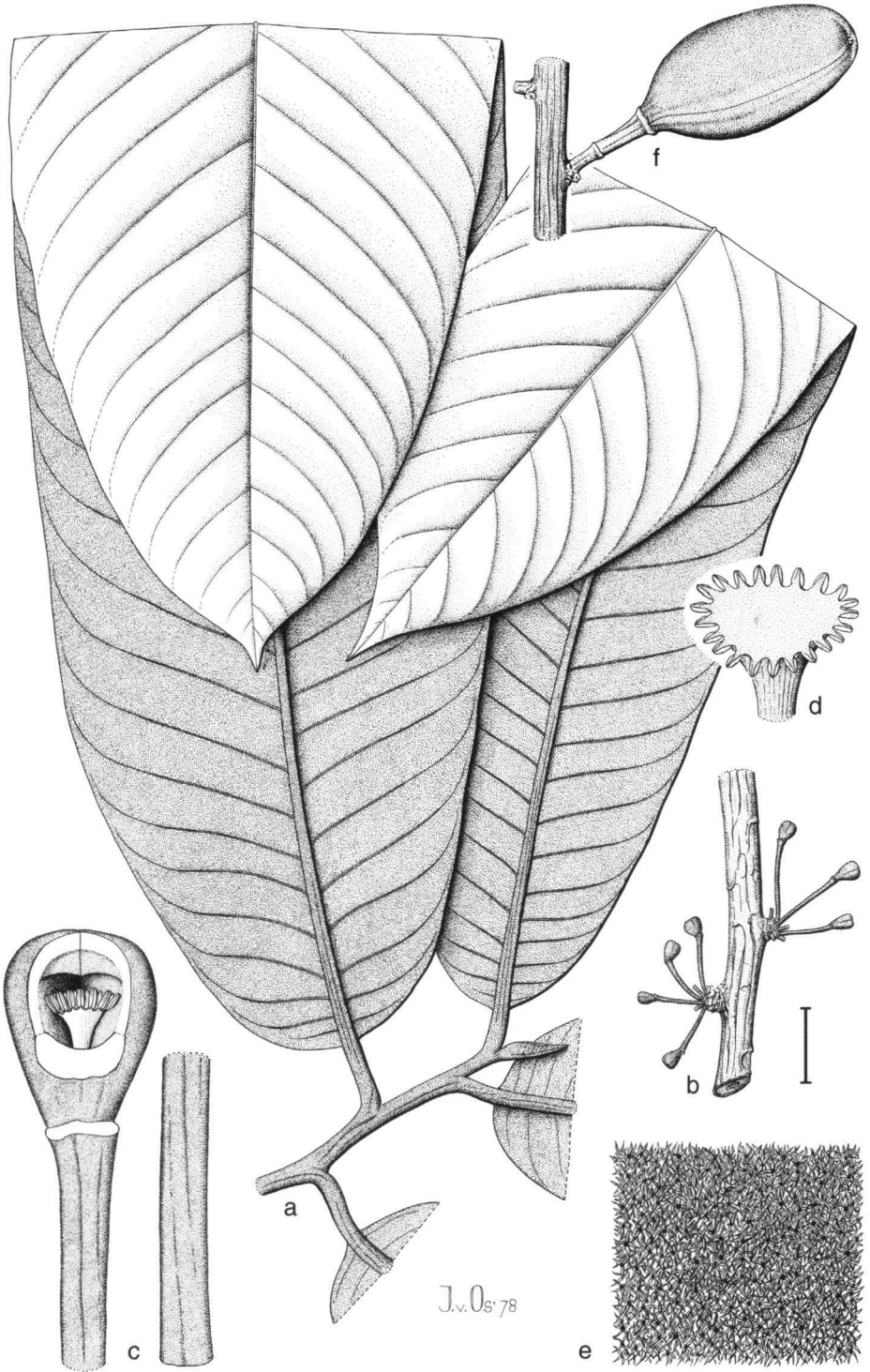
Note — Sinclair (l.c.) erroneously included *Jaheri 611*, the only male specimen known to him when describing *K. ashtonii*. Since then, *S 23449* (identical with the type) has been collected, with good male flowers, quite different from those of *Jaheri 611*, which is described as *K. sericea*.

#### KEY TO THE VARIETIES

- 1a. Lower leaf surface glabrous or nearly so, and then only with sparse, weak, whitish, stellate scale-like hairs. Fruiting pedicel 10–15(–20) mm long, the bracteole scar above the middle. Male pedicel 9 mm long . . . . . **a. var. ashtonii**
- b. Lower leaf surface densely brownish grey to cinnamon brown pubescent, silky to the touch. Fruiting pedicel 20–30 mm long, the bracteole scar at about the middle. Male pedicel 20–25 mm . . . . . **b. var. cinnamomea**

#### **a. var. ashtonii**

Indumentum of twig apex, petioles, and fruits dull grey-brown, chocolate, or rusty brown. *Leaves* beneath glabrous or with scattered minute, weak, grey or whitish sessile



stellate-scaly hairs; the lower leaf surface not silky to the touch. *Male flowers*: pedicel 9 mm long; buds 5.5 by 4.5–5 mm, androecium 2 mm long, somewhat tapering, staminal disc flat or faintly convex, including anthers 3 mm in diameter, anthers 14 or 15, short-stalked. *Fruits* 5–7.5(–8) by 3(–3.5) cm, apex subacute to obtuse; fruiting pedicel 10–15(–20) mm long, the bracteole scar at or close to the apex.

Field-notes — Bark smooth, ochre. Sometimes with a few stilt-roots.

Distribution — *Malesia*: Borneo (Sarawak: most collections from 4th Div.; Brunei, Sabah).

Habitat & Ecology — Preferably growing on alluvial soils along streams; 0–200 m altitude.

Note — Certain smaller leaved specimens, if sterile or with young fruits, may be reminiscent of *K. woodii* or *K. luteola*.

#### b. var. *cinnamomea* W.J. de Wilde

*Knema ashtonii* J. Sinclair var. *cinnamomea* W.J. de Wilde, *Blumea* 25 (1979) 386, f. 3; *Tree Fl. Sabah & Sarawak* 3 (2000) 405. — Type: *S 23449* (*Haji Suib*), Sarawak.

Indumentum on twig apex, petioles, and fruits chocolate, rusty brown, or cinnamon. *Leaves* beneath with persistent indumentum silky to the touch, consisting of densely interwoven sessile stellate-scaly hairs, brownish grey or cinnamon. *Male flowers*: pedicel 20–25 mm long; buds 7–8 by 6 mm, androecium tapering, 1.5–2 mm long, disc subtriangular, flat, including anthers 3.5 mm in diameter; anthers 22–24, just stiped. *Fruits* 5–8 by 3–4 cm, apex obtuse; fruiting pedicel 20–30 mm long, the bracteole scar about median. — **Fig. 35.**

Field-notes — Bark smooth, reddish to greyish brown, without furrows or flakes. Leaves medium green, glossy above; cinnamon to grey-brown scaly beneath. Immature leaves with golden indumentum. Fruits (yellowish) brown or orange; seeds (aril?) yellow.

Distribution — *Malesia*: Borneo (Sarawak, Central E Kalimantan).

Habitat & Ecology — Often along streams; sandy soil subject to flooding, basalt-derived and rich clay soils; up to 600 m altitude.

#### 4. *Knema celebica* W.J. de Wilde

*Knema celebica* W.J. de Wilde, *Blumea* 25 (1979) 464; 27 (1981) 233, f. 3. — Type: *Boschproefstation Cel./II-318* (L), Central Sulawesi.

Tree c. 10 m. *Twigs* sometimes slightly flattened, 2–4 mm in diameter, smooth, at first with dense rusty hairs 0.5–1 mm long, glabrescent; bark smooth, not cracking or flaking. *Leaves* coriaceous, oblong, 12–20 by 3–7 cm, apex truncate, base attenuate; upper surface dark brown, with remnants of indumentum on the midrib, lower surface early gla-

Fig. 35. *Knema ashtonii* J. Sinclair var. *cinnamomea* W.J. de Wilde. a. Twig apex with leaves; b. part of older twig with male inflorescences, flowers submature; c. opened mature male bud showing androecium; note bracteole scar apically on pedicel; d. androecium; e. detail of lower leaf surface showing dense indumentum; f. infructescence; note bracteole scar about halfway on the fruiting pedicel [a–d: *S 23449*; e, f: *Kostermans 10415*]. — Scale bar for a, b, f = 2 cm; for c = 2.8 mm; for d = 1.4 mm; for e = 0.07 mm.

J.V.O's '80

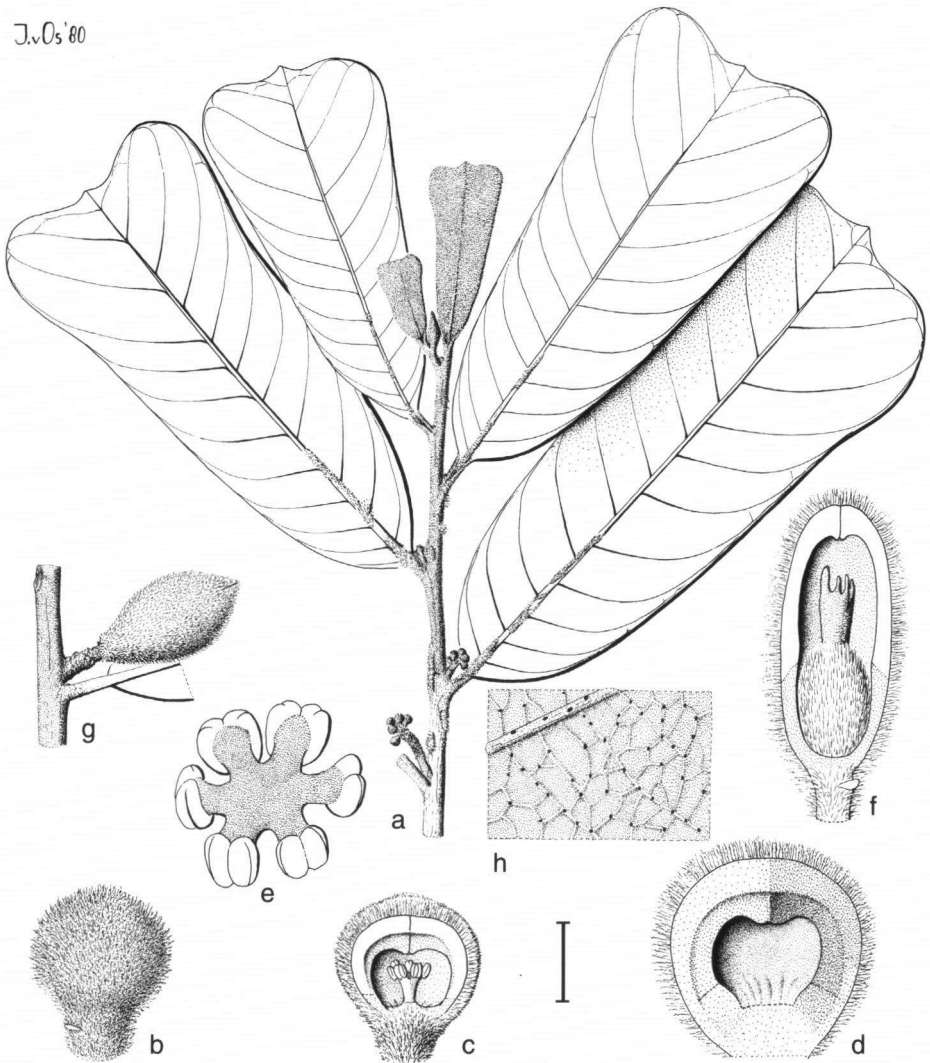


Fig. 36. *Knema celebica* W.J. de Wilde. a. Habit of male flowering twig; b. male bud; c. opened male bud showing the androecium; d. lobe of male bud seen from inside; e. androecium seen from above; f. opened female bud showing pistil; g. twig with fruit; h. detail of lower leaf surface showing minute blackish dots on the veinlets [a–e, h: *van Balgooy 3847*; f, g: *van Balgooy 3947*]. — Scale bar for a = 2 cm; for b, c, f = 1.8; for d = 1 mm; for e = 0.5 mm; for g = 1 cm; for h = 1.65 mm.

brescent, greyish; dots present; midrib raised above; nerves c. 15 pairs, raised; venation fine; petiole at first with dense indumentum, late glabrescent, 10–13 by 2–3 mm. *Inflorescences*: peduncle 1–4 mm, brachyblast simple or forked, up to 10 mm long; in male (5–)10-flowered, in female 1–4-flowered; flowers with persistent rusty hairs 0.5–0.7 (–1) mm long, the perianth 3-lobed, reddish inside. *Male flowers*: pedicel (0.5–)1–2 mm

long, bracteole  $\pm$  persistent, apical; buds subglobose, 2.5–3 mm in diameter, cleft 2/3–4/5, lobes 0.5 mm thick; staminal disc flat, circular, 1.2–1.5 mm in diameter; anthers 6–9, distinctly stiped, horizontal, 0.2–0.3 mm, spaced; androphore 0.5–0.7 mm long. *Female flowers*: pedicel 0.5–1.5 mm long, bracteole minute, persistent, median to sub-apical; buds ellipsoid-oblong, 5–7 by 2–3 mm, cleft slightly over half, lobes at sutures 0.4 mm thick; ovary ellipsoid, 2.5–3 by 2–2.5 mm, with dense hairs 1–1.5 mm long; style 1 mm long, stigma 1 mm long, erect, 2-lobed and each lobe again deeply 2–5-lobulate. *Fruits* 1 (or 2) per infructescence, ellipsoid-fusiform, 2–2.2 by 1.2–1.3 cm,  $\pm$  acute at both ends, with dense rusty hairs 1–1.5 mm long; dry pericarp 1.5 mm thick; fruiting pedicel 2 mm long. — **Fig. 36.**

Distribution — *Malesia*: Sulawesi (Central: Malili-Oesoe; N part of SE Peninsula: near Soroako).

Habitat & Ecology — Lowland forest; forest on ultrabasic rock; 100–600 m altitude; fl. Feb.–Apr. & July; fr. July.

Notes — 1. Although a member of the group of species with dotted leaves, *K. celebica* is obviously also related to *K. tomentella*; the latter differs in having sessile inflorescences, striate twigs, chartaceous (not coriaceous) leaves with a less prominent reticulation above, and a  $\pm$  late glabrescent lower leaf surface without dots.

2. The leaf apices are very typically (variously) truncate.

## 5. *Knema cinerea* (Poir.) Warb.

*Knema cinerea* (Poir.) Warb., Mon. Myrist. (1897) 611, t. 25; J. Sinclair, Gard. Bull. Sing. 18 (1961) 169, f. 3A–G (p. p., for var. *cinerea* only); W. J. de Wilde, Blumea 25 (1979) 457; 32 (1987) 129. — *Myristica cinerea* Poir., Dict. Encycl. Suppl. 4 (1816) 35; Spreng., Syst. 3 (1826) 65; A. DC., Prodr. 14, 1 (1856) 207; Miq., Fl. Ind. Bat. 1, 2 (1858) 72. — Type: *Labillardière s.n.*, Pulau Bouton, SE off Sulawesi.

*Myristica peltata* Roxb., Fl. Ind. 3 (1832) 846; A. DC., Prodr. 14, 1 (1856) 207; Miq., Fl. Ind. Bat. 1, 2 (1858) 72. — *Knema peltata* (Roxb.) Warb., Mon. Myrist. (1897) 599. — Type: *Roxburgh s.n.*, 1802, culta.

[*Myristica caesia* Zipp. ex Span., Linnaea 15 (1841) 346 (Icon. 15), nom. nud.]

Tree 4–15 m. *Twigs* 1–3.5 mm in diameter, at first with hairs 0.1 mm long or less, glabrescent; bark striate, not tending to crack or flake. *Leaves* membranous or chartaceous, elliptic to oblong-lanceolate, 8–25 by 2.5–9 cm., apex acute-acuminate, base rounded to attenuate; upper surface olivaceous, lower surface greyish, with persistent dense or sparse greyish scale-like hairs 0.1 mm long or less (lens!); dots absent; midrib flat to faintly raised above; nerves 10–25 pairs, raised above; venation distinct above; petiole 8–20 by 1–2.5 mm. *Inflorescences*: peduncle up to 3(–5) mm, brachyblast simple or  $\pm$  warded, to 5 mm long; in male 5–10-flowered, in female 1–5-flowered; flowers with persistent greyish to rusty hairs 0.1 mm long or less; perianth 3-lobed, pink inside. *Male flowers*: pedicel 6–11 mm long, bracteole caducous, at or somewhat above halfway; buds globose, 3.5–4.5 mm in diameter, cleft nearly to the base, lobes 0.7–1.2 mm thick; staminal disc flat or nearly so, circular, 1.8–2.5 mm in diameter; anthers 9–14, just to distinctly stiped, horizontal, 0.3–0.5 mm, spaced; androphore 0.5–1.5 mm long. *Female flowers*: pedicel 3–13 mm long, bracteole caducous, submedian; buds ovoid-ellipsoid to oblong, 4–6 mm long, cleft just over halfway; ovary ovoid, 2 by 1.5–2 mm; style 0.5 mm long,



stigma suberect, 2-lobed and each lobe again (1- or) 2- or 3-lobulate. *Fruits* 1 or 2 per infructescence, subglobose to  $\pm$  obovoid, apex obtuse, faintly pointed by style-remnant, 1.2–1.8 by 1–1.6 cm, with persistent hairs 0.1–0.2(–0.3) mm long; dry pericarp 1 mm thick; fruiting pedicel 3–13 mm long.

Field-notes — Bark smooth, dark. Colour of the perianth pink inside (once recorded); in the resembling *K. glauca* it is creamy.

Distribution — *Malesia*: Lesser Sunda Islands E of Bali (Lombok, Sumbawa, Flores, Tanimbar), Sulawesi, Moluccas (Sula I., Banda), Philippines (one collection only, see note 3).

Habitat & Ecology — Forest and scrub; 0–1000 m altitude; fl. & fr. Jan.–Dec.

Notes — 1. The lower leaf surface of specimens from the Lesser Sunda Islands is densely scale-like hairy, whereas in Sulawesi the surface is more sparsely, fine-stellately hairy.

2. *Knema cinerea* is related to *K. stenophylla*, *K. patentinervia* and *K. glauca* with almost similar habit and flowers, the latter species mainly differing in the lower leaf surface with very weak stellate hairs, early glabrescent, and larger glabrescent fruits. Specimens of *K. glauca* from Bali have small fruits, 2.2 cm long, and may resemble *K. cinerea*.

3. The only collection from the Philippines (Zamboanga Prov., Mindanao), *FB 23328*, probably belongs to *K. cinerea*; it is in fruit, 1.8 by 1.3 cm, fruiting pedicel 12–13 mm long, lower leaf surface with minute persistent scale-like hairs. The indumentum of the resembling *K. glomerata*, common in the Philippines, consists of much softer stellate hairs, which are either persistent or early shed; the flowers and twig apices in *K. glomerata* have longer, woolly dendroid hairs, up to 0.5 mm long.

## 6. *Knema communis* J. Sinclair

*Knema communis* J. Sinclair, Gard. Bull. Sing. 16 (1958) 297, f. 10, pl. IX B; 18 (1961) 193, p.p., excl. specimens from Borneo and *Shah & Kadim 526* (female fl.) from Peninsular Malaysia; W.J. de Wilde, *Blumea* 25 (1979) 461. — Type: *SF 40522* (*Sinclair*), Singapore.

Tree to 20 m. *Twigs* often blackish, 1.5–2 mm in diameter, at first with scurfy rusty or greyish hairs 0.1 mm long, glabrescent; bark finely striate, sometimes finely cracking, not flaking. *Leaves* chartaceous or thinly coriaceous, oblong-lanceolate to lanceolate, (6–)10–25 by (2–)2.5–5 cm, apex acute-acuminate, base cuneate, upper surface (greenish) brown above, lower surface grey-glaucous, with subsistent dense rusty to greyish hairs 0.1–0.2 mm long, or late glabrescent, with distinct hair scars; dots absent; midrib raised above; nerves 15–22 pairs, slightly raised above; venation very fine; petiole 7–20 by 1–3 mm. *Inflorescences*: sessile, brachyblast slender, simple or 2- to 3-fid, up to 10 mm long; in male 3–10-flowered, in female 1–3-flowered; flowers with persistent rusty hairs 0.1 mm long, perianth 3-lobed, pink or reddish inside. *Male flowers*: pedicel 2–5 mm long, bracteole caducous, at the middle or somewhat above; buds globose, 2.5–3 mm in diameter, cleft to over 3/4, lobes 0.5–1 mm thick; the staminal disc flat, circular, 1.5 mm in diameter, whitish; anthers 7–9, just stalked, almost horizontal, 0.3 mm long, spaced; androphore 1 mm long, red. *Female flowers*: pedicel 3 mm long, bracteole above the middle,  $\pm$  caducous; buds  $\pm$  obovoid, 4 by 3 mm, cleft to about halfway, lobes 0.5–1 mm thick; ovary  $\pm$  ovoid, nearly 2 mm long; stigma sessile, 2-lobed and each lobe

irregularly serrate or subentire. *Fruits* 1 or 2 per infructescence, ellipsoid to obovoid, 1.5–1.8 by 1–1.3 cm, with rusty hairs 0.1 mm long; dry pericarp 1 mm thick; fruiting pedicel 5–10(–15) mm long.

Field-notes — Bole fluted at base; bark smooth or nearly so, or sparingly flaky; inner bark pink or red; sapwood white or yellowish. Leaves glossy dark green above, whitish green or glaucous with brownish midrib and veins beneath. Flowers pink inside, sweet scented when crushed. Fruits greenish yellow or orange, with rusty or reddish indumentum.

Distribution — *Malesia*: Peninsular Malaysia (Perak, Trengganu, Pahang, Selangor, Johore), Singapore.

Habitat & Ecology — Lowland forest; 0–300 m altitude; fl. & fr. Jan.–Dec.

Notes — 1. *Knema communis* resembles *K. glaucescens*, a species also with subpersistent indumentum on the lower leaf surface. The resembling *K. malayana* has larger and longer pedicelled male flowers, with 9–13 anthers, and a different indumentum on the lower leaf surface.

2. Apparently the species is restricted to Peninsular Malaysia. The records for Borneo mentioned by Sinclair (Gard. Bull. Sing. 18, 1968, 163) are now referred to *K. glaucescens*. *Shah & Kadim 526* (Peninsular Malaysia), after which Sinclair drew the emended description of the female flowers of *K. communis*, is now referred to *K. glaucescens* as well.

## 7. *Knema conferta* (King) Warb.

*Knema conferta* (King) Warb., Mon. Myrist. (1897) 578, t. 24; Gamble, Mat. Fl. Malay Penins. 5, 23 (1912) 243; Ridl., Fl. Malay Penins. 3 (1924) 70; J. Sinclair, Gard. Bull. Sing. 16 (1958) 286, f. 6; 18 (1961) 194; W. J. de Wilde, Blumea 25 (1979) 472; Tree Fl. Sabah & Sarawak 3 (2000) 406. — *Myristica conferta* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 315, pl. 150. — Lectotype: *King's coll. 6211*, Peninsular Malaysia, Perak.

Tree 10–25 m. *Twigs* 2–5 mm in diameter, at first with dense rusty hairs 0.2–1 mm long, glabrescent; bark coarsely striate, not tending to crack or flake. *Leaves* chartaceous to coriaceous, oblong to lanceolate, 10–30 by 3–12 cm, base subcordate to cuneate, apex subobtusate or acute-acuminate; above glossy (greenish) brown, with distinct hair scars above or not; lower surface greyish or glaucous, finely papillate, and with scattered minute brownish black dots especially on the veinlets (lens!), with persistent indumentum of mixed sessile-stellate and stalked stellate-dendroid hairs of variable size, (0.2–)0.3–1 mm long; midrib raised above; nerves 12–28 pairs, ± raised; venation ± fine, distinct; petiole 5–15 by 1.5–5 mm, late glabrescent. *Inflorescences*: peduncle up to 1 mm, brachyblast simple or 2- (to 3-)furcate, up to 15 mm long; in male (5–)10–40-flowered, in female up to 10-flowered; flowers with dull rusty hairs (0.1–)0.2–0.3 mm long, perianth 3-lobed, greenish or yellowish inside. *Male flowers*: pedicel 7–15 mm long, bracteole ± persistent or caducous, about the middle or above; buds subglobose, often ± triangular, 4–4.5 mm in diameter, cleft nearly to the base, lobes 1–1.5 mm thick; staminal disc flat to slightly convex, circular, or ± triangular, 2–3 mm in diameter; anthers (10–)12–17, (just) stiped, horizontal, 0.3–0.7 mm long, spaced; androphore 0.8–1.5 mm long. *Female flowers*: pedicel 5–10 mm long, bracteole about the middle or above; buds obovoid, 5 mm long, cleft about halfway, lobes 1–1.5 mm thick; ovary subglobose to ovoid, 1.5–

2 mm in diameter; style 0–1 mm long, stigma 3- or 2-lobed and each lobe again 2–5-lobulate. *Fruits* 1–5 per infructescence, subglobose, ellipsoid or obovoid, (1.5–)2–4 by (1–)2–3 cm, hairs 0.5 mm long, later on largely shed; dry pericarp 2–5 mm thick; fruiting pedicel 5–10 mm long.

*Field-notes* — Bole straight, with buttresses to 3 m high, extending 30 cm over the ground, 10 cm thick (once); bark smooth,  $\pm$  rough, or often peeling off in narrow strips or in isodiametric scales 1–1.5 mm thick; living bark 5–8 mm thick, light red or red-brown inside; sapwood whitish, yellowish, or reddish brown, heartwood reddish brown. Leaves glossy dark green above, glabrous except midrib which becomes glabrous later, beneath whitish green with stellate indumentum to varying degree. Flowers greenish or yellowish inside, with a brown-pink blotch at base of lobes; stigma red (?). Fruits rusty or orange.

*Distribution* — *Malesia*: Sumatra (Tapanuli, E Coast, Indragiri, Djambi, Palembang, Bangka, Billiton, Riau Arch.), Peninsular Malaysia (Perak, Pahang, Malacca, Johore), Singapore, Borneo (Sarawak, Sabah, W, E, & NE Kalimantan, Nunukan Is.).

*Habitat & Ecology* — Forest, including inundated and swamp forest; 0–600 m altitude; fl. Jan.–Dec.; fr. mainly Nov.–Mar.

*Note* — *Knema conferta* is a homogeneous species which, in the vegetative state, may be confused with *K. laurina*, *K. oblongata*, *K. scortechinii*, or *K. pubiflora*, all different in details of male flowers and indumentum; *K. pubiflora* is similar in the dotted lower leaf surface with almost identical indumentum, but the perianth is hairy inside. The fruits are variable, in size as well as in shape. They are more or less ellipsoid, but some specimens from Nunukan Is. and the Leila Forest Reserve (Sabah) differ by their nearly globose fruits, 2.5–3.5 cm in diameter, with conspicuously thick (4–5 mm) dry pericarp.

### 8. *Knema curtisii* (King) Warb.

*Knema curtisii* (King) Warb., Mon. Myrist. (1897) 567, t. 25; J. Sinclair, Gard. Bull. Sing. 16 (1958) 281, f. 4; 18 (1961) 196, f. 6, 7 (excl. var. *linguiformis*); W.J. de Wilde, Blumea 25 (1979) 416, f. 9; Tree Fl. Sabah & Sarawak 3 (2000) 406. — *Myristica curtisii* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 326, pl. 167. — *Lectotype*: *Scortechini* 292, Peninsular Malaysia, Perak.

For more references and synonyms see the varieties.

Shrub or tree 2–10(–35) m. *Twigs* sometimes faintly 2- or 3-angled, (0.5–)1–2 mm in diameter, yellow to brownish, at first with indumentum composed of greyish hairs 0.1 mm long or less, early glabrescent; bark finely striate, not cracking nor flaking. *Leaves* membranous or chartaceous, of variable shapes, elliptic, obovate, or ovate to lanceolate, 3.5–15(–20) by 1.2–4(–6.5) cm., base cuneate to attenuate, rarely  $\pm$  rounded, apex acute (-acuminate), sometimes blunt or rounded; greenish or dark brown above; on lower surface greyish, very finely papillate, at first with dense hairs 0.1 mm long, early glabrescent; dots absent; midrib raised above, nerves (6–)8–14(–20) pairs, flat to slightly raised above; venation (very) fine, distinct above or not; petiole 5–20 by 0.7–1.5 mm. *Inflorescences*: peduncle up to 1 mm, brachyblast simple or forked, up to 5 mm long, in male (2–)5–15-flowered, in female 1–3(–5)-flowered; flowers with persistent or partially caducous grey-brown or rusty hairs 0.1–0.3 mm long, perianth 3- (or 4-)lobed, cream to pink inside. *Male flowers*: pedicel 5–11 mm long, bracteole subsistent, median, or considerably

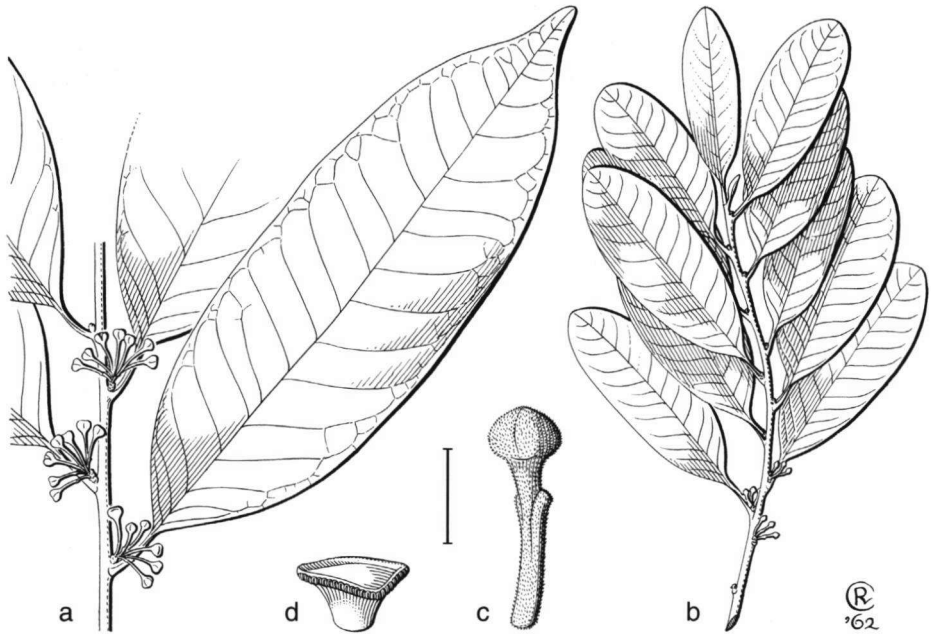


Fig. 37. *Knema curtisii* (King) Warb. — a. var. *curtisii*: part of branchlet with male inflorescences. — b-d. var. *paludosa* J. Sinclair: b. twig with male inflorescences; c. (sub)mature male bud; d. androecium [a: Achmad 93; b-d: SF 26155 (Corner)]. — Scale bar for: a, b = 2 cm; c = 3.3 mm; d = 0.85 mm.

below or above; buds subglobose or broadly obovoid, apex often depressed, in cross section circular, obtusely or sharply angled (see the note under the type variety), 2.5–5 (–5.5) mm in diameter, cleft  $2/3$ – $4/5$ , lobes 0.5 (–0.8) mm thick; staminal disc flat, slightly concave, or with a small minute mammilla, subtriangular, 1.7–3 mm in diameter; anthers 9–25 (–30) (i.e., with 18–50 thecae), completely sessile, 0.2–0.4 mm, closely appressed, erect or horizontal, hidden under the rim of the staminal disc or partially emergent; androphore slender or broad and tapering, 1–2 mm long. *Female flowers*: pedicel 5–10 mm long, bracteole about the middle; buds ellipsoid to obovoid or subglobose, 4–5 by 2.5–4 mm, cleft  $1/2$ – $2/3$ , lobes 0.7–1 mm thick; ovary ovoid, 1.5–3 mm long; style up to 0.5 mm long, stigma 6–8-lobulate, i.e., 2-lobed and each lobe again 3–4 (–5)-lobulate. *Fruits* 1 or 2 per infructescence,  $\pm$  ellipsoid, ridged, apex acute, base obtuse, or often up to 5 mm narrowed (beaked) at both ends, 2–5 by 1.5–3 cm, with greyish to rusty hairs 0.1–0.2 mm long, or glabrescent; dry pericarp 1–2.5 mm thick; fruiting pedicel 8–16 mm long. — Fig. 37.

*Distribution* — *Malesia*: Sumatra, Peninsular Malaysia, Borneo.

*Note* — A complex species in which four varieties are recognized. Sinclair accepted five varieties, but his var. *linguiformis* is now treated as a separate species. The remaining four varieties display a considerable difference in general habit, distribution area and habitat.

*Knema curtisii* and the related *K. linguiformis* and *K. viridis* can easily be distinguished within *Knema* by the androecium with many tightly appressed anthers. The androecium of *K. curtisii* has been described by previous authors as having 30–45 anthers; in fact there are only 9–25(–30) anthers of which the thecae are completely sessile and closely set and touching, and thus appearing to have twice as many anthers as there actually are.

#### KEY TO THE VARIETIES

- 1a. Leaves membranous, 5–15(–20) cm long, drying greenish, apex acute or acuminate; nerves and venation distinct at both sides. Male buds tending to become partially glabrescent, with blunt or sharp angles. — Lowland forest. Sumatra, Peninsular Malaysia (anthers 17–25), Borneo (anthers 9–15) . . . . . **a. var. curtisii**
- b. Leaves membranous or chartaceous, 3.5–10 cm long, drying ± greenish brown to dark brown above; apex acute, acuminate, obtuse, or rounded; nerves and venation indistinct. Male buds with persistent indumentum, or partially glabrescent. Anthers 18–25(–30) . . . . . 2
- 2a. Male buds with minute mainly sessile stellate hairs, tending to be partly shed or easily rubbed off; angles sharp. Leaves drying dark brown above; apex obtuse, rounded, or subacuminate with obtuse tip . . . . . 3
- b. Male buds with persistent indumentum of mixed sessile-stellate and dendroid hairs; angles rounded. Leaves drying ± greenish brown above; apex acute to acuminate. — Ridges in forest, often on sandy soils. Borneo . . . . . **c. var. arenosa**
- 3a. Leaves membranous or chartaceous, elliptic to oblong. — Usually in lowland marshy forest. Sumatra, Peninsular Malaysia, Borneo . . . . . **d. var. paludosa**
- b. Leaves chartaceous, lanceolate, with nearly parallel sides. — Ridges in lowland forest. Borneo (Brunei) . . . . . **b. var. amoena**

#### **a. var. curtisii**

*Knema curtisii* (King) Warb., Mon. Myrist. (1897) 567, t. 25; Gamble, Mat. Fl. Malay Penins. 5, 23 (1912) 240; Ridl., Fl. Malay Penins. 3 (1924) 69; J. Sinclair, Gard. Bull. Sing. 16 (1958) 281, f. 4; 18 (1961) 196, f. 6, 7 (excl. var. *linguiformis*); W. J. de Wilde, Blumea 25 (1979) 418, f. 9a; Tree Fl. Sabah & Sarawak 3 (2000) 407. — *Myristica curtisii* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 326, pl. 167.

*Myristica* sp. Hook. f., Fl. Brit. India 5 (1886) 113 (*Maingay*, *Kew Distr.* 1301).

Stem without stilt-roots, sometimes with buttresses. *Leaves* membranous, drying greenish, elliptic, obovate, or oblong-lanceolate, broadest at or ± above the middle, in Borneo sometimes ± parallel-sided, 5–15(–20) cm long, base cuneate or attenuate, apex blunt to acute, or acuminate with blunt or acute tip; nerves (6–)8–16(–18) pairs, nerves and venation distinct at both surfaces. *Male flowers*: buds in cross section either with obtuse angles (Peninsular Malaysia, some, and all specimens from Sumatra and Borneo), or with sharp angles (most specimens from Peninsular Malaysia), 2.5–4 mm in diameter, with mixed stellate and dendroid hairs 0.1–0.3 mm long, partly tending to be shed; anthers either 17–25 (in Peninsular Malaysia, the anthers ± horizontal, under the rim of the disc), or 9–15(–18) (in Borneo and Sumatra, with the anthers more laterally on the disc, suberect). Stigma 6–8-lobulate. *Fruits* scurfy, 2–4.5 cm long, ridged; fruiting pedicel 8–16 mm long. — **Fig. 37a.**

Field-notes — Bole sometimes with buttresses up to 50 cm high; bark smooth, with scattered small dents, or  $\pm$  fissured; slash inner bark red-brown or yellow, slash wood white; exudate pale reddish, once yellow. Leaves glossy dark green above, glaucous with yellowish green midrib beneath. Tepals pinkish or red inside. Fruits yellow, brown, orange-brown, or red, with light brown powdery scale-like hairs, seeds grey-white.

Distribution — *Malesia*: Sumatra (E Coast, Palembang, Simeuluë I.), Peninsular Malaysia (Perak, Kelantan, Trengganu, Pahang, Selangor, Negri Sembilan, Malacca, Johore, Penang I., P. Tioman), Borneo (W, C, E Kalimantan, Sarawak, Brunei, Sabah).

Habitat & Ecology — Primary and degraded forest, hill slopes; on a variety of soil types: clay, loam, sandy clay, sandstone, lime-containing soils; 0–1000 m altitude; fl. & fr. Jan.–Dec.

Notes — 1. The male buds (when dry) are variable in shape, size, and number of anthers as given in the description.

2. *Knema curtisii*, particularly var. *curtisii*, resembles *K. membranifolia*, a species also with yellowish twigs, but generally more distinctly angular, and with the flowers on the older wood, below the leaves. In *K. curtisii* the inflorescences are found among the leaves.

3. Sterile specimens, or material of which the androecium is not examined, may be confused with *K. globularia*.

#### b. var. *amoena* J. Sinclair

*Knema curtisii* (King) Warb. var. *amoena* J. Sinclair, Gard. Bull. Sing. 18 (1961) 198, f. 7; W.J. de Wilde, Blumea 25 (1979) 420. — Type: *Sinclair (& Kadim) 10442*, Brunei.

Stem without stilt-roots. *Leaves* chartaceous or coriaceous, drying dark brown, oblong to lanceolate, nearly parallel-sided, 5–8 by 1–1.8 cm, base cuneate to attenuate, apex obtuse; nerves 10–20 pairs, nerves and venation indistinct at both surfaces. *Male flowers*: buds with sharp angles, 4–5 mm in diameter, with hairs 0.1 mm long or less, tending to become glabrescent or apparently so; creamy inside; anthers 16 or 17, almost horizontal, just under the rim of the staminal disc. *Female flowers* and *fruits* not seen. — Fig. 34b.

Field-notes — Tree c. 20 m; bark pale grey, smooth; sap pink, not very copious. Leaves medium green and glossy above, paler and glaucous beneath, midrib paler. Flowers fragrant when crushed, cream inside when fully open.

Distribution — *Malesia*: Borneo (Brunei, known only from the type).

Habitat & Ecology — Ridge in lowland forest; fl. Aug.

Note — This variety is readily distinguishable by its leaf shape, and possibly deserves the status of a separate species.

#### c. var. *arenosa* J. Sinclair

*Knema curtisii* (King) Warb. var. *arenosa* J. Sinclair, Gard. Bull. Sing. 18 (1961) 198, f. 6D; W.J. de Wilde, Blumea 25 (1979) 420; Tree Fl. Sabah & Sarawak 3 (2000) 408. — Type: *Kostermans 8653*, Nunukan Is.

Tree 6–35 m, without stilt-roots. *Leaves* membranous or chartaceous, drying brown or some greenish brown, elliptic to lanceolate, broadest at or below the middle, or more or less parallel-sided, 3.5–13 cm long, base cuneate to attenuate, apex acute or acumi-

nate, rarely obtuse; nerves 12–18 pairs, nerves and venation indistinct at both surfaces. *Male flowers*: buds with rounded angles, 3–5 mm in diameter, with persistent minute mixed sessile-stellate and dendroid hairs 0.1–0.3 mm long; anthers 18–23, suberect to almost horizontal, at or just under the rim of the  $\pm$  triangular staminal disc. *Female flowers* and *fruits* not seen.

Field-notes — Trunk slender; buttresses to 50 cm high; bark grey, pale brown, or straw, smooth with scattered very small dents; inner bark 10 mm thick, (brown-)red, with copious red latex; wood white, yellow, or brown. Flowers brown or light green, fragrant when crushed.

Distribution — *Malesia*: Borneo (S, SE, E, NE Kalimantan, Nunukan Is., Sarawak).

Habitat & Ecology — Ridges in forest; found on sandy loam and sandstone; 0–600 m altitude; fl. Jan.–Dec.

Note — This variety is characterized by small chartaceous leaves with scarcely visible nerves and venation.

#### d. var. *paludosa* J. Sinclair

*Knema curtisii* (King) Warb. var. *paludosa* J. Sinclair, Gard. Bull. Sing. 18 (1961) 201, f. 6A, E; W.J. de Wilde, Blumea 25 (1979) 420, f. 9b–d; Tree Fl. Sabah & Sarawak 3 (2000) 408. — Type: SF 26155 (Corner), Singapore.

Stilt-roots usually present. *Leaves* membranous or chartaceous, drying brown, elliptic or (obovate-)oblong, broadest at or above the middle, 4–10 cm long, base cuneate or attenuate, apex either subacute or sometimes faintly acuminate with blunt tip, obtuse or rounded; nerves 6–16 pairs, nerves and venation faint on both surfaces. *Male flowers*: buds with sharp angles (always?), 3–5 mm in diameter, with mixed sessile-stellate and dendroid hairs 0.1–0.2 mm long, partially tending to become glabrescent; anthers 20–30, nearly horizontally under the rim of the triangular staminal disc. Stigma 8-lobulate (i.e., 2-lobed and each lobe again 4-lobulate, these often again with smaller incisions). *Fruits* (fide Sinclair) ridged on the line of suture, 4–5 cm long; fruiting pedicel 10 mm long, thicker than in var. *curtisii*. — Fig. 37b–d.

Distribution — *Malesia*: Sumatra (fide Sinclair: Tapanuli, Palembang), Peninsular Malaysia (Perak, Johore), Singapore, Borneo (Sarawak).

Habitat & Ecology — Primary lowland forest, clearings; preferably marshy forest, and then with stilt-roots; 0–200 m altitude; fl. June–Oct.

Note — Apparently predominantly a freshwater swamp forest species. Trees usually with stilt-roots. Furthermore characterized by leaves smaller than in the type variety, elliptic-oblong to obovate, with obtuse apex, drying brown, and with faint nerves and reticulation.

#### 9. *Knema elmeri* Merr.

*Knema elmeri* Merr., Univ. Calif. Publ. Bot. 15 (1929) 75; J. Sinclair, Gard. Bull. Sing. 18 (1961) 202, f. 8; W.J. de Wilde, Blumea 25 (1979) 383; Tree Fl. Sabah & Sarawak 3 (2000) 408. — Type: Elmer 21527, Sabah.

Tree 5–15 m, sometimes with stilt-roots. *Twigs*  $\pm$  angled, 2–4(–5) mm in diameter, at first with rusty hairs 0.1–0.2 mm long, glabrescent; bark grey-brown, tending to crack

longitudinally, later on flaking. *Leaves* chartaceous, elliptic to oblong(-oblanceolate), 12–32 by 4–13 cm, base rounded to acute, apex acute-acuminate; drying greenish or light brown above, early glabrescent, lower surface with persistent, silvery to pale brown, dense interwoven hairs 0.1–0.2 mm long, silky to the touch; midrib sunken to prominent above; nerves 12–20(–25) pairs, (slightly) raised or flat above; venation distinct above; petiole 8–18 by 2–4 mm. *Inflorescences*: sessile, brachyblast simple or irregularly warted, up to 8 mm in diameter, in male 5–25-flowered, in female 2–7-flowered; flowers with dense pale brown to rusty hairs 0.1 mm long, perianth 3-lobed, red or purple inside. *Male flowers*: pedicel 7–14 mm long, bracteole subpersistent, about median; buds broadly ovoid to depressed globose, often  $\pm$  sagged at base, 3–4 by 4–4.5 mm, cleft nearly to the base, lobes 0.5–0.8 mm thick; staminal disc circular, distinctly convex in the centre, 2–2.5 mm in diameter; anthers 10–14, just sessile or stalked, horizontal, 0.3–0.6 mm, not touching; androphore 0.5–0.8 mm, clasped by the somewhat thickened perianth base. *Female flowers*: pedicel 1–2 mm long, bracteole about median; buds  $\pm$  ellipsoid, 6 mm long, cleft about halfway, lobes 1 mm thick; ovary ellipsoid, 3 mm long; style 0–1 mm long, stigma 2-lobed and each lobe again shallowly 2–3(–4)-lobulate. *Fruits* 1–6 per infructescence, obovoid to ellipsoid(-oblong), apex obtuse or shortly beaked, 2–2.5 by 1.1–1.6 cm, with rusty hairs 0.1–0.2 mm; dry pericarp 2 mm thick; fruiting pedicel 1–5 mm long. — **Fig. 34d.**

**Field-notes** — Crown rounded; bole sometimes with stilt-roots, no buttresses; bark smooth, scaly, flaky, or cracky, hard; inner bark white, reddish, or red-brown; sapwood brown. Leaves glossy dark green above, silvery beneath.

**Distribution** — *Malesia*: Borneo (Sarawak, Brunei, Sabah, NE Borneo: Nunukan Is.).

**Habitat & Ecology** — Primary and disturbed forest, riverine or mixed dipterocarp forest; on rich or sandy clay soils, also limestone; 0–1500 m altitude; fl. & fr. throughout the year.

**Notes** — 1. *Knema elmeri* is characterized by the silky indumentum on the lower leaf surface, flaking bark of the twigs,  $\pm$  globose male flower buds, and a distinctly convex staminal disc.

2. The nature of the indumentum of the lower leaf surface places *K. elmeri* along with *K. ashtoni*, *K. retusa*, and *K. sericea*, but there is also a close alliance with *K. latericia*, especially subsp. *ridleyi*, on account of the cracking bark of the twigs, and the convex staminal disc.

## 10. *Knema emmae* W.J. de Wilde

*Knema emmae* W.J. de Wilde, *Blumea* 41 (1996) 384; *Tree Fl. Sabah & Sarawak* 3 (2000) 409. — Type: *Amdjah 144*, NE Kalimantan.

Treelet c. 4 m. *Twigs* 1.5–2 mm in diameter, yellowish brown, at first with hairs 0.5 (–1) mm, glabrescent; bark smooth or finely striate, not cracking nor flaking; lenticels minute. *Leaves* thinly chartaceous, elliptic-oblong or oblong-lanceolate, 12–20 by 3.5–7 cm, base short-attenuate, apex  $\pm$  blunt or (acute-)acuminate; upper surface drying green-olivaceous; lower surface slightly paler, glabrous, not or but little papillose; dots absent; midrib slender above, nerves 12–15 per side, flat or slightly raised above; venation fine, distinct at both surfaces. Petiole 10 by 2 mm. *Inflorescences*: sessile or pedunculate to 1.5 mm, brachyblast wart-like, 1–2 mm long, pubescent, glabrescent; in male and fe-



male 2–5-flowered; flowers with rusty hairs (0.2–)0.5–0.7 mm, perianth 3-lobed, colour inside not known. *Male flowers*: pedicel 6–7 mm long, slender, bracteole less than 1 mm, subsistent, slightly above median; buds  $\pm$  depressed globose, 3 by 4 mm, cleft 3/4(–4/5), lobes 0.5 mm thick; staminal disc circular, flat, 2 mm in diameter; anthers 14 or 15, sessile, 0.3 mm, not tightly contiguous, under the rim of the disc, androphore tapering, narrow at base, 0.5–0.8 mm long. *Female flowers*: pedicel 4 mm; buds obovoid, 3.5 mm long; ovary not seen. *Fruits* 2–4 per infructescence (slightly immature), ovoid-oblong, 2.5–3 by 1.5–1.6 cm, base  $\pm$  truncate or broadly rounded, apex narrowly rounded, with stigma remnant, 1 mm, dry pericarp 0.5(–1) mm thick, with rusty mealy hairs 0.5 mm; fruiting pedicel 7–10 mm long, scar of bracteole  $\pm$  median.

Field-notes — Low tree: bole 2 m, total height 4 m; sapwood whitish; the bark dark brownish, inner bark brownish with red latex. Fruits yellowish.

Distribution — *Malesia*: Borneo (Sabah: Keningau; NE Kalimantan).

Habitat & Ecology — Hill-side forest; probably at low altitudes; fl & fr. June.

Note — *Knema emmae* is obviously related to *K. curtisii* (var. *curtisii*) and *K. linguiformis*. *Knema curtisii* is distinguishable by more slender twigs, 1(–1.5) mm in diameter, and smaller leaves with more slender lateral nerves and petiole; the fruits are  $\pm$  similar in size (although variable) but early or late glabrescent. *Knema linguiformis* often has a  $\pm$  rounded leaf base, fruits glabrous (early glabrescent), at base  $\pm$  contracted towards a short fruiting pedicel. *Knema emmae* is noticeable especially for its male flowers, with a circular staminal disc, with beneath 14 or 15 not tightly contiguous small anthers; in the other two species mentioned here there are more anthers (although often only 9–18 in Bornean specimens of *K. curtisii* var. *curtisii*), attached to a bluntly triangular staminal disc.

## 11. *Knema furfuracea* (Hook. f. & Thomson) Warb.

*Knema furfuracea* (Hook. f. & Thomson) Warb., Mon. Myrist. (1897) 581, t. 24; Gamble, Mat. Fl. Malay Penins. 5, 23 (1912) 245; Ridl., Fl. Malay Penins. 3 (1924) 70; Corner, Wayside Trees (1940) 476; J. Sinclair, Gard. Bull. Sing. 16 (1958) 275, f. 2, pl. I B; 18 (1961) 209; W.J. de Wilde, Blumea 25 (1979) 387; 27 (1981) 223. — *Myristica furfuracea* Hook. f. & Thomson, Fl. Ind. 1 (1855) 159; Miq., Fl. Ind. Bat. 1, 2 (1858) 70; Hook. f., Fl. Brit. India 5 (1886) 112; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 318, p.p., pl. 155, incl. var. *major*. — Type: *Porter or Wallich in Hb. Hooker s.n.*, Peninsular Malaysia.

*Myristica longifolia* auct. non Blume: Hook. f. & Thomson, Fl. Ind. 1 (1855) 156, p.p.

Tree 8–25 m. *Twigs* sometimes faintly angular, 4–8(–10) mm in diameter, at first with dense furfuraceous hairs 1–1.5 mm long, soon rubbed off, glabrescent; bark striate or not, lower down brown to blackish, conspicuously longitudinally cracking and flaking. *Leaves* coriaceous, oblong or (ob)lanceolate, (10–)25–50 by (3–)5–21 cm, apex acute (–acuminate), sometimes rather blunt, base narrowly to broadly cordate; drying (greenish) brown, glossy or dull above, lower surface early glabrescent, finely papillate; dots absent; midrib stout, raised above; nerves 20–40(–50) pairs, raised above; venation raised or sunken above; petiole 5–25 by 4–8 mm, late glabrescent. *Inflorescences*: sessile, brachyblast simple or coarsely warted or furcate, up to 15 mm in diameter, in male 3–30-flowered, in female up to 20-flowered; flowers with dense furfuraceous hairs 0.5–1 mm long, subsistent or glabrescent, perianth 3- or 4-lobed, red inside. *Male flowers*: pedi-

cel 3–15 mm long, bracteole subsistent or caducous, about median, sometimes towards the apex; buds depressed obovoid or depressed globose, somewhat triangular, 4–5 by (4–)4.5–5 mm, cleft  $3/4$ – $4/5$ , lobes 1–1.5 mm thick; staminal disc circular or faintly triangular, flat or slightly concave, 2–2.5 mm in diameter; anthers 10–14, just sessile, oblique or nearly horizontal, 0.5–0.7 mm, not touching, androphore 1–2 mm long, striate. *Female flowers*: pedicel 1.5–2 mm long, bracteole median to apical; buds ellipsoid or obovoid, 6–8 by 5–7 mm, cleft c.  $2/3$ , lobes 1.5 mm thick; ovary ovoid or subglobose, 2.5–4 mm long; stigma subsessile,  $\pm$  flat, 2-lobed, each lobe with 5–9 lobes or serrations. *Fruits* 1–4 per infructescence, ovoid, subglobose, or obovoid, 2.5–3.5 by 2–2.8 cm, with rusty hairs 1–2 mm long; dry pericarp 3–5 mm thick; fruiting pedicel 2–5 mm long.

Field-notes — Crown dome-shaped; trunk once recorded with buttresses; bark smooth with longitudinal flakes or scale-like hairs, or fissured; outer bark slash red, fibrous, inner bark white, laminated or fibrous, cambium red; sapwood whitish, heartwood light red to dark brown. Flower buds yellow, pink, or deep red inside; fruits red(-brown) or apricot.

Distribution — Southern Peninsular Thailand and *Malesia*: Sumatra (sterile coll.), Peninsular Malaysia (all provinces except Perlis and Wellesley Prov.), Singapore.

Habitat & Ecology — Primary and degraded rain forest; in S Peninsular Thailand in evergreen forest; hillsides, ridges, ridge-tops over granite, limestone; on clay and black soil; 0–900 m altitude; fl. & fr. throughout the year.

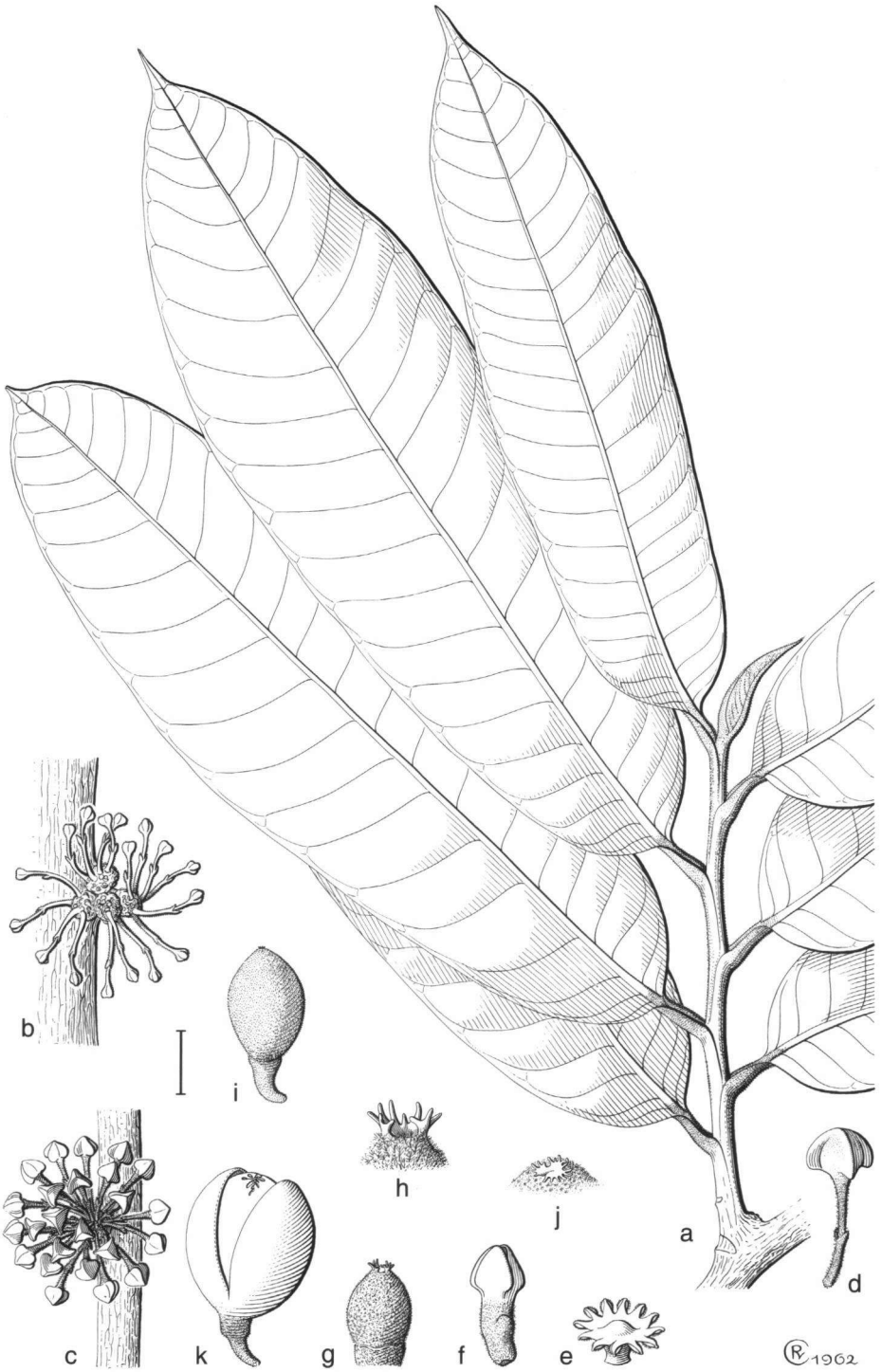
Notes — 1. *Knema furfuracea* is related to *K. hookeriana*, *K. lampongensis*, *K. lamellaria*, and *K. pallens*; the leaves also resemble large-leaved specimens of *K. latericia* and *K. lunduiensis*, species with non-cordate leaf bases. The pyramidal shape of the tree, and the flaking bark of *K. furfuracea* are similar in *K. hookeriana*.

2. The present circumscription of *K. furfuracea* is much narrower than that accepted by Sinclair (l.c.). The Indochinese specimens cited by him are now referred to *K. pierrei* Warb. (not in *Malesia*); specimens from Thailand have been described as *K. tenuinervia* (not in *Malesia*); specimens cited from Sumatra have been described as *K. lampongensis*, those from Borneo as *K. pallens*; some recent specimens from Peninsular Malaysia, also resembling *K. furfuracea*, have been segregated as *K. lamellaria*.

## 12. *Knema galeata* J. Sinclair

*Knema galeata* J. Sinclair, Gard. Bull. Sing. 18 (1961) 211, f. 10; W.J. de Wilde, Blumea 25 (1979) 422, f. 10; Tree Fl. Sabah & Sarawak 3 (2000) 409. — Type: *S 4855* (*Anderson & Md. Hasan*), Brunei.

Tree 5–30 m. *Twigs* stout, sometimes somewhat flattened or angular, 4–10 mm in diameter, at first with rusty hairs 1–2 mm long, glabrescent, (blackish) brown; bark finely striate, when older tending to crack or flake. *Leaves* thickly coriaceous, oblong or lanceolate, 15–50 by 2.5–14 cm, base rounded, or subcordate or subcuneate, apex obtusish or acute-acuminate; olivaceous, glossy above; lower surface at first with dense rusty indumentum, early glabrescent, greyish to pinkish; dots absent; midrib much raised above; nerves 20–35 pairs, raised above, distinctly interarching; venation faint above; petiole 12–30(–40) by 3–8 mm. *Inflorescences*: sessile, brachyblast simple or warty with up to 10 protuberances, up to 20 by 10 mm, in male (5–)10–50-flowered, in female 5–25-



flowered; flowers at first with hairs 0.4–1 mm long, glabrescent, perianth 3-lobed, white, pink or red inside. *Male flowers*: pedicel (15–)20–30 mm long, bracteole 1–3 mm long, subsistent, about median; buds mitriform, triquetrous in cross section, 6–10 by 9–15 mm, cleft nearly to the base, lobes broad, reniform, 0.5(–1) mm thick; staminal disc flat or  $\pm$  convex, circular or  $\pm$  triangular, 3–5 mm in diameter; anthers 14–23, just sessile, oblong, 1–1.5 mm long, horizontal or  $\pm$  oblique, not touching; androphore 0.5–1 mm. *Female flowers*: pedicel 12–25 mm long, bracteole about median; buds subovoid-mitriform, narrower than in male, 7–9 by 5–7 mm, cleft nearly to the base, lobes 0.5–1 mm thick; ovary globose or ovoid, 3–3.5 by 2.5–3 mm; stigma sessile, 2-lobed and each lobe again (deeply) 4–8-lobulate. *Fruits* (1–)2–5 per infructescence, obovoid or pear-shaped, often contracted towards the base, 2–5 by 1.5–3 cm, sometimes ridged, apex sometimes beaked; pericarp 2–3 mm thick, at first with indumentum of hairs 0.5 mm long, glabrescent; fruiting pedicel 15–30 mm long. — Fig. 38.

Field-notes — Bark smooth, finely flaky or fissured; inner bark brownish; sapwood pink-yellow, pale brown, or whitish. Leaves very glossy green with whitish green midrib above, glaucous with yellowish green midrib and veins beneath. Flowers with rusty indumentum, pure white or reddish inside; stamens yellow; fruits dark yellow, orange, or rusty brown.

Distribution — *Malesia*: Borneo (Sarawak, Brunei, Sabah, E Kalimantan).

Habitat & Ecology — Primary mixed lowland dipterocarp forest, hill-side and ridge forest, open kerangas, and marshy forest; on sandy soils, on yellow podzolic soils, marshy soil, yellow clay soil, and sandy loam; at low altitudes; fl. & fr. throughout the year.

Notes — 1. The stout inflorescences are ramiflorous on the older branches of 1–2 cm diameter

2. *S 12935 (Anderson)* (in L) with mainly male flowers, has one female flower with a normal pistil, but with the perianth similar to the male flowers.

### 13. *Knema glauca* (Blume) Petermann

*Knema glauca* (Blume) Petermann, Pflanzenreich (1838–1845) 294; W.J. de Wilde, Blumea 25 (1979) 452; 32 (1987) 126; Tree Fl. Sabah & Sarawak 3 (2000) 410. — *Myristica glauca* Blume, Cat. (1823) 111; Bijdr. 2 (1825) 576. — Type: *Blume s.n.*, W Java.

For more references and synonyms see the varieties.

Tree 5–30 m. Twigs (1–)1.5–3.5 mm in diameter, at first with grey or brown hairs 0.1 mm long or less, early glabrescent; bark coarsely striate, not tending to crack or flake. Leaves membranous or chartaceous, elliptic to lanceolate, 6–20(–25) by 2–5.5(–11) cm, apex obtuse or (acute-)acuminate, base  $\pm$  rounded to attenuate, greenish to (blackish)

Fig. 38. *Knema galeata* J. Sinclair. a. Twig with leaves; b. old male inflorescence with immature flowers, on older wood; c. older branch with male inflorescence and (sub)mature flowers; d. mature male bud; e. androecium; f. (sub)mature female bud; g. pistil; h. apex of ovary with sessile lobed stigma, lateral view; i. young fruit; j. apex of young fruit with sessile lobed stigma; k. mature fruit showing seed [a, b: *Kostermans 7062*; c: *S 1177*; d, e: *S 4855*; f–h: *Ladi anak Bikas s.n./27-2-1961*; i, j: *Ladi anak Bikas s.n./6-1-1961*; k: *Ladi anak Bikas s.n./23-3-1961*]. — Scale bar for a–c = 2 cm; for d, f, i, k = 10 mm; for e, h = 2 mm; for g = 5 mm; for j = 3.3 mm.

brown, dull or glossy above; lower surface grey or pale brown, at first with scattered, very weak, greyish (or pale brown) hairs 0.1 mm long or less, early glabrescent; dots absent; midrib little raised above; nerves 12–22(–25) pairs, raised to flat above; venation coarse (areoles 0.5 mm in diameter or more), distinct above; petiole 7–20 by 1–3 mm. *Inflorescences*: sessile or (in E Java and Borneo) with peduncle up to 3 mm, brachyblast simple or 2- or 3-fid, up to 15 mm long; in male (2–)5–20-flowered, in female 1–8-flowered; flowers with persistent greyish brown scale-like hairs 0.1 mm long or less, perianth 3- (or 4-)lobed, red or in Java and Bali also yellowish (?). *Male flowers*: pedicel 4–10 mm long, bracteole 0.5–1 mm, persistent, median or above; buds subglobose, 2.5–3.5 mm in diameter, cleft c. 4/5, lobes 0.5–0.8 mm thick; the staminal disc flat to faintly convex, sometimes finely papillate, circular, 1.5–2(–2.5) mm in diameter; anthers 8–10, or in Borneo, E Java, and Bali frequently 11–15, subsessile to stiped, spaced, 0.3–0.5 mm long,  $\pm$  horizontal, the connective broad or narrow above, the thecae opening nearly laterally; androphore 0.5–1 mm long. *Female flowers*: pedicel 1–6 mm long, bracteole somewhat above median; buds ovoid-ellipsoid or obovoid-oblong, 4–6 mm long, cleft to about halfway, lobes at sutures 0.8–1.5 mm thick; ovary ovoid, 1.5–2.5 by 1–2 mm; style 0–0.5 mm long, stigma  $\pm$  flat to erect, 2-lobed and each lobe again 2–4-lobulate. *Fruits* 1–4 per infructescence, subglobose to ovoid or ellipsoid, 1.8–3(–4?) by 1.4–1.8(–2.5?) cm, at first with short scale-like hairs 0.1 mm long or less, early glabrescent, leaving a fine-granulate surface; dry pericarp 1.5–2.5 mm thick; fruiting pedicel 3–12 mm long.

## KEY TO THE VARIETIES

- 1a. Leaves membranous or chartaceous, elliptic to lanceolate. Fruiting pedicel 3–7(–10) mm long; fruits drying greyish brown . . . . . **a. var. *glauca***  
 b. Leaves membranous, oblong to lanceolate. Fruiting pedicel 8–12 mm long; fruits  $\pm$  bright brown . . . . . **b. var. *riparia***

**a. var. *glauca***

*Knema glauca* (Blume) Petermann, Pflanzenreich (1838–1845) 294; Warb., Mon. Myrist. (1897) 594, t. 25 (for var. *typica* only); W.J. de Wilde, Blumea 25 (1979) 452; 32 (1987) 126; Tree Fl. Sabah & Sarawak 3 (2000) 411. — *Myristica glauca* Blume, Cat. (1823) 111; Bijdr. (1826) 576; Rumphia 1 (1835) 187, t. 60; Miq., Pl. Jungh. (1852) 171; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 320, pl. 157, p.p.; Koord. & Valeton, Med. Lands Pl. Tuin 17 (1896) 189.

*Myristica intermedia* Blume var. *minor* Miq., Fl. Ind. Bat. 1, 2 (1858) 70. — Type: *Teijsmann s.n.*, Java.

*Myristica corticosa* (Lour.) Hook. f. & Thomson var. *lanceolata* Miq., Fl. Ind. Bat., Suppl. 1 (1861) 384. — Type: *Junghuhn s.n.*, Sumatra, Tapanuli.

*Myristica palembanica* Miq., Fl. Ind. Bat., Suppl. 1 (1861) 384. — *Knema palembanica* (Miq.) Warb., Mon. Myrist. (1897) 592, t. 25. — Type: *Teijsmann 3640*, Sumatra, Palembang.

*Myristica corticosa* auct. non Lour.: Hook. f. & Thomson, Fl. Ind. 1 (1855) 158; A. DC., Prodr. 14, 1 (1856) 205, p.p.; Miq., Fl. Ind. Bat. 1, 2 (1858) 69, p.p.

*Knema glaucescens* Jack var. *glaucescens* auct. non Jack: J. Sinclair, Gard. Bull. Sing. 16 (1958) 304, f. 12, 13 A, p.p.

*Knema cinerea* (Poir.) Warb. var. *sumatrana* auct. non (Blume) J. Sinclair: J. Sinclair, Gard. Bull. Sing. 18 (1961) 185, p.p.; Backer & Bakh. f., Fl. Java 1 (1964) 140.

Tree 5–30 m. *Twigs* 1.5–3.5 mm in diameter. *Leaves* membranous or chartaceous, drying greenish to blackish brown, 6–20(–25) by 2–5.5(–11) cm, apex obtuse or acute (-acuminate), base sometimes rounded; petiole 7–20 by 1–3 mm. *Inflorescences*: peduncle 0–3 mm, brachyblast to 15 mm long, in male 2–20-flowered, in female 1–8-flowered, flowers thinly pubescent, perianth reddish or yellow inside. *Male flowers*: pedicel 4–10 mm long; buds 2.5–3.5 mm in diameter, cleft 4/5; staminal disc 1.5–2.5 mm in diameter, anthers 8–15, subsessile or stiped, horizontal, androphore 0.5–1 mm. *Female flowers*: pedicel 1–6 mm; buds 4–6 mm long. *Fruits* 1–4 per infructescence, 1.8–3(–4?) by 1.4–1.8(–2.5?) cm, glabrescent; dry pericarp 1.5–2.5 mm thick; fruiting pedicel 3–7(–10) mm long. — **Photo 5.**

Field-notes — Stilt-roots sometimes present, up to 1 m high; bark smooth, cracked, flaky, scaly, or sometimes peeling off in strips 1 cm wide; bark 0.5–1 cm thick, pinkish or red-brown; cambium brown; sapwood whitish, heartwood reddish; sap copious, pinkish. Leaves glossy dark green above, grey-glaucous to cinereous or whitish, with pale yellowish or brownish midrib beneath. Flowers usually reddish inside, from Bali and Borneo yellowish. Fruits yellow(-green), orange, or (pale) apricot; aril scarlet.

Distribution — Peninsular Thailand and *Malesia*: Sumatra, Peninsular Malaysia, Java, Bali, Borneo.

Habitat & Ecology — Primary and degraded evergreen forest, including mixed dipterocarp forest; forest edges, riverine forest, periodically inundated forest, pole forest, thickets; on a great variety of soils including sandstone, clay, and lateritic, granitic, and black soil, (coral-)limestone, alluvial soils; 0–1500 m altitude; fl. & fr. throughout the year.

Notes — 1. *Knema glauca* is variable in a) the number of anthers, b) the mode of attachment of the anthers, i.e. stiped or not, and with upper side of the connective broad or narrow, hence, thecae opening  $\pm$  downwards or laterally, c) the colour of the flowers inside, reddish or yellowish, and d) the size of the fruits. These features need more detailed study in the field.

2. Specimens from Central and E Java, Bali, and Borneo frequently have as many as 12–15 anthers, as compared to 8–10(–12) generally in W Java and other areas; in W Java, Sumatra, and Peninsular Malaysia 12–18 anthers is characteristic for the related species *K. sumatrana*.

3. As can be seen in the keys, *Knema glauca* belongs to a group of related (resembling) species, in which *K. sumatrana* is perhaps the one most closely allied; in most of their overlapping area morphologically intergrading specimens (leaf size, fruit size) can be found.

#### **b. var. riparia** W.J. de Wilde

*Knema glauca* (Blume) Petermann var. *riparia* W.J. de Wilde, Blumea 32 (1987) 126; Tree Fl. Sabah & Sarawak 3 (2000) 411. — Type: *S 18949* (*Chai*), Sarawak.

Tree 5–12 m. *Twigs* 1.2–2 mm in diameter. *Leaves* membranous, drying olivaceous above, 11–22 by 2–6(–9) cm, apex acute or long-acuminate, base short or long attenuate; petiole 10–15 by 1.5 mm. *Inflorescences*: peduncle up to 1 mm long, brachyblast simple or forked, up to 4 mm long, in male 2–6(–10)-flowered, in female 1–2(–4)-flowered; flowers sometimes subglabrescent; perianth red inside. *Male flowers*: pedicel 8–10

mm long; buds subglobose, 3(–3.5) mm in diameter, cleft c. 5/6; staminal disc  $\pm$  flat, subcircular, 2 mm in diameter; anthers 9–13, distinctly stiped, spaced, horizontal (opening downwards), 0.4–0.5 mm long; androphore  $\pm$  cylindrical, slender, (1–)1.5 mm long. *Female flowers*: pedicel 6 mm long; buds 4 by 2 mm. *Fruits* 1 or 2 per infructescence, ellipsoid, apex sometimes  $\pm$  acute, 2–2.5 by 1.5–1.8(–2) cm, early glabrescent,  $\pm$  granulate, bright brown, dry pericarp 1 mm thick; fruiting pedicel 8–12 mm long.

Field-notes — Bark sometimes flaky. Flowers reddish inside, anthers yellow, disc red. Fruits yellow to red, aril bright red, seeds whitish.

Distribution — *Malesia*: Borneo (Sarawak, W Kalimantan).

Habitat & Ecology — Primary riverine forest, on steep slopes; alluvial, rich clay, yellow clay, or loamy soil; 0–500 m altitude; fl. & fr. throughout the year.

Note — This variety is distinguishable by a strikingly different general habit, with twigs often with a yellowish tinge, comparatively narrow leaves drying greenish, and bright brown long-stalked fruits. It superficially resembles *K. luteola* but that species has a much finer venation on the upper leaf surface, larger fruits (4–7 cm), and the perianth yellowish inside.

#### 14. *Knema glaucescens* Jack

*Knema glaucescens* Jack, Mal. Misc. 7 (1821) 35; Warb., Mon. Myrist. (1897) 616 (under neglected species); J. Sinclair, Gard. Bull. Sing. 16 (1958) 302, p.p.; W.J. de Wilde, Blumea 25 (1979) 462; Tree Fl. Sabah & Sarawak 3 (2000) 411. — *Myristica glaucescens* (Jack) Hook. f. & Thomson, Fl. Ind. 1 (1855) 157; Fl. Brit. India 5 (1889) 111 (for the type only). — Type: *Jack s.n.*, Sumatra (Bencoolen).

*Myristica geminata* Miq., Fl. Ind. Bat., Suppl. 1 (1861) 385. — *Knema geminata* (Miq.) Warb., Mon. Myrist. (1897) 604, p.p.; Gamble, Mat. Fl. Malay Penins. 5, 23 (1912) 247, p.p.; Ridl., Fl. Malay Penins. 3 (1924) 72, p.p. — Types: *Teijsmann 3620, 3924*, Sumatra.

*Knema cinerea* (Poir.) Warb. var. *sumatrana* auct. non Blume: J. Sinclair, Gard. Bull. Sing. 18 (1961) 185, p.p.

Tree 8–15 m. *Twigs* 1–2(–3) mm in diameter, at first with very fine rusty, scurfy hairs 0.1 mm long, glabrescent; bark finely striate, not tending to crack or flake. *Leaves* chartaceous or thinly coriaceous, ovate-oblong to lanceolate, 6–20(–23) by 2–6.5(–7.5) cm, apex acute-acuminate, base rounded or subattenuate; greenish or brown above; lower surface greyish, with subsistent  $\pm$  dense stellate hairs 0.1–0.2 mm long, mixed with larger stellate-dendroid hairs, when shed leaving minute hair scars; dots absent; midrib flat or raised above; nerves 13–20 pairs, raised above, venation distinct above; petiole 5–15 by 1–2 mm. *Inflorescences*: peduncle up to 2 mm, brachyblast simple or forked, to 5 mm long; in male 5–20-flowered, in female 1–10-flowered; flowers with persistent grey to rusty hairs 0.1–0.2 mm long, perianth 3-lobed, creamy or yellowish inside. *Male flowers*: pedicel 6–11 mm long; bracteole early or late caducous, median or somewhat higher up; buds globose, 2.5–3.5 mm in diameter, cleft c. 4/5, lobes 0.8–1 mm thick; staminal disc flat to low-mammillate, circular or subtriangular, 1.5–2 mm in diameter; anthers 9–13(–15?, see note 2), slightly to distinctly stiped,  $\pm$  horizontal, 0.2–0.4 mm long, spaced; androphore 0.5–1 mm long. *Female flowers*: pedicel 3–6 mm long; bracteole  $\pm$  median; buds ellipsoid-obovoid, 4–5(–5.5) by 2.5–4 mm, cleft slightly over halfway, lobes 1 mm thick; ovary ovoid, 2–2.5 mm long; stigma sessile,  $\pm$  flat, (1- or) 2–4-lobed and each lobe again few- to many- (up to 15-)lobulate or serrate. *Fruits* 1 or 2 per

infructescence, ellipsoid or broadly obovoid, sometimes ridged, 1.8–2.2 by 1.2–1.8 cm, with mealy hairs 0.1–0.3 mm long; dry pericarp 1(–2) mm thick; fruiting pedicel (3–) 4–11 mm long.

Field-notes — Bark ochre-brown, nearly smooth, not or only slightly flaking; wood white. Leaves coriaceous, glossy dark green with whitish green midrib above, glaucous or dirty white with brownish midrib beneath; venation not visible. Fruits with rusty brown scurf. Aril hot, then cold in the mouth, tasting like cloves and nutmeg (*Sinclair SF 40280, 40368*).

Distribution — *Malesia*: Sumatra (Indragiri, Benkulu, Palembang, Bangka), Peninsular Malaysia (Kelantan, Johore), Singapore, Borneo (Sarawak, Sabah, NW & SE Kalimantan).

Habitat & Ecology — Forest, including swamp forest; sand, granitic sand, and clayey soil; 0–500 m altitude; fl. & fr. throughout the year.

Notes — 1. *Knema glaucescens* keys out together with *K. scortechinii* and *K. communis* on account of the subpersistent indumentum on the lower leaf surface; *K. scortechinii* has a stouter habit, with larger male flowers; *K. communis* has smaller male flowers, and smaller fruits.

2. Jack (l.c.) mentions in the original description 12–15 anthers; in the type, *Jack s.n.* (L), 9–13 anthers were counted.

3. As compared to specimens from Sumatra and Peninsular Malaysia, those from Borneo have more broadly obovoid or subglobose fruits (as against ellipsoid), shorter stalked, 3–5 mm (6–11 mm in Sumatra). In general, the leaves of the Borneo specimens are somewhat more coriaceous, and have a slightly coarser venation above.

The specimens *S 23624* and *23644* from Sarawak 3rd Div., and *S 27203* from 4th Div., have subcoriaceous leaves with a particularly coarse venation on the upper surface, broadly obovoid to subglobose fruits, all fairly deviating from the rest of the material. These specimens may be found to represent a separate taxon, but because matching male flowering material is lacking, they are tentatively included in *K. glaucescens*.

## 15. *Knema globularia* (Lam.) Warb.

*Knema globularia* (Lam.) Warb., Mon. Myrist. (1897) 601; J. Sinclair, Gard. Bull. Sing. 16 (1958) 325, f. 18; 18 (1961) 214; W.J. de Wilde, Blumea 25 (1979) 411; 32 (1987) 120, f. 2. — *Myristica globularia* Lam., Mém. Ac. Paris (1788) 162. — Type: *Sonnerat in Hb. Lamarck s.n.*, Peninsular Malaysia (?).

*Knema corticosa* Lour., Fl. Cochinch. (1790) 605; ed. 2 (Willd.) (1793) 742; Warb., Mon. Myrist. (1897) 593, t. 25 (incl. var. *tonkinensis* Warb.); Lecomte, Not. Syst. 1, 4 (1909) 101; Fl. Indo-Chine 5 (1914) 105, f. 10, 14; Merr., Trans. Amer. Phil. Soc. 24 (1935) 163. — *Myristica corticosa* (Lour.) Hook. f. & Thomson, Fl. Ind. 1 (1855) 158, p.p., only for the type; A. DC., Prodr. 14, 1 (1856) 205, p.p.; Kurz, For. Fl. Brit. Burma 2 (1877) 284, p.p. — *Knema bicolor* Rafin., Sylva Tellur. (1838) 137. — Type: *Loureiro s.n.*, Cochinchina.

*Myristica sphaerula* Hook. f. & Thomson, Fl. Brit. India 5 (1890) 859. — *Knema sphaerula* (Hk. f. & Thomson) Airy Shaw, Kew Bull. (1939) 545. — Type: *Cantley 31*, Peninsular Malaysia.

*Myristica missionis* Wall. ex King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 321, pl. 158. — *Knema missionis* (King) Warb., Mon. Myrist. (1897) 602, t. 24; Gamble, Mat. Fl. Malay Penins. 5, 23 (1912) 247; Ridl., Fl. Malay Penins. 3 (1924) 71; Corner, Wayside Trees (1940) 477, f. 159, 161. — Type: *Wall. Cat. 6788*, Peninsular Malaysia.



*Myristica lanceolata* Wall., Cat. (1832) n. 6794.

*Myristica glaucescens* auct. non Jack: Hook. f. & Thomson, Fl. Ind. 1 (1855) 157, p.p.; Fl. Brit. India 5 (1886) 111, p.p.

Tree 5–20 m. *Twigs* 1–2(–2.5) mm in diameter, at first with yellowish brown hairs 0.1–0.3 mm long, glabrescent; bark striate, not or but rarely tending to crack, never flaking. *Leaves* membranous or thinly coriaceous, at first with indumentum mainly of stellate golden brown or grey hairs 0.1 mm long, early or late glabrescent, oblong to lanceolate, parallel-sided or broadest at or below the middle, 6–18(–24) by 1.5–4(–7) cm, apex acute or acuminate, base attenuate, rarely rounded; olivaceous to dark brown, usually with a blackish metallic lustre above; lower surface greyish, finely papillate (lens!); dots absent; midrib sunken above; nerves 10–18(–22) pairs, faint, flat or sunken above; venation inconspicuous; petiole 7–13 by 1–1.5(–3) mm. *Inflorescences*: sessile or peduncle 1–5 mm, brachyblast simple or bifurcate, to 10 mm long; in male 5–20-flowered, in female 1–10-flowered; flowers with persistent, rusty,  $\pm$  woolly hairs (0.05–) 0.1–0.3(–0.7) mm long, perianth 3- (or 4-)lobed, creamy or reddish (?) inside. *Male flowers*: pedicel 3–5 mm long (outside Malesia to 11 mm long), bracteole above half-way (in Malesia often apically), caducous or persistent; buds subglobose to broadly obovoid, often triangular in the basal part, 3–5 mm in diameter, cleft c. 2/3, lobes 0.3–0.6 mm thick; staminal disc circular or angled, flat, 1.5–2.5 mm in diameter; anthers 8–13(–16), subsessile or just stiped, horizontal, 0.3–0.7 mm, not touching; androphore 0.5–1 mm long. *Female flowers*: pedicel 1.5–4 mm long, bracteole (nearly) apical; buds ellipsoid-urceolate to ovoid, 4–5 by 2.5–3.5 mm, cleft about halfway; ovary subglobose or conical, 1.5–2 mm long; style 0.5–1 mm long, stigma  $\pm$  flat,  $\pm$  2-lobed and each lobe again (2–)3–7-lobulate. *Fruits* 1–5 per infructescence, ellipsoid, subglobose, or sometimes  $\pm$  pear-shaped, 1.2–2 by 1–1.5 cm, at first with grey-brown to rusty hairs 0.1–0.2 mm long,  $\pm$  glabrescent, dry pericarp 2 mm thick; fruiting pedicel 3–10 mm long.

*Field-notes* — Bole fluted (once reported); bark flaking in small, thin scales; inner bark pink, soft; sap red, copious. Leaves membranous or thinly coriaceous, dark green, glossy above, glaucous, slightly pubescent beneath when young. Flowers cream or yellowish inside (occasionally red in Thailand); staminal disc red, purple-red towards the anthers. Fruits yellowish or orange, with thin orange-brown or rusty indumentum, tending to be rubbed off.

*Distribution* — NE India (doubtful), China (Yunnan), Burma, Vietnam, Laos, Cambodia, Thailand; in *Malesia*: Sumatra (Aceh, Riau), most of Peninsular Malaysia, Singapore, W Java.

*Habitat & Ecology* — Lowland primary and degraded forests on hill slopes, in South Thailand, Peninsular Malaysia, and Java often in coastal areas: islands, rocky hill sides, riverbanks, often along seashores; in Thailand in evergreen forest; 0–500 m altitude (in Assam and Yunnan to c. 800 m); fl. Apr.–July, in Thailand mainly Nov.–Feb.; fr. throughout the year.

*Notes* — 1. Specimens of *K. globularia* from the Asian continent, e.g. Thailand, may deviate by slightly larger male flowers, with buds 3.5–5 mm in diameter. Specimens from Vietnam have large fruits, 2.5 by 2 cm.

2. *Knema globularia* seems related to *K. attenuata* from the Indian Peninsula; through *K. globulateria* from Thailand it is connected with the Malesian *K. latericia*, the latter differing, e.g., in flaking bark of twigs, and convex staminal disc.

**16. Knema glomerata** (Blanco) Merr.

- Knema glomerata* (Blanco) Merr., J. Straits Branch Roy. Asiat. Soc. no 76 (1917) 81; Sp. Blanc. (1918) 151; Enum. Philipp. Flow. Pl. 2 (1923) 183; J. Sinclair, Gard. Bull. Sing. 18 (1961) 219, f. 11, map 9 (p.p., excl. syn. *Knema stenocarpa* Warb.); W.J. de Wilde, Blumea 25 (1979) 437; 32 (1987) 125; Tree Fl. Sabah & Sarawak 3 (2000) 412. — *Sterculia glomerata* Blanco, Fl. Filip. (1837) 764; ed. 2 (1845) 525; ed. 3, 3 (1879) 164; Fern.-Vill., Noviss. Append. (1880) 27; Merr., Publ. Gov. Lab. Philipp. n. 27 (1905) 24, 73. — Neotype: *Merrill Sp. Blanc.* 504, Luzon.
- Sterculia decandra* Blanco, Fl. Filip. (1837) 766; ed. 2 (1845) 526; ed. 3, 3 (1879) 166. — Type: not indicated.
- Myristica heterophylla* Fern.-Vill., Noviss. Append. (1880) 178; Vidal, Rev. Pl. Vasc. Filip. (1886) 220. — *Knema heterophylla* (Fern.-Vill.) Warb., Mon. Myrist. (1897) 573, t. 25; Merr., Philipp. J. Sci., Suppl. 1 (1906) 55; *ibid.*, Bot., 3 (1908) 407. — Type: *Vidal* 507, Luzon.
- Knema heterophylla* (Fern.-Vill.) Warb. var. *pubescens* Warb., Mon. Myrist. (1897) 576. — [*Myristica laurina* auct. non Blume: Vidal, Rev. Pl. Vasc. Filip. (1886) 221.] — Type: *Vidal* 509, Luzon.
- Knema vidalii* Warb., Mon. Myrist. (1897) 615; Merr., Enum. Philipp. Flow. Pl. 2 (1923) 184. — [*Myristica iners* auct. non Blume: Vidal, Rev. Pl. Vasc. Filip. (1886) 221.] — Type: *Vidal* 1679, Philippines.
- Knema gitingensis* Elmer, Leaf. Philipp. Bot. 3 (1911) 1065. — Type: *Elmer* 12200, Philippines.
- Knema acuminata* Merr., Philipp. J. Sci. 17 (1920) 256. — Type: *Klemme* 11266, Luzon.
- Myristica corticosa* auct. non (Lour.) Hook. f. & Thomson: Fern.-Vill., Noviss. Append. (1880) 178; A. DC., Prodr. 14, 1 (1856) 205, p.p., only for the Philipp. specimens; Vidal, Phan. Cuming. Philipp. (1885) 139; Rev. Pl. Vasc. Filip. (1886) 220.
- Myristica glaucescens* auct. non (Jack) Hook. f. & Thomson: Ceron, Cat. Pl. Herb. Manila (1892) 141, p.p.
- Knema glauca* auct. non (Blume) Warb.: Merr., Enum. Philipp. Flow. Pl. 2 (1923) 183, p.p.

Tree 5–20 m. Twigs 1.5–2.5(–3) mm in diameter, at first with ± woolly or scurfy rusty hairs 0.2–0.5 mm long, glabrescent; bark finely striate or smooth, not tending to crack or flake. Leaves chartaceous, rarely faintly lobed in the upper part, elliptic-oblong to lanceolate, 10–23(–35) by 3–7(–10) cm, base rounded to attenuate, apex acute(–acuminate), rarely obtuse; greenish or brown above; lower surface at first with greyish, loose, soft-stellate hairs 0.1–0.3 mm long, glabrescent, longer persistent on midrib and nerves; dots absent; midrib ± raised above; nerves (12–)15–20(–22) pairs, ± flat above, often brownish beneath; venation faint or distinct; petiole early or late glabrescent, 5–15 by 1–3 mm. *Inflorescences*: sessile, brachyblast simple, sometimes forked, up to 8 by 6 mm; in male 4–20-flowered, in female 3–10-flowered; flowers with greyish brown or rusty hairs 0.2–0.5 mm long; perianth 3-lobed, pink or red inside. *Male flowers*: pedicel 4–11 mm long, bracteole caducous, ± median; buds (depressed) globose, 3–5 mm in diameter, cleft nearly to the base, lobes 0.3–0.7 mm thick; staminal disc ± flat, slightly convex, or low mammillate, circular, 2–2.5 mm in diameter, anthers 9–13(–15), sessile to stiped, horizontal, 0.5 mm long, not touching; androphore slender, 1–2 mm long. *Female flowers*: pedicel 2–4 mm long, bracteole ± median; buds ellipsoid-obovoid, 5 mm long, cleft about half-way, lobes 0.5–0.7 mm thick; ovary ovoid, 2 mm long; stigma ± sessile, with 2 lobes and each lobe again 5- or 6-lobulate. *Fruits* 1–3 per infructescence, subglobose or globose-ellipsoid, obtuse, 1.5–2.5(–3) by 1.2–2.3 cm, with greyish brown, scurfy hairs 0.1–0.2 mm long; dry pericarp 1.5 mm thick; fruiting pedicel (2–)4–6(–10) mm long.

Field-notes — Bark grey, smooth or slightly flaking in old trees. Leaves dull to glossy medium green above, glaucous beneath. Flowers pink inside; staminal disc whitish; ovary chocolate-brown tomentose, stigma sessile, green.

Distribution — *Malesia*: Philippines (all over the archipelago: Mindoro, Batanes, Babuyan, Luzon, Polillo, Marinduque, Cetanduanes, Sibuyan, Ticao, Samar, Leyte, Biliran, Cebu, Negros, Panay, Guimaras, Sulu Is., Basilan, Mindanao, Palawan); one collection from Borneo (Sarawak: 4th Div., see note 2); one collection from Seram.

Habitat & Ecology — Primary and degraded (rain) forest, dipterocarp forest; 0–600 m altitude; fl. Jan.–Dec.; fr. June–Dec.

Notes — 1. *Knema glomerata* is the most common species of *Knema* in the Philippines. It is close to *K. korthalsii*, which differs in 20–35 pairs of lateral nerves, somewhat larger flowers, in male with an average of 18 anthers, and a more pronounced mammilla on the staminal disc. It is also close to *K. tomentella* (for differences see the key), but this latter species possibly does not occur in the Philippines.

2. The specimen *S 24419*, from Sarawak, is highly questionable as regards the locality, far away from the main area of the species in the Philippines. It has male flowers, which agree with *K. glomerata*.

3. *Knema glomerata* is variable in the amount and length of the (deciduous) hairs on flowers, twig apices, and petioles: in a woolly form, the hairs are relatively long, up to 1 mm, and longer persistent, on the lower leaf surface it is denser; short-haired specimens may resemble *K. cinerea*, which differs in a flat staminal disc, a very short indumentum on the flowers, and the perianth being usually creamy or greenish inside, not pinkish red.

## 17. *Knema hirtella* W.J. de Wilde

*Knema hirtella* W.J. de Wilde, Blumea 25 (1979) 459; 32 (1987) 130; Tree Fl. Sabah & Sarawak 3 (2000) 413. — Type: SAN 30235 (*Mikil*), Sabah.

Tree 5–25 m. Twigs striate or not, 2–3.5 mm in diameter, at first with minute scurfy hairs 0.1–0.2(–0.3) mm long, early glabrescent; bark finely striate, not tending to crack or flake. Leaves chartaceous, oblong(-lanceolate), 7–25 by 2.5–10 cm, apex up to 1.5 cm acute-acuminate or subobtusate, base subcordate, broadly rounded, or attenuate, olivaceous-brown, with scattered hair scars above; lower surface greyish, with persistent sparse yellowish hairs 0.1 mm long, or early to late glabrescent, at first with weak greyish hairs of mixed sizes, 0.1–0.2(–0.3) mm long, in both cases mixed with scattered scars of early shed coarser hairs; dots absent; midrib little raised above; lateral nerves 10–22 pairs, flat or sunken above; venation ± coarse (areoles 0.5 mm or more in diameter), distinct or indistinct; petiole 8–12 by 1.5–2.5 mm. Inflorescences: sessile, brachyblast simple or bifurcate, up to 5 mm long; in male 2–6(–10)-flowered, in female 1–6-flowered; flowers with dense hairs 0.1 mm long or less, perianth 3-lobed, yellowish (?) inside. Male flower (var. *hirtella*): pedicel 4.5–7 mm long, bracteole caducous or persistent, at or 1–2 mm below the apex; buds globose or broadly obovoid, 3–4 mm in diameter, cleft 3/4–4/6, lobes 0.5–0.8 mm thick; staminal disc flat or slightly convex, circular, 1.5–1.7 mm in diameter; anthers 9–13(–15), stiped or half-sessile, ± horizontal or oblique, 0.2–0.4 mm long, opening more or less downwards, spaced; androphore ± tapering, 1–1.5 mm long, in var. *hirtella* at base minutely hairy. Female flowers: pedicel 4–7.5 mm long, bracteole caducous, at or above the middle; buds ellipsoid or long-obovoid, 4.5–6 by 3.5–4 mm, cleft about halfway, lobes 0.7–1 mm thick; pistil 2.5–3 mm long, ovary ovoid, 1.5–2 by 1.5–2 mm, stigma subsessile, 2-lobed and each lobe again 6–8-lobulate or serrate. Fruits 1 or 2 per infructescence, ellipsoid or ovoid, 2.5–3(–3.5) by 1.7–2.6 cm, base rounded,

apex rounded or acute, often with style remnant 0.5 mm, with hairs up to 0.5 mm long; dry pericarp 1.5(–2) mm thick; fruiting pedicel 4–10(–15) mm long.

Distribution — *Malesia*: Borneo (Sarawak, Sabah, C & E Kalimantan).

Habitat & Ecology — Lowland and lower montane forest; on hill slopes and ridges; on sandy soil, sandstone, lateritic and clay soils; 0–1000 m altitude; fl. May–July; fr. throughout the year.

Notes — 1. *Knema hirtella* is a variable species which can easily be confused with *K. glauca* and *K. stenophylla*; *K. glauca* differs in a very weak, early shed indumentum on the lower leaf surface, persistent bracteole, glabrous androphore, and glabrous (glabrescent) fruits; *K. stenophylla* s.l. differs in a less stout habit, generally smaller fruits, and glabrous androphore. *Knema piriformis* also resembles the present species, but has differently shaped male buds.

2. Arbitrarily two largely sympatric varieties can be recognized, mainly based on indumentum. Within the species there is a considerable variation in size and shape of the fruits, but this cannot be used for a subdivision. The status of the accepted varieties is not quite clear, moreover because male flowers of the variety *pilocarpa* are not known.

#### KEY TO THE VARIETIES

- 1a. Twigs at apex and leaf buds with minute hairs 0.1 mm long. Fruits with stellate (–dendroid) hairs 0.1 mm long or less. Androphore minutely pubescent at base . . . . . **a. var. hirtella**
- b. Twigs at apex and leaf buds with hairs 0.1–0.2(–0.3) mm long. Fruits with rough dendroid hairs 0.5 mm long, especially towards the base . . . . . **b. var. pilocarpa**

#### **a. var. hirtella**

*Twigs* at apex with hairs 0.1 mm long or less. *Leaves* with persistent pale yellowish stellate hairs 0.1 mm long, intermixed with early shed coarser hairs leaving distinct hair scars (lens!) beneath. Androphore towards the base with minute greyish stellate hairs. *Fruits* obtuse at apex; the indumentum of stellate(–dendroid) hairs 0.1 mm long or less.

Distribution — *Malesia*: Borneo (Sarawak: 4th Div.; Sabah).

#### **b. var. pilocarpa** W.J. de Wilde

*Knema hirtella* W.J. de Wilde var. *pilocarpa* W.J. de Wilde, *Blumea* 25 (1979) 461; 32 (1987) 131; *Tree Fl. Sabah & Sarawak* 3 (2000) 414. — Type: *SAN 85084 (Cockburn)*, Sabah.

*Twigs* at apex with rusty stellate-dendroid hairs 0.1–0.2 mm long. *Leaves* with persistent yellowish hairs 0.1(–0.2) mm long, intermixed with early shed coarser hairs leaving distinct hair scars beneath. Mature *male* and *female* flowers not seen. *Fruits* obtuse to acute(–acuminate) at apex; the indumentum, especially towards the base of the fruit, of stout rusty dendroid hairs 0.5 mm long.

Distribution — *Malesia*: Borneo (Sarawak, Sabah, E Kalimantan).

Habitat & Ecology — Periodically inundated forest.

Note — The specimen *SAN 99720* (E Sabah), with immature male flowers, probably belongs here according to its indumentum and large leaves up to 23 by 7.5 cm; the an-

droecium (with 9 anthers) and glabrous androphore is reminiscent of *K. subhirtella*, a species with smaller leaves.

**18. *Knema hookeriana* (Wall. ex Hook. f. & Thomson) Warb.**

*Knema hookeriana* (Wall. ex Hook. f. & Thomson) Warb., Mon. Myrist. (1897) 551, t. 24; Gamble, Mat. Fl. Malay Penins. 5, 23 (1912) 237; Ridl., Fl. Malay Penins. 3 (1924) 67; Corner, Wayside Trees (1940) 476; J. Sinclair, Gard. Bull. Sing. 16 (1958) 272, f. 1 & pl. I; 18 (1961) 226; W.J. de Wilde, Blumea 25 (1979) 387. — *Myristica hookeriana* Wall. ex Hook. f. & Thomson, Fl. Ind. 1 (1855) 156; A. DC., Prodr. 14, 1 (1856) 204; Miq., Fl. Ind. Bat. 1, 2 (1858) 69, & Suppl. 1 (1861) 384; Hook. f., Fl. Brit. India 5 (1886) 109; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 325, pl. 163. — Type: *Wall. Cat. 6802A*, Peninsular Malaysia.

Tree 5–30 m. Twigs 5–10 mm in diameter, with dense, buff, woolly hairs (3–)5–8 mm long, late glabrescent, the indumentum shed in compact rags; bark brown, longitudinally cracking, and flaking. *Leaves* coriaceous, when immature with dense hairs (2–)5–8 mm long, (oblong-)lanceolate, ± narrowed towards the base, 25–60 by 5–22 cm, apex subobtusate, acute, or acuminate, base subattenuate, rounded, or subcordate; olivaceous to dark brown above, lower surface glabrescent, greyish, faintly papillate or not; dots absent; midrib raised above; nerves 25–33 pairs, ± raised above, reddish to yellowish brown; venation distinct; petiole 10–30 by 8–12 mm, late glabrescent, hairs (1–)2–3 mm long. *Inflorescences*: sessile, brachyblast simple or 2–4-furcate, up to 20 mm in diameter, in male 5–20-flowered, in female 4–10-flowered; flowers with dense woolly hairs 1–3 mm long, perianth 3- (or 4-)lobed, striate and red inside. *Male flowers*: pedicel 15–20 mm long, bracteole caducous, at or somewhat above the middle; buds depressed globose-obovoid, 7–9 by 8–10 mm, cleft c. 2/3, lobes 1–2 mm thick; staminal disc blunt-triangular, ± concave, 3–4 mm in diameter; anthers 15–25, just sessile, half-erect or horizontal, 0.6–1 mm, not touching; androphore ± tapering, 2(–3) mm long. *Female flowers*: pedicel (5–)10–20 mm long, bracteole ± median to subapical; buds subglobose, or ovoid, or depressed-obovoid, 8–10 by 8–10 mm, cleft about halfway, lobes 1–2.5 mm thick; ovary subglobose, 2–4 mm in diameter, hairs 2 mm long; style 1.5–2 mm long, stigma ± 2-lobed and each lobe again 3- or 4-lobulate, these again 2–4-lobulate, hence stigma c. 20-lobulate-serrate. *Fruits* 1–3 per infructescence, ellipsoid, 4.5–7(–8) by 3–4.5 cm, with thick, buff woolly hairs 5–13 mm long, not easily rubbed off; dry pericarp 3–8 mm thick; fruiting pedicel 5–10(–20?) mm long.

*Field-notes* — Bole straight, not buttressed; crown conical; bark smooth but scaly by several layers of thin brittle blackish adherent flakes, rectangular or elongate. Branches drooping or horizontal. Young foliage appearing periodically, pendulous, clothed in a dense fawn down; older leaves glossy dark green above, glaucous beneath.

*Distribution* — Southern Peninsular Thailand and *Malesia*: Sumatra (East Coast, Palembang), Peninsular Malaysia (known from all provinces except Perlis and Wellesley Prov.), Singapore.

*Habitat & Ecology* — Primary and degraded forest; ridge tops, hill sides; 0–800 m altitude; fl. Feb.–May; fr. June–Dec.

*Note* — *Knema hookeriana* is a characteristic species, noticeable for its twigs with flaking bark, large leaves, and long, dense, woolly indumentum on twigs, petioles, flowers, and fruits.

**19. Knema intermedia** (Blume) Warb.

*Knema intermedia* (Blume) Warb., Mon. Myrist. (1897) 564, t. 25; Gamble, Mat. Fl. Malay Penins. 5, 23 (1912) 239; Koord., Exk. Fl. Java 2 (1912) 258; Ridl., Fl. Malay Penins. 3 (1924) 68; Corner, Wayside Trees (1940) 477; Backer & Bakh. f., Fl. Java 1 (1964) 140; J. Sinclair, Gard. Bull. Sing. 16 (1958) 315, f. 15, pl. II B; 18 (1961) 227; W.J. de Wilde, Blumea 25 (1979) 427; Tree Fl. Sabah & Sarawak 3 (2000) 414. — *Myristica intermedia* Blume, Rumphia 1 (1835) 187; Hook. f. & Thomson, Fl. Ind. 1 (1855) 158; A. DC., Prodr. 14, 1 (1856) 206; Miq., Fl. Ind. Bat. 1, 2 (1858) 70; Hook. f., Fl. Brit. India 5 (1886) 112; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 317, pl. 154; Koord. & Valetton, Med. Lands Pl. Tuin 17 (1896) 192. — Type: *Blume s.n.*, Java.

*Myristica glabra* De Vriese, Pl. Ind. Bat. Orient. (Pl. Reinw.) (1857) 85. — Type: *Reinwardt s.n.*, Java.

*Myristica iteophylla* Miq., Fl. Ind. Bat. 1, 2 (1858) 59. — Type: *Teijsmann 478*, Sumatra.

*Myristica corticosa* (Lour.) Hook. f. & Thomson var. *decipiens* Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 51. — Type: *Korthals s.n.*, Kalimantan.

*Myristica glauca* auct. non Blume: Zollinger msc., Moritzi, Syst. Verz. Java (1845) 38.

Tree 5–15(–30) m, sometimes with stilt-roots. Twigs slender or stout, subterete, slightly angled, or flattened, 1.5–4(–5) mm in diameter, at first with rusty hairs 0.3–0.5 mm long, glabrescent; bark smooth or finely striate, not tending to crack or flake. Leaves chartaceous or coriaceous, oblong to lanceolate, (7–)9–35 by 1.3–8 cm, apex acute (–acuminate), base rounded, cuneate, or attenuate; greenish brown above, lower surface grey-brown, at first with dense indumentum, early glabrescent; dots absent; midrib raised above; nerves 12–25 pairs, much raised; venation distinct; petiole (late) glabrescent, 10–25 by 2–3 mm. *Inflorescences*: peduncle up to 2 mm long, brachyblast simple or 2- or 3-furcate, up to 15 mm long, in male 5–25-flowered, in female 1–10-flowered; flowers with woolly or mealy rusty hairs 0.3–0.5 mm long, perianth 3-lobed, creamy or pinkish (?) inside. *Male flowers*: pedicel 5–13 mm long, bracteole subpersistent, median to apical; buds subglobose, circular to subtriangular in cross section, (3–)4–5 by (3–)4–5.5 mm, cleft (2/3–)3/4, lobes 0.3–0.4 mm thick; staminal disc circular to subtriangular, 2–2.5 mm in diameter, with a conspicuous mammilla 1–1.5 mm long; anthers 11–15, horizontal, 0.3–0.5 mm, subsessile or shortly stiped, not touching, androphore 0.5 mm long. *Female flowers*: pedicel 2–8 mm long, bracteole ± median; buds obovoid, 5(–6) by 3.5–4 mm, cleft about halfway, lobes 0.5–0.7 mm thick; ovary subglobose or ovoid, 2.5 by 2.5–3 mm; stigma sessile, 2-lobed, each lobe again (2–)3–5-lobulate. *Fruits* 1–4 per infructescence, ellipsoid, 2.5–4 by 1.5–2.3 cm, often ridged, with hairs 0.3–0.5 mm long, ± easily rubbed off; dry pericarp 2–3 mm thick; fruiting pedicel (3–)5–14 mm long.

Field-notes — Trunk without buttresses, though frequently with stilt-roots; bark smooth, scaly, or flaky; wood white or somewhat reddish. Leaves bright dark green, glossy, the midrib much paler, yellowish above, very glaucous or light blue-green or whitish beneath; newly emerged leaves velvety golden by the indumentum at both sides. Flower buds yellowish brown, cream inside, stamens and disc pink; fruits often yellow or orange with rusty or red indumentum.

Distribution — *Malesia*: Sumatra (W Coast, E Coast, Palembang, Lampong, Bangka, Riau-Lingga Arch.), Peninsular Malaysia (all provinces except Perlis, Kedah, Trengganu, Negeri Sembilan), Java (W Java), Borneo (S & SE Kalimantan; Sarawak; Sabah, see note 2; Natuna I.).

**Habitat & Ecology** — Mixed lowland forest, peat forest; once from granitic sand; 0–1000 m altitude; fl. & fr. throughout the year.

Sinclair (1958) mentioned that the flower buds, observed on the tree in the Singapore arboretum, remained closed for six weeks before opening, and that they probably had been in the unopened stage for quite a considerable time prior to having been noticed. The same phenomenon was seen in *Knema leuserensis*, in which apparently full-grown flower buds of male and female specimens remained closed for about six weeks before opening.

**Notes** — 1. *Knema intermedia* is characterized by the conspicuous long-mammillate staminal disc. It is related to *K. plumulosa*; for differences see under that species.

2. *SAN 71155*, the only collection seen from Sabah, differs in a stout habit, with thick twigs, large leaves, and short fruiting pedicels only 2–4 mm long.

## 20. *Knema kinabaluensis* J. Sinclair

*Knema kinabaluensis* J. Sinclair, Gard. Bull. Sing. 18 (1961) 229, f. 12; W. J. de Wilde, Blumea 25 (1979) 450; Tree Fl. Sabah & Sarawak 3 (2000) 415. — Type: *Sinclair 9224*, Sabah.

Tree 5–25 m. *Twigs* sometimes ± blunt-triangular, 1.5–2.5 mm in diameter, drying blackish brown, at first with yellowish rusty hairs 0.1 mm long, glabrescent; bark striate or not, not cracking or flaking. *Leaves* (rigidly) coriaceous, (oblong-)lanceolate, 9–21 by 2.5–5 cm, base (rounded or) attenuate, apex acute-acuminate; dark brown above; lower surface grey-glaucous, at first with fairly dense mixed stellate and scale-like hairs 0.1 mm long or less, early glabrescent, leaving hair scars; dots absent; the midrib raised above; nerves 12–25 pairs, raised above; venation ± coarse (areoles 0.5 mm in diameter), very distinct above; petiole 10–20 by 2–3 mm. *Inflorescences*: sessile, brachyblast simple or bifid, up to 15 mm long; in male 4–10-flowered, in female 1–4-flowered; flowers with mealy, rusty hairs 0.1–0.2 mm long; perianth 3-lobed, pink or reddish inside. *Male flowers*: pedicel 3–6 mm long, bracteole caducous, about median; buds subglobose, 2.5–3.5 mm in diameter, cleft (3/4–)4/5, lobes 0.5–1 mm thick; staminal disc flat or slightly convex, circular, pink, 1.5(–2) mm in diameter; anthers 7 or 8(–10?), just sessile, almost horizontal to oblique, 0.7 mm long, with broad connective, the thecae opening downwards, spaced; androphore 1 mm long. *Female flowers*: pedicel 3–4 mm long, bracteole caducous, about median; buds obovoid-oblong, 5 mm long, cleft about halfway; ovary ovoid, 2 mm long; stigma ± sessile, 2-lobed, lobes not clearly lobulate, 1 mm long. *Fruits* 1 or 2 per infructescence, ovoid or oblong, base rounded, apex acute or short-apiculate, ± ridged along the line of suture, 2–4.5 by 1.5–3 cm, with yellowish brown to rusty hairs 0.1–0.2 mm long; dry pericarp 2–4 mm thick; fruiting pedicel 3–10 mm long. — **Photo 6.**

**Field-notes** — Bark smooth, or fine and shallowly fissured; inner bark pale brown to reddish; sapwood whitish, cambium reddish. Leaves glossy dark green with whitish green midrib above, glaucous with yellowish midrib beneath. Flowers pale pink or reddish inside. Fruits orange or golden brown, or brown scurfy; aril red with pink tinge.

**Distribution** — *Malesia*: Borneo (Sabah, endemic to the Mt Kinabalu area).

**Habitat & Ecology** — Montane (degraded) rain forest; on ridges and slopes, along rivers; on sandstone; also occurring in the coppermining area near Ranau; 1000–2300 m altitude; fl. & fr. throughout the year.

Notes — 1. *Knema kinabaluensis* comes close to *K. cinerea* and *K. glauca*, possibly most closely to the latter which differs in less coriaceous leaves, persistent bracteole, and early glabrescent fruits. By its coriaceous leaves *K. kinabaluensis* resembles *K. rigidifolia* from Peninsular Malaysia and also resembles certain coriaceous-leaved forms referred to *K. pectinata* from Sarawak, and *K. kunstleri* subsp. *alpina* from Sabah. *Knema rigidifolia* differs in the shape of male buds and fruits, and the indumentum on the lower leaf surface; *K. pectinata* has stouter twigs, larger male buds, and more globose fruits; *K. kunstleri* can always be recognized by the blackish dots on the lower leaf surface.

2. In most of the herbarium material the mature fruits are partly ridged along the line of suture, but in a few specimens this ridge is lacking.

## 21. *Knema korthalsii* Warb.

*Knema korthalsii* Warb., Mon. Myrist. (1897) 557. — *Myristica korthalsii* (Warb.) Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 90. — Type: *Korthals s.n.*, Kalimantan.

Tree 2–30 m. Twigs faintly flattened or (2- or) 3-angular, 2–5 mm diameter, at first with rusty hairs 0.3–0.5 mm long, glabrescent; bark striate, thinly flaking or not. Leaves chartaceous or thinly coriaceous, oblong to oblanceolate, 12–35 by 2.5–9(–12) cm, base cuneate to subattenuate, or rounded, apex acute(-acuminate); greenish (dark) brown above; lower surface greyish, largely glabrescent, sometimes with indumentum remaining on midrib and nerves; dots absent; midrib slightly raised above; nerves 12–35(–40) pairs, raised; venation distinct above; petiole tomentose or late glabrescent, 8–25 by 2–5 mm. *Inflorescences*: sessile, brachyblast simple or ± warty, to 8 mm diameter, in male in umbels of (1–)5–20 flowers, female up to 10-flowered; flowers with persistent rusty hairs 0.2–0.7 mm long, perianth 3-lobed, red inside. *Male flowers*: pedicel 5–13 mm long, bracteole subsistent or caducous, 0.5–1 mm, ± median; buds depressed globose, often obtusely angular in cross section, 4–6(–7) mm diameter, cleft c. 4/5, lobes 0.5 mm thick, at base 1 mm thick; staminal disc circular, convex or mammillate, sometimes ± flat (especially in Philippines), 2–2.8 mm diameter; anthers 10–20, subsessile, horizontal, 0.5 mm long, not touching, opening ± to beneath; androphore 0.7–1 mm long, ± clasped by the thickened base of the perianth. *Female flowers*: pedicel 1.5–2.5 mm long, bracteole about median, caducous; buds obovoid-oblong, 5–6 mm long, cleft c. 2/3, lobes 0.5–1 mm thick; ovary ovoid, 2 mm long; stigma ± sessile, 2-lobed, and each lobe again with 3–6 lacinations. *Fruits* 1–3 per infructescence, ellipsoid or oblong, 1.5–4 by 1–2 cm, with rusty hairs 0.5–1 mm long; dry pericarp 3 mm thick; fruiting pedicel 1–6 mm long.

Distribution — *Malesia*: Borneo, S Philippines (Balabac I., Palawan, Sulu Is., Basilan, Mindanao mainly in Zamboanga Prov.).

### KEY TO THE SUBSPECIES

- 1a. Twigs towards apex 3–5 mm diam., older bark not flaking. Lateral nerves to 40 per side, usually clearly interarching. Fruits 2–4 cm, pedicel 2–6 mm long; persistent style and stigma to 1 mm long . . . . . a. subsp. **korthalsii**
- b. Twigs towards apex 2–3 mm diam., older bark thinly flaking. Lateral nerves 12–22 per side, lines of interarching more faint. Fruits 2 cm long, pedicel 1–2 mm long; persistent stigma sessile (as in *K. latericia*) . . . . . b. subsp. **rimosa**



**a. subsp. korthalsii**

*Knema korthalsii* Warb., Mon. Myrist. (1897) 557; J. Sinclair, Gard. Bull. Sing. 18 (1961) 232, f. 13; W.J. de Wilde, Blumea 25 (1979) 428; 43 (1998) 242; Tree Fl. Sabah & Sarawak 3 (2000) 417. — *Myristica korthalsii* (Warb.) Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 90.

*Knema insularis* Merr., Philipp. J. Sci. 30 (1926) 394. — Type: BS 44288 (Ramos & Edaña), Sulu Islands.

*Knema cenabrei* Merr. & Quisumbing, Philipp. J. Sci. 37 (1928) 144, pl. 3. — Type: FB 29973 (Cenabre), Palawan.

*Myristica mindanaensis* auct. non Warb.: Merr., Bull. Bur. For. Philipp. 1 (1903) 21; Philipp. J. Sci., Bot. 3 (1908) 76. — *Knema mindanaensis* auct. non (Warb.) Merr.: Merr., Enum. Philipp. Flow. Pl. 2 (1923) 184, p.p., excl. type.

Tree 7–30 m. Twigs 3–5 mm diameter, not flaking. Leaves chartaceous or coriaceous, oblong to oblanceolate, 12–35 by 2.5–9(–12) cm, base (sub)attenuate; nerves (14–)20–35(–40) per side; petiole late glabrescent, (8–)10–25 by 2–5 mm. Flowers with hairs 0.3–0.7 mm. Male flowers: pedicel 7–13 mm, bracteole ± median, caducous, buds depressed subglobose, obtusely trigonous, 4–6(–7) mm diameter, anthers (10–)12(–20). Female flowers as the species. Fruits 1.5–4 cm long, with hairs 0.5–1 mm, stigma more or less withering, fruiting pedicel 2–6 mm long.

Field-notes — Bark of trunk smooth or scaly, grey; slash of outer bark 3 mm, soft, chocolate or blackish, inner bark 10 mm, soft, reddish; sapwood red or white; cambium reddish or yellow; wood hard, brown. Leaves whitish or glaucous beneath.

Distribution — See the species.

Habitat & Ecology — Primary forest on level land or hill sides, mixed dipterocarp forest; found on a variety of soil types: brown soil, (sandy) loam, clay, basalt rock, limestone, and sandstone; 0–400 m altitude; fl. in Borneo July–Oct., in the Philippines May–June; fr. May–Oct.

Notes — 1. *Knema korthalsii* belongs to the group of species with the staminal disc distinctly convex or with a mammilla; it is also related to a group of species to which *K. glomerata*, *K. pectinata*, and *K. woodii* belong. Subsp. *korthalsii* seems most closely related to *K. glomerata*, which differs in a ± flat staminal disc, more slender twigs, leaves with fewer lateral nerves, 12–20 pairs, and fewer anthers, 9–13, as against 10–20, for *K. korthalsii*. *Knema glomerata* and *K. korthalsii* overlap in area in Mindanao, Samar, and the Sulu Islands. *Knema pectinata* has much more lateral nerves, and *K. woodii* can be distinguished by the more numerous sessile anthers, and shorter indumentum on the twig apices and flowers. Subsp. *korthalsii* can be confused easily with *K. membranifolia*.

2. BS 44288 (Ramos & Edaña), the type of the synonym *K. insularis*, is intermediate with *K. glomerata*, and might belong to this latter species.

**b. subsp. rimosa** W.J. de Wilde

*Knema korthalsii* Warb. subsp. *rimosa* W.J. de Wilde, Blumea 43 (1998) 242; Tree Fl. Sabah & Sarawak 3 (2000) 417. — Type: SANA 1996 (Wood), Sabah.

Tree 2–10(–15) m. Twigs towards apex 2–3(–5) mm diam. Bark of older twigs thinly flaking. Leaves (thinly) chartaceous, elliptic- or obovate-oblong, 15–30 by 3.5–8.5 cm, base acute or rounded; nerves 12–22 per side; petiole 8–12 by 2–4 mm, tomentose or

late glabrescent. *Flowers* with hairs 0.2–0.5 mm long; male pedicel (4–)5–10 mm long; bracteole subpersistent, 0.5–1 mm long, buds depressed-globose, 3–4 by 4–6 mm; anthers 10–12. *Female flowers* and *fruits* resembling those of *K. latericia* subsp. *ridleyi*. *Fruits* ellipsoid or obovoid, 2–2.3 cm, with hairs 0.5–1 mm long, persistent sessile lobed stigma; fruiting pedicel 1–2(–3) mm long.

Field-notes — Bark smooth, blackish, (irregular) scales reveal orange-brown patches below. No buttresses. Outer bark pale brown, soft, flaky; inner bark fibrous, pink; sapwood off-white, no smell. The type specimen flowering abundantly throughout the crown. Perianth brown, tomentose, inside red. Anthers yellow, disc swollen, pink. Leaves glaucous below.

Distribution — *Malesia*: Borneo (endemic to SE Sarawak and E Sabah).

Habitat & Ecology — In lowland forest, dipterocarp forest, on brown sandy soil, leached loam over sandstone; well-drained soils; up to 900 m altitude; fl. Mar., Apr.; fr. Apr.–June.

Note — Subsp. *rimosa* deceptively resembles *K. latericia* subsp. *ridleyi* in the vegetative state and female flowers or fruits. The male flowers are quite distinct. Both subspecies share the flaking bark of the older twigs, a character regarded as important for the distinction of taxa and for a proper distinction one should examine fully mature male flowers still in buds, or just opened.

## 22. *Knema kostermansiana* W.J. de Wilde

*Knema kostermansiana* W.J. de Wilde, *Blumea* 25 (1979) 455; 32 (1987) 127; *Tree Fl. Sabah & Sarawak* 3 (2000) 417. — Type: *SAN 19047 (James Ah Wing)*, Sabah.

Tree 6–20 m. *Twigs* finely to coarsely striate, 2–4 mm diameter, at first with greyish stellate hairs less than 0.1 mm long, early glabrescent; bark striate, not tending to crack or flake. *Leaves* membranous or chartaceous, elliptic or oblong, 12–30(–40) by 5.5–12(–19) cm, apex acute-acuminate, base shallowly cordate to broadly rounded; olivaceous above; lower surface greyish, finely papillate or not, at first with inconspicuous, weak, greyish sessile-stellate hairs 0.1 mm long or less, early glabrescent; dots absent; midrib slightly raised above; nerves 15–22 pairs, sunken or  $\pm$  flat above; venation  $\pm$  coarse (areoles 0.5 mm diam. or more), distinct above, faint in older leaves; petiole 10–15 by 2–3 mm. *Inflorescences*: sessile, brachyblast 2- or 3-furcate, up to 5 mm long; in male 5–10-flowered, female few-flowered; flowers with scale-like hairs less than 0.1 mm long, perianth 3-lobed, reddish (?) inside. *Male flowers*: pedicel 2.5–7 mm long, bracteole minute, caducous, apical; buds (depressed) globose, 3–3.2 mm diameter, cleft c. 4/5, lobes 0.8 mm thick; staminal disc flat or faintly mammillate, circular, 1.5–2 mm diameter; anthers 8–12, subsessile to just stiped, 0.5–0.6 mm long, horizontal, spaced; androphore 0.6–0.7 mm long. *Female flowers*: pedicel 3–4 mm long, bracteole caducous, (sub)apical; buds ellipsoid-oblong,  $\pm$  narrowed in the middle, (4–)5–6 by (2–)2.5–3 mm, cleft c. 1/2, lobes 1 mm thick; ovary long-ovoid, 2–2.5 by 1.5 mm; style slender, 1–1.5 mm long, glabrous, with 2-lobed fleshy stigma, each lobe again shallowly 3-lobulate. *Fruits* solitary or 2 or 3 together, oblong(-lanceolate),  $\pm$  fusiform, 7 by 2 cm, base tapering, apex long-tapering or beaked, with grey-brown scale-like hairs less than 0.1 mm, appearing as if subglabrous; dry pericarp 2 mm thick; fruiting pedicel rather stout, 8–10 mm long, with the bracteole scar nearly median.

Field-notes — Medium-sized tree to 20 m; bark chocolate- to dark-brown, fissured dark greyish, inner bark whitish brown, sapwood white, yellowish, or brownish; exudate red. Flowers greenish or grey-brown, turning yellowish, pink inside. Fruits greenish.

Distribution — *Malesia*: Borneo (Sabah, including border area of NE Kalimantan).

Habitat & Ecology — Logged-over forest, riverbank forest; on sandstone; 0–700 m altitude; fl. June–Oct.; fr. July–Oct.

Note — *Knema kostermansiana* may resemble *K. glauca* and *K. pulchra*. *Knema glauca* differs in its shorter fruits, and median bracteole, narrower leaves, and  $\pm$  raised nerves; *K. pulchra* is distinguishable by pear-shaped, not globose, male buds and by much broader ellipsoid fruits with rounded apex. The slender,  $\pm$  fusiform fruits of 7 cm length of *K. kostermansiana* much resemble those of *K. luteola*, and somewhat those of *K. ashtonii* var. *ashtonii*; both differ in a much finer venation on the upper leaf surface, the first by narrow-rounded or attenuate leaf base and generally somewhat smaller fruits (up to 70 mm long), the second in stouter habit and the fruits with  $\pm$  blunt apex, not pointed.

### 23. *Knema krusemaniana* W.J. de Wilde

*Knema krusemaniana* W.J. de Wilde, Blumea 41 (1996) 385. — Type: *Mogea & de Wilde 4216*, Kalimantan.

Tree 4–6 m. Twigs 4–5 mm diameter, with dense, dark brown, coarse hairs 1–2 mm long, late glabrescent; bark blackish brown, finely striate, not cracking nor flaking, inconspicuously lenticellate. Leaves (thinly) chartaceous, oblong, 15–35 by 4–10 cm, base narrowly rounded or cuneate, apex (acute-)acuminate; olivaceous or bright brown above; lower surface pale brown or grey-brown, minutely papillose, with sparse but conspicuous stellate and stellate-dendroid hairs 0.5–1.5 mm, sometimes late glabrescent; dots present (lens!); midrib raised above, nerves 14–18 pairs, raised, venation distinct at both surfaces; petiole 6–14 by 2.5–4 mm, late glabrescent. Inflorescences: sessile, brachyblast wart-like or slenderly worm-like, simple or 2- (or 3-)armed, to 12 mm long, with woolly rusty stellate hairs 0.5–1 mm, late glabrescent, in male with 10–25 clustered flowers; flowers with dense woolly stellate and stellate-dendroid hairs 0.5–1 mm long, perianth 4-lobed, pink inside. Male flowers: pedicel 4–5 mm long, slender or thickish, bracteole 1 mm long or less, 1–1.5 mm below the apex, caducous; buds (slightly immature) subglobose, 2 mm diameter, cleft 3/4–4/5, lobes cariose, at base enclosing the androecium; staminal disc flat or slightly convex, circular, 1–1.7 mm diameter, anthers 7 or 8, short-stiped, spaced, each 4-sporangiate (each with 2 thecae), androphore hardly 0.5 mm long. Female flowers not seen. Fruits 2.5–3 by 1.7–2 cm, obtuse, with hairs 0.5–1 mm, fruiting pedicel 10 mm.

Field-notes — Small, slender tree, 4–6 m. Indumentum of young twigs brown. Leaves glaucous at underside. Flower buds pale yellowish brown; flowers pink.

Distribution — *Malesia*: Borneo (W & Central Kalimantan, area of the upper Katingan: Mendawai and Kahayan Rivers).

Habitat & Ecology — Old degraded forest and forest with *Agathis* over poor sandy soil with thin peat layer; locally common; 200–220 m altitude; fl. Mar., Dec.

Note — *Knema krusemaniana* belongs, with *K. conferta* and *K. pedicellata*, to a group of species with dots on the lower leaf surface. It is distinguishable by thinner leaves,

twigs with longer-haired persistent conspicuous indumentum, and smaller male flowers, with only 8 anthers. The perianth in *K. krusemaniana* is 4-lobed, in the related *K. conferta* and *K. pedicellata* it is 3-lobed and 4- or 5-lobed, respectively. The pedicels are exceedingly long in *K. pedicellata*, short in *K. krusemaniana*. The staminal disc is conspicuously convex in *K. pedicellata*,  $\pm$  flat in *K. krusemaniana* and *K. conferta*; in *K. pedicellata* the perianth has a raised disc at base, which is lacking in both other species. Finally there are remarkable differences in the almost stalked anthers: 8 in *K. krusemaniana*, which are uniquely 4-sporangiate; in *K. conferta* and *K. pedicellata* there are (10–)12–18 bisporangiate anthers.

#### 24. *Knema kunstleri* (King) Warb.

*Knema kunstleri* (King) Warb., Mon. Myrist. (1897) 568, t. 25; W.J. de Wilde, Blumea 25 (1979) 468; 43 (1998) 244; Tree Fl. Sabah & Sarawak 3 (2000) 418. — *Myristica kunstleri* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 314, pl. 149. — Lectotype: *King's coll. 4216*, Peninsular Malaysia.

For more references and synonyms see the subspecies.

Tree 5–30 m. *Twigs* 1.5–3(–4) mm diameter, at first with rusty, chocolate, or grey-brown hairs 0.1–0.2 mm long or less, glabrescent; bark striate or not, not tending to crack or flake. *Leaves* membranous or coriaceous, variable, broadly elliptic or ovate, to oblong-lanceolate, 5–28 by (1.5–)2–10 cm, base attenuate to broadly rounded, apex sub-obtuse to acute(-acuminate); greenish to brown above, the lower surface greyish, finely papillate, with (sub)persistent golden to grey-brown, mostly stellate scale-like hairs 0.1 mm long (0.3 mm in subsp. *pseudostellata*);  $\pm$  dense or remote dots, especially present on the veinlets; midrib raised above; nerves 6–18 pairs, raised above; venation fine or coarse, raised and distinct or not (in subsp. *kunstleri* raised and of a lighter colour); petiole 5–20 by 1.5–3 mm. *Inflorescences*: sessile or pedunculate, up to 5 mm, sometimes supra-axillary, brachyblast simple, warted, or  $\pm$  forked, 2–4 mm long; in male 3–15-flowered, female 1–5-flowered; flowers with persistent scale-like hairs 0.1–0.2 mm long, perianth 3- (or 4-)lobed, reddish or cream inside (subsp. *coriacea* and *alpina* always creamy?). *Male flowers*: pedicel 5–11 mm long, bracteole subpersistent, median or somewhat above, rarely nearly apical; buds (depressed) globose, sometimes  $\pm$  angular, 2.5–3(–4) mm diameter, cleft nearly to the base, lobes 0.5–1 mm thick; staminal disc flat or slightly convex, circular or somewhat angular, 1.3–2(–3) mm diameter; anthers 8–14, just to distinctly stiped, 0.3–0.6 mm, horizontal, spaced; androphore 0.5–1 mm long. *Female flowers*: pedicel 2–9 mm long, bracteole about median or subapical; buds  $\pm$  obovoid, 4–5 by 2.5–3.5 mm, cleft c. 1/2, lobes 1(–1.5) mm thick; ovary ovoid, 2 mm long; stigma sessile, 2-lobed and each lobe again 2–5-lobulate. *Fruits* 1–4 per infructescence, subglobose or ellipsoid, 1.5–4.2 by 1–2.8 cm, base rounded or narrowed, apex rounded to subacute, with minute scale-like hairs 0.2 mm long or less, sometimes seemingly glabrous; dry pericarp 1–2 mm thick; fruiting pedicel 3–15 mm long.

Field-notes — Bark smooth, fine scaly, rough, or sometimes fissured; grey, reddish, or dark brown; slash pink or reddish; wood cream, sometimes yellow-brown or pink. Leaves glossy green above, dirty white or glaucous beneath. Flowers greenish yellow inside, or reddish in subsp. *kunstleri* (always?), or in subsp. *coriacea* and *alpina* cream or pale yellow. Fruits yellow, red brown, dark (olive-)brown, or orange.

Distribution — A polymorphous species with 7 subspecies, each with a different geographical area or habitat. *Malesia*: Sumatra, Peninsular Malaysia, Borneo, Philippines.

Note — Distinguishable by the minute dark brown or blackish dots, on both surfaces of the leaves, visible with a lens.

#### KEY TO THE SUBSPECIES

- 1a. Leaves 13–28 by 5.5–10 cm. Twigs at apex 4 mm diameter. Swamp forest. — Sumatra ..... **e. subsp. macrophylla**
- b. Leaves up to 20 by 8.5 cm. Twigs at apex 1.5–3 mm diameter ..... 2
- 2a. Twigs 1.5–2 mm diameter, striate. Leaves chartaceous or thinly coriaceous, drying greenish or brownish, with prominent venation above. Leaf base attenuate. Anthers 8–11. Fruits 1.5–2.5 cm; fruiting pedicel 7–15 mm long. — Lowland, but not in peat swamp forest ..... 3
- b. Twigs 2–3 mm diameter, not or but little striate. Leaves thinly to thickly coriaceous, drying brownish, with venation prominent or not above. Leaf base ± rounded, sometimes attenuate. Anthers (7–)10–14. Fruits 1.7–4 cm; fruiting pedicel 3–9(–12) mm long. — Lowland peat swamp forest or montane forest ..... 4
- 3a. Leaves drying greenish, with the nerves and venation paler and contrasting above. — Peninsular Malaysia ..... **a. subsp. kunstleri**
- b. Leaves drying more brownish, the nerves and venation not or but faintly paler, and little contrasting above. — Philippines ..... **f. subsp. parvifolia**
- 4a. [Venation on upper leaf surface little prominent, distinct or indistinct.] Fruits 1.7–2 cm long ..... 5
- b. Fruits 3–4.5 cm long. Plant usually from montane area ..... 6
- 5a. Indumentum of lower leaf surface consisting of scattered scale-like hairs 0.1 mm. — Lowland peat swamp forest or kerangas ..... **c. subsp. coriacea**
- b. Indumentum of lower leaf surface consisting of mixed sessile hairs, 0.1 mm, and few elongate hairs, to 0.3 mm. — Montane areas ..... **g. subsp. pseudostellata**
- 6a. Venation on upper leaf surface prominent and distinct; blade thinly or thickly coriaceous, base generally rounded. Fruits 3–4 cm, apex (subacute or) rounded. Usually in montane forest, at (100–)900–2000 m. — Borneo ..... **b. subsp. alpina**
- b. Venation on upper surface fine and hence indistinct; blade chartaceous (subcoriaceous), base attenuate. Fruits 3.5–4.5 cm long, apex (sub)acute. Hill forest at 750 m. — Eastern W Kalimantan ..... **d. subsp. leptophylla**

#### **a. subsp. kunstleri**

*Knema kunstleri* (King) Warb., Mon. Myrist. (1897) 568, t. 25; Gamble, Mat. Fl. Malay Penins. 5, 23 (1912) 241; Ridl., Fl. Malay Penins. 3 (1924) 69; J. Sinclair, Gard. Bull. Sing. 16 (1958) 291, f. 8; 18 (1961) 236 (as var., p.p., excl. syn. *Gymnacranchera cryptocaryoides* Elmer and all specimens from Borneo and the Philippines, and excl. *Knema kunstleri* var. *surigaoensis*); W.J. de Wilde, Blumea 25 (1979) 468; 43 (1998) 244; Tree Fl. Sabah & Sarawak 3 (2000) 418. — *Myristica kunstleri* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 314, pl. 149.

Twigs 1.5–2 mm diameter, coarsely striate. Leaves chartaceous to thinly coriaceous, elliptic(–oblong), 5–20 by 1.5–8.5 cm, base cuneate or attenuate, apex acute-acuminate; blade drying greenish, midrib, nerves and veins paler and contrasting above; nerves

6–14 pairs; venation prominent above. *Inflorescences*: sessile or all or partly with slender peduncle 1–4 mm long. *Male flowers*: pedicel 8–11 mm long; buds 2.5 by 2.5–3 mm; lobes reddish inside; anthers 8–11. *Female flowers*: pedicel 7–9 mm long. *Fruits* 1.5–2.5(–3.2) by 1–1.8(–2.5) cm; fruiting pedicel 8–15 mm long.

Distribution — *Malesia*: Peninsular Malaysia (Perak, Kelantan, Trengganu, Pahang, Selangor, Negri Sembilan, Malacca, Johore).

Habitat & Ecology — Primary and degraded forest; hill sides, crests, bamboo forest; 0–900 m altitude; fl. mainly Jan.–June; fr. mainly July–Dec.

Notes — 1. Specimens may resemble subsp. *parvifolia* from the Philippines.

2. *Shah & Noor MS 2009* and *FRI 28013*, from Pahang, deviate by the oblong shape and brown drying colour of the leaves, but particularly by large fruits, 3–3.2 by 2.5–2.8 cm; *MS 2007*, from the same locality, is typical *K. kunstleri* subsp. *kunstleri*.

*FRI 8806 (Whitmore)*, from N Johore, is probably of hybrid origin; it is collected at c. 600 m altitude (with immature flowers) and deviates mainly by an oblong-lanceolate leaf shape.

#### b. subsp. *alpina* (J. Sinclair) W.J. de Wilde

*Knema kunstleri* (King) Warb. subsp. *alpina* (J. Sinclair) W.J. de Wilde, *Blumea* 25 (1979) 471; *Tree Fl. Sabah & Sarawak* 3 (2000) 418. — *Knema cinerea* (Poir.) Warb. var. *alpina* J. Sinclair, *Gard. Bull. Sing.* 18 (1961) 287. — Type: *S 4514 (Anderson)*, Sarawak.

*Twigs* sometimes angular, (1.5–)2–3 mm diameter, faintly finely striate. *Leaves* (thickly) coriaceous, elliptic-oblong to oblong-lanceolate, 4–21 by 1.5–7 cm, sometimes broadest below the middle, base rounded to attenuate, apex acute; blade drying brown, with the nerves not or but faintly paler, not much contrasting in colour above, lower surface glabrescent; nerves 10–18 pairs, venation prominent above. *Inflorescences* sessile. *Male flowers*: pedicel 5–8 mm long; buds 3 by 3–4 mm, lobes pale yellowish inside; staminal disc flat or shallowly convex, anthers (7–)10–14. *Female flowers*: pedicel 2–3 mm long. *Fruits* 3–4.2(–4.5) by 2–2.8 cm; fruiting pedicel (3–)5–9(–12) mm long.

Distribution — *Malesia*: Borneo (Sarawak, Brunei, Sabah, W and S Kalimantan).

Habitat & Ecology — (Sub)montane forest, mossy forest, ridges; andesite-derived soils; (100–)900–2000 m altitude; fl. Feb., June, Oct., Nov.; fr. throughout the year.

Notes — 1. Specimens may resemble *K. kinabaluensis*, and can easily be noticed by lacking minute dots on the upper and lower leaf surface.

2. *S 27923 (Ilias Paie)*, Sarawak, differs in thinly (not thickly) coriaceous leaves and proportionally long fruiting pedicels 7–9(–12) mm. *De Vogel 851*, from S Kalimantan at c. 250 m altitude, has chartaceous leaves, non-striate twigs, with the staminal disc somewhat convex, not flat. *Dransfield JD 7129* (male flowers with 7 anthers) and *Prance 30585* (11 anthers), both from Brunei, have leaves glabrescent underneath; they may represent a separate taxon.

#### c. subsp. *coriacea* (Warb.) W.J. de Wilde

*Knema kunstleri* (King) Warb. subsp. *coriacea* (Warb.) W.J. de Wilde, *Blumea* 25 (1979) 470; *Tree Fl. Sabah & Sarawak* 3 (2000) 419. — *Knema coriacea* Warb., *Mon. Myrist.* (1897) 614. — *Myristica coriacea* (Warb.) Boerl., *Handl. Fl. Ned. Ind.* 3, 1 (1900) 92. — Type: *Beccari 670*, Sarawak.



Fig. 39. *Knema kunstleri* (King) Warb. subsp. *leptophylla* W.J. de Wilde. Habit; note the remarkable different stages of development of the fruits on one twig [Church, Ismail, Ruskandi 2489]. — Scale bar = 2 cm.

*Twigs* 2–3 mm diameter, smooth or but faintly striate, sometimes coarsely striate or  $\pm$  angular. *Leaves* coriaceous, elliptic to oblong or ovate-oblong, broadest sometimes below the middle, 6–21 by 3–7.5 cm, base rounded or attenuate, apex acute-acuminate; blade drying light brownish, with the nerves and veins not or but faintly contrasting above; nerves 8–18 pairs; venation prominent above. *Inflorescences* sessile or peduncle stout, up to 5 mm long. *Male flowers*: pedicel 6–10.5 mm long; buds 2.2–2.5 by 2.5–3 mm, lobes creamy inside (always?); anthers 10–12. *Female flowers* not seen. *Fruits* 1.7–2 by 1.4–1.6 cm; fruiting pedicel 3–7(–9) mm long.

Field-notes — Flowers cream inside; fruits ochreous yellow.

Distribution — *Malesia*: Borneo (Sarawak, Brunei, Sabah).

Habitat & Ecology — Tree with stilt-roots in primary *Shorea albida* peat swamp forest; kerangas soil; 0–100 m altitude; fl. Apr.–June; fr. July–Nov.

#### d. subsp. *leptophylla* W. J. de Wilde

*Knema kunstleri* (King) Warb. subsp. *leptophylla* W. J. de Wilde, *Blumea* 41 (1996) 386, f. 2. — Type: Church, Ismail, Ruskandi 2489, Kalimantan.

*Twigs* 1.5–2 mm diameter, early glabrescent, hairs less than 0.1 mm, faintly striate, hardly lenticellate. *Leaves* chartaceous, (oblong-)lanceolate, 8–13 by 1–3 cm, base cuneate, apex (narrowly) acute-acuminate; blade drying bright dark brown, somewhat glossy above, lower surface with sparse brown-centred scale-like hairs less than 0.1 mm; nerves 15–17 per side, venation slightly raised, not very distinct at both surfaces. *Male inflorescences* not known. *Female inflorescences* (immature): few-flowered, peduncle 1–1.5 mm; mature buds not seen, bracteole apical, caducous. Infructescence among the leaves. *Fruits* 1 per infructescence,  $\pm$  fusiform, with sharp edge, 3.5–4.5 by 4.5–2 cm, fruiting pedicel 7–9 mm long, broadened to above, scar of bracteole at or above halfway. — Fig. 39.

Field-notes — Tree 25 m tall, 30 cm dbh. Outer bark reddish brown, flaking in large patches, inner bark salmon. Sap red. Leaves glaucous beneath, dark green above, shiny. Fruits yellowish brown.

Distribution — *Malesia*: Borneo, known only from the type collection, 5 km SW of Uut Labang (W Kalimantan).

Habitat & Ecology — In sloping primary dipterocarp forest, red clay soil, semi-light environment; seldom; 750 m altitude.

Note — The slender twigs, narrow chartaceous leaves and elongate fruits, with very inconspicuous indumentum, give this subspecies a distinctive appearance within the complex entity *K. kunstleri*. Also, the dots on the lower leaf surface (lens!) are finer, and less confined to the smaller veins. Fruits on one twig are in different stages of development. The status of subsp. *leptophylla* is uncertain because it is known only from a single fruit gathering.

#### e. subsp. *macrophylla* W. J. de Wilde

*Knema kunstleri* (King) Warb. subsp. *macrophylla* W. J. de Wilde, *Blumea* 25 (1979) 469. — Type: Buwalda 6782, Sumatra.

*Twigs* 4 mm diameter, coarsely striate. *Leaves* chartaceous, elliptic-oblong, 13–28 by 5.5–10 cm, base rounded, apex acute-acuminate; blade drying (greenish) brown, with



the nerves (not the venation) sometimes paler coloured above; nerves 8–15 pairs; venation fine, prominent above. *Inflorescences* sessile. *Male flowers*: pedicel 10–12 mm long; buds 2–2.3 by 2.8–3 mm; lobes reddish (?) inside; anthers 10. *Female flowers* and *fruits* not seen.

Field-notes — Leaves white at underside. Flower buds brown-yellow.

Distribution — Possibly Thailand, and *Malesia*: Central Sumatra (Indragiri).

Habitat & Ecology — Lowland swamp forest; fl. May.

Note — Known only from the type collection. Closely related to subsp. *kunstleri*, though distinguishable by a stout habit, with the twigs considerably thicker and the leaves much larger, with a more brownish drying colour; the contrasting paler venation absent. The male flowers are similar to those of subsp. *kunstleri*.

#### f. subsp. *parvifolia* (Merr.) W.J. de Wilde

*Knema kunstleri* (King) Warb. subsp. *parvifolia* (Merr.) W.J. de Wilde, Blumea 25 (1979) 470. — *Knema parvifolia* Merr., Philipp. J. Sci., Bot. 13 (1918) 287; Enum. Philipp. Flow. Pl. 2 (1923) 184. — Type: *FB 10573* (Curran), Luzon.

*Twigs* (1–)1.5–2 mm diameter, coarsely striate or grooved. *Leaves* membranous or chartaceous, ovate-oblong to lanceolate, 4–11 by 1.5–5 cm, base cuneate to attenuate, apex subobtuse, acute(-acuminate); blade drying ± greenish brown to bright brown above; nerves and veins not distinctly paler and not much contrasting in colour above; nerves 8–14 pairs; venation coarse to very fine, prominent and distinct. *Inflorescences* sessile or peduncle up to 4 mm. *Male flowers*: pedicel 7–10 mm long; buds 2.5 by 2.5–3 mm, lobes reddish (?) inside; anthers 8–11. *Female flowers* not seen. *Fruits* 1.5–1.7 by 1.3–1.5 cm; fruiting pedicel 7–11 mm long.

Distribution — *Malesia*: Philippines (Luzon, Samar).

Habitat & Ecology — Primary dipterocarp forest; 0–300 m altitude; fl. June, Nov.–Dec.; fr. Mar.–May.

Note — This subspecies often resembles subsp. *kunstleri*, from which it differs in a number of ill-defined characters, including the thinner leaves and the lacking of much paler contrasting venation, which is typical in subsp. *kunstleri*.

#### g. subsp. *pseudostellata* W.J. de Wilde

*Knema kunstleri* (King) Warb. subsp. *pseudostellata* W.J. de Wilde, Blumea 43 (1998) 244. — Type: *Church c.s. 2560*, Kalimantan.

*Twigs* 2 mm diameter, finely striate. *Leaves* coriaceous, oblong, 10–15 by 2.5–4.5 cm, base subcuneate to broadly rounded; drying olivaceous-brown, lateral nerves c. 15 per side, flat and indistinct above, reticulation hardly visible; lower surface with persistent open indumentum of minute stellate hairs, 0.1 mm long, mixed with dendroid hairs 0.3 mm long. *Male inflorescences* and *flowers* not known. *Female inflorescences* axillary of leaves, sessile, wart-like, 2 mm diameter, with 1 (or 2) flowers. *Female flowers*: pedicel 3 mm long. *Fruits* solitary, long-ellipsoid, 2 by 1 cm; fruiting pedicel 4–5 mm, with bracteole scar subapical.

Field-notes — Tree 9 m tall, 10 cm dbh. Inner bark light orange. Sap red. Leaves fleshy, glaucous beneath, dark green above. Fruits covered by rusty indumentum.

Distribution — Malesia: Borneo (eastern W. Kalimantan, Serawai); known only from the type specimen.

Habitat & Ecology — Primary forest; fagaceous and hill dipterocarp forest (with *Shorea*, *Dipterocarpua*, *Quercus*, *Lithocarpus*); ridge and hillside forest; red clay soil; not common; 1200 m altitude; fl. & fr. Oct.

Note — Subsp. *pseudostellata* superficially is reminiscent of *K. stellata* (Philippines).

## 25. *Knema lamellaria* W.J. de Wilde

*Knema lamellaria* W.J. de Wilde, Blumea 25 (1979) 389. — Type: FRI 3482 (Whitmore), Peninsular Malaysia.

Tree 10–20 m. Twigs 7–12 mm diameter, at first with coarse rusty hairs 1–2 mm long, glabrescent; bark pale- or grey-brown, glabrous, not or hardly striate, coarsely flaking. Leaves chartaceous or coriaceous, oblong(-lanceolate), 45–65 by 13–24 cm, apex bluntish to acute-acuminate, base broadly rounded or cordate, with the basal nerves  $\pm$  crowded, when immature with dense hairs 2 mm long, early glabrescent, dull greenish to brown above; lower surface glabrous, faintly papillate or not; dots absent; midrib stout, raised above; nerves 21–30 pairs, raised; venation distinct; petiole at first with dense rusty hairs 1–2 mm long, late glabrescent, 15–20 by 8–10 mm. Inflorescences: sessile, brachyblast simple or warty, 10–15 mm diameter, in male (5–)10–25-flowered, female 2–6-flowered; flowers with dense  $\pm$  woolly hairs 0.8–1 mm long, for the larger part early glabrescent or easily rubbed off; perianth 3-lobed, inside at base ridged or coarsely striate, reddish (?). Male flowers: pedicel 16–21 mm long, bracteole subpersistent, about median; buds  $\pm$  depressed globose-obovoid, 7 by 8 mm, cleft 3/4–4/5, lobes 0.5–1 mm thick; staminal disc circular, flat, 3.5 mm diameter; anthers c. 20, subsessile or just stiped, nearly horizontal, 0.6 mm, not touching; the androphore tapering, 1.5 mm long, striate. Female flowers not seen. Fruits 1–3 per infructescence, obovoid or oblong, 4–4.5 by 2–2.6 cm, with dense coarsely woolly brown hairs 3–5 mm long, caducous or easily rubbed off; dry pericarp 3 mm thick; fruiting pedicel 18–25 mm long, with the scar of the bracteole at or somewhat above halfway.

Field-notes — Bark black-brown, with brittle rectangular flakes; copious red sap; slash wood white.

Distribution — Malesia: Peninsular Malaysia (Pahang, Trengganu).

Habitat & Ecology — Flat or undulating lowland forest, once at base of limestone rock; 100–200 m altitude; fl. Mar.; fr. June–July.

Note — *Knema lamellaria* is related to *K. lampongensis* from Sumatra and *K. pallens* from Borneo; it resembles also *K. furfuracea*, with smaller flowers.

## 26. *Knema lampongensis* W.J. de Wilde

*Knema lampongensis* W.J. de Wilde, Blumea 25 (1979) 388. — Type: Iboet 159, Sumatra.

Tree 10–15 m. Twigs 5–10 mm diameter, at first with dense conspicuous rusty hairs 1–2.5 mm long, glabrescent; bark hardly striate, lower down reddish brown to blackish, conspicuously flaking. Leaves chartaceous or coriaceous, oblong(-oblanceolate), 23–36 (–56) by 5–12(–14) cm, apex acute(-acuminate), base rounded to cordate, with the basal nerves somewhat crowded; greenish brown, and  $\pm$  glossy above; lower surface glabrous,

finely papillate; dots absent; midrib distinctly raised above; nerves 17–25 pairs, raised; venation fine or coarse, faint; petiole late glabrescent, 10–16 by 4–5 mm. *Inflorescences*: sessile, brachyblast simple or up to 7-furcate or warty, 5–15 mm long, in male 2–5 (–30)-flowered, female 2–5-flowered; flowers with persistent brown hairs 0.7–1.2 mm long; perianth 3-lobed, at base somewhat thickened and coarsely striate or grooved into separate pads, red(?) inside. *Male flowers*: pedicel 7–9 mm long, bracteole caducous or subsistent, about median or below; buds  $\pm$  depressed globose-obovoid, 5–6 by 5–6.5 mm, cleft 2/3–3/4, lobes 1 mm thick; staminal disc faintly triangular, flat, 2–2.5 mm diameter; anthers 13 or 14, subsessile, almost horizontal, 0.5–0.7 mm, not touching; androphore tapering, striate, 1–1.5 mm long. *Female flowers* not seen. *Fruits* 1 or 2 per infructescence, obovoid or subglobose, 2.5 by 2 cm, with dense dark brown hairs 0.6–1 mm long; dry pericarp 2.5 mm thick; fruiting pedicel 10 mm long; stigma remnants many-lobulate, sessile.

Distribution — *Malesia*: Sumatra (E Coast, Palembang, Lampung, Riau Arch.); Anambas Is.

Habitat & Ecology — Lowland and hill forest, 100–300 m altitude; fl. Apr., Nov.

Note — *Knema lampongensis* is more or less intermediate between the species *K. furfuracea*, *K. lamellaria*, and *K. pallens*, morphologically as well as geographically; for differentiating characters see the key to the species.

## 27. *Knema latericia* Elmer

*Knema latericia* Elmer, Leaf. Philipp. Bot. 5 (1913) 1815; J. Sinclair, Gard. Bull. Sing. 16 (1958) 278, f. 3, pl. IIA; 18 (1961) 238, f. 15B, C, G, excl. var. *lunduensis* J. Sinclair; W.J. de Wilde, Blumea 25 (1979) 395; 43 (1998) 245; Tree Fl. Sabah & Sarawak 3 (2000) 419. — Type: *Elmer 12757*, Philippines, Palawan.

For more references and synonyms see the subspecies and varieties.

Erect shrub or tree 2–20 m. *Twigs* (1–)2–4 mm diameter, sometimes  $\pm$  angular, at first with rough, rusty, grey-brown, or yellowish brown hairs 0.5–2 mm long, glabrescent; bark striate or fissured, cracking, later on coarsely or finely flaking, or not. *Leaves* membranous or thinly coriaceous, oblong to (ob)lanceolate (broadest below the middle in subsp. *latericia*), 8–30 by 1.5–9 cm, apex acute(-acuminate), base attenuate to rounded, drying brown or greenish above; lower surface glabrous, grey(-brown) or whitish, not obviously papillate; dots absent; midrib raised above (when dry reddish in subsp. *ridleyi*, pale brown or whitish in subsp. *albifolia*); nerves 9–25(–30) pairs, raised; venation faint or distinct; petiole (5–)10–18 by 1.5–3.5 mm. *Inflorescences*: sessile, brachyblast simple, warty or furcate, up to 10 mm long, in male 3–20-flowered, female 2–10-flowered; flowers with pale brown to rusty hairs 0.2–0.7 mm long; perianth 3- (or 4-)lobed, red inside. *Male flowers*: pedicel 2–6 mm long, bracteole caducous, median to subapical; buds depressed obovoid (subsp. *albifolia*) or depressed globose, 3–3.5 by (3–)4–4.5 mm, cleft 2/3–4/5, lobes 0.5(–1) mm thick; staminal disc circular, flat,  $\pm$  convex, or low-mammillate, 2 mm diameter; anthers 9–12, shortly stiped, 0.5 mm long, horizontal, not touching; androphore 1 mm long. *Female flowers*: pedicel to 1.5 mm long, bracteole subapical; buds much larger than in male, obovoid, 5–8 by 4–5 mm, cleft 1/3–2/3, lobes 0.5–1 mm thick; ovary subglobose to ovoid, 2.5–3 mm long; the stigma subsessile,  $\pm$  2-lobed and each lobe again deeply (3–)4–6-serrate. *Fruits* 1–4 per infructescence,

broadly ellipsoid to obovoid, sometimes subglobose, apex rounded, (1–)1.5–3 by 1–2.5 cm, with rough hairs 1–2 mm long; dry pericarp (1–)2–3 mm thick, the fruiting pedicel 2–5 mm long.

Field-notes — Slender tree, pyramidal in outline; trunk without buttresses; bark (reddish) brown or chocolate, scaly or flaking in fairly large elongate portions, not furrowed; inner bark pink or reddish, sapwood white, pale yellow, or pale brown, sometimes with streaks. Leaves dark green with whitish green midrib above, glaucous beneath. Flowers outside yellow brown or rusty, red inside; disc pink. Fruits yellow brown or dark rusty.

Distribution — Peninsular Thailand; in *Malesia*: Sumatra (Bangka, no specimens seen), Peninsular Malaysia, Singapore, Borneo, Palawan.

Habitat & Ecology — Primary and degraded forest; on hill sides, ridges, etc., dipterocarp forest, also in kerangas; found on a variety of soils: sand, loam, clay, black and brown soils, limestone, sandstone, basalt hills, well-drained soils, and leached soils; 0–1500 m altitude; fl. & fr. throughout the year, in Borneo mainly May–Oct.

Note — *Knema latericia* is a complex species in which three subspecies are recognized. Subsp. *latericia* (with 2 varieties), from Palawan, has twigs with non-flaking bark, and therefore *K. latericia* appears twice in the general key to the species.

#### KEY TO THE SUBSPECIES

- 1a. Bark of older twigs not or hardly longitudinally cracking, nor flaking. Twig apex coarsely rusty pubescent, striate or ridged,  $\pm$  angled. [Male buds pear-shaped; staminal disc  $\pm$  flat above.] — Palawan . . . . . **a. subsp. *latericia***
- b. Bark of older twigs usually longitudinally cracking, later on (finely) flaking (not flaking in subsp. *ridleyi* forma *nana*). Twig apex variably hairy, striate or not, not angled . . . . . **2**
- 2a. Indumentum of twig apex and flowers dark brown. Male buds obconical or globose, often somewhat broader than long. Leaves usually large, 4–10 cm broad, drying dark (greenish) brown above, pale brown or grey-glaucous beneath. Fruits variable of size, with brown to rusty-reddish indumentum. — Peninsular Thailand and Malaysia, Bangka, Borneo . . . . . **c. subsp. *ridleyi***
- b. Indumentum of twig apex and flowers pale or yellowish brown. Male buds obovoid. Leaves generally smaller, 11–22 by 2–5 cm, drying pale (greenish) brown above, whitish beneath. Fruits 1.4–2(–3.5) cm long, with pale or yellowish brown indumentum. — Borneo . . . . . **b. subsp. *albifolia***

#### **a. subsp. *latericia***

*Knema latericia* Elmer subsp. *latericia*; W.J. de Wilde, Blumea 25 (1979) 396; 32 (1987) 115, f. 1. — *Knema latericia* Elmer var. *latericia*; J. Sinclair, Gard. Bull. Sing. 18 (1961) 240, p.p., for the type only.

Twigs  $\pm$  angled, at apex roughly rusty tomentose; bark coarsely striate, not or hardly finely cracking, nor flaking. Leaves 5–25 by 1–6 cm, drying dark brown with brownish midrib, with fine prominent reticulation above, greyish beneath. Male flowers with dense coarse dark rusty hairs 0.7 mm long, pedicel 1–2 mm long with bracteole subapical to median, persistent; buds depressed-obovoid to pear-shaped, 3.5 by 3.5 mm, cleft c. 2/3,



J.v.G.'86

lobes 3, red inside, 0.5 mm thick; staminal disc faintly triangular, flat, 1.5–2 mm diameter; anthers 7–9, shortly stiped, horizontal, 0.5 mm long, mutually not touching; androphore 1–1.5 mm long. *Female buds*: 5.5 mm long, sessile. *Fruits* broadly ellipsoid, 1.5–2 cm long, with rusty indumentum.

Note — Delicate specimens are segregated as variety *subtilis*.

#### a1. var. *latericia*

Twigs at apex 2–4 mm diameter; bark not or hardly cracking, not flaking. *Leaves* chartaceous, 7–25 by 2.5–6 cm, lateral nerves 11–18 pairs. *Fruits* 2 cm long, hairs 0.5–1 mm long. — Fig. 40a–d.

Distribution — *Malesia*: Philippines (Palawan).

Notes — 1. Resembles vegetatively (leaves) *K. tomentella* (Moluccas); the twig apex is reminiscent of *K. korthalsii* (Palawan and Borneo).

2. In the obovoid male buds subsp. *latericia* agrees with subsp. *albifolia*, rather than with subsp. *ridleyi* which has depressed-globose male buds.

#### a2. var. *subtilis* W.J. de Wilde

*Knema latericia* Elmer subsp. *latericia* var. *subtilis* W.J. de Wilde, Blumea 32 (1987) 118, f. 1e; 41 (1996) 388. — Type: SMHI 1642 (*Ridsdale c.s.*), Palawan.

Twigs 1–1.5 mm diameter; bark of older twigs striate, not flaking. *Leaves* membranous, small, elliptic to lanceolate, 5–13.5 by 1–4.5 cm, lateral nerves 8–12 pairs. *Fruits* ellipsoid, 1.5–2 by 1.2 cm, indumentum of rough hairs 0.5(–1) mm long. — Fig. 40e.

Field-notes — Small tree, leaves pallid blue-green at underside, fruits brown.

Distribution — *Malesia*: Philippines (Palawan); possibly Sarawak and Brunei, see note 2.

Habitat & Ecology — On primary and logged ridges in broad-leaved dipterocarp forest, once recorded from limestone; 0–100 m altitude; fl. & fr. Apr.

Notes — 1. The occurrence of var. *subtilis* may be related to the nature of the bedrock, possibly limestone. It much resembles the delicate species *K. stenocarpa* from the Sulu Is. and Mindanao.

2. Some delicate specimens from Brunei and Sarawak, discussed by De Wilde (1996), approach var. *subtilis*.

#### b. subsp. *albifolia* (J. Sinclair) W.J. de Wilde

*Knema latericia* Elmer subsp. *albifolia* (J. Sinclair) W.J. de Wilde, Blumea 25 (1979) 397; 43 (1998) 246, f. 1a; Tree Fl. Sabah & Sarawak 3 (2000) 420. — *Knema latericia* Elmer var. *albifolia* J. Sinclair, Gard. Bull. Sing. 18 (1961) 243, f. 15C. — Type: Sinclair 9269, Sabah.

Fig. 40. *Knema latericia* Elmer subsp. *latericia* var. *latericia*. a. Habit of male flowering branchlet, note finely striate bark, not flaking; b. male bud; c. ditto, longitudinally opened, showing position of androecium; d. androecium. — *K. latericia* subsp. *latericia* var. *subtilis* W.J. de Wilde. e. Fruiting branchlet [a–d: SMHI 693 (*Podzorski*); e: SMHI 1642 (*Ridsdale*)]. — Scale bar for a, e = 2 cm; for b, c = 1.6 mm; for d = 0.9 mm.



Twigs 1–2 mm diameter, with fine, pale grey-brown or yellowish brown scurfy indumentum; bark coarsely striate or ridged, later on longitudinally cracking and flaking. *Leaves* narrow, 11–22 by 2–5 cm; drying pale (greenish) brown above, midrib pale, venation fine, distinct, whitish beneath. *Male flowers*: pedicel short, with pale hairs; buds more or less depressed obovoid; staminal disc rather flat or slightly convex; anthers 10. *Female flowers*: buds 5 mm long. *Fruits* (sub)sessile, subglobose, ellipsoid, or obovoid, 1.4–2(–3.5, see note) cm long, with bright (yellowish) brown indumentum. — Fig. 41a.

Distribution — *Malesia*: Borneo (Sarawak; S & E Kalimantan, Nunukan Is.; Sabah).

Note — This subspecies is marked by a paler colour in diverse parts, and narrower leaves; the shape of the male buds is depressed obovoid, not depressed (sub)globose, and the staminal disc is rather flat, not (low) mammillate. Several specimens apparently seem to be ± intermediate with subsp. *ridleyi*. The collection *Argent & Saridan 9333* from Central Kalimantan differs in its large fruits, 3.5 cm long.

c. subsp. *ridleyi* (Gand.) W.J. de Wilde

*Knema latericia* Elmer subsp. *ridleyi* (Gand.) W.J. de Wilde, *Blumea* 25 (1979) 396; 27 (1981) 223; 43 (1998) 246; *Tree Fl. Sabah & Sarawak* 3 (2000) 420. — *Myristica ridleyi* Gand., *Bull. Soc. Bot. Fr.* 66 (1919) 226, in clavi. — Type: *Ridley s. n.*, Singapore.

*Knema conferta* (King) Warb. var. *borneensis* Warb., *Mon. Myrist.* (1897) 580, p.p. — *Myristica conferta* King var. *borneensis* (Warb.) Boerl., *Handl. Fl. Ned. Ind.* 3, 1 (1900) 1. — Lectotype: *Beccari 2003*, Sarawak.

*Knema meridionalis* J. Sinclair, *Gard. Bull. Sing.* 13 (1951) 297, f. 1. — Type: *SF 38561 (Sinclair)*, Singapore.

*Knema latericia* Elmer var. *latericia* auct.: J. Sinclair, *Gard. Bull. Sing.* 18 (1961) 240, f. 15B, F, G, p.p., excl. type.

[*Knema elongata* Warb., nom. nud. in sched.]

Twigs 1.5–4(–8) mm diameter, variably rusty tomentose, not angled; bark striate, lower down longitudinally cracking and flaking (not flaking in forma *nana*). *Leaves* 4–10 cm broad; drying dark brown with brownish midrib above, venation distinct or not, grey-brown beneath. *Male flowers*: pedicel 5 mm long; buds obconical or globose; staminal disc flat or low-mammillate; anthers 9–12. *Female flowers*: buds 5–8 mm long; pedicel up to 1.5 mm long. *Fruits* variable, (1–)1.5–3 cm long, with coarse rusty indumentum.

Distribution — Peninsular Thailand (one deviating specimen); in *Malesia*: Sumatra (N Sumatra, E Coast, Bangka), Peninsular Malaysia (Kedah, Perak, Trengganu, Johore), Singapore, Borneo (Sarawak, S & SE, E & NE Kalimantan, Sabah).

Note — Robust sterile forms can easily be confused with small-leaved specimens of the related *K. lunduensis*.

Fig. 41. Some taxa of *Knema* likely to be confused in the vegetative state. — a. *K. latericia* Elmer subsp. *albifolia* (J. Sinclair) W.J. de Wilde, mature fruit. — b. *K. latericia* subsp. *ridleyi* (Gand.) W.J. de Wilde forma *nana* W.J. de Wilde, mature fruit. — c. *K. minima* W.J. de Wilde, fruit slightly immature. — d. *K. tridactyla* Airy Shaw aff. subsp. *sublaevis* W.J. de Wilde [a: *SAN 38982*; b: *Wong WKM 1411*; c: *Kesler c.s. 394*; d: *Wong WKM 1366*]. — Scale bar for all = 2 cm.



## KEY TO THE FORMS

- 1a. Bark of older twigs thinly flaking. Leaves (15–)20–35 by 4–9 cm . . . . . 2  
 b. Bark not flaking. Leaves smaller, 6–15 by 1–1.5(–2) cm, lanceolate. — E Sarawak, Brunei . . . . . **c2.** subsp. **ridleyi** forma **nana**
- 2a. Plants rather stout. Leaves drying olivaceous. — E Sabah, SE Kalimantan . . . . .  
 . . . . . **c3.** subsp. **ridleyi** forma **olivacea**  
 b. Plants of variable habit. Leaves drying (dark) brown. — S Thailand, Peninsular Malaysia, Sumatra, Borneo . . . . . **c1.** subsp. **ridleyi** forma **ridleyi**

**c1.** subsp. **ridleyi** forma **ridleyi**

Description as the subspecies, excluding the main differentiating characters as in the key to the forms.

Distribution — S Thailand; *Malesia*: Sumatra, Peninsular Malaysia, Borneo.

**c2.** subsp. **ridleyi** forma **nana** W.J. de Wilde

*Knema latericia* Elmer subsp. *ridleyi* (Gand.) W.J. de Wilde forma *nana* W.J. de Wilde, Blumea 43 (1998) 246, f. 1b. — Type: *Anderson K 10*, Sarawak.

Tree 7–18 m. *Twigs* towards apex 1.5–2 mm diameter, at first with rusty indumentum, hairs 0.5–1 mm long; bark of older twigs finely striate, not flaky. *Leaves* thinly coriaceous, (oblong-)lanceolate, 6–15 by 1–1.5(–2) cm, base (narrowly) attenuate, drying (light) brown above, pale brown beneath. *Male perianth* buds 3 by 4 mm, pedicel 2–2.5 mm long; anthers 6 or 7. *Female perianth* 4 mm long. *Fruits* obovoid, 1.3–1.8 by 1–1.2 cm, with rusty indumentum of rough hairs 1 mm long. — **Fig. 41b.**

Field-notes — Bark smooth or slightly flaky. Leaves glaucous below.

Distribution — *Malesia*: Borneo (E Sarawak: Mt Mulu area; Brunei, Sabah).

Habitat & Ecology — Hill dipterocarp forest, ridge and hillside forest, sandy-clay soil; 300–550 m altitude; fl. July; fr. July, Sept., Oct.

**c3.** subsp. **ridleyi** forma **olivacea** W.J. de Wilde

*Knema latericia* Elmer subsp. *ridleyi* (Gand.) W.J. de Wilde forma *olivacea* W.J. de Wilde, Blumea 43 (1998) 248. — Type: *Endert 3342*, Borneo, W. Kutai.

Tree 3–10 m. *Twigs* at apex 3–4(–6) mm diameter, with dense rusty or light brown indumentum with hairs 0.5(–1) mm long; bark lower down longitudinally cracking and flaking. *Leaves* thinly coriaceous, (15–)20–35 by 4–9 cm; upper surface drying olivaceous, lower surface pale grey-brown; nerves 14–16(–22?) pairs, yellowish brown, contrasting; petiole late glabrescent. *Inflorescences*, *male* and *female flowers* as in the type form of subsp. *ridleyi*. *Fruits* ellipsoid, 2–3.5 cm long, indumentum of hairs (0.5–)1 mm long.

Field-notes — Treelet, bark smooth or scaly; living bark 13 mm, light red; leaves blue-green below. Flowers rusty, inside pink. Fruits brown.

Distribution — *Malesia*: Borneo (Sabah, E & SE Kalimantan).

Habitat & Ecology — Flat and hilly country; in forest on sand- or limestone; altitude 10–700 m; fl. July, Nov.; fr. June, Sept.

Note — Specimens of forma *olivacea* were previously included in subsp. *ridleyi*, but differ in the distinctive pale greenish drying colour of the leaves. The fruits possibly are slightly larger than those in forma *ridleyi*.

## 28. *Knema latifolia* Warb.

*Knema latifolia* Warb., Mon. Myrist. (1897) 610, t. 25; J. Sinclair, Gard. Bull. Sing. 18 (1961) 244, f. 16; W.J. de Wilde, Blumea 25 (1979) 414, f. 7; Tree Fl. Sabah & Sarawak 3 (2000) 421. — Syntypes: *Forbes 2997, 3188*, Sumatra; *Beccari 1991*, Sarawak.

*Knema umbellata* Warb., Mon. Myrist. (1897) 609. — *Myristica umbellata* (Warb.) Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 92, nom. inval. — Type: *Beccari 1894*, Sarawak.

*Knema nitida* Merr., J. Straits Branch Roy. Asiat. Soc. no 85 (1922) 190. — Type: *Ramos 1530*, Sabah.

*Knema winkleri* Merr., J. Straits Branch Roy. Asiat. Soc. no 85 (1922) 189. — Type: *Winkler 2390*, Kalimantan.

Tree 4–20 m. Twigs (1–)2–3 mm diameter, at first with minute greyish hairs 0.1 mm long, early glabrescent; bark finely or coarsely striate, sometimes faintly cracking, not flaking. Leaves (thinly) coriaceous, (elliptic-)oblong to obovate-oblong, (7–)10–30 by (2.5–)4.5–12.5 cm, apex broadly acute(-acuminate) or subobtuse, base attenuate to rounded; greenish brown to blackish, often glossy above; lower surface grey or pinkish brown, at first with sparse stellate scale-like hairs 0.1 mm long, early glabrescent; dots absent; midrib ± raised above; nerves 8–16 pairs, slightly raised above; venation distinct above; petiole 15–30 by 2–4 mm. Inflorescences: sessile or pedunculate up to 5 mm, brachyblast simple or 2–4-furcate, to 8 mm long; in male 5–15-flowered, female 1–5-flowered; flowers with grey-brown stellate hairs 0.1(–0.2) mm long or less, subglabrescent; perianth 3- (or 4-)lobed, pale yellowish inside (always?). Male flowers: pedicel 5–10 mm long, bracteole subpersistent, subapical; buds depressed globose or broadly (ob)ovoid, ± trigonous, 2.5–3.5 by 3.5–5 mm, cleft 4/5(–5/6), lobes 0.5–1 mm thick; staminal disc sharply 3- (or 4-)angled, flat or slightly convex, 2–2.5 mm diameter; anthers 3 (or 4), sessile below the angles of the disc, horizontal, 0.5–1 mm long, not touching; androphore slender, 0.5–1 mm long. Female flowers: pedicel (4–)5–10 mm long, bracteole median or above; buds ellipsoid-obovoid, with a faint constriction below the middle, 5–7 by 4 mm, cleft 2/3–3/4, lobes 1 mm thick; ovary ovoid, 2–2.5 mm long; style 0.5–0.8 mm long; stigma fleshy, ± 2-lobed and each lobe again (2–)3–5-lobulate. Fruits 1 or 2 per infructescence, globose-ellipsoid or ellipsoid-oblong, somewhat flattened, often ridged, often somewhat saccate at base, 2–3.5 by 2–3 cm; dry pericarp 2–3 mm thick, with grey to rusty hairs 0.1–0.2 mm long, subglabrescent; fruiting pedicel 7–20 mm long. — Fig. 34c, 42.

Field-notes — Bole without buttresses; crown cylindrical or pyramidal; bark nearly smooth, peeling in narrow strips; inner bark brittle, pinkish, red, or light brown; wood off-white, pale yellow, or pinkish. Leaves very glossy green above, grey-green or glaucous beneath; midrib yellow-green, drying brown to red-brown beneath. Flowers outside (yellowish) green, yellowish inside. Fruits yellow or (orange-)brown, the furry greyish to rusty.

Distribution — *Malesia*: Sumatra (Palembang) and Borneo (Kalimantan, Nunukan Is., Sarawak, Brunei, Sabah).

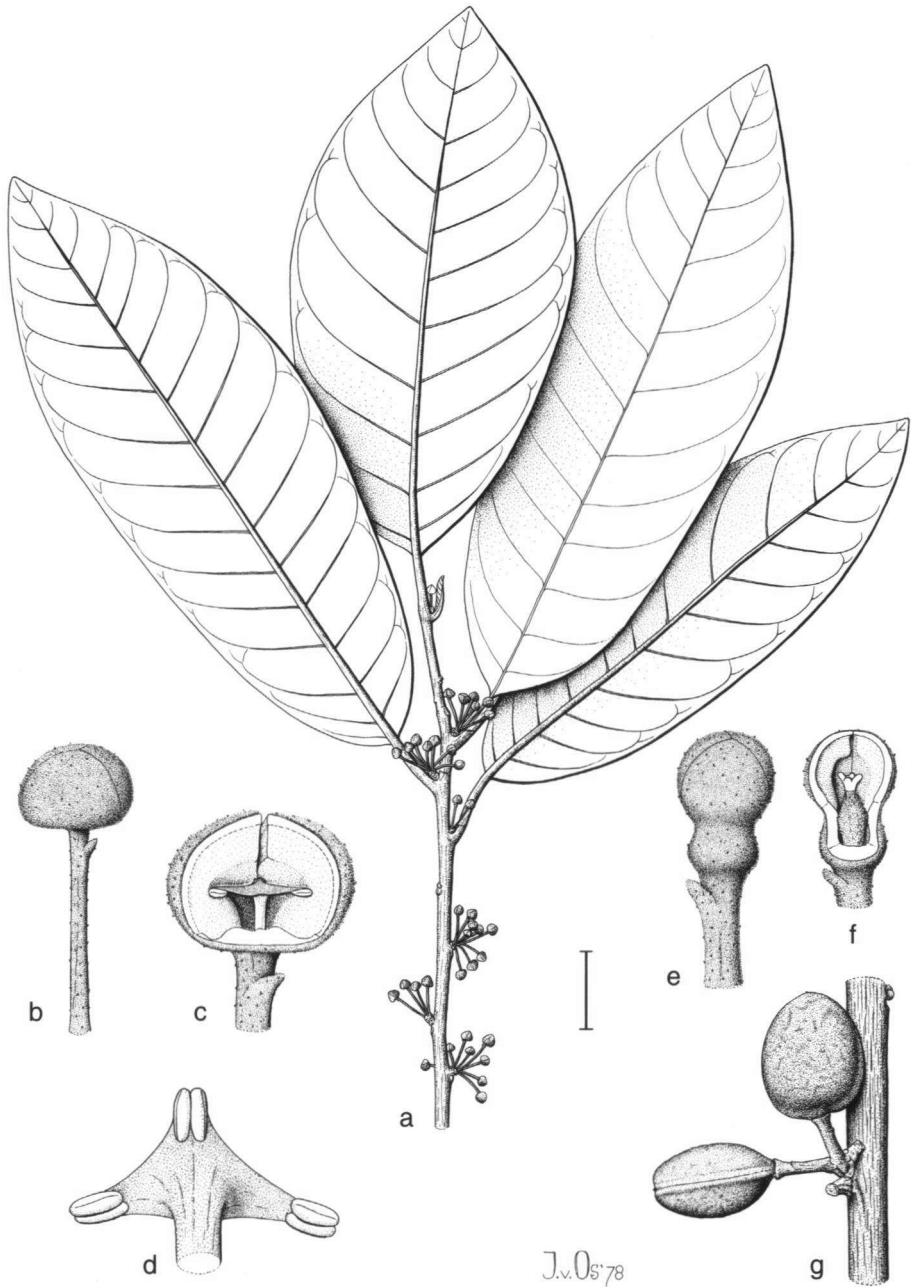


Fig. 42. *Knema latifolia* Warb. a. Twig with male inflorescences; b. male bud; c. opened male bud showing the androecium; d. androecium, seen from  $\pm$  below; e. female bud; f. opened female bud showing the pistil; g. infructescence [a–d: SAN 51920; e, f: S 15642; g: SAN 82573]. — Scale bar for a, g = 2 cm; for b, e, f = 2.8 mm; for c = 1.4 mm; for d = 0.66 mm.

**Habitat & Ecology** — Primary or degraded lowland forest; forest on hill sides, ridges, low undulating ground, sometimes swamp forest; mixed dipterocarp forest, *Agathis* forest; on loam-, clay-, sand-, acid-, and lime-containing soils; 0–500 m altitude; fl. throughout the year; fr. mainly Aug.–Dec.

**Notes** — 1. *Knema latifolia* is a well-defined species characterized by only 3 (or 4) anthers, one at each angle of the triangular staminal disc. The fruits are somewhat flattened, ridged, and saccate at the base. The leaves are dry dark brown or blackish, glossy above, with distinct coarse venation.

2. *Winkler 2390*, type of synonym *K. winkleri*, contains some 4-merous flowers, with a 4-angular disc and 4 anthers.

## 29. *Knema laurina* (Blume) Warb.

*Knema laurina* (Blume) Warb., Mon. Myrist. (1897) 606, t. 24 (excl. var. *malayana*, p. p.; incl. var. *amboinensis*, *bancana*, *borneensis*); W. J. de Wilde, Blumea 25 (1979) 379; Tree Fl. Sabah & Sarawak 3 (2000) 421. — *Myristica laurina* Blume, Rumphia 1 (1835) 189, t. 61. — Type: *Blume s. n.*, Java.

For more references and synonyms see the varieties.

Shrub or tree 3–20(–30) m. *Twigs* 2–5 mm diameter, at first with dense, rough, rusty hairs 0.5–2 mm long, late glabrescent; bark smooth or striate, not tending to crack or flake. *Leaves* membranous or coriaceous, obovate-elliptic to oblong-lanceolate, 9–30 by 2.5–10.5 cm, base attenuate, rounded, obtuse, rarely subcordate, apex subobtusate to acute-acuminate; drying greenish to brown above, lower surface finely papillate, with persistent ± equally long-stalked dendroid hairs 1 mm long (var. *laurina*), or hairs of mixed sizes, sessile and stalked dendroid (var. *heteropilis*); dots absent; midrib ± raised above, late glabrescent; nerves 12–28 pairs, flat or sunken above; venation raised, clearly visible above; petiole late glabrescent, 10–20 by 1.5–3.5 mm. *Inflorescences*: sessile or pedunculate up to 0.5 mm, brachyblast simple or 2-fid, to 7 mm long, in male 5–20-flowered, female 3–8-flowered; flowers with dense rusty hairs 0.5–1.5(–2) mm long; perianth 3-lobed, pink or red inside. *Male flowers*: pedicel (0.5–)2–5 mm long, bracteole subpersistent or caduous, (nearly) apical; buds obovoid(-oblong), 3–5(–6) by 2–4 mm, cleft c. 1/2, lobes 0.5–1 mm thick; staminal disc circular, flat or slightly concave, 1–1.5 mm diameter; anthers 6–9, sessile, (sub)erect, 0.3–1 mm long, not or little touching; androphore somewhat tapering, 1.5–2.5 mm long, rarely minutely pubescent at the base. *Female flowers*: pedicel to 1 mm long, bracteole apical; buds ovoid(-oblong), 4–6 by 2.5–3.5 mm, cleft c. 1/2, lobes 0.5(–1) mm thick; ovary subglobose, (1.5–)2–2.5 mm diameter; style slender, including 2-lobed stigma (1–)1.5–2 mm long, each lobe ± erect, 4-lobulate. *Fruits* 1–5 per infructescence, ovoid or ellipsoid(-oblong), apex obtuse to subacute, 1.5–2.5(–3) by 1–2 cm, with rusty hairs 1–3 mm long; dry pericarp 1.5–2 mm thick; fruiting pedicel 1(–5) mm long.

**Field-notes** — Bark grey or (reddish) brown, essentially smooth but fine scaly or slightly cracked, sometimes furrowed; inner bark reddish; sapwood white, yellowish, red with brown rays, light brown, or yellow with brown stripes. Leaves glossy above, glaucous with yellowish veins beneath. Flowers pink or red inside. Fruits up to 3.5 by 3 cm, yellow, golden brown, or red-brown hairy.

Distribution — Peninsular Thailand; in *Malesia*: Sumatra (incl. Simeulue, Siberut, Bangka), Peninsular Malaysia, W and C Java, Borneo (incl. Anambas, Karimata, and Nunukan Is.).

Habitat & Ecology — Primary and degraded rain forest; mixed dipterocarp forest; found on a variety of soils: sand, sandstone, sandy ridges, granitic sand, basalt-derived soils, black soil, yellow clayey soil, and shales; 0–1000(–1500) m altitude; fl. & fr. throughout the year.

Note — *Knema laurina* may be confused with other species, e.g. *K. pseudolaurina* and *K. conferta*, with persistent indumentum on the lower leaf surface. *Knema pseudolaurina* has mainly sessile stellate hairs. *Knema conferta* differs essentially in the shape of the male buds, and by the dark dots on the lower leaf surface.

#### KEY TO THE VARIETIES

- 1a. Lower leaf surface with predominantly stalked (stellate-)dendroid hairs, of almost equal size and shape. Fruits 1.5–2.5(–3) cm long . . . . . **a. var. laurina**  
 b. Lower leaf surface with sessile stellate and stalked (stellate-)dendroid hairs of mixed size and shape. Fruits 1.5–2 cm long . . . . . **b. var. heteropilis**

#### **a. var. laurina**

*Knema laurina* (Blume) Warb., Mon. Myrist. (1897) 606, t. 24 (excl. var. *malayana*, p.p.; incl. var. *amboinensis*, *bancana*, *borneensis*); Gamble, Mat. Fl. Malay Penins. 5, 23 (1912) 248; Koord., Exk. Fl. Java 2 (1912) 258; Ridl., Fl. Malay Penins. 3 (1924) 72; J. Sinclair, Gard. Bull. Sing. 16 (1958) 329, f. 19, p.p.; ibid. 18 (1961) 248, p.p., excl. most synonyms; W.J. de Wilde, Blumea 25 (1979) 379; Tree Fl. Sabah & Sarawak 3 (2000) 421. — [*Myristica tomentosa* auct. non Thunberg: Blume, Bijdr. 2 (1825) 577.] — *Myristica laurina* Blume, Rumphia 1 (1835) 189, t. 61; A. DC., Prod. 14, 1 (1856) 206; de Vriese, Pl. Ind. Bat. Orient. (Pl. Reinw.) (1857) 96; Miq., Fl. Ind. Bat. 1, 2 (1858) 70, & Suppl. 1 (1861) 385; Hook. f., Fl. Brit. India 5 (1886) 112; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 319, pl. 156; Koord. & Valetton, Med. Lands Pl. Tuin 17 (1896) 186.

*Myristica laurina* Blume var. *longifolia* Miq., Fl. Ind. Bat. 1, 2 (1858) 71, & Suppl. 1 (1861) 385. — Syntypes: *Teijsmann s.n.*, 484, Sumatra.

*Myristica laurina* Blume var. *borneensis* Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 51. — Type: *Korthals s.n.*, Kalimantan.

*Myristica cantleyi* Hook. f., Fl. Brit. India 5 (1886) 110, not sensu King and later authors. — *Knema cantleyi* (Hook. f.) Warb., Mon. Myrist. (1897) 554, p.p., for the type only. — Type: *Cantley 195*, Singapore.

*Myristica laurina* Blume var. *bancana* (Warb.) Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 92, nom. alt., inval. — Type not indicated.

*Myristica laurina* Blume var. *amboinensis* (Warb.) Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 92, nom. alt., inval. — Type: *Beccari s.n.*, introd. Hort. Bogor.

Twigs at apex with hairs 0.5–2 mm long, lower down smooth, not striate. Leaves on lower surface with persistent hairs all or predominantly stalked (stellate-)dendroid, of almost equal size and shape. Mature male flowers: pedicel 2–5 mm long, bracteole (sub) apical; buds 3.5–5(–6) by 2–3.5(–4) mm, with hairs 0.5–1.5(–2) mm long; anthers 6–9. Fruits 1.5–2.5(–3) cm long; fruiting pedicel 0–1(–5) mm long.

Distribution — As the species.

Notes — 1. Var. *malayana* Warb. is excluded by its lectotype, which is *K. pseudo-laurina*. Var. *amboinensis* Warb. is included in the synonymy; its type, *Beccari s. n.*, was originally collected in the botanical garden at Bogor, but cannot have originated from Ambon, as explained by Sinclair (1961: 254).

2. Specimens from Peninsular Malaysia sometimes have relatively large fruits, up to 2.5 cm long; in Borneo fruits may reach a length of 30 mm.

#### b. var. *heteropilis* W.J. de Wilde

*Knema laurina* (Blume) Warb. var. *heteropilis* W.J. de Wilde, *Blumea* 25 (1979) 381. — *Knema furfurascens* Gand., *Bull. Soc. Bot. Fr.* 66 (1919) 226, in clavi. — Type: *Junghuhn s. n.*, 1855, Java.

*Twigs* at apex with dense rusty hairs 1 mm long, (coarsely) striate. *Leaves* on lower surface with persistent hairs of variable size and shape. *Male flower*: pedicel 0.5–2.5 mm long, bracteole apical; buds 3–3.5 by 2–2.5 mm, with hairs 1–1.5 mm long; anthers 7 or 8. *Fruits* 1.5(–2) cm long; fruiting pedicel 1 mm long.

Distribution — *Malesia*: Sumatra (Simeuluë I.), Peninsular Malaysia (Kedah, Perak, Selangor, Negri Sembilan), W Java.

Notes — 1. Specimens of var. *heteropilis* from Peninsular Malaysia and Java have somewhat narrower leaves as compared to those from Simeuluë I. and to those generally found in the type variety. The specimens from Simeuluë I. (*Achmad* 63, 1195, 1808), are stout, with large, broad leaves, strong twigs at apex 4 mm diameter, and fruits 2 by 1.2 cm; typical var. *laurina* is known from Siberut (*Iboet* 178).

2. The specimen *Lütjeharms* 4421, from Enggano, is possibly of hybrid origin, in the vicinity of *K. glaucescens* and *K. losirensis*.

### 30. *Knema linguiformis* (J. Sinclair) W.J. de Wilde

*Knema linguiformis* (J. Sinclair) W.J. de Wilde, *Blumea* 25 (1979) 416, f. 8; 27 (1981) 227; 32 (1987) 121; *Tree Fl. Sabah & Sarawak* 3 (2000) 423. — *Knema curtisii* (King) Warb. var. *linguiformis* J. Sinclair, *Gard. Bull. Sing.* 18 (1961) 200, f. 6B. — Type: *Sinclair (Kadim & Kapis)* 9294, Sabah.

Tree 6–25 m. *Twigs* 1–2 mm diameter, sometimes ± angled, at first with pale brown to dark rusty woolly hairs 0.2–0.5 mm long, late glabrescent; bark pale, yellowish to brown, ± striate, not tending to crack or flake. *Leaves* chartaceous or thinly coriaceous, oblong to lanceolate, 5–15 by 1.5–5(–6) cm, base attenuate to rounded, apex acute to obtuse, rarely subacuminate; drying greenish above; lower surface greenish grey, minutely papillate, early glabrescent; dots absent; midrib raised above; nerves 8–20 pairs, raised above; venation distinct above; petiole late glabrescent, 6–15 by 1–1.5 mm. *Inflorescences*: sessile, brachyblast simple or forked, 2–5 mm long; in male 5–20-flowered, female 2–10-flowered; flowers with persistent (yellowish) rusty hairs (0.1–)0.2–0.4 mm long; perianth 3- (or 4-)lobed, pink inside. *Male flowers*: pedicel 5.5–13 mm long, bracteole persistent or late caducous, about median; buds depressed globose to broadly obovoid, rounded or obtusely trigonous in cross section, 3–6 mm in diameter, cleft c. 3/4, lobes 0.5–1 mm thick; staminal disc subcircular or obtusely trigonous, flat, 1.5–3 mm diameter; anthers 19–25 (i. e., 40–50 closely appressed thecae), entirely sessile, suberect to

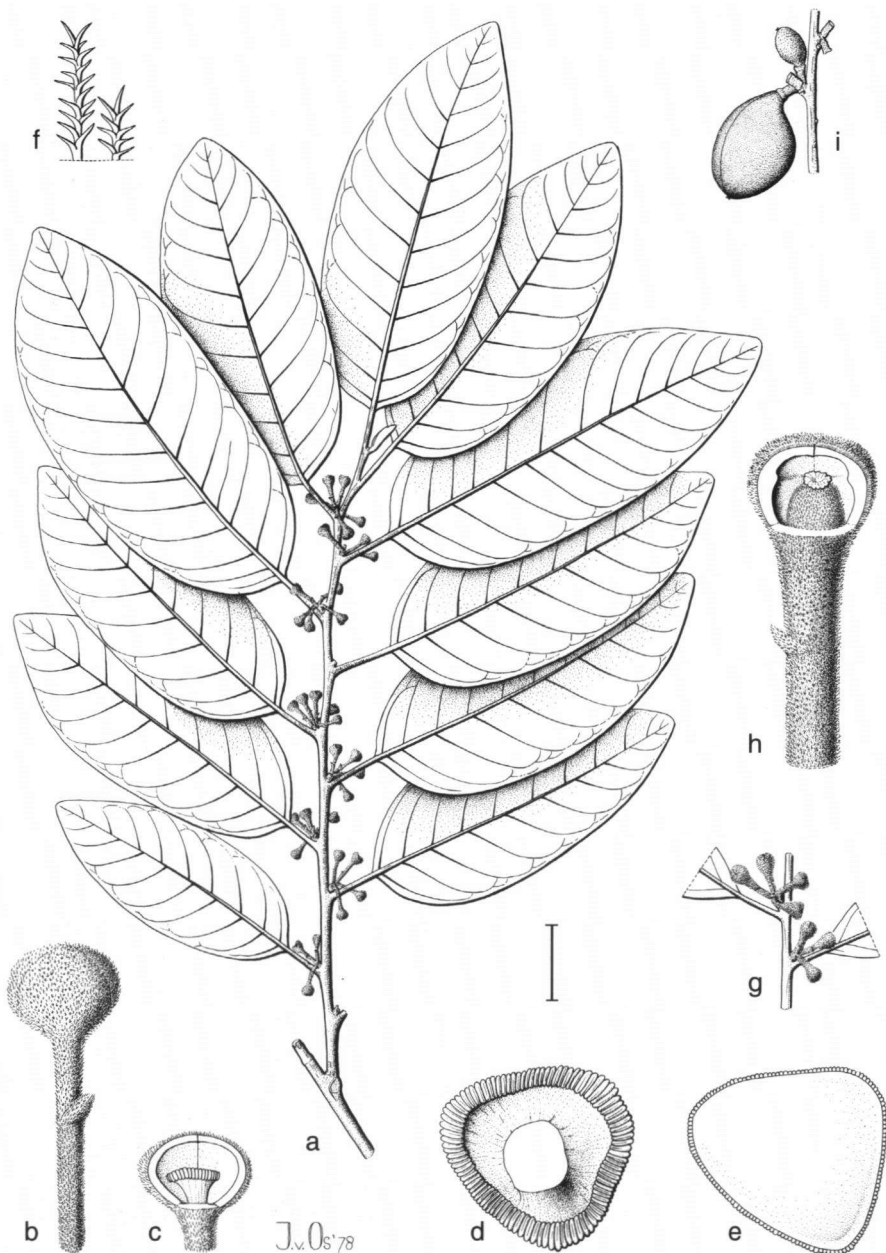


Fig. 43. *Knema linguiformis* (J. Sinclair) W.J. de Wilde. a. Branchlet with male inflorescences; b. male bud; c. opened male bud showing androecium; d. androecium seen from beneath; e. androecium (staminal disc) seen from above (thecae of anthers  $\pm$  schematic); f. sample of hairs from male bud; g. twig with female inflorescences; h. opened female bud showing the pistil; i. infructescence with submature and immature fruit [a–f: *S* 26978; g, h: *S* 32290; i: *SAN* 81118]. — Scale bar for a, g, i = 2 cm; for b, c, h = 2.8 mm; for d, e = 0.66 mm; for f = 0.16 mm.

oblique, hidden under the staminal disc, 0.2–0.3 mm; androphore tapering, 0.5–2 mm long. *Female flowers*: pedicel 5–8 mm long, bracteole about median; buds depressed globose, ellipsoid, or obovoid, 4–6 by 4–5.5 mm, cleft 1/2–2/3, lobes 0.7–1 mm thick; ovary (broadly) ovoid, 2–3 by 1.5–2.5 mm; stigma sessile,  $\pm$  flat, subcircular, faintly 2-lobed and each lobe again 4–10(–20)-lobulate. *Fruits* 1–3 per infructescence, ellipsoid to ovoid, at base often contracted to 5 mm long, 3.5–4 by 2–2.5 cm, at first with minute indumentum, glabrescent; dry pericarp 2 mm thick; fruiting pedicel 5–8 mm long. — **Fig. 43.**

**Field-notes** — Trunk sometimes with low-footed buttresses; bark (almost) smooth, or slightly scaly; inner bark soft, 5 mm thick, reddish or brown; sapwood dirty whitish. Leaves medium green, glossy above, dull glaucous with yellowish green midrib beneath. Flowers with yellowish to rusty indumentum, pink inside; pollen pale yellow or whitish. Fruits yellowish to deep orange.

**Distribution** — *Malesia*: Borneo (C, S and E Kalimantan, Sarawak, Sabah, Brunei).

**Habitat & Ecology** — Lowland and submontane primary and degraded forest; hill-sides and ridges; sandy soil, yellow clayey soil, sandy loam, poor soil, and sandstone; 0–1500 m altitude, up to 1650 m in the Mt Kinabalu area; fl. Jan.–Dec., mainly June–July; fr. throughout the year.

**Note** — *Knema linguiformis* is related to *K. curtisii*, which differs in more ellipsoid, herbaceous leaves, less thickly pubescent twigs, and longer stalked fruits.

### 31. *Knema longepilosa* (W.J. de Wilde) W.J. de Wilde

*Knema longepilosa* (W.J. de Wilde) W.J. de Wilde, *Blumea* 41 (1996) 389, f. 3; *Tree Fl. Sabah & Sarawak* 3 (2000) 425. — *Knema percoriacea* J. Sinclair forma *longepilosa* W.J. de Wilde, *Blumea* 25 (1979) 394. — Type: S 22985 (*Sibat*), Sarawak.

Tree 3–10 m. *Twigs* 2–4 mm diameter, looking as 4–6 mm diameter because of the dense cloth of yellow-brown or dark rusty  $\pm$  shaggy hairs 2–3 mm long, late glabrescent; bark reddish brown, thinly and finely flaking. *Leaves* chartaceous or thinly coriaceous, elliptic-oblong to lanceolate, 13–25 by 3–6 cm, base narrowly rounded or cuneate, apex acute-acuminate; drying olivaceous or greenish above, lower surface greyish, early glabrescent, with midrib and nerves brown-yellow, contrasting; dots absent; midrib narrow, pale, much raised above; lateral nerves 10–15 per side, raised; venation distinct at both surfaces; petiole 10–15 by 1.5–2 mm, reddish brown, transversely wrinkled when dry, at first with dense yellow-brown or rusty hairs 2–4 mm, contrasting with the early glabrescent leaf blades; leaf buds short, 5(–10) mm long, looking bluntish by a dense cloth. *Inflorescences*: sessile, brachyblast simple or forked, to 5(–10) mm long, late glabrescent, in male with clusters of 2–6 long-pubescent flowers. *Male flowers*: with dense, rough, yellow-brown or rusty hairs (2–)4 mm, appearing as mops 6–8 mm in diameter; perianth 3-lobed, colour inside not known; pedicel 3–4 mm, bracteole oblong, 0.5–1 mm long, long-pubescent like pedicel and perianth, at 0.5–1 mm below the apex; buds subglobose, 3.5–4 mm diameter, cleft c. 1/2, lobes 0.5 mm thick; staminal disc flat, blunt-subtriangular, 1.5(–2) mm diameter; anthers 15–18, lateral, contiguous, sessile, suberect; androphore short, tapering, 1 mm long, glabrous. *Female flowers* and *fruits* not known. — **Fig. 44.**



Field-notes — Small tree, dbh c. 5 cm; bark (reddish) brown, latex red. Leaves glaucous beneath. Flowers and buds entirely covered by light brown or rusty indumentum.

Distribution — *Malesia*: Borneo (C Sarawak: 4th Div.; West-Central Kalimantan).

Habitat & Ecology — Hill-side forest; occasional, in mixed dipterocarp forest on basaltic soil, clay soil; 100–250 m altitude; fl. Jan., Apr.

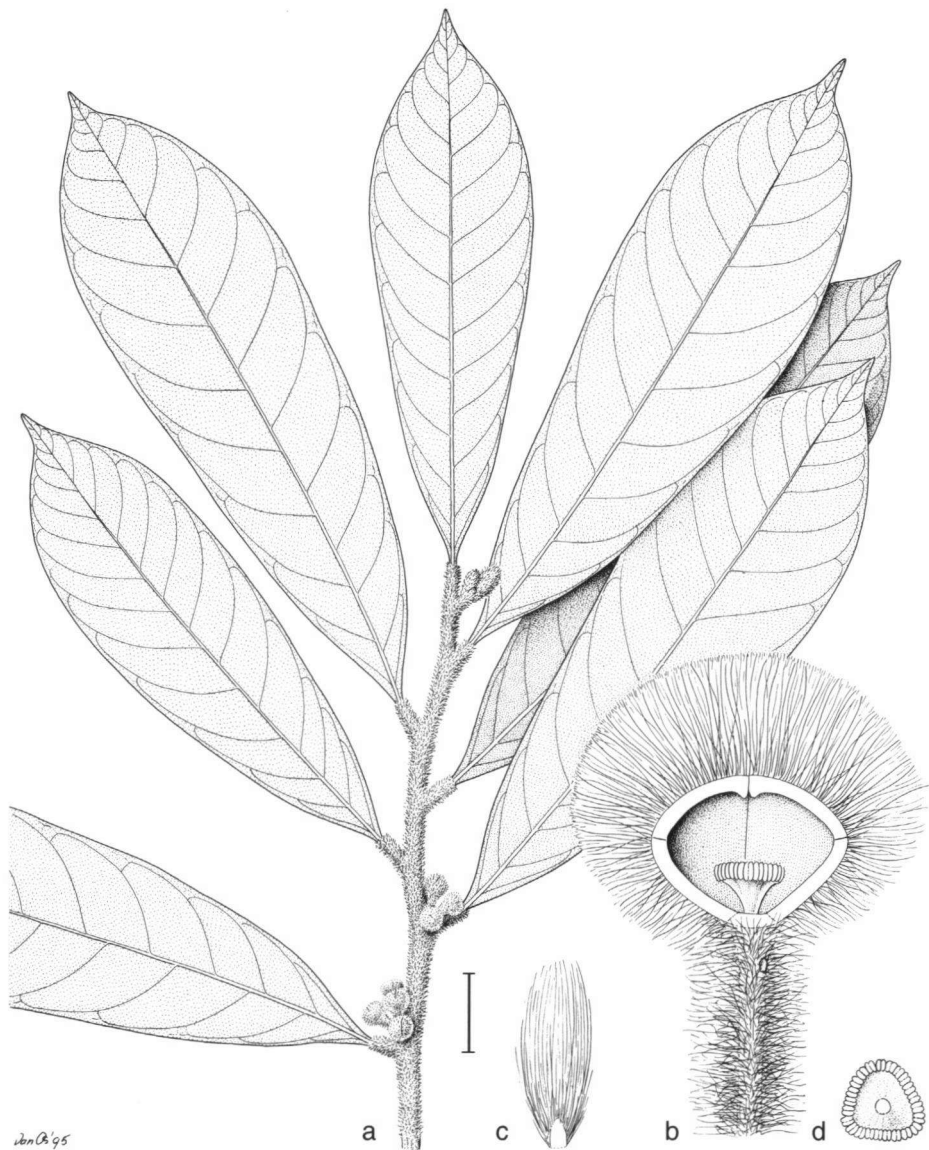


Fig. 44. *Knema longepilosa* (W.J. de Wilde) W.J. de Wilde. a. Leafy twig with male inflorescences; b. lengthwise opened male flower; c. bracteole of male flower; d. androecium, seen from below [a: Church & Mahyar 1613; b–d: Church & Mahyar 1466]. — Scale bar for a = 2 cm; for b–d = 2 mm.

Note — *Knema longepilosa* is readily recognized by the conspicuous dense and long indumentum of the sterile apical leaf buds, twig apex, petioles, and flowers. It resembles the Malayan *K. plumulosa*, which differs in the mammillate staminal disc and by a disc around the base of the androphore.

### 32. *Knema losirensis* W.J. de Wilde

*Knema losirensis* W.J. de Wilde, *Blumea* 25 (1979) 463, f. 16; 27 (1981) 231. — Type: *de Wilde & de Wilde-Duyffes 16578*, Aceh, N Sumatra.

Tree 10–20 m. *Twigs* 1.5–2.5 mm diameter, at first with stellate hairs 0.1–0.2 mm long, early glabrescent; bark striate, not cracking or flaking. *Leaves* membranous or chartaceous, elliptic-oblong to oblong-lanceolate, 13–26 by 4–8 cm, apex up to 1.5 cm acute-acuminate, base rounded to attenuate; greenish to brown above, the midrib late glabrescent; lower surface greyish, at first with sparse to dense greyish hairs of mixed size (0.1–0.2 mm long, and coarser stellate dendroid hairs 0.3–0.5 mm long), late glabrescent, the longer hairs earlier shed and leaving hair scars (lens!); dots absent; midrib and nerves (20–25 pairs) slightly raised above; venation fine (areoles 0.5 mm diameter or less), distinct above; petiole 8–13 by 1.5–2.5 mm. *Inflorescences*: sessile or pedunculate to 1 mm, brachyblast simple or 2- or 3-fid, up to 5 mm long; in male 5–10-flowered, female 1–6-flowered, flowers with persistent yellowish brown hairs 0.1 mm long or less; perianth 3-lobed, greenish or yellowish inside. *Male flowers*: pedicel (3–) 5–9 mm long, bracteole caducous, 1–3 mm below the apex; buds depressed globose to broadly obovoid, 3–4 by (3–)3.5–5 mm, cleft c. 4/5, lobes 1 mm thick; staminal disc flat to faintly convex, subcircular, 2–2.5(–3) mm diameter; anthers 10–15, ± stiped, more or less horizontal, 0.4–0.6 mm long, spaced, the connective broad above, thecae opening downwards; androphore 1.2–1.5 mm long. *Female flowers*: pedicel 1.5–5 mm long, bracteole caducous, above median; buds (depressed) obovoid-oblong, 4–6 by 2.5–5 mm, cleft over 1/2, lobes 1–1.5 mm thick; ovary ovoid, 3 by 2 mm, stigma ± sessile, 2-lobed, each lobe suberect, and again 2–4-lobulate. *Fruits* 1–5 per infructescence, broadly ellipsoid, more or less ridged, base rounded, apex subacute, 2–2.7 by 1.5–2 cm, with dense rusty hairs 0.1–0.2 mm long; dry pericarp 1–1.5 mm thick; fruiting pedicel 2–5 mm long. — **Fig. 45.**

**Field-notes** — Bark rather smooth, slash orange-red, smelling like pine resin; wood creamy. Leaves glaucous beneath. Male buds over 6 mm diameter, greenish brown or very light brown; perianth greenish or pale yellow inside; staminal disc distinctly convex, pale yellow or whitish; anthers sessile, yellow; stigma pale yellow. Fruits orange-brown.

**Distribution** — *Malesia*: Sumatra (Aceh, E Coast, Palembang).

**Habitat & Ecology** — Forest edges, forest of alluvial terraces, hill slopes; 200–600 m altitude; fl. & fr. throughout the year.

**Note** — *Knema losirensis* is related to *K. glaucescens*, particularly resembling the Sumatran specimens of the latter. These differ in a less stout habit of the leafy twig, with smaller male flowers and smaller fruits. The comparatively large, ridged fruits of *K. losirensis* are quite different from the fruits of *K. glaucescens*, especially as found in Peninsular Malaysia and Borneo. The stouter habit of *K. losirensis* possibly is partly due to more favourable conditions in forest on rich alluvial soil.

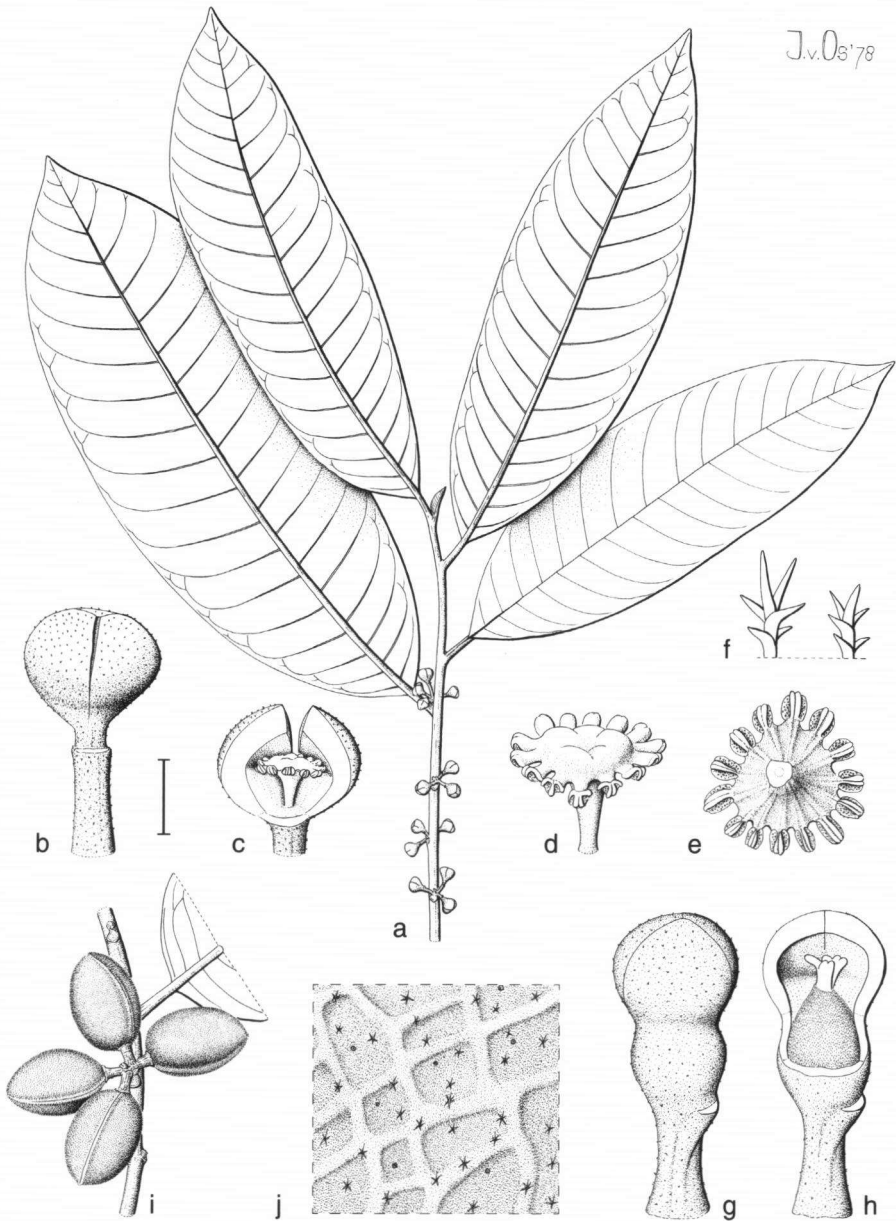


Fig. 45. *Knema losirensis* W.J. de Wilde. a. Twig with male inflorescences; b. male bud; note scar of fallen bracteole; c. opened male bud showing the androecium; d. androecium, almost lateral view; e. androecium seen from below; f. hair sample of indumentum of male bud, half-schematic; g. female bud; note scar of fallen bracteole; h. opened female bud showing pistil; i. branchlet with infructescence; j. detail of lower leaf surface with tertiary venation and scattered small (sub)sessile stellate hairs [a–f, j: *de Wilde/Duyffes 16578*; g, h: *de Wilde/Duyffes 16577*; i: *de Wilde/Duyffes 12565*]. — Scale bar for a, i = 2 cm; for b, c, g, h = 2.8 mm; for d, e = 1.4 mm; for f = 0.15 mm; for j = 0.33 mm.

**33. *Knema lunduensis* (J. Sinclair) W.J. de Wilde**

*Knema lunduensis* (J. Sinclair) W.J. de Wilde, Blumea 25 (1979) 395; 41 (1996) 391; Tree Fl. Sabah & Sarawak 3 (2000) 426. — *Knema latericia* Elmer var. *lunduensis* J. Sinclair, Gard. Bull. Sing. 18 (1961) 244, f. 15A, D, E. — Type: *Sinclair (& Kadim) 10381*, Sarawak.

Tree 3–10(–20) m. Twigs 4–6(–10) mm diameter, at first with rusty hairs (0.5–)1–1.5 mm long, glabrescent; bark coarsely striate, lower down finely longitudinally cracking and flaking. Leaves chartaceous to thinly coriaceous, at first with dense indumentum, early glabrescent, elliptic to (ob)lanceolate, 15–50 by 4.5–16(–20) cm, apex (sub)obtuse to acute(–acuminate), base obtuse, rounded, subtruncate, or rarely subcordate; brown above, grey(–brown), glabrous, not or but little papillate, with scattered hair scars beneath; dots absent; midrib raised above; nerves 12–30 pairs, raised; venation coarse, ± fairly distinct; petiole 10–30 by 3–7 mm. Inflorescences: sessile, brachyblast simple or forked, up to 10 mm diameter; in male 5–15-flowered, female 1–6-flowered; flowers with rusty hairs (0.4–)0.5–1.5(–2) mm long; perianth 3- (or 4-)lobed, pink-red inside. Male flowers: pedicel 3–4 mm long; bracteole ± persistent, slightly above median; buds depressed globose, small or large (see note 2), 3–3.5 by 4–5(–6) mm, cleft c. 4/5, lobes 0.5 mm thick; staminal disc flat or slightly convex, subtriangular to circular, 1.8–2 mm diameter; anthers 10–14, just stiped, 0.6 mm, horizontal, not touching; androphore tapering, 0.6–1 mm long. Female flowers not seen; stigma remnants (on fruit): sessile, many-lobed. Fruits 1–6 per infructescence, ellipsoid, (2–)2.5–3.5(–4.5) by 1.5–2.5(–3.5) cm, with coarse hairs 1–2 mm long, dry pericarp 2–4 mm thick; fruiting pedicel up to 3 mm long.

Field-notes — Bark of trunk flaky, fissured, or smooth; slash light red; wood white. Leaves dark glossy green above, with whitish green midrib. Flowers pale flesh-coloured inside. Fruits brown, red, or chocolate; aril rich yellow, or orange.

Distribution — *Malesia*: Borneo (Sarawak: frequently collected in the Lundu district, 1st Div.; Sabah).

Habitat & Ecology — Primary forest; on granitic soils, granodiorite, tertiary granitic rock, ridges; 100–1500 m altitude; also from *Quercus* forest at 1500 m altitude; fl. June; fr. June–Nov.

Notes — 1. *Knema lunduensis* is related to *K. latericia*, *K. furfuracea*, and *K. percoriacea* and is more or less intermediate between the first two species mentioned. *Knema latericia* generally has a more slender habit, with smaller leaves, often a convex or mammillate staminal disc, and smaller fruits with shorter indumentum; *K. furfuracea* has cordate leaf bases, though the leaf base in *K. lunduensis* is occasionally subcordate in larger leaves; *K. percoriacea* has a differing general habit, with more coriaceous leaves. Some specimens included in *K. lunduensis* come close to certain stout, large-fruited forms of *K. latericia* subsp. *ridleyi*.

2. SAN 9957, from Sabah, has extremely large male buds, 7 by 5.5 mm, with coarse hairs 1–5(–2) mm long; anthers 13.

**34. *Knema luteola* W.J. de Wilde**

*Knema luteola* W.J. de Wilde, Blumea 25 (1979) 451; Tree Fl. Sabah & Sarawak 3 (2000) 426. — Type: *Enderi 2822*, Central E Kalimantan.

Tree 8–20 m. *Twigs* somewhat flattened, sometimes blunt-triangular, pale brownish, smooth, 1.5–2.5(–3) mm diameter, at first with greyish brown scale-like hairs, 0.1 mm long or less, early glabrescent; bark smooth or finely striate, not tending to crack or flake. *Leaves* chartaceous, oblong or lanceolate, 12–30 by 3–9.5 cm, base rounded to cuneate, apex up to 1.5 cm acute-acuminate; greenish brown above; lower surface greyish, at first with minute, weak, grey or pale brown scale-like and stellate-dendroid hairs, early glabrescent; dots absent; midrib raised above; nerves 16–25 pairs, slender, hardly raised above; venation fine (areoles less than 0.5 mm diameter), distinct above; petiole 10–15 by 1.5–2.5 mm. *Inflorescences*: sessile, brachyblast simple or 2–4-fid, to 5 mm long; in male 5–12-flowered, flowers with persistent yellowish brown stellate scale-like hairs 0.1 mm long or less; perianth 3-lobed, (pale) yellow inside. *Male flowers*: pedicel 4–7.5 mm long, bracteole caducous, 1–2.5 mm below the apex; buds globose, at base rounded, apical part rounded or somewhat narrowed, not depressed, 2.5–4 mm diameter, cleft 3/4–4/5, lobes 1 mm thick; staminal disc flat, circular, 1.7–2.3 mm diameter; anthers 9 or 10, (just) stiped, nearly horizontal, 0.5 mm long, spaced, thecae opening  $\pm$  laterally; androphore 0.5 mm long. *Female flowers* not known. *Fruits* 1–4 per infructescence, ellipsoid to ellipsoid-oblong, 3–7 by 2–2.3 cm, usually beaked at apex, with minute scale-like hairs less than 0.1 mm long; dry pericarp 2 mm thick; fruiting pedicel stout, 15–20 mm long, bracteole scar  $\pm$  at or below median.

Field-notes — Bole straight; bark brownish, rather fissured, or strongly peeling off; inner bark 3 mm thick, reddish or yellow inside; sapwood pale yellowish.

Distribution — *Malesia*: Borneo (Sarawak, W, C and E Kalimantan).

Habitat & Ecology — Hill forest, often on stream banks; 100–700 m altitude; fl. June, Aug., Dec.; fr. Feb.–Mar.

Note — *Knema luteola* is one of the few species of *Knema*, besides *K. rubens* (Sumatra, Peninsular Malaysia) and *K. oblongifolia* (Peninsular Malaysia), with the twigs in the apical part  $\pm$  flattened. *Knema rubens* differs in its longer and thicker indumentum of twig apices, reddish in colour, hairs remaining on the lower side of the midrib, and coarser venation of the leaves, with areoles more than 0.5 mm diameter; *K. oblongifolia* has differently shaped male buds. Stout sterile or fruiting specimens may resemble *K. ashtonii* var. *ashtonii*, which obviously is related, but differs in its larger fruits. The fruits of *K. luteola* resemble those of *K. kostermansiana*, which are generally larger (longer) and fusiform.

### 35. *Knema malayana* Warb.

*Knema malayana* Warb., Mon. Myrist. (1897) 570, t. 25; Gamble, Mat. Fl. Malay Penins. 5, 23 (1912) 242; Ridl., Fl. Malay Penins. 3 (1924) 69; J. Sinclair, Gard. Bull. Sing. 16 (1958) 293; 18 (1961) 260; W.J. de Wilde, Blumea 25 (1979) 456. — *Myristica malayana* (Warb.) Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 91, nom. inval. — Syntypes: *Wray 176*; *King's coll. 5706, 6128, 10594*; *Cantley 20*; *Griffith 5706*; all Peninsular Malaysia.

*Myristica glaucescens* auct. non (Jack) Hook. f. & Thomson: Hook. f. & Thomson, Fl. Ind. 1 (1855) 157, p.p.; Hook. f., Fl. Brit. India 5 (1886) 111, p.p.; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 323, pl. 161, p.p.

*Myristica corticosa* auct. non (Lour.) Hook. f. & Thomson: Hook. f. & Thomson, Fl. Ind. 1 (1855) 158, p.p.; A.DC., Prod. 14, 1 (1856) 205, p.p.; Miq., Fl. Ind. Bat. 1, 2 (1858) 69, p.p.

Tree 3–20 m. *Twigs* 1–2 mm diameter, at first with rusty stellate scale-like hairs 0.1 mm long or less, glabrescent; bark finely striate, not tending to crack or flake. *Leaves* membranous, elliptic to oblong-lanceolate, 7–21 by 2–7 cm, base cuneate-attenuate to rounded, apex up to 2.5 cm acute-acuminate; greenish brown above, grey-glaucous beneath, at first with sparse, greyish, scale-like hairs, 0.1 mm long or less, glabrescent; dots absent; midrib raised above; nerves 14–20 pairs, raised above; venation very fine, prominent and distinct above; petiole 7–15 by 1.5–2.5 mm. *Inflorescences*: sessile, brachyblast simple or bifurcate, to 5 mm long; in male 3–15-flowered, female 1–6-flowered; flowers with persistent grey-rusty hairs 0.1 mm long or less; perianth 3- (or 4-) lobed, cream-coloured inside (always?). *Male flowers*: pedicel 7–15 mm long, bracteole caducous, median or above; buds (depressed) globose, 3–4.5 mm diameter, cleft c. 4/5, lobes 0.6–1.2 mm thick; the staminal disc flat, circular or subtriangular, 2–2.3 mm in diameter; anthers 9–13, shortly stiped, horizontal, 0.3–0.5 mm long, spaced; androphore 0.5–1 mm long. *Female flowers*: pedicel 6–10 mm long, bracteole (somewhat above) median; buds 4–5 by 2.5–3.5 mm, cleft 1/2–2/3; lobes 1–1.5 mm thick; ovary ovoid, 1.5–2 mm long; style to 0.5 mm long; stigma erect, irregularly peltate, 5-lobed. *Fruits* 1–3 per infructescence, ellipsoid or obovoid, apex subobtuse, base often narrowed, 1.2–1.6 by 0.8–1 cm, with mealy hairs 0.2–0.4 mm long; dry pericarp 1–1.5 mm thick; fruiting pedicel (4–)6–15 mm long.

*Field-notes* — Bark not furrowed, not or but slightly flaky, nearly smooth; inner bark pinkish, orange, or brownish, granular; wood white. Leaves slightly coriaceous, when dry membranous. Flowers light yellow; stigma green. Ripe fruits light or dark brown, or yellow.

*Distribution* — Peninsular Thailand; in *Malesia*: Peninsular Malaysia (most provinces), Singapore.

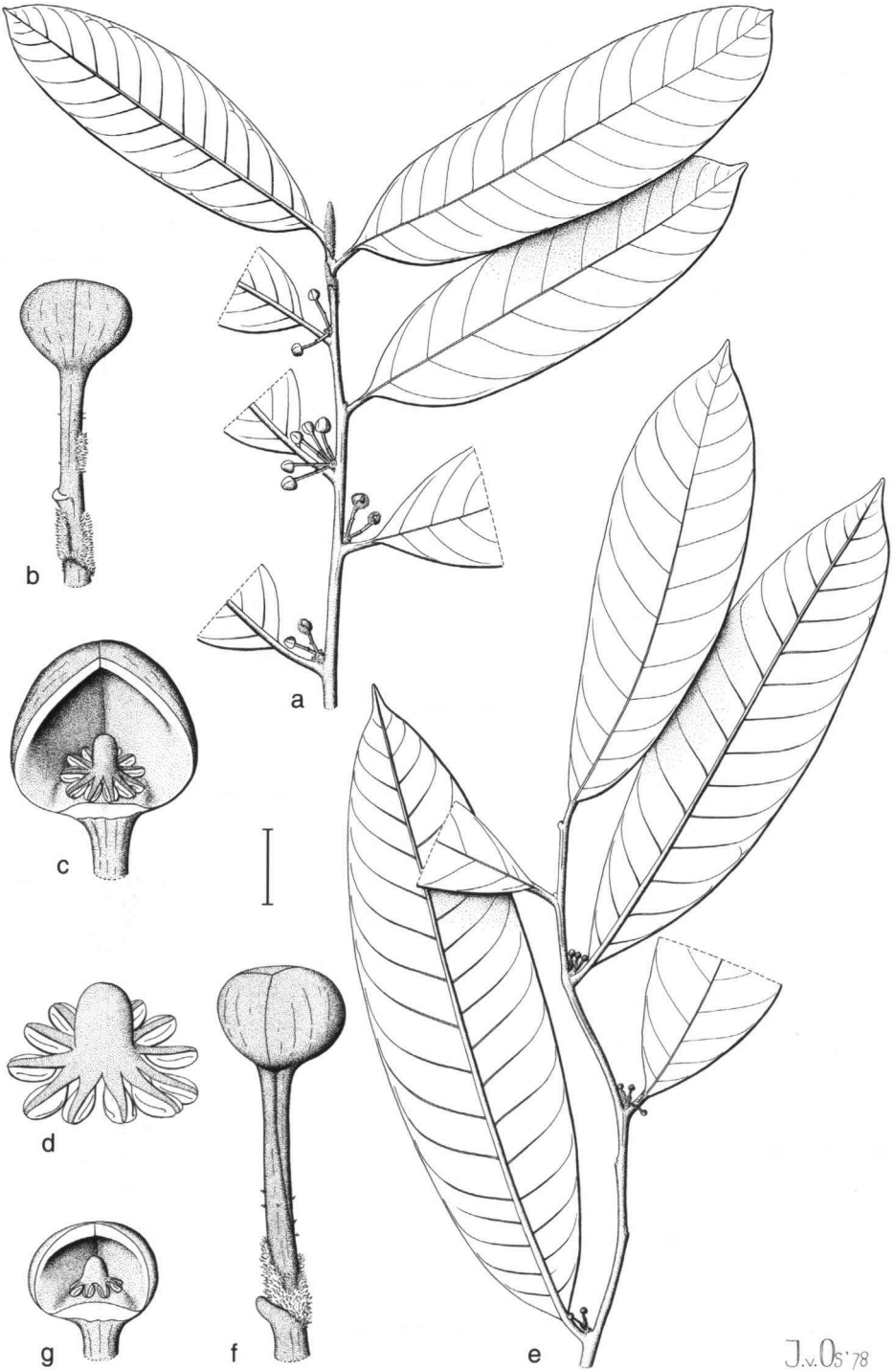
*Habitat & Ecology* — Lowland and hill forest, old bamboo forest, ridges; 0–800 m altitude; fl. throughout the year; fr. mainly May–Aug.

*Note* — Not in Sumatra, as was stated by Sinclair.

### 36. *Knema mamillata* W.J. de Wilde

*Knema mamillata* W.J. de Wilde, *Blumea* 25 (1979) 424, f. 12. — Type: *Anderson* 7 (1975), S Kalimantan.

Tree 5–10 m. *Twigs* sometimes bluntly 2–3-angled, 1.5–2.5 mm diameter, at first with woolly soft dendroid hairs 1 mm long, early glabrescent; bark smooth, or finely striate, not tending to crack or flake. *Leaves* chartaceous or thinly coriaceous, oblong(-lanceolate), (7–)11–25 by (2–)3–6.5 cm, apex acute(-acuminate), base attenuate to nearly rounded; olivaceous to dark brown above, lower surface ± reddish brown, at first with dense hairs 0.5–1 mm long, early glabrescent; dots absent; midrib much raised above; nerves 11–16 pairs, raised above; venation coarse, raised and visible above; petiole 7–18 by 1.5–2.5 mm. *Inflorescences*: sessile, brachyblast simple or 2- or 3-fid, to 5 mm long; in male (2–)5–10-flowered; flowers at first with dense woolly dendroid hairs 0.6–1 mm long, early glabrescent; perianth 3- (or 4-)lobed, reddish (?) inside. *Male flowers*: pedicel 5–10 mm long, bracteole caducous or persistent, median or below; buds (depressed) globose, obtusely 3- (or 4-)angular in cross section, 2–3.5 by 2.5–4.5 mm, cleft 4/5, lobes 0.3–0.5 mm thick; staminal disc circular, 1.5–2 mm diameter, with very distinct



mammilla 0.5–1 mm long; anthers 9–12, just stiped, 0.5–0.7 mm long, not touching, horizontal, thecae opening downwards; androphore 0.5–1 mm long. *Female flowers* and *fruits* not seen. — Fig. 46.

Distribution — *Malesia*: Borneo (S Kalimantan).

Habitat & Ecology — *Agathis* forest on sand ridges in peat forest; riparian along a peaty river; 0–50 m altitude; fl. Mar., Aug.

Note — *Knema mamillata* is related to *K. membranifolia*, *K. intermedia*, and *K. uliginosa*, especially to the latter. *Knema uliginosa* differs in flowers with persistent much shorter indumentum, and staminal disc convex or only low-mammillate; in *K. mamillata* the mammilla is conspicuous, up to 1 mm long, nearly as long as the androphore.

### 37. *Knema mandaharan* (Miq.) Warb.

*Knema mandaharan* (Miq.) Warb., Mon. Myrist. (1897) 553, t. 24; J. Sinclair, Gard. Bull. Sing. 16 (1958) 319, f. 16; 18 (1961) 261; W. J. de Wilde, Blumea 25 (1979) 404. — *Myristica mandaharan* Miq., Fl. Ind. Bat., Suppl. 1 (1861) 384; Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 48. — Type: *Diepenhorst in Teijsmann 3091*, Sumatra.

Tree 10–25 m. *Twigs* (4–)5–8 mm diameter, at first with rusty felty hairs (0.5–)1–1.5 mm long, ± easily rubbed off, glabrescent; bark striate or not, not or only occasionally tending to crack or flake. *Leaves* coriaceous, oblong to lanceolate, (15–)25–55 by (2.5–) 5–14 cm, base rounded to cordate, or sometimes attenuate, apex (long-)acute; glossy or bright brown above, lower surface glabrous, grey(-brown), or glaucous, not or but little papillate; dots absent; midrib stout, much raised above; nerves 14–40 pairs, distinct, little or much raised above; venation fine, faint or distinct; petiole late glabrescent, 15–20 by 5–8 mm. *Inflorescences*: sessile, brachyblast warded, 5–15 mm diameter; in male 2–10-flowered, female 1–4(–8)-flowered; flowers with rusty persistent hairs 0.5–1 mm long; perianth (3–)4(–5)-lobed, red (?) inside. *Male flowers*: pedicel 3–6 mm long, bracteole caducous, (sub)apical; buds obovoid, (3.5–)4–6 by (3.5–)4–5.5 mm, cleft 2/3 (–3/4), lobes 0.5–0.7 mm thick; the staminal disc circular, flat or slightly convex, or concave, 1.5–2.5 mm diameter; anthers 10–17, half-sessile to just stalked, 0.5–0.7 mm, oblique to nearly horizontal, not or but little touching; androphore tapering, 1–1.5 mm long. *Female flowers*: pedicel 4–7 mm long, bracteole submedian to apical; buds ellipsoid-obovoid, 8–10 by 5–6.5 mm, cleft c. 1/2, lobes 1–1.5 mm thick; ovary ovoid, 4 mm long; style to 1 mm long; stigma ± flat, 2-lobed and each lobe again with 8–10 linear lobelets. *Fruits* 1–2(–4) per inflorescence, ovoid or ellipsoid, 3–6 by 2.5–3.8 cm, with dark brown hairs 1–2 mm long; dry pericarp 2–8 mm thick; fruiting pedicel 4–8 mm long.

Fig. 46. *Knema mamillata* W. J. de Wilde. a. Twig with male inflorescences; b. male bud; note glabrescence and scar of bracteole about halfway the pedicel; c. opened male bud showing androecium; d. androecium, seen almost laterally; note strongly mammillate staminal disc; e. twig with male inflorescences; note the much smaller size of the buds as compared to a; f. male bud; note glabrescence and bracteole towards the base of the pedicel; g. opened male bud showing mammillate androecium [a–d: *Anderson 7* (1975); e–g: *Buwalda 7658*]. — Scale bar for a, e = 2 cm; for b = 2.8 mm; for c, f, g = 1.4 mm; for d = 0.7 mm.



Field-notes — Bark smooth, fissured, cracked, or flaky; inner bark pinkish brown; wood white.

Distribution — *Malesia*: Sumatra (Aceh, Tapanuli, W Coast, E Coast), Peninsular Malaysia (Perak, Trengganu, Selangor, Johore).

Habitat & Ecology — Primary forest on hill sides, in Peninsular Malaysia also in marshy forest at lower altitudes; 100–1800 m altitude; fl. Mar.; fr. throughout the year.

Notes — 1. *Knema mandaharan* is variable in the distinctness of the venation of the upper leaf surface, and size of the fruits and the thickness of the pericarp. In the material from N Central Sumatra possibly two forms can be distinguished, e.g., stout plants, with thick twigs and large leaves with faint venation above, the fruits large, 4–6 cm long, with short-haired pericarp 4–8 mm thick; the other form in N Sumatra has smaller leaves with distinct venation above, with looser, more farinose hairs on immature leaves, smaller fruits, 3–4 cm long, with longer, more lanose indumentum, especially at the base of the fruits, and with the pericarp only 2–3 mm thick. In other material from Sumatra and Peninsular Malaysia these differences are not apparent, as most of these specimens have a distinct venation.

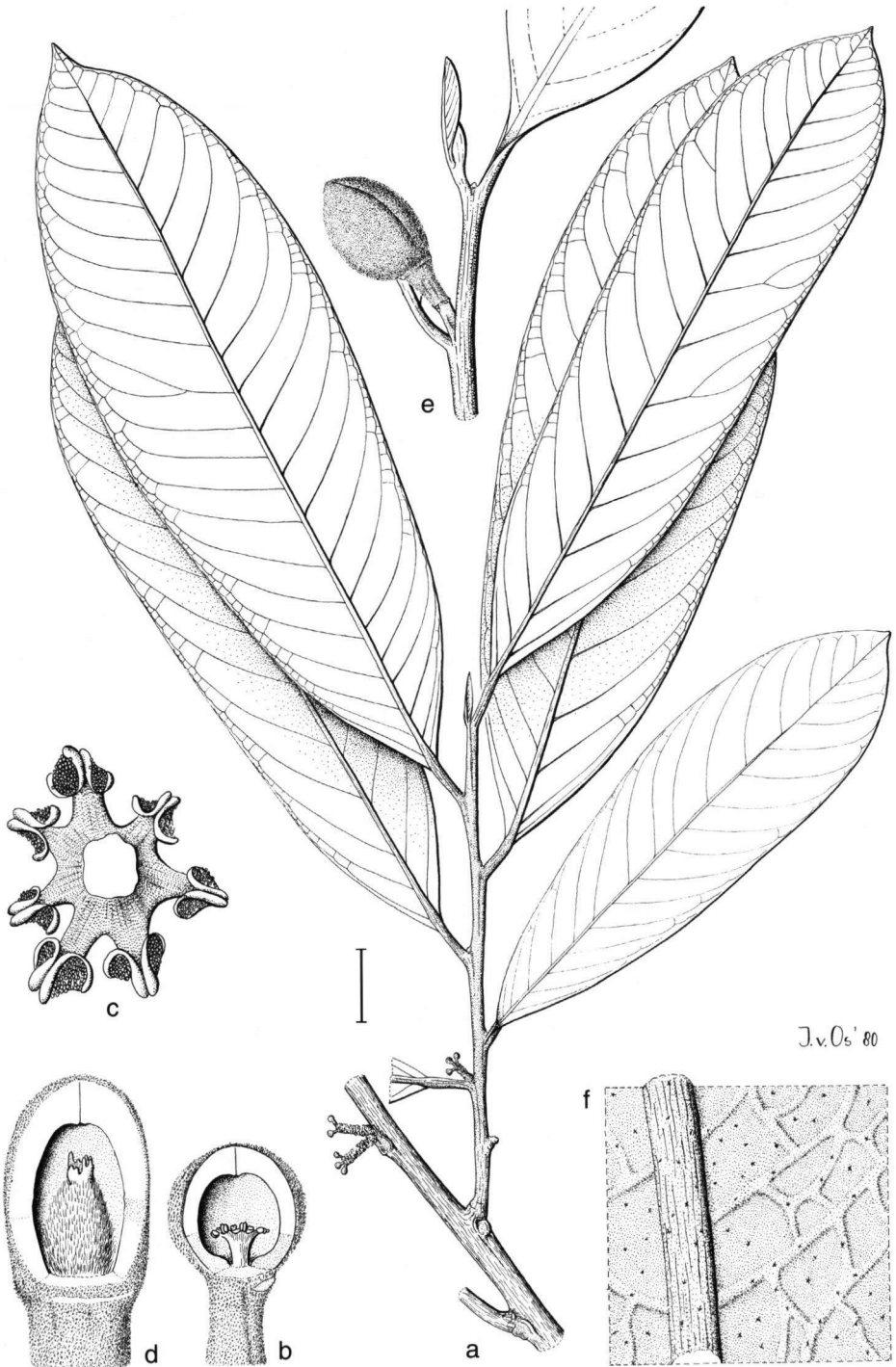
2. The aril in *de Wilde 13769* is incised to nearly halfway, which is unusual in *Knema*.

### 38. *Knema matanensis* W.J. de Wilde

*Knema matanensis* W.J. de Wilde, *Blumea* 27 (1981) 228, f. 2. — Type: *de Vogel 6060*, Sulawesi.

Tree 6–25 m. *Twigs* sometimes faintly angled, 3–5 mm diameter, with hairs 0.1 mm long or less, early glabrescent; bark smooth, not tending to crack. *Leaves* coriaceous, oblong(-lanceolate), 14–31 by 4.5–10.5 cm, base attenuate, apex up to 1.5 cm acute-acuminate; olivaceous to brown above; the lower surface at first with sparse stellate (-dendroid) hairs of mixed size, 0.1 mm long or less, subglabrescent; dots absent; midrib broad, ± flat above; nerves 18–26 pairs, little raised above; venation fine, distinct above; petiole 7–18 by 2–5 mm. *Inflorescences*: sessile, brachyblasts to 20 mm long, single, 2, or 3 together, in male and female 2–5-flowered; flowers with dark rusty hairs 0.1–0.2 mm long; perianth 3-lobed, creamy to yellow inside. *Male flowers*: pedicel 2–3 mm, bracteole apical, 0.5 mm long, persistent; buds (sub)globose, 2.5(–3) by 2.5–3 mm, cleft c. 4/5, lobes 1.2 mm thick; staminal disc subtriangular, ± flat, 1.5 mm diameter; anthers 7 or 8, stiped, horizontal, 0.2–0.3 mm long, opening ± downwards; androphore 0.5–0.7 mm long. *Female flowers*: pedicel 1 mm long; buds ovoid-oblong, 4.5 by 2.5 mm, cleft c. 1/2, lobes 1 mm thick; ovary ovoid, 2 by 2 mm, with dense hairs 0.2 mm long; style less than 0.5 mm, stigma 0.5 mm long, of 2 broad lobes, each 3- or 4-lobulate. *Fruits* 1 or 2 per infructescence, (immature) ellipsoid, 2 by 1.2 cm, with dense dark rusty dendroid hairs 0.2–0.3(–0.5) mm; thickness of mature dry pericarp not known; fruiting pedicel rather stout, 5 mm long. — **Fig. 47.**

Fig. 47. *Knema matanensis* W.J. de Wilde. a. Male flowering twig; b. opened male bud, showing the androecium; c. androecium seen from beneath; d. opened female bud, showing pistil; e. twig with submature fruit; f. detail of lower leaf surface showing scattered minute stellate hairs [a–c, f: *de Vogel 6109*; d, e: *de Vogel 6128*]. — Scale bar for a = 2 cm; for b, d = 1.65 mm; for c = 0.4 mm; for e = 1 cm; for f = 0.8 mm.



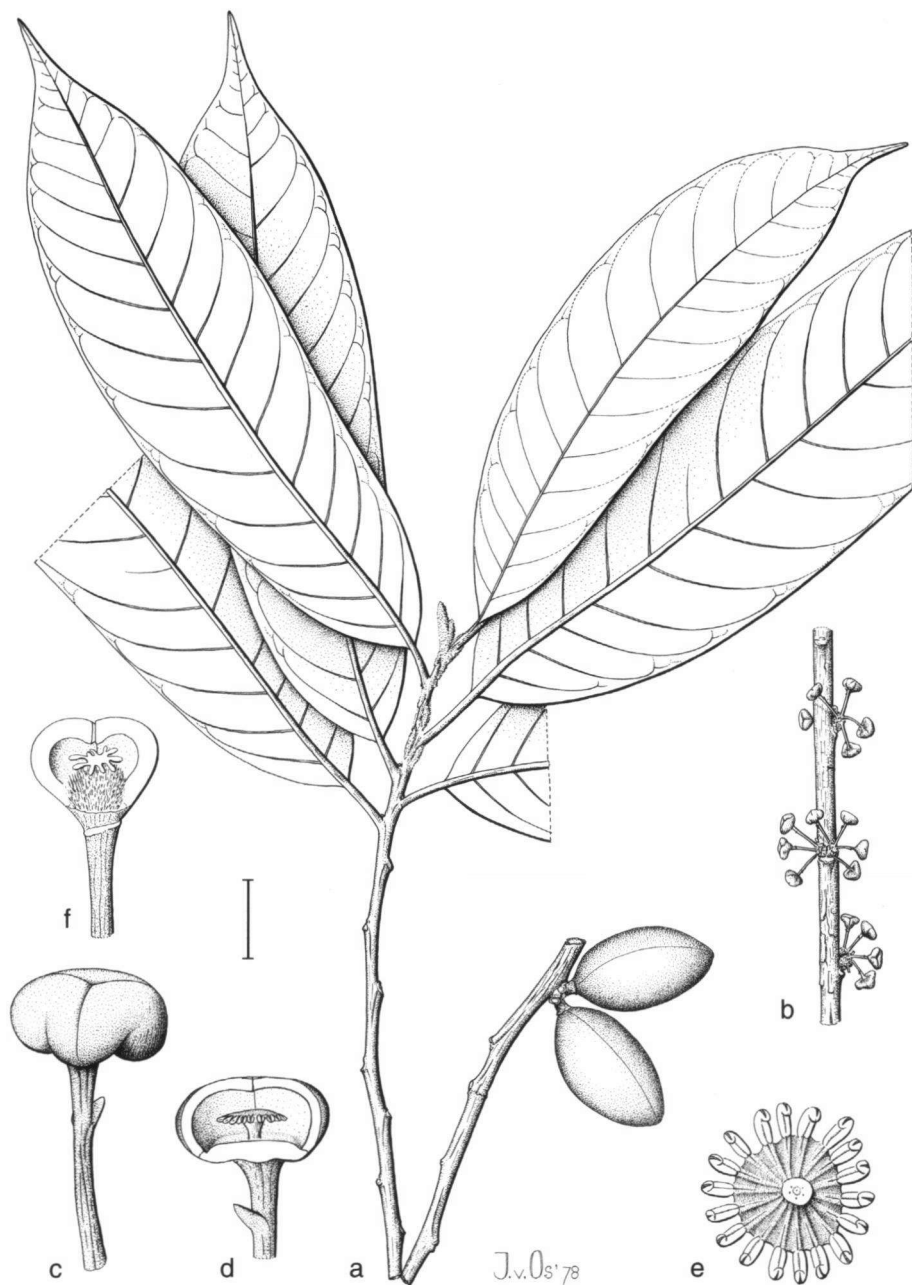


Fig. 48. *Knema membranifolia* H.J.P. Winkler. a. Twig with leaves and infructescence; b. older branchlet with male inflorescences in the axils of fallen leaves; c. male bud; note glabrescent perianth; d. opened male bud showing androecium laterally; e. androecium seen from below, anthers somewhat curved downwards; f. opened (sub)mature female bud, reconstructed from immature flower and stigma persistent on fruit [a: *S* 19225; b–e: *S* 23277; f: *Kostermans* 9536]. — Scale bar for a, b = 2 cm; for c, d = 2.8 mm; for e = 1.4 mm; for f = 2 mm.

Field-notes — In both sexes the perianth is outside (ochreous) brown, yellow or cream inside, in male with a bright dark red androphore.

Distribution — *Malesia*: Central Sulawesi (northern SE Peninsula, N side of Lake Matano).

Habitat & Ecology — Forest on thin soil cover over conglomeratic rock; also on alluvial flatland; c. 600 m altitude.

Notes — 1. *Knema matanensis* seems related to species in the group of *K. glauca* (with, e.g., *K. cinerea*, *K. glauca*, and *K. kinabaluensis*); it seems particularly related to *K. kostermansiana*, a species also with small globose male buds, and the bracteole apically on the pedicel, but differing in membranous leaves with cordate base, 8–10 anthers, and caducous bracteole.

2. *Knema matanensis* (and *K. stellata* subsp. *minahassae*) was not seen in the area with ultrabasic rock south of Lake Matano, where *K. celebica* exclusively was found.

### 39. *Knema membranifolia* H.J.P. Winkler

*Knema membranifolia* H.J.P. Winkler, Bot. Jahrb. Syst. 49 (1913) 368; J. Sinclair, Gard. Bull. Sing. 18 (1961) 262, f. 18; W.J. de Wilde, Blumea 25 (1979) 422, f. 11; Tree Fl. Sabah & Sarawak 3 (2000) 427. — Lectotype: *Hubert Winkler 2460*, SE Kalimantan.

Tree 6–25 m. *Twigs* sometimes bluntly 2- or 3-angular, 1.5–3 mm diameter, at first with dense rusty hairs 1 mm long, glabrescent; bark pale brown to yellowish, striate, when old tending to crack or flake. *Leaves* membranous or thinly coriaceous, oblong to lanceolate, 12–28 by 3.5–8.5 cm, base cuneate-attenuate to subobtuse, apex obtuse to acute-acuminate; drying pale brown or olivaceous above; lower surface early glabrescent, greenish grey; dots absent; midrib stout, prominent above; nerves 12–17 pairs, hardly raised above; venation lax or fine, distinct; petiole 15–25 by 1.5–3 mm. *Inflorescences*: sessile, brachyblast simple, wart-like, or up to 2–4-tubercled, to 10 mm long; in male 5–30-flowered, female 1–4-flowered; flowers at first with dense hairs 0.5–1 mm long, early glabrescent, or with only a few scattered hairs left; perianth 3-lobed, red (?) inside. *Male flowers*: pedicel 6–9 mm long, bracteole caducous, about median; buds depressed globose, obtusely trigonous in cross section, 3.5–5 by 5–7(–8) mm, cleft 3/4–4/5, lobes 0.7–1 mm thick; staminal disc flat to convex, not mammillate, circular, 3–3.5 mm diameter; anthers 19 or 20(–23?), ± stiped, horizontal, 0.7–1 mm, not touching; androphore tapering, 0.7–1 mm long. *Female flowers*: pedicel 1–4 mm long, bracteole above the middle; buds subglobose or broadly obovoid, 3.5–4.5 mm diameter, cleft c. 3/4; ovary subglobose to ovoid, 1.5–2 mm long; stigma ± sessile, with 2 main lobes and each lobe again deeply (2–)4–7-lobulate. *Fruits* 1–3 per infructescence, ellipsoid or obovoid, 2.5–4.5 by 2–3.5 cm, at first with rusty indumentum, hairs c. 1 mm long, early glabrescent; dry pericarp glossy, 1.5–2 mm thick; fruiting pedicel 1–5 mm long. — **Fig. 34e, 48.**

Field-notes — Bark thin, smooth, peeling off in thin strips, or flaky; living bark 3–5 mm, brown; wood pale brown or white; exudate of bark (yellowish) red. Flowers brown outside. Fruits with easily detachable brown cover, becoming reddish or yellow.

Distribution — *Malesia*: Borneo (Sarawak, Sabah, E & SE Kalimantan).

Habitat & Ecology — Lowland dipterocarp forest, on loam, sandstone, basalt, and lime-containing soils; 0–500 m altitude; fl. mainly Apr.–June; fr. throughout the year.

Note — *Knema membranifolia* resembles typical *K. curtisii* by the glabrescent yellowish twigs; that species, however, has terete twigs, non-flaking bark, and a different androecium. The closest alliance of *K. membranifolia* is possibly with *K. korthalsii*, which differs in non-flaking bark of twigs, generally larger (longer) leaves with more veins, flowers with persistent indumentum, 12–20 smaller anthers, and smaller fruits.

#### 40. *Knema minima* W.J. de Wilde

*Knema minima* W.J. de Wilde, Blumea 43 (1998) 249, f. 1c. — Type: *Dransfield c.s. JD 7071*, Brunei.

Treelet, 2–5 m. Twigs bluntly angular, 1–1.5 mm diameter, with dense rusty hairs 0.5 mm, glabrescent; bark (yellow-)brown, finely striate, not or faintly finely cracking. Leaves chartaceous, elliptic-oblong or lanceolate, 6–18 by 1–3(–4) cm, base cuneate, rarely nearly rounded, apex acute, early glabrescent, at first with dense woolly yellow-brown hairs 0.5 mm; drying dull greenish above, lower surface grey-green; dots absent; midrib raised above, nerves 10–20 per side, slightly raised, beneath yellow-brown, contrasting; venation fine, not prominent; petiole 5–10 by 1(–1.5) mm. *Inflorescences*: among the leaves, sessile, brachyblast simple (or 2- or 3-furcate), wart- or worm-like, 1–5 mm long; in male 1–3-flowered, female 1- or 2-flowered; flowers with dense hairs, 0.5 mm; perianth 3-lobed, red inside. *Male flowers*: pedicel 1.5(–2) by 0.5 mm, bracteole persistent, at 1/3 below apex; buds globose, 1.5–1.8 by 2–2.2 mm, cleft c. 4/5, lobes 0.3 mm thick; staminal disc flat, subcircular, 1–1.5 mm diameter, anthers 7–10, shortly stiped, 0.3–0.5 mm, opening outward; androphore slender, 0.5–0.8 mm. *Female flower* (from remnants under immature fruits): subsessile, 1.5–3 mm long. *Fruits* 1 (or 2) per infructescence, obovoid-ellipsoid, 1.2–2 by 0.8–1 cm, with dense bright (yellow) rusty hairs 0.5–1 mm; dry pericarp thin, 1 mm or less; fruiting pedicel 1–1.5 mm long. — **Fig. 41c.**

Field-notes — Small tree, 2–5 m; branches plagiotropic, young growth rusty brown; bark rough. Leaves dull green above, paler, glaucous beneath, midrib brownish. Inflorescences racemose, axillary, few-flowered. Flowers deep red. Fruits solitary, axillary, rusty copper-brown.

Distribution — *Malesia*: Borneo (S Brunei, known from a restricted area).

Habitat & Ecology — Mixed dipterocarp forest on ridges, possibly restricted to forest on sandstone or Setap shales; loamy or podzolic soil; 50–350 m altitude; fl. Jan., Feb., June, July; fr. Jan., Mar., July.

Notes — 1. *Knema minima* resembles and may be confused with *K. latericia* subsp. *latericia* var. *subtilis* or tiny forms of *K. latericia* subsp. *ridleyi* (see De Wilde, Blumea 41, 1996, 389), or with plants provisionally identified as *K. tridactyla* aff. subsp. *sublaevis*. With *K. tridactyla* it has the small male flowers in common, but it differs e.g. in leaf texture and subsistent indumentum on the lower surface of the leaves.

2. *Knema curtisii* and *K. minima* rank among the species of the lowest stature; also the male perianth is small, perhaps the smallest known beside those of *K. curtisii*, *K. mogeana*, *K. muscosa*, and *K. tridactyla*.

#### 41. *Knema mogeana* W.J. de Wilde

*Knema mogeana* W.J. de Wilde, Blumea 32 (1987) 136, f. 4; Tree Fl. Sabah & Sarawak 3 (2000) 428. — Type: *Mogea (& de Wilde) 4446*, C Kalimantan.

Tree 4–15 m. *Twigs* 1–1.5(–2) mm diameter, with dull brown hairs 0.1–0.2 mm long, (late) glabrescent; bark finely striate, not flaking. *Leaves* membranous, oblong to lanceolate, 8–17(–24) by 1.5–4(–7) cm, base narrowly rounded to attenuate, apex acute-acuminate, drying olivaceous or dark brown above, lower surface with persistent, sparse, not touching, pale yellowish stellate scale-like hairs of mixed sizes, 0.1–0.2 mm; dots absent; midrib raised above; nerves 13–20 pairs,  $\pm$  flat above, venation moderately fine, not very distinct; petiole 8–12(–15) by 1–2(–3) mm. *Inflorescences*: sessile, brachyblast simple or 2- or 3-forked, to 4 mm long, in male 4–8-flowered, female 2–6-flowered; flowers with dense rusty hairs 0.1–0.2 mm long; perianth 3-lobed, greenish creamy inside. *Male flowers*: pedicel 2–4 mm long, bracteole persistent, broadly ovate, 0.5–1 mm long, 0.5 mm below the apex; buds broadly obovoid, (2–)2.5 mm diameter, cleft 4/5–5/6, lobes 0.5(–0.8) mm thick; staminal disc circular, flat, 1–1.5 mm diameter, anthers 6–8(–10), short-stiped, horizontal, 0.3 mm long, not touching, opening downwards; androphore 1(–1.4) mm long. *Female flowers*: pedicel 3–6(–8) mm long, bracteole persistent, about median or up to 2 mm below the apex; buds long-obovoid, 4 by 2.5 mm, cleft c. 1/2, lobes 0.5 mm thick; ovary ovoid, 1.5 by 1(–1.3) mm, with hairs 0.1 mm long or less, stigma sessile, 1 mm long, 2-lobed and each lobe 4- or 5-lobulate. *Fruits* 1–6 per infructescence, ellipsoid or ellipsoid-oblong, 1.5–2 by 1–1.2 cm, apex rounded or short-acute, with hairs 0.1 mm long; dry pericarp 1 mm thick, fruiting pedicel 4–10 mm long. — **Fig. 49.**

**Field-notes** — Small tree, bark smooth, dark brown, rough when old, with some pustules, not furrowed or striate; sap copious, red. Leaves glaucous beneath, with yellowish green midrib. Perianth outside yellow-brown, greenish creamy inside, androphore whitish, anthers pale yellow; fruits yellowish green.

**Distribution** — *Malesia*: Borneo (Sarawak, Sabah, C & E Kalimantan: E Kutei).

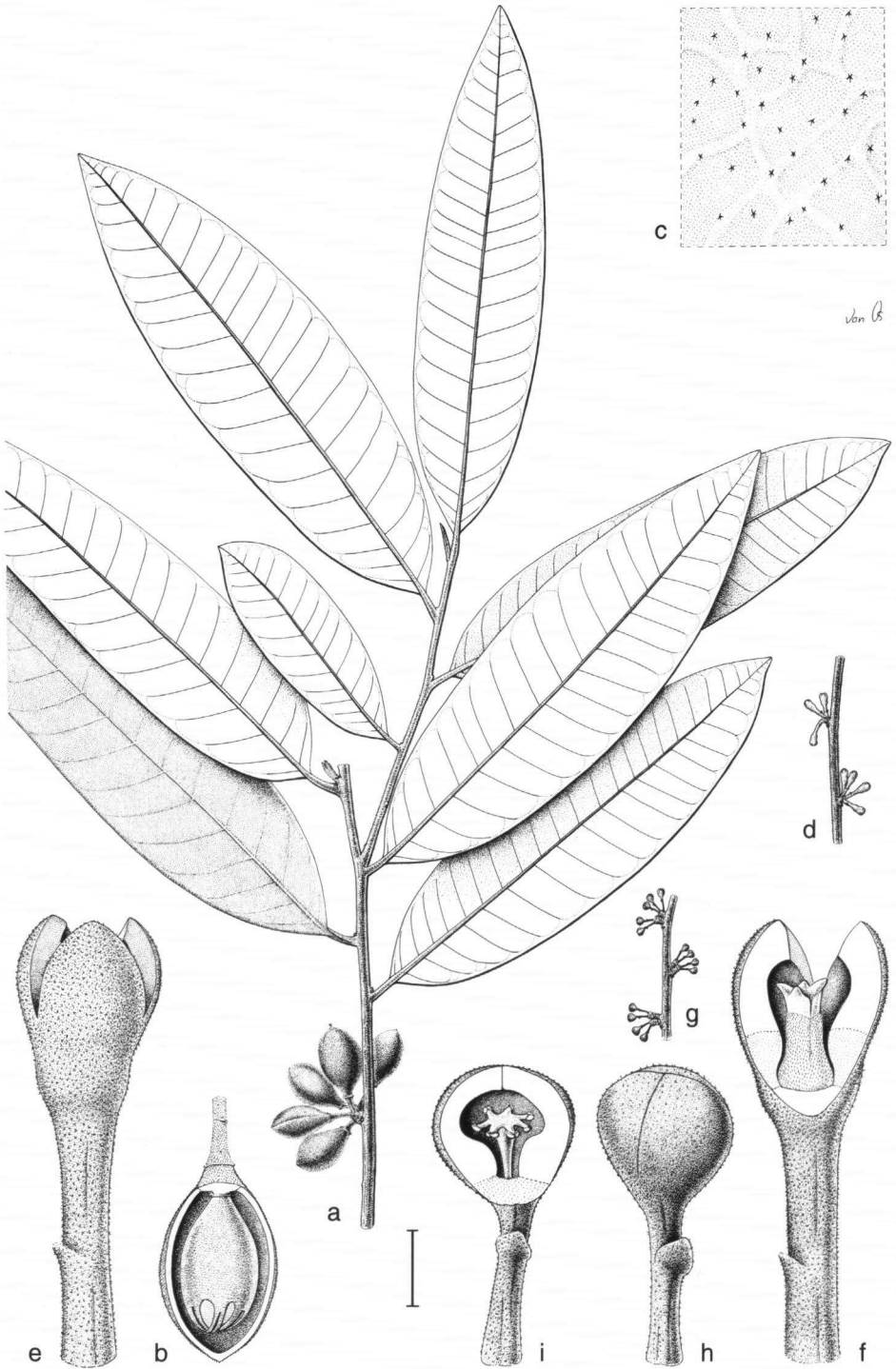
**Habitat & Ecology** — Primary forest, hill-slope forest, mixed dipterocarp forest, ridge forest in kerangas; on sandy soil, sand loam soil, diorite, sandstone, limestone; 0–300 m altitude; fl. Dec., Jan., May, June; fr. Jan., June–Sept.

**Note** — *Knema mogeana* may be confused with *K. hirtella*, *K. stenophylla*, and *K. subhirtella*. *Knema stenophylla* has more equal-sized minute hairs on the lower leaf surface, and larger male buds; *K. hirtella* and *K. subhirtella* both differ in stouter habit, leaves more prominently reticulate above, androphore often minutely pubescent at base, more anthers, 8–13(–15), and larger fruits. In *K. subhirtella* the bracteoles are late caducous and the perianth is cleft less deeply.

#### 42. *Knema muscosa* J. Sinclair

*Knema muscosa* J. Sinclair, Gard. Bull. Sing. 18 (1961) 264, f. 19; W.J. de Wilde, Blumea 25 (1979) 466; Tree Fl. Sabah & Sarawak 3 (2000) 428. — Type: *Clemens 22120*, Sarawak.

Tree c. 8 m. *Twigs* 1–1.5 mm diameter, at first with dense rusty hairs of variable sizes, 0.2–0.7 mm long, glabrescent; bark smooth or very finely striate, not tending to crack or flake. *Leaves* chartaceous, oblong(-lanceolate), 5.5–12(–15) by 1.5–3.5 cm, base (sub) attenuate, apex acute or up to 2 cm acute-acuminate; drying brown above; lower surface brownish grey, at first with conspicuous dense rusty mixed sessile and dendroid hairs 0.2–0.7 mm long, early or late glabrescent; dots present (lens!); midrib slender, raised above; nerves 7–14 pairs, slender, raised; venation fine, visible above; petiole 7–10 by



1.5 mm. *Inflorescences*: peduncle up to 2 mm long, brachyblast simple or 2- or 3-forked, to 3 mm long; in male (1- or) 2–8-flowered; flowers with persistent rusty woolly hairs 0.2–0.5 mm long; perianth 3-lobed, colour inside not known. *Male flowers*: pedicel 2–3 mm long, bracteole  $\pm$  persistent,  $\pm$  median; buds subglobose or broadly obovoid, 2–2.5 mm diameter, cleft c. 3/4, lobes 0.5 mm thick; staminal disc flat, circular, 1–1.3 mm diameter; anthers 6–8,  $\pm$  stiped,  $\pm$  horizontal to oblique, 0.3(–0.5) mm long, spaced; androphore 0.7–1 mm long. *Female flowers* not known. *Fruits* solitary, obovoid-oblong, apex shortly acute-mucronate, 1.7–1.8 by 1 cm, with hairs 0.3 mm long; dry pericarp 0.5 mm thick; fruiting pedicel 6–7 mm long, with the scar of the bracteole  $\pm$  median.

Distribution — *Malesia*: Borneo (Sarawak: Mt Majau, Gat, upper Rejang River area).

Habitat & Ecology — Montane moss forest of Mt Majau; exact altitude not known.

Note — *Knema muscosa* superficially resembles slenderly built specimens of *K. kinabaluensis*, or also *K. tomentella*, *K. malayana*, and especially *K. stenophylla*, but from all these it differs by the blackish dots on the lower leaf surface, and the leaves at first with conspicuous dense hairs of variable sizes below, glabrescent. *Knema kinabaluensis* has much larger fruits; *K. tomentella* has more striate twigs; *K. malayana* has larger flowers; *K. stenophylla* has a much less distinct venation on the upper leaf surface.

#### 43. *Knema oblongata* Merr.

*Knema oblongata* Merr., J. Straits Branch Roy. Asiat. Soc. no 85 (1922) 190; W.J. de Wilde, Blumea 25 (1979) 400, f. 5; Tree Fl. Sabah & Sarawak 3 (2000) 429. — Type: *Ramos 1663*, Sabah.

Shrub or tree 4–20 m. *Twigs* sometimes faintly angular, 2–5(–8) mm diameter, at first with rusty hairs 0.2–0.6 mm long, glabrescent; bark (finely) striate, not cracking or flaking. *Leaves* chartaceous or coriaceous, elliptic to (oblong-)lanceolate, 11–45 by 2.5–14 cm, base subattenuate, rounded, or shallowly cordate, apex acute(-acuminate); drying greenish brown,  $\pm$  glossy above, with scattered hair scars (lens!), lower surface greyish, finely papillate, with yellow-brown to rusty hairs of variable size, persistent or partially late glabrescent; dots absent; midrib raised above; nerves (10–)18–26 pairs, sunken or raised above; venation fine, distinct; petiole late glabrescent, 10–25 by 2–6 mm. *Inflorescences*: peduncle up to 4 mm (see the subspecies), brachyblast simple or forked, to 5 mm long, in male 5–25-flowered, female 1–5-flowered; flowers with rusty hairs 0.1–1(–2) mm long; perianth 3- (or 4-)lobed, yellow (?) or red inside. *Male flowers*: pedicel 2–8 mm long, bracteole caducous, median to subapical; buds depressed broadly obovoid, tapering in the lower half, grooved when dry, 2.5–5 by 2.5–5 mm, cleft 1/2–2/3(–3/4, see note under subsp. *oblongata*), lobes 0.5–1 mm thick; staminal disc circular or faintly triangular, flat or slightly concave, 1.5–3 mm diameter; anthers 7–9 (subsp. *parviflora* and *pedunculata*), or 13–18(–21),  $\pm$  half-sessile to just stiped,  $\pm$  oblique or suberect,

Fig. 49. *Knema mogeana* W.J. de Wilde. a. Fruiting twig; b. opened fruit showing seed with aril lacinate at apex; c. lower leaf surface with scattered small hairs; d. twig with female inflorescences; e. female flower; f. ditto, opened, showing pistil; g. twig with male inflorescences; h. male flower; i. ditto, longitudinally opened, showing androecium with 7 stalked anthers [a–c: *SAN 31172*; d–f: *Veldkamp 8135*; g–i: *S 21495 (Ashton)*]. — Scale bar for a, d, g = 2 cm; for b = 6.6 mm; for c = 0.4 mm; for e, f, h, i = 1.65 mm.



(0.3–)0.5–0.7 mm, not or but slightly touching; androphore tapering or not, 1–2 mm long. *Female flowers*: pedicel 2.5–10 mm long, bracteole at or above the middle; buds ellipsoid to obovoid, 6–7.5 by 4–6 mm, cleft c. 1/2, lobes 0.5–1 mm thick; ovary subglobose, 3–3.5 mm diameter; style 1–1.5 mm; stigma 2-lobed and each lobe again 3–5-lobulate. *Fruits* 1–3 per infructescence, subovoid or obovoid, apex subacute to obtuse, base attenuate to rounded, 2–3.8 by 1.5–2 cm, with rusty hairs 1–1.5 mm long, easily rubbed off; dry pericarp 2–4 mm thick; fruiting pedicel 3–10 mm long.

Field-notes — Bark of trunk smooth, sometimes scaly or ± fissured, once lenticellate; inner bark red-brown, beef-red, or pinkish; slash wood pale yellowish, pale brownish, or white. Perianth lemon-yellow to red inside. Fruits yellow or orange, reddish hairy.

Distribution — *Malesia*: Borneo (Sarawak, rare; Sabah; E Kalimantan).

Habitat & Ecology — Primary and degraded forest, mixed dipterocarp forest, marshy or hill-side forest; on poor, brown, or sticky soil, and sandy ridges; 0–1200 m altitude; fl. & fr. throughout the year.

Note — *Knema oblongata* is a variable species, with three subspecies. It may be confused with *K. tridactyla* and *K. laurina* (the type variety), with ± uniform dendroid hairs on the lower leaf surface, absence of crateriform hair scars on the upper leaf surface, and elongate male buds.

#### KEY TO THE SUBSPECIES

- 1a. Twigs at apex with hairs 0.2(–0.3) mm long. Lateral nerves c. 10 pairs. Male buds 2.5 mm diameter, with hairs 0.1(–0.2) mm long. [Inflorescences sessile; male pedicel 2 mm long; anthers 8, short-stiped.] . . . . . **b. subsp. parviflora**  
 b. Twigs at apex with hairs 0.3–0.6 mm long. Lateral nerves 18–26 pairs. Male buds 3.5–5 mm diameter, with hairs 0.4–1(–2) mm long . . . . . 2  
 2a. Leaves narrow, oblong or lanceolate, 2–5.5 cm wide, base attenuate to obtuse. Inflorescences 1–4 mm pedunculate. Male buds 4 mm diameter; pedicel 2–3 mm long; anthers 7–9, almost entirely sessile . . . . . **c. subsp. pedunculata**  
 b. Leaves broader, elliptic to oblong-lanceolate, 4–14 cm wide, base broadly rounded or shallowly cordate, rarely subattenuate. Inflorescences sessile or up to 1 mm pedunculate. Male buds 3.5–5 mm diameter; pedicel 2–8 mm long; anthers 13–21, half-sessile to just stiped . . . . . **a. subsp. oblongata**

#### **a. subsp. oblongata**

*Knema oblongata* Merr. subsp. *oblongata*; W.J. de Wilde, Tree Fl. Sabah & Sarawak 3 (2000) 431.  
 — *Knema obovoidea* Merr., Univ. Calif. Publ. Bot. 15 (1929) 75.

*Twigs* stout, at apex 2.5–5(–8) mm diam., with hairs 0.3–0.6 mm long. *Leaves* broad, 11–45 by 4–14 cm, base broadly rounded or shallowly cordate, rarely subattenuate; lateral nerves c. 20 pairs. *Inflorescences*: sessile or to 1 mm pedunculate; flowers with hairs 0.4–1 mm long. *Male flowers*: pedicel 2–8 mm long; buds broadly obovoid to obconical, 4–5 by 3.5–5 mm, cleft c. 1/2–2/3(–3/4, see note); lobes 3 (or 4), at sutures 0.5–1 mm thick; anthers 13–18(–21), half-sessile to just stiped. *Female pedicel* 2.5–10 mm long. *Fruits* 2–3.8 by 1.5–2 cm, apex obtuse; fruiting pedicel 3–10 mm long. — **Fig. 50.**

Distribution — As the species.

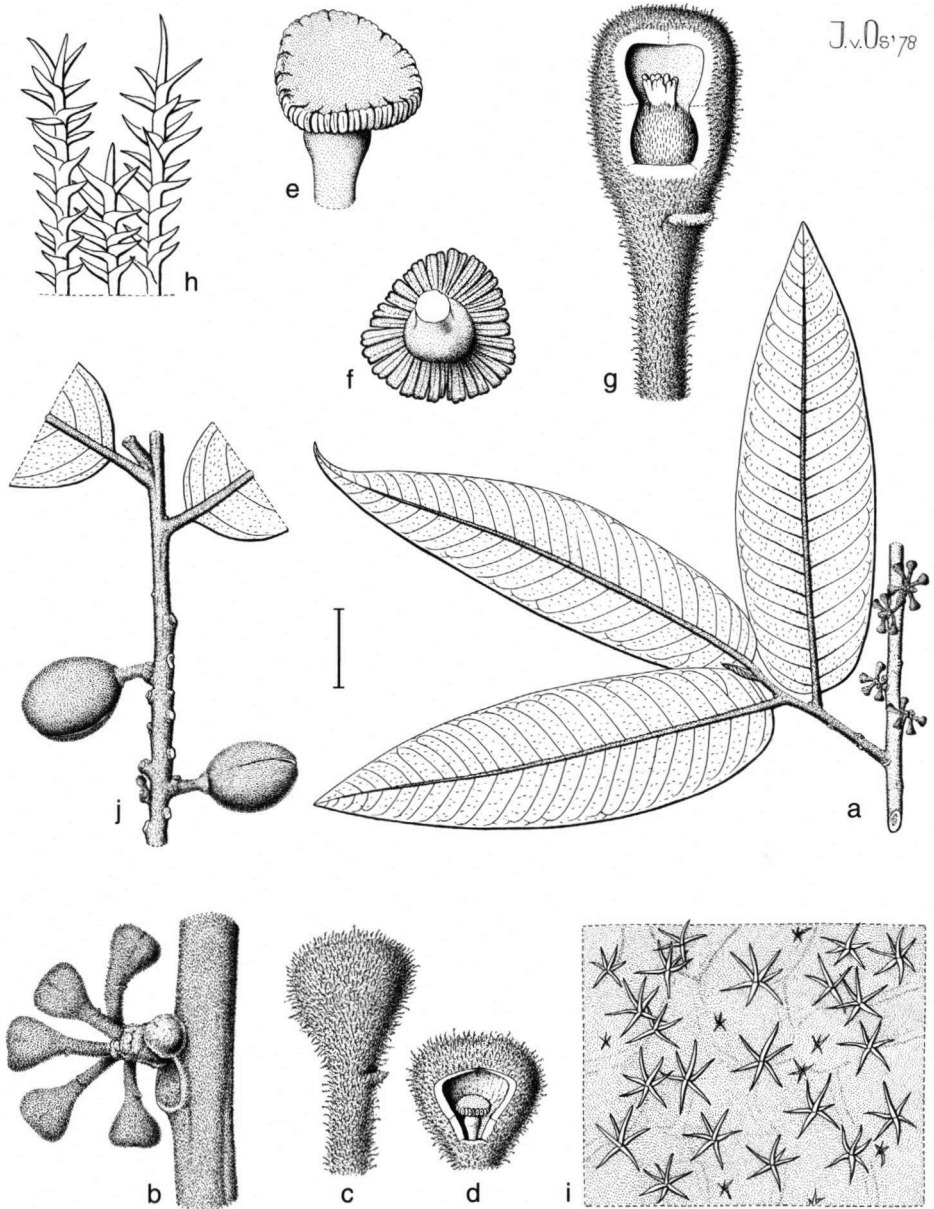


Fig. 50. *Knema oblongata* Merr. subsp. *oblongata*. a. Branchlet with male inflorescences; b. male inflorescence; c. male bud; d. opened male bud showing the androecium; e. androecium in half-lateral view; f. androecium seen from below; g. opened female bud showing the pistil; h. sample of hairs of male flower; i. detail of lower leaf surface with stellate-dendroid hairs of mixed sizes; j. twig with infructescences, each with a single mature fruit [a, b: SAN 30740; c–f, h, i: SAN 30369; g: Sinclair 9291; j: SAN 32857]. — Scale bar for a = 4 cm; for b = 6.6 mm; for c, d, g = 2.8 mm; for e, f = 0.66 mm; for h = 0.16 mm; for i = 0.3 mm; for j = 2 cm.

Note — Variable in the size of male buds and number of anthers. *KEP FN 80161*, (Brunei) differs in its exceedingly broad male buds, 4–4.5 by 4.5–5 mm, cleft c. 3/4; with 14–16 just stiped, rather horizontally positioned anthers.

**b. subsp. parviflora** W.J. de Wilde

*Knema oblongata* Merr. subsp. *parviflora* W.J. de Wilde, *Blumea* 25 (1979) 404; *Tree Fl. Sabah & Sarawak* 3 (2000) 431. — Type: *SAN 31488 (Agam)*, Sabah.

*Twigs* fairly slender, at apex 2–3 mm diameter, with hairs 0.1–0.3 mm long. *Leaves* 8–17 by 3–6.5 cm, base rounded; lateral nerves c. 10 pairs. *Inflorescences*: sessile; flowers with hairs 0.1 mm long. *Male flowers*: pedicel 2 mm long, bracteole apical; buds broadly obovoid, 2.5 mm diameter, cleft c. 2/3, lobes 3, at sutures 0.5 mm thick; anthers 8, just stiped, 0.3–0.4 mm long. *Fruits* 20 mm long, pedicel 3–4 mm long.

Distribution — *Malesia*: Borneo (Sabah: Lahad Datu District).

Habitat & Ecology — Primary forest on hill side; c. 150 m altitude; fl. May.

Note — Known only from the type. Its status as subspecies in *K. oblongata* is provisional; it also seems close to *K. tridactyla*, a species with small flowers and only 8 anthers.

**c. subsp. pedunculata** W.J. de Wilde

*Knema oblongata* Merr. subsp. *pedunculata* W.J. de Wilde, *Blumea* 25 (1979) 403; *Tree Fl. Sabah & Sarawak* 3 (2000) 431. — Type: *SAN 49195 (Aban Gibot)*, Sabah.

*Twigs* fairly slender, at apex 2–3.5 mm diameter, with hairs 0.5 mm long. *Leaves* narrow, oblong to lanceolate, 11–32 by 2–5.5 cm, base attenuate to obtuse; lateral nerves c. 20 pairs. *Inflorescences*: peduncle 1–4 mm long; flowers with hairs 0.4–2 mm long. *Male flowers*: pedicel 2–3 mm long; buds obovoid, 3–4 by 3–4.2 mm, cleft 1/2 or slightly over, lobes 3, variable in thickness, 0.3–1.5 mm; anthers 7–9, just sessile. *Fruits* (immature) 2 by 1 cm, apex acute; fruiting pedicel 6 mm long.

Field-notes — Bark chocolate; inner bark reddish; sapwood pale yellow. Flowers and fruits reddish.

Distribution — *Malesia*: Borneo (W Sabah).

Habitat & Ecology — Primary forest on ridges and hill sides; yellow or brownish soil; 0–600 m altitude; fl. Sept.

Note — This subspecies may be confused with *K. tridactyla* and *K. laurina* var. *heteropilis*.

**44. Knema oblongifolia** (King) Warb.

*Knema oblongifolia* (King) Warb., *Mon. Myrist.* (1897) 586, t. 24; J. Sinclair, *Gard. Bull. Sing.* 16 (1958) 321, f. 17A, B; 18 (1961) 266; W.J. de Wilde, *Blumea* 25 (1979) 369. — *Myristica oblongifolia* King, *Ann. Roy. Bot. Gard. Calc.* 3 (1891) 313, p.p., pl. 148 f. 1–7, 10, 11. — Syntypes: *King's coll.* 835, 5983 (lecto), Peninsular Malaysia.

*Myristica oblongifolia* King var. *monticola* King, *Ann. Roy. Bot. Gard. Calc.* 3 (1891) 314, pl. 148, f. 8, 9. — *Knema oblongifolia* (King) Warb. var. *monticola* (King) Warb., *Mon. Myrist.* (1897) 587; J. Sinclair, *Gard. Bull. Sing.* 16 (1958) 323, f. 17C–G; 18 (1961) 266. — Syntypes *King's coll.* 3582, 3810, 8322, 10953; *Scortechini s.n.*; *Wray* 993, 1077, 1087 (lecto); all Peninsular Malaysia.

Shrub or tree (2–)5–15 m. *Twigs* somewhat flattened or coarsely 2- or 3-angular, 2–4 (–6) mm diameter, at first with fine woolly hairs up to 1 mm long, early glabrescent; bark smooth, finely striate,  $\pm$  glossy, not tending to crack or flake. *Leaves* chartaceous, (elliptic-)oblong, 10–25(–45) by 2.5–8(–16) cm, base attenuate to rounded, rarely subcordate, apex acute(-acuminate); drying (greenish) brown above, often with a typical pitted structure like the rind of an orange (lens!); lower surface greyish, at first with scattered greyish brown stellate hairs, 0.3 mm long, persistent or glabrescent; dots absent; midrib raised above; nerves 18–30 pairs,  $\pm$  flat above; venation faint; petiole 10–22 by 1.5–3 mm. *Inflorescences*: peduncle up to 5 mm, axillary or up to 6 mm supra-axillary, brachyblast simple or forked, 2–6 mm long, in male 2–10-flowered, female 1–4-flowered; flowers with hairs 0.2–0.5 mm long; perianth 3-lobed, reddish (?) inside. *Male flowers*: pedicel (1–)2–3 mm long, bracteole persistent or caducous, almost apical; buds ellipsoid(-oblong) to ovate, or obovate, often somewhat contracted in the middle, 3.5–5 by 2–3 mm, cleft 1/3–1/2, lobes 0.5 mm thick; staminal disc small,  $\pm$  circular, flat, 0.5–1 (–1.5) mm diameter; anthers 6–9, half-sessile, suberect, 0.3–0.6 mm, not tightly touching; androphore terete, slender, 1.7–3 mm long. *Female flowers*: pedicel 0.5–1 mm long, bracteole (sub)apical; buds ovoid, 5–6.5 by 3.5–4.5 mm, cleft c. 1/2, lobes 0.5(–1) mm thick; ovary subglobose, 1.7–3 mm diameter; style 1.5–2 mm long; stigma inconspicuous, 2-lobed and each lobe again 2- or 3-lobulate. *Fruits* 1–3 per infructescence, globose or (ob)ovoid, apex to 3 mm beaked, 2–3 by 1.5–2.3 cm, with rusty hairs 0.2–0.3 mm long; dry pericarp 2 mm thick; fruiting pedicel 1–3(–4) mm long.

Field-notes — Bark smooth; outer bark brittle, inside red, granular. Fruits rusty brown, eaten by squirrels.

Distribution — *Malesia*: Peninsular Malaysia (Perak, Kelantan, Trengganu, Pahang, Selangor).

Habitat & Ecology — Lowland and montane forest; 0–1700 m altitude; fl. Feb.–Mar.; fr. Mar., July, Sept., Dec. The wide altitudinal range is unusual in *Knema*.

Notes — 1. Fruits are typically up to 3 mm beaked at the apex, subsessile or but shortly stalked.

2. Especially specimens from lower altitudes have the upper leaf surface with a fine punctate-pitted structure, under magnification reminiscent of the rind of an orange.

3. Specimens from mountain areas often have conspicuous axillary vegetative buds, rarely found in other *Knemas*.

4. *Knema oblongifolia* is one of the few species, besides *K. luteola* and *K. rubens*, with the younger twigs  $\pm$  flattened in the apical part.

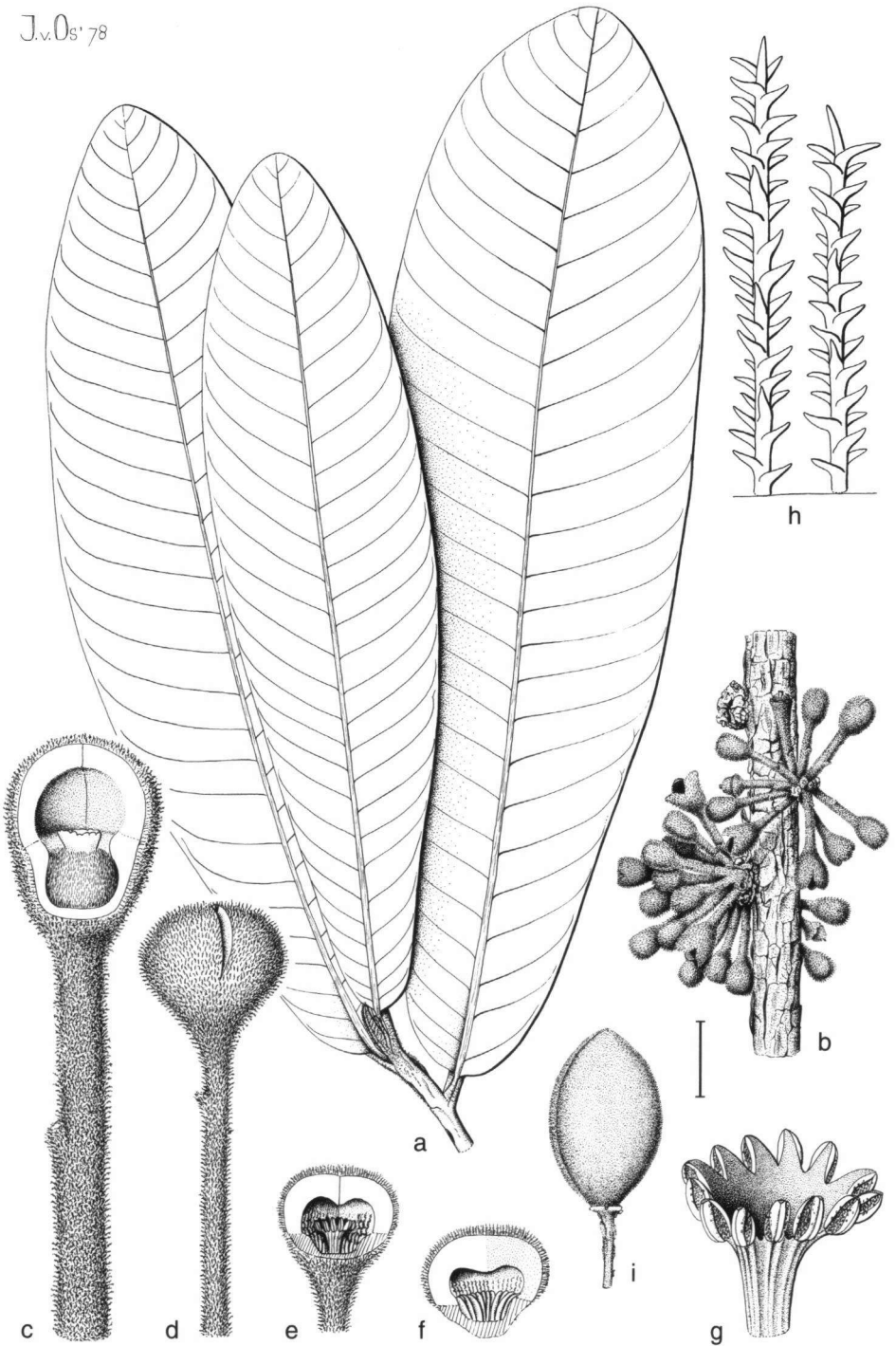
#### 45. *Knema pallens* W.J. de Wilde

*Knema pallens* W.J. de Wilde, Blumea 25 (1979) 391, f. 4; Tree Fl. Sabah & Sarawak 3 (2000) 432.

— Type: SAN 73312 (*Saikeh*), Sabah.

Tree 8–30 m. *Twigs* sometimes  $\pm$  angular, 5–12 mm diameter, at first with pale brown hairs 0.2–2(–2.5) mm long, glabrescent; bark greyish brown, not striate, conspicuously longitudinally cracking, and flaking. *Leaves* chartaceous or coriaceous, when immature with dense indumentum, elliptic to lanceolate, 25–55 by (5–)6–23 cm, apex acute-acuminate or obtuse, base cordate, rarely rounded or subattenuate; greenish brown,  $\pm$  glossy above; lower surface pale, glabrous, finely papillate; dots absent; midrib stout, raised

J.v.Os' 78



above; nerves 18–32 pairs, raised above; venation coarse, sunken, faint above; petiole late glabrescent, 10–20 by 5–8 mm. *Inflorescences*: sessile, brachyblast simple, furcate, or warty, 5–20 mm diameter, in male (5–)10–30-flowered, female 10–20(–40)-flowered; flowers with yellowish brown hairs (0.1–)1 mm long; perianth 3- (or 4-)lobed, reddish inside, at base thickened into a  $\pm$  striated disc. *Male flowers*: pedicel 12–20 mm long, bracteole 2–3 mm, caducous or (sub)persistent, median to (sub)apical; buds (depressed) globose or broadly obovoid, 6–10 by 6.5–10 mm, cleft 4/5 or more, lobes 1.5–2.5(–5) mm thick; staminal disc circular, flat or slightly concave, 2.5–4.5 mm diameter; anthers 15–23, just sessile, almost horizontal, 0.6–1 mm long, sometimes shortly apiculate, not touching; androphore somewhat tapering, 1–1.5 mm long. *Female flowers*: pedicel (7–)10–20 mm long, bracteole about median; buds obovoid, 11 by 8–9 mm, cleft c. 2/3, lobes 2 mm thick; ovary subglobose, 3.5 mm diameter; style 1–1.5 mm long; stigma  $\pm$  flat, 2-lobed and each lobe again 5–7-lobulate. *Fruits* 1–6 per infructescence, ellipsoid, 3.5–7 by 2.5–3.5(–4.5) cm, with light brown hairs 1–2 mm long; dry pericarp 4–7 mm thick; fruiting pedicel (10–)14–30 mm long. — **Fig. 51.**

Field-notes — Bark scaly; inner bark light red or whitish; sapwood yellow(-ochre), heartwood dark brown, medium hard. Leaves dark green above, glaucous beneath. Fruits yellowish.

Distribution — *Malesia*: Borneo (Sarawak, Sabah, E Kalimantan).

Habitat & Ecology — Lowland forest; kerangas, forest behind mangrove, forest on alluvial sandstone; 0–300 m altitude; fl. Jan.–May, fr. throughout the year.

Note — *Knema pallens* is distinguishable by a stout habit, flaky bark of twigs, large male flowers, and large, long-pedicelled female flowers; it resembles *K. lamellaria* from Peninsular Malaysia, a species also with long fruiting pedicels and fruits with hairs 3–5 mm long, caducous or easily rubbed off.

#### 46. *Knema patentinervia* (J. Sinclair) W.J. de Wilde

*Knema patentinervia* (J. Sinclair) W.J. de Wilde, *Blumea* 25 (1979) 456. — *Knema glaucescens* Jack var. *patentinervia* J. Sinclair, *Gard. Bull. Sing.* 16 (1958) 308, f. 13C. — *Knema cinerea* (Poir.) Warb. var. *patentinervia* J. Sinclair forma *patentinervia*; J. Sinclair, *Gard. Bull. Sing.* 18 (1961) 182, 261, 276, f. 5F–H. — Type: *CF 1873 (Ludin)*, Peninsular Malaysia.

Tree 3–16 m. *Twigs* 1.5–2 mm diameter, at first with minute rusty or yellowish hairs 0.1–0.2 mm long, glabrescent; bark smooth or finely striate, not tending to crack or flake. *Leaves* thinly coriaceous, elliptic to lanceolate, 6–21 by 1.7–7 cm; apex obtuse, acute, or short acute-acuminate, base attenuate to rounded; drying greenish brown,  $\pm$  glossy above; lower surface greyish, with subpersistent sparse scale-like hairs 0.1 mm long; dots absent; midrib flat or somewhat raised above; nerves rather patent, 12–24

Fig. 51. *Knema pallens* W.J. de Wilde. a. Habit of twig apex with leaves; b. part of older branch with female inflorescences; c. opened female bud showing the pistil, pedicel with bracteole scar about halfway; d. male bud; e. opened male bud showing the androecium, somewhat shrunken by drying; f. ditto, androecium removed, showing furrowed inner basal part of perianth; g. androecium; h. sample of hairs of male bud; i. fruit, with remnants of indumentum on the fruiting pedicel [a–c: *SAN 73312*; d–h: *SAN 29851*; i: *S 32964*]. — Scale bar for a = 4 cm; for b, i = 2 cm; for c–f = 4 mm; for g = 1 mm; for h = 0.16 mm.

pairs, slender, flat, indistinct above (sometimes raised in young leaves); venation indistinct; petiole 8–12 by 1–1.5 mm. *Inflorescences*: sessile, brachyblast simple or  $\pm$  warty, up to 4 mm long; in male 5–10-flowered, female 1–6-flowered; flowers with grey-brown or yellowish hairs 0.1 mm long or less; perianth 3-lobed, yellowish inside. *Male flowers*: pedicel 5–16 mm long, bracteole caducous,  $\pm$  median; buds (depressed) globose, at base truncate or  $\pm$  sagged below the lobe sutures, 2.5–4 by 3.5–5 mm, cleft c. 4/5, lobes 1–1.2 mm thick; staminal disc flat, circular or blunt-triangular, 2–3 mm diameter; anthers 11–17, stiped, horizontal, 0.3–0.5 mm long, not touching; androphore 0.5–1 mm long, tapering. *Female flowers*: pedicel (3–)5–8 mm long, bracteole  $\pm$  median; buds obovoid, apical part  $\pm$  triangular in cross section, 4–5 by 4–5 mm, cleft 2/3, lobes 1 mm thick; ovary ovoid, 2–2.5 mm long; stigma  $\pm$  sessile,  $\pm$  flat, 2-lobed and each lobe again 3- or 4-lobulate. *Fruits* 1–3 per infructescence, subglobose or obovoid, apex rounded and often short-acuminate, base rounded or attenuate, 1.3–2.1 by 1–1.5 cm, with yellowish brown or rusty mealy hairs 0.2–0.5 mm long; dry pericarp 1.5 mm thick; fruiting pedicel (3–)5–11 mm long.

Field-notes — Bark smooth, rugulose, finely scaly, or flaking in thin strips; inner bark pink or red, granular, or cream and fibrous; slash wood whitish. Flowers yellowish inside (always?), slightly fragrant. Fruits yellow or red, aril red.

Distribution — *Malesia*: Sumatra (Tapanuli, Palembang, Bangka), Peninsular Malaysia (Perak, Kelantan, Trengganu, Pahang, Negri Sembilan, Malacca, Johore).

Habitat & Ecology — Primary and old degraded forest; hill slopes, ridges, ridge tops, crests; also in seasonal swamp forest; 0–600 m altitude; fl. mainly Feb.–May; fr. all records June, July.

Note — In Sumatra possibly two forms exist, one with larger, the other with smaller male perianth.

#### 47. *Knema pectinata* Warb.

*Knema pectinata* Warb., Mon. Myrist. (1897) 556, t. 24; J. Sinclair, Gard. Bull. Sing. 18 (1961) 266, f. 20; W. J. de Wilde, Blumea 25 (1979) 430; 27 (1981) 227; Tree Fl. Sabah & Sarawak 3 (2000) 432. — *Myristica pectinata* (Warb.) Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 90, nom. inval. — Type: *Beccari 1607*, Sarawak.

Tree 10–25 m. *Twigs* sometimes faintly angled, 3–6 mm diameter, at first with yellowish or rusty,  $\pm$  scale-like stellate hairs 0.1–0.2 mm long, early glabrescent; bark striate, not tending to crack or flake. *Leaves* (rigidly) coriaceous, oblong to lanceolate, (15–)20–45 by 3.5–10 cm, base broadly truncate, obtuse, or attenuate, apex obtuse or acute(-acuminate); drying olivaceous to dark brown, often with scattered hair scars above; lower surface early glabrescent or with subpersistent grey-brown hairs 0.1–0.3 mm long, especially near the nerves; dots absent; midrib little raised above; nerves 25–50 pairs, little raised but distinct above; venation raised and distinct; petiole 15–25 by 3–7 mm. *Inflorescences*: sessile, brachyblast simple or  $\pm$  warty, 3–5 mm diameter, in male 2–6 (–10)-flowered; flowers with yellowish brown or rusty hairs 0.1 mm long or less; perianth 3-lobed, pale pink inside. *Male flowers*: pedicel 5–15 mm long, bracteole caducous, about median; buds broadly obovoid to depressed globose, (3.5–)4–7 mm diameter, cleft 3/4–4/5, lobes 0.8–2 mm thick; staminal disc flat or slightly concave, circular or sub-triangular, 2–4 mm diameter; anthers 11–15, half-sessile to nearly stiped, horizontal or

half-erect, 0.5–0.6 mm, not or hardly touching; androphore 1–2 mm long, clasped by the swollen base of perianth. *Female flowers* not seen; stigma (on immature fruits) subsessile, 1–1.5 mm diam., 2-lobed and each lobe again with 4 or 5 lacinations. *Fruits* 1 or 2 per infructescence, ellipsoid, 3–5 by 1.7–3 cm, sometimes flanged along the line of suture; dry pericarp 2–4 mm thick, with hairs 0.2 mm long; fruiting pedicel 2–10 mm long.

## KEY TO THE SUBSPECIES

- 1a. Leaves coriaceous. Lower leaf surface with inconspicuous, sparse, minute hairs of variable size, subsistent or glabrescent. Fruits flanged along the line of suture or not ..... **a. subsp. pectinata**  
 b. Leaves rigidly coriaceous. Indumentum of lower leaf surface largely persistent, of densely set minute stellate hairs, mixed with fewer emergent ones. Fruits not flanged ..... **b. subsp. vestita**

**a. subsp. pectinata**

*Twigs* 3–6 mm diameter, hairs 0.1–0.2 mm. *Leaves* coriaceous, on lower surface with sparse indumentum or glabrescent; leaf blade oblong or lanceolate, sometimes parallel-sided, up to 45 cm long, lateral nerves to 50 pairs. *Fruits* 3–5 cm long, flanged or not, fruiting pedicel 2–10 mm long.

Field-notes — Bark hard, with a few large flakes and dents where flakes have fallen out, otherwise smooth. Leaves dark glossy green, with whitish midrib above, glaucous beneath. Perianth pale reddish inside. Immature fruits tawny or orange, flanged.

Distribution — *Malesia*: Borneo (Sarawak, Sabah).

Habitat & Ecology — Lower montane and montane forest; (400–)500–1500 m altitude; fl. & fr. June–Oct.

Notes — 1. Subsp. *pectinata* is related to *K. korthalsii* and *K. glomerata* in various aspects, but these species differ in having a convex staminal disc. It is also related to *K. woodii* and *K. scortechinii*, with which it has the thick-fleshy perianth lobes in common; *K. woodii* differs in less coriaceous leaves with fewer lateral nerves, and by the androecium with 18–23 sessile anthers; *K. scortechinii* has stiped anthers, and different fruits.

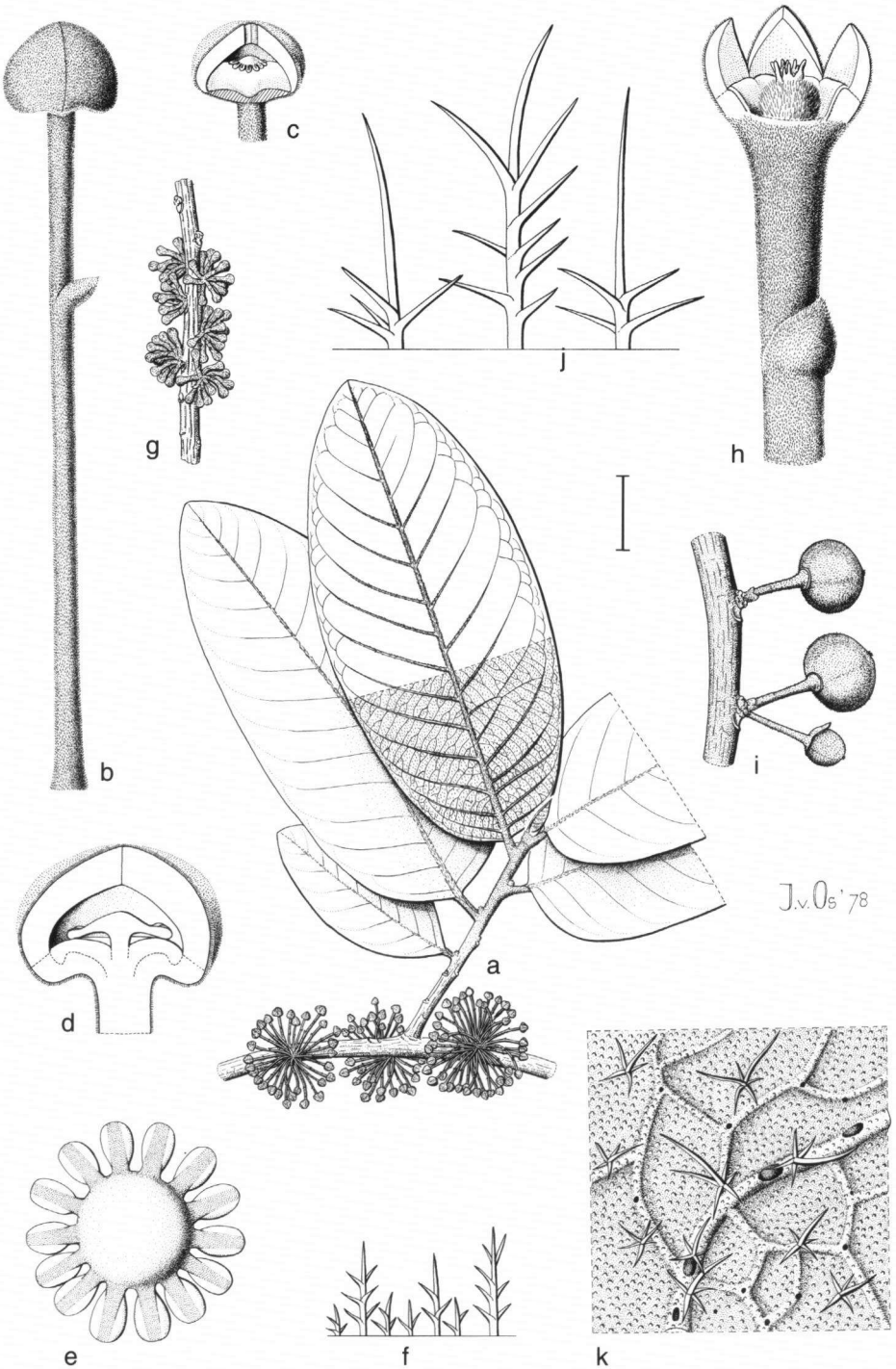
2. The subspecies is variable in the size of the male buds and the number of anthers. Small-flowered specimens, and specimens with very coriaceous leaves may be confused with *K. kinabaluensis*.

**b. subsp. vestita** W.J. de Wilde

*Knema pectinata* Warb. subsp. *vestita* W.J. de Wilde, *Blumea* 27 (1981) 228; *Tree Fl. Sabah & Sarawak* 3 (2000) 434. — Type: *S 26349 (Ilias Paie)*, Sarawak.

*Twigs* stout, at apex 3–5 mm diameter, rusty puberulous by minute stellate scale-like hairs 0.1 mm long or less. *Leaves* rigidly coriaceous, on the lower surface with greyish to yellowish rusty subsistent densely set stellate hairs 0.1–0.2 mm long or less, mixed with fewer slightly longer hairs; leaf blade elliptic-oblong to lanceolate, (10–)20–30 by 3–10.5 cm, base rounded to cuneate, apex obtuse to acute-acuminate; midrib and nerves raised above, nerves 25–30 pairs; venation fine, distinct at both surfaces. *Flowers* not seen. *Fruits* 1 per infructescence, broadly ellipsoid-obovoid, 3–4(–5) by 2.7–3(–4) cm,





not flanged along the line of suture, with hairs 0.1–0.2 mm long; fruiting pedicel 3 mm long.

Field-notes — Trees 6–25 m tall, fruits orange or brown.

Distribution — *Malesia*: Borneo (Sarawak).

Habitat & Ecology — Forest at 1400–1600 m altitude.

Note — The subspecies is reminiscent of *K. kinabaluensis* from Sabah, the latter with a less stout habit and on the lower leaf surface scattered minute stellate scale-like hairs, the fruits generally smaller, and ridged.

#### 48. *Knema pedicellata* W.J. de Wilde

*Knema pedicellata* W.J. de Wilde, *Blumea* 25 (1979) 474, f. 18; *Tree Fl. Sabah & Sarawak* 3 (2000) 434. — Type: *S 16626 (Ilias Paie)*, Sarawak.

Tree 15–30 m. *Twigs* 4–6 mm diameter, at first with rusty hairs 0.5–1 mm long, glabrescent; bark striate, not or but rarely tending to crack or flake. *Leaves* chartaceous, elliptic or oblong, (12–)17–36 by (5–)7–13 cm, base shallowly cordate or subcuneate, apex acute(-acuminate); glabrescent except midrib (which remains longer pubescent in the basal part), drying greenish to brown, with distinct hair scars above; lower surface greenish grey, finely papillate, with subpersistent mixed sessile and stalked hairs 0.3–1.2 mm long; dots present, predominantly on the finer nerves; midrib slightly raised above; nerves 14–22 pairs, flat or slightly raised; venation  $\pm$  flat, distinct; petiole late glabrescent, 6–18 by 3–5 mm. *Inflorescences*: sessile, brachyblast simple, warty or forked, 4–8 mm diameter; in male 20–50-flowered, female 10–40-flowered; flowers with pale to dark brown hairs 0.1–0.5(–0.8) mm long; perianth (3- or 4- or 5-lobed, reddish (?) inside. *Male flowers*: pedicel slender, 20–30 mm long; bracteole 1 (or 2), 1–2 mm long, persistent, about median; buds depressed globose,  $\pm$  sagged at base, 3–4 by 4–5 mm, cleft 3/4–4/5, lobes 0.6–1 mm thick, perianth at base with a conspicuous disc surrounding the androphore; staminal disc appressed to perianth disc, distinctly mammillate, circular, 2–3 mm diameter; anthers 14–18, just stiped, horizontal, 0.5–0.6 mm long, spaced; androphore 0.6–1 mm long. *Female flowers*: pedicel 10–12 mm long, bracteole persistent, about median; buds ellipsoid-obovoid, 6 by 5 mm, inside with disc at base, cleft 1/2–2/3, lobes 1 mm thick; ovary subglobose, 1.5–2 mm diameter, stigma subsessile, about 5-lobed, each lobe again shallowly 2–8-lobulate. *Fruits* 1–4 per infructescence, subglobose, somewhat broader than long, 2–3 by 2.5–2.8 cm, with dark brown hairs, 0.3–0.5 mm long; suture grooved, dry pericarp 4–5 mm thick; fruiting pedicel 18–30 mm long. — **Fig. 52.**

Fig. 52. *Knema pedicellata* W.J. de Wilde. a. Branchlet with male inflorescences; b. male bud; c. opened male bud showing disc at bottom and androecium, perianth lobes 4 or 5; d. halved male bud showing disc and androecium with convex staminal disc; e. androecium seen from above; f. sample of hairs: indumentum of male bud, half-schematic; g. branchlet with female inflorescences; h. opened female flower, showing disc at bottom of perianth and pistil; i. branchlet with infructescences, fruits submature; j. sample of hairs of lower leaf surface, half-schematic; k. detail of lower leaf surface with scattered persistent stellate-dendroid hairs and minute blackish dots on the veinlets [a–f, j, k: *S 16626 (Paie)*; g, h: *S 34477*; i: *S 16682*]. — Scale bar for a, g = 4 cm; for b, c, h = 2.8 mm; for d = 1.4 mm; for e = 0.7 mm; for f, j = 0.16 mm; for k = 0.33 mm; for i = 2 cm.

Field-notes — Bole buttressed to 50 by 30 cm; bark smooth or flaky; inner bark brownish; sapwood whitish. Indumentum of young twigs, undersurface of leaves, and flowers (yellowish) brown. Latex pinkish or dark red.

Distribution — *Malesia*: Borneo (Sarawak, Sabah).

Habitat & Ecology — Mixed dipterocarp forest; forest on sandstone, sandy soil, or sandy clay derived from granite; ridges; 0–700 m altitude; fl. May–July; fr. Nov.–Dec.

Notes — 1. *Knema pedicellata* resembles in habit *K. conferta* and *K. pubiflora*, but is readily distinguishable by the rather stout twigs, broad chartaceous leaves, long flower pedicels, mammillate staminal disc, conspicuous disc at the base of the perianth, and broad subglobose fruits. All three species have typically reddish brown or blackish dots on the lower leaf surface. The male flowers have hairs 0.1–0.3 mm long, the only female flowers seen (*S* 34477) have hairs 0.2–0.5(–0.8) mm long.

2. Most flowers have 4 or 5 perianth lobes; all other species of *Knema* have 3 perianth lobes. Sometimes there are 2 bracteoles.

#### 49. *Knema percoriacea* J. Sinclair

*Knema percoriacea* J. Sinclair, Gard. Bull. Sing. 18 (1961) 268, f. 21; W.J. de Wilde, Blumea 25 (1979) 392; 41 (1996) 392; Tree Fl. Sabah & Sarawak 3 (2000) 436. — Type: *Kostermans 9945*, E Kalimantan.

Tree 5–25 m. Twigs sometimes faintly angled, 3–6 mm diameter, at first with pale to dark brown hairs 0.5–2 mm long, late glabrescent; bark smooth or striate, then usually slightly to distinctly longitudinally cracking, and flaking. Leaves chartaceous or coriaceous, (oblong-)lanceolate, 12–40 by 2.5–9(–15) cm, apex subobtuse to acute(-acuminate), base attenuate to rounded, drying olivaceous or brown above, lower surface glabrous, not or but little papillate, with scattered hair scars (lens!); dots absent; midrib much raised above; nerves 15–25 pairs, raised above; venation distinct; petiole sometimes ± pulvinate, late glabrescent, 7–25 by 3–8 mm. Inflorescences: peduncle up to 2 mm long, brachyblast simple, warted, or 2-furcate, up to 15 mm long; in male 10–20-flowered, female up to 15-flowered; flowers with light brown or dark brown hairs 0.5–2 mm long, sometimes partly deciduous; perianth 3-lobed, red inside. Male flowers: pedicel 3–4.5 mm long, bracteole persistent, at or above the middle; buds depressed (globose-)obovoid, (3.5–) 4–5.5 by (3.5–)4–5.5 mm, cleft 2/3–3/4, lobes 0.5(–1) mm thick; staminal disc circular or subtriangular, flat, 2–2.5 mm diameter; anthers 10–18, shortly stiped or sessile, half-erect or curved upward, 0.3–1 mm long, not or but little touching; androphore 1–1.5 mm, finely striate. Female flowers: pedicel 2–4 mm long, bracteole subapical; buds ovoid or ellipsoid, 6.5–8(–9) by 5–7 mm, cleft slightly over halfway, lobes 0.5–0.7 mm thick; ovary subglobose, 3.5–4 mm diameter, stigma sessile, 2-lobed and each lobe again 8–10-lobulate or serrate. Fruits 1 or 2 per infructescence, (broadly) ellipsoid, sometimes slightly flattened, 3–4.5(–5) by 2.5–3.5(–4.5) cm, with rusty hairs 1–2 mm long; dry pericarp 4 mm thick; fruiting pedicel 2–3 mm long.

Field-notes — Bark of trunk rather smooth, fissured, scaly, or flaking; living bark inside red-brown or pinkish; wood usually white, sometimes reddish, or red brown. Leaves glossy dark green with whitish midrib above, glaucous with yellowish green midrib beneath. Flowers with yellow to rusty indumentum. Fruits ellipsoid or round, with yellowish or rusty indumentum.

Distribution — *Malesia*: Borneo (Sarawak, Brunei, Sabah, NE and E Kalimantan).

Habitat & Ecology — Primary and degraded forest, on hill sides, ridges; sandy soil, clay, sandy loam soil; 0–700 m altitude; fl. & fr. throughout the year, but mainly July–Nov.

Note — A complex species, in which three forms are distinguished. The species as a whole seems closest related to *K. latericia* and *K. furfuracea*, both with longer male flower pedicels. *Knema latericia* has thinner twigs, less coriaceous leaves and smaller male flowers, with a different androecium. Also *K. lunduensis* is related; for differences see under that species.

#### KEY TO THE FORMS

- 1a. Twigs at apex 3–4 mm diameter, with rusty red hairs 0.5 mm long. Anthers 10–12. Leaves coriaceous. — E Borneo ..... **a. forma percoriacea**
- b. Twigs at apex 4–6 mm diameter, with either pale brown hairs 0.5 mm long, or hairs chocolate or dark brown, 1–2 mm long. Anthers 11–15. Leaves chartaceous to coriaceous ..... 2
- 2a. Leaves chartaceous. Twig apex with pale brown or yellowish brown hairs 0.3–1 mm long. Anthers 11–14. — Sarawak, Brunei, Sabah, Nunukan Is. .... **c. forma sarawakensis**
- b. Leaves coriaceous [the venation on the lower surface indistinct]. Twig apex with chocolate or dark brown hairs 1–2 mm long. Anthers 15. [Flowers with hairs 1 mm long.] — Brunei, Sarawak ..... **b. forma fusca**

#### **a. forma percoriacea**

*Twigs* usually 3–4 mm diameter, smooth, not or little striate, with dense rusty red hairs 0.5 mm long; bark lower down inconspicuously flaking. *Leaves* relatively small, coriaceous; venation distinct at both surfaces. Indumentum of flowers of hairs 0.5(–1) mm long. Anthers 10–12.

Distribution — *Malesia*: Borneo (E, SE, C, and W Kalimantan); usually in kerangas.

#### **b. forma fusca** W.J. de Wilde

*Knema percoriacea* J. Sinclair forma *fusca* W.J. de Wilde, *Blumea* 25 (1979) 394; *Tree Fl. Sabah & Sarawak* 3 (2000) 437. — Type: *BRUN 5164 (Ashton)*, Brunei.

*Twigs* 6 mm diameter, with dark brown hairs 1.5 mm long; bark early flaking. *Leaves* coriaceous; venation indistinct on both surfaces. Flowers with dark brown hairs 1 mm long. Anthers 15, subsessile.

Distribution — *Malesia*: Borneo (Brunei).

Note — In habit, not in the flowers, this form resembles *K. plumulosa* from Peninsular Malaysia.

#### **c. forma sarawakensis** W.J. de Wilde

*Knema percoriacea* J. Sinclair forma *sarawakensis* W.J. de Wilde, *Blumea* 25 (1979) 393; *Tree Fl. Sabah & Sarawak* 3 (2000) 437. — Type: *S 23889 (E. Wright)*, Sarawak.

*Twigs* 4–6 mm diameter, coarsely striate, with pale brown or yellowish brown hairs 0.3–1 mm long; bark coarsely striate, lower down coarsely flaking. *Leaves* generally relatively large, chartaceous to coriaceous; venation distinct on both surfaces. Indumentum of flowers of hairs (0.5–)1 mm long. Anthers 11–14.

Distribution — *Malesia*: Borneo (Sarawak, Brunei, Sabah, NE & C Kalimantan, Nunukan Is.).

Note — In this form the indumentum of the flowers is often partly deciduous or easily rubbed off, as in *K. furfuracea*.

### 50. *Knema piriformis* W.J. de Wilde

*Knema piriformis* W.J. de Wilde, *Blumea* 25 (1979) 400; *Tree Fl. Sabah & Sarawak* 3 (2000) 437.  
— Type: SAN 34619 (Meijer), Sabah.

Tree 6–12 m. *Twigs* sometimes  $\pm$  angular, 1.5–3 mm diameter, at first with hairs 0.1 (–0.2) mm long, glabrescent; bark smooth or finely striate, not tending to crack or flake. *Leaves* thinly coriaceous, oblong or lanceolate, 15–25 by 3–7 cm, apex acute(–acuminate), base rounded to attenuate; drying olivaceous or brown, with scattered hair scars above; lower surface at first with soft greyish stellate hairs 0.1 mm long, early or late glabrescent, sometimes mixed with sparse larger yellow-brown hairs, early shed and leaving hair scars; dots absent; midrib  $\pm$  flat above; nerves 20–25 pairs,  $\pm$  flat; venation faint or distinct; petiole 8–15 by 1.5–3 mm. *Inflorescences*: sessile, brachyblast simple or forked, to 6 mm long; in male 5–10-flowered; flowers with hairs 0.1–0.2 mm long, or less; perianth 3-lobed, yellow (?) inside. *Male flowers*: pedicel 2–5 mm long, bracteole  $\pm$  caducous, at or above the middle; buds obovoid, 4–5 by 3–4 mm, tapering in the lower half, cleft 1/2(–2/3), lobes 0.4–0.6 mm thick; staminal disc circular, flat, 1.5–2 mm diameter; anthers 11 or 12, just stiped, almost horizontal to oblique, 0.3 mm long, not touching; androphore slender, 1.5–2.2 mm long. *Female flowers* not seen. *Fruits* 1 or 2 per infructescence, ovoid or ellipsoid, faintly ridged, apex subobtusate, base subtruncate, 2.4–2.6 by 1.5–1.7 cm, with grey hairs 0.1 mm long; dry pericarp 2 mm thick; fruiting pedicel 6 mm long.

Field-notes — Flowers yellow.

Distribution — *Malesia*: Borneo (Sarawak; Sabah: mainly at Kinabalu and its vicinity).

Habitat & Ecology — Montane forest, hill sides, ridges; (400?–)1000–2000 m altitude; fl. Apr.–July; fr. Jan.

Notes — 1. The obovoid male buds may be quite similar to those of *K. latericia* subsp. *albifolia*, which differs in the flaking bark, a much more conspicuous indumentum of the twig apices, and more pronounced, not largely sunken, lateral nerves. As judged from the shape of the male buds, *K. piriformis* seems most related to *K. pulchra* and *K. oblongata*.

2. Some sterile specimens (with the lateral nerves above largely sunken) are reminiscent of *K. patentinervia* (Peninsular Malaysia); they may be confused also with *K. hirtella*, *K. glauca*, and *K. cinerea* (Lesser Sunda Islands), all latter species having  $\pm$  globose male buds.

**51. Knema plumulosa** J. Sinclair

*Knema plumulosa* J. Sinclair, Gard. Bull. Sing. 16 (1958) 312, f. 14; 18 (1961) 272; W.J. de Wilde, Blumea 25 (1979) 426. — Type: SF 40455 (Sinclair & Kiah), Peninsular Malaysia.

[*Myristica glaucescens* auct. non *Knema glaucescens* Jack: Wallich, Cat. (1832) n. 6810, nom. nud.] — *Knema intermedia* (Blume) Warb. var. *dubia* Warb., Mon. Myrist. (1897) 567.

*Myristica furfuracea* auct. non Hook. f. & Thomson: A. DC., Prod. 14, 1 (1856) 206.

*Myristica cantleyi* auct. non Hook. f.: King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 327, pl. 168, p. p., excl. the Cantley specimens which are *Knema laurina*. — *Knema cantleyi* auct. non (Hook. f.) Warb.: Warb., Mon. Myrist. (1897) 554, t. 24; Gamble, Mat. Fl. Malay Penins. 5, 23 (1912) 238; Ridl., Fl. Malay Penins. 3 (1924) 68.

Tree 5–15 m. Twigs 3–5 mm diameter, at first with dense rusty lanose hairs 2–4 mm long, glabrescent; bark grey-brown, smooth or finely striate, not tending to crack, incidentally minutely flaking. Leaves coriaceous, oblong to lanceolate, 15–35(–45) by 2.5–8(–9) cm, apex acute(-acuminate), base rounded to cuneate; drying dull greenish brown above; lower surface (grey-)brown, at first with dense indumentum, glabrescent; dots absent; midrib raised above; nerves 12–23 pairs, raised; venation distinct; petiole 10–25 by 2–4 mm, late glabrescent. Inflorescences: peduncle to 3 mm long, brachyblast simple or warted, to 10 mm long; in male (3–)5–10-flowered, female 1–5-flowered; flowers with dense hairs 1.5–2.5 mm long; perianth 3-lobed, creamy, greenish or pinkish (?) inside. Male flowers: pedicel 5–12 mm long, bracteole subpersistent, subapical; buds depressed globose to broadly obovoid, 4.5–5.5 by 5–7 mm, cleft 3/4–4/5, lobes 0.3–0.4 mm thick; staminal disc convex or mammillate, circular, 2.5–3.5 mm diameter; anthers 12–15, horizontal, 0.5–0.7 mm, shortly stiped, not touching; androphore (0.5–)1–2 mm long, clasped by an annular disc 1 mm high at the base of the perianth, on which the staminal disc rests. Female flowers: pedicel 2–6 mm, bracteole towards the apex; buds obovoid, 7–9 by 7 mm, cleft over over halfway, lobes 0.4 mm thick; ovary subglobose, 2.5 mm diameter, with a conspicuous disc around the base; stigma sessile, 2-lobed and each lobe again (5–)6–7-lobulate or serrated. Fruits 1–3 per inflorescence, ellipsoid, 3–3.5 by 2 cm, with coarse rusty hairs 2 mm long; dry pericarp 2–3 mm thick; fruiting pedicel 3–6 mm long; perianth persistent under the fruit.

Field-notes — Bark pale brown, once scaly; inner bark white or red; sapwood white. Leaves glossy dark green above, pale green or glaucous beneath, the nerves at both sides much paler. Flowers cream or pinkish inside; staminal disc pink, anthers creamy.

Distribution — *Malesia*: Peninsular Malaysia (Perak, Trengganu, Selangor, Johore, P. Penang).

Habitat & Ecology — Primary and logged forest on hill sides, ridges, and in flat land; also in marshy forest and then provided with a few stilt-roots; 0–300 m altitude; fl. & fr. throughout the year.

Notes — 1. *Knema plumulosa* is related to *K. intermedia*, a species with which it has the distinct mammillate staminal disc in common; *K. intermedia* differs in its shorter, not lanose indumentum, thinner twigs, smaller leaves, the perianth non-persistent in fruits, and in the absence of a disc at the base of the perianth. According to Sinclair both species have stilt-roots if growing in wet soil.

2. By the woolly indumentum of the young twigs, and the glabrous coriaceous leaves, the species resembles *K. percoriacea* from Borneo, which differs in the flat staminal disc, absence of perianth disc, and perianth not persistent under the fruit.

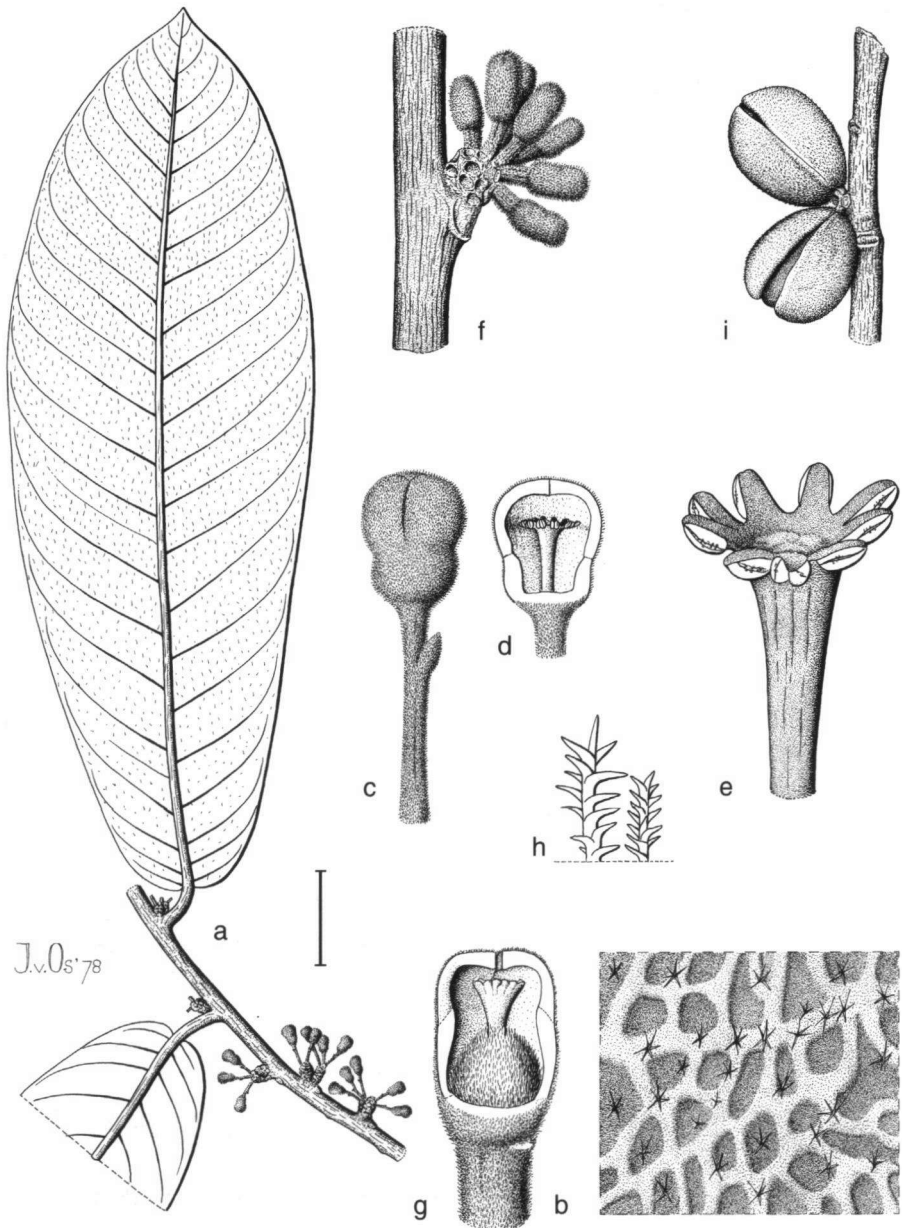


Fig. 53. *Knema pseudolaurina* W. J. de Wilde. a. Habit of male flowering branchlet; b. detail of the lower leaf surface showing areoles of venation and stellate hairs of mixed sizes; c. male bud; d. opened male bud showing the androecium; e. androecium; f. female inflorescence; g. opened female bud showing the pistil; h. sample of hairs of female perianth (schematic); i. infructescence [a, c–e: KEP FN 99355; b: Soepadmo & Mahmud 1169; f–h: FRI 7832; i: FRI 4044]. — Scale bar for a, i = 2 cm; b: 0.33 mm; c, d, g = 2.8 mm; e = 0.7 mm; f = 6.5 mm; h = 0.16 mm.

**52. *Knema pseudolaurina* W.J. de Wilde**

*Knema pseudolaurina* W.J. de Wilde, *Blumea* 25 (1979) 377, f. 2. — Type: *Curtis 1044*, Peninsular Malaysia.

*Knema laurina* (Blume) Warb. var. *malayana* Warb., *Mon. Myrist.* (1897) 607, p. p., for the lectotype only: *Curtis 1044*, Peninsular Malaysia.

Tree 5–30 m. *Twigs* (2–)3–5 mm diameter, with dense yellow brown or rusty hairs (mixed) 0.05–0.5 mm long, (late) glabrescent; bark striate, not tending to crack or flake. *Leaves* chartaceous or coriaceous, oblong to (ob)lanceolate, 12–40 by 3–12 cm, base (sub)attenuate to rounded, rarely subcordate, apex acute(-acuminate), sometimes obtuse; olivaceous above, lower surface finely papillate, with (largely) persistent pale yellowish to brown sparse hairs 0.1–0.2 mm long, mixed with larger stellate-dendroid hairs (lens!); dots absent; midrib flat or slightly raised above; nerves 18–30 pairs, flat or ± sunken above; venation (very) fine, raised, distinct above; petiole 10–22 by 1.5–3.5 mm late glabrescent. *Inflorescences*: sessile, brachyblast simple or warty, or 2- or 3-fid, to 10 mm long; in male 3–25-flowered, female 3–15-flowered; flowers with short dense yellow-brown, rusty, or golden hairs 0.1–0.5 mm long; perianth 3-lobed, reddish inside. *Male flowers*: pedicel 4.5–8.5 mm long, bracteole subsistent or caducous, at or up to 2 mm below the apex; buds obovoid(-oblong), 4–6 by 2.5–4.5 mm, cleft 1/2–2/3, lobes 1–1.5 mm thick; staminal disc flat or slightly concave, circular, 1.5–2 mm diameter; anthers 8–11, half sessile to just stiped, half erect to nearly horizontal, 0.3–0.6 mm long, not or only little touching, androphore tapering, 1.5–2.5 mm long, rarely with hairs 0.1 mm at base. *Female flowers*: pedicel to 1.5 mm long, bracteole apical; buds ovoid-oblong, 6–8 by 3.5–4.5 mm, cleft c. 1/3, lobes 1–1.5 mm thick; ovary globose or broadly ovoid, 3–3.5 by 2.5 mm, style and stigma 2–2.5 mm long, the latter ± spreading, 2-lobed and each lobe again indistinctly 3–5-lobulate. *Fruits* 1–5 per infructescence, broadly ovoid or oblong, apex obtuse or subacute, base (broadly) obtuse, (2.5–)3–5 by (1.5–)2–3.5 cm, with stiff rusty hairs 1–2 mm long; dry pericarp 3 mm thick; fruiting pedicel 1–6 mm long. — **Fig. 53.**

**Field-notes** — Bark rather smooth or granulose, fine and thinly scaly, or somewhat fissured; slash of outer bark pink(-orange), slash wood whitish; sap copious, red. Leaves medium green above, dirty white or grey-white beneath. Fruits yellowish with short, coarse, rusty indumentum. Seed whitish, aril red.

**Distribution** — Peninsular Thailand; in *Malesia*: Sumatra (Aceh, E Coast) and the whole of the Malay Peninsula excluding Singapore.

**Habitat & Ecology** — Primary and degraded evergreen forest, in flat and hilly country, on crests; over granite, sandstone, limestone, and alluvial soils; 0–1000 m altitude; fl. mainly Jan.–Apr.; fr. mainly Apr.–Aug.

**Note** — Specimens of *K. pseudolaurina* were formerly confused with *K. laurina* which differs, among others, in the indumentum of the lower leaf surface, composed of stalked dendroid hairs, shorter male flower pedicels, fewer anthers, and smaller fruits.

**53. *Knema psilantha* W.J. de Wilde**

*Knema psilantha* W.J. de Wilde, *Blumea* 25 (1979) 391; 41 (1996) 392; *Tree Fl. Sabah & Sarawak* 3 (2000) 438. — Type: *S 14373 (Anderson)*, Sarawak.



Tree 5–10 m. *Twigs* 3–5 mm diameter, at first with woolly bright brown to yellowish hairs 0.5–1 mm long, soon glabrescent; bark striate or ridged, lower down cracking and flaking. *Leaves* thinly coriaceous, lanceolate, 20–50 by 3.5–9.5 cm, apex (narrowly) acute, base obtuse or (broadly) rounded; drying greenish brown above; lower surface glabrous, inconspicuously finely papillate; dots absent; midrib raised above; nerves 30–35 pairs, raised above; venation raised, distinct or not; petiole 5–15 by 3–5 mm, late glabrescent. *Inflorescences*: sessile, brachyblast simple or  $\pm$  warty, 2–5 mm diameter; in male 5–25-flowered, female 1–5-flowered; flowers with pale brown hairs 0.5–0.7 mm long, early glabrescent in the upper half or more; perianth 3-lobed, red inside. *Male flowers*: pedicel 2–3 mm long, bracteole subsistent, at or above the middle; buds ellipsoid-obovoid, 4.5–5 by 3–3.5 mm, cleft 3/4–4/5, lobes 0.5 mm thick; staminal disc circular,  $\pm$  flat, 1.5 mm diameter; anthers 6–9, each 0.5 mm long, stiped for 0.5–0.7 mm,  $\pm$  horizontal, not touching; androphore cylindrical, 1–1.2 mm long. *Female flowers*: pedicel 1–2 mm long, bracteole  $\pm$  caducous, median; buds much larger than in male flowers, ovoid, 8–9 by 5–5.5 mm, cleft c. 1/2, lobes 0.5 mm thick; ovary subglobose, 4.5 by 5 mm, stigma sessile,  $\pm$  2-lobed and each lobe again 5- or 6-lobulate or serrate. *Fruits* 1–3 per infructescence, subellipsoid, apex obtusish, base broadly rounded, 2.5–3 by 2 cm, with rough yellowish brown hairs 1 mm long, sometimes partly glabrescent; dry pericarp 3 mm thick; fruiting pedicel 2 mm long.

Field-notes — Bark smooth, with fine lenticels, outer bark brittle, inner bark white mottled with reddish. Flowers cream-hairy outside, scarlet inside, in the males with a paler spot at base of stamens.

Distribution — *Malesia*: Borneo (Sarawak, Sabah, NW & E Kalimantan).

Habitat & Ecology — Mixed dipterocarp forest on ridges, hill sides; 50–300 m altitude; fl. Aug.–Sept.; fr. June.

Note — *Knema psilantha* resembles *K. latericia* and to a lesser extent *K. furfuracea*; *K. latericia* differs in the more depressed globose mature male flower buds, not glabrescent, with different androecium, and less conspicuously flaking, more slender twigs; *K. furfuracea* also has differently shaped male buds, with quite different androecium, but in that species the flowers are often glabrescent as well. *Knema psilantha* is well characterized by the partly glabrescent, ellipsoid, male flower buds, and only 6 or 7 conspicuously long-stiped anthers.

#### 54. *Knema pubiflora* W.J. de Wilde

*Knema pubiflora* W.J. de Wilde, *Blumea* 25 (1979) 466, f. 17; *Tree Fl. Sabah & Sarawak* 3 (2000) 438. — Type: *SAN 25105 (Meijer)*, Sabah.

Tree 10–40 m. *Twigs* 1.5–3 mm diameter, at first with dense rusty scurfy hairs 0.1–0.2 mm long, glabrescent; bark coarsely striate, not tending to crack or flake. *Leaves* chartaceous or thinly coriaceous, (ovate-)oblong, 4–15 by 1.5–7 cm, base rounded to subattenuate, apex subacute to short acute-acuminate; drying dark brown above; lower surface grey-brown, finely papillate, at first with mixed sessile and dendroid hairs 0.2–0.5 mm long, persistent or late glabrescent; dots present; midrib slender,  $\pm$  raised above; nerves 7–14 pairs, slightly raised above; venation distinct; petiole 5–10 by 0.7–2 mm, late glabrescent. *Inflorescences*: peduncle to 2 mm long, brachyblast simple, warty, or  $\pm$  forked, to 4 mm diameter; in male 5–20-flowered, female 3–10-flowered; flowers

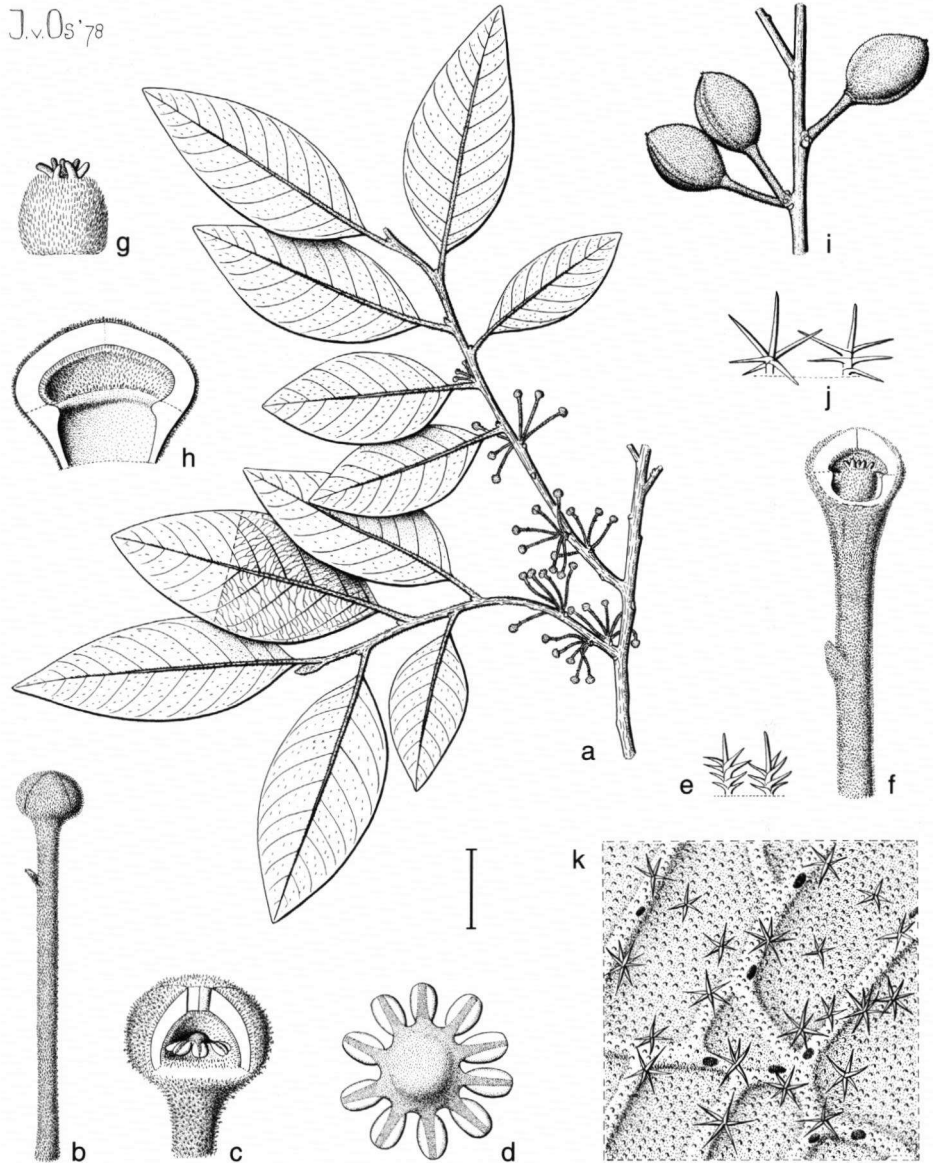


Fig. 54. *Knema pubiflora* W.J. de Wilde. a. Branchlet with male inflorescences; b. male bud; c. opened male bud showing hairy inner surface and androecium; d. androecium seen from above; e. sample of hairs of indumentum on the outer surface of male perianth, half-schematic; f. opened female bud showing pistil; g. pistil; h. lobe of female bud showing hairy inner surface; i. branchlet with infructescences; j. sample of hairs of lower leaf surface, half-schematic; k. detail of lower leaf surface with scattered stellate-dendroid hairs and minute blackish dots [a–e, j, k: SAN 25105 (Meijer); f–h: Kostermans 8634; i: Kostermans 10359]. — Scale bar for a, i = 2 cm; for b, f = 2.8 mm; for c, g, h = 1.4 mm; for d = 0.66 mm; for e, j = 0.16 mm; for k = 0.33 mm.

with dark rusty hairs 0.1 mm long; perianth 3- (or 4-)lobed, inside densely stellate-hairy, colour not known. *Male flowers*: pedicel 10–15 mm long, bracteole persistent or more or less late caducous, about median; buds (depressed) globose, 2–2.5 by 2.5–3 mm, cleft 3/4–4/5, lobes 0.5(–0.7) mm thick; staminal disc convex, circular, 1.2–1.5 mm diameter; anthers 10–13, just sessile, horizontal, 0.2–0.4 mm long, not touching; androphore 0.3–0.6 mm long. *Female flowers*: pedicel 7–10 mm long, bracteole  $\pm$  median; buds obovoid or pear-shaped, 3–4 by 3–4 mm, cleft 1/2–2/3, lobes 0.5–1 mm thick; ovary subglobose-ovoid, 1.5 mm diameter; stigma sessile, indistinctly 2-lobed and each lobe again deeply (3- or 4- or 5-lobulate. *Fruits* 1–5 per infructescence, subglobose or short ellipsoid, often  $\pm$  flattened and ridged at one side towards the base, 1.5–2.5 by 1.5–2.3 cm, with rusty hairs 0.1–0.2 mm long; dry pericarp 1.5 mm thick; fruiting pedicel 10–14 mm long. — **Fig. 54.**

**Field-notes** — Bole with buttresses to 2 m high, extending to 30 cm; bark smooth, when old peeling off in soft irregular small scales; living bark chocolate, brown, or reddish; sapwood reddish white, pale brown, or pale pinkish; latex reddish. Flowers with rusty indumentum. Fruits greenish or yellow, with rusty indumentum; aril dark red, sweet-acid.

**Distribution** — *Malesia*: Borneo (Sarawak, Sabah, NE, E & SE Kalimantan; many collections from Nunukan Is.).

**Habitat & Ecology** — Forest on sandy soil, clay, or loam, also on brown soil; hill sides, ridges, rolling sandy areas; in *Shorea laevifolia* forest, scattered but locally common; 0–300 m altitude; fl. & fr. throughout the year.

**Note** — *Knema pubiflora* may be confused with *K. conferta* and *K. kunstleri*, both also with dotted lower leaf surfaces; *K. conferta* differs in a stouter habit, flowers glabrous inside, and flat staminal disc; *K. kunstleri* has a different indumentum on the lower leaf surface consisting of sparse minute scale-like hairs, flowers glabrous inside, and flat staminal disc. *Knema pubiflora* is the only species of *Knema* with the perianth hairy inside and the leaves have a remarkable dark brown drying colour.

## 55. *Knema pulchra* (Miq.) Warb.

*Knema pulchra* (Miq.) Warb., Mon. Myrist. (1897) 600, t. 24; W.J. de Wilde, Blumea 25 (1979) 399; 27 (1981) 224; Tree Fl. Sabah & Sarawak 3 (2000) 439. — *Myristica pulchra* Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 51. — Type: *Korthals s. n.*, Kalimantan.

*Knema glaucescens* Jack var. *cordata* J. Sinclair, Gard. Bull. Sing. 16 (1958) 310, f. 13D. — *Knema cinerea* (Poir.) Warb. var. *cordata* (J. Sinclair) J. Sinclair, Gard. Bull. Sing. 18 (1961) 181. — Type: SF 39959 (Sinclair & Kiah), Peninsular Malaysia.

Tree (2.5–)6–15 m. *Twigs* 3–6(–8) mm diameter, at first with short grey brown to rusty hairs 0.1 mm long, glabrescent; bark finely striate, not tending to crack or flake. *Leaves* chartaceous or thinly coriaceous, elliptic-oblong to oblong-lanceolate, (20–)30–50 by (6–)10–17 cm, base rounded or cordate, apex acute(–acuminate); drying greenish brown, often  $\pm$  glossy above; lower surface with persistent or deciduous sparse pale brown or greyish stellate hairs 0.1–0.2 mm long; dots absent; midrib raised above; nerves 18–25 pairs,  $\pm$  flat above; venation (in)distinct; petiole 15–40 by 3–5 mm. *Inflorescences*: sessile, brachyblast simple, warted, or 2- or 3-furcate, to 10 mm long, in male 1–10-flowered, female 1–5-flowered; flowers with greyish brown hairs 0.1 mm long or

less; perianth 3-lobed, creamy or pale brown inside. *Male flowers*: pedicel 4–8 mm long, bracteole caducous or subsistent, median to subapical; buds obovoid, (3–)4–5.5 by 3–5 mm, cleft 1/2–3/4, lobes 0.7–1 mm thick; staminal disc circular or faintly triangular, flat or concave, 1.8–3 mm diameter; anthers 12–25 (14–25 in Borneo), ± half-erect, just sessile, 0.5–0.7 mm long, not or only little touching; androphore slender, sometimes tapering, 0.8–1.5 mm long. *Female flowers*: pedicel (2–)5–8 mm long, bracteole about median; buds obovoid-oblong, 5–6 by 3.5–4.5 mm, cleft c. 1/2, lobes 1 mm thick; ovary ovoid, 2.5–3 by 1.5–2 mm; style 1.5 mm long, stigma ± flat, inconspicuously 2-lobed and each lobe again 2–4(–5)-lobulate. *Fruits* variable, 1 or 2 per infructescence, subglobose to ellipsoid-oblong, ridged and sometimes slightly saccate at base or not, apex obtuse to subacute, (3–)4–6 by 2–3.5 cm, with hairs (0.1–)0.2 mm long, sometimes glabrescent; dry pericarp 3–4 mm thick; fruiting pedicel (2–)5–12 mm long.

Field-notes — Sometimes with a few stilt-roots; bark smooth with a few lenticels, pustulate, or finely fissured; living bark orange-brown; wood pale brown or white. Leaves dark green with whitish green midrib and nerves above, glaucous with brownish midrib and nerves beneath. Perianth pale brown or cream inside.

Distribution — *Malesia*: Peninsular Malaysia (Trengganu, Johore), Borneo (Sarawak, Brunei, Sabah, Kalimantan).

Habitat & Ecology — Primary forest, lowland dipterocarp forest, swamp forest, also on ridges; sandy soil, loam soil with lime, swampy soil, basalt-derived soils; 0–1000 m altitude; fl. May–Sept.; fr. Mar.–Aug.

Note — *Knema pulchra* is close to the more slenderly built *K. piriformis* and possibly also related to *K. oblongata*, which differs in the conspicuous rusty indumentum on twigs, lower leaf surfaces, and flowers. In general habit, not in the shape of the flowers, it recalls *K. kostermansiana*, also a broad-leaved species.

## 56. *Knema retusa* (King) Warb.

*Knema retusa* (King) Warb., Mon. Myrist. (1897) 612, t. 25; J. Sinclair, Gard. Bull. Sing. 16 (1958) 318; 18 (1961) 272, f. 22; W.J. de Wilde, Blumea 25 (1979) 384. — *Myristica retusa* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 330, pl. 171. — Type: *King's coll. 7690*, Peninsular Malaysia.

Tree 5–20 m. *Twigs* 5–6 mm diameter, at first with pale rusty hairs 0.1–0.2 mm long, glabrescent; bark (coarsely) striate, not tending to crack or flake. *Leaves* coriaceous, obovate to (elliptic-)oblong, (20–)30–60 by (10–)14–25 cm, apex broadly obtuse, often retuse, base rounded or cordate; drying brown above, lower surface with persistent dense grey, pale brown, or rusty hairs 0.1–0.2 mm long, ± silky to the touch; dots absent; midrib stout, flat or ± depressed above; nerves 15–25 pairs, widely (2–4 cm) apart, ± flat above; venation distinct; petiole 15–30 by 5–10 mm. *Inflorescences*: peduncle to 5 mm long, brachyblast simple, warted, or 2- or 3-furcate, 5–20 mm long; in male 5–10-flowered, female 1–5-flowered; flowers with brownish hairs 0.1–0.3 mm long; perianth 3-lobed, whitish inside. *Male flowers*: pedicel 10–15 mm long, the bracteole caducous or subsistent, 2–4 mm long, apical; buds broadly obovoid, 7–8 by 6–7 mm, cleft about 4/5, lobes 1 mm thick; staminal disc subtriangular, flat or ± concave, 4 mm diameter; anthers c. 15, subsessile, ± horizontal or somewhat oblique, 0.6–0.7 mm long, not touching; androphore tapering, 1–1.5 mm long. *Female flowers*: pedicel 3–5 mm long, bracteole caducous, apical; buds obovoid, 9 by 6–7 mm, cleft c. 2/3, lobes 1 mm thick;

ovary ovoid or subglobose, 3.5–4 by 3 mm; style 1 mm long; stigma 2-lobed and each lobe with 2 or 3 serrations of variable depths. *Fruits* 1–3 per infructescence, ovoid-ellipsoid, 3–4.5(–6?) by 2–3.5(–5?) cm, apex 3 mm apiculate, with chocolate hairs 0.2 mm; dry pericarp 3–4 mm thick; fruiting pedicel 8–10 mm long.

Field-notes — Bark of trunk dark brown, slightly rough, but not flaking nor furrowed. Leaves dark green, glossy, with whitish green midrib above, greyish or glaucous with a cover of minute pale brownish scale-like or stellate hairs beneath. Male buds 10–12 by 7 mm, whitish inside, slightly fragrant, pollen whitish; female buds 14 by 10 mm.

Distribution — *Malesia*: Peninsular Malaysia (Perak).

Habitat & Ecology — Mixed lowland forest; flat land; 0–500 m altitude; fl. Oct.; fr. May.

Notes — 1. *Knema retusa* is a rare species of a restricted area; no recent collections are known. Its flowers are large for the genus, and for *Myristicaceae* in general.

2. Sinclair described the anthers as stalked, but I found them rather subsessile. King described the aril as embracing only the base of the seed, but possibly this was an incidental case, or due to the drying.

### 57. *Knema riangensis* W.J. de Wilde

*Knema riangensis* W.J. de Wilde, *Blumea* 32 (1987) 138; *Tree Fl. Sabah & Sarawak* 3 (2000) 440.

— Type: *Veldkamp 7941*, C Kalimantan.

Tree 3–12 m. *Twigs* subterete or ± angular, 1.5–3(–4) mm diameter, with minute dull brown hairs 0.1 mm long, glabrescent; bark coarsely striate, not flaking. *Leaves* membranous, elliptic-oblong to oblong-lanceolate, 14–30 by 5–10.5 cm, base short-attenuate or rounded, apex acute-acuminate; drying olivaceous above, paler, with (sub)persistent dense pale yellowish to greyish almost uniform hairs 0.1(–0.2) mm long beneath; dots absent; midrib raised above; nerves 15–23 pairs, ± flat to raised above, venation distinct; petiole 10–20 by 2–4 mm, late glabrescent. *Inflorescences*: peduncle to 1 mm long, brachyblast wart-like, simple, or forked, to 5 mm long; in male 2–6-flowered, female 2–4-flowered; flowers with dull brown hairs 0.1(–0.2) mm; perianth 3-lobed, reddish inside. *Male flowers*: pedicel 3–4 mm long, bracteole persistent, 0.5 mm long, 0.5–1 mm below the apex; buds broadly obovoid, 2 by 1.7 mm, cleft 5/6, lobes 0.5 mm thick; staminal disc circular or subtriangular, flat, 0.8–1 mm diameter, anthers 9, sessile, suberect, 0.3 mm long, closely set; androphore tapering (obconical), 0.8 mm long, sometimes with few minute hairs at base. *Female flowers*: rather stout, pedicel 5–12 mm long, bracteole slightly above median; buds ± obovoid, 4–5 by 3 mm (or 7 by 4 mm, see note 2), cleft c. 1/2, lobes 0.5–1 mm thick; ovary ovoid, 2–4 mm long, with dense hairs 0.1(–0.2) mm long; style broad, 0.5 mm long, stigma lobes 2, each coarsely 2–4-lobulate. *Fruits* 1 or 2 per infructescence, ellipsoid, 2.4–4 by 1.7–2.5 cm, with persistent rust-brown hairs 0.1 mm long, dry pericarp 1–2 mm thick; fruiting pedicel 8–12 mm.

Field-notes — Young shoots cinnamon. Leaves glossy above, whitish underneath. Flowers (pink-)red, column yellowish. Fruits orange, aril edible, somewhat sour, bright red; pericarp edible, sweetish; outer testa white, inner black.

Distribution — *Malesia*: Borneo (Sarawak: possibly; C Kalimantan).

Habitat & Ecology — Primary forest, riverine forest; yellow sandy clay; 100–600 m altitude; fl. & fr. Jan., Feb.; fr. May.

Notes — 1. *Knema riangensis* is, among its relatives, characterized by a lower leaf surface with (sub)persistent dense slightly interwoven hairs of almost uniform size, 0.1–0.2 mm long, male buds small, 2 by 1.7 mm, cleft nearly to the base, androphore distinctly tapering, sometimes with a few minute hairs at base (which points to relationship with *K. hirtella*), anthers 9, sessile, suberect, close to each other, style distinct, 0.5 mm long (almost as in *K. stylosa*), and medium-sized fruits, with short persistent indumentum.

2. *Veldkamp 8209* has considerably large female flowers, pedicel 12 mm long, buds 7 by 4 mm, ovary 4 by 3 mm, much larger than those in *Veldkamp 7970* (a collection of mixed male and female specimens).

### 58. *Knema ridsdaleana* W. J. de Wilde

*Knema ridsdaleana* W. J. de Wilde, Blumea 41 (1996) 392. — Type: *Ridsdale ISU 451*, Philippines, NE Luzon.

Small tree 8 m. *Twigs* 3(–4) mm diameter, at first with dense rusty hairs 0.5(–1) mm, late glabrescent; bark blackish, coarsely striate, not tending to crack or flake, lenticels not apparent. *Leaves* chartaceous(-coriaceous), (ovate-)oblong, 15–25 by 5.5–8(–9) cm, base broadly rounded, apex acute-acuminate; drying olivaceous or dark-brown above, lower surface (ashy-)grey, glabrescent but indumentum ± remaining on and near lower part of midrib; minutely punctate but (larger) dots absent; midrib raised above, nerves 15–18 per side, raised above, venation distinct at both surfaces; petiole 15(–20) by (2–)2.5 mm, late glabrescent. *Inflorescences*: pubescent, among the leaves, peduncle 10–15 by 2–2.5 mm, brachyblast simple or 2- or 3-forked, to 5 mm long; in male with subumbels of 1–3 buds of various sizes; flowers with dense dark brown woolly hairs 0.3(–0.5) mm, as a dense mat, at anthesis (when dry) largely falling off in large flakes, leaving the perianth completely glabrous; perianth 4-lobed, colour inside not known. *Male flowers*: pedicel 3–4(–5) mm long, bracteole persistent, (2–)2.5 mm long, 1 mm below the apex, with low ridges decurrent on the pedicel; buds depressed (sub)globose, 3 by 4–4.5 mm, cleft 4/5(–9/10), lobes 0.4 mm thick; staminal disc flat, circular, 1.8(–2) mm diameter, anthers ± contiguous, 11–13, half-sessile, and adnate to the tapering androphore, anthers 4-sporangiate, thecae nearly 1 mm long, androphore short (less than 0.5 mm), striate. *Female flowers and fruits* not seen.

Field-notes — Small tree, 8 m; bark dark brown, flaky, inner bark red. Flowers reddish brown.

Distribution — *Malesia*: Philippines (NE Luzon, Palanan area; known only from the type).

Habitat & Ecology — Streamside forest over ultrabasic rock; c. 50 m altitude; fl. Apr.

Note — This species is superficially reminiscent of *K. glomerata* (especially in the leaves) and *K. tomentella* (as regards the conspicuous indumentum, falling off in pieces). *Knema ridsdaleana* is readily distinguishable by its grey leaf undersurface, with minute dark punctation (not to be confused with coarser dots, strong lens!), conspicuous indumentum, long-stalked (male) inflorescences, 4-merous perianth, with conspicuously shedded indumentum, and 11–13 large (long) ± contiguous subsessile 4-sporangiate anthers.

**59. *Knema rigidifolia* J. Sinclair**

*Knema rigidifolia* J. Sinclair, Gard. Bull. Sing. 16 (1958) 284, f. 5, excl. B–D; 18 (1961) 274; W.J. de Wilde, Blumea 25 (1979) 398. — Type: SF 33226 (*Corner*), Peninsular Malaysia.

Tree 5–15 m. *Twigs* 2–4(–5) mm diameter, smooth or striate, at first with hairs 0.1–0.2 mm long, glabrescent; bark smooth or striate, not tending to crack or flake. *Leaves* coriaceous, (oblong-)lanceolate, base attenuate, rounded, cordate, or subtruncate, apex subobtusate or acute-acuminate, 12–28 by 4–8.5 cm, drying brown, with scattered hair scars above; lower surface late glabrescent or with subpersistent scale-like hairs 0.1 mm long or less, sometimes mixed with weak stellate-dendroid hairs 0.1–0.2 mm long; dots (almost) absent; midrib hardly raised above; nerves 15–28 pairs,  $\pm$  flat, venation raised and distinct; petioles 15–25 by 2–4 mm. *Inflorescences*: sessile, brachyblast simple or warty, up to 5 mm diameter; in male 5–20-flowered, female 1–5-flowered; flowers with rusty hairs 0.1–0.2 mm long; perianth 3-lobed, reddish (?) inside. *Male flowers*: pedicel 3–5 mm, slender or thickish, 0.5(–1) or 1.5–2 mm diameter, bracteole caducous, about median; buds depressed broadly obovoid, variable in size and consistency (see under the subspecies), 3.5–4 by 4–4.5 mm, cleft 3/4–4/5, lobes 0.5 or 1–1.5 mm thick; staminal disc circular,  $\pm$  concave, 1.7–2.2 mm diameter; anthers 8 or (12?–)14–16 (see the subspecies), half-sessile, 0.5–0.7 mm long, suberect, not or hardly touching; androphore tapering, 1–1.4 mm long. *Female flowers* not known. *Fruits* 1 (or 2?) per infructescence, almost globose, 3–4 cm diameter, with hairs 0.2 mm long; dry pericarp 2–4 mm thick; fruiting pedicel 1–3 mm long.

Field-notes — Bark smooth, slightly fissured, or faintly hooped. Flowers borne behind the leaves. Leaves grey at underside.

Distribution — *Malesia*: Peninsular Malaysia (Pahang, Selangor).

Habitat & Ecology — Montane forest, on crests and slopes; 1000–1800 m altitude; fl. Feb.–Apr.; fr. Apr.–Sept.

Note — *Knema rigidifolia* is a montane species, characterized by coriaceous leaves and globose fruits. The male flowers of the two specimens known differ in shape, consistency, and morphology, related to differences in general habit, leaf shape, and distribution. By the differences in the male flowers in the two here accepted subspecies, *K. rigidifolia* keyed out on two places in the general key to the species.

## KEY TO THE SUBSPECIES

- 1a. Twigs at apex slender, 2–4 mm diameter. Leaves coriaceous, at base rounded or attenuate. Male flowers not robust; pedicel 0.5–1 mm diameter; buds cleft c. 4/5, lobes 0.5 mm thick; anthers 8 ..... a. subsp. **rigidifolia**  
 b. Twigs stout, at apex 3–5 mm diameter. Leaves rigidly coriaceous, at base rounded or cordate. Male flowers robust; pedicel 1.5–2 mm diameter; buds cleft 2/3–3/4; lobes 1–1.5 mm thick ..... b. subsp. **camerona**

**a. subsp. *rigidifolia***

*Twigs* in apical part 2–4 mm diameter, smooth or finely striate. *Leaves* coriaceous, at base rounded or attenuate. *Male flowers*: pedicel 3–3.5 mm long, 0.5–1 mm diameter; buds 3.5 by 4 mm, cleft c. 4/5, lobes 0.5 mm thick. Staminal disc including anthers 1.7–

1.8 mm diameter; anthers 8, half-sessile, half-erect; androphore 1.4 mm long. *Fruits* subglobose, 3–3.5 cm diameter

Distribution — *Malesia*: Peninsular Malaysia (Pahang: Fraser's Hill, Pine Tree Hill, and Selangor: G. Bunga Bua).

Note — *Knema rigidifolia* subsp. *rigidifolia* resembles *K. kinabaluensis* from Sabah and *K. pectinata* from Sarawak (see there).

**b. subsp. *camerona* W. J. de Wilde**

*Knema rigidifolia* J. Sinclair subsp. *camerona* W. J. de Wilde, *Blumea* 25 (1979) 398. — Type: *SF s. n.* (*Henderson*), Peninsular Malaysia.

*Twigs* in apical part 3–5 mm diameter, coarsely striate. *Leaves* rigidly coriaceous, at base broadly rounded or shallowly cordate. *Male flowers* robust; pedicels 5 mm long, 1.5–2 mm diameter; buds 4 by 4–4.5 mm, cleft 2/3–3/4, lobes 1–1.5 mm thick. Staminal disc including anthers 2–2.2 mm diameter; anthers 14–16, half-sessile, suberect; androphore stout, 1–1.2 mm long. *Fruits* 3.8–4 cm diameter.

Distribution — *Malesia*: Peninsular Malaysia (Pahang, near the Pahang/Perak border: Cameron Highlands), at 1500–1800 m altitude.

**60. *Knema rubens* (J. Sinclair) W. J. de Wilde**

*Knema rubens* (J. Sinclair) W. J. de Wilde, *Blumea* 25 (1979) 450. — *Knema glaucescens* Jack var. *glaucescens* forma *rubens* J. Sinclair, *Gard. Bull. Sing.* 16 (1958) 307, f. 13B. — *Knema cinerea* (Poir.) Warb. var. *rubens* (J. Sinclair) J. Sinclair, *Gard. Bull. Sing.* 18 (1961) 185, p.p., excl. specimens from Borneo. — Type: *Ridley 4819*, Singapore.

Tree 5–25 m. *Twigs* ± flattened or blunt-triangular, 1.5–2 mm diameter, at first with short farinose yellow-brown, reddish, or pale rusty hairs 0.1–0.2 mm long, glabrescent; bark smooth, then striate, not tending to crack or flake. *Leaves* membranous or thinly coriaceous, elliptic-oblong to lanceolate, (5–)8–25 by 2–5(–8.5) cm, base attenuate, rarely rounded, apex acute-acuminate, drying greenish or brown, often with a very fine-pitted structure above, (lens!), lower surface greyish, with a reddish tinge, glabrescent except for the basal part of the midrib with farinose stellate scale-like hairs; dots absent; midrib raised above; nerves (10–)15–25 pairs, ± raised above; venation faint or distinct; petiole late glabrescent, 6–11 by 1.5–2.5 mm. *Inflorescences*: peduncle up to 1 mm long, brachyblast simple or 2- or 3-fid, to 5 mm long; in male 5–10-flowered, female 2–5-flowered; flowers with rusty hairs 0.1–0.2 mm long; perianth 3-lobed, reddish inside. *Male flowers*: pedicel 3.5–4.5 mm long, bracteole subpersistent, about median; buds (depressed) globose, 2–3 by 2–4 mm, cleft c. 4/5, lobes 0.8 mm thick; staminal disc slightly convex or low-mammillate, circular, 2–2.2 mm diameter; anthers 10–12, shortly stiped, horizontal, 0.4 mm long, spaced; androphore 0.6–1 mm long. *Female flowers*: pedicel 1.5–3 mm long, the bracteole subapical; buds ellipsoid to oblong, 3–3.5 by 2–2.5 mm, cleft c. 1/2, lobes 0.5 mm thick; ovary ovoid-globose, 1.5 mm diameter, stigma subsessile, faintly 2-lobed and each lobe again shallowly 1–3-lobulate. *Fruits* 1–4 per infructescence, ellipsoid, base and apex obtuse or subacute, 1.7–2.7 by 1.2–2 cm, with mealy yellowish brown or rusty hairs 0.2 mm long; dry pericarp 1.5–2 mm thick; fruiting pedicel 2–7 mm long.



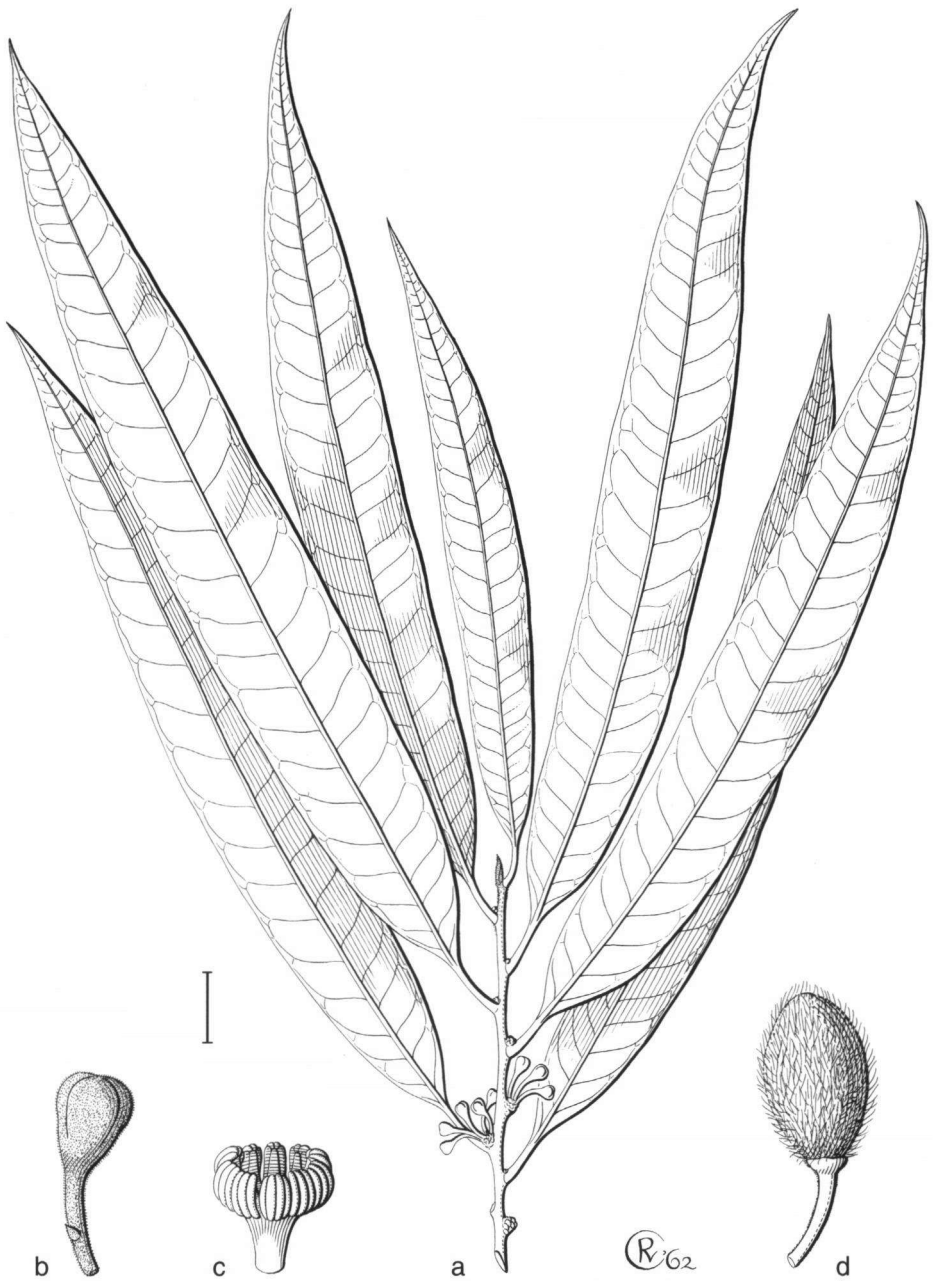


Fig. 55. *Knema rufa* Warb. a. Habit of twig with male inflorescences; b. immature male bud with the pedicel not yet fully developed; c. immature androecium; d. fruit, the bracteole not discernible, apparently minute, attached at the base of the fruiting pedicel [a: *S* 13146; b, c: *Sinclair* 10451; d: *Sinclair* 10191]. — Scale bar for a = 2 cm; for b = 4 mm; for c = 1.65 mm; for d = 1 cm.

Field-notes — Bole straight, slender; bark smooth or slightly flaky; inner bark red, granulate; slash wood (yellowish) white. Leaves dark green above, dirty whitish, grey-green, or glaucous beneath. Fruits yellow(-brown) or orange, aril bright red.

Distribution — *Malesia*: N Sumatra (E Coast, Tapanuli, Simeulue I.), Peninsular Malaysia (Kedah, Kelantan, Trengganu, Pahang, Johore, Penang I.), Singapore.

Habitat & Ecology — Lowland forest, often along streams; sandstone, red soil; altitude 0–800 m; fl. Feb., Apr., Aug.; fr. in Peninsular Malaysia mainly July–Sept., in Sumatra Jan., June, Sept.

Note — *Knema rubens* is characterized by the more or less flattened twig apices, which also occur in *K. luteola* and *K. oblongifolia*; it resembles in appearance *K. latericia* subsp. *ridleyi* which differs in the scaly bark of the (subterete) twigs, more pronounced convex staminal disc, and thicker indumentum on twigs and flowers.

### 61. *Knema rufa* Warb.

*Knema rufa* Warb., Mon. Myrist. (1897) 556, t. 24; J. Sinclair, Gard. Bull. Sing. 18 (1961) 274, 288, f. 23; W.J. de Wilde, Blumea 25 (1979) 409, f. 6; Tree Fl. Sabah & Sarawak 3 (2000) 441. — *Myristica rufa* (Warb.) Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 90, nom. alt. inval. — Type: *Beccari 1798*, Sarawak.

Tree 5–20 m. *Twigs* slightly angular, 2–3 mm diameter, at first with rusty hairs 0.3 mm long, glabrescent; bark faintly striate, not or very faintly tending to crack or flake. *Leaves* thinly coriaceous, oblong to lanceolate, 15–30 by 1.5–4(–5.5) cm, base attenuate, apex acute or long acute-acuminate; drying olivaceous to blackish brown above, lower surface dull grey-brown; at both surfaces at first with dense rusty hairs 0.5 mm long, early glabrescent; dots absent; midrib raised above; nerves 15–25(–30) pairs, with lesser side nerves in between, raised above; venation distinct; petiole 10–20 by 2–3 mm. *Inflorescences*: peduncle up to 2 mm long, brachyblast simple, to 10 mm long; in male 2–10-flowered, female 1–3-flowered; flowers with rusty hairs 0.3 mm long; perianth 3- (or 4-)lobed, red inside (always?). *Male flowers*: pedicel 10–15 mm, bracteole caducous, above the middle; buds depressed obovoid, when dry ± furrowed, 6–7 by 5–6 mm, cleft c. 2/3, lobes inside with finely warty ridges, 0.5 mm thick; staminal disc circular, concave, 2–2.5 mm diameter; anthers 9–15, largely sessile, suberect, not or but little touching, the connectives extended slightly beyond the thecae; androphore tapering, 1 mm long. *Female flowers* not seen. *Fruits* 1(–3) per infructescence, ellipsoid, 2.5 by 1.5 cm, with rusty ± glossy hairs 3 mm long; dry pericarp 2(–3) mm thick; fruiting pedicel 10–20 mm long. — **Fig. 55.**

Field-notes — Bark not furrowed nor flaking, sparsely covered with lenticels. Leaves dull dark green with whitish green midrib above, glaucous with yellowish green midrib beneath. Male flowers red or cream inside.

Distribution — *Malesia*: Borneo (Sarawak, Brunei).

Habitat & Ecology — Primary mixed dipterocarp forest; sandy clay soil; 0–200 m altitude.

Note — The shaggy indumentum of the fruits is quite unlike that of other species of the genus *Knema*.

**62. *Knema scortechinii* (King) J. Sinclair**

*Knema scortechinii* (King) J. Sinclair, Gard. Bull. Sing. 16 (1958) 288, f. 7; 18 (1961) 276; W.J. de Wilde, Blumea 25 (1979) 431. — *Myristica scortechinii* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 317, pl. 153 (excl. female fl.). — *Knema conferta* (King) Warb. var. *scortechinii* (King) Warb., Mon. Myrist. (1897) 580. — Lectotype: *King's coll. 5617*; several syntypes, Peninsular Malaysia.

Tree 5–20 m. *Twigs* 2–4(–5) mm diameter, at first with pale yellow to rusty hairs 0.1–0.2 mm long, glabrescent; bark smooth or ± wrinkled, not longitudinally striate, not cracking or flaking. *Leaves* coriaceous, oblong or lanceolate, 10–32 by 2–8.5 cm, base subcordate to cuneate, apex subobtuse or acute(-acuminate); drying greenish brown to brown above; lower surface greyish, not distinctly papillate, late glabrescent or with persistent golden to pale brown or greyish, usually sessile-stellate hairs 0.2–0.4 mm long; dots absent; midrib raised above; nerves 18–30 pairs, raised above; venation ± raised, distinct; petiole 5–20 by 1.5–4(–5) mm. *Inflorescences*: sessile, brachyblast simple or 2–4-furcate, to 10 mm long; in male 4–10-flowered, female 1–5-flowered; flowers with rusty hairs 0.1–0.2 mm long; perianth 3- (or 4-)lobed, hard-carnose, creamy (?) inside. *Male flowers*: pedicel 7–16 mm long, bracteole caducous, about median; buds depressed globose, 3.5–5 mm diameter, cleft c. 5/6, lobes (0.8–)1–2 mm thick; staminal disc flat, circular or subtriangular, 2–2.5 mm diameter; anthers 11–16, just sessile to short-stiped, 0.5 mm, horizontal, not touching; androphore ± slender, 1–1.5 mm long. *Female flowers*: pedicel 3–11 mm long, bracteole about median; buds obovoid, 4.5–5 mm long, cleft over 1/2, lobes 1 mm thick; ovary subglobose to ovoid, 1.5–3 mm diameter, style 0.5–1.5 mm long, stigma ± flat, many-lobulate or ± 2-lobed and each lobe again 5–8-lobulate. *Fruits* 1–3 (or 4) per infructescence, subglobose or ellipsoid, 2–2.5 by 1.5–2 cm, with rusty hairs 0.1–0.3 mm long, subglabrescent; dry pericarp 1–2 mm thick; fruiting pedicel (4–)10–12 mm long.

Field-notes — Bark dark brown with a dark reddish tinge, (nearly) smooth, adherent scaly and probably flaky later, or closely fissured; slash inner bark pink red. Leaves dark green, glossy above, glaucous beneath.

Distribution — *Malesia*: Sumatra (E Coast, Indragiri), Peninsular Malaysia (Kedah, Perak, Kelantan, Trengganu, Pahang, Selangor, Negri Sembilan, Malacca, Johore).

Habitat & Ecology — Primary and disturbed rain forest; sandy soil; 0–500 m altitude; fl. Mar.–June; fr. June, Sept., Oct.

Note — *Knema scortechinii* may be confused with *K. conferta*, which differs in the presence of dark dots on the lower leaf surface, a coarser indumentum, and striated twigs.

**63. *Knema sericea* W.J. de Wilde**

*Knema sericea* W.J. de Wilde, Blumea 25 (1979) 383; 41 (1996) 394; Tree Fl. Sabah & Sarawak 3 (2000) 441. — Type: *Jaheri 611*, NE Kalimantan.

Tree 10–20 m. *Twigs* 4–5 mm diameter, at first with dense grey-rusty scale-like hairs 0.1 mm long or less, glabrescent; bark finely striate, not tending to crack or flake. *Leaves* membranous or chartaceous, oblong(-lanceolate), 30–45 by 9–15.5 cm, apex rounded, retuse, or acute-acuminate, base rounded to shallowly cordate, with the basal nerves

somewhat crowded, drying greenish to blackish brown above, lower surface very finely papillate or not, with persistent short, dense, greyish brown or pale cinnamon hairs 0.2 mm long, silky to the touch, mixed with sparse somewhat stouter ones; dots absent; midrib raised above; nerves 30–35 pairs, raised above; venation very fine, distinct; petiole 12–20 by 4–6 mm. *Inflorescences*: peduncle stout, 5–7 mm long, brachyblast  $\pm$  simple, 5 mm diameter; in male 4–10-flowered, female 2–5-flowered; flowers with dense greyish brown scurfy hairs 0.1 mm long; perianth 3-lobed, colour inside not known. *Male flowers*: pedicel 12–18 mm long, bracteole caducous, (sub)apical; buds subglobose, 6–10 mm diameter, cleft c. 4/5, lobes 0.5 mm thick; staminal disc circular, convex to mammillate, 3 mm diameter; anthers 10–15, long-stiped,  $\pm$  hanging down, horizontal, or slightly curved upwards, 0.6–0.7 mm long, not touching; androphore 0.5 mm long. *Female flowers* not known. *Fruits* 1 or 2 per infructescence, subglobose to broadly ovoid, apex 1–2 mm beaked, 3.5–5 by 3.5–4 cm, with grey-brown to rusty scale-like hairs 0.1 mm long; dry pericarp 5 mm thick; fruiting pedicel 15–20 mm, with scar of bracteole at or somewhat above the middle.

Field-notes — Stem without buttresses; bark smooth; twigs light green, pale brown mottled. Lower leaf surface with golden indumentum. Fruits yellowish green covered with golden hairs.

Distribution — *Malesia*: Borneo (Sarawak: 1st Div.; Brunei; C & NE Kalimantan).

Habitat & Ecology — Forest; at foot of limestone mountain; 50–350 m altitude; fr. Jan.

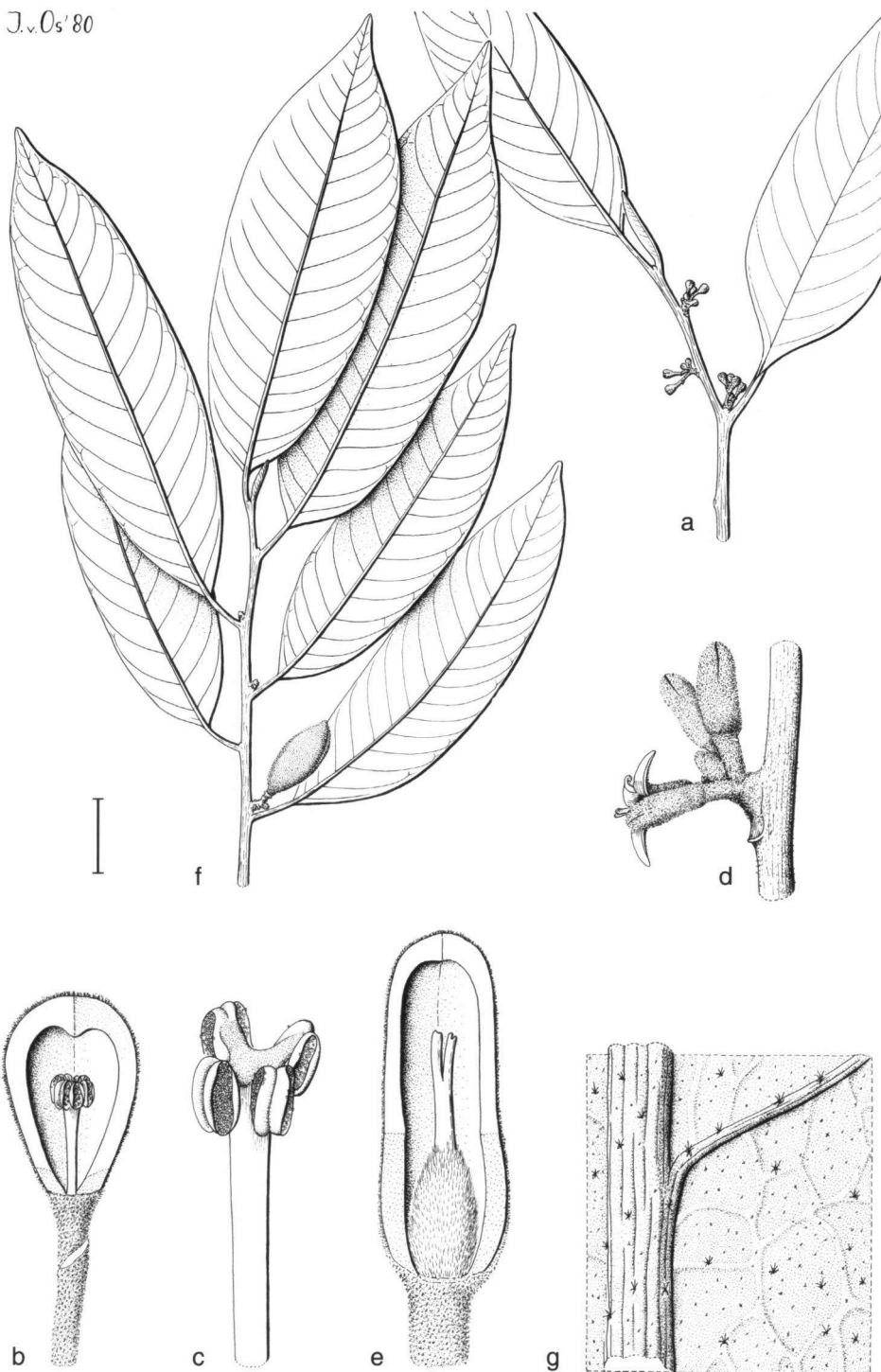
Note — *Knema sericea* is related to *K. retusa*, *K. ashtonii* (var. *cinnamomea*), and *K. elmeri*, with which it has the dense silky indumentum on the lower leaf surface in common. *Knema elmeri* has similar, though smaller male flowers, also with a convex or mammillate staminal disc, and differs in the less stout habit of the twigs, with flaking bark. *Knema retusa* (Peninsular Malaysia) differs in its stout obtuse leaves and broad, subglobose or ovoid,  $\pm$  apiculate fruits, and the pedunculate inflorescences. The short indumentum on the lower leaf surface in *K. sericea* is more fluffy than that of *K. ashtonii* var. *cinnamomea*, for which it can easily be mistaken, but which has a quite different androecium.

#### 64. *Knema steenisii* W.J. de Wilde

*Knema steenisii* W.J. de Wilde, *Blumea* 27 (1981) 224, f. 1. — Type: *Schmutz 4162*, W Flores.

Tree. *Twigs* 1–2(–3) mm diameter, with stellate scale-like and dendroid hairs 0.1–0.2 mm long, glabrescent; bark smooth or finely striate, not tending to crack. *Leaves* membranous or thinly chartaceous, (oblong-)lanceolate, 7–19 by 2–6 cm, base attenuate or narrowly rounded, apex acute(-acuminate); drying olivaceous or brown above; lower surface with subsistent mixed scale-like and dendroid hairs 0.1 mm long or less, and with few emergent ones up to 0.4 mm; dots absent; midrib slightly raised; nerves 15–25 pairs, little raised; venation  $\pm$  distinct; petiole 10–15 by 1–1.5 mm, late glabrescent. *Inflorescences*: sessile, brachyblast simple, 1–4 mm long; in male and female 1–5-flowered; flowers with rusty hairs 0.1–0.2 mm; perianth 3-lobed, pinkish(?) inside. *Male flowers*: pedicel 2–3 mm, bracteole 0.5 mm long, about median, caducous; buds obovoid or pear-shaped, at base tapering, apex  $\pm$  truncate, 2.8–3.5 by 2–2.2 mm, cleft c. 5/6, lobes 0.3–0.4 mm thick, inside at apex knobby; staminal disc circular,  $\pm$  flat, 0.8 mm

J. v. Os'80



diameter; anthers 4 or 5, just stiped, suberect, 0.4(–0.5) mm long; androphore slender, slightly tapering, 1.1–1.5 mm long. *Female flowers*: pedicel 0.5–1.5 mm long; buds ovoid-oblong, 5–6 by 1.5–2.5 mm, cleft slightly over 1/2, lobes 0.5 mm thick; ovary ovoid-ellipsoid, 2 mm long, with dense hairs 0.2(–0.3) mm, style glabrous, 1 mm long, stigma 1–1.5 mm long, of 2 erect lobes, 1–1.5 mm long, each entire or faintly 2-lobulate at apex. *Fruits* 1(–3?) per infructescence; ellipsoid-oblong, apex subacute, 2.2–2.4 by 1 cm, with brown-grey hairs 0.2–0.3(–0.5) mm long, late glabrescent; dry pericarp 0.5 mm thick; fruiting pedicel 1–1.5 mm long. — **Fig. 56.**

Field-note — Ripe fruits yellow.

Distribution — *Malesia*: Lesser Sunda Islands (W Flores).

Habitat & Ecology — Lower montane forest; 780–900 m altitude.

Notes — 1. *Knema steenisii* is distinguishable by small flowers, with a unique structure: 4 or 5 anthers, androphore slender, much longer than the diameter of the staminal disc, perianth cleft nearly to the base.

2. When sterile the species may be confused notably with *K. cinerea* and *K. stenocarpa*. Both these species (East Malesia) have globose male buds, and differ vegetatively in the indumentum on the lower leaf surface; in *K. cinerea* this consists of uniformly sized smaller stellate scale-like hairs, in *K. stenocarpa* of more woolly mixed stellate and dendroid hairs, not scale-like; in both species pistil and fruits are also different.

## 65. *Knema stellata* Merr.

*Knema stellata* Merr., Philipp. J. Sci., Bot. 11 (1916) 182. — Type: BS 24276 (*Ramos*), Philippines, Samar I.

For more references and synonyms see the subspecies.

Tree 5–35 m. *Twigs* 1.5–4 mm diameter, at first with rusty hairs 0.1–1 mm long, glabrescent; bark coarsely striate or grooved, not tending to crack or flake. *Leaves* membranous or chartaceous; (ovate-)elliptic or lanceolate, 6–20(–27) by 1.5–7 cm, base slightly rounded or cuneate-attenuate, the apex acute or acuminate; drying (greenish) brown above, early or late glabrescent; lower surface greyish, at first with stellate- and stellate-dendroid hairs of mixed sizes, 0.2–0.7 mm long, late glabrescent, the dendroid hairs sometimes more early shed and leaving distinct hair scars; dots present, especially on the veins; midrib ± flat or raised above; nerves (8–)15–24 pairs, ± raised above; venation prominent, distinct; petiole 7–13 by 1.5–2 mm. *Inflorescences*: peduncle up to 2 mm long, brachyblast simple, 2–4 mm diameter; in male 5–10-flowered, female 2–6-flowered; flowers with persistent hairs 0.2–0.3 mm long, mixed with emergent hairs 0.5 mm long; perianth 3-lobed, reddish (?) inside. *Male flowers*: pedicel (subsp. *cryptocaryoides*) 5–9 mm long, bracteole caducous, apical; buds subglobose, 3 by 3–3.5 mm, cleft 3/4–4/5, lobes 0.5–0.7(–1) mm thick; the staminal disc flat, circular, 1.5–2 mm diameter;

Fig. 56. *Knema steenisii* W.J. de Wilde. a. Male flowering twig; b. opened male bud, showing the androecium; c. mature androecium; d. female inflorescence; e. female flower, opened, showing the pistil; f. habit of fruiting twig; g. detail of lower leaf surface, showing minute stellate hairs of mixed sizes [a–c: *Schmutz 4162*; d, e: *Schmutz 4164*; f, g: *Schmutz 4420*]. — Scale bar for a = 1 cm; for b, e = 1.3 mm; for c = 0.4 mm; for d = 3.3 mm; for f = 2 cm; for g = 0.85 mm.

anthers 11, just stiped, 0.4–0.5 mm long, horizontal, spaced; androphore 0.5–1 mm long. *Female flowers*: pedicel 2–5 mm long, bracteole median to apical; buds obovoid-oblong, 5 by 3 mm, cleft c. 1/2, lobes 1 mm thick; ovary ovoid, 2 by 1.5 mm, stigma subsessile, 2-lobed and each lobe again  $\pm$  2-lobulate. *Fruits* 1–5 per infructescence, subglobose or broadly obovoid, base rounded or contracted into a short stipe (pseudostalk) up to 2 mm, 1.6–2.4 by 1.6–1.8 cm, with hairs either 0.1 mm or 0.5–1 mm long; dry pericarp 1–1.5 mm thick; fruiting pedicel 3–10 mm long.

Distribution — *Malesia*: Philippines and N & C Sulawesi.

Note — A variable species, divided into three closely related subspecies, each with a restricted area.

#### KEY TO THE SUBSPECIES

- 1a. Hairs on fruits 0.5–1 mm long. Fruiting pedicel 6–10 mm long. — Philippines (Samar) ..... **a. subsp. stellata**  
 b. Hairs on fruits 0.1–0.2 mm long. Fruiting pedicel 3–10 mm long ..... 2  
 2a. Male pedicel 5–9 mm long; buds subglobose, 3 by 3–3.5 mm; anthers 11. — Philippines (Mindanao, Sibuyan, Luzon) ..... **b. subsp. cryptocaryoides**  
 b. Male pedicel 1 mm long; buds  $\pm$  broadly obovoid, 2.5(–3) by 2(–2.5) mm; anthers 5. — N & C Sulawesi ..... **c. subsp. minahassae**

#### **a. subsp. stellata**

*Knema stellata* Merr., Philipp. J. Sci., Bot. 11 (1916) 182; Enum. Philipp. Flow. Pl. 2 (1923) 184; W.J. de Wilde, Blumea 25 (1979) 471; 27 (1981) 234.

*Twigs* 2–4 mm diameter, with woolly hairs 0.5–0.7 mm long. *Leaves* chartaceous, (oblong-)lanceolate, 10–24 by 2–6 cm, on lower surface with mixed coarse sessile-stellate and stellate-dendroid hairs, persistent or late glabrescent. Nerves 18–24 pairs. *Female inflorescences* to 1 mm pedunculate, wart-like. *Flowers* not known. *Fruits* subglobose or broadly ellipsoid, 1.8–2.4 by 1.8–2 cm, with coarse or woolly hairs 0.5–1 mm long; fruiting pedicel 6–10 mm long, the bracteole scar somewhat above the middle.

Distribution — *Malesia*: Philippines (Samar).

Habitat & Ecology — Forest at low altitudes; fr. Feb.–May.

#### **b. subsp. cryptocaryoides** (Elmer) W.J. de Wilde

*Knema stellata* Merr. subsp. *cryptocaryoides* (Elmer) W.J. de Wilde, Blumea 25 (1979) 471. — *Gymnacranthera cryptocaryoides* Elmer, Leaflet Philipp. Bot. 3 (1911) 1060; J. Sinclair, Gard. Bull. Sing. 16 (1958) 115. — Type: *Elmer 12262*, Philippines, Sibuyan I.

*Knema kunstleri* (King) Warb. var. *surigaoensis* J. Sinclair, Gard. Bull. Sing. 18 (1961) 238, f. 14. — Type: *Wenzel 2680*, Philippines, Mindanao.

*Twigs* 1.5–2.5 mm diameter, with scurfy hairs 0.1–0.3 mm long. *Leaves* membranous or chartaceous, ovate-oblong to oblong-lanceolate, 10–17 by 2.5–6 cm, on lower surface with subsistent sparse sessile-stellate hairs 0.2–0.3 mm, mixed with early shed longer hairs leaving hair scars, the hairs on and near midrib and nerves longer persistent. Nerves 12–22 pairs. *Inflorescences* sessile to 2 mm pedunculate. *Male flowers* with woolly hairs 0.2 mm long, mixed with emergent hairs 0.5 mm long. *Female flowers* not seen.

*Fruits* subglobose or broadly ellipsoid, 1.5–1.8(–2.5, according to Elmer) by 1.4–1.7 cm, with scurfy hairs 0.1 mm long; fruiting pedicel 5–10 mm long, the bracteole scar at or below the middle.

Distribution — *Malesia*: Philippines (Luzon, Sibuyan, Mindanao).

Habitat & Ecology — Forest on fertile soil; c. 250 m altitude; fl. Sept.–Oct; fr. Feb., Apr.

**c. subsp. minahassae (Warb.) W.J. de Wilde**

*Knema stellata* Merr. subsp. *minahassae* (Warb.) W.J. de Wilde, *Blumea* 25 (1979) 472; 27 (1981) 233. — *Knema laurina* (Blume) Warb. var. *minahassae* Warb., *Mon. Myrist.* (1897) 620. — Syntypes: *Koorders 18167, 18169*, N Sulawesi.

*Twigs* 1.5–3 mm diameter, with short-scurfy or woolly hairs 0.2–1 mm long. *Leaves* membranous or chartaceous, elliptic to oblong-lanceolate, 6–19(–27) by 2–7 cm, on lower surface at first with mixed scale-like stellate and dendroid hairs, late glabrescent; nerves 8–18 pairs. *Inflorescences*: peduncle to 2 mm long. *Male flowers*: pedicel 1–1.2 mm long, bracteole late caducous, apical; buds subglobose to broadly obovoid, 2.5(–3) by 2(–2.5) mm, cleft c. 4/5, lobes 0.2–0.3 mm thick; staminal disc ± flat, subcircular, 0.8 mm diameter; anthers 5, half-erect, short-stiped, 0.3–0.4 mm long; androphore 0.6–0.7 mm long. *Female flowers*: pedicel 2 mm long, bracteole subapical. *Fruits* obovoid-ellipsoid, 1.8–2.5 by 1.5–1.7 cm, with scurfy scale-like hairs 0.1–0.2 mm long; fruiting pedicel 3–6 mm long.

Field-note — Perianth yellow, with a red centre within.

Distribution — *Malesia*: C & N Sulawesi (Minahassa).

Habitat & Ecology — Montane forest, forest on conglomeratic rock, not on ultrabasic; 600–1000 m altitude; fl. July; fr. Mar.

Note — *Knema stellata* subsp. *minahassae* is reminiscent of *K. celebica* (both with dotted leaves) in the inflorescences and the male flowers, but they differ in leaf shape and indumentum of twigs and leaves. Vegetatively subsp. *cryptocaryoides* can hardly be distinguished, but both subspecies differ considerably in the male flowers.

**66. *Knema stenocarpa* Warb.**

*Knema stenocarpa* Warb., *Mon. Myrist.* (1897) 577, p.p., only the fruiting collection, not the male specimens; Elmer, *Leafl. Philipp. Bot.* 3 (1911) 1064; Merr., *Enum. Philipp. Flow. Pl.* 2 (1923) 184; W.J. de Wilde, *Blumea* 25 (1979) 436. — *Myristica stenocarpa* (Warb.) Boerl., *Handl. Fl. Ned. Ind.* 3, 1 (1900) 91, nom. alt. inval. — Syntypes: *Warburg 13303, 13303a*, Philippines, S Mindanao.

Tree or shrub 3–10 m. *Twigs* 1–1.5(–2) mm diameter, at first with woolly yellowish to rusty hairs 0.5 mm long, glabrescent; bark smooth or finely striate, not tending to crack or flake. *Leaves* herbaceous or chartaceous, ovate to obovate, or oblong(-lanceolate), occasionally faintly lobed in the upper part, base attenuate to subobtuse, apex acute (-acuminate); drying greenish above, lower surface greyish, at first with soft hairs 0.2 mm long, late glabrescent; dots absent; midrib ± raised above; nerves 10–20 pairs, ± raised above, often brownish; venation distinct; petiole 5–15 by 0.7–1.5 mm. *Inflorescences*: peduncle up to 1 mm long, brachyblast usually simple, slender, to 10 mm long; in male 5–25-flowered, in female 2–6-flowered; flowers with greyish to rusty hairs 0.2–



0.4 mm long; perianth 3-lobed, reddish (?) inside. *Male flowers*: pedicel 2–4.5 mm long, bracteole late caducous, median to apical; buds globose, 2–2.5 by 2–2.5(–3?) mm, cleft over 2/3, lobes 0.3–0.5 mm thick; staminal disc flat or occasionally low-mammillate, circular to faintly angled 1.2–1.5 mm diameter; anthers 6–9, just sessile or distinctly stiped, 0.3–0.5 mm long,  $\pm$  horizontal, not touching; androphore slender, 0.7–1 mm long. *Female flowers*: pedicel 0.5–2 mm long, bracteole about median; buds  $\pm$  ellipsoid, 4 mm long, cleft 1/2–2/3, lobes 0.4 mm thick; ovary ovoid, 1.5 by 1.2–1.5 mm; stigma subsessile, (1-) or 2-lobed and each lobe again 3–5-lobulate. *Fruits* 1 or 2 per infructescence, ellipsoid, apex subacute, 1.3–1.5 by 0.8–0.9 cm, with scurfy hairs 0.1 mm long or less; dry pericarp 1 mm thick; fruiting pedicel 1–3 mm long.

Distribution — *Malesia*: Philippines (Sulu Is.; Mindanao: mainly Zamboanga Prov.).

Habitat & Ecology — Primary and degraded forest; 300–500 m altitude; fl. & fr. throughout the year.

Note — *Knema stenocarpa* is closely related to *K. glomerata*, which differs in its stouter habit: thicker twigs, larger leaves with more nerves, larger male and female flowers, and different fruits, subglobose, 1.5–2.5 cm diameter. The leaves in *K. stenocarpa* are densely fine grey woolly beneath, and later glabrescent as compared to *K. glomerata*.

### 67. *Knema stenophylla* (Warb.) J. Sinclair

*Knema stenophylla* (Warb.) J. Sinclair, Gard. Bull. Sing. 16 (1958) 300, f. 11. — *Gymnacranthera stenophylla* Warb., Mon. Myrist. (1897) 364, t. 20. — Type: *Kehding 150*, Peninsular Malaysia. For more references and synonyms see the subspecies.

Tree 5–25 m. *Twigs* sometimes faintly angled, 0.5–2(–3) mm diameter, at first with minute hairs 0.1 mm long or less, sometimes mixed with longer hairs 0.2–0.3 mm, glabrescent; bark finely striate, not tending to crack or flake. *Leaves* membranous or chartaceous; elliptic to lanceolate, (3–)5–18 by 1–5 cm, apex acute-acuminate, base attenuate or cuneate, drying greenish to brown above; lower surface greyish, with subpersistent, scattered, mainly stellate scale-like hairs of  $\pm$  equal size, 0.1 mm long or less; dots absent; midrib flat to raised above; nerves 10–21 pairs, slender, sunken or but slightly raised, indistinct above; venation either raised and distinct, or sunken and indistinct; petiole 6–16 by 0.5–2 mm. *Inflorescences*: peduncle up to 1 mm long, brachyblast simple or 2- or 3-fid, 1–3(–7) mm long; in male (1–)3–10-flowered, female 1–6-flowered; flowers with greyish to rusty hairs 0.1 mm long, sometimes with emergent hairs up to 0.3 mm; perianth 3-lobed, creamy or yellowish inside (always?). *Male flowers*: pedicel 5–10 mm long, bracteole persistent or caducous, about median to nearly apical; buds subglobose or broadly obovoid, (1.5–)2–3(–4?) mm diameter, cleft 3/4–2/3, lobes 0.5–0.8 mm thick; staminal disc  $\pm$  flat, circular or subtriangular, 1–2.2 mm diameter; anthers 6–11, just to distinctly stiped, (almost) horizontal, 0.3–0.5 mm long, spaced; androphore 1 mm long. *Female flowers*: pedicel 3–12 mm long, bracteole about median; buds ellipsoid or obovoid, 3.5–5 mm long, cleft c. 1/2; ovary ovoid, 1.5–2 by 1–1.5 mm, style 0.5 mm long, stigma 2-lobed and each lobe again (2–)3–10-lobulate or serrate. *Fruits* 1–5 per infructescence, subglobose or obovoid, apex rounded to subacute, base rounded, sometimes  $\pm$  attenuate, (1.2–)1.5 by 0.7–1 cm, with rusty scale-like hairs 0.1 mm long or less; dry pericarp 1 mm thick; fruiting pedicel 4–20 mm long.

Field-notes — Bark smooth or rough with some pustules or flakes when old, not striate or furrowed; slash bark reddish, granular; slash wood pale. Leaves glossy dark green above, glaucous with yellowish green midrib beneath. Flowers creamy or yellow inside, fragrant. Fruits greenish brown, yellow, apricot, or orange.

Distribution — *Malesia*: Sumatra, Peninsular Malaysia (subsp. *stenophylla*), Borneo (subsp. *longipedicellata*).

Habitat & Ecology — Primary and degraded forest; often on hill sides, crests, ridges, also in swamp forest, periodically inundated forest, pole forest and kerangas; on sandstone, loam, sandy and clayey soil, shales; 0–800(–1200) m altitude; fl. & fr. throughout the year, in Borneo fl. mainly Mar.–July; fr. mainly July–Dec., in Sumatra fl. Apr.

Notes — 1. *Knema stenophylla* resembles *K. cinerea*, *K. glauca*, *K. hirtella*, *K. malayana*, *K. patentinervia*, and *K. subhirtella*; for differences see the key to the species.

2. The variability in *K. stenophylla* abounds in the venation on the upper leaf surface, which can be either distinct, indistinct, or invisible; the length of the male and female pedicels, the diameter of the male buds, and the number of anthers, varying from 6 to 11. These characters show some overlap with *K. malayana*, which differs in the generally thinner and broader leaves with a very distinct venation on the upper leaf surface, generally larger male flowers with longer pedicels, and the indumentum of the fruits which is more farinose. *Knema patentinervia* has larger male flowers, *K. subhirtella* has larger fruits.

#### KEY TO THE SUBSPECIES

- 1a. Male pedicel 5–6 mm long. Fruiting pedicel 4–8 mm long. — Sumatra, Peninsular Malaysia . . . . . **a. subsp. stenophylla**  
 b. Male pedicel 7–10 mm long. Fruiting pedicel 10–20 mm long. — Borneo . . . . .  
 . . . . . **b. subsp. longipedicellata**

#### **a. subsp. stenophylla**

*Knema stenophylla* (Warb.) J. Sinclair, Gard. Bull. Sing. 16 (1958) 300, f. 11; 18 (1961) 276; W.J. de Wilde, Blumea 25 (1979) 457, p.p., excl. stouter forms from Borneo, now in *K. subhirtella*; 32 (1987) 129; Tree Fl. Sabah & Sarawak 3 (2000) 442. — *Gymnacranthera stenophylla* Warb., Mon. Myrist. (1897) 364, t. 20. — *Myristica stenophylla* (Warb.) Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 88.

*Myristica geminata* auct. non Miq.: King, Ann. Roy. Bot. Gard. Calc. 8 (1891) 322, pl. 160, p.p.

Indumentum of twig apex and flowers ± reddish brown. Leaf blades chartaceous, usually ± glossy above, with very faint nerves and reticulation; nerves faint below. Male pedicels 5–6 mm long. Stalk of fruits 4–8 mm long.

Distribution — *Malesia*: Sumatra, Peninsular Malaysia.

Habitat & Ecology — Dryland or mossy forest.

#### **b. subsp. longipedicellata** (J. Sinclair) W.J. de Wilde

*Knema stenophylla* (Warb.) J. Sinclair subsp. *longipedicellata* (J. Sinclair) W.J. de Wilde, Blumea 32 (1987) 130; Tree Fl. Sabah & Sarawak 3 (2000) 442. — *Knema cinerea* (Poir.) Warb. var. *patentinervia* J. Sinclair forma *longipedicellata* J. Sinclair, Gard. Bull. Sing. 18 (1961) 182, f. 5A–E. — Type: *Clemens* 20345, Borneo, Sarawak.

Indumentum of twig apex and flowers greyish brown. Leaf blades membranous or chartaceous, dull above, with nerves and reticulation clearly discernible; nerves distinct below. Male pedicels 7–10 mm long. Stalk of fruits 10–20 mm long

Distribution — *Malesia*: Borneo (throughout).

Habitat & Ecology — Dryland forest on poor soils, kerangas.

### 68. *Knema stylosa* (W.J. de Wilde) W.J. de Wilde

*Knema stylosa* (W.J. de Wilde) W.J. de Wilde, *Blumea* 32 (1987) 119; *Tree Fl. Sabah & Sarawak* 3 (2000) 443. — *Knema hirtella* W.J. de Wilde var. *stylosa* W.J. de Wilde, *Blumea* 25 (1979) 460.

— Type: *SAN 30179 (Mikil)*, Sabah.

Tree 8–20(–25) m. *Twigs* 2–3 mm diameter, at first with pale brown or grey-brown hairs 0.1 mm long or less, glabrescent; bark striate, not tending to crack or flake. *Leaves* thinly chartaceous, (elliptic-)oblong, 12–24 by 3.5–7 cm, base (subcordate or) rounded to short-attenuate, apex acute-acuminate; drying olivaceous to brown above, lower surface glabrescent or with subsistent sparse hairs less than 0.1 mm long, mixed with scars of coarser caducous hairs 0.2 mm; dots absent; midrib convex, but (partly) sunken under surface level; nerves 15–20 pairs, flat or sunken; venation usually distinct; petiole 10–20 by 2–3 mm, late glabrescent. *Inflorescences*: sessile, brachyblast wart-like, simple or forked, to 4 mm long; in male and female 3–6(–10)-flowered; flowers with dense (pale) brown hairs 0.1 mm long; perianth 3-lobed, greenish (?) inside. *Male flowers*: pedicel 4–5 mm long, bracteole apical, persistent; buds obovoid, 3.5–4 by 3–3.5 mm, cleft c. 2/3, lobes 0.7 mm thick; staminal disc  $\pm$  flat, blunt-triangular, 1.4 mm diameter; androphore tapering, 1.2 mm long, glabrous; anthers 11, half-sessile, suberect, 0.5 mm long. *Female flowers*: pedicel 3–5 mm long, bracteole caducous, median to apical; buds  $\pm$  obovoid-ellipsoid, 4.5 by 3.5 mm, cleft c. 1/2, lobes 0.7(–1) mm thick; ovary ovoid, 1.5 by 1 mm, densely minutely pubescent, style (0.5–)1 mm long, stigma broadly 2-lobed and each lobe again 6–12-lobulate. *Fruits* solitary or 2 or 3 per infructescence, ovoid, 2.5–3.5 by 1.8–2.5 cm, with dense or sparse pale brown hairs 0.1 mm or less, sometimes glabrescent, style persistent or leaving a scar; dry pericarp 1.5–2.5 mm thick; fruiting pedicel 3–6 mm long.

Field-notes — Bark smooth, slash pinkish with (dark) red exudate, sapwood whitish. Flowers (pale) chocolate-brown, (greenish inside?). Fruits green or orange.

Distribution — *Malesia*: Borneo (NE Sarawak: 5th Div.; Sabah).

Habitat & Ecology — Primary forest, hill sides, often on blackish soil, sandstone or sandstone-derived soils; 0–800 m altitude, fl. June; fr. throughout the year.

Note — *Knema stylosa*, with obovoid male buds, belongs in the group of *K. obovoidea*, in the vicinity of species like *K. pulchra* and *K. piriformis*, hence species with male buds narrowly pear-shaped, cleft c. 2/3 only. In habit it may be confused with *K. glauca*, a species also with a weak indumentum on the lower leaf surface, distinct in globose male buds, stiped anthers, and early glabrescent fruits. An additional character of *K. stylosa* is the largely sunken midrib into a groove above. *Knema pulchra* is much stouter, always with a cordate or broadly rounded leaf base, larger male buds, more anthers, and larger fruits; *K. piriformis* is a mountain species, with more narrowly pear-shaped male buds, stiped anthers, the indumentum on the lower leaf surface more distinct.

**69. Knema subhirtella** W.J. de Wilde

*Knema subhirtella* W.J. de Wilde, *Blumea* 32 (1987) 131; *Tree Fl. Sabah & Sarawak* 3 (2000) 443.  
— Type: S 43132 (*Yi et al.*), Sarawak.

Tree 5–25 m. *Twigs* sometimes blunt-triangular, 1.5–2(–2.5) mm diameter, with grey-brown or pale rusty hairs 0.1–0.3 mm long, glabrescent; bark faintly or finely striate, not flaking. *Leaves* membranous, elliptic-oblong or lanceolate, 9–20 by 1.5–5.5 cm, base short- to long-cuneate, apex acute-acuminate, drying olivaceous to brown above, lower surface with persistent sparse hairs of mixed sizes, 0.1–0.2(–0.3) mm; dots absent; the midrib raised above; nerves 15–25 pairs,  $\pm$  flat or raised above, venation coarse, distinct; petiole  $\pm$  late glabrescent, 8–12 by 1–2 mm. *Inflorescences*: peduncle up to 1 mm long, brachyblast simple or forked, to 4 mm long; in male 4–7-flowered, female 1–4-flowered; flowers with dense hairs 0.1–0.3 mm long; perianth 3-lobed, creamy greenish inside. *Male flowers*: pedicel 2–5 mm long, bracteole late caducous, 0.5–1.5 mm below the apex; buds broadly obovoid, 2.5–3.5(–4) by 2.5–3.5 mm, cleft (1/2–)2/3–3/4, lobes 0.5 mm thick; staminal disc circular, flat or somewhat convex, 1.2–1.5(–2) mm diameter, anthers 7–15, short-stiped, 0.3–0.4 mm long, horizontal (opening downwards), not touching; androphore little tapering, 1–1.5 mm long, glabrous or with some minute stellate hairs towards the base. *Female flowers*: pedicel 4–7(–10) mm, bracteole  $\pm$  median; buds  $\pm$  obovoid, 5 by 3 mm, cleft c. 1/2, lobes 0.5 mm thick; ovary 2.5 by 1.5 mm, with dense hairs 0.1 mm long or less, stigma sessile, 1.5 mm high, 2-lobed, each lobe  $\pm$  2- or 3-lobulate. *Fruits* solitary or 2 per infructescence, broadly ellipsoid, 2–2.7 by 1.5–2 cm, with dense hairs 0.1 mm long, dry pericarp 1.5 mm thick; fruiting pedicel 4–10 mm long.

*Field-notes* — Understorey tree; bark usually chocolate-brown,  $\pm$  smooth or dippled, not furrowed; outer bark brittle, inner bark pink-cream, fibrous; sapwood cream; exudate pink to blood-red. Perianth outside yellow-brown, greenish cream inside. Fruits yellow-green, apricot, or orange; aril red. The wood is used as firewood.

*Distribution* — *Malesia*: Borneo (Sarawak, W Sabah).

*Habitat & Ecology* — Mixed dipterocarp forest; hill slopes, ridges; sandy clay and loam, basalt rock, shales; 0–800(–1200) m altitude; fl. Mar.–May(–Aug.); fr. mainly Sept., Oct.

*Note* — *Knema subhirtella* is related to *K. mogeana* and *K. hirtella*, all three with a similar indumentum on the lower leaf surface. In general habit the species may be confused with *K. stenophylla*, *K. glaucescens*, and *K. piriformis*. *Knema mogeana* differs in its smaller male buds, and distinctly smaller fruits. *Knema hirtella* has stouter twigs, larger male buds, the androphore always with hairs towards the base, and somewhat larger fruits. In *K. subhirtella* the androphore is either glabrous or with a few hairs towards the base only. *Knema stenophylla* (in Borneo subsp. *longipedicellata*) differs in the subglobose (not obovoid) male buds, cleft almost to the base, and an inconspicuous indumentum on the lower leaf surface, consisting of scattered stellate hairs of only 0.1 mm diameter. *Knema glaucescens*, also with a globose male buds, has much denser hairs on the lower leaf surface. *Knema piriformis* (known from a limited number of specimens from montane localities) generally has more elongate male buds, with the androphore longer than the diameter of the disc. Through its rather variable,  $\pm$  pear-shaped male buds, *K. subhirtella* obscures the demarcation of the group of species around *K. glauca*, in which it obviously has a marginal position. On account of its ill-defined bud shape, it keyed out twice in the general key to male flowering specimens.

**70. *Knema sumatrana* (Blume) W.J. de Wilde**

*Knema sumatrana* (Blume) W.J. de Wilde, *Blumea* 25 (1979) 454. — *Myristica sumatrana* Blume, *Rumphia* 1 (1835) 187. — *Myristica glauca* Blume var. *sumatrana* (Blume) Miq., *Pl. Jungh.* (1852) 171. — *Myristica corticosa* (Lour.) Hook. f. & Thomson var. *sumatrana* (Blume) Miq., *Fl. Ind. Bat., Suppl.* 1 (1861) 384. — *Knema glauca* (Blume) Warb. var. *sumatrana* (Blume) Warb., *Mon. Myrist.* (1897) 597. — *Knema cinerea* (Poir.) Warb. var. *sumatrana* (Blume) J. Sinclair, *Gard. Bull. Sing.* 18 (1961) 185, p.p., for the basionym only. — Type: *Korthals s.n.* (male fl., lecto), Sumatra.

*Myristica wrayi* King, *Ann. Roy. Bot. Gard. Calc.* 3 (1891) 315, pl. 151. — *Knema wrayi* (King) Warb., *Mon. Myrist.* (1897) 572, t. 24; Gamble, *Mat. Fl. Malay Penins.* 5, 23 (1912) 243; Ridl., *Fl. Malay Penins.* 3 (1924) 70. — Syntypes: *Wray s.n.*; *King's coll.* 5299, 8277, 10444 (lecto), Peninsular Malaysia.

*Knema glaucescens* auct. non Jack: J. Sinclair, *Gard. Bull. Sing.* 16 (1958) 304 (var. *glaucescens*, p.p.).

Tree 10–20 m. *Twigs* 2–3 mm diameter, at first with minute scale-like hairs 0.1 mm long or less, very early glabrescent; bark finely striate, not tending to crack or flake. *Leaves* membranous or chartaceous, elliptic to oblong-lanceolate, 12–30 by 4.5–12 cm, apex obtuse to acute-acuminate, base rounded, subtruncate, or short-attenuate, drying greenish to brown above; lower surface greyish, at first with inconspicuous scale-like hairs 0.1 mm long or less, early glabrescent, sometimes with minute lanose hairs at blade edge near the base, soon glabrescent; dots absent; midrib  $\pm$  flat or raised above; nerves 17–22 pairs,  $\pm$  flat above; venation (areoles 1 mm diameter or more) distinct; petiole 12–16 by 1.5–3 mm. *Inflorescences*: sessile, brachyblast simple or forked, to 8 mm long; in male 10–20-flowered, female 1–5(?)-flowered; flowers with greyish brown hairs less than 0.1 mm long; perianth 3- (or 4-)lobed, red inside. *Male flowers*: pedicel 10–11 mm long, bracteole 1 mm long, at or above median, persistent or late caducous; buds subglobose, 3–4 mm diameter, cleft c. 4/5, lobes 0.5–0.8 mm thick; staminal disc slightly convex, finely papillate, circular, 2–2.5 mm diameter; anthers 12–18, distinctly stiped, spaced, horizontal, 0.3–0.4 mm long (connective narrow above, thecae opening  $\pm$  laterally); androphore 1–1.2 mm long. *Female flower* (from aged flowers in *Korthals s.n.*): pedicel 2–4 mm long, bracteole median to subapical, subpersistent; buds obovoid-ellipsoid, 4 by 2.5 mm, cleft slightly over 1/2; ovary ovoid, 1.5 by 1 mm, stigma sessile, 2-lobed and each lobe again 3- or 4-lobulate. *Fruits* 1–3 per infructescence, ovoid-ellipsoid or ellipsoid-oblong, apex and base subacute, 3–4 by 1.4–2 cm, at first with minute indumentum, early glabrescent, leaving a finely granulate surface; dry pericarp 3 mm thick; fruiting pedicel 3–6 mm long. — **Photo 7.**

**Field-notes** — Perianth bright red inside, anthers creamy white, disc dirty red.

**Distribution** — Peninsular Thailand; in *Malesia*: Sumatra (incl. Simeulue I.) and Peninsular Malaysia (Perak, Kelantan).

**Habitat & Ecology** — Rain forest; along rivers, *Saraca* streams, hill slopes; 0–1200 m altitude; fl. & fr. throughout the year.

**Note** — *Knema sumatrana* is closely related to *K. glauca*; several of the stouter specimens included in *K. glauca* are difficult to separate from *K. sumatrana*. Possibly these specimens are hybrids, with an intermediate habit. In most instances, however, *K. glauca* can easily be distinguished by the smaller size of twigs and leaves, smaller male flowers with fewer anthers (8–11, or in E Java up to 14), and by smaller fruits, 1.8–2.5(–4) cm

long, as against 3–4 cm in *K. sumatrana*. Other characters of diagnostic value of *K. sumatrana* are the early glabrescent twig apex and lower leaf surface, persistent bracteole, many (12–18) distinctly stiped anthers, somewhat convex, finely papillate staminal disc, narrow connective, and almost laterally opening thecae.

### 71. *Knema tomentella* (Miq.) Warb.

*Knema tomentella* (Miq.) Warb., Mon. Myrist. (1897) 588, t. 25; J. Sinclair, Gard. Bull. Sing. 18 (1961) 277, f. 24, map 18, p.p., excl. syn. *K. laurina* var. *minahassae*, *K. stellata*, *K. alvarezii*; W.J. de Wilde, Blumea 25 (1979) 438; 41 (1996) 394. — *Myristica corticosa* (Lour.) Hook. f. & Thomson var. *tomentella* Miq., Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 207. — *Myristica tomentella* (Miq.) Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 91. — Type: *de Fretes in Teijsmann s.n.*, Moluccas, Ambon.

[*Palala sexta* Rumph., Herb. Amb. 2 (1750) 28.]

*Myristica corticosa* var. *amplifolia* Miq., Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 202. — Type: *Riedel in Beccari 7772*, Sulawesi.

*Myristica corticosa* var. *ceramensis* Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 51. — Type: *Teijsmann & de Vriese (12, 13)*, Seram.

*Knema glauca* (Blume) Warb. var. *bancana* Warb., Mon. Myrist. (1897) 597. — *Myristica glauca* Blume var. *bancana* (Warb.) Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 92. — Type: *culta Hort. Bog. (Beccari s.n.)*.

Tree 5–15(–30?) m. Twigs 2–3 mm diameter, at first with rusty hairs 0.3–0.6 mm long, glabrescent; bark striate or in Sulawesi and Seram (partly) sometimes faintly striate, not tending to crack or flake. *Leaves* chartaceous, elliptic, subobovate, or (ob)lanceolate, 7–26 by 2–7.5 cm, apex acute(–acuminate), rarely subtruncate, base attenuate to rounded, drying (greenish) brown above, lower surface grey-glaucous, at first with hairs of mixed size, 0.3–0.6 mm long, largely glabrescent, with some indumentum remaining on or near the midrib and nerves, finely papillate, with hair scars; dots absent; midrib raised above; nerves 16–26 pairs, raised above; venation very distinct; petiole 10–20 by 1.5–3.5 mm. *Inflorescences*: sessile, brachyblast simple or bifurcate, to 10 mm long; in male 2–15-flowered, female 1–5-flowered; flowers with rusty woolly hairs (0.2–)0.3–1 mm long; perianth 3-lobed, reddish (?) inside. *Male flowers*: pedicel 2–5 mm long, bracteole late caducous, (sub)apical; buds broadly obovoid or globose, 2.5–3 mm diameter, cleft nearly to the base, lobes 0.5–0.7 mm thick; staminal disc flat, circular, 1–1.5(–2) mm diameter; anthers 6–9(–11), stiped, horizontal or slightly oblique, 0.3–0.5 mm long, spaced; androphore slender, 0.7–1 mm long. *Female flowers*: pedicel 2–4 mm long, bracteole subapical; buds obovoid-oblong, 4.5–6 mm long, cleft c. 1/2, lobes 0.5 mm thick; ovary ovoid, 1.5–2 mm long, stigma sessile, 2-lobed and each lobe again 2–5-lobulate. *Fruits* 1–3 per infructescence, obovoid, pear-shaped, or ellipsoid, apex obtuse or shortly beaked, (1–)1.5–2.5 by (0.8–)1–1.8 cm, with harsh rusty hairs 0.5 mm long; dry pericarp 1.5–2 mm thick; fruiting pedicel 2–5 mm long.

Field-notes — Bark smooth, brownish grey, with some dents, no flakes or fissures; inner bark red; wood dirty white. Leaves glossy dark green with whitish midrib above, glaucous with greenish yellow midrib beneath.

Distribution — *Malesia*: Philippines (Samar), Sulawesi (N, SW, & SE Peninsula), Moluccas (Morotai, Halmahera, Bacan, Obi, Buru, Seram, Ambon), New Guinea (Bird's Head, one coll.).

**Habitat & Ecology** — Primary and degraded forest; once from sandy loam soil; altitude 0–1500 m; fl. June, Nov.–Feb.; fr. Apr., May, Aug.

**Notes** — 1. This is the only *Knema* occurring in New Guinea (and known only from a single collection). Most specimens formerly recorded for the Philippines belong to *K. glomerata*, a related species differing in the finer reticulation on the upper leaf surface, bracteole median on the pedicel, and a  $\pm$  convex staminal disc. In the Philippines *K. tomentella* is known only from Samar.

2. Specimens from Sulawesi may be reminiscent of *K. celebica* or *K. glomerata*.

## 72. *Knema tridactyla* Airy Shaw

*Knema tridactyla* Airy Shaw, Kew Bull. 10, 1939 (1940) 543; W.J. de Wilde, Blumea 25 (1979) 434, f. 13; 41 (1996) 395; 43 (1998) 251; Tree Fl. Sabah & Sarawak 3 (2000) 444. — Type: Richards 1220, Sarawak.

Treelet 2–10 m. *Twigs* sometimes faintly 2- or 3-angular, 1.5–4 mm diameter, at first with rusty woolly hairs 0.5–1(–1.5) mm long (subsp. *tridactyla*),  $\pm$  late glabrescent, or with inconspicuous scale-like hairs 0.1 mm long or less (subsp. *sublaevis*), early glabrescent; bark (finely) striate, not tending to crack or flake. *Leaves* chartaceous or thinly coriaceous, oblong or lanceolate, 7–28 by 2–5.5(–7.5) cm, base cuneate to rounded, apex acute(-acuminate), drying olivaceous or brown above, often glossy and with minute hair scars (lens!); lower surface either with subpersistent greyish stellate hairs 0.3–0.5 mm long, intermixed with stronger dendroid hairs (subsp. *tridactyla*), or at first with sparse scale-like hairs 0.1 mm long or less, early glabrescent (subsp. *sublaevis*), surface greyish, not or hardly papillate, with scars of shed coarser hairs; dots absent; midrib much raised above (in subsp. *tridactyla* towards base with appressed scale-like hairs); nerves 10–23 pairs, flat or sunken above; venation very fine, distinct above; petiole  $\pm$  late glabrescent, 5–15 by 1.5–3 mm. *Inflorescences*: peduncle up to 3 mm long, brachyblast simple or 2- or 3-fid, slender or rather thick (worm-like), to 17 mm long, 1–2(–2.5) mm thick; in male (2–)4–10-flowered, female 1–5-flowered; flowers with hairs either 0.3–1(–1.5) mm long (subsp. *tridactyla* & *pachydactyla*) or (scale-like) 0.1 mm long (subsp. *sublaevis*); perianth 3-lobed, pinkish (?) inside. *Male flowers*: pedicel 1.5–3.5 mm long, bracteole subpersistent, at or above the middle; buds globose to broadly obovoid, 1.5–2(–2.3) by 1.5–2.5 mm, cleft 3/4–4/5, lobes 0.2–0.5 mm thick; staminal disc flat, circular or faintly triangular, 0.6–1.2 mm diameter; anthers 5–11, partly or completely sessile, 0.2–0.3 mm long, half-erect, not or hardly touching; androphore 0.3–0.7 mm long. *Female flowers*: pedicel 1.5 mm long, bracteole at or above the middle; buds more or less obovoid, 2–2.5 by 1.5 mm, cleft c. 2/3, lobes 0.2–0.3 mm thick; ovary subglobose, 1 mm diameter, style including stigmas 1–1.5 mm long, the latter 2-lobed and each lobe again  $\pm$  2-lobulate. *Fruits* 1 (or 2) per infructescence, ellipsoid or (ob)ovoid-oblong, 1.4–2 by 0.8–1.6 cm, with hairs either 0.2–0.5 mm long (subsp. *tridactyla*), or scale-like, 0.1 mm long (subsp. *sublaevis*); dry pericarp 1–1.5 mm thick; fruiting pedicel 2–3 mm long.

**Field-note** — Bark brown, smooth.

**Distribution** — *Malesia*: Borneo (Sarawak, Brunei, Sabah).

**Habitat & Ecology** — Primary lowland dipterocarp forest; pole forest; clay or yellow sandy soil; once from steep ridge; 0–1000 m altitude; fl. Jan.–Dec.; fr. Oct., Dec., Feb.

Note — Distinguishable by the small flowers. The inflorescences are often pedunculate, and, as in the type *Richards 1220*, typically 2- or 3-fid, the ramifications worm-like, up to 17 mm long. In other specimens the inflorescences are not or hardly branched and much shorter.

## KEY TO THE SUBSPECIES

- 1a. Indumentum of twig apices, flowers, and fruits with hairs 0.5–1 mm long. Anthers 6–11 ..... 2  
 b. Indumentum consisting of hairs 0.1 mm long. Male perianth 1.5–2 mm diam.; anthers 5 or 6 ..... **d. subsp. *sublaevis***  
 2a. Leaves narrow, 7–12 by 1.5–2.5 cm, lateral nerves 8–12 pairs. Male perianth 1.5 mm diam.; anthers 6 ..... **c. subsp. *salicifolia***  
 b. Leaves larger, lateral nerves 12–23 per side ..... 3  
 3a. Indumentum consisting of hairs 0.5–1 mm long. Branches of male inflorescences (1–)1.5–2 mm thick; perianth 1.5–2 mm diam.; anthers 6–8 . . **a. subsp. *tridactyla***  
 b. Indumentum consisting of hairs 1(–1.5) mm long. Branches of male inflorescences 2–2.5 mm thick; perianth 2–2.3 mm diam.; anthers 10 or 11 **b. subsp. *pachydactyla***

**a. subsp. *tridactyla***

Twigs at apex with distinct dendroid hairs 0.5(–1) mm long. Leaves beneath with dense stellate hairs, intermixed with coarser dendroid hairs up to 0.5 mm long. Indumentum of flowers and fruits consisting of mixed sessile stellate, and dendroid hairs 0.5–1 mm long. Anthers 6–8. — **Fig. 57.**

Distribution — *Malesia*: Borneo (Sarawak: 4th Div.; W Sabah).

Notes — 1. The leaves have conspicuous scattered crateriform hair scars on the upper surface (lens!), similar to those found e.g. in *K. oblongata* subsp. *pedunculata*, the latter differing in shape and size of the male flowers. In the indumentum on the lower leaf surface it is somewhat reminiscent of *K. scortechinii* and *K. conferta*.

2. The midrib is prominent above, usually covered with characteristic appressed scale-like hairs towards the base.

**b. subsp. *pachydactyla* W.J. de Wilde**

*Knema tridactyla* Airy Shaw subsp. *pachydactyla* W.J. de Wilde, *Blumea* 43 (1998) 251; *Tree Fl. Sabah & Sarawak* 3 (2000) 446. — Type: *SAN 134086 (Madani et al.)*, male fl., Sabah.

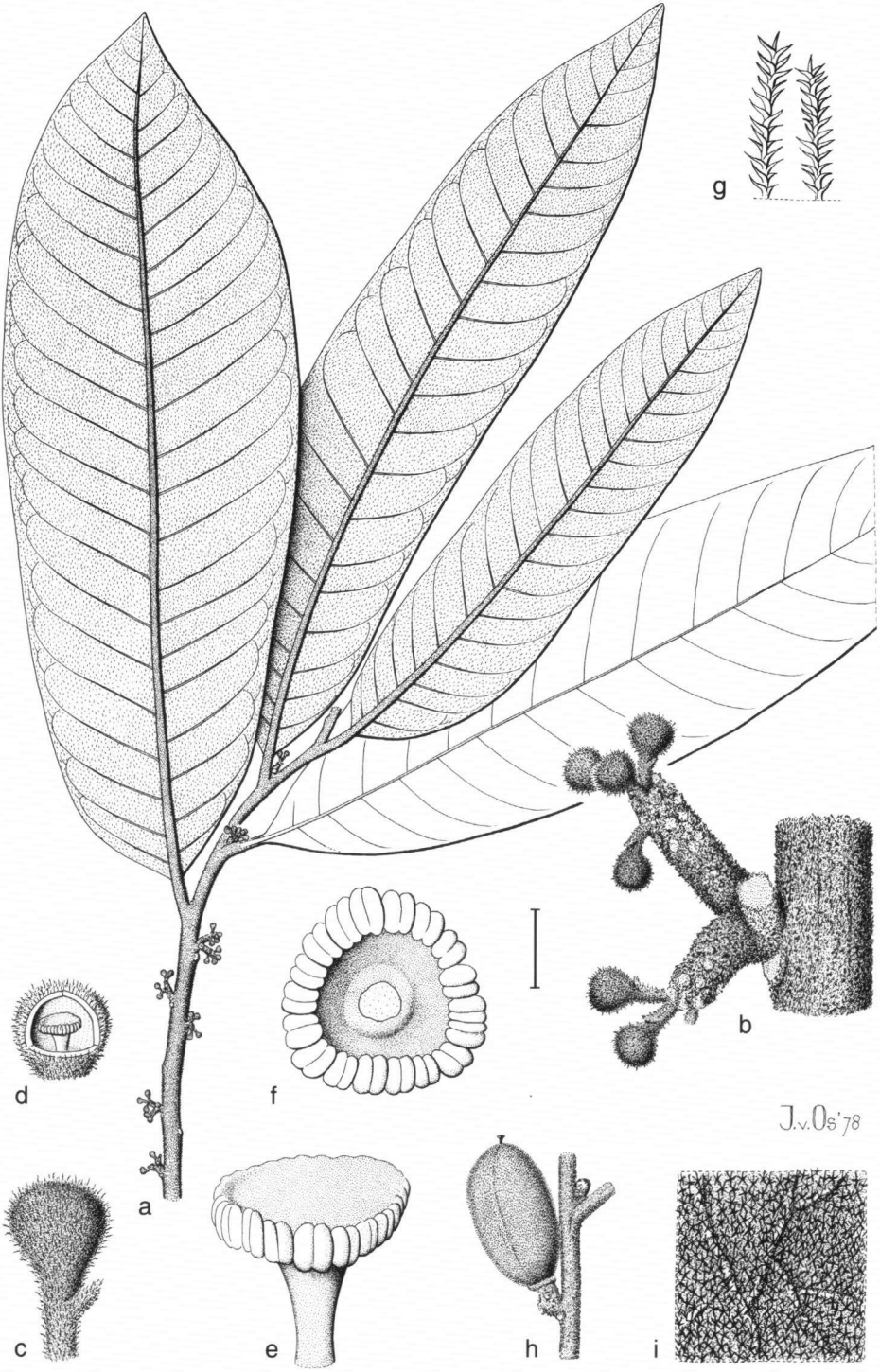
Tree c. 7 m. Twigs at apex, lower leaf surface, and flowers with hairs 1(–1.5) mm long. Branches of male inflorescences 2(–2.5) mm thick. Male perianth 2–2.3 mm diam.; anthers 10 or 11. Female flowers and fruits not known.

Distribution — *Malesia*: Borneo (N Sabah, Penampang Distr.); known only from the type collection; see note.

Habitat & Ecology — On ridge; c. 400 m altitude; fl. Aug.

Note — The specimen on which the present subspecies has been based represents an exceptionally stout plant. The distinction with subsp. *tridactyla* may prove to be problematic, but the type of *K. tridactyla*, with slenderly branched male inflorescences and small flowers (perianth 1.5 mm diam., 6 or 7 anthers), is quite different.





**c. subsp. salicifolia** W.J. de Wilde

*Knema tridactyla* Airy Shaw subsp. *salicifolia* W.J. de Wilde, *Blumea* 43 (1998) 251; *Tree Fl. Sabah & Sarawak* 3 (2000) 446. — Type: *SAN A 4237 (Wood)*, N Sabah.

Tree c. 10 m. Twigs at apex, lower leaf surface and flowers with hairs 0.5(–1) mm long. Leaves narrow, 7–11 by 1.5–2.5 cm. Branches of male inflorescences 1.5 mm thick. Male perianth 1.5 mm diam.; anthers 6. Female flowers and fruits not known.

Distribution — *Malesia*: Borneo (N Sabah, Kota Belud Distr.); known only from the type collection.

Habitat & Ecology — On hills; c. 650 m altitude; fl. Sept.

**d. subsp. sublaevis** W.J. de Wilde

*Knema tridactyla* Airy Shaw subsp. *sublaevis* W.J. de Wilde, *Blumea* 25 (1979) 434; 41 (1996) 395; 43 (1998) 251, f. 1d; *Tree Fl. Sabah & Sarawak* 3 (2000) 446. — Type: *S 13590 (Ilias Paie)*, Sarawak.

Twigs at apex seemingly glabrous, with scale-like hairs 0.1 mm long. Leaves beneath with sparse minute scale-like hairs, mixed with scattered somewhat coarser scale-like hairs. Indumentum of flowers and fruits thin, consisting of scale-like hairs 0.1 mm long. Anthers 5 or 6. — **Fig. 41d.**

Distribution — *Malesia*: Borneo (Sarawak: 1st Div.).

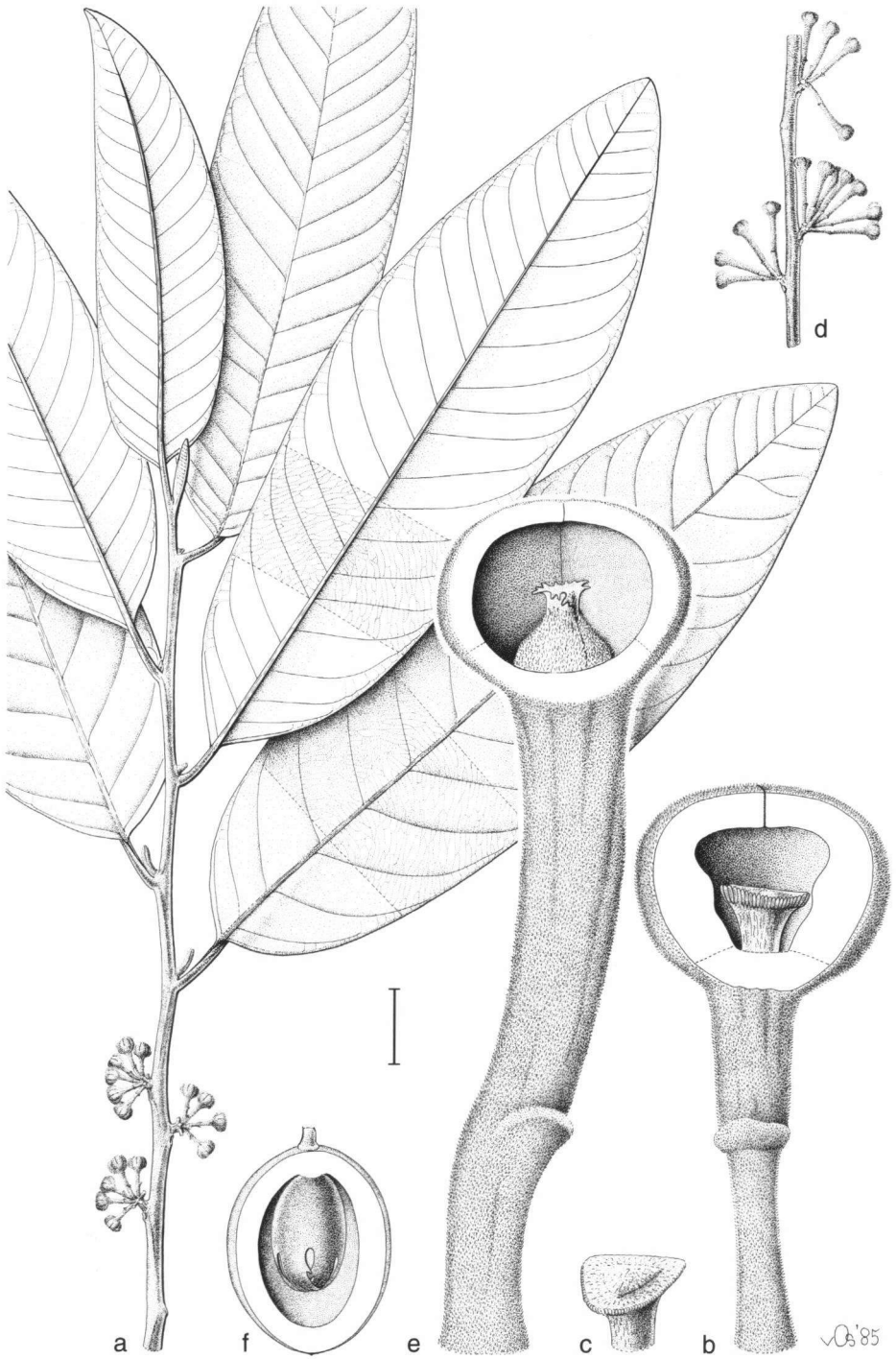
Note — Some slender specimens from Brunei, differing in male flowers with 10–12 anthers (instead of 5 or 6), and in a more conspicuous indumentum of the twigs, have been discussed under subsp. *sublaevis* (De Wilde 1996: 395).

**73. Knema uliginosa** J. Sinclair

*Knema uliginosa* J. Sinclair, *Gard. Bull. Sing.* 18 (1961) 281, f. 25; W.J. de Wilde, *Blumea* 25 (1979) 428; *Tree Fl. Sabah & Sarawak* 3 (2000) 447. — Type: *Main 2098 (exp. Polak)*, W Kalimantan.

Shrub or tree to 10 m. Twigs sometimes bluntly 2- or 3-angular, 1.5–3(–4) mm diameter, at first with dense hairs 0.5–1 mm long, glabrescent; bark grey-brown, smooth or finely striate, not tending to crack or flake. Leaves thinly coriaceous, oblong or lanceolate, 9–35 by 2–7.5 cm, apex subacute or acute-acuminate, base rounded to attenuate, drying olivaceous or brown above; lower surface at first with dense bright brown hairs 0.5–1 mm long, early glabrescent, greyish to reddish brown; dots absent; midrib raised above; nerves 8–15 pairs, much raised above; venation raised, distinct; petiole 10 by 2–3 mm. *Inflorescences*: sessile, brachyblast simple or forked, to 5 mm long; in male

**Fig. 57.** *Knema tridactyla* Airy Shaw subsp. *tridactyla*. a. Branchlet with male inflorescences; b. piece of branchlet with male inflorescence; c. male bud; d. opened male bud showing androecium; e. androecium, somewhat lateral view; f. ditto, seen from beneath; g. sample of hairs of male perianth, half-schematic; h. piece of branchlet with infructescence; note fruit with persistent style; i. detail of lower leaf surface showing rather dense persistent indumentum of small stellate hairs [a–g: *S 21378 (Othman)*; h, i: *S 27758 (Ingah Kudi)*]. — Scale bar for a = 2 cm; for b = 2.8 mm; for c, d = 1.4 mm; for e, f, i = 0.32 mm; for g = 0.16 mm; for h = 1 cm.



5–20-flowered, female 1–5-flowered; flowers with rusty hairs 0.3–0.4 mm long; perianth 3- or 4-lobed, reddish (?) inside. *Male flowers*: pedicel 5–10 mm long, bracteole subsistent or caducous, (sub)apical; buds depressed globose, faintly angled in cross section, 3–4 by 4–5 mm, cleft c. 4/5, lobes 0.5 mm thick; staminal disc circular, 2–2.5 mm diameter, convex or low-mammillate; anthers 10–13, almost horizontal, 0.5 mm long, just stiped, spaced; androphore 0.5–1 mm long. *Female flowers*: pedicel 4–5 mm long, bracteole subapical; buds obovoid, 5 by 3.5 mm, cleft over 1/2; ovary ovoid-globose, 2.5 mm long; stigma sessile, 2-lobed and each lobe again deeply 4- or 5-lobulate. *Fruits* 1–3 per infructescence, subglobose or broadly obovoid, 1.8–2.5 by 1.5–1.7 cm, with rusty hairs 0.3 mm long; fruiting pedicel 4–6 mm long.

Distribution — *Malesia*: Borneo (Sarawak, W & E Kalimantan).

Habitat & Ecology — Freshwater and peat swamp forest, lowland forest; 0–300 m altitude; fl. Oct.

Note — *Knema uliginosa* is related to *K. intermedia*, which differs in the more pronounced mammillate staminal disc, more distinctly reticulate leaves, and fruits with an easily rubbed off scurfy indumentum, and also to *K. plumulosa* which differs in the more conspicuous indumentum on twigs and leaves. *Knema uliginosa* may resemble *K. latericia*, which differs in the cracking and flaking bark of the older twigs; compare also *K. korthalsii*.

#### 74. *Knema viridis* W.J. de Wilde

*Knema viridis* W.J. de Wilde, Blumea 32 (1987) 121, f. 3; Tree Fl. Sabah & Sarawak 3 (2000) 447.

— Type: S 37882 (*Yi Puan Ching*), Sarawak.

*Knema linguiformis* auct. non (J. Sinclair) W.J. de Wilde: W.J. de Wilde, Blumea 27 (1981) 227.

Tree 5–30 m. *Twigs* somewhat flattened or blunt-triangular by ridges from the base of the petioles, (2–)2.5–4.5 mm diameter, at first with dense pale brown hairs 0.2–0.3 mm, early glabrescent; bark yellowish turning purple-brown, not or but little striate, neither cracking nor flaking. *Leaves* chartaceous or thinly coriaceous, oblong(-lanceolate), 12–30 by 3.5–10.5 cm, base attenuate to rounded, apex blunt to acute; drying greenish above, lower surface early glabrescent, greyish green; dots absent; midrib raised above; nerves 14–23 pairs, raised; venation distinct; petiole 12–18 by 1.5–3 mm. *Inflorescences*: peduncle up to 2 mm long, brachyblast wart-like, simple or bifurcate, 2–5 mm diameter, in male 8–12-flowered, female 4–7-flowered; flowers with (pale) brown scale-like hairs 0.1(–0.2) mm; perianth 3-lobed, inside colour not recorded. *Male flowers*: pedicel stout, 7–10 mm long, bracteole blunt-triangular, 1–1.5 mm long, caducous, about median, the pedicel above the scar distinctly thicker than below; buds depressed-globose, 4.5–5 by 6–7 mm, faintly angled in cross section, cleft 3/4–4/5, lobes (1–)1.5–2 mm thick; staminal

Fig. 58. *Knema viridis* W.J. de Wilde. a. Habit of male flowering twig; b. opened male flower, showing thick perianth and androecium with many appressed anthers; c. androecium seen from somewhat above, staminal disc subtriangular in outline; d. part of twig with female inflorescences; e. opened female flower, showing pistil with pubescent ovary, short style and many-lobed stigma; f. opened fruit, pericarp glabrous, thick-lobed, aril of seed lacinate at the apex [a–c: S 37882; d, e: S 42885; f: S 38068]. — Scale bar for a, d, f = 2 cm; for b, c, e = 1.65 mm.

disc flat, sometimes convex in the centre, blunt-triangular in outline, 2.5–3 mm diameter, anthers 25–30 (thecae 50–60), sessile, 0.5–0.7 mm long, closely set,  $\pm$  hidden under the disc below the margin; androphore tapering, 1–1.5 mm long, at base 1 mm diameter. *Female flower* (slightly immature): pedicel stout, 15–17 mm long, bracteole  $\pm$  below median; buds depressed-globose, 3.5 by 5 mm, cleft 3/4–4/5, lobes 0.5–1 mm thick; ovary broadly ovoid, 1.5 mm diameter, with dense brown hairs 0.2–0.3 mm at apex, narrowed into a style-like part 0.5 mm, pubescent at base, stigma 1.5 mm diameter, broadly subpeltately 2- (or 3-)lobed and each lobe again shallowly 4–6-lobulate. *Fruits* 1–3 per infructescence, ellipsoid, broadly rounded at both ends, early glabrescent (hairs not known), bright brown, 5–6 by 4–4.5 cm; dry pericarp 10 mm thick; fruiting pedicel 15 mm long. — **Fig. 58.**

*Field-notes* — Slender tree to c. 30 m, c. 95 cm girth, without or with buttresses to one side, c. 80 cm wide; bark smooth, slightly scaly, or with lenticels, brown or blackish; exudate red; inner bark soft. Twigs green with dark patches, dirty green or black, when young with brown indumentum. Leaves glaucous at underside. Flowers light brown or brown-green. Fruits elliptic or oblong, yellowish green, with slight brown indumentum. Aril yellow to red, sweet, lacinate at apex for 1/5–1/4.

*Distribution* — *Malesia*: Borneo (Sarawak).

*Habitat & Ecology* — Lowland and hill mixed dipterocarp forest; on gentle slope; wet slope near ridge; 50–600 m altitude; fl. Aug.–Nov.; fr. Sept.

*Note* — *Knema viridis* belongs in the group of *K. curtisii*, and seems most related to *K. linguiformis*. It is markedly stouter in all parts, with larger leaves, and stouter male buds with shorter hairs, and larger fruits with spongy dry, very thick pericarp (1 cm). The fruits of the related *K. linguiformis* are 3.5–4 cm long with fruiting pedicel up to 8 mm long and pericarp 1–2 mm thick, but with seeds of about the same size as those in *K. viridis* (seeds 25–30 mm long). Male buds of *K. linguiformis* may reach 6 mm diameter, but the flower is more delicate, with woolly hairs up to 0.4 mm long. *Knema viridis* also shows affinities with *K. woodii*, with similar twigs and thick perianth lobes, a similar obconical androecium (but with the anthers spaced, not tightly appressed), and a pistil with the ovary narrowed into a slender style-like part.

## 75. *Knema woodii* J. Sinclair

*Knema woodii* J. Sinclair, Gard. Bull. Sing. 18 (1961) 283, f. 26; W.J. de Wilde, Blumea 25 (1979) 429; 32 (1987) 125; Tree Fl. Sabah & Sarawak 3 (2000) 449. — Type: Sinclair & Kadim 9298, Sabah.

Tree 6–30 m. Twigs  $\pm$  3-angled or ridged, often blackish, 2.5–4 mm diameter, at first with puberulous hairs 0.1–0.2 mm long, early glabrescent; the bark almost smooth or  $\pm$  striate, not tending to crack or flake. Leaves thinly coriaceous, oblong to (ob)lanceolate, 15–35 by (2–)4–9 cm, base rounded to cuneate-attenuate, apex acute(-acuminate), drying (greenish) brown above; lower surface greyish, at first with hairs 0.1–0.2 mm long, early glabrescent; dots absent; midrib flat or raised above; nerves 22–30 pairs, sunken above, light brown beneath; venation faint or distinct; petiole 10–20 by 3–4 mm. *Inflorescences*: (sub)sessile, brachyblast simple or warty, 2–5(–10) mm diameter, in male and female 1–10-flowered; flowers with pale brown or yellowish brown stellate hairs up to 0.3 mm long, sometimes seemingly glabrous; perianth 3-lobed, red inside. *Male flow-*

*ers*: pedicel 8–15 mm long, bracteole ± caducous, about median or lower; buds subglobose, (5–)6–8 mm diameter, cleft c. 3/4, lobes 1.5–2 mm thick; staminal disc subtriangular, flat, 3–5 mm diameter; anthers 18–23, sessile, ± oblique, often hidden under the disc, 0.3–0.4 mm long, not or hardly touching; androphore stout, tapering, 2(–3) mm long, clasped by the thickened fleshy basal part of the perianth. *Female flowers*: pedicel 3–4 mm long, bracteole about median; buds obovoid, 5–7 mm long, cleft c. 2/3, lobes 1–2 mm thick; ovary ovoid, 1.5–2 mm long, style 1–1.5 mm long, stigma of 2 main lobes and each lobe again 4–6-lobulate. *Fruits* 1 or 2 per infructescence, ellipsoid, 3–4(–5) by 2–2.5(–4) cm, thinly with mealy greyish or yellowish brown scale-like stellate hairs 0.1 mm long or less, subglabrescent; dry pericarp 4–7 mm thick; fruiting pedicel 7–10 mm long. — **Fig. 34a.**

**Field-notes** — Bark of trunk grey or brown, flaking in thin strips or pieces; living bark 8–10 mm thick, (pale) red; wood reddish or dirty white. Leaves glossy green above, glaucous beneath. Flowers fleshy, red inside; male flowers fragrant, androecium pink with yellow or brownish anthers, pollen yellow; female flowers with the pistil brown at base, green at apex. Fruits ramiflorous, more or less solitary, with yellow pericarp; dry seed obliquely ellipsoid, 23–25 by 16–18 mm.

**Distribution** — *Malesia*: Borneo (Sarawak, Sabah, E & NE Kalimantan).

**Habitat & Ecology** — Mixed dipterocarp forest, periodically flooded forest along rivers; locally common on alluvial soil in Central Kutai; clay soil, sandstone; 0–500 m altitude; fl. throughout the year.

**Notes** — 1. *Knema woodii* seems related to *K. pectinata*, *K. glomerata*, and *K. korthalsii*. It is distinct in the numerous, 18–23, sessile anthers. *Knema pectinata* is close by similarly thick perianth lobes, and very minute indumentum, but differs in more pairs of lateral nerves. In *K. korthalsii* the staminal disc is convex or mammillate, with 11–19 (–20) anthers, the indumentum on the twig apices is more distinct, and the inflorescences have more flowers.

2. When sterile, *K. woodii* may be recognized by the pale yellow, ± mealy stellate-dendroid hairs on the twig.

## MYRISTICA

*Myristica* Gronov., Fl. Orient. (1755) 141, nom. cons.; Warb., Mon. Myrist. (1897) 374; J. Sinclair, Gard. Bull. Sing. 16 (1958) 333–368; 28 (1968) 1–540; W.J. de Wilde, Beitr. Biol. Pflanzen 66 ('1991', 1992) 113; Kubitzki et al., Fam. & Gen. Vasc. Pl. 2 (1993) 466; W.J. de Wilde, Blumea 35 (1990) 233–260; 38 (1994) 349–406; 40 (1995) 237–344; 42 (1997) 111–190; Tree Fl. Sabah & Sarawak 3 (2000) 449. — *Myristica* sect. *Myristica* Blume, Rumphia 1 (1836) 180; Hook. f. & Thomson, Fl. Ind. 1 (1855) 162 (sect. *Eumyristica* p.p.); A.D.C., Prodr. 14, 1 (1856) 189, p.p.; Miq., Fl. Ind. Bat. 1, 2 (1858) 53; Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 205, p.p.; Hook. f., Fl. Brit. India 5 (1886) 102; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 286. — Type species: *Myristica fragrans* Houtt.

[*Comacum* Adans., Fam. 2 (1763) 345. — A superfluous name for *Myristica* Gronov.]

Trees, dioecious (occasionally *M. fragrans* monoecious, *M. crassa* paroeious); stilt-roots sometimes present. *Twigs* lenticellate, sometimes flaky, in some New Guinea species with ridges and in places swollen, hollow, inhabited by ants; bark sometimes coal black. *Leaves* brittle when dry, lower surface often pale, papillose or not, dots present or

absent; reticulation scalariform or a lax network (never as dense as in *Knema*, more abundant than in *Horsfieldia*). *Inflorescences* sometimes supra-axillary, either a pedunculate branched panicle with the flowers in subumbels, or a (sub)sessile woody simple or 2–4-armed wart-like or worm-like densely scar-covered brachyblast producing flowers at the apex (as in *Knema*), or less often a combination of the two types when the basal part is smooth and bears 1–3 sparsely or densely scarred brachyblasts at its extremity; basal cataphylls absent; bracts caducous. *Flowers* pedicellate, bracteole mostly persistent, often apical and embracing the perianth. *Male flowers*: perianth urceolate or tubular, leathery or carnosely, tubular, inside glabrous, creamy; buds variable, cleft to various depths, lobes 3 (also 2 or 4), reflexed in anthesis. Androecium a stalked column with 8–30 completely fused linear anthers; androphore cylindrical, glabrous or pubescent; synandrium elongate, the apex often sterile, rarely shallowly hollowed. *Female flowers*: larger and more swollen than the male; ovary glabrous or hairy; style absent, stigma minutely bilobed. *Infructescences* sessile or stalked. *Fruits* globose to oblong, or pyriform, 1–10 cm long, glabrous, tomentose, or lanose; pericarp mostly thick, fleshy but firm; aril lacinate (nearly) to the base; seeds not variegated; albumen ruminant, with fixed oil and starch; cotyledons connate at the base and edges, divaricate. — **Fig. 59–93.**

**Distribution** — Some 175 species, from S India and Indochina (rare) through *Malesia* east to NE Australia and in the Pacific east to Fiji. Most species occur in New Guinea, with many endemics. — Map 5 (see p. 5).

**Habitat & Ecology** — All species are confined to undisturbed rain forests and many have a restricted distributional area and altitudinal range, sometimes restricted to soils derived from specific bedrock, e.g. limestone or ultrabasic. Most species occur in lowland forests or lower to mid-montane forests; a few species in New Guinea reach an altitude of c. 2000 m.

**Taxonomy** — Sinclair, in his monograph (1968), distinguished two sections, 1) sect. *Myristica*, with inflorescences more or less branched panicle-like, and with a smooth, non-scar-covered (often  $\pm$  flattened) peduncle, generally lasting but one flowering season, and 2) sect. *Fatua*, with (sub)sessile, simple or forked scar-covered, wart- or worm-like inflorescences (as in the genus *Knema*), lasting several flowering seasons. Within each section respectively 9 and 10 series are recognized, slightly less (and differently defined) as was done by Warburg (1897). Sinclair (1958, 1968) was aware of the many intermediate forms of inflorescences of the species, rendering the distinction of the two sections very weak. As discussed by De Wilde (1992, 1994) the shape and architecture of the inflorescences are useful in the keys, but a (monophyletic) division of the genus into two sections is unwarranted. At present, no sections or series are recognized.

The nutmeg of commerce, *M. fragrans*, has delicate inflorescences of a variable structure, and a large part of the material actually should be grouped in the section with *M. fatua*-type inflorescences. However, *M. fragrans* is the type species of the genus *Myristica*, and hence of section *Myristica*.

**Note to the Keys:** Besides a general key to the species (1), mostly based on male flowering specimens, separate regional keys (2–7) are given, mainly based on female flowering and fruiting material, although vegetative characters are also used. Because most species of New Guinea are different from those of the rest of the Malesian area, but difficult to segregate from the others in a general key, they are keyed out separately (8).

## (1) GENERAL KEY TO THE SPECIES OF MALESIA (EXCLUDING NEW GUINEA)

(applicable for male flowering specimens, based on characters of male inflorescences and flowers\*; vegetative characters and also fruit characters\*\* have been used additionally)

- 1a. Male inflorescences branched (rarely unbranched), with a slightly flattened peduncle, or (sub)sessile, delicate, flowers few and spaced; see further the definitions under lead 2. Inflorescences lasting one or but a few flowering seasons . . . . . 2
- b. Inflorescences sessile or short-pedunculate densely scar-covered short-shoots, lasting several flowering seasons, each season producing new flowers at the apex; peduncle smooth, terete, to 5 mm long; short shoot simple or 2–4-forked, rather thick, wart- or worm-like . . . . . 37
- 2a. Inflorescences with flowers in fascicles or subumbels of buds varying in size at the end of the ramifications; occasionally unbranched, then peduncle apically with buds in a single fascicle not growing out into a densely scar-covered short-shoot (see Fig. 1 l–n, p. 11) . . . . . 3
- b. Inflorescences either simple, delicate, subsessile, with few spaced flowers, or pedunculate, branched, the branches ending in spike-like ± densely scar-covered short-shoots, producing new flowers at the apex (see Fig. 1 o, p. 11) . . . . . 31
- 3a. Mature leaves on lower surface glabrous or early glabrescent, or with scattered, neither touching nor interwoven weak hairs 0.1–0.3 mm or less, or with very thin cobweb-like covering and leaves seeming glabrous . . . . . 4
- b. Mature leaves densely hairy below, but hairs may be very small (lens!); old leaves may be glabrescent . . . . . 26
- 4a. Leaf bud with hairs 0.1–0.2(–0.3) mm or less [Apex of young twigs and inflorescences with dense or sparse similar indumentum, or glabrescent.] . . . . . 5
- b. Leaf bud with hairs (0.3–)0.5 mm long or more (appressed hairs may seem shorter) . . . . . 21
- 5a. Buds sharply angular or winged along the lobe sutures. Leaves 10–20(–30) by 3–9 cm, nerves 8–13 per side. — S Thailand, West Malesia . . . . . **38. *M. elliptica***
- b. Buds rounded to subangled. Leaves variable . . . . . 6
- 6a. Leaves 2(–3) times longer than broad, 16–44 by 8–14.5(–18) cm, apex blunt or acute, base ± rounded or subcordate; nerves (16–)20–28 per side. — Borneo . . . . . **102. *M. papyracea***
- b. Leaves large or small, about 3 times longer than broad or more, nerves 10–33 per side, apex acute(–acuminate), base various, rarely subcordate; leaves smaller with apex acute or blunt in most of *M. gigantea* . . . . . 7
- 7a. Plants glabrous. [Male flowers not known; infructescence partly not known.] — Moluccas (Seram) . . . . . **104. *M. perlaevis***
- b. Plants glabrescent, or (partly) pubescent . . . . . 8
- 8a. Androphore at anthesis much shorter than the synandrium . . . . . 9
- b. Androphore almost as long as the synandrium . . . . . 16

\*) Male inflorescences and flowers of several species are not known, and the place in the key of these species may be erroneous.

\*\*\*) The use of fruit characters in a key mainly for male flowering specimens may be helpful when obviously identical material of both sexes is available.



- 9a. Twigs 4–8 mm diam. [Buds 5–7 mm long.] Androecium (synandrium) cylindrical, 3–5 mm long. [Androphore pubescent at base.] . . . . . 10
- b. Twigs 2–5 mm diam. Androecium short, often  $\pm$  club-shaped or ellipsoid(-oblong), 1.5–3(–3.5) mm long . . . . . 11
- 10a. Leaves blackish; lower leaf surface with minute  $\pm$  interwoven hairs, sometimes glabrescent. — Sumatra, Peninsular Malaysia, Borneo . . . . . **88. *M. maxima***
- b. Leaves drying slightly olivaceous; lower leaf surface with minute scattered hairs. — Philippines . . . . . **51. *M. frugifera***
- 11a. Buds 6–6.5 mm long. — Philippines . . . . . **77. *M. laevis***
- b. Buds 3–4(–4.5) mm long . . . . . 12
- 12a. Twigs and inflorescences often drying yellowish, the leaves greenish yellow or olivaceous, papillose below. [Buds cleft c. 1/2(–2/3). Androecium  $\pm$  ellipsoid, androphore pubescent. Fruits with persistent scurfy short indumentum.] — Borneo . . . . . **12. *M. borneensis***
- b. Twigs and inflorescences drying brownish, the leaves (olivaceous-)brown . . 13
- 13a. Androecium cylindrical or ellipsoid, androphore pubescent. Inflorescences 3–6 cm long. — Philippines (incl. Palawan) . . . . . 14
- b. Androecium  $\pm$  club-shaped, androphore glabrous. Inflorescences more than 6 cm long . . . . . 15
- 14a. Midrib and lateral nerves on lower leaf side yellowish. [Fruits with grey-brown indumentum.] — Philippines (excl. Palawan) . . . . . **1. *M. agusanensis***
- b. Midrib and lateral nerves on lower leaf side dark purplish or reddish, contrasting with greyish surface. [Fruits with rusty or orange-brown indumentum.] — Philippines (Palawan, Mindoro) . . . . . **116. *M. rubrinervis***
- 15a. Inflorescences 7–10 cm long; buds 3–3.5 mm long, cleft 1/4–1/3; androecium without sterile apex, androphore short or absent. [Fruits glabrous or largely nearly so.] — Sumatra, Peninsular Malaysia, Borneo . . . . . **86. *M. malaccensis***
- b. Inflorescences 10–15 cm long; buds 4(–4.5) mm long, cleft nearly 2/3; sterile apex of androecium  $\pm$  blunt, 0.2–0.3 mm long; androphore distinct. [Fruits scurfy.] — Borneo . . . . . **40. *M. extensa***
- 16a. Buds 7–8 mm long. Leaves below seemingly glabrous, but actually with scattered minute scale-like hairs less than 0.1 mm (lens!). [Inflorescences usually unbranched. Fruits subglobose or broadly ovoid, 3–4.5 cm long, with persistent scurf of hairs 0.1 mm or less.] — An inland species of C & E Java. (Compare also *M. crassa*) . . . . . **135. *M. teijsmannii***
- b. Buds 7 mm long or less. Leaves below glabrous (early glabrescent) . . . . . 17
- 17a. Twigs 1.5–3(–3.5) mm diam. Lateral nerves above sunken, distinct. Peduncle 2–40 mm long, the central branch present. Buds 4–6(–7) mm long, pubescent or glabrescent. Fruits 3.5–8.5 cm long . . . . . 18
- b. Twigs 1–2 mm diam. Leaves papillose below (lens!), lateral nerves indistinct above. Inflorescences almost unbranched, peduncle 4–10 mm, flowers in a subumbel. Buds 5 mm long, glabrescent. Fruits 3.5–4 cm long. — Philippines (Palawan) . . . . . **141. *M. umbellata***
- 18a. Leaves (15–)20–35 cm long, drying dull greyish (olivaceous) brown, not papillose. Lateral nerves below flat or but slightly raised. Buds 5 mm long; androecium 3–3.5 mm long, androphore glabrous. [Fruits 5.5–8.5 cm long, pericarp (5–)10–15 mm thick.] — Sumatra (doubtful), Peninsular Malaysia, Sabah **152. *M. wyatt-smithii***

- b. Leaves smaller, 7–24 cm long, olivaceous. Lateral nerves raised below. Androphore pubescent . . . . . 19
- 19a. Leaf apex acute-acuminate, lower surface not papillose. Buds 4–6(–7) mm long, (late) glabrescent; androecium 3–6 mm long. Fruits 3–6(–8) cm long, pericarp 3–10 mm thick. — Thailand to Borneo . . . . . 20
- b. Leaf apex blunt to acute (in leaves of sterile sapling shoots acute-acuminate), lower surface papillose. Buds 4–4.5 mm long, with persistent indumentum; androecium 3.5 mm long. Fruits 5–8 cm long, pericarp 15–20 mm thick. — Sumatra, Peninsular Malaysia, Borneo . . . . . **56. M. gigantea**
- 20a. Leaves membranous, chartaceous, or subcoriaceous, 7–24 cm long. Female inflorescences or infructescences with peduncle to 1 cm long. Fruits 4–6(–8) cm long, pericarp 4–10 mm thick, late or early glabrescent. Buds 4–6(–7) mm long . . . . . **66. M. iners**
- b. Leaves thinly membranous, 7–14 cm long. Peduncle of female inflorescences or infructescences slender, 1–2.5 cm long. Fruits 3–4 cm long, early glabrescent; pericarp 3–4 mm thick. Buds 3 mm long . . . . . **41. M. fallax**
- 21a. Twigs 1.5–2(–2.5) mm diam. Leaves 7–12(–15) cm long, apex subacute or rounded; lateral nerves 10–15(–18) per side. Buds 4–4.5 mm long; synandrium without sterile apex. Fruits 5–8 cm long, late glabrescent, at first with scurfy hairs 0.2–0.3 mm. — Sumatra, Peninsular Malaysia, Borneo . . . . . **56. M. gigantea**
- b. Twigs generally thicker; leaves larger, the apex acute-acuminate, lateral nerves 13–18 per side or more. Synandrium with small sterile apex. Fruits pubescent or glabrescent, with hairs 0.2 mm or more . . . . . 22
- 22a. Twigs (1.5–)2–4 mm diam. Leaves membranous or thinly coriaceous. Buds 4–7 mm long. [Sterile apex of synandrium present, acute or ± blunt, entire.] Fruits glabrous or early glabrescent . . . . . 23
- b. Twigs 3–6 mm diam. Leaves chartaceous or coriaceous. Buds variable. Fruits glabrous or with persistent indumentum, rarely late glabrescent . . . . . 24
- 23a. Twigs 1.5–3 mm diam. Leaves membranous, the lower surface not papillose. Buds 4–6(–7) mm long. Fruits (3.5–)4–6(–8) cm long. — Stout form; mainly from NE Borneo . . . . . **66. M. iners**
- b. Twigs (2–)2.5–4 mm diam. Leaves chartaceous or thinly coriaceous, lower surface distinctly papillose. Buds 6–7 mm long. Fruits 7–9 cm long, glabrescent, at first with scurfy hairs 0.5 mm. — Peninsular Thailand, Peninsular Malaysia . . . . . **85. M. maingayi**
- 24a. Leaves coriaceous, papillose below. Flowers pubescent with hairs 0.5–1 mm; buds 4–4.5 mm long; sterile apex of synandrium ± lobed. Fruits with conspicuous shaggy hairs 1–2 mm. — Sumatra, Peninsular Malaysia, Borneo . . . . . **84. M. lowiana**
- b. Leaves chartaceous or coriaceous. Flowers with hairs 0.3–0.5 mm; buds 5 mm long or more; sterile apex of synandrium not lobed. Fruits glabrous or with scurfy hairs 0.5 mm . . . . . 25
- 25a. Buds 5–5.5 mm long. Bark of leafy twigs early cracking. Leaves not papillose below. Fruits glabrous (early glabrescent). — Borneo . . . . . **28. M. corticata**
- b. Buds (5–)6–8 mm long. Bark of twigs late cracking. Leaves papillose or not. Fruits with scurfy indumentum or late glabrescent. — Philippines . . . . . **105. M. philippensis**

- 26a. Twigs (4–)5–8 mm diam. Leaves large, 16–40 cm long; lateral nerves 23–33 per side. [Lower leaf surface with persistent indumentum or glabrescent; hairs  $\pm$  scattered, minute, scale-like, 0.1(–0.2) mm or less.] Inflorescences stout, 6–12(–18) cm long. Fruits 6–9 cm long, with scurfy hairs 0.1 mm or less, sometimes late glabrescent. — Sumatra, Peninsular Malaysia, Borneo . . . . . **88. *M. maxima***
- b. Twigs 5 mm diameter or less. Leaves generally smaller with fewer pairs of lateral nerves. Male inflorescences shorter. Fruits of various sizes . . . . . 27
- 27a. Leaf bud and young twig apex with hairs 0.1 mm. Lower leaf surface densely pubescent with scale-like hairs 0.1(–0.2) mm (old leaves sometimes glabrescent). Buds cylindrical or slightly contracted in the middle; apical part of bud  $\pm$  angled; sterile apex of synandrium  $\pm$  blunt or subacute, usually finely pubescent (glabrous in Sumatra). [Fruits 5–9 cm long, minutely scurfy.] — Peninsular Malaysia to Philippines . . . . . **21. *M. cinnamomea***
- b. Leaf bud, twig apex, and lower leaf surface with hairs short or long, 0.1 mm or much longer. Buds  $\pm$  ellipsoid, apical part not angled; apex of synandrium  $\pm$  flat or shallowly hollowed, the excavation concealed by the somewhat incurved apices of the anthers or not . . . . . 28
- 28a. Twigs 1.5–3 mm diam. Leaf bud and twig apex with hairs 0.1 mm. Buds 3–4 mm long; androecium 1.5–2.5 mm long; anthers 6–8(–10). Fruits with hairs 0.1 mm or less, sometimes glabrescent. — Not generally a coastal species . . . . . 29
- b. Twigs 3–5(–10) mm diam. Leaf bud and twig apex with conspicuous hairs (0.1–) 0.2–0.5(–1) mm. Buds larger, 4–7 mm, androecium larger, anthers 8–12. Fruits 2.5–4.5 cm long, with more conspicuous persistent hairs 0.5–1(–2) mm. — Generally a coastal species; Burma, east to Bali and Philippines **59. *M. guatteriifolia***
- 29a. Androecium 1.5 mm long. Lateral nerves 45–80° to the midrib. Fruits 5–7 cm long, with dense scurfy indumentum. — Sumatra, Peninsular Malaysia, Borneo . . . . . **35. *M. depressa***
- b. Androecium 2.5 mm long. Lateral nerves c. 45° or less to the midrib. — Philippines . . . . . 30
- 30a. Midrib and nerves on lower leaf surface (grey-)brown. Fruits 3–4.7 cm long, minutely dull grey-brown, scurfy, sometimes partly glabrescent. — Philippines (excl. Palawan) . . . . . **1. *M. agusanensis***
- b. Midrib and nerves purplish or reddish brown, contrasting with grey-brown lower leaf surface. Fruits 3–7 cm long, with short dark rusty or orange-brown indumentum, sometimes partly glabrescent in var. *duplex*. — Philippines (Palawan, Mindoro) . . . . . **116. *M. rubrinervis***
- 31a. Buds elongate, mostly markedly angular towards the apex; the apex (sub)acute . . . . . 32
- b. Buds not angular, apex rounded. [Lower leaf surface generally papillose.] . . 33
- 32a. Buds ovoid-oblong, (4.5–)5–7 by 3–4 mm, hairs 0.1 mm. Leaves below grey-brown with contrasting bright brown nerves, not or but indistinctly papillose. — Philippines . . . . . **32. *M. cumingii***
- b. Buds  $\pm$  elongate, (elliptic-)oblong, 4.5–8 by 2–3 mm, with hairs (0.1–)0.2–0.5 mm. Leaves below dull, sometimes whitish (origin of pale colour unknown), nerves not much contrasting. — W Sarawak, W & NE Kalimantan, Sulawesi, Sulu Is., Philippines, N Moluccas (Sula, Bacan) . . . . . **123. *M. simiarum***

- 33a. Buds 5–11 mm long. — Moluccas (or cultivated) . . . . . 34  
 b. Buds 3–4.5(–5) mm long, rough-pubescent. Nerves on upper leaf surface flat or distinctly impressed . . . . . 36
- 34a. Buds either glabrous, early glabrescent, or short-haired. Nerves 6–12(–15) per side, above flat or but little impressed, much raised below . . . . . 35  
 b. Buds conspicuously pubescent. Leaves large, 25–45 cm long, lateral nerves 25–30 per side, impressed above. Bark of twigs longitudinally cracking. — N Moluccas (Bacan) . . . . . **47. *M. fissurata***
- 35a. Pedicel more than 1 mm thick. Flowers thinly pubescent. Leaves subcoriaceous, 9–22 cm long, below late glabrescent, at first with minute indumentum. Twigs 2–3.5 mm diam. — N Moluccas . . . . . **131. *M. succedanea***  
 b. Pedicel less than 1 mm thick. Flowers glabrescent, at first with sparse very minute indumentum. Leaves chartaceous, 6–13 cm long, early glabrescent. Twigs 1–2 mm diam. — Originating from Banda (Moluccas); known only from cultivated specimens . . . . . **50. *M. fragrans***
- 36a. Leaves membranous, whitish below, not obviously papillose. — Sulawesi . . . . . **63. *M. impressinervia***  
 b. Leaves chartaceous, pale brownish below, distinctly papillose. — Moluccas, Papua Barat (Bird's Head) . . . . . **11. *M. bifurcata***
- 37a. Buds elongate, (10–)13–15 by 2.5–5 mm . . . . . 38  
 b. Buds ± ovate, less than 10 mm long . . . . . 39
- 38a. Twigs ridged or winged, myrmecophilous. — Kai Is. (& New Guinea) . . . . . **129. *M. subalulata***  
 b. Twigs not winged, not myrmecophilous. — Moluccas (Halmahera, Obi) . . . . . **110. *M. pubicarpa***
- 39a. Most parts with conspicuously long hairs, 1–3 mm (lower leaf surface glabrescent). Bark of twigs blackish, longitudinally cracked or flaking. [Fruits 4–6(–7) cm long with hispid hairs 2–3(–4) mm.] — Borneo . . . . . **147. *M. villosa***  
 b. Hairs shorter, very short or up to 1 mm long, or indumentum (almost) absent 40
- 40a. Twigs 4–7(–10) mm diam. (in Peninsular Malaysia 3 mm diam.) . . . . . 41  
 b. Twigs generally 1–4(–5) mm diam. (sometimes 4–5 mm diam. in *M. beccarii*, *M. fatua*, *M. nivea*). — Plants not from Sumatra or Peninsular Malaysia . . . . . 48
- 41a. Leaves rather narrow, 11–24(–30) by 3–6 cm, coriaceous. — Philippines (NE Luzon) . . . . . **24. *M. colinridsdalei***  
 b. Leaves generally larger, comparatively broader, (15–)17–40 cm long; membranous or chartaceous . . . . . 42
- 42a. Lower leaf surface early glabrescent or with scattered minute scale-like hairs less than 0.1 mm (lens!) . . . . . 43  
 b. Lower leaf surface densely tomentose (hairs may be very minute), not or not evidently papillose . . . . . 45
- 43a. Lower leaf surface papillose (lens!). Buds 4.5–6 mm long. Fruits 3.5–5.5 cm long, with scurfy hairs 0.1 mm. — West Malesia (Sumatra, Peninsular Malaysia, Borneo) . . . . . **29. *M. crassa***  
 b. Lower leaf surface not or not evidently papillose . . . . . 44
- 44a. Buds 8–8.5 mm long. Fruits not known. Twigs 5–10 mm diam.; leaves 30–40 by 14–20 cm, nerves distinct. — N Moluccas (Bacan) . . . . . **114. *M. robusta***

- b. Male flowers not known. Fruits globose, 5 cm diam. Twigs 4–5 mm diam.; leaves 20–30 by 6–10 cm, coriaceous, nerves indistinct. — C Sulawesi . . . . . 36. *M. devogelii*
- 45a. Lower leaf surface with pale scale-like hairs 0.1 mm only, thus seemingly glabrous. [Fruits 6 cm long, with rusty hairs 0.5–1 mm.] — Philippines . . . . . 150. *M. wenzelii*
- b. Hairs on lower leaf surface conspicuous, brownish, 0.2–0.3(–0.4) mm. — Borneo, E Malesia . . . . . 46
- 46a. Flowers pedicellate. Two species, distinguishable in the indumentum of the fruits . . . . . 47
- b. Flowers sessile. Fruits 2.5–3.5 cm long, with shaggy hairs 1–1.5 mm. — Lesser Sunda Islands . . . . . 133. *M. sumbawana*
- 47a. Buds 6 mm long. Fruits 5.5–8.5 cm long, pericarp 10–15 mm thick, with scurfy hairs 0.1–0.2 mm. — N Moluccas . . . . . 118. *M. sangowensis*
- b. Buds 4–6 mm long. Fruits 4–7 cm long, pericarp 3–12 mm thick, hairs 0.5–1 mm. — Philippines (Mindanao), Moluccas, Sulawesi, and a deviating specimen with male flowers from limestone in SE Kalimantan . . . . . 43. *M. fatua*
- 48a. Lower leaf surface glabrous or early glabrescent, or with minute scattered hairs . . . . . 49
- b. Lower leaf surface densely hairy; sometimes hairs small and scale-like, but densely set or interwoven (lens!) . . . . . 66
- 49a. Petiole proportionally long; leaves 10–15 cm long, petiole 20–35 mm long. [Male inflorescences and flowers not known.] — Philippines . . . . . 82. *M. longepetiolata*
- b. Petiole proportionally shorter . . . . . 50
- 50a. Leaves small, elliptic-oblong, thinly coriaceous, (2.5–)4–7.5 cm long; lateral nerves faint. [Flowers not known. Fruits ovoid-ellipsoid, 2–2.5 cm long, pericarp 1–2 mm thick, with dense scurfy hairs 0.1 mm or less.] — Central Sulawesi . . . . . 140. *M. ultrabasica*
- b. Leaves larger . . . . . 51
- 51a. Buds ± cylindrical, narrow; androphore about as long as the synandrium. — Moluccas, W New Guinea . . . . . 52
- b. Buds proportionally broader, ± ovoid, ellipsoid(-oblong); androphore about as long as or shorter than the synandrium. [Androphore mostly pubescent, at least at base. Lateral nerves not particularly closely set.] — Mainly E Malesia . . . . . 54
- 52a. Androphore glabrous. Lateral nerves comparatively closely set . . . . . 53
- b. Androphore densely pubescent. [Buds 3.5–4 mm long.] Leaves pale below, lateral nerves not particularly closely set. — Moluccas . . . . . 2. *M. alba*
- 53a. Leaves membranous; venation distinct below. Buds 2.5–3 mm long. Fruits 2.2–3.6 cm long, minutely scurfy. — NE Moluccas, Papua Barat (Bird's Head) . . . . . 80b. *M. lepidota* subsp. *montanoides*
- b. Leaves chartaceous; venation faint below. Buds 4–6 mm long. Fruits 1.5–2.5(–3) cm long, minutely scurfy. — Moluccas, W New Guinea . . . . . 78. *M. lancifolia*
- 54a. Lower leaf surface whitish grey or glaucous, glabrescent, at first with thin indumentum of which the stouter hairs leave minute scattered dark-coloured dots (lens!) . . . . . 55
- b. Leaf surfaces more concolorous; if whitish below, then not punctate . . . . . 57

- 55a. Twigs 2–4 mm diam. Leaves 20–40 cm long. Buds 5–6 mm long. — Philippines (Mindanao), N Moluccas (Talaud Is.) . . . . . **95. *M. nivea***  
 b. Twigs 1.5–3 mm diam. (in *M. impressa* up to 5 mm diam.). Leaves up to 25 cm long. Buds 4(–5) mm long (only known in *M. impressa*, *M. pilosigemma*) . . . . . 56
- 56a. Leaf bud with hairs 1 mm. — Philippines . . . . . **107. *M. pilosigemma***  
 b. Hairs shorter. Three species from Sulawesi: for distinction see the regional key . . . . . **62. *M. impressa*, 74. *M. kjellbergii*, 75. *M. koordersii***
- 57a. Buds more than 3 mm long . . . . . 58  
 b. Buds 2.5 mm long. — N Moluccas . . . . . **11b. *M. bifurcata* subsp. *sulaica***
- 58a. Buds ± angular towards apex. — Philippines [incl. one fruiting collection from C Sulawesi, *Kjellberg 2990*, discussed under *M. impressa*.] . . . . . **32. *M. cumingii***  
 b. Buds not angular . . . . . 59
- 59a. Twigs 2–2.5 mm diam. or more . . . . . 60  
 b. Twigs 1–2(–2.5) mm diam. — Moluccas, W New Guinea . . . . . 64
- 60a. Male flowers not known but, judged from the sessile female flowers, subsessile or with short pedicel. — Lesser Sunda Islands . . . . . **117. *M. rumphii***  
 b. Pedicel about as long as the perianth . . . . . 61
- 61a. Bark of twigs soon cracking and/or flaking. Fruits 6 cm long, glabrescent; male flowers not known. — Philippines (Basilan) . . . . . **8. *M. basilanica***  
 b. Bark not or faintly cracking and flaking. Fruits smaller, with indumentum of minute hairs . . . . . 62
- 62a. Leaves coriaceous. — S Taiwan, Philippines (N Luzon); mainly a coastal species . . . . . **18. *M. cagayanensis***  
 b. Leaves ± chartaceous . . . . . 63
- 63a. Inflorescences much resembling a subsessile wart-like scar-covered brachyblast, but possibly essentially paniculate. Fruits 4.5–6.5 cm long, powdery pubescent with hairs 0.1 mm, or partly glabrescent. — Andaman and Nicobar Islands . . . . . ***M. andamanica* Hook. f.**  
 b. Fruits 2.5–4.5 cm long, with hairs 0.1–0.2 mm, sometimes partly glabrescent. — Philippines (Mindanao), Moluccas . . . . . **92. *M. mindanaensis***
- 64a. Buds with hairs 0.1 mm. Pedicel about as long as the perianth. [Upper and lower leaf surface ± concolorous; lower leaf surface not papillose, venation indistinct. Bracteole persistent. Fruits subglobose, 2.5–3 cm long, pericarp 4–8 mm thick, hairs 0.1 mm.] — Moluccas, W New Guinea . . . . . **138. *M. tristis***  
 b. Hairs longer, 0.2–0.5 mm. Pedicel usually shorter than the perianth . . . . . 65
- 65a. Buds cleft c. 1/3 to nearly 1/2. Inflorescences pedunculate. — N Moluccas, Papua Barat (Bird's Head) . . . . . **11a. *M. bifurcata* subsp. *bifurcata***  
 b. Buds cleft c. 1/4. Inflorescences all sessile. — SE Moluccas (Tanimbar), S New Guinea, N Australia . . . . . **70. *M. insipida***
- 66a. Leaf bud and apex of young twigs with minute greyish hairs, glabrescent; lower leaf surface with minute grey-silvery scale-like hairs less than 0.1 mm. [Fruits 4.5–6.5 cm long, ± glabrescent or with scurfy minute hairs 0.1 mm.] — Andaman and Nicobar Islands . . . . . ***M. andamanica* Hook. f.**  
 b. Indumentum more conspicuous, cinnamon or pale rufous, hairs (0.1–)0.2 mm or more . . . . . 67

- 67a. Twigs (2.5–)4–5 mm diam., bark lower down with lenticels. Leaves 20 cm long or more, membranous or chartaceous. — E Malesia . . . . . 68  
 b. Twigs 1–4(–5) mm diam., if 4(–5) mm, then without lenticels. Leaves 20(–25) cm long or less . . . . . 69
- 68a. Male flowers pedicellate. Fruits 4–7 cm long, with hairs 0.5–1 mm. — Philippines (Mindanao), Sulawesi, Moluccas (*M. fatua*), Aru Is. (*M. inutilis*) . . . . . 43. *M. fatua*, 72. *M. inutilis*  
 b. Judged from female, flowers subsessile. Fruits 2.5–3.5 cm long, with shaggy hairs 1–1.5 mm. — Lesser Sunda Islands . . . . . 133. *M. sumbawana*
- 69a. Twigs 1–2 mm diam. [Leaves membranous to thinly coriaceous. Buds 2–2.5 mm long.] — W New Guinea, Aru Is. . . . . 80a. *M. lepidota* subsp. *lepidota*  
 b. Twigs 2–4(–5) mm diam. . . . . 70
- 70a. Twigs 2–3 mm diam. Leaves thinly coriaceous, base rounded or short-acute, nerves above not distinct. Flowers insufficiently known. Fruits 2.5–3.5 cm long, with scurfy hairs 0.2–0.5 mm. — Borneo . . . . . 126. *M. smythiesii*  
 b. Twigs 3–4(–5) mm diam. Leaves coriaceous, at base rounded or emarginate, or sometimes short-acute; nerves above sunken, but distinct. Flowers with a conspicuous collar of hairs at base of androecium, sterile apex minutely pubescent. Fruits 2.5–3.5 cm long, hairs woolly, 0.5–1 mm. — Sumatra, Borneo . . . . . 9. *M. beccarii*

(2) REGIONAL KEY TO THE SPECIES — PENINSULAR MALAYSIA, SINGAPORE,  
 SUMATRA, JAVA (14 species)

(based on male flowering, female flowering and fruiting specimens,  
 with emphasis on vegetative characters)

- 1a. Inflorescences sessile, a densely scar-covered wart-like brachyblast; peduncle absent or up to 2 mm long . . . . . 2  
 b. Inflorescences pedunculate, branched . . . . . 4
- 2a. Leaf bud with hairs more than 0.2 mm. Mature leaves short-pubescent below. [Male flowers: androecium ± sessile, with a collar of conspicuous hairs around the base, sterile apex ± pubescent.] . . . . . 9. *M. beccarii*  
 b. Leaf bud with hairs 0.2 mm or less. Lower leaf surface finely papillose, early glabrescent . . . . . 3
- 3a. Leaves membranous to thinly chartaceous. Female buds (4–)5–6(–9) mm long; lobes 0.4 mm thick. Fruits 3–4.5 cm long. Male pedicel 4–6 mm long. A species close to *M. crassa*. — C & E Java . . . . . 135. *M. teijsmannii*  
 b. Leaves chartaceous to thinly coriaceous. Female buds 4–5 mm long; lobes 0.2–0.3 mm thick. Fruits (3.5–)4–5.5 cm long. Male pedicel (5–)6–12 mm long. Plant generally stouter than *M. teijsmannii* . . . . . 29. *M. crassa*
- 4a. Leaf bud with short hairs 0.1–0.2(–0.3) mm or less . . . . . 5  
 b. Leaf bud with hairs more than 0.2 mm long . . . . . 13
- 5a. Lower leaf surface with (sub)persistent dense indumentum (hairs, even if small, touching or interwoven; old leaves may be glabrescent). Fruits with scurfy hairs 0.1 mm long . . . . . 6  
 b. Lower leaf surface glabrous (early glabrescent) or with ± sparse, neither touching nor interwoven, minute hairs. Indumentum of fruits variable, or fruits glabrous . . . . . 8

- 6a. Buds (preferably to be seen in male flowers)  $\pm$  angular in the upper part. Twigs 1.5–2.5(–4) mm diam. Leaves (8–)10–22 cm long, lateral nerves 10–17 per side. [Fruits 5–9 cm long, often subsessile.] . . . . . **21. *M. cinnamomea***
- b. Buds not angular. Twigs 2–8 mm diam., leaves 15–40 cm long, with 16–33 lateral nerves per side . . . . . 7
- 7a. Twigs (4–)5–8 mm diam. Leaves 16–40 cm long, drying dark brown, lateral nerves (20–)23–33 per side. Fruits 6–9 cm long . . . . . **88. *M. maxima***
- b. Twigs 2–3 mm diam. Leaves 15–30 cm long, drying olivaceous, nerves 16–23 per side. Fruits 5–7 cm long . . . . . **35. *M. depressa***
- 8a. Fruits glabrous, or largely or almost completely glabrescent, or fruits inconspicuously pubescent with remote or scattered (not densely set) minute hairs, in glabrescent fruits rarely some minute indumentum remaining in sheltered places near the insertion of the pedicel. Lateral nerves c. 20 per side, or fewer . . . . . 9
- b. Fruits with persistent dense-scurfy indumentum, or fruits but partly glabrescent and then always with distinct patches of (dense) indumentum in sheltered places of the dried fruits, especially towards the insertion of the pedicel (hairs may be very small). Lateral nerves (20–)23–30 per side; lines of interarching distinct. [Inflorescences widely paniculate. Twigs stout. Fruits (4.5–)6–9 cm long. Male buds 5–7 mm long.] . . . . . **88. *M. maxima***
- 9a. Twigs and leaves drying yellowish; lateral nerves 8–13(–15) per side. [Fruits drying dark brown or blackish, often with a green-yellowish exudate, 4.5–7.5 cm long, glabrescent, at first with minute scattered hairs 0.1 mm. Buds angular in the apical part.] . . . . . **38. *M. elliptica***
- b. Twigs drying brown, leaves olivaceous or brown; lateral nerves 10 per side or more . . . . . 10
- 10a. Lines of interarching of the lateral nerves on lower surface of mature (older) leaves raised and distinct. Male buds 3–3.5 mm long. Female buds 2–2.5 mm long, ovary glabrous. [Twigs 2–4 mm diam. Lateral nerves 14–20 per side. Papillae on lower leaf surface not apparent. Fruits 4–6 cm long, glabrous.] . . . . . **86. *M. malaccensis***
- b. Lines of interarching indistinct. Male and female flowers larger (female flowers not known of *M. gigantea*) . . . . . 11
- 11a. Leaves (15–)20–35 cm long, drying a dull greyish brown; lateral nerves below  $\pm$  flat or but slightly raised; not papillose. Fruits 5.5–9 cm long, drying (dark) brown, glabrescent, at first with hairs 0.1 mm, pericarp (5–)10–15(–20) mm thick . . . . . **152. *M. wyatt-smithii***
- b. Leaves smaller, 7–24 cm long, drying olivaceous-brown; lateral nerves raised below; papillose or not. Fruits 3.5–8 cm long, drying bright brown, glabrescent, hairs woolly-scurfy, 0.1–0.3 mm . . . . . 12
- 12a. Leaf apex acute-acuminate; lower surface not papillose. Fruits 3.5–6(–8) cm long, pericarp 4–10 mm thick . . . . . **66. *M. iners***
- b. Apex of leaves of fertile twigs acute or blunt; apex of leaves of sterile sapling twigs (acute-)acuminate; lower surface distinctly papillose. Fruits 5–8 cm long, pericarp 15–20 mm thick . . . . . **56. *M. gigantea***
- 13a. Leaves (12–)15–35 cm long, with persistent indumentum below; lateral nerves 15–19(–25) per side. Leaf bud with hairs to 1(–1.5) mm. Fruits 2.5–4.5 cm long, hairs dense, shaggy, 0.5–1 mm. — Mainly a coastal species, but sometimes inland in degraded forest . . . . . **59. *M. guatteriifolia***



- b. Leaves 7–35 cm long, glabrous (glabrescent) below; papillose; lateral nerves 10–18 per side. Leaf bud with appressed hairs 0.5–1 mm. Fruits 5 cm long or more, glabrescent or with persistent indumentum . . . . . 14
- 14a. Twigs 1.5–2.5(–3) mm diam. Leaves (of fertile twigs) small, 7–12(–15) cm long, apex acute, blunt, or rounded; lateral nerves 10–15(–18) per side. Fruits 5–8 cm long, (late) glabrescent, hairs scurfy, 0.2 mm. Flowers with hairs 0.2–0.5 mm . . . . . **56. M. gigantea**
- b. Twigs (2–)2.5–6 mm diam. Leaves 12–35 cm long, the apex acute-acuminate; lateral nerves 13–22 per side. Hairs of fruits larger, 0.5 mm or more. Hairs of flowers 0.5–1 mm . . . . . 15
- 15a. Twigs (2–)2.5–4 mm diam. Leaves chartaceous or thinly coriaceous. Fruits 7–9 cm long, glabrescent, hairs scurfy, 0.5 mm. Male buds 6–7 mm long **85. M. maingayi**
- b. Twigs 3–6 mm diam. Leaves coriaceous. Fruits (5–)6–7 cm long, with conspicuous persistent shaggy hairs 1–2 mm. Male buds 4–4.5 long . . . . . **84. M. lowiana**

(3) REGIONAL KEY TO THE SPECIES — BORNEO (20 species)  
 (applicable for all fertile specimens; characters primarily vegetative)

- 1a. Leaf bud with minute, appressed hairs, 0.1–0.2(–0.3) mm or less . . . . . 2
- b. Hairs more than 0.2 mm . . . . . 14
- 2a. Lower leaf surface with (sub)persistent dense indumentum (hairs may be very small), old leaves sometimes glabrescent. Fruits with woolly scurfy hairs 0.1 mm. [Inflorescences with distinct peduncle (often short in female).] . . . . . 3
- b. Lower leaf surface glabrous or early glabrescent or with scattered (not dense) minute hairs. Fruits with variable indumentum, glabrous, or glabrescent . . . . . 5
- 3a. Buds (best to be seen in male flowers) ± angular in the upper part. Twigs 1.5–2.5 (–4) mm diam. Leaves (8–)10–22 cm long, lateral nerves 10–17 per side. [Fruits 5–9 cm long, often sessile. Check also *M. smythiesii*.] . **21. M. cinnamomea**
- b. Buds not angular. Twigs 2–8 mm diam. Leaves 15–40 cm long, with 16–33 lateral nerves per side . . . . . 4
- 4a. Twigs (4–)5–8 mm diam. Leaves 16–40 cm long, drying dark brown; lateral nerves (20–)23–33 per side. Fruits 6–9 cm long . . . . . **88. M. maxima**
- b. Twigs 2–3 mm diam. Leaves 15–30 cm long, drying olivaceous; nerves 16–23 per side. Fruits 5–7 cm long . . . . . **35. M. depressa**
- 5a. Inflorescences pedunculate; perianth largely glabrous (except in *M. gigantea* and *M. papyracea*). Fruits glabrous, glabrescent, or with minute scattered hairs; in glabrescent fruits sometimes a minute indumentum remaining in sheltered places near the insertion of the pedicel . . . . . 6
- b. Inflorescences sessile brachyblast, or pedunculate; perianth pubescent. Fruits with persistent dense-scurfy indumentum, or partly glabrescent but with dense indumentum remaining in sheltered places . . . . . 11
- 6a. Buds (especially in male flowers) sharply angular in the apical part. Twigs and leaves drying yellowish; lateral nerves 8–13(–15) per side. [Fruits drying dark brown or blackish, often with a green-yellowish exudate, 4.5–7.5 cm long, glabrescent, hairs minute, scattered, 0.1 mm.] . . . . . **38. M. elliptica**
- b. Buds rounded. Twigs drying (yellowish) brown, leaves olivaceous or brown; lateral nerves 10–30 per side . . . . . 7

- 7a. Lines of interarching of lateral nerves on lower leaf surface (of mature leaves) indistinct . . . . . 8
- b. Lines of interarching raised and distinct . . . . . 10
- 8a. Bracteole (in male flowers) subpersistent or late caducous. Leaf apex acute-acuminate; lower leaf surface not papillose. Fruits 3–6(–8) cm long, pericarp 3–10 mm thick . . . . . 9
- b. Bracteole caducous. Apex of leaves of fertile twigs acute or blunt; lower leaf surface papillose. Fruits 5–8 cm long, pericarp 15–20 mm thick . . . **56. M. gigantea**
- 9a. Leaves membranous, chartaceous, or subcoriaceous, 7–24 cm long. Peduncle in female to 1 cm long, 1–2 mm thick. Fruits 4–6(–8) cm long, pericarp 4–10 mm thick, late or early glabrescent. Male buds 4–6(–7) mm long . . . . . **66. M. iners**
- b. Leaves thinly membranous, 7–14 cm long. Peduncle in female 1–2.5 cm long, 1.5 mm thick. Fruits 3–4 cm long, early glabrescent; pericarp 3–4 mm thick. Male buds 3 mm long . . . . . **41. M. fallax**
- 10a. Twigs 2–4 mm diam. Leaves about 3 times longer than broad, 10–30 by 4–9.5 cm, apex acute-acuminate, base rounded to acute; lateral nerves 14–20 per side; lower leaf surface papillose or not. Male buds 3–3.5 mm long. Female buds 2–2.5 mm long. Fruits 4–6 cm long . . . . . **86. M. malaccensis**
- b. Twigs 4–8 mm diam. Leaves large and comparatively broad, 16–44 by 8–14.5 (–18) cm, apex blunt or acute, not acute-acuminate, base ± rounded or subcordate; nerves (16–)20–28 per side; lower leaf surface papillose. Male buds 6–8 mm long. Female buds 6 mm long. Fruits 7–9 cm long . . . . . **102. M. papyracea**
- 11a. Inflorescences (and infructescences) with a peduncle, and ± branched . . . . . 12
- b. Inflorescences sessile, a short, scar-covered sessile brachyblast. [Leaves chartaceous or thinly coriaceous.] . . . . . **29. M. crassa**
- 12a. Leaves 16–40 cm long; lateral nerves 16–30 per side. Inflorescences large, widely paniculate, 6–18 cm long in male, (1.5–)5–9 cm in female. Fruits 6–8 cm long 13
- b. Leaves 10–30 cm long; lateral nerves 13–20(–22) per side. Inflorescences 2–6 cm long in male, 1.5–2.5 cm long in female. Fruits (4.5–)5–7.5 cm long. [Male buds 3–4 mm long.] . . . . . **12. M. borneensis**
- 13a. Twigs (4–)5–8 mm diam. Leaves: lateral nerves (20–)23–30 per side; lines of interarching ± distinct; papillae usually apparent. Male buds 5–7 mm long . . . . . **88. M. maxima**
- b. Twigs 2.5–5 mm diam. Leaves: lateral nerves 16–24 per side; lines of interarching ± indistinct; papillae not apparent. Male buds 4(–4.5) mm long **40. M. extensa**
- 14a. Twigs 5–10 mm diam. [Bark usually conspicuously cracking and flaking.] Leaf bud [and fruits] with very conspicuous villous hairs (1–)2–3 mm. [Inflorescences sessile.] . . . . . **147. M. villosa**
- b. Twigs 6 mm diam. or less. Leaf bud with hairs 1.5 mm or less . . . . . 15
- 15a. Leaves pubescent below. Fruits 2.5–4.5 cm long . . . . . 16
- b. Leaves glabrous below. Fruits 5 cm long or more . . . . . 20
- 16a. Inflorescences (best to be seen in male specimens) branched and with distinct ± flattened main peduncle, with flowers in subumbels or spikes. Fruits 2.5–4.5 cm long . . . . . 17
- b. Inflorescences (sub)sessile scar-covered short-shoots lasting several flowering seasons. Fruits densely pubescent, 2.5–3.5 cm long. [Leaf bud with hairs up to 0.5(–1) mm. — Inland species; not from limestone.] . . . . . 18

- 17a. Twigs 3–5(–10) mm diam. Leaves (12–)15–35 cm long; lateral nerves 15–19(–25) per side. Leaf bud with hairs to 1(–1.5) mm. Buds rounded towards apex. Fruits 2.5–4.5 cm long, densely shaggy pubescent with hairs 0.5–1 mm. — Mainly a coastal species, but sometimes inland in degraded forest . . . **59. *M. guatteriifolia***
- b. Twigs 1.5–3.5 mm diam. Leaves 11–20 cm long; lateral nerves 10–18 per side. Leaf bud with appressed hairs 0.5–1 mm. Buds sharply angular towards apex. Fruits 3.5–4 cm long, glabrescent or with thin scattered pale brown appressed hairs to 0.5 mm. — W Sarawak, NE Kalimantan; mostly from limestone . . . . . **123c. *M. simiarum* subsp. *calcarea***
- 18a. Twigs 2–3 mm diam. Leaves thinly coriaceous, base rounded or short acute; nerves not distinct above. Fruits 2.5–3.5 cm long, with scurfy hairs 0.2–0.3(–0.5) mm . . . . . **126. *M. smythiesii***
- b. Twigs 3–4(–5) mm diam. Leaves coriaceous, base rounded or emarginate, sometimes short-acute; nerves distinct above. Fruits 2.5–3.5 cm long, with woolly hairs 0.5–1 mm . . . . . **19**
- 19a. Male flowers: androecium ± sessile, with a collar of conspicuous hairs at base, sterile apex ± pubescent . . . . . **9. *M. beccarii***
- b. Androecium with distinct androphore, sterile apex without hairs. One collection, see note 3 under . . . . . **43a. *M. fatua* subsp. *fatua***
- 20a. Lower leaf surface concolorous with upper surface, not papillose. Fruits glabrous (early glabrescent) . . . . . **21**
- b. Lower leaf surface distinctly papillose, generally paler than upper leaf surface. Fruits either with persistent indumentum, late glabrescent, or early glabrescent in *M. gigantea* . . . . . **22**
- 21a. Leaves membranous, up to 24 cm long, base attenuate. Twigs up to 4 mm diam., smooth or striate, the bark of the twigs lower down cracking or not; leaf bud slender, 7–12 by 1–2 mm. Fruits to 8 cm long, pericarp 5–10 mm thick. — Stout forms, mainly from NE Borneo . . . . . **66. *M. iners***
- b. Leaves chartaceous, 15–35 cm long, base broadly rounded. Twigs (4–)5–6 mm diam., bark early conspicuously cracking; leaf bud stout, 10–15 by 4–6 mm. Fruits 7.5–9.5 cm long, pericarp 15–20 mm thick. — NE Borneo . . . **28. *M. corticata***
- 22a. Twigs 1.5–2.5(–3) mm diam. Leaves 7–12(–15) cm long, chartaceous, apex acute, blunt, or rounded; lateral nerves 10–15(–18) per side. Fruits 5–8 cm long, (late) glabrescent, hairs scurfy, 0.2 mm . . . . . **56. *M. gigantea***
- b. Twigs 3–6 mm diam. Leaves 14–35 cm long, coriaceous, the apex acute-acuminate; lateral nerves 13–22 per side. Fruits (5–)6–7 cm long, with conspicuous persistent shaggy hairs 1–2 mm . . . . . **84. *M. lowiana***

(4) REGIONAL KEY TO THE SPECIES — LESSER SUNDA ISLANDS (3 species)

- 1a. Inflorescences or infructescences short peduncled. — Bali **59. *M. guatteriifolia***
- b. Inflorescences sessile . . . . . **2**
- 2a. Leaves with persistent dense indumentum below. Fruits 2.5–3.5 cm long, hairs shaggy, (1–)1.5 mm. — Sumbawa, Flores . . . . . **133. *M. sumbawana***
- b. Lower leaf surface glabrescent. Fruits 2.5–4 cm long, hairs 0.5 mm. — Not in Bali or Lombok . . . . . **117. *M. rumphii***

## (5) REGIONAL KEY TO THE SPECIES — SULAWESI (8 species)

(applicable for all fertile specimens)

- 1a. Leaves (15–)20–40(–50) cm long; lower surface with persistent short dense indumentum. [Inflorescence a (sub)sessile, short brachyblast.] **43b. *M. fatua* subsp. *affinis***
- b. Leaves generally smaller; lower surface glabrous, glabrescent, or with minute sparse indumentum . . . . . 2
- 2a. Inflorescences (infructescences) with a peduncle. Buds angular in apical part. Fruits glabrescent or with sparse greyish hairs . . . . . **123b. *M. simiarum* subsp. *celebica***
- b. Inflorescences sessile or pedunculate. Buds rounded in apical part, not angular (of some species male flowers not known). Fruits with (minute) rusty indumentum . . . . . 3
- 3a. Twigs 1–2 mm diam. . . . . 4
- b. Twigs generally thicker, 1.5–5 mm diam. Inflorescence a (sub)sessile brachyblast, peduncle absent or to 2 mm long only . . . . . 5
- 4a. Leaves membranous, 9–19 cm long. Inflorescences slenderly pedunculate, sometimes subsessile. Flowers small, conspicuously rough-hairy. Fruits not known . . . . . **63. *M. impressinervia***
- b. Leaves coriaceous, (2.5–)4–7.5 cm long. Inflorescences sessile. Flowers not known. Fruits ± ellipsoid, 2–2.5 cm long. — Ultrabasic soils of Central Sulawesi . . . . . **140. *M. ultrabasica***
- 5a. Twigs 4–5 mm diam. Leaves coriaceous, lower leaf surface not whitish, not minutely dotted (lens!). [Fruits subglobose, 5 cm diam.; pericarp nearly woody, 10 mm thick.] — Central Sulawesi; soils on conglomeratic and ultrabasic bedrock; 400 m . . . . . **36. *M. devogelii***
- b. Twigs 1.5–5 mm diam. Leaves membranous, lower surface conspicuously pale, minutely dark-dotted (lens!) . . . . . 6
- 6a. Twigs 4–5 mm diam. Female flowers and fruits (sub)sessile. Fruits subglobose, 2–2.5(–3) cm long; pericarp 1–3 mm thick, hairs 0.1–0.2 mm. [Male flowers not known.] — N, C and SW Sulawesi . . . . . **74. *M. kjellbergii***
- b. Twigs 1.5–4(–5) mm diam. Female flowers and fruits stipitate. Fruits ± ellipsoid, 3–4 cm long; pericarp 3–6(–8) mm thick, hairs 0.1 mm . . . . . 7
- 7a. Twigs 1.5–3 mm diam. Fruiting pedicel 6–10 mm long, conspicuously pubescent, hairs 1–1.5 mm. [Male flowers not known.] — NE Sulawesi (Minahasa) . . . . . **75. *M. koordersii***
- b. Twigs 2–4(–5) mm diam. Fruiting pedicel 3–5(–7) mm long, glabrescent or with hairs to 0.5 mm only. — Sulawesi (except Minahasa); incl. *Kjellberg 2990* . . . . . **62. *M. impressa***

## (6) REGIONAL KEY TO THE SPECIES — PHILIPPINES (20 species)

(applicable for all fertile specimens; characters primarily vegetative)

- 1a. Lower leaf surface with a persistent dense indumentum; whenever the hairs are small they are densely interwoven . . . . . 2
- b. Lower leaf surface either with ± spaced silky hairs, with a very minute cobweb-like covering (to be seen with a lens only), glabrous, or glabrescent . . . . . 7

- 2a. Hairs of leaf bud (0.1–)0.5–1 mm. [Inflorescences mostly pedunculate. Fruits 2.5–4 cm long, with conspicuous shaggy hairs 0.5–1(–2) mm.] **59. *M. guatteriifolia***  
 b. Hairs of leaf bud shorter . . . . . 3
- 3a. Twigs (3–)4–8 mm diam. Leaves (15–)20 cm long or more. Inflorescences a (sub-)sessile scar-covered wart-like brachyblast. Fruits with minute or longish hairs, to 1 mm . . . . . 4  
 b. Twigs 1–2.5(–4) mm diam. Leaves (5–)8–22 cm long. Inflorescences pedunculate. Fruits with short scurfy hairs, 0.1–0.2 mm . . . . . 6
- 4a. Leaves coriaceous, oblong-lanceolate, (15–)20 cm long. [Petiole proportionally long, 20–35 mm.] — NE Luzon: Palanan area . . . . . **24. *M. colinridsdalei***  
 b. Leaves herbaceous or chartaceous, elliptic-oblong, 15–50 cm long . . . . . 5
- 5a. Twigs 5–8 mm diam. Leaves tapered (narrowed) in the lower half, nerves 30–35 per side; lower leaf surface with whitish dense felty hairs 0.1 mm or less, thus seemingly glabrous (lens!). Fruits (5–)6–6.5 cm long . . . . . **150. *M. wenzelii***  
 b. Twigs 3–4(–6) mm diam. Lower leaf surface with yellowish brown hairs 0.1–0.2(–0.5) mm. Fruits 3.5–6.5(–7) cm long . . . . . **43. *M. fatua* subsp. *fatua***
- 6a. Lower leaf surface with minute persistent hairs. Midrib below brown or yellowish. Fruits 5–9 cm long. — Probably Mindanao . . . . . **21. *M. cinnamomea***  
 b. Lower leaf surface late glabrescent. Midrib below purplish, contrasting with greyish surface. Fruits 3–7 cm long. — Palawan, Mindoro . . . . . **116. *M. rubrinervis***
- 7a. Buds in apical part sharp-angular. Inflorescences mostly pedunculate and branched. Fruits rather small, 1.5–3 cm, with scattered hairs or glabrescent . . . . . **123. *M. simiarum* [subsp. *simiarum* and subsp. *celebica*]**  
 b. Apical part of buds not or not sharply angular. Inflorescences sessile or pedunculate (and branched). Fruits variable . . . . . 8
- 8a. Leaves chartaceous or coriaceous, 10–24(–30) cm long; petiole proportionally long, 20–35 mm. Inflorescences (infructescences) sessile. Fruits large, (5–)6–7 cm long [with minute dark rusty scurfy indumentum] . . . . . 9  
 b. Leaves coriaceous, chartaceous, or membranous; petiole proportionally shorter. Inflorescences sessile or pedunculate. Fruits large, or smaller . . . . . 10
- 9a. Leaves coriaceous, 11–24(–30) by 3–6 cm; lateral nerves (15–)20 per side. Twigs 4–6 mm diam. — NE Luzon: Palanan area . . . . . **24. *M. colinridsdalei***  
 b. Leaves chartaceous, 10–15 by 2.5–6 cm; nerves c. 10 per side. Twigs 2–3 mm diam. Petiole proportionally long — Luzon, Biliran . . . . . **82. *M. longepetiolata***
- 10a. Twigs 3–5(–10) mm diam. Leaves large, to 45 cm long. Inflorescences or infructescences with a peduncle. Fruits large, (4–)5–8 cm long, with persistent indumentum . . . . . 11  
 b. Twigs 1–5 mm diam. Leaves generally smaller, to 20(–30) cm long, and inflorescences pedunculate or (sub)sessile brachyblasts. Whenever fruits are large, they are glabrescent . . . . . 12
- 11a. Leaf bud with hairs 1(–2) mm. Fruits with hairs 0.3–0.5 mm . . . . . **105. *M. philippensis***  
 b. Leaf bud with hairs 0.1–0.2(–0.3) mm. Fruits with scurfy hairs 0.1 mm. [Female flowers not known.] . . . . . **51. *M. frugifera***

- 12a. Twigs 1–2 mm diam. Fruits 3.5–4 cm long, indumentum minute, soon glabrescent. Lower leaf surface distinctly papillose. Bracteole in female flowers well below the perianth. — Palawan . . . . . **141. *M. umbellata***
- b. Twigs 2–5 mm diam. Fruits pubescent or glabrescent. Lower leaf surface papillose or not. Bracteole at apex of pedicel . . . . . 13
- 13a. Leaves lanceolate, lateral nerves 20–30 per side, flat or slightly raised below (not to be felt with the finger); very distinctly papillose (lens!). Pericarp 10 mm thick . . . . . **77. *M. laevis***
- b. Leaves elliptic or lanceolate, lateral nerves c. 20 per side or fewer, generally raised below; papillae absent or present, conspicuous or not (lens!). Pericarp usually less than 10 mm thick . . . . . 14
- 14a. Nerves c. 45° or less to the midrib. Inflorescences (best to be seen in male specimens) pedunculate, the flowers in subumbels . . . . . 15
- b. Nerves c. 45° or more to the midrib. Inflorescences with few flowers at the end of a sessile scar-covered, wart-like brachyblast lasting several flowering seasons 17
- 15a. Nerves (45–)60° to the midrib. Lower leaf surface not papillose. — Mindanao: Surigao (*Wenzel 3537*) . . . . . **66. *M. cf. iners***
- b. Nerves less than 60° to the midrib. Lower leaf surface ± papillose . . . . . 16
- 16a. Fruits 3–4.7 cm long, with dull grey-brown scurfy indumentum. Midrib on lower leaf surface (yellow-)brown when dry, not much contrasting **1. *M. agusanensis***
- b. Fruits 3–7 cm long, with bright dark rusty or orange-brown scurfy indumentum. Midrib on lower leaf surface drying dark purplish or reddish, much contrasting . . . . . **116. *M. rubrinervis***
- 17a. Leaves below whitish, contrasting with upper surface; lower leaf surface minutely dotted by the scars of fallen larger hairs . . . . . 18
- b. The two leaf surfaces ± concolorous or not, not dotted . . . . . 19
- 18a. Twigs 1.5–2.5 mm diam. Leaves 20 cm long or less. Fruits ellipsoid, 3.5 cm long, with conspicuous fine-woolly hairs 0.5(–1) mm. Hairs of leaf bud 1 mm. — Mindanao, Samar . . . . . **107. *M. pilosigemma***
- b. Twigs 2–4 mm diam. Leaves 20–40 cm long, greyish below. Fruits ellipsoid, 3.5–4 cm long, hairs 0.1 mm or less. Hairs of leaf bud 0.1 mm. — Mindanao . . . . . **95. *M. nivea***
- 19a. Bark of twigs soon cracking and/or flaking. Fruits 6 cm long, glabrous (glabrescent). [Male flowers not known.] — Basilan . . . . . **8. *M. basilanica***
- b. Bark not or only slightly cracking and flaking. Fruits shorter with minute indumentum . . . . . 20
- 20a. Twigs 3–4 mm diam., lower down densely set with lenticels. Leaves coriaceous. [Fruits subglobose, 3–4 cm long, hairs 0.1–0.2 mm.] — Mainly a coastal species; S Taiwan, Philippines (N Luzon) . . . . . **18. *M. cagayanensis***
- b. Twigs (1–)1.5–3 mm diam.; lenticels present or not. Leaves membranous or chartaceous . . . . . 21
- 21a. Lenticels of twigs few and inconspicuous. Fruits subglobose or ellipsoid, 3.5–5 cm long, hairs 0.1 mm. Leaves 8.5–23(–28) cm long . . . . . **32. *M. cumingii***
- b. Lenticels present, distinct or not. Fruits ellipsoid, (2.5–)3–3.5(–4.5) cm long, hairs 0.1–0.2 mm. Leaves 14–35 cm long. — Mindanao . . . . . **92. *M. mindanaensis***

## (7a) REGIONAL KEY TO THE SPECIES — MOLUCCAS (20 species)

(based on male flowering specimens)

- 1a. Male inflorescences branched, with a smooth main peduncle sometimes subsessile, slender, simple or branched; inflorescences lasting one or a few flowering seasons only ..... 2
- b. Inflorescences (sub)sessile densely scar-covered simple or 2–4-furcate thickish woody short-shoots, lasting several flowering seasons, each season producing a number of new flowers at the apex; peduncle (non scar-covered part) absent or up to 2 mm long ..... 7
- 2a. Plant wholly conspicuously glabrous. [Male flowers not known.] — Seram ..... 104. *M. perlaevis*
- b. Indumentum obvious on terminal leaf bud ..... 3
- 3a. Buds narrow, 6–8 by 2–3 mm, the apical part markedly angular, apex (sub)acute. — N Moluccas (Sula Is., Bacan, Buru) .... 123b. *M. simiarum* subsp. *celebica*
- b. Buds variable, not angular, apex rounded ..... 4
- 4a. Buds 3–4.5(–5) mm long, [rough-pubescent. Nerves on upper leaf surface flat or impressed, lower leaf surface papillose.] — N Moluccas ..... 11. *M. bifurcata* (with 2 subspecies)
- b. Buds 5–11 mm long ..... 5
- 5a. Buds conspicuously pubescent. Leaves large, 25–45 cm long, lateral nerves 25–30 per side, impressed above. Bark of older twigs longitudinally cracked. — N Moluccas (Bacan) ..... 47. *M. fissurata*
- b. Buds either glabrous, glabrescent, or short-haired. Leaves smaller, 6–22 cm long, lateral nerves fewer, above flat or but little impressed ..... 6
- 6a. Pedicel 1 mm thick. Flowers thinly pubescent. Leaves subcoriaceous, 9–22 cm long, lower surface with minute indumentum, late glabrescent. Twigs 2–3.5 mm diam. — N Moluccas ..... 131. *M. succedanea*
- b. Pedicel less than 1 mm thick. Flowers glabrescent with sparse, very minute indumentum. Leaves chartaceous, 6–13 cm long, early glabrescent. Twigs 1–2 mm diam. — Origin Banda; known only from cultivated specimens .... 50. *M. fragrans*
- 7a. Buds (10–)13–15 mm long ..... 8
- b. Buds less than 10 mm long ..... 9
- 8a. Twigs ridged or winged; inhabited by ants. — SE Moluccas (Kai Is.) and New Guinea ..... 129. *M. subalulata*
- b. Twigs not winged. — N Moluccas (Obi, Halmahera) ..... 110. *M. pubicarpa*
- 9a. Twigs 4–7(–10) mm diam. Leaves (15–)17–40 cm long ..... 10
- b. Twigs 1–4(–5) mm diam. (4–5 mm in some material of *M. fatua* and *M. inutilis*). Leaves generally much shorter than 40 cm (15–40 cm in *M. nivea*) ..... 12
- 10a. Lower leaf surface early glabrescent or with scattered, minute, scale-like hairs less than 0.1 mm (lens!). [Male buds 8–8.5 mm long.] — N Moluccas (Bacan) ..... 114. *M. robusta*
- b. Lower leaf surface densely tomentose (hairs may be minute). [Two species, distinguishable mainly by fruit characters.] ..... 11
- 11a. Buds 6 mm long. — N Moluccas ..... 118. *M. sangowoensis*
- b. Buds 4–6 mm long. — Moluccas (and Sulawesi, Philippines) ..... 43a. *M. fatua* subsp. *fatua*

- 12a. Lower leaf surface densely and persistently pubescent, the hairs may be short and scale-like (lens!) ..... 13  
 b. Lower leaf surface glabrous, early glabrescent, or with minute scattered hairs 15
- 13a. Twigs (2.5–)4–5 mm diam. Leaves 20 cm long or more. Buds 4–6 mm long . 14  
 b. Twigs 1–2 mm diam. Leaves 15 cm long or less. Buds 2–2.5 mm long. —Aru Is. .... **80a. *M. lepidota* subsp. *lepidota***
- 14a. Bracteole caducous; buds 4.5–6 mm long ..... **43a. *M. fatua* subsp. *fatua***  
 b. Bracteole persistent; buds 3–4.5 mm long. — Aru Is. .... **72b. *M. inutilis* subsp. *papuana***
- 15a. Lower leaf surface with scattered dark brown dots and dashes (lens!). — Aru Is. .... **122. *M. scripta***  
 b. Leaves without larger dots; small dots present or absent ..... 16
- 16a. Leaves pale below, with minute dots representing hair scars. — Known in the Moluccas only from one sterile collection from Talaud Is. .... **95. *M. nivea***  
 b. Lower leaf surface not conspicuously pale, without dark dots (lens!) ..... 17
- 17a. Buds cylindrical, narrow; androphore about as long as the synandrium ..... 18  
 b. Buds ovoid or ellipsoid(-oblong); androphore about as long as or shorter than the synandrium, mostly pubescent, at least at base. [Lateral nerves not particularly dense.] ..... 20
- 18a. Androphore glabrous ..... 19  
 b. Androphore densely pubescent. [Buds small, 3.5–4 mm long. Leaves pale below.] — N Moluccas (Bacan, Obi, Buru) ..... **2. *M. alba***
- 19a. Leaves membranous; venation distinct below. Buds 2.5–3 mm long. — NE Moluccas ..... **80b. *M. lepidota* subsp. *montanoides***  
 b. Leaves chartaceous; venation faint below. Buds 4–6 mm long ..... **78. *M. lancifolia* (with 2 subspecies)**
- 20a. Buds 2.5 mm long. — N Moluccas (Sula Is., Halmahera, Obi) ..... **11b. *M. bifurcata* subsp. *sulaica***  
 b. Buds more than 3 mm long ..... 21
- 21a. Twigs 2–2.5 mm diam. or more ..... **92. *M. mindanaensis***  
 b. Twigs 1–2(-2.5) mm diam. .... 22
- 22a. Perianth with hairs 0.1 mm. Pedicel about as long as the perianth. — N Moluccas ..... **138. *M. tristis***  
 b. Perianth with hairs 0.2–0.5 mm. Pedicel usually shorter than the perianth ... 23
- 23a. Buds cleft about 1/3 to nearly halfway. Inflorescences sessile or pedunculate. — N Moluccas ..... **11a. *M. bifurcata* subsp. *bifurcata***  
 b. Buds cleft c. 1/4. Inflorescences sessile. — SE Moluccas (Tanimbar) ..... **70. *M. insipida***

## (7b) REGIONAL KEY TO THE SPECIES — MOLUCCAS (20 species)

(based on female flowering and fruiting specimens)

- 1a. Lower leaf surface with persistent dense indumentum; whenever the hairs are short they may be densely interwoven and thus the leaf may seem glabrous ..... 2  
 b. Lower leaf surface either glabrous, glabrescent, with sparse minute scattered hairs, or with a very minute cobweb-like covering (only visible with a lens) ..... 5



- 2a. Twigs 1–2.5(–4) mm diam. Leaves 4.5–15 by 1.5–6 cm. Fruits 2.5–3 cm long, with scurfy hairs 0.1–0.2 mm. —Aru Is. . . . . **80a. *M. lepidota* subsp. *lepidota***
- b. Twigs 3–6 mm diam. Leaves 20 cm long or more. Fruits either with distinct hairs, 0.5–1 mm, or hairs scurfy . . . . . 3
- 3a. Fruits 4–6.5(–7) cm long, with conspicuous rusty hairs 0.5–1 mm. [Two taxa, with a different distribution, and distinguishable mainly by characters of the male flowers.] . . . . . 4
- b. Fruits 5–8.5 cm long, hairs dull cinnamon, scurfy, 0.1–0.2 mm. — N Moluccas . . . . . **118. *M. sangowensis***
- 4a. Male buds 4.5–6 mm long; bracteole mostly caducous . . . . . **43a. *M. fatua* subsp. *fatua***
- b. Male buds 3–4.5 mm long; bracteole persistent. — Aru Is. . . . . **72b. *M. inutilis* subsp. *papuana***
- 5a. Twigs distinctly ridged or winged; myrmecophilous. [Fruits subsessile, more or less ovoid, 2 cm long, apiculate, minutely tomentulose.] —Kai Is. . . . . **129. *M. subalulata* (with 2 subspecies)**
- b. Twigs neither ridged nor winged; not myrmecophilous . . . . . 6
- 6a. Plants conspicuously glabrous. Flowers not known. — Seram . . . . . **104. *M. perlaevis***
- b. Indumentum present on terminal leaf bud, twig, and flowers . . . . . 7
- 7a. Leaves 6–17(–25) cm long, lower surface with scattered dots and dashes. — Aru Is. . . . . **122. *M. scripta***
- b. Leaves of various sizes, without dots and dashes . . . . . 8
- 8a. Female buds much narrowed towards the acute apex, the apical part sharp-angular in cross section. Leaves to 30 cm long . . . . . 9
- b. Apex of female buds narrowed or not, in cross section circular or at most bluntly angular, but not sharply angular. Leaves small or large, to 40 cm long . . . . . 10
- 9a. Buds 5–6 mm long. Leaves below glabrous or with minute scattered hairs. Fruits 3–3.5 cm long, with scattered hairs 0.3–0.5 mm, or glabrescent. — N Moluccas (Sula Is., Bacan, Buru) . . . . . **123b. *M. simiarum* subsp. *celebica***
- b. Buds 10 mm long. Leaves below with dense or scattered scale-like hairs 0.1–0.2 mm. Fruits 5–6 cm long, densely dark brown short-pubescent, hairs 0.2–0.3 mm. — N Moluccas . . . . . **110. *M. pubicarpa***
- 10a. Twigs 3–5(–10) mm diam. Leaves 25–45 cm long . . . . . 11
- b. Twigs 1–5 mm diam. Leaves mostly less than 30 cm long (up to 43 cm long in *M. nivea*). [Fruits 2–5.5 cm long, pubescent, or fruits larger but then glabrous or early glabrescent.] . . . . . 12
- 11a. Twigs 4–7(–10) mm diam.; bark of twigs conspicuously longitudinally cracking, ± flaking. Lower leaf surface papillose (lens!). [Fruits large, (4–)5–8 cm long, with persistent scurfy hairs 0.1–0.2 mm.] — N Moluccas (Bacan) . . . . . **47. *M. fissurata***
- b. Twigs 5–10 mm diam.; bark of twigs striate, at most finely cracking and finely flaking. Lower leaf surface not papillose. [Female flowers and fruits not known.] — N Moluccas (Bacan) . . . . . **114. *M. robusta***

- 12a. Fruits glabrous or largely early glabrescent, hairs 0.1 mm or less. Inflorescences delicate, few-flowered, without or with a slender peduncle. [Leaves elliptic, with few lateral nerves per side.] . . . . . 13
- b. Fruits with persistent indumentum, hairs may be very short and inconspicuous. Inflorescences with or without a peduncle, with the flowers in a woody scar-covered short-shoot . . . . . 14
- 13a. Twigs 2–3.5 mm diam. Leaves ± coriaceous, 9–22 cm long, below late glabrescent. Fruits 4.5–8 cm long. — N Moluccas . . . . . **131. *M. succedanea***
- b. Twigs 1–2 mm diam. Leaves chartaceous, 6–13 cm long, below early glabrescent. Fruits 4–6 cm long. — Cultivated (origin Banda) . . . . . **50. *M. fragrans***
- 14a. Leaves pale below, with scattered dark-coloured small dots, representing hair scars (lens!). — Known in the Moluccas only from a sterile collection from Talaud Is. . . . . **95. *M. nivea***
- b. Leaves not conspicuously pale below, without scattered dots . . . . . 15
- 15a. Fruits 3–4 cm long, with conspicuous coarse hairs, (0.5–)1 mm . . . . . **11a. *M. bifurcata* subsp. *bifurcata***
- b. Fruits variable in size, hairs mealy, scurfy, or woolly, shorter, 0.1–0.5(–0.8) mm long . . . . . 16
- 16a. Lower leaf surface greyish or whitish, glabrescent, indumentum weak, its stoutest hairs leaving numerous regularly spaced, small, dark dot-like scars (lens!). Fruits short-ellipsoid, 3–4.2 cm long, hairs 0.1–0.5 mm; pericarp thick and woody, 5 mm thick. — N & C Moluccas . . . . . **2. *M. alba***
- b. Upper and lower leaf surface more concolorous, or, whenever greyish or whitish, without small dots . . . . . 17
- 17a. Leaves elliptic to oblong-lanceolate, 14–35 cm long. Fruits ellipsoid, (2.5–)3–3.5 (–4.5) cm long, hairs 0.1–0.2 mm . . . . . **92. *M. mindanaensis***
- b. Leaves generally smaller, elliptic to lanceolate, to 20 cm long. Fruits variable 18
- 18a. Lower leaf surface not papillose (lens!). Fruits subglobose, 2.5–3 cm long; pericarp 4–8 mm thick, hairs 0.1 mm or less. — N Moluccas . . . . . **138. *M. tristis***
- b. Lower leaf surface papillose. Fruits ellipsoid; pericarp 1–5 mm thick, hairs short or long, 0.1–1 mm. [Four taxa, difficult to segregate without male flowers.] . . . 19
- 19a. Male inflorescences (short) pedunculate; male buds 2.5 mm long. [Fruits ovoid-ellipsoid, 3–4 cm long, with scurfy hairs 0.2 mm.] — N Moluccas (Sula Is., Halma-hera, Obi) . . . . . **11b. *M. bifurcata* subsp. *sulaica***
- b. Male inflorescences (sub)sessile; male buds 3–6 mm long . . . . . 20
- 20a. Leaves membranous. [Venation on lower leaf surface distinct. Fruits 2–3.5 cm long, hairs 0.1(–0.2) mm.] Male buds small, 3 mm long — NE Moluccas . . . . . **80b. *M. lepidota* subsp. *montanoides***
- b. Leaves chartaceous. Male buds 4–6 mm long . . . . . 21
- 21a. Venation on lower leaf surface generally indistinct; lateral nerves 8–20 per side, rather dense; blade 4–17 cm long. Fruits 1.3–2.6(–3) cm long, hairs 0.1 mm . . . . . **78. *M. lancifolia* (with 2 subspecies)**
- b. Venation distinct or not; lateral nerves more lax, 6–12 per side; blade 7–24 cm long. Fruits 2.5–3.5(–3.8) cm long, hairs 0.3–1 mm. — SE Moluccas (Tanimbar Is.) . . . . . **70. *M. insipida***

## (8) REGIONAL KEY TO THE SPECIES — NEW GUINEA (99 species)

(based on male flowering, female flowering, and fruiting specimens)

- 1a. Lower leaf surface with scattered brown or blackish dashes or dots (lens!) . . . . 2
- b. Lower leaf surface not dotted (including all specimens with lower leaf surface covered with dense indumentum) . . . . . 22
- 2a. Male buds before anthesis with hooded bracteole, 8–9 mm long, enveloping the perianth, then caducous (compare also *M. brassii*). [Female flowers not known.] — Papua New Guinea; (250–)800–1000 m . . . . . **31. *M. cucullata***
- b. Bracteole, where known, much smaller, caducous or not, sometimes enveloping the perianth in very immature stages only . . . . . 3
- 3a. Twigs (2–)3–5 mm diameter or more; most leaf blades 15 cm long or more . . . . 4
- b. Twigs 1–2(–3) mm diameter; most leaf blades 15(–20) cm long or less . . . . . 9
- 4a. Leaves with dots on both upper and lower leaf surface; this sometimes apparent only towards the margin of the blade; lower leaf surface with subpersistent short and dense scale-like hairs 0.1 mm or less. Inflorescences (infructescences) short pedunculate\*. — W New Guinea, but not known from Bird's Head; (sub)montane . . . . . **37. *M. duplopunctata***
- b. Leaves with dots on lower surface only; lower leaf surface glabrous or glabrescent, indumentum minute. Inflorescences sessile or pedunculate . . . . . 5
- 5a. Inflorescences (best to be seen in male flowering specimens) without peduncle 6
- b. Inflorescences with peduncle 5 mm long or more. Leaves membranous, chartaceous, or coriaceous . . . . . 7
- 6a. Leaves chartaceous or subcoriaceous; nerves 20–30 per side, faint below. Male flowers: bracteole large, cucullate, caducous; androphore glabrous. — Papua New Guinea; (250–)800–1000 . . . . . **31. *M. cucullata***
- b. Leaves coriaceous; nerves c. 15 per side, distinct and contrasting in colour below. Male flowers: bracteole not seen; androphore conspicuously pubescent in the lower half. [Fruits not known.] — W New Guinea (SW of Bernhard Camp on Idenburg R.); c. 1700 m . . . . . **14. *M. brassii***
- 7a. Twigs (2–)3 mm diam. Leaves 15–23 cm long, membranous; nerves c. 20 per side, on lower leaf surface contrasting in colour and clearly visible. [Infructescences short-pedunculate. Fruits 4.5–5 cm long. Flowers not known.] — Papua Barat (N Bird's Head, Tamrau Range); 500–800 m . . . . . **134. *M. tamrauensis***
- b. Twigs 5–7 mm diam. Leaves 20–40 cm long, chartaceous or coriaceous; nerves  $\pm$  concolorous, 20–40 per side . . . . . 8
- 8a. Leaves chartaceous or thinly coriaceous, drying dull with minutely wrinkled surface; lateral nerves thin but clearly visible below. Fruits 5.5–6 cm long. Flowers not known. — Central New Guinea; montane . . . . . **91. *M. millepunctata***
- b. Leaves (thinly) coriaceous, drying smooth; lateral nerves faint below. Mature fruits not known. Male flowers: androphore completely pubescent.— Papua Barat (Bird's Head); lowland . . . . . **94. *M. neglecta***

\*) The peduncle is the non scar-covered stalk bearing a scar-covered part with flowers, the latter sometimes much reduced and few-flowered, especially in female specimens.

- 9a. Specimen with female flowers and/or fruits . . . . . 10  
 b. Specimen with male flowers (not known in *M. leptophylla*) . . . . . 17
- 10a. At least some inflorescences or infructescences with a peduncle\* 3 mm long or more . . . . . 11  
 b. Inflorescences or infructescences all sessile, or with a smooth peduncle up to 3 mm long . . . . . 13
- 11a. Female buds 10 mm long. Fruits 4.5–6.5 cm long, style often persistent. — Most of New Guinea; lowland and submontane forest; up to 1000 m **27. *M. cornutiflora***  
 b. Female buds (not seen in *M. arfakensis*) less than 10 mm long. Fruits 3–4.5 cm long, style not persistent. — Montane species, at 1000 m or more . . . . . 12
- 12a. Dots on lower leaf surface clearly visible only with a lens. Fruits, including pseudostalk\*\*, 3.5–4(–4.5) cm long. — Throughout New Guinea; montane . . . . . **100. *M. pachyphylla***  
 b. Dots visible to the naked eye. Fruits (without pseudostalk) 3 cm long. — Papua Barat (Bird's Head); montane . . . . . **4. *M. arfakensis***
- 13a. Fruits 1.5–2.5 cm long (not known in *M. flavovirens*). Nerves on lower leaf surface generally faint. — Lowland; up to 700 m (in Bird's Head to 1200 m) . . . . . 14  
 b. Fruits 3.5–4.5 cm long. Nerves quite visible below. — Montane; 1400–2000 m 16
- 14a. Leaves greenish. — Papua Barat (Bird's Head) . . . . . 15  
 b. Leaves (dark) brown. [Twigs 2–3 mm diam. Fruits rounded at base.] — New Guinea, except Bird's Head . . . . . **122. *M. scripta***
- 15a. Twigs 1(–2) mm diam., brown. Leaves below grey(–brown). Fruits at base contracted into a 3 mm long pseudostalk . . . . . **26. *M. conspersa***  
 b. Twigs 2–3 mm diam., blackish. Leaves below yellowish. Fruits not known. — Papua Barat (Bird's Head); montane . . . . . **48. *M. flavovirens***
- 16a. Leaves (4–)6–14 cm long, (sub)coriaceous. Fruiting pedicel (1–)2 mm thick. — Throughout New Guinea; montane . . . . . **100. *M. pachyphylla***  
 b. Leaves 10–20 cm long, membranous or (thinly) chartaceous. Fruiting pedicel 4(–5) mm thick. — Papua New Guinea (W Sepik Prov.); 1500 m **81. *M. leptophylla***
- 17a. Inflorescences with a smooth, often more or less flattened peduncle (1–)3 mm long or more . . . . . 20  
 b. Inflorescences (sub)sessile, simple or forked, short, scar-covered, (± woody) brachyblasts producing flowers at the apex, lasting several seasons; peduncle absent or up to 3 mm long (including *M. leptophylla* of which male inflorescences and flowers are not known) . . . . . 18
- 18a. Twigs 1(–2) mm diam. Male buds 3.5 by 1.5 mm. [Leaves greenish. Inflorescence sessile or 1(–2) mm pedunculate. Bracteole small, persistent.] — Papua Barat (Bird's Head); lowland up to 900 m . . . . . **26. *M. conspersa***  
 b. Twigs generally stouter, 2–3 mm diam. Male buds 3.5–5 mm long; if smaller, then not occurring in Bird's Head. — Throughout New Guinea . . . . . 19

\*) Usually the stalk of the fruit in single-fruited infructescences is thickened and woody; it is made up of the peduncle and the pedicel; the demarcation between the two parts may become obscure with age.

\*\*\*) The pseudostalk is a stalk-like contraction of the basal part of the fruit proper, demarcated from the fruiting pedicel by the scar of the perianth.

- 19a. Twigs dull or blackish brown. Leaves (dark) brown above, lower surface pale brown, not conspicuously papillose even seen under a strong lens. Inflorescences sessile. Flowers: pedicel 2–4 by 0.7 mm, bracteole caducous; buds 3.5–5 by 2–2.5 mm. — Throughout New Guinea; lowland up to 600 m . . . . . **122. *M. scripta***
- b. Twigs blackish. Leaves greenish above, lower surface yellowish, densely papillose. Inflorescences with peduncle 1(–2) mm long. Flowers: pedicel 4 by 1(–1.5) mm, bracteole minute, 1 mm long, persistent; buds 5 by 2.5 mm. — Papua Barat (Bird's Head); c. 1200 m . . . . . **48. *M. flavovirens***
- 20a. Male buds 10 mm long or more. — Throughout New Guinea; lowland and lower montane areas . . . . . **27. *M. cornutiflora***
- b. Male buds 8(–10) mm long or less . . . . . 21
- 21a. Dots on lower leaf surface mostly clearly visible only with a lens. Buds elongate, 6–7(–8?) mm long. — Most of New Guinea; montane . . . . . **100. *M. pachyphylla***
- b. Dots visible to the naked eye. Buds comparatively shorter and broader, 3.5–4 mm long. — Papua Barat (Bird's Head); montane . . . . . **4. *M. arfakensis***
- 22a. Twigs medium-sized or stout, conspicuously hollow and  $\pm$  angled by distinct raised lines or wings up to 2 mm high, at both sides of the twig connecting the bases of the petioles; perforated ant-swellings present (but sometimes not collected). Wings indistinct in *M. ingrata* subsp. *velata* . . . . . 23
- b. Twigs slender, medium-sized, or stout, generally solid or narrowly hollow, (sub-)terete or  $\pm$  angled, rarely with raised lines, without wings (stem sometimes ridged but not conspicuously hollow in *M. hollrungii* and *M. sulcata*); ant-swellings absent . . . . . 29
- 23a. Twigs and leaves exceedingly stout: twig 10 mm diam., leaves to 43 by 18 cm. Fruits 3.5 cm long with conspicuous hairs 1(–1.5) mm. — N Papua New Guinea (Sepik Prov.); lowland . . . . . **34. *M. dasycarpa***
- b. Twigs generally narrower, leaves smaller. Fruits with shorter indumentum . . 24
- 24a. Male buds cleft into lobes to over halfway; sizes of buds in one inflorescence variable; bracteole either small, 2–3 mm long (subsp. *kostermansii*), or large, (5–)7–8 mm long (subsp. *fissiflora*). [Lines of interarching of lateral nerves and venation distinct. Fruits not known with certainty.] — N New Guinea; lowland . . . . . **46. *M. fissiflora***
- b. Male buds cleft 1/3 or less; bracteole 2–3 mm long . . . . . 25
- 25a. Male buds ovoid or ellipsoid(-oblong), cleft 1/3–1/4; apex of synandrium blunt, sterile apex absent or to 0.2 mm long. Fruits rather small, up to 4 cm long . . 27
- b. Male buds oblong or tubiform, cleft 1/6–1/8, lobes 1–1.5 mm long; sterile apex of synandrium acute, 0.5–1 mm long. Fruits small or large, 1.5–7 cm long . . . . 26
- 26a. Bracteole caducous at anthesis. Fruits 1.5–2.5(–3) cm long, generally with persistent, short indumentum; fruiting pedicel 2–10 mm long. Venation generally faint. — Throughout New Guinea, incl. Aru and Kai Is., not in the Bismarck Archipelago; 0–2100 m . . . . . **129. *M. subalulata***
- b. Bracteole persistent at anthesis. Fruits 5–7 cm long, (late) glabrescent. Venation faint or distinct. — Papua New Guinea (Bismarck Archipelago); lowland . . . . . **10. *M. bialata***

- 27a. Sizes of flower buds in one inflorescence generally variable; bracteole persistent. [Female pedicel 2–5(–6) mm long. Fruits ovoid-ellipsoid, 2.5 cm long, apex narrowly or broadly rounded (with minute apiculum); fruiting pedicel  $\pm$  stout, 3–10 mm long.] Lines of interarching of lateral nerves on lower leaf surface and venation generally faint. [Fruiting specimens may be confused with *M. subalulata*.] — N & S New Guinea; lowland and montane . . . . . **68. *M. ingrata***
- b. Flower buds in one inflorescence all of about the same size; bracteole caducous. Lines of interarching of lateral nerves on lower leaf surface and venation generally distinct . . . . . 28
- 28a. Male buds 15 mm long, carnose; pedicel 7–8 mm long, bracteole scar below apex. Female flowers and fruits not known. — N Papua Barat; lowland **119. *M. sarcantha***
- b. Male buds 5 mm long; pedicel longer (10 mm) with bracteole apical. Female pedicel 10 mm long; fruiting pedicel 10–15 mm long. — Papua New Guinea (W Sepik Prov., Upper Sepik River); lowland . . . . . **42. *M. fasciculata***
- 29a. Twigs lined to sharply angular. — Central New Guinea; montane; 1500–2000 m or more . . . . . 30
- b. Twigs lined, ridged, or terete. Plants from lowland or montane areas, but in the latter case twigs (sub)terete, neither lined nor angular . . . . . 32
- 30a. [Flowers not known.] Twigs  $\pm$  stout, 4–5 mm diam. Fruits subglobose, 6 cm diam., pericarp 20 mm thick. — Papua New Guinea (Milne Bay Prov., Mt Dayman); c. 1500 m . . . . . **99. *M. pachycarpidia***
- b. Twigs generally more slender. Fruits smaller, 2–5.5 cm long,  $\pm$  ellipsoid . . . . 31
- 31a. Male buds 6 or 9 mm long (according to the subspecies); bracteole persistent. Fruits 2.5 cm long. Twigs 2–4 mm diam. — Mountains of Papua New Guinea . . . . . **145. *M. velutina***
- b. Male buds 10–14 mm long; bracteole caducous. Fruits 2 cm long. Twigs 5 mm in diam. — Papua New Guinea (Western Highlands Prov., Mt Hagen and vicinity); c. 2000 m . . . . . **129. *M. subalulata* var. *hagensis***
- c. Male buds 7–9 mm long, at base verrucose inside; bracteole caducous. Fruits 3.5–5.5 cm long. Twigs slender or medium-sized, 1.5–3 mm diam. — Throughout New Guinea; montane . . . . . **30. *M. crassipes***
- 32a. Twigs 1–3 mm diam., most leaves of fertile twigs 15(–17) cm long or less (specimens of *M. inutilis*, *M. sphaerosperma*, and *M. subcordata* may have rather small leaves, but these species have only been entered in the alternative lead) . . . . 33
- b. Twigs (2–)3–5 mm diam. or more, generally most leaves of a specimen 15 cm long or more . . . . . 143
- 33a. Specimen with female flowers or fruits. [Female flowers and fruits not known of several species, incl. *M. schlechteri*.] . . . . . 34
- b. Specimen with male flowers. [Male flowers not known of several species.] . 88
- 34a. At least some of the inflorescences or infructescences with a non scar-covered peduncle\* of 2 mm long or more . . . . . 35
- b. All inflorescences sessile: a short simple or forked scar-covered brachyblast, sessile or with a smooth peduncle up to 2 mm long . . . . . 52

\*) Usually the stalk of the fruit in single-fruited infructescences is thickened and woody; it is made up of the peduncle and the pedicel; the demarcation between the two parts may become obscure with age.

- 35a. Leaves ensiform, parallel-sided, 12–22 cm long. Understorey near-tree of 1.5 m height. — Papua New Guinea (Western Prov.); c. 80 m; once found . . . . . **39. *M. ensifolia***  
 b. Leaves elliptic or oblong(-lanceolate). Trees generally larger . . . . . 36
- 36a. Hairs of leaf bud (0.2–)0.5 mm or more . . . . . 37  
 b. Hairs of leaf bud short, 0.1–0.2(–0.3) mm or less . . . . . 42
- 37a. Lower leaf surface with persistent dense indumentum, sometimes late glabrescent. — E Papua New Guinea (Morobe); montane; 1000–1500 m . . **125. *M. sinclairii***  
 b. Lower leaf surface early (sometimes late) glabrescent or glabrous (or sometimes with persistent indumentum in *M. mediovibex*) . . . . . 38
- 38a. Lower leaf surface papillose (lens!) . . . . . 39  
 b. Lower leaf surface not obviously papillose . . . . . 40
- 39a. Fruits 3–4 cm long, with coarse hairs 0.5–0.8 mm long. — Moluccas and Papua Barat (Bird's Head) . . . . . **11. *M. bifurcata* subsp. *bifurcata***  
 b. Fruits 4–4.5 cm long, hairs 0.1 mm. — Papua New Guinea . . **22. *M. clemensii***
- 40a. Bracteole caducous, about halfway the pedicel. [Mature fruits (incl. pseudostalk) 4 cm long. Lower leaf surface late glabrescent or with persistent indumentum.] — Northern part of W New Guinea . . . . . **89. *M. mediovibex* var. *mediovibex***  
 b. Bracteole at or towards the apex of the pedicel . . . . . 41
- 41a. Female peduncle slender, 20 mm long, 0.5–1 mm thick; fruiting pedicel 7–9 mm long. Fruits (incl. pseudostalk) 5–5.5 cm long. — E Papua New Guinea . . . . . **106. *M. pilosella***  
 b. Peduncle 10 mm long, 1 mm thick; fruiting pedicel 14 mm long. Fruits incl. pseudostalk 2–2.5 cm long. — NE Papua Barat . . . . . **137. *M. trianthera***  
 c. Peduncle 3–4 mm long; fruiting pedicel 2–4 mm long. Fruits (without pseudostalk) 2.5 cm long. — Papua New Guinea (Morobe Prov.); c. 100 m **112. *M. pygmaea***
- 42a. Lower leaf surface seemingly glabrous, but actually with dense, very short indumentum (lens!) . . . . . 43  
 b. Leaves below glabrous or glabrescent, or with a lax indumentum, hairs  $\pm$  scattered, scale-like, minute only. [Female buds generally less than 8 mm long.] . . . . . 45
- 43a. Lower leaf surface with silvery short cobweb-like indumentum; leaf base cuneate. Older twigs rugose with conspicuous wart-like lenticels. Female buds 8–10 by 5–5.5 mm. Fruits early glabrescent, 7 cm long, wrinkled. — W Papua Barat; lowland . . . . . **5. *M. argentea***  
 b. Indumentum of lower leaf surface largely grey-brown or rust-coloured, very short. Bark of twigs not coarsely warty-lenticellate. [Flowers not known.] Fruits shortly rusty pubescent, not wrinkled . . . . . 44
- 44a. Fruits 7 cm long. Petiole 2–3 cm long; blade base broadly rounded or  $\pm$  cordate — Papua New Guinea (Western Prov.); lowland . . . . . **3. *M. archboldiana***  
 b. Fruits 2.5–3.5 cm long. Petiole 1.5 cm long; blade base cuneate — N Papua Barat . . . . . **89. *M. mediovibex* var. *kosteriana***
- 45a. Lower leaf surface papillose (lens!). Peduncle conspicuously flattened. Fruits (not known in *M. rosselensis*) ellipsoid or oblong, 2–3.5 cm long, glabrescent except at the ends . . . . . 46  
 b. Leaves not papillose below. Peduncle  $\pm$  flattened or terete. Fruits variable in shape, 2.7 cm long or more, with minute scurfy indumentum (hairs scale-like) . . . . . 47

- 46a. Leaves narrow, oblong-lanceolate, base (sub)acute; lateral nerves c. 20 per side; nerves and venation faint. — Louisiade Archipelago . . . . . **115. *M. rosselensis***  
 b. Leaves proportionally broader, elliptic-oblong, base rounded; lateral nerves 8–15 per side; lateral nerves and venation  $\pm$  evident. — N Papua New Guinea (Bismarck Archipelago), E to Solomon Islands; mostly coastal . . . . . **121. *M. schleinitzii***
- 47a. Lower leaf surface grey-white, glabrous. Inflorescences (infructescences) conspicuously supra-axillary. [Flowers not known.] Fruits without pseudostalk, ellipsoid-oblong, 2.7 cm long. — Papua New Guinea (Madang Prov.); at low altitude . . . . . **33. *M. cylindrocarpa***  
 b. Lower leaf surface somewhat whitish or not. Inflorescences axillary or only shortly supra-axillary. Fruits 4 cm long or more, including pseudostalk (mature fruits not known in *M. olivacea*) . . . . . 48
- 48a. Leaves drying conspicuously greenish. Inflorescences slender, the peduncle 3 cm long; pedicel 18–20 mm, longer than the perianth. [Bracteole persistent.] — Papua New Guinea (Central Prov.); lowland . . . . . **96. *M. olivacea***  
 b. Leaves drying (olivaceous-)brown; peduncle of inflorescences (infructescences) much shorter; pedicel variable . . . . . 49
- 49a. [Female flowers and fruits not known.] Leaves drying conspicuously blackish brown. Bracteole in male flowers persistent. — Papua Barat and Papua New Guinea (Ingembit area, on the S border); lowland . . . . . **6. *M. atrescens***  
 b. Leaves drying olivaceous or (dark) brown. Bracteole caducous. . . . . 50
- 50a. Lateral nerves on lower leaf surface slightly raised, brown, contrasting with rest of blade . . . . . 51  
 b. Lateral nerves on lower leaf surface flat or  $\pm$  sunken, almost concolorous. [Inflorescences generally lacking a peduncle.] — Papua New Guinea; montane . . . . . **76. *M. laevifolia***
- 51a. Fruits (incl. pseudostalk) 4.5–6 cm long. — Papua New Guinea (Central Prov.); local, hill rain forest at 500–700 m (a deviating fruiting specimen from montane forest at 1300 m in Central Papua Barat) . . . . . **83. *M. longipes***  
 b. Fruits 4 cm long. — Papua New Guinea (Central and Madang Prov.); montane forest at (400–)1200–1600 m . . . . . **52. *M. fugax***
- 52a. Fruits narrow, 8 by 1.5–2 cm. — SW Papua Barat; lowland or montane . . . . . **54. *M. fusiformis***  
 b. Fruits broader or shorter . . . . . 53
- 53a. Lower leaf surface early glabrescent or covered with very minute scattered pale cobweb-like hairs only less than 0.1 mm long and papillose (lens!), the papillae rather uniform and regularly set. — Note: some species with the lower leaf surface very densely papillose and the papillae closely contiguous, or with the papillae irregular in shape and size or indistinct, are included in both leads or in the alternative lead; specimens of *M. insipida* and *M. lancifolia* may be indistinctly papillose . . . . . 54  
 b. Lower leaf surface glabrous, glabrescent, or pubescent, not or but faintly papillose, or papillae not readily recognized as such . . . . . 57
- 54a. Fruiting pedicel 15–20 mm. Nerves at c. 45° to the midrib. — Papua New Guinea (Western Prov.); lowland . . . . . **101. *M. papillatifolia***  
 b. Fruiting pedicel 5 mm long or less. Nerves at 60° or more to the midrib . . . . 55



- 55a. Lateral nerves 8–20 per side, not much contrasting in colour and faint below; venation generally indistinct. [Fruits small, ellipsoid, 1.3–1.6 cm long, with hairs 0.1 mm.] — Moluccas and W & E New Guinea . . . **78. *M. lancifolia*** subsp. ***lancifolia***
- b. Nerves 6–14 per side, below contrasting in colour or not; venation not much contrasting, indistinct or not . . . . . 56
- 56a. Fruits ellipsoid, 1.5–2.5 cm long, including the short pseudostalk, with hairs 0.1–0.3 mm. [Fruiting pedicel 2–4 mm.] — E Papua New Guinea . . . **25. *M. concinna***
- b. Fruits sessile, ellipsoid(-oblong), 2.5–3.5(–3.8) cm long, with hairs 0.3–1 mm. — S New Guinea (also in S Moluccas and N Australia) . . . . . **70. *M. insipida***
- c. Fruits sessile, ± ellipsoid, 3 cm long, with hairs 0.1(–0.2) mm. — Local endemic of S Papua New Guinea (Central Prov.); sea level . . . **13. *M. brachypoda***
- 57a. [Flowers not known.] Lateral nerves c. 25 per side, faint. Fruits egg-shaped, 7 by 5 cm, early glabrescent (a few light brown scattered appressed hairs excepted). — Rossel I.; at 200 m . . . . . **98. *M. ovicarpa***
- b. Lateral nerves c. 20 per side or less. Fruits generally less than 7 cm long . . . . 58
- 58a. Flowers glabrous or almost so. Fruits minutely pubescent or glabrescent . . . . 59
- b. Flowers pubescent (hairs may be minute and dense, the perianth seemingly glabrous (lens!); sometimes parts of the perianth late glabrescent). Fruits pubescent, hairs minute or larger. [Flowers not seen in *M. brevistipes*, *M. firmipes*, or *M. lasiocarpa*; fruits glabrescent in *M. crassipes*.] . . . . . 61
- 59a. Fruiting pedicel 2–7 mm; fruits glabrescent. — Lowland; 0–250 m . . . . . **139. *M. tubiflora***
- b. Fruiting pedicel 10 mm long or more . . . . . 60
- 60a. Fruiting pedicel (20–)25–30 mm by 0.5 mm; fruits minutely pubescent, with long pseudostalk. — E Papua New Guinea (Lae subprov.); 0–15 m . . . **44. *M. filipes***
- b. Fruiting pedicel stouter, 10–18 by 2 mm; fruits glabrescent, with short pseudostalk. — Papua New Guinea; montane, 1000–1800 m . . . . . **76. *M. laevifolia***
- 61a. Leaves below either glabrescent (sometimes late), or with extremely minute indumentum of scale-like, ± spaced, not densely interwoven hairs . . . . . 62
- b. Leaves below with persistent or subsistent indumentum, with hairs densely set, long or short; or late glabrescent; hairs may be extremely short and scale-like 82
- 62a. Innovations and flowers conspicuously densely clothed in rusty hairs 0.5–1 mm. — E Papua New Guinea; lowland . . . **20. *M. chrysophylla***, **120. *M. schlechteri***
- b. Hairs much shorter . . . . . 63
- 63a. Fruiting pedicel 2 mm long, 1–2 mm thick; fruits 2.5–3 cm long, ellipsoid-oblong. [Flowers not known.] . . . . . 64
- b. Fruiting pedicel more than 2 mm long, slender or thick; fruits variable, comparatively broader: globose, short-ellipsoid, or ± pear-shaped . . . . . 66
- 64a. Leaves pale below, nerves thin and faint on both surfaces. Bark of older twigs ± corky. — Local endemic of S Central New Guinea; 150 m **90. *M. mediterranea***
- b. Leaves brown-green, not pale below, nerves stronger; twigs not corky . . . . . 65
- 65a. Indumentum of fruits conspicuously woolly. Lower leaf surface faintly papillose. — S New Guinea (also in Moluccas, N Australia) . . . . . **70. *M. insipida***
- b. Indumentum of fruits short-woolly. Leaves not papillose. — Local endemic of Papua New Guinea (Central Prov.) (Check also *M. concinna* and *M. brachypoda*.) . . . . . **15. *M. brevistipes***

- 66a. Twigs  $\pm$  2-lined or 2-angled (usually indistinctly so in *M. crassipes*) . . . . . 67
- b. Twigs not or only faintly angled, including *M. atrocorticata*, a species with somewhat angled twigs but distinguishable by the flaking bark of older twigs . . . . . 73
- 67a. Lower leaf surface drying (pale) brownish, nerves comparatively faint, yellow or orange-brown, not much contrasting. Fruits 2.5–4 cm long; seed attached above the base of the pericarp and hence  $\pm$  transversely positioned in the fruit; fruiting pedicel  $\pm$  stout, 10–25 by 2–3 mm; perianth sometimes glabrescent. — N & NE New Guinea; lowland and montane . . . . . **149. *M. warburgii***
- b. Lower leaf surface drying pale, greyish or not, midrib and nerves brown, and these generally contrasting. Fruits variable; seeds basal. Perianth minutely thinly pubescent, the hairs sometimes extremely small, thus the perianth seemingly glabrous . . . . . 68
- 68a. Twigs 1 mm diam. Fruits in lower half contracted into a long pseudostalk . . . . . 69
- b. Twigs (1.5–)2–3 mm diam. Fruits without or with pseudostalk; fruiting pedicel short or long . . . . . 70
- 69a. Fruiting pedicel 20 by 0.5 mm. — E Papua New Guinea . . . . . **111. *M. pumila***
- b. Fruiting pedicel 3–4 by 2 mm. — Papua New Guinea (Central Prov., Sogeri area) . . . . . **127. *M. sogeriensis***
- 70a. Lowland; up to 500 m altitude . . . . . 71
- b. Montane; 500 m altitude or higher . . . . . 72
- 71a. Fruiting pedicel 30–35 by 1 mm; fruits with 10 mm long pseudostalk. — E Papua New Guinea . . . . . **49. *M. flosculosa***
- b. Fruiting pedicel 3–10 by (3–)4–5 mm, fruits without or with short pseudostalk. [Leaves usually more than 15 cm long.] — Throughout New Guinea . . . . . **132. *M. sulcata***
- 72a. Fruiting pedicel 4–10(–12) by 3–5(–6) mm. — Throughout New Guinea . . . . . **30. *M. crassipes***
- b. Fruiting pedicel 10–15 mm by 1.5–3 mm. — E Papua New Guinea . . . . . **149. *M. warburgii* subsp. *hybrida***
- c. Fruiting pedicel 25–30 by 1 mm. — Papua Barat; 500 m . . . . . **58. *M. gracilipes***
- 73a. Small tree, 1.5–8 m tall. Fruits solitary, with slender peduncle; fruiting pedicel 8–10 by 0.5 mm, the fruits itself with distinct pseudostalk, 10 mm long. — E Papua New Guinea . . . . . **93. *M. nana***
- b. Tree small or large. Fruits of variable sizes, single or 2–4 together per infructescence; fruiting pedicel stronger and proportionally shorter; fruits without or with much shorter pseudostalk . . . . . 74
- 74a. Leaves coriaceous or membranous. — Montane; (300?–)1600–1800 m . . . . . 75
- b. Leaves subcoriaceous or membranous. [Fruits either globose,  $\pm$  ellipsoid, or  $\pm$  pear-shaped; fruiting pedicel short or medium-sized.] — Plants generally from lowland areas; 0–1000(–1500) m . . . . . 76
- 75a. Fruits ellipsoid or  $\pm$  fusiform, 3 cm long, the pericarp 3 mm thick; fruiting pedicel 10 by 3.5 mm. — Papua Barat (near Wissel Lakes); c. 1800 m (species resembling *M. laevifolia*, but nerves contrasting below) . . . . . **148. *M. vinkeana***
- b. Fruits globose, 2.5–3 cm diam., the pericarp 7 mm thick; fruiting pedicel 5–8 mm long. — Papuan Islands: Goodenough, possibly Tagula; 1600 m (and 300 m?; see note 2 under the species) . . . . . **108. *M. polyantha***

- 76a. [Male and female flowers not known.] Fruits  $\pm$  pear-shaped, 6–7 cm long, pericarp thick, woody, 10 mm thick; fruiting pedicel short and thick, broader than long, 4–10 by 5–9 mm. — W Papua New Guinea . . . . . **45. *M. firmipes***  
 b. Fruits globose or  $\pm$  ellipsoid, smaller, pericarp thinner; fruiting pedicel proportionally more slender . . . . . 77
- 77a. Leaves below usually pale, grey-glaucous, with brownish contrasting nerves and coarsely reticulate contrasting venation. [Fruits variable in size and shape, (short-) ellipsoid or subglobose, 1.5–3.2(–4) cm long, with persistent short hairs 0.1–0.5 (–0.8) mm.] — Widespread; 0–600(–1500) m . . . . . **57. *M. globosa***  
 b. Both leaf surfaces generally rather concolorous; venation more faint . . . . . 78
- 78a. Twigs 2–2.5 mm diam., somewhat angular . . . . . 79  
 b. Twigs 1–2 mm diam., subterete. [Bark of older twigs striate,  $\pm$  flaking or not. Petiole long and slender (but proportionally shorter than in *M. atrocorticata* and *M. inundata*), 10–20(–23) mm long. Leaves glabrous (early glabrescent) below. Fruits with hairs 0.1(–0.2) mm.] . . . . . 81
- 79a. Bark of older twigs blackish, longitudinally cracking, or flaking. Petiole 20 mm long. [Leaves below late glabrescent, at first with minute scale-like hairs.] . . 80  
 b. Twigs brown, bark not flaking (but sometimes transversely cracked). Petiole 10–13 mm long. — Northern part of New Guinea; lowland . . **16. *M. buchneriana***
- 80a. Leaves oblong-lanceolate. Bracteole much shorter than the perianth. [Fruits not known.] — W Papua Barat (Bird's Head) and Papua New Guinea (Western Prov.); lowland . . . . . **7. *M. atrocorticata***  
 b. Leaves (elliptic-)oblong. Bracteole in male flowers about as long as the perianth. [Female flowers not known.] — Papua New Guinea (Western Prov.) . . . . . **71. *M. inundata***
- 81a. Fruits subglobose or ellipsoid, 2.5–3.5 cm long. — Moluccas and West & East New Guinea . . . . . **138. *M. tristis***  
 b. Fruits  $\pm$  ellipsoid-oblong, 2–3 cm long. — Moluccas and Papua Barat (Bird's Head). [See also *M. concinna*, but fruits ellipsoid, 1.5–2.5 cm long, and leaves usually papillose below.] . . . . . **80. *M. lepidota* subsp. *montanoides***  
 [c. Fruits ellipsoid, 4.5–5 cm long. — Southern Solomon Islands . . . . . *M. guadalcanalensis* W.J. de Wilde]
- 82a. Twigs 1.5 mm diameter. Leaves 4–14 cm long. — Moluccas and West New Guinea . . . . . **80. *M. lepidota* subsp. *lepidota***  
 b. Twigs 2 mm diameter or more. Leaves generally 10 cm long or more . . . . . 83
- 83a. Leaves below with silky, very short, (sub)persistent indumentum; venation  $\pm$  trabeculate. — Papua New Guinea (Northern Prov.); montane . . **17. *M. byssacea***  
 b. Indumentum more scaly or felty, short or longer; venation reticulate, or hardly visible . . . . . 84
- 84a. Fruits 2 cm long; fruiting pedicel 15–18 by 1.5–2 mm. — Papua New Guinea (Madang Prov.); lowland . . . . . **103. *M. pedicellata***  
 b. Fruits larger; fruiting pedicel shorter and thicker . . . . . 85
- 85a. Flowers, fruits, and lower leaf surface with short hairs, 0.3(–0.5) mm long or less . . . . . 86  
 b. Flowers, fruits, and usually lower leaf surface with longer, shaggy hairs . . . 87
- 86a. Lower leaf surface with scale-like hairs 0.1 mm long only. — Papuan Islands . . . . . **136. *M. tenuivenia***

- b. Lower leaf surface with dense, stellate hairs of mixed sizes, more than 0.1 mm long. — Widespread (check also *M. subcordata*.) . . . . . **72. *M. inutilis***
- c. Lower leaf surface with dense minute scale-like hairs, less than 0.1 mm long. [Female flowers and fruits not known.] — Papua New Guinea (Western Prov.); lowland, periodically inundated forest . . . . . **71. *M. inundata***
- d. Lower leaf surface densely short-felty, with hairs 0.2–0.3 mm. — Papua New Guinea (West Sepik Prov., Telefomin subprov.; possibly Morobe Prov., Kuper Range); c. 2000 m . . . . . **23. *M. coacta***
- 87a. Fruits subsessile. — E Papua New Guinea; lowland . . . . . **20. *M. chrysophylla***
- b. Fruiting pedicel (5–)10 mm long. [Flowers not known.] — Papua New Guinea (Morobe Prov., Kuper Range); 1600–2000 m . . . . . **79. *M. lasiocarpa***
- 88a. Inflorescences with a smooth, often  $\pm$  flattened peduncle (1–)2 mm long or more, lasting one or several seasons . . . . . **89**
- b. Inflorescences (sub)sessile simple or forked scar-covered woody brachyblasts producing flowers at the apex, mostly lasting several flowering seasons; in some species with a peduncle to 2 mm long, in *M. insipida* the peduncle occasionally up to 4 mm long; inflorescences sometimes delicate with only a few flowers . . . . . **109**
- 89a. Leaves narrow, ensiform, 12–22 cm long. An understorey near-tree of 1.5 m. — Papua New Guinea (Western Prov.); c. 80 m . . . . . **39. *M. ensifolia***
- b. Leaves elliptic or oblong(-lanceolate). Trees or shrubs, generally larger . . . . . **90**
- 90a. Leaf bud (and generally also young twig apices, inflorescences, and flowers) with hairs of a flossy appearance, the majority (0.2–)0.5 mm long or more . . . . . **91**
- b. Hairs 0.1–0.2(–0.3) mm long or less . . . . . **97**
- 91a. Male buds oblong, 7 mm long or more. [Male flowers not known in *M. mediovibex*, *M. pilosella*, *M. pygmaea*.] . . . . . **92**
- b. Male buds ellipsoid(-oblong), 5 mm long or less . . . . . **95**
- 92a. Lower leaf surface with persistent  $\pm$  dense indumentum, sometimes late glabrescent. Peduncle of male inflorescence up to 3 mm long . . . . . **93**
- b. Leaves early glabrescent or glabrous below. Peduncle longer . . . . . **94**
- 93a. Plants from montane area; 1000–1600 m. — Papua New Guinea (Morobe Prov.) . . . . . **125. *M. sinclairii***
- b. Plants from lowland area; c. 100 m [Male flowers not known.] — Papua New Guinea (Morobe Prov.) . . . . . **112. *M. pygmaea***
- 94a. Bracteole in female flowers caducous, borne halfway the pedicel. [Male flowers not known.] — N Papua Barat; lowland . . . . . **89. *M. mediovibex***
- b. Bracteole persistent, at the apex of the pedicel. — E Papua New Guinea; montane . . . . . **106. *M. pilosella***
- 95a. Lower leaf surface papillose (lens!). Male buds  $\pm$  ellipsoid; anthers 6–8 . . . . . **96**
- b. Lower leaf surface not papillose. Male buds ellipsoid-oblong; anthers 3. — NE Papua Barat; lowland . . . . . **137. *M. trianthera***
- 96a. Leaves ovate-oblong or oblong-lanceolate. Apical part of male buds rounded in cross section. — Moluccas and Papua Barat (Bird's Head) . . . . . **11. *M. bifurcata***
- b. Leaves oblong-lanceolate. Apical part of male buds often  $\pm$  triangular (sometimes not apparent). [Dry fruits 4–5.5 cm long.] — Papua New Guinea (Morobe, Northern, S Highlands Prov. & New Britain) . . . . . **22. *M. clemensii***

- 97a. Leaves below seemingly glabrous, but very short and dense indumentum evident under a lens ..... 98
- b. Leaves below glabrous, (late) glabrescent, or with small but scattered hairs only. Male buds either less than 12 mm long, or if 12 mm long then only 2–3 mm across (here also included is *M. cylindrocarpa*, of which the flowers are not known) ..... 100
- 98a. Leaves below silvery by its short cobweb-like indumentum. Older twigs rugose with coarse wart-like lenticels. Male buds ovoid-oblong, 11–12 by 5–5.5 mm. — W Papua Barat; lowland ..... **5. *M. argentea***
- b. Indumentum rust-coloured. Older twigs not with wart-like lenticels. Flowers not known ..... 99
- 99a. Petiole 2–3 cm long; base of leaf blade broadly rounded or  $\pm$  cordate. — Papua New Guinea (Western Prov.); lowland ..... **3. *M. archboldiana***
- b. Petiole 1.5 cm long; base of leaf blade cuneate. — Papua Barat (Jayapura Prov.); lowland ..... **89. *M. mediovibex* var. *kosteriana***
- 100a. Lower leaf surface papillose (lens!). Peduncle of inflorescence conspicuously flattened. Male buds ovoid to oblong, 6 mm long or less ..... 101
- b. Lower leaf surface not papillose. Peduncle flattened or not. Male buds oblong-lanceolate, 6 mm long or more [Flowers not known in *M. cylindrocarpa*; male buds 4 mm in *M. atrescens*.] ..... 102
- 101a. Leaves oblong-lanceolate, nerves and venation faint. Male inflorescences with flattened peduncle, with sessile simple lateral flower-bearing brachyblasts; male buds 5.5 mm long or less. — Louisiade Archipelago ..... **115. *M. rosselensis***
- b. Leaves  $\pm$  elliptic-oblong, lateral nerves and venation  $\pm$  distinct. Male inflorescence with flattened peduncle, with stalked simple or branched brachyblasts; male buds 5.5–6.5 mm long. — Most frequent in coastal area of northern Papua New Guinea, Bismarck Archipelago, E to Solomon Islands ..... **121. *M. schleinitzii***
- 102a. Leaves below glabrous, (grey-)whitish. Infructescence (inflorescence) 10 mm supra-axillary. [Flowers not known.] — Papua New Guinea (Madang Prov.); low altitude ..... **33. *M. cylindrocarpa***
- b. Leaves below grey or brown. Inflorescences up to 6 mm supra-axillary ... 103
- 103a. Leaves conspicuously greenish above. Inflorescences slender, with peduncle 3–5 cm long. Male buds 11–13 mm long; pedicel long, slender, 10–12 mm long, bracteole persistent. — Papua New Guinea (Central Prov.); lowland ..... **96. *M. olivacea***
- b. Leaves (olivaceous-)brown. Peduncle 1.5 cm long or less. Male buds shorter; bracteole persistent or caducous ..... 104
- 104a. Leaves conspicuously blackish brown. Male buds 4 mm long; bracteole persistent. — SE Papua Barat; lowland ..... **6. *M. atrescens***
- b. Leaves olivaceous, brown, or dark brown. Male buds 6 mm long or more; bracteole (late) caducous ..... 105
- 105a. Male buds 10 by 3 mm [inner surface smooth; pedicel 5–6 mm long.] — Local endemic in rain forest of Papua New Guinea (Central Prov.), 500–700 m (possibly also Central Papua Barat, 1300 m) ..... **83. *M. longipes***
- b. Male buds 6–9 by 1.5–2(–3) mm. — Plants from lowland or montane area 106

- 106a. Male buds inside smooth. [Lateral nerves on lower leaf surface flat or sunken, concolorous; a species generally with sessile, non-pedunculate inflorescences.] — N & E Papua New Guinea; montane . . . . . **76. *M. laevifolia***
- b. Male buds inside with verrucose ridges in the lower half. [Pedicel 3.5–6 mm long.] (Check also *M. pumila*, a species from low altitudes, usually with completely sessile inflorescences) . . . . . 107
- 107a. Twigs 2–3 mm diam. — Throughout New Guinea; montane . . . . . **30. *M. crassipes***
- b. Twigs 1–2 mm diam. . . . . 108
- 108a. Nerves on lower leaf surface much contrasting in colour. Male buds 7 mm long, apex acute, verrucose ridges on inside faint; bracteole persistent. — Papua New Guinea (Central Prov., Sogeri area); c. 400 m . . . . . **127. *M. sogeriensis***
- b. Nerves less contrasting. Male buds  $\pm$  blunt, 4–6 mm long, verrucose ridges distinct; bracteole caducous. — Papua New Guinea (Gulf, Central, East Sepik, and Madang Prov.); foothill and montane forest; 300–1600 m . . . . . **52. *M. fugax***
- 109a. Lower leaf surface glabrous (or early glabrescent, or with scattered very minute pale hairs less than 0.1 mm), with distinct uniform and similarly shaped papillae (papillae may be less prominent in *M. insipida* and *M. lancifolia*) . . . . . 110
- b. Lower leaf surface glabrous (glabrescent), or pubescent; surface not or but faintly papillose (papillae either present but extremely small, very closely set and mutually appressed, or extremely irregular in shape and size) . . . . . 113
- 110a. Nerves making a comparatively sharp angle to the midrib, c. 45°. [Male flowers not known.] — S Central New Guinea . . . . . **101. *M. papillatifolia***
- b. Nerves with a wider angle to the midrib . . . . . 111
- 111a. Male buds narrow, 4–4.5 mm long, with hairs 0.1 mm; pedicel about as long as the perianth or somewhat shorter; androphore glabrous. [Anthers 5 or 6. Lateral nerves on lower leaf surface faint, comparatively dense.] — New Guinea: Papua Barat (Bird's Head, N Papua Barat); Papua New Guinea (E to Madang Prov.); also Moluccas . . . . . **78. *M. lancifolia***
- b. Male buds slender or not; pedicel considerably shorter than the perianth; androphore glabrous or pubescent in the lower half . . . . . 112
- 112a. Twigs delicate, 1–1.5 mm diam. Lateral nerves on lower leaf surface faint, comparatively dense. Male buds  $\pm$  slender, 3.5–5 mm long, 1.5–2 mm wide, with hairs 0.1 mm; androphore pubescent in the lower half; anthers 3 (or 4). — Papua New Guinea . . . . . **25. *M. concinna***
- b. Twigs 1–2 mm diam. Nerves distinct below, rather far apart. Male buds  $\pm$  ellipsoid-oblong, 4.5–6 mm long, 2–3 mm wide, with hairs (0.1–)0.2–0.4 mm; androphore glabrous or pubescent towards the base; anthers 6–8. [Fruits ellipsoid, 2.5–3.5(–3.8) cm long, hairs 0.3–1 mm.] — S New Guinea; also S Moluccas and N Australia . . . . . **70. *M. insipida***
- c. Twigs delicate, 1–1.5 mm diam.; nerves distinct below, far apart. [Fruits 3 cm long, subsessile, hairs 0.1 mm.] — Local endemic of southern Papua New Guinea . . . . . **13. *M. brachypoda***
- 113a. Leaves with c. 25 nerves per side, faint and closely set. [Male flowers not known.] — Rossel I. . . . . **98. *M. ovicarpa***
- b. Leaves with c. 10 nerves per side. [Male flowers not known.] — SW Papua Barat; lowland . . . . . **54. *M. fusiformis***
- c. Leaves with c. 20 nerves per side, or less . . . . . 114

- 114a. Vegetatively difficult to define, distinguishable by its fruit characters: fruits large,  $\pm$  pear-shaped, 6–7 cm long, with thick woody pericarp, 10 mm thick; fruiting pedicel short and thick, often wider than long, 6–9(–10) mm wide. — W Papua New Guinea ..... **45. *M. firmipes***
- b. Fruits generally (much) smaller, with less thick pericarp, and proportionally more slender peduncle. [Fruits not known in *M. schlechteri*.] ..... 115
- 115a. Leaves below with (sub)persistent, mostly dense indumentum ..... 116
- b. Leaves below glabrous or glabrescent, or late glabrescent, hairs scale-like, 0.1 mm or less. [Venation (sometimes faint) reticulate. Twigs angular or not.] 120
- 116a. Leaves 4–14 cm long. Male buds 3 mm long. — West New Guinea and Moluccas ..... **80. *M. lepidota* subsp. *lepidota***
- b. Leaves 10 cm long or more. Male buds, where known, 5 mm long or more 117
- 117a. Indumentum of lower leaf surface subsistent, of silky, appressed hairs; venation  $\pm$  trabeculate. [Twigs with two sharply raised lines. Male flowers not known.] — E Papua New Guinea (Northern Prov.); montane forest; 1600 m ..... **17. *M. byssacea***
- b. Indumentum more scaly or felty; venation reticulate or hardly visible .... 118
- 118a. Male buds 5 mm long. Indumentum of lower leaf surface felty, composed of short  $\pm$  stellate hairs of mixed sizes (check also *M. chrysophylla* and *M. lasiocarpa*). — Widespread (small-leaved forms; for differences see lead 167 in this key) ..... **72. *M. inutilis* and 130. *M. subcordata***
- b. Hairs on lower leaf surface 0.2–0.3 mm long. [Male flowers not known.] — Papua New Guinea (West Sepik Prov., Telefomin subprov.); c. 2000 m **23. *M. coacta***
- c. Indumentum of lower leaf surface dense, hairs very minute, scale-like. [Male flowers not known, species only distinguishable by fruit characters.] ..... 119
- 119a. Fruits 2 cm long; fruiting pedicel comparatively slender, 1.5 cm long. — Papua New Guinea (Madang Prov.) ..... **103. *M. pedicellata***
- b. Fruits larger; fruiting pedicel (peduncle) shorter. — Papuan Islands ..... **136. *M. tenuivenia***
- 120a. Leaves membranous, lateral nerves thin and faint on both surfaces, venation almost invisible; lower surface grey-white. Bark of older twigs corky, longitudinally fissured. [Male flowers not known.] — Local endemic of the border area in Central S New Guinea; c. 150 m ..... **90. *M. mediterranea***
- b. Leaves variable, nerves and venation below generally stouter, clearly visible. Bark of older twigs either smooth, striate, or flaking, but not corky ..... 121
- 121a. Species distinguishable by its fruits; small tree, 5 m, leaves drying greenish; fruits subsessile. [Male flowers not known.] — Local endemic of Papua New Guinea (Central Prov.); at low altitude. (Compare also *M. insipida*) **15. *M. brevistipes***
- b. Fruiting pedicel longer or thicker (fruits not known in some species) ..... 122
- 122a. Male buds much elongated, oblong or  $\pm$  tubiform (cylindrical), slender, (6–)7 mm long or more, at least 3 times longer than broad ..... 123
- b. Male buds variable in shape, ovoid, (narrowly) ellipsoid, or nearly tubiform, 7 mm long or less, at most 3 (or 4) times longer than broad ..... 132
- 123a. Flowers glabrous or almost so; androphore glabrous ..... 124
- b. Flowers sparsely or densely pubescent, sometimes hairs very minute, thus seemingly glabrous, occasionally with a few scale-like hairs towards the apex of the perianth only; androphore wholly or partly pubescent (lens!) ..... 125

- 124a. Male buds 8.5–11 mm long; bracteole persistent. — Papua Barat and western part of Papua New Guinea; lowland, up to 250 m . . . . . **139. *M. tubiflora***  
 b. Male buds 7 mm long; bracteole caducous. — Eastern Papua New Guinea (local endemic of Lae subprov.); 0–15 m . . . . . **44. *M. filipes***
- 125a. Lower leaf surface with nerves and venation (much) contrasting in colour 126  
 b. Nerves not much contrasting in colour; venation usually inconspicuous. [Male buds narrowed at the apex,  $\pm$  acute, perianth inside not warty.] — NW Papua Barat; Papua New Guinea . . . . . **149. *M. warburgii***
- 126a. Male flowers not known, but presumably perianth inside in the basal part not minutely warty. Two taxa, pending more material at present only satisfactorily separated on fruit characters . . . . . 127  
 b. Male buds  $\pm$  blunt; perianth inside in the basal part with thickened and minutely warty surface . . . . . 128
- 127a. Fruiting pedicel 10–15 by 2 mm. — Papua New Guinea (Eastern Highlands Prov.); c. 1000 m . . . . . **149. *M. warburgii* subsp. *hybrida***  
 b. Fruiting pedicel 25–35 by 1 mm. — N Papua Barat; c. 500 m . . . . . **58. *M. gracilipes***
- 128a. Twigs 1 mm diam. Pedicel of male flower 6–10 mm long, slender . . . . . 129  
 b. Twigs medium, 2–3 mm diam. Pedicel of male flower 5–7 mm long . . . . . 131
- 129a. Flowers with thick-woolly indumentum; synandrium subsessile. — Papua New Guinea (Morobe Prov.) . . . . . **120. *M. schlechteri***  
 b. Flowers with minute indumentum; synandrium long-stalked . . . . . 130
- 130a. Male buds 7–10 mm long, 2 mm wide; pedicel 7–10 mm long, bracteole caducous. — E Papua New Guinea . . . . . **111. *M. pumila***  
 b. Male buds 7 mm long, slender, 1(–1.5) mm wide, acute; pedicel 6 mm long, bracteole persistent. — E Papua New Guinea (Central Prov.) . **127. *M. sogeriensis***
- 131a. Plants from lowland and foothill areas, up to c. 300 m. Fruiting pedicel long. — E Papua New Guinea . . . . . **49. *M. flosculosa***  
 b. Plants from montane areas; 600–2000 m. Fruits without or with a short pseudostalk; fruiting pedicel short or medium-sized. — Throughout New Guinea . . . . . **30. *M. crassipes***
- 132a. Male buds 3.5–4.5 by 1 mm,  $\pm$  tubiform . . . . . 133  
 b. Male buds larger, 5–7 mm long, narrow or not. [Trees of variable sizes.] . 135
- 133a. Small tree or shrub, 1.5–8 m. [Anthers 3.] — E Papua New Guinea . . . . . **93. *M. nana***  
 b. Tree 10–35 m tall . . . . . 134
- 134a. Anthers 5. — W New Guinea, also Moluccas . . . . . **80. *M. lepidota* subsp. *montanoides***  
 b. Anthers 6–9. [Leaves usually more than 15 cm long; twigs  $\pm$  angular.] — Throughout New Guinea; lowland . . . . . **132. *M. sulcata***
- 135a. Leaves generally (thickly) chartaceous or coriaceous; tree of montane areas, c. 1000 m altitude or more . . . . . 136  
 b. Leaves generally membranous or (thinly) coriaceous; tree of lowland or submontane areas, up to 1000(–1500) m. [Bracteole small, caducous or not; androphore pubescent, often only in the lower half, or subglabrous.] . . . . . 138



- 136a. Flowers short-pubescent; bracteole apical ..... 137  
 b. Flowers almost glabrous; bracteole small, caducous, the scar 3 mm below the perianth. [Androphore glabrous or with extremely small hairs towards the base, thus seemingly glabrous. Leaves pale brown below, glabrous, nerves flat or sunken, not contrasting. Fruits ellipsoid or fusiform.] — E Papua New Guinea; montane forest ..... **76. *M. laevifolia***
- 137a. Bracteole (male flower) persistent; the androphore almost completely pubescent. Leaves pale below, indumentum consisting of minute scale-like hairs, late glabrescent; nerves distinct, contrasting in colour. — W Papua Barat (Wissel Lake area); 1600–1800 m ..... **148. *M. vinkeana***  
 b. Bracteole (male flowers) caducous; the androphore with scattered, extremely minute hairs less than 0.1 mm, or glabrous. Nerves on lower leaf surface contrasting in colour or not. [Fruits globose, with thick pericarp.] — E Papua New Guinea; 1600 m ..... **108. *M. polyantha***
- 138a. Leaves below pale, grey-glaucous, with darker contrasting nerves and coarsely reticulate venation. Male buds cleft 1/4–1/2. [Fruits with persistent short hairs 0.1–0.5(–0.8) mm.] — Widespread ..... **57. *M. globosa***  
 b. Leaves below pale or not; venation not much contrasting. Male buds cleft c. 1/6–1/2 ..... 139
- 139a. Male pedicel 1–3 mm long ..... 140  
 b. Male pedicel more than 3 mm long. [Bracteole persistent. Fruits short-haired.] . . . . . 141
- 140a. Indumentum of flowers short; bracteole caducous. [Fruits rough-haired.] — NE Papua Barat, N Papua New Guinea; lowland ..... **16. *M. buchneriana***  
 b. Indumentum of flowers conspicuously long-haired and woolly; bracteole minute, persistent. — E Papua New Guinea; lowland ..... **20. *M. chrysophylla***
- 141a. Petiole proportionally long, 20 mm. Bark of older twigs blackish, conspicuously cracking. Lower leaf surface with minute indumentum, late glabrescent. Androphore subglabrous ..... 142  
 b. Petiole usually shorter, 12–20 mm long. Bark of older twigs striate, rarely cracking. Lower leaf surface glabrous (early glabrescent). Androphore almost wholly or partially pubescent. — Moluccas; New Guinea: Papua Barat; Papua New Guinea (E to Sepik Prov., and Louisiade Archipelago) ..... **138. *M. tristis***
- 142a. Leaves oblong-lanceolate; lateral nerves faint below. Bracteole (male flower) small, much shorter than the perianth. — Papua Barat (Bird's Head); Papua New Guinea (Western Prov.); lowland ..... **7. *M. atrocorticata***  
 b. Leaves (elliptic-)oblong; nerves distinct below. Bracteole (male flower) about as long as the perianth, 4 mm. — Papua New Guinea (Western Prov.); swampy lowland forest ..... **71. *M. inundata***
- 143a. Inflorescences with a distinct, smooth peduncle, slightly flattened or not, (in male) 5 mm long or more; inflorescences branched or not ..... 144  
 b. Inflorescences (sub)sessile, a wart- or worm-like, simple or forked, scar-covered brachyblast, sessile or subsessile, or up to 5 mm pedunculate (e.g. in *M. sphaerosperma*) ..... 154
- 144a. Leaves glabrous or glabrescent below, or with sparse minute scale-like hairs not touching each other, not forming a dense felt-like layer (flossy hairs 1–2 mm long remaining on lower midrib in *M. uncinata*) ..... 145

- b. Leaves with persistent indumentum below, or late glabrescent, but some (short, dense) indumentum usually remaining on and near midrib . . . . . 152
- 145a. Leaves papillose below (lens!) . . . . . 146
- b. Leaves not papillose . . . . . 147
- 146a. [Flowers not known.] Peduncle of infructescence stout, 5–10 mm long, 4–6 mm thick, not flattened; fruits 5–6 cm long, pubescent. — Papua New Guinea (Western Prov.); lowland inland forest . . . . . **97. *M. ornata***
- b. Peduncle slender, 10–40 by 1.5–3.5 mm, ± flattened; fruits 2–3.5 cm long, glabrescent. [Mature male and female buds in the apical part not or but faintly angular.] — Widespread; mainly coastal . . . . . **121. *M. schleinitzii***
- 147a. Mature male and female buds not angular in cross section. Fruits variable 148
- b. Apical part of mature buds angular. Fruits 4.5–6 cm long, with minute indumentum, glabrescent. [Whole plant early glabrescent. Veins of leaf hardly visible.] — Northern Papua Barat . . . . . **55. *M. garciniifolia***
- 148a. Leaves whitish below, glabrescent except lower midrib. Leaf bud often uncinatate, densely pilose, hairs 1–1.5 mm long. Fruits 6–7 cm long, apex often uncinatate; indumentum dark brown, persistent, with hairs 1–1.5 mm [Male flowers not known.] — Papua New Guinea (Central Prov., near Boridi); 1300–1400 m . . . . . **143. *M. uncinata***
- b. Leaves glabrous below, whitish or brownish. Leaf bud straight, its indumentum and that of fruits shorter. — Papua New Guinea; lowland . . . . . 149
- 149a. Leaves conspicuously pale, whitish below. [Leaves (thinly) chartaceous; nerves flat and faint above, venation obscure on both surfaces. Hairs of leaf bud 0.5 mm. Male buds 7 mm long, obtuse; anthers 15. Fruits ± ellipsoid, 5–7 by (3–)4–4.5 cm, with rusty hairs 0.5–1 mm.] — Papua New Guinea (Morobe, Northern Prov.) . . . . . **142. *M. umbrosa***
- b. Leaves grey-brown below . . . . . 150
- 150a. Male buds with acute apex. [Leaves membranous; lateral nerves and venation moderately distinct above; hairs of leaf bud 0.3–0.5 mm. Male buds 8–10 mm long, anthers 12–14. Fruits oblong, ± fusiform, 4–4.5(–5) by 1.5–2 cm, with sub(persistent) rusty hairs (0.2–)0.5 mm.] — Papua New Guinea (SE Morobe, Northern Prov.) . . . . . **19. *M. carrii***
- b. Male buds with rounded apex . . . . . 151
- 151a. Male buds ellipsoid, 9–14(–16) mm long; anthers 12–20. Leaves membranous; lateral nerves and venation on lower leaf surface obscure; hairs of leaf bud 0.5–1 mm. Fruits 6–8 cm long, with minute brown indumentum, glabrescent. — Papua New Guinea (Morobe, Northern, Central, Milne Bay Prov., including Normanby) . . . . . **61. *M. hooglandii***
- b. Male buds ovoid-ellipsoid, 7 mm long, obtuse; anthers 8 or 9. Leaves thinly chartaceous; lateral nerves and venation contrasting below. Hairs of leaf bud 0.1 (–0.3) mm. Fruits 5–5.5 cm long, glabrous, green. — Manus I. **109. *M. psilocarpa***
- 152a. Upper surface of leaves drying blackish brown, lower surface with pale, whitish brown, floccose indumentum. Male buds ellipsoid or obovoid, 7–9 by 5–8 mm; pedicel 7–12 mm long. Fruits subglobose or ellipsoid, 3–5.5 cm long. [Pericarp 4–9 mm thick, with hairs (0.5–)1–1.5(–3) mm. Inflorescences sometimes grouped into synflorescences.] — Eastern Papua New Guinea . . **87. *M. markgraviana***

- b. Leaves drying brown or olivaceous-brown, lower surface brown-pubescent or glabrescent. Male buds ellipsoid-oblong, 8–10 mm long, narrower; pedicel 3–5 mm long. Fruits generally smaller. — Papuan Islands . . . . . 153
- 153a. Leaves subcordate at base; lower leaf surface with dense subpersistent indumentum. Sterile apex of synandrium consisting of protuberances 0.1 mm long only, equal in number to the anthers. Fruits 2–2.5 cm long, pericarp 1(–2) mm thick. — Rossel I. . . . . **65. *M. incredibilis***
- b. Leaves glabrescent, rounded at base, not cordate. Sterile apex of synandrium simple, 1 mm long,  $\pm$  acute. Immature fruits 3 by 2.5 cm, pericarp 5–6 mm thick. — Tagula I. . . . . **69. *M. inopinata***
- 154a. Leaves below either with persistent short-felty indumentum (hairs scale-like), or with persistent indumentum of conspicuous hairs; old leaves may have become glabrous. Fruits variously pubescent . . . . . 155
- b. Leaves below glabrous or glabrescent, or with  $\pm$  open indumentum, hairs minute, scattered (spaced), and seeming glabrous. Fruits pubescent or glabrescent. [Leaves below sometimes with dense scale-like hairs, late glabrescent, in *M. holrrungii*.] . . . . . 169
- 155a. Leaves below papillose (lens!) in between the spaced, to 1.5 mm long, dark brown hairs . . . . . 156
- b. Leaves either not or but indistinctly or irregularly papillose below; hairs contiguous, or much smaller . . . . . 157
- 156a. Twigs 4–5 mm diam. Hairs of lower leaf surface of mixed sizes, 0.5–1.5 mm long. Bracteole on female pedicel subapical. Fruits oblong, 6–7 cm long [dry pericarp 4–5 mm thick, hairs 1–1.5 mm.] — C & E New Guinea . **53. *M. fusca***
- b. Twigs 2.5–3 mm diam. Hairs of lower leaf surface mixed, of two types: short ones, 0.1 mm, intermixed with slender long ones, 1 mm. Bracteole on female pedicel about median. Fresh immature fruits said to be 7 by 5 cm. — Papua Barat (Bird's Head) . . . . . **64. *M. inaequalis***
- 157a. Indumentum of lower leaf surface felt-like, of two kinds of hairs, a dense layer of short matted hairs 0.1–0.2 mm, intermixed with numerous emergent hairs of variable sizes, the longest 1 mm or more, or indumentum composed of only long hairs 1 mm or more . . . . . 158
- b. Indumentum either dense, short, felt-like, or more open, or indumentum flocculose by longer emergent hairs less than 1 mm, or without emergent hairs . . . . . 161
- 158a. Fruits acorn-like, depressed at base, 2 cm diam. Leaves without sunken nerves. [Flowers not known.] — E Papua New Guinea; lowland . **113. *M. quercicarpa***
- b. Fruits different, not depressed at base. Leaves with nerves sunken on upper surface . . . . . 159
- 159a. Flowers and fruits with hairs 1 mm or more. — E Papua New Guinea; submontane or lowland . . . . . **20. *M. chrysophylla***
- b. Flowers and fruits with hairs 1 mm or less. Tree generally of montane areas 160
- 160a. Fruits large, globose, 6–9 cm diam.; fruiting pedicel short, 3–5 mm long. Leaves below with long hairs, 0.1–1(–2) mm. [Male flowers not known.] — Papua New Guinea (Eastern Highlands Prov.); montane forest at 800–2300 m . . . . . **151. *M. womersleyi***

- b. Fruits large, somewhat elongate, 6–8 cm long; fruiting pedicel longer, 7–15 mm long. Leaves below with shorter hairs, 0.1–0.2(–1) mm. — Northern part of New Guinea; (sub)montane forest; (300–)800–1800 m . . . **128. *M. sphaerosperma***
- 161a. Indumentum of lower leaf surface inconspicuous, consisting of a dense silvery-brown layer of very short, appressed scale-like hairs, sometimes late glabrescent (lens!). Fruits 2.5–3.5 cm long, with very short, mealy, grey-brown or yellowish brown hairs 0.1 mm or less, glabrescent. [Bark of older twigs often blackish, often flaking.] — S Papua Barat, Papua New Guinea; lowland . . . . . **144. *M. undulatifolia***
- b. Indumentum more conspicuous, hairs either minute, dense, or longer and dense to scattered . . . . . 162
- 162a. Leafy twigs stout, 4–8 mm diam. Male flowers large, firmly carnosose or leathery, buds 8 by 5 mm. Fruits large, 9–12 by 7–8.5 cm, pericarp 20 mm thick; aril small, the laciniae covering only the basal part of the seed. — Central Papua New Guinea; montane, 1200–1800 m . . . . . **67. *M. ingens***
- b. Twigs 2–6 mm diam. Flowers and fruits not as above. — Lowland or lower montane; 0–1200(–1800) m (*M. subcordata* var. *gigacarpa* at 1200–1800 m) . . . 163
- 163a. Fruits large, 6–8 cm long, pericarp 5–12 mm thick. — Northern part of New Guinea; (sub)montane . . . . . **128. *M. sphaerosperma***
- b. Fruits generally smaller, pericarp thinner (fruits not known in *M. simulans*) 164
- 164a. Male buds cleft nearly halfway. [Androphore distinctly shorter than the synandrium; anthers 6–10. Fruits 4–7 cm long.] — Moluccas and possibly Papua Barat . . . . . **43. *M. fatua***
- b. Male buds cleft 1/4–1/3 (or less). — New Guinea . . . . . 165
- 165a. Leaves below with weak indumentum of minute sparse grey hairs, largely glabrescent; venation on lower leaf surface indistinct. [Male buds 5–6 mm long; androphore much shorter than synandrium; anthers 7 or 8. Fruits 3–4.5(–6) cm long, with rough hairs 0.5–1 mm.] — Northern New Guinea; lowland . . . . . **16. *M. buchneriana***
- b. Leaves below with indumentum of densely interwoven hairs (hairs scale-like or not); venation on lower leaf surface obscured by indumentum . . . . . 166
- 166a. Male buds 8(–10) mm long, hairs 1 mm long; androphore much shorter than the synandrium, glabrous; anthers 7 or 8. [Flowers with hairs 1 mm. Fruits not known.] — E Papua New Guinea (endemic of Modewa I.) . . . . . **124. *M. simulans***
- b. Male buds 12 mm long or less, hairs 0.1–0.5 mm; androphore about (or nearly) as long as the synandrium, mostly (partly) pubescent . . . . . 167
- 167a. Leaves 12–24 cm long. Male buds ellipsoid-oblong, 3–4.5 mm long. [Bracteole persistent; anthers (3–)5. Fruits variable in size, 2.5–5 cm long; fruiting pedicel 1–3 mm long.] — Widespread . . . . . **72. *M. inutilis*** (subsp. ***papuana***)
- b. Leaves 12–35 cm long. Male buds larger . . . . . 168
- 168a. Male buds ± narrow, almost tubiform, (6.5–)7–8(–10) mm long; bracteole caducous; anthers 5 or 6; perianth towards base smooth inside. [Fruits (3.5–)4–5.5 cm long; fruiting pedicel 1–10 mm long (fruiting specimens can be confused with *M. inutilis*).] — Throughout New Guinea; lowland and lower montane . . . . . **130. *M. subcordata***

- b. Male buds  $\pm$  oblong, 10–12 mm long; bracteole (sub)persistent; anthers 8 or 9; perianth finely warty towards base inside. Fruits not known. — W Papua Barat (limestone) . . . . . **146. *M. verruculosa***
- 169a. Leaves papillose below. Bark of older twigs blackish, flaking. — Papua Barat, Papua New Guinea; lowland, scattered . . . . . **73. *M. kalkmanii***
- b. Leaves not or indistinctly papillose below. Bark of older twigs brown, not or inconspicuously flaking . . . . . 170
- 170a. Pedicel of male flowers 3 mm long or less. Fruits with conspicuous hairs 0.5 mm or more . . . . . 171
- b. Pedicel of male flowers more than 3 mm long. Fruits with much shorter hairs, persistent or glabrescent. [Twigs often lined or angled; no ant-swellings present.] . . . . . 172
- 171a. Pedicel of male flowers 2–3 mm long; flowers with hairs 0.2–0.3 mm. Fruits 3–4.5(–6) cm long, hairs 0.5–1 mm. — Northern part of New Guinea; lowland . . . . . **16. *M. buchneriana***
- b. Pedicel of male flowers 1–2 mm long; flowers with hairs 0.5–1.5 mm. Fruits 2.5–4.5 cm long, hairs 1.5–3 mm. — E Papua New Guinea; up to 430 m . . . . . **20. *M. chrysophylla* subsp. *entrecasteauxensis***
- 172a. Twigs (at least at apex) angled, 2–4 mm diam. Leaves usually dark brown. Male buds 4 mm long. Fruits subglobose or broadly ellipsoid, (3–)3.5–4 cm diam. — Papua Barat, Papua New Guinea; lowland . . . . . **132. *M. sulcata***
- b. Twigs subterete, often lined (often  $\pm$  hollow and somewhat lined, rarely faintly winged), not angled, 2–5(–10) mm diam. Leaves  $\pm$  olivaceous. Male buds 4–6 (–6.5) mm long. Fruits subglobose or (globose-)ellipsoid, 2.5–4.5(–5) cm long, often short pointed at the apex. — Widespread in New Guinea (incl. Bismarck Archipelago); lowland . . . . . **60. *M. hollrungii***
- c. Twigs  $\pm$  angled or winged, 4–8(–15) mm diam. Leaves olivaceous-brown. Male buds 10–13 mm long. Fruits  $\pm$  fusiform or ellipsoid, 5–7 cm long. — Bismarck Archipelago . . . . . **10. *M. bialata***

### 1. *Myristica agusanensis* Elmer

*Myristica agusanensis* Elmer, Leafl. Philipp. Bot. 8 (1915) 2775. — Type: *Elmer 13284*, Mindanao. For more references and synonyms see the subspecies.

Tree 10–20 m. *Twigs* 1.5–3 mm diameter, early glabrescent, hairs pale rusty, 0.1 mm; older twigs striate, not flaking; lenticels absent or few. *Leaves* membranous or thinly chartaceous, elliptic-oblong or oblong-lanceolate, 9–29 by 2.5–7.5 cm, base short-attenuate, apex gradually narrowed, acute-acuminate, or bluntish; upper surface olivaceous-brown, lower surface often greyish, pubescent or glabrescent, hairs lax or dense, 0.1 mm, with or without few scattered emergents 0.2–0.3 mm; papillose; dots absent; lateral nerves 10–18 per side, at (30–)45° to the midrib, above flat or sunken, below with lines of interarching and venation sometimes faint; petiole 10–30 by 1–2(–3) mm; leaf bud 10–15 by 1–1.5 mm, with hairs 0.1 mm. *Inflorescences* pedunculate, sometimes compound (see under the subspecies), axillary to leaves or to caducous cataphylls, with hairs 0.1–0.3 mm; bracts 1–1.5 mm, caducous; in male: twice branched, 3–6 by 3–5 cm, peduncle to 20 mm,  $\pm$  angled or flattened, branches usually subopposite, with clusters



Fig. 59. Inflorescences of some species of *Myristica*. — a. *M. hollrungii* Warb.; b. *M. fragrans* Houtt., female; c. *M. cornutiflora* J. Sinclair subsp. *cornutiflora*; d & e. *M. subalulata* Miq. var. *subalulata*, male & female [a: BW 9399 (Schram); b: Blume s.n.; c: BW 6413 (Kalkman); d: Hoogland 3982; e: NGF 11018]. — Scale bar for all = 2 cm. — See also Fig. 60.

of 2–7 flowers, buds of different sizes; female inflorescences: few-flowered, 1–1.5 cm long, peduncle 0.5–1 cm; flowers with dense grey-brown hairs 0.1–0.3 mm. *Male flowers*: pedicel slender, 2–3 mm, bracteole broadly ovate or subcircular, 1–1.5 mm, caducous; buds ellipsoid, not angled, 3(–3.5) by 2 mm, apex rounded, base attenuate to rounded, cleft 1/3, lobes suberect or spreading, 0.2–0.4 mm thick. Androecium 2.5 mm; androphore 1 mm, subglabrous or for the larger part with pale hairs less than 0.1 mm; synandrium ± oblong, (1–)1.5–2 by 0.6–0.7 mm, thecae 6–10, sterile apex blunt, to 0.1 mm, glabrous or with a few minute hairs, or central column to 0.2 mm hollowed. *Female flowers*: pedicel 1.5 mm; perianth (broadly) ovoid, 2 mm; ovary ovoid, 1.8 by 1 mm, appressed short-pubescent. *Fruits* single or in pairs, subglobose, ellipsoid or oblong, 3–4.7 by 2–3.5 cm, ± glabrescent, hairs rusty, 0.1 mm or less; pericarp 3–4 mm thick; seeds 2.5 cm; fruiting pedicel 3–5 mm.

Distribution — *Malesia*: Philippines (Luzon to Mindanao).



Fig. 60. Inflorescences of some species of *Myristica*. — a & b. *M. maxima* Warb., female & male; c. *M. umbellata* Elmer, male; d. *M. iners* Blume, female [a: Sinclair 10604; b: Ridley 3363; c: Elmer 12820; d: Endert 57 E IP 554]. — Scale bar for all = 2 cm. — See also Fig. 59.

KEY TO THE SUBSPECIES

- 1a. Leaves elliptic-oblong to oblong-lanceolate, 9–29 cm; lower surface ± late glabrescent, at first with dense woolly or arachnoid greyish stellate hairs, with a few emergent pale brown hairs. Male inflorescences axillary to leaves. Flowers with hairs 0.1–0.2 mm ..... a. subsp. *agusanensis*
- b. Leaves oblong-lanceolate to lanceolate, 9–13 cm; lower surface with scattered, minute brown scale-like hairs 0.1 mm or less. Male inflorescences sometimes axillary to reduced leaves, but then vegetative apical bud of twig present. Flowers with hairs 0.2–0.3 mm ..... b. subsp. *squamulosa*

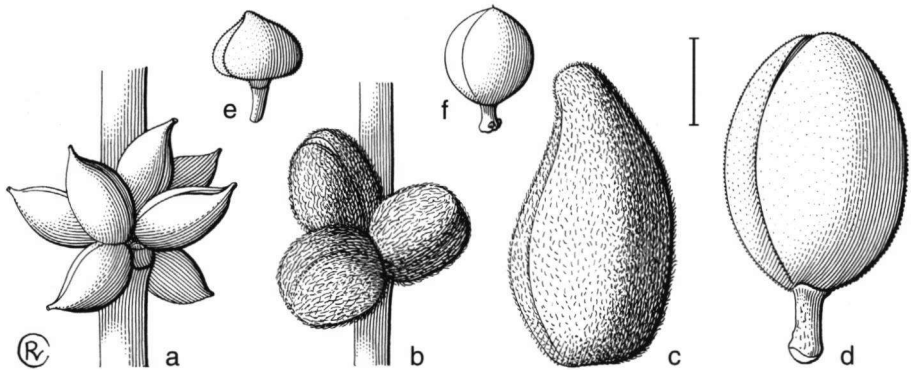


Fig. 61. Diverse forms of *Myristica* fruits. — a. *M. subalulata* Miq. var. *subalulata*. — b. *M. chrysophylla* J. Sinclair subsp. *chrysophylla*. — c. *M. villosa* Warb. — d. *M. fatua* Houtt. subsp. *fatua*. — e. *M. quercicarpa* (J. Sinclair) W.J. de Wilde. — f. *M. tristis* Warb. subsp. *tristis* [a: BW 5557 (van der Sijde); b: Hoogland 3642; c: SAN 15253; d: Kuswata & Soepadmo 14; e: NGF 1270; f: Hoogland 4393]. — Scale bar for all = 2 cm. — See also Fig. 62.

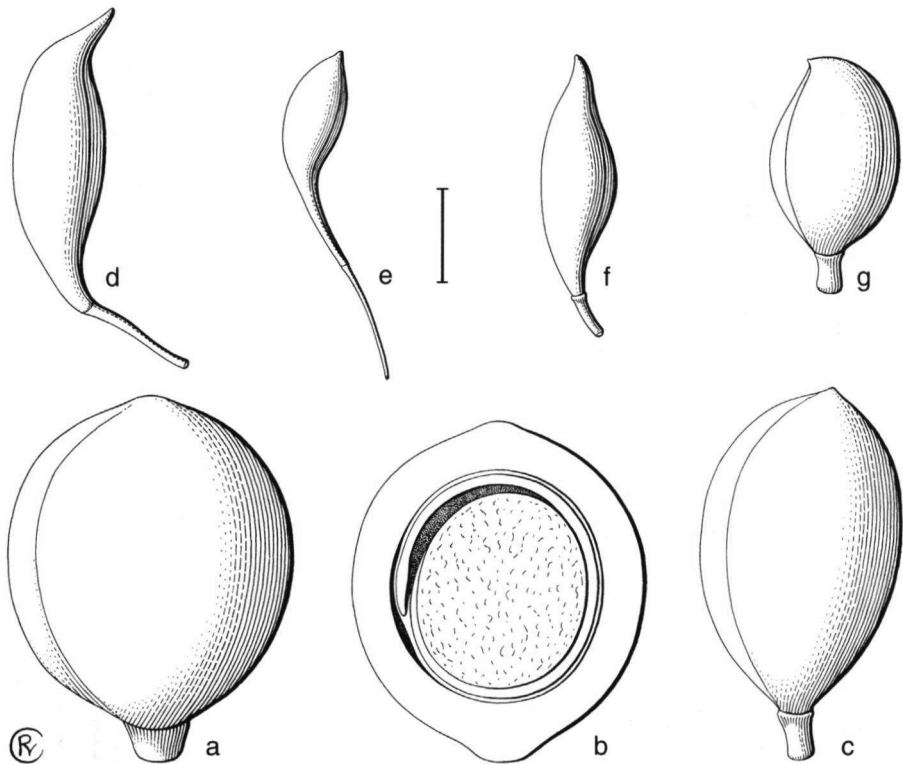


Fig. 62. Diverse forms of *Myristica* fruits. — a. *M. womersleyi* J. Sinclair; b. ditto, longitudinal section. — c. *M. maxima* Warb. — d. *M. fusiformis* W.J. de Wilde subsp. *pseudostipitata* W.J. de Wilde. — e. *M. pumila* W.J. de Wilde. — f. *M. laevifolia* W.J. de Wilde. — g. *M. crassipes* Warb. subsp. *crassipes* [a & b: Womersley 11374; c: FMS 12132 (Strugnell); d: von Römer 304; e: Hoogland 3971; f: Carr 13239; g: Carr 14897]. — Scale bar for all = 2 cm. — See also Fig. 61.



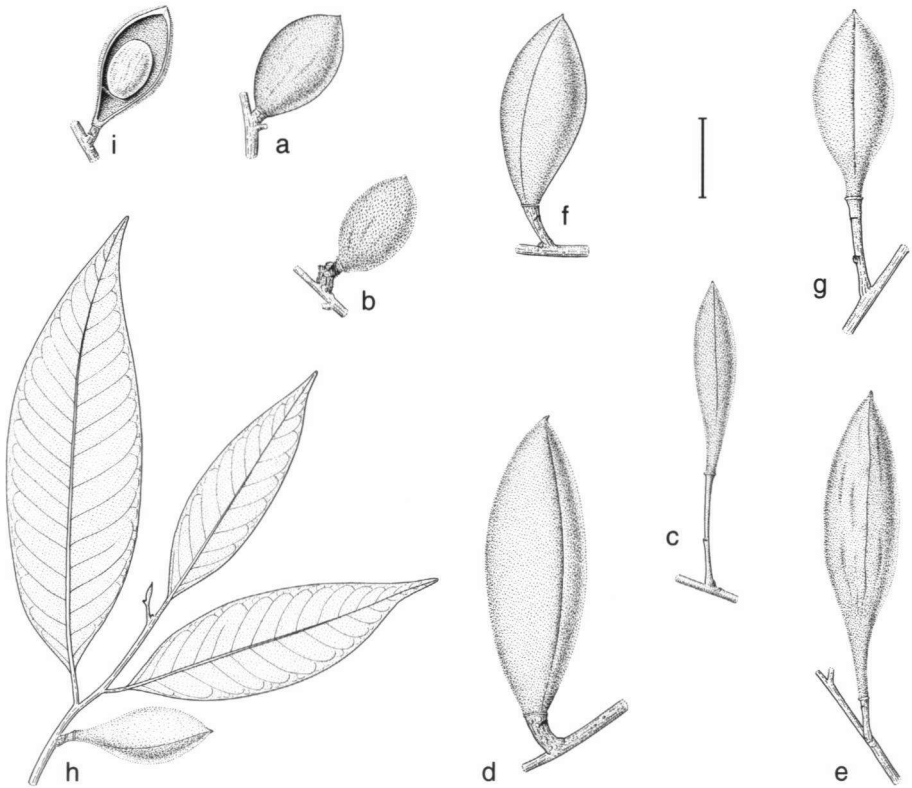
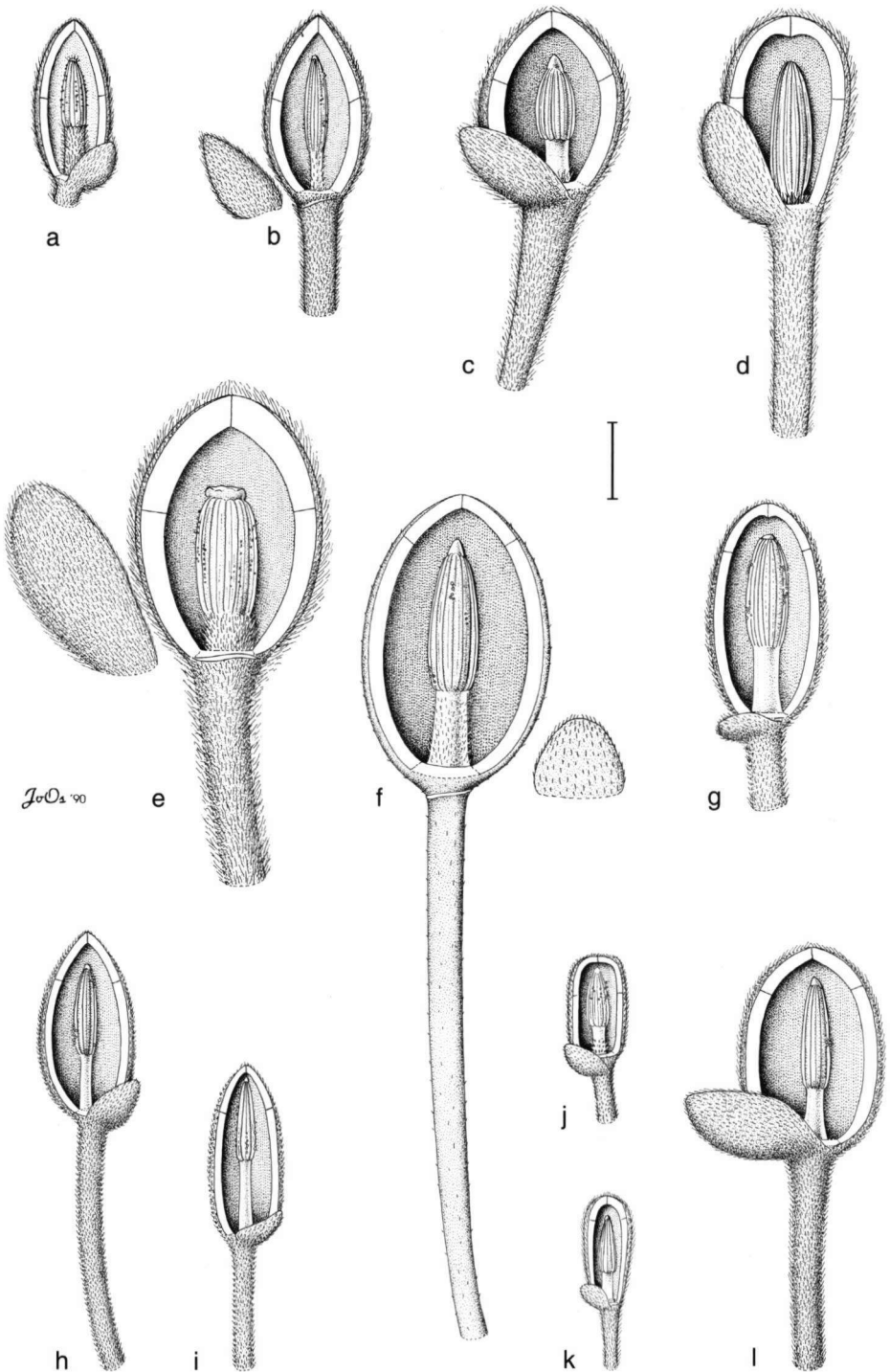
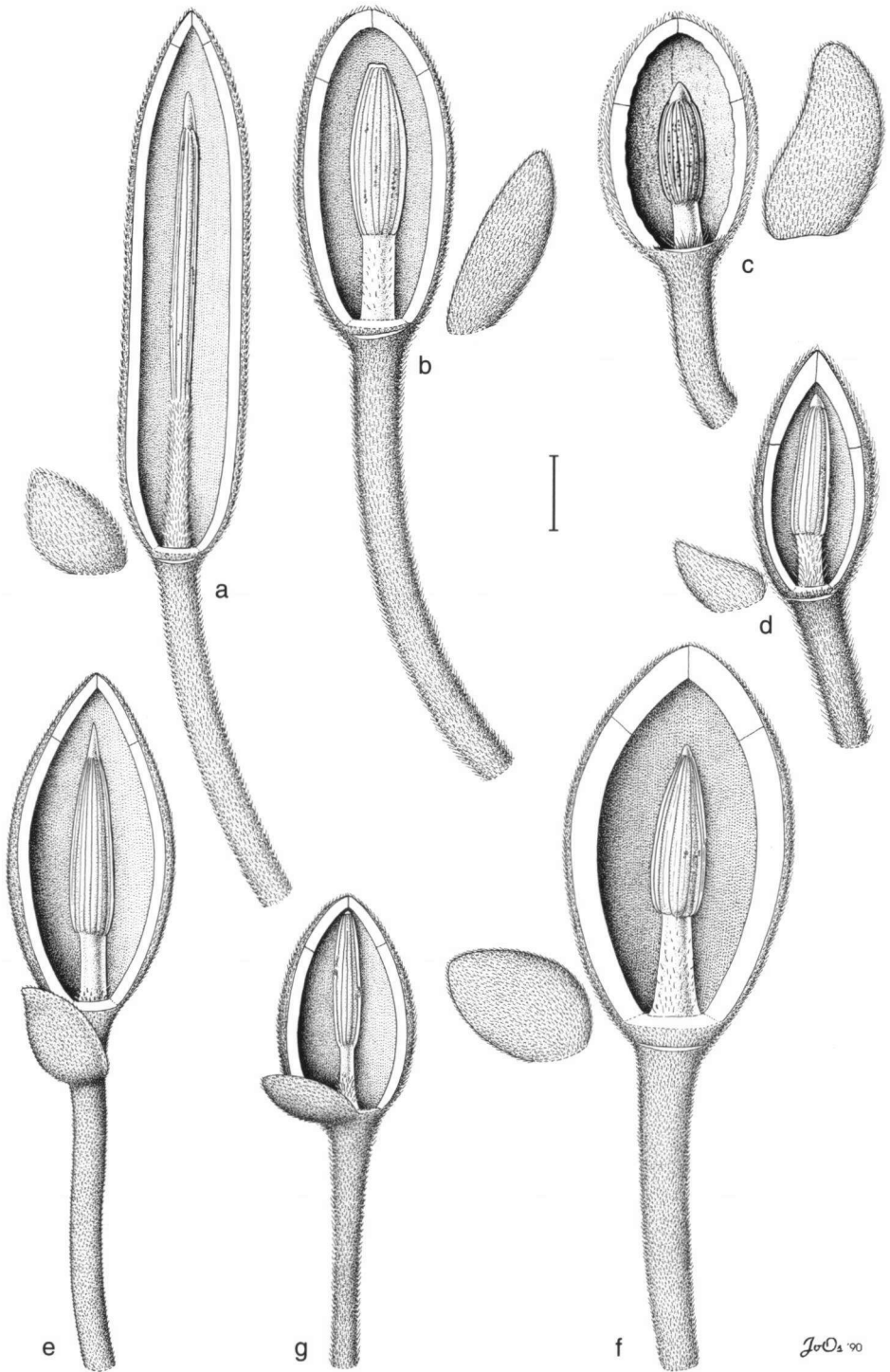


Fig. 63. Fruits of various small-leaved *Myristica* species. — a. *M. brachypoda* W.J. de Wilde, pericarp glabrescent [NGF 8079]. — b. *M. brevistipes* W.J. de Wilde, pericarp short-pubescent [Darbyshire 929]. — c. *M. flosculosa* J. Sinclair; note long slender fruiting pedicel, fruit with pseudostalk [Guillianetti in McGregor s.n.]. — d. *M. fusiformis* W.J. de Wilde subsp. *fusiformis*, pericarp largely glabrescent [Milliken 1408]; e. subsp. *pseudostipitata* W.J. de Wilde, fruit largely glabrescent; note pseudostalk [von Römer 304]. — f. *M. laevifolia* W.J. de Wilde, fruit glabrescent [Craven & Schodde 1073]. — g. *M. longipes* Warb., fruit minutely mealy pubescent; note stalked inflorescence [Schodde 2963]. — h. *M. sogeriensis* W.J. de Wilde, fruit minutely pubescent, with distinct pseudostalk; i. ditto, dry fruit, opened, showing seed [Forbes 396]. — Scale bar for all = 2 cm.

Fig. 64. Male flowers of *Myristica* species from the Moluccas. — a. *M. alba* W.J. de Wilde [de Vogel 3975]. — b. *M. bifurcata* (J. Sinclair) W.J. de Wilde subsp. *bifurcata* [Kostermans 944]. — c. *M. fatua* Houtt. subsp. *fatua* [Reinwardt s.n.]; d. ditto [de Vogel 3497, from Halmahera], deviating by the short androphore, completely fine-pubescent. — e. *M. fissurata* W.J. de Wilde [de Vogel 3836]. — f. *M. fragrans* Houtt. [de Vriese & Teijsmann s.n.]. — g. *M. insipida* R.Br. [Schodde in Hartley 13735, from Arnhem Land, N Australia]. — h. *M. lancifolia* Poir. subsp. *lancifolia* [Teijsmann 7585, from Bird's Head, Papua Barat]; i. subsp. *montana* (Roxb.) W.J. de Wilde [van Borssum Waalkes 3300]. — j. *M. lepidota* Blume subsp. *lepidota* [Aet 279, from SW New Guinea]; k. subsp. *montanoides* (Warb.) W.J. de Wilde [Beccari FI 7756]. — l. *M. mindanaensis* Warb. [Kuswata & Soepadmo 57]. — Scale bar for all = 2 mm. — See also Fig. 65.





**a. subsp. agusanensis**

*Myristica agusanensis* Elmer, Leafl. Philipp. Bot. 8 (1915) 2775; Merr., Enum. Philipp. Flow. Pl. 2 (1923) 178; J. Sinclair, Gard. Bull. Sing. 23 (1968) 218, f. 17, p. p.; W.J. de Wilde, Blumea 42 (1997) 146.

*Myristica laxiflora* Merr., Philipp. J. Sci. 17 ('Sept. 1920', Jan. 1921) 254; Enum. Philipp. Flow. Pl. 2 (1923) 179. — Type: *BS 15498 (Reillo)*, Basilan I.

*Myristica sorsogonensis* Elmer ex Merr., Enum. Philipp. Flow. Pl. 2 (1923) 178, in obs. sub *Myristica agusanensis* Elmer, nom. nud.; Elmer, Leafl. Philipp. Bot. 10 (1939) 3809, nom. nud.; Kew Index Suppl. 10 (1947) 149, nom. nud. — Voucher: *Elmer 16010*, Luzon.

*Leaves* elliptic-oblong to oblong-lanceolate, 9–29 by 2.5–7.5 cm, apex gradually attenuate, very tip ± blunt or acute; lower leaf surface late or early glabrescent, at first with dense woolly greyish stellate hairs 0.1–0.2 mm, often mixed with a few pale brownish, slightly emerging hairs. *Male inflorescences* solitary in the leaf axils, or compound, resembling those of *Horsfieldia* or *Gymnacranthera*, paniculate, 3–6 cm, with peduncle to 2 cm, the central branch with up to 6 lateral branches. *Flowers* with hairs 0.1–0.2 mm. *Female inflorescences* (from infructescences) paniculate, 1.5 cm. *Female flowers* not seen.

Field-notes — Tree branched at the apex in a dense crown, bark brown, flaking slightly in small portions; sap red. Perianth inside cream, rust-coloured outside (Sinclair, l. c.).

Distribution — *Malesia*: Philippines (except for Palawan).

Habitat & Ecology — Inland forests, at low altitudes (50 m); fl. July–Aug.; fr. throughout the year.

Note — Sinclair (l. c.) suggested that *M. agusanensis* and *M. guatteriifolia* are close, the former being a miniature replica of the latter, but this suggestion may not be warranted. *Myristica guatteriifolia* has larger male flowers, with a stouter androecium, more anthers, and a more hairy androphore, and the indumentum is much longer than that of *M. agusanensis*. *Myristica agusanensis* is not a coastal species like *M. guatteriifolia*.

**b. subsp. squamulosa** W.J. de Wilde

*Myristica agusanensis* Elmer subsp. *squamulosa* W.J. de Wilde, Blumea 42 (1997) 146. — *Gymnacranthera lanceolata* Merr., Philipp. J. Sci., Suppl. 1 (1906) 55; Elmer, Leafl. Philipp. Bot. 3 (1911) 1058 [non *Myristica lanceolata* Wall., Cat. (1832) n. 6794, nom. nud. = *Knema globularia*]. — *Myristica lancifolia* Merr., Enum. Philipp. Flow. Pl. 2 (1923) 178 [non *Myristica lancifolia* Poir. (1816)], nom. inval. — Type: *FB 3236 (Meyer)*, Luzon.

*Leaves* (oblong-)lanceolate, 9–13 cm, apex subacute or ± blunt; lower leaf surface with inconspicuous widely spaced bright brown scale-like hairs 0.1 mm long or less, late glabrescent. *Male inflorescences* axillary to normal leaves or (*Loher 6716*) axillary to caducous reduced leaves, and arranged in short shoot-like twigs ending in a vegetative

Fig. 65. Male flowers of *Myristica* species from the Moluccas. — a. *M. pubicarpa* W.J. de Wilde [*de Vogel 4000*]. — b. *M. robusta* W.J. de Wilde [*de Vogel 3918*]. — c. *M. sangowoensis* (J. Sinclair) W.J. de Wilde [*Whitemore c.s. TCW 3608*]. — d. *M. simiarum* A.D.C. subsp. *celebica* (Miq.) W.J. de Wilde [*Koorders 18161*]. — e. *M. subalulata* Miq. var. *subalulata* [Aet 16, exp. Lundquist, SW New Guinea]. — f. *M. succedanea* Blume [*de Vogel 3626*] — g. *M. tristis* Warb. subsp. *tristis* [*van Royen 3579*, Bird's Head, Papua Barat]. — Scale bar for all = 2 mm. — See also Fig. 64.

bud;  $\pm$  paniculate, peduncle 5–20 mm, central branch short, up to 5 mm, simple or with two lateral branches. *Flowers* with hairs 0.2–0.3 mm. *Female inflorescences* c. 1 mm, few-flowered. *Fruits* not seen.

Distribution — *Malesia*: N & C Philippines (Luzon, Sibuyan).

Habitat & Ecology — Lower montane forest; fl. Apr.–June.

Note — This subspecies was originally described by Merrill in *Gymnacranthera*, apparently on account of the small, ellipsoid flowers, and the inflorescences which are often compound (subsp. *agusanensis*) or grouped in short-shoots.

## 2. *Myristica alba* W.J. de Wilde

*Myristica alba* W.J. de Wilde, Blumea 35 (1990) 238, f. 1: 1. — Type: *de Vogel* 3975, Moluccas.

Tree 4–20 m. *Twigs* (1–)1.5–2.5 mm diameter, glabrescent, hairs dull brown, 0.1 mm; older twigs grey-brown, striate; lenticels present but inconspicuous. *Leaves* membranous or subcoriaceous, elliptic-oblong, 14–22 by 6–8.5 cm, base shortly attenuate or rounded, apex acute-acuminate, the very tip sometimes  $\pm$  blunt; upper surface glabrous, dark or blackish brown, lower surface greyish white (possibly due to irregularly shaped papillae), glabrescent, hairs widely spaced, stellate or scale-like, 0.1 mm long, the stouter hairs leaving minute dark scars (lens!); dots absent; midrib above slender, slightly raised, lateral nerves 12–15 per side, at 50–70° to the midrib,  $\pm$  sunken above, on the lower leaf surface bright dark (purplish) brown, contrasting with the whitish background; lines of interarching sometimes distinct, venation coarse, faint; petioles blackish, 7–14 by 2–3 mm; leaf bud 8–12 by 2 mm, hairs dense, dull brown, appressed, 0.1–0.3 mm. *Inflorescences* between the leaves, of the *Knema*-type, sessile, brachyblasts to 5 mm, slender, with brown hairs 0.3 mm; bracts 1 mm, caducous; in male: with 1–4 flowers, buds of different sizes; female inflorescences (from infructescences): similar to males; flowers with dull brown  $\pm$  appressed hairs 0.2–0.3 mm. *Male flowers*: pedicel 0.5–1 mm, bracteole broadly rounded or reniform, 1–1.5 mm, persistent; buds ellipsoid-oblong, 3.5–4 by 1.5 mm, apex acutish, not angled, base  $\pm$  rounded, cleft 1/3–1/2, lobes 0.2–0.3 mm thick. Androecium 3 mm; androphore 1.5 mm, hairs dense, pale brown, curved, 0.3–0.5 mm; synandrium cylindrical, 1.5–1.7 by 0.6–0.7 mm, thecae c. 8, sterile apex minute, irregularly lobed, 0.1 mm, glabrous or with a few pale hairs 0.2 mm. *Female flowers* not seen. *Fruits* solitary, subsessile, variable in shape (see note 2), ellipsoid-oblong or subglobose (when slightly immature), 3–4.2 by 2.5 cm, apex sometimes shortly beaked, at base contracted into a thick, 3–5 mm long pseudostalk; hairs dense, scurfy or  $\pm$  woolly, 0.1 or 0.5 mm (see note 2); pericarp conspicuously woody, 5 mm thick; seeds not seen; fruiting pedicel 3 mm. — **Fig. 64a.**

Field-notes — Low solitary tree, bole to 30 cm diameter. Leaves whitish glaucous below. Flowers yellow.

Distribution — *Malesia*: Moluccas (Bacan, Obi, Buru).

Habitat & Ecology — Primary forest with some undergrowth on deep clayey soil with scattered limestone boulders, forest on flat land along river, or on steep sloping terrain, on limestone; 100–500 m altitude; fl. Nov.; fr. Aug., Dec.

Notes — 1. Resembles *M. pubicarpa* from the same area, *M. nivea* from the Philippines, and *M. impressa* and *M. impressinervia* from Sulawesi, all having whitish leaves below, later on becoming finely dark-punctate by hair scars (lens!). *Myristica alba* dif-

fers from these species in its small, nearly sessile, elongate male flowers. Both fruiting collections of *M. alba* have the fruits conspicuously contracted at the base into a short pseudostalk.

2. The specimen *bb 23157* has ellipsoid fruits with dense curly woolly hairs 0.5(–1) mm. *Nooteboom 5369* (Buru) has almost globose fruits, 2.5 cm diameter, with a 3–5 mm long pseudostalk; the scurfy hairs are very short, 0.1 mm. More collections are needed to judge the taxonomic significance of these differences.

### 3. *Myristica archboldiana* A. C. Sm.

*Myristica archboldiana* A. C. Sm., J. Arnold Arbor. 22 (1941) 73; J. Sinclair, Gard. Bull. Sing. 23 (1968) 329, f. 47; Foreman, Handb. Fl. Papua New Guinea 1 (1978) 186; W. J. de Wilde, Blumea 40 (1995) 259. — Type: *Brass 6982*, Papua New Guinea.

Tree 30 m. *Twigs* coarsely striate, 2–3.5 mm diameter, blackish, early glabrescent, hairs less than 1 mm, grey-white; older twigs grey-brown, 5–6 mm diameter, coarsely striate, then cracking, fissured and flaking; lenticels not apparent. *Leaves* thinly chartaceous, elliptic-oblong or obovate-oblong, 8–15 by (3–)5–7 cm, base shallowly cordate, rounded, or short-attenuate, apex bluntish or shortly acute-acuminate; upper surface dull blackish brown, glabrous, lower surface (greyish) rusty, largely pubescent, hairs dense, scale-like, 0.1 mm or less; not papillose; dots absent; midrib slender, in a shallow groove above, lateral nerves 16–21 per side, at 60–70° to the midrib, slender and faint, sunken above, not much contrasting below, lines of interarching and venation indistinct; petiole comparatively long, 20–30(–40) by 1.5–2 mm, blackish, glabrous; leaf bud 15–20 by 2–3 mm, hairs dense, appressed, grey (whitish), 0.1 mm or less. *Male and female flowers* not seen. *Inflorescences* (from infructescences) between the lower leaves, peduncle 15–20 mm, coarsely fissured and lenticellate. *Fruits* (1 or) 2 or 3 per infructescence, ovoid-oblong, 6.7–7 by 4 cm, apex rounded, tip slightly oblique, ± blunt, base narrowed (pseudostalk absent), hairs mealy, dense, rusty, 0.1 mm; pericarp smooth, 10 mm thick (towards the base nearly 20 mm thick); seeds (nearly mature) ellipsoid, 2.5–3 cm; fruiting pedicels ± thick, 3(–5) mm long, bracteole scar not seen.

*Field-notes* — Large canopy tree with straight bole spurred at base; bark pale brown, lenticellate, reddish when cut. Leaf blades brown below, ribbed above with impressed nerves. Fruits rufous-brown, aril yellow.

*Distribution* — *Malesia*: Papua New Guinea (Western Prov., at Palmer River, 2 miles below junction with Black River); known only from the type.

*Habitat & Ecology* — Common in forest along lower ridges; 100 m altitude; fr. June.

*Note* — *Myristica archboldiana* is easily distinguishable from other members of the group of species with smaller leaves by its usually cordate leaves that are pubescent below, and its relatively long petiole and the thick-walled fruits. Sinclair (l.c.: 331) suggested a relationship with *M. pedicellata* and *M. tenuivenia* on account of the indumentum on the lower leaf surface and mode of venation, but these species have sessile scar-covered inflorescences.

### 4. *Myristica arfakensis* W. J. de Wilde

*Myristica arfakensis* W. J. de Wilde, Blumea 40 (1995) 259. — Type: *Kostermans 2440*, Irian Jaya, Bird's Head.

Tree 6–10 m. *Twigs* 1–1.5(–2) mm diameter, slightly angular, glabrescent, hairs 0.1 mm or less, grey-brown, scale-like; older twigs blackish, striate, but not cracking or flaking; lenticels not apparent. *Leaves* chartaceous or subcoriaceous (brittle),  $\pm$  ovate-elliptic or oblong, 5–12 by 1.5–5 cm, base (short-)attenuate, apex up to 1 cm acute-acuminate; upper surface brown, lower surface bright brown, early glabrescent; not papillose; dots distinct; midrib slender, raised above, lateral nerves 10–15 per side, at 60–70° to the midrib, slender, sunken above, little raised or  $\pm$  flat below, generally with inter-secondary nerves, lines of interarching and venation indistinct; petiole 8–15 by 1–1.5 mm; leaf bud acute, 5–10 by 1–1.5 mm, hairs brown-grey, less than 0.1 mm. *Inflorescences* axillary or to 4 mm supra-axillary, between the leaves or below, early glabrescent, indumentum minute, peduncle slightly flattened, smooth, 5–10 by 1–1.5 mm, ending in a short scar-covered brachyblast; bracts minute, minutely pubescent, late caducous; male inflorescences: brachyblast to 13 mm long, flowers 1–4, buds of different sizes; female inflorescences: 1- or 2- (or 3-)flowered; flowers with sparse brown-grey hairs 0.1 mm or less. *Male flowers*: pedicel 3–4 by 0.5 mm, bracteole broadly ovate, 0.5(–1) mm, caducous; buds  $\pm$  ellipsoid-oblong, somewhat parallel-sided (or faintly narrowed in the middle), 3.5–4 by (1.5–)2 mm, apex  $\pm$  blunt, not angled, base broadly rounded, cleft 1/4–1/3, lobes  $\pm$  membranous, 1.5 mm long, 0.3 mm thick. Androecium 3–3.5 mm; androphore 1.5–2 by 0.5–0.6 mm, glabrous; synandrium ellipsoid-oblong, 1.5 by 0.6–0.7(–0.8) mm, thecae 10–12, not tightly appressed, sterile apex subtruncate, 0.2 mm. *Female flowers* not seen. *Fruits* generally solitary, ellipsoid-oblong, 3 by 1.5 cm, apex acute, base contracted into a pseudostalk up to 5 mm long, hairs dull-brown, scurfy, less than 0.1 mm; pericarp 1(–2) mm thick; seeds ellipsoid-oblong, 2.3 cm; stalk (including fruiting pedicel) slender, 1–1.5 cm, bracteole scar 2–3 mm below the apex.

Field-note — Flowers whitish.

Distribution — *Malesia*: Papua Barat (NE Bird's Head, Arfak Mts).

Habitat & Ecology — Mountain forest at 1000–1800 m altitude; fl. Oct.; fr. May.

Note — Obviously related to *M. pachyphylla*, with which it has the brown-black dots on the lower leaf surface and the general habit in common, but in *M. pachyphylla* the dots are small, while in *M. arfakensis* they are readily visible with the naked eye. *Myristica pachyphylla* furthermore differs in its larger, more elongate male flowers and larger fruits (4 cm).

## 5. *Myristica argentea* Warb.

*Myristica argentea* Warb., Bot. Jahrb. Syst. 13 (1891) 311; Die Muskatnuss (1897) 347; Mon. Myrist. (1897) 446; K. Heyne, Nutt. Pl. Ned. Indië (1927) 638; Burk., Dict. Econ. Prod. Malay Penins. (1935) 1523; Markgr., Bot. Jahrb. Syst. 67 (1935) 165; J. Sinclair, Gard. Bull. Sing. 23 (1968) 235, f. 20; Foreman, Handb. Fl. Papua New Guinea 1 (1978) 187; W.J. de Wilde, Blumea 40 (1995) 260. — Type: *Warburg 20717*, West New Guinea.

*Myristica finschii* Warb. [Bot. Jahrb. Syst. 13 (1891) 311, as sp. nov. aff. *Myristica buchneriana*], Mon. Myrist. (1897) 534, p. p.; K. Schum. & Laut., Fl. Schutzgeb. Südsee (1900) 328, p. p. — Type: *Warburg 20715*, n.v.; according to Markgraf (l.c.: 169), *M. finschii* consisted of a separate fruit of *M. fatua* var. *papuana* and a leafy twig of *M. argentea*.

Tree 5–20(–40) m. *Twigs* 1.5–2 mm diameter, with minute indumentum, early glabrescent; older twigs 3–5 mm diameter, grey-black, coarsely striate, with cracks and conspicuous raised pustulate lenticels. *Leaves* membranous, elliptic-oblong to oblong

(-lanceolate), 9–25 by 3–10 cm, base broadly to narrowly attenuate, apex acute-acuminate; upper surface olivaceous, lower surface silvery (brownish), seemingly glabrous, with a  $\pm$  rough cobweb-like texture, hairs scattered, grey or pale brown, scale-like, less than 0.1 mm; not papillose; dots absent; midrib above slender, slightly raised above, raised below, bright-brown, contrasting in colour with the silvery lower surface of the blade, lateral nerves 9–17 per side, at (45–)60° to the midrib, slightly sunken above, lines of interarching distinct or not, venation fine,  $\pm$  scalariform, faint on both surfaces; petiole 10–20 by 1.5–2.5 mm; leaf bud somewhat curved,  $\pm$  oblique, 6–10 by 1 mm, hairs 0.1 mm or less. *Inflorescences* axillary or to 5 mm supra-axillary, among the leaves, sometimes axillary to reduced caducous leaves, early glabrescent, paniculate; in male: 3–5 cm, peduncle slender,  $\pm$  flattened, (5–)10–30 mm long, ending in one central flower and two lateral brachyblasts to 20 mm, with scars of fallen bracts and pedicels, each ending in a loose cluster of 2–5 flowers, buds of different sizes; female inflorescences: peduncle 5–10(–15) mm, ending in a single stout-pedicelled flower; flowers with scattered appressed dark brown hairs less than 0.1 mm, denser towards the apex. *Male flowers*: pedicel slender, 10–17 by 0.6–1 mm, bracteole as a low collar 1 mm high, caducous, leaving a narrow ring-shaped scar; buds ovoid-oblong or ellipsoid-oblong, 11–12 by 5–5.5 mm, apex subobtuse, not angled, base broadly to narrowly rounded, cleft 1/6, lobes at anthesis  $\pm$  erect, 0.3 mm thick. Androecium slender, 8–9.5 mm; androphore 3 by 0.5–0.7 mm, subglabrous or hairs pale, less than 0.1 mm, scattered towards the base; synandrium oblong, 5–6.5 by (1–)1.5–2 mm, thecae c. 15, sterile apex 0.3 mm. *Female flowers*: pedicel straight, stout, 8–12 by 1–1.5 mm, with scattered wart-like lenticels; buds ovoid-oblong, narrowed towards the apex, 8–10 by 5–5.5 mm, cleft 1/4–1/5, lobes 2(–2.5) mm long; ovary fusiform or flask-shaped, 6 by 2–2.5 mm, gynophore 1 mm, all densely minutely grey-brown pubescent. *Fruits* solitary,  $\pm$  ellipsoid-fusiform, 6.5–7.5 by 3.5–4.5 cm, apex narrowed, base somewhat contracted into a pseudostalk, 3–8 mm long, early glabrescent, brown, usually set with conspicuous coarse pale pustules or lenticels; seeds 4 cm; fruiting pedicel 8–18 mm.

Field-notes — Stilt-roots sometimes present. Perianth greenish white, with scattered brown hairs. Mature fruits yellow or brown with brown pustules, 8 by 5–5.5 cm.

Distribution — *Malesia*: Papua Barat (W Bird's Head, Mt Cluer Bay area, Geelvink Bay), locally endemic; elsewhere cultivated, e.g. in the Moluccas (Seram).

Habitat & Ecology — Primary forest, sloping forest; on sandy clay over limestone; 0–250 m altitude; fl. June; fr. May, Aug.

Uses — Cultivated in W New Guinea for its aromatic mace; the nut is less aromatic as compared to that of *M. fragrans*, but is said to be used medicinally, especially in Java.

Notes — 1. Clearly related to *M. fragrans*, but easily distinguishable by its somewhat larger leaves with silvery undersurface and the coarsely lenticellate-pustulate twigs.

2. Some variation has been found in *BW 6346 (Kalkman)*, with the male buds broadly rounded at the base and a grooved disc-like thickening around the insertion of the androphore, features not found in e.g. *Atasrip 707*.

## 6. *Myristica atrescens* W. J. de Wilde

*Myristica atrescens* W. J. de Wilde, Blumea 40 (1995) 260. — Type: *Soengeng Reksodihardjo 424*, SE Irian Jaya.



Tree 20 m. *Twigs* 1.5–2(–2.5) mm diameter, glabrescent, hairs (pale) brown, 0.1 mm; older twigs blackish brown, coarsely striate, tending to crack longitudinally, not flaking; lenticels indistinct. *Leaves* thinly chartaceous (but conspicuously brittle when dry), elliptic-oblong, 7–12 by 3–5.5 cm, base short-attenuate to broadly rounded, apex broadly acute(–acuminate) with blunt tip; upper surface dark (olivaceous to) brown, glabrous, lower surface dark brown, glabrous; not papillose; dots absent; midrib slender, raised above, lateral nerves 10–13 per side, at c. 60° to the midrib, slender, flat and faint above, slightly raised, concolorous below, lines of interarching and venation (a coarse network) indistinct; petiole 12–15 by 1.5 mm; leaf bud 8–10 by 1.5 mm, hairs dense, appressed, yellow-brown, 0.2(–0.3) mm. *Inflorescences* among the leaves, glabrescent, hairs 0.1–0.2 mm; in male: peduncle 5–7 mm, ending in a short scar-covered brachyblast 1 mm, buds 2 or 3, of different sizes, hairs greyish, 0.1 mm; bracts minute, caducous. *Male flowers*: pedicel 4 by 0.3–0.4 mm, bracteole ovate-ellipsoid, 1 mm, persistent; buds membranous, ovoid-oblong, 4–4.2 by 2–2.2 mm, apex ± blunt, not angled, base broadly rounded, cleft 1/4, lobes 1 mm long, 0.2 mm thick, at anthesis ± curved outwards. Androecium 4 mm; androphore 1.5 by 0.4 mm, glabrous but drying with an irregularly warty surface; synandrium 2 by 0.5 mm, thecae 12–14, sterile apex ± blunt, 0.2–0.3 mm. *Female flowers* and *fruits* not seen.

Field-notes — Tree, 20 m tall, diameter 15 cm, bark smooth, dark brown, 0.3 mm, live bark light brown, with scanty red sap. Flowers pale green.

Distribution — *Malesia*: SE Papua Barat (border of Western Prov. in Papua New Guinea: at Ingembit, road to Opka), known only from the type.

Habitat & Ecology — Lowland forest; fl. June.

Note — Noticeable for a number of unique features: small leaves with faint nerves, blades glabrous below with neither dots nor papillae, inflorescences pedunculate, perianths small, 4 mm. The leaves dry conspicuously dark, to a blackish brown colour. Superficially *M. atrescens* resembles *M. tristis*, but that species has sessile inflorescences, larger male perianths and a (partly) pubescent androphore. The androphore in *M. atrescens*, as seen in the boiled-up flowers, has a peculiar warty-bullate surface, which may be an artefact.

## 7. *Myristica atrocorticata* W. J. de Wilde

*Myristica atrocorticata* W. J. de Wilde, Blumea 40 (1995) 261. — Type: NGF 33391, Papua New Guinea, Western Prov.

Tree 25–30 m. *Twigs* 1.5–3 mm diameter, drying often ± 2- or 3-angled, grey or (blackish) brown, glabrescent, hairs grey-brown, 0.1 mm or less; older twigs blackish brown, coarsely longitudinally cracking and flaking; lenticels few, conspicuous or inconspicuous, or absent. *Leaves* chartaceous (to thinly coriaceous), oblong-lanceolate, 6–15 by 1.5–3.5 cm, gradually narrowed to the acute apex, base broadly attenuate or rounded; upper surface olivaceous or (dark) brown, dull, lower surface grey-brown or light brown, dull, early or late glabrescent, hairs ± dense, brownish, scale-like or stellate, 0.1 mm or less (lens!); not distinctly papillose; dots absent; midrib slender, flattish above, lateral nerves 16–21 per side, at 60–70° to the midrib, flat and very faint above, faint, not contrasting below, lines of interarching and venation indistinct; petiole proportionally long, (13–)15–22 by 1.5–2 mm; leaf bud 10–15 by 1.5–2 mm, hairs grey(-brown), appressed,

0.1 mm or less. *Inflorescences* between and below the leaves, sometimes on the older wood, of the *Knema*-type, brachyblast sessile, short, simple, to 3 mm, densely rusty pubescent, with 5–15 flowers in a loose apical cluster, buds  $\pm$  equal in size; flowers with dense dark brown hairs 0.1 mm. *Male flowers* (immature): pedicel slender, 3–5 mm, bracteole ovate or rounded, 1 mm, (sub)apical, persistent; buds ovoid to broadly ellipsoid, 3 by 2–2.2 mm, rounded at apex and base, cleft 1/3, lobes 1 mm long, 0.3 mm thick. Androecium broad-cylindrical, 2 mm; androphore 0.3 by 0.6 mm (to 1 mm long at anthesis), glabrous except for a few scattered pale hairs less than 0.1 mm; synandrium 1.7 by 0.7–0.8(–1) mm, thecae c. 15, sterile apex  $\pm$  blunt or truncate, 0.1–0.2 mm. *Female flowers* (NGF 33391): pedicel straight, 4–5 by 1 mm, bracteole ovate, nearly 1 mm, subapical; buds ovoid, 4 by 3 mm, the apical part narrowed into a  $\pm$  blunt apex, base broadly rounded, cleft 1/3, lobes 1.4 mm long; ovary long-ovoid, 2.2–2.5 by 1.8 mm, hairs dense, golden-brown, appressed, 0.2–0.3 mm. *Fruits* not seen, fructescences probably with several fruits, judged from the many-flowered female inflorescences.

Field-notes — Occasional or locally common tall forest tree, 30 m or more tall. Trunk (*Brass* 7079) raised on short flying or prop-roots, or without buttresses (*BW* 122951). Bark blackish, scaly, hard, or longitudinally fissured or not; underbark olive or light brown; inner bark red with red sap; wood white or pink. Leaves (*NGF* 31774) yellow green above, rusty below. Flowers yellow.

Distribution — *Malesia*: Central New Guinea (Papua New Guinea: upper Fly River area); West New Guinea (Bird's Head: Warsamson River valley, E of Sorong).

Habitat & Ecology — Lowland forest, on low ridges near river, forest on well-drained flat land, on podzol (with *Myrtaceae*, *Vatica*, *Camptosperma*), and in valley swamp forest; 30–160 m altitude; fl. June, July.

Note — *Myristica atrocorticata* is known only from a female flowering specimen and two male flowering specimens with immature flowers; fruits are not known. It resembles the variable and widespread *M. tristis* but is readily distinguishable by the conspicuously cracking blackish bark of the older twigs, the comparatively long petioles, the faint nervation, and the late glabrescent undersurface of the leaves with inconspicuous minute scale-like hairs (but especially densely haired in *Brass* 7079). Superficially the present species may be confused with *M. firmipes*. *Myristica inundata* is similar as well; for differences see under that species.

## 8. *Myristica basilanica* W.J. de Wilde

*Myristica basilanica* W.J. de Wilde, *Blumea* 42 (1997) 148. — Type: *FB* 18928 (*Miranda*), Philippines.

Tree. *Twigs* 2.5–3 mm diameter, yellowish brown; older twigs conspicuously cracking and flaking; lenticels absent or not apparent. *Leaves* membranous, (elliptic-)oblong, 11–22 by 5–7.5 cm, base rounded or short-cuneate, apex acute-acuminate or  $\pm$  blunt; upper surface olivaceous, lower surface pale greenish yellow, early glabrescent, hairs scattered, pale, 0.1 mm or less, hair scars pale brown; papillose; dots absent; midrib flat above, lateral nerves (10–)13–17 per side, at (45–)60–80° to the midrib, sunken above, yellowish, much raised below, lines of interarching and coarsely reticulate venation yellowish, distinct; petiole 15–25 by 2–3 mm, yellow-brown; leaf bud 10–15 by 3–3.5 mm, hairs appressed, dull (grey-)brown, 0.2–0.3 mm. *Inflorescences* (female) (sub)sessile,

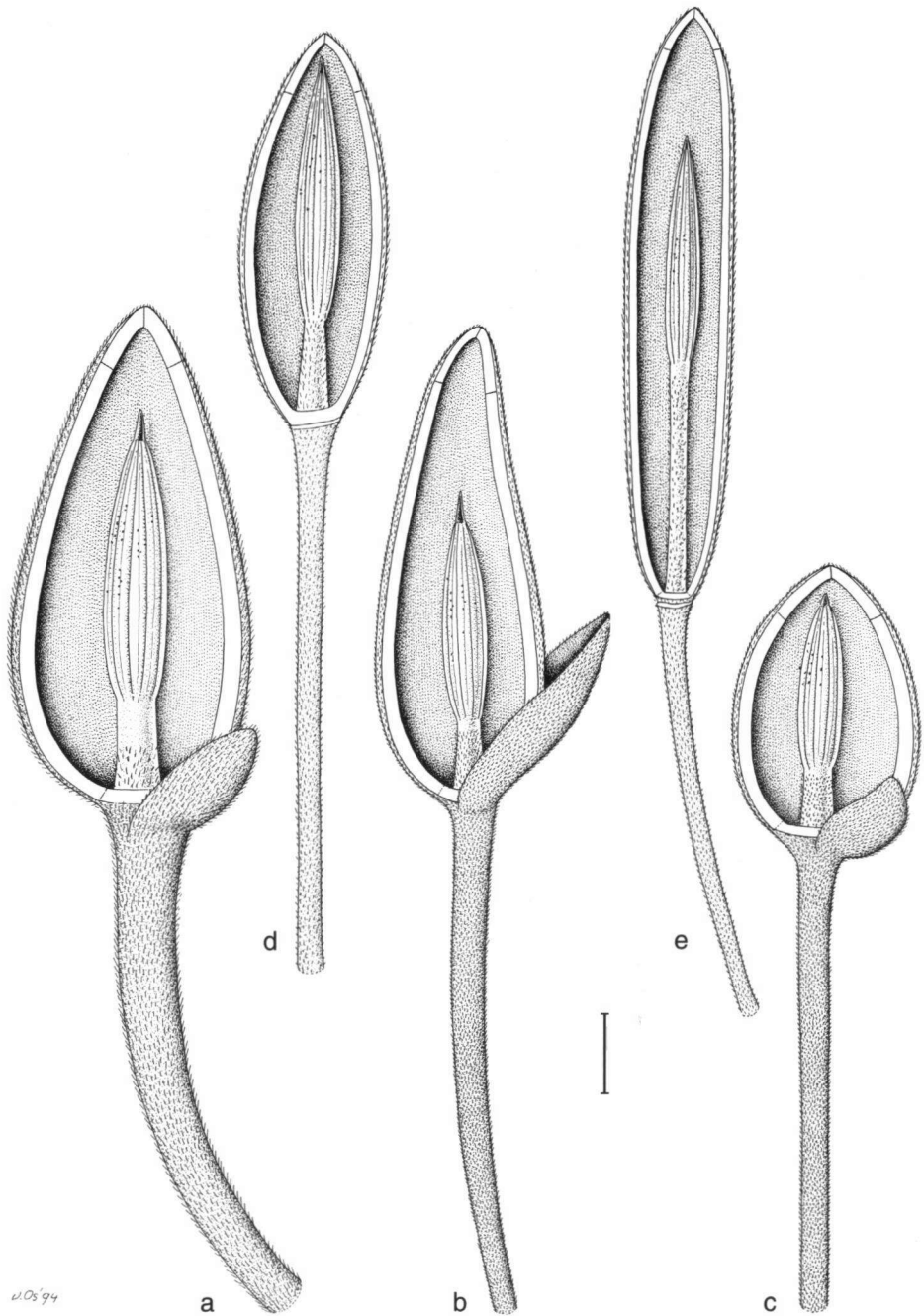


Fig. 66. Male flowers of *Myristica* species. — a. *M. bialata* Warb. var. *bialata* [NGF 29400 (Henty)]; b. var. *brevipila* W.J. de Wilde [NGF 22472 (Gillison)]. — c. *M. ingrata* W.J. de Wilde subsp. *ingrata* [Weinland s. n.]. — d. *M. subalulata* Miq. var. *subalulata* [Hartley TGF 11419]; e. var. *pedunculata* W.J. de Wilde [Sands c.s. 1481]. — Scale bar for all = 2 mm. — See also Fig. 75.

largely as in *Knema*: peduncle to 1 mm, sometimes with a central axis to 1 mm, hairs dull, rusty, 0.2–0.3 mm, with 3–6 flowers in a cluster, buds of about the same size, hairs 0.1–0.2 mm. *Male inflorescences* or *male flowers* not seen. *Female flowers*: pedicel 1–2 by 1.5 mm, bracteole broadly ovate, rounded, 4 mm, late caducous; buds broadly ovoid, 5 by 4–4.5 mm, cleft 1/5, lobes 1 mm long, 0.2–0.3 mm thick; ovary broadly ovoid or subglobose, 4 mm diameter, hairs pale brown, of mixed sizes, (0.1–)0.5–0.7 mm. *Fruits* solitary, sessile, broadly ovoid, 6 by 4.5–5 cm, apex and base broadly rounded, early glabrescent; pericarp 8–10 mm thick; seeds ellipsoid, 4 cm; fruiting pedicel not seen.

Distribution — *Malesia*: Philippines (Basilan); known only from the type.

Habitat & Ecology — Flowers and mature fruits Aug.–Sept.

Notes — 1. Obviously close to *M. iners*, which is widespread in W Malesia and in the Philippines known only from *Wenzel 3537*, a  $\pm$  deviating collection from Mindanao (Surigao), and quite different from *M. basilanica*. *Myristica iners* has pedunculate inflorescences and leaves of which the lower surface is not papillose. *Myristica cumingii* is similar and related, but has smaller fruits, 5(–5.5) cm, with a persistent indumentum.

2. The type specimens of *Gymnacranthera urdanetensis*, from Mindanao (Agusan Prov.), are intermediate between *M. basilanica* and *M. cumingii*, but *G. urdanetensis* has been sunk into *M. cumingii*.

## 9. *Myristica beccarii* Warb.

*Myristica beccarii* Warb., Mon. Myrist. (1897) 518, t. 14; Merr., Enum. Born. (1921) 269; J. Sinclair, Gard. Bull. Sing. 23 (1968) 319, f. 43; W.J. de Wilde, Blumea 42 (1997) 149; Tree Fl. Sabah & Sarawak 3 (2000) 453. — Type: *Beccari 247*, Sarawak.

Tree 10–24 m. *Twigs* 3–4(–5) mm diameter, late glabrescent, hairs rufous, 0.5(–1) mm; older twigs blackish, longitudinally cracking and somewhat flaking; lenticels absent. *Leaves* coriaceous, elliptic-oblong to oblong-lanceolate, 9–20(–25) by 3.5–6.5(–9) cm, more or less tapering to the  $\pm$  blunt or acute apex, base rounded, sometimes subcordate or short-acute; upper surface olivaceous-brown; lower surface with dense scale-like grey-brown or pale cinnamon hairs 0.1–0.3 mm, emergent hairs scattered, caducous, to 0.4 mm; not obviously papillose; dots absent; midrib above  $\pm$  flat, with some indumentum towards the base, lateral nerves (11–)14–19 per side, at 60–80° to the midrib, sunken but distinct above, lines of interarching and venation indistinct on both surfaces; petiole short, 5–10(–15) by 3–4 mm; leaf bud 7–10 by 3 mm, hairs rusty, 0.5–1 mm. *Inflorescences* of the *Knema*-type; in male: sessile, simple or forked, woody, persistent, brachyblasts to 12 mm, hairs dull, rusty, 0.5 mm, flowers few, buds of different sizes; female inflorescences small, one- or few-flowered, bracts  $\pm$  triangular, 1 mm; flowers with dense rusty woolly hairs 0.3–0.8 mm. *Male flowers*: pedicel 3–4 mm, bracteole broadly ovate-circular, 2–4.5 mm, blunt or acute,  $\pm$  apical, late caducous; buds ovoid-ellipsoid, 4–5.5 by 2.5–4.5 mm, apex faintly angled or not, cleft 1/2, lobes  $\pm$  coriaceous, 0.2(–0.8 at base) mm thick, at anthesis erect. Androecium 2.2–3 mm; androphore (0–) 0.2–0.4 by 0.5 mm, subglabrous but at base a dense collar of stoutish rusty hairs 0.5–0.8(–1) mm; synandrium subcylindrical, 2–3 by 0.6–0.8 mm, thecae c. 15, sterile apex irregularly shaped,  $\pm$  blunt, 0.2–0.3 mm, hairs dense or sparse, pale brown, 0.1 mm or less. *Female flowers* (not fully known): buds ellipsoid, 5 by 3 mm, perianth lobes  $\pm$  recurved; ovary (immature) ovoid, 2–3 mm, with bright rufous-red hairs 0.5–1 mm. *Fruits*

usually solitary, subsessile, ellipsoid(-obovoid), 2.5–3.5 by 1.5–2 cm, hairs dense, rufous-red, fine-woolly, 0.5–1 mm, longest towards the base of the fruit; pericarp 1–2 mm thick; seeds ellipsoid, 2(–2.5) cm; fruiting pedicel stoutish, 2–4 mm.

Field-notes — Medium-sized tree, with low buttresses or a few stilt-roots. Bark rough, fissured with narrow strips 1–3 mm thick, or flaky, brown-black; inner bark (orange-) brownish, with yellowish or red sap; wood white. Flowers yellow, fragrant. Fruits yellow. Leaves glossy dark green above, cinnamon below.

Distribution — *Malesia*: Sumatra (Riau) and Borneo (Sarawak, Sabah, NE, E, & SE Kalimantan, incl. Nunukan).

Habitat & Ecology — Lowland dipterocarp forest on (leached) sandy clay soil; rolling sandy area, ridges in kerangas; 0–600 m altitude; fl. & fr. throughout the year.

Notes — 1. *Myristica beccarii* resembles *M. cinnamomea* in foliage, but often the base of the blade is  $\pm$  subcordate, and the petiole shorter; the fruits are smaller and the pericarp much thinner. *Myristica beccarii* also closely resembles *M. smythiesii*, but that species has more coriaceous leaves, more distinct nerves, and stouter twigs. Both *M. smythiesii* and *M. beccarii* have *Knema*-type inflorescences. The indumentum of the fruits is coarser than that of both *M. cinnamomea* or *M. smythiesii*.

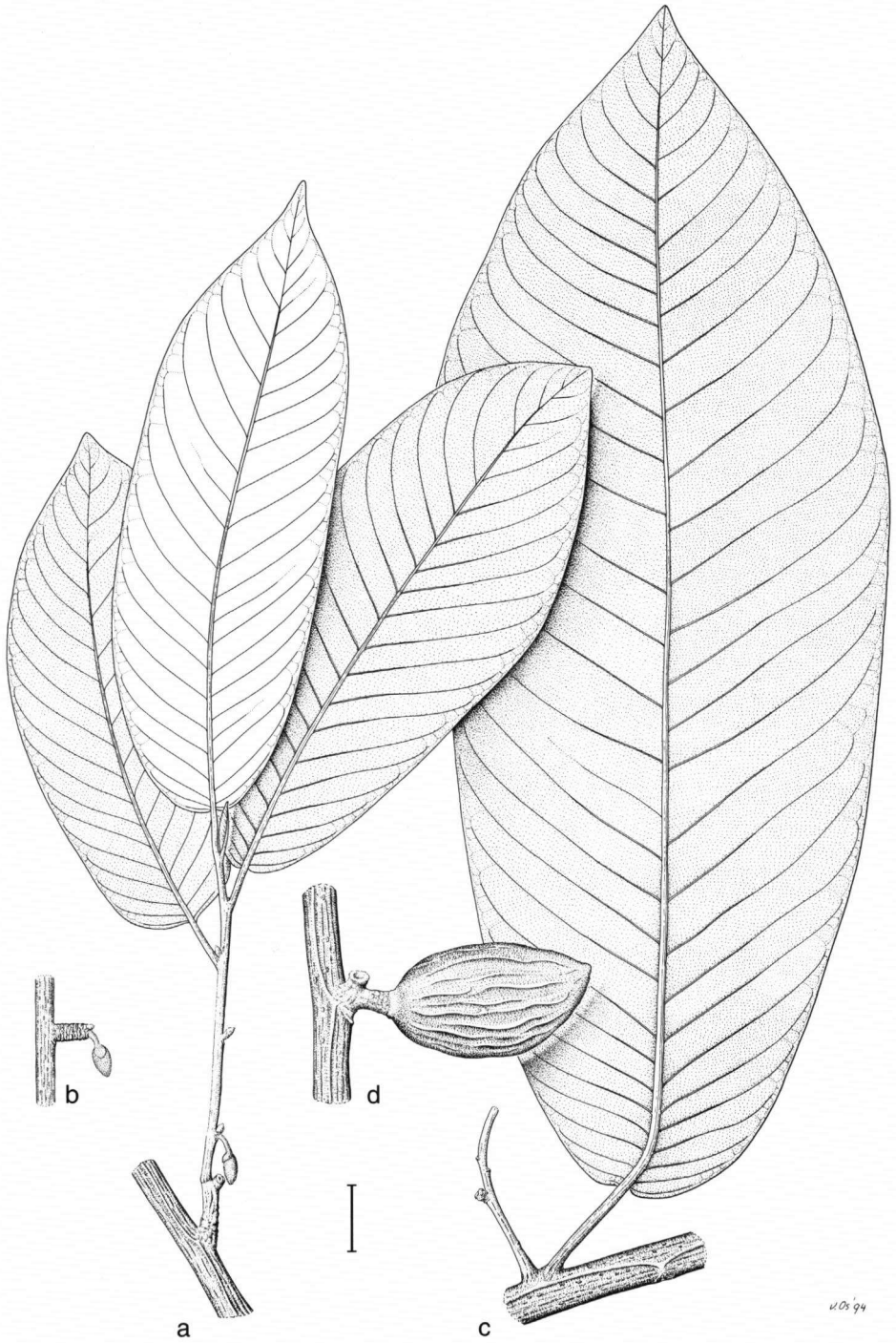
2. Apparently *M. beccarii* is a rare species, in Borneo mainly collected in Sarawak (1st & 2nd Div.) and eastern Kalimantan; only two collections are known from Riau, Sumatra (pointing to Corner's Riau-pocket distribution type).

## 10. *Myristica bialata* Warb.

*Myristica bialata* Warb., Bot. Jahrb. Syst. 13 (1891) 308; Mon. Myrist. (1897) 483; K. Schum., Notizbl. Bot. Gart. Berlin 2 (1898) 117; K. Schum. & Laut., Fl. Schutzgeb. Südsee (1900) 326; Markgr., Bot. Jahrb. Syst. 67 (1935) 159; Peekel, Fl. Bismarck Arch. (transl. Henty) (1984) 185, f. 302; W.J. de Wilde, Blumea 40 (1995) 264, f. 1, 2a; 43 (1998) 171. — Type: *Warburg 20706*, Bismarck Archipelago.

Tree 8–30 m. *Twigs* subterete or slightly flattened, with two raised lines or shallow wings up to 2 mm high joining the petioles, 4–8(–15) mm diameter, smooth or finely striate, early glabrescent, hairs 0.1 mm or less, stem hollow and in places somewhat swollen and with a longitudinal opening (ant-swellings) or without distinct ant-swellings; older twigs coarsely striate, sometimes transversely cracked; lenticels conspicuous or inconspicuous. *Leaves* membranous or (thinly) chartaceous, (obovate-)oblong or oblong-lanceolate, 18–52 by 6–22 cm, base rounded or shallowly cordate, apex acute-acuminate; upper surface olivaceous or dull brown, lower surface grey, glabrescent, indumentum minute; not conspicuously papillose; dots absent; midrib faintly raised above, lateral nerves 20–30(–35) per side, at 60–80° to the midrib,  $\pm$  flat above, lines of inter-arching not very prominent, venation often scalariform, distinct or indistinct; petiole 15–20 by 2.5–5 mm; leaf bud 10–20 by 3–4 mm, hairs appressed, 0.1–0.2 mm. *Inflores-*

Fig. 67. *Myristica bialata* Warb. var. *bialata*. a. Lateral twig with young male inflorescence bearing one mature male flower; b. ditto, with old male inflorescence with one mature flower; c. part of shoot with full-grown leaf, axillary to lateral twig and a flowerless inflorescence; d. part of older twig with infructescence and mature fruit [a, b: NGF 29400 (Henty); c, d: LAE 65435 (Croft & Lelean)]. — Scale bar for all = 2 cm.



*cences* among the leaves or below, of the *Knema*-type, indumentum minute, glabrescent; in male: brachyblast simple or forked, scar-covered, wart- or worm-like, to 1.5 cm, sessile or with peduncle to 1 cm (var. *brevipilis*), with 1–5 flowers apically, buds of different sizes; female inflorescences: subsessile, 1–3(–5)-flowered; flowers minutely pubescent, ± glabrescent. *Male flowers*: pedicel 6–15 by 0.8–2 mm, bracteole ovate(-elliptic), 3–5.5 mm, persistent; buds ovoid-lanceolate, 10–13 by 3.5–6 mm, apex narrowed, blunt, base ± rounded, cleft c. 1/8, lobes 1.5 mm long, 0.2–0.3(–0.5) mm thick. Androecium 6.5–9 mm; androphore 1.5–2 by 0.8–1 mm, subglabrous or minutely pubescent in the lower 2/3–3/4; synandrium narrowed to the apex, 3.5–6 by 0.8–1.5 mm, thecae 12–14, sterile apex subacute, narrow, 0.5–1 mm. *Female flowers*: pedicel 3–5 by 2–2.5 mm, bracteole broadly rounded, 2 mm; buds ± leathery, ovoid-oblong, ± narrowed to the apex, (5–)7–9 by 3–4.5 mm, lobes 1.5–2 mm; ovary ovoid-oblong, finely pubescent, including stigma, 5–6 mm. *Fruits* 1–6 per infructescence, (sub)sessile, ± fusiform or ellipsoid, 5–7 by 3.5–4.5 cm, minutely mealy brown pubescent, glabrescent; pericarp 10(–15) mm thick, coarsely wrinkled; seeds ellipsoid, (2.5–)3–4 cm; fruiting pedicel (4–)5–12 by 3–5 mm, with some lenticels. — **Fig. 67.**

Distribution — *Malesia*: Papua New Guinea (lowland areas of Manus I. and Bismarck Archipelago); two varieties.

Notes — 1. *Myristica bialata* was included in *M. subalulata* by Sinclair [Gard. Bull. Sing. 23 (1968) 385] and Foreman [Handb. Fl. Papua New Guinea 1 (1978) 210], but this inclusion is unwarranted. Both species have winged twigs that may contain ants, but the flower of *M. subalulata* has a deciduous bracteole, and fruits 1.5–2(–2.5) cm. *Myristica bialata* generally is a larger tree (to 30 m tall) as compared to *M. subalulata*. *Myristica hollrungii* is a similar species, but with twigs not or less distinctly lined, smaller flowers, and smaller fruits. The collection *NGF 43453* (Bagabag I.) has large fruits to 5 cm and approaches *M. bialata*, but is here included in *M. hollrungii*. Compare also *M. verruculosa*.

2. Fresh fruits are ovoid or nearly globose (from field-notes and the figure in Peekel, l. c.); apparently the ± juicy pericarp shrinks on drying.

3. Specimens from a small area in West New Britain differ from the type species in the extremely short hairs on perianth, ovary, and (immature) fruits, and are recognized here as a separate variety, var. *brevipila*.

#### KEY TO THE VARIETIES

- 1a. Flowers (incl. bracteole and immature fruits) with hairs 0.1–0.3 mm; ovary with hairs 0.2–0.4 mm; mature fruits glabrescent. — Manus I. and Bismarck Archipelago ..... **a. var. bialata**
- b. Flowers and immature fruits with hairs less than 0.1 mm, partly glabrescent; ovary densely covered with cinnamon scale-like hairs much less than 0.1 mm; mature fruits not seen. — W New Britain, Kandrian subdist. .... **b. var. brevipila**

#### **a. var. bialata**

Twigs 4–10 mm diameter. *Leaves* to 40 by 16 cm. *Inflorescences* without peduncle. *Female flowers*: buds ovoid, 5–7 by 3.5–4.5 mm, with hairs 0.1–0.3 mm; ovary ovoid,

with hairs 0.3–0.4 mm. *Fruits* 1 or 2 per infructescence, immature fruits with bright brown or yellow brown mealy hairs (0.1–)0.2–0.3 mm; mature fruits glabrescent. — **Fig. 66a, 67.**

**Field-notes** — Slender tree, to 30 m, branches horizontal or  $\pm$  drooping, often more or less whorled. Trunk spurred at base, bark brown, shallowly fissured; blaze red-brown; inner bark red-brown; red sap; wood straw, pale brown, or cream, strongly laced with red channels; wood soft. Leaves grey or glaucous below. Flowers cream, brown hairy. Fruits greenish yellow with loose orange-brown or grey-brown farinose indumentum; seeds deep chocolate-brown.

**Distribution** — As the species.

**Habitat & Ecology** — Lowland rain forest, coastal or riverine forest; clay soil; also in forest over limestone; found in association with *Pometia*, *Octomeles*, *Eucalyptus deglupta*, *Homalium foetidum*, *Syzygium*, *Dillenia*; 0–350 m altitude; fl. & fr. throughout the year, but mostly fr. in Mar.

**Note** — The twigs are usually hollowed, in places thickened and with a slit-like perforation, and are inhabited by ants.

#### **b. var. brevipila** W.J. de Wilde

*Myristica bialata* Warb. var. *brevipila* W.J. de Wilde, *Blumea* 40 (1995) 264, f. 2b; 43 (1998) 171. — Type: NGF 27188 (*Henty*), West New Britain.

Twigs 5–12(–15) mm diameter. *Leaves* to 52 by 22 cm. *Inflorences* sessile or (in male) with smooth peduncle to 10 mm. *Female flowers*: perianth in bud  $\pm$  flask-shaped, narrowed in the upper half, 9 by 4 mm, with hairs less than 0.1 mm; ovary (ovoid-) oblong, 6 by 2.5 mm, with dense scale-like hairs less than 0.1 mm. *Fruits* 2–6 per infructescence, when immature with dense hairs 0.1 mm or less; mature fruits not seen. — **Fig. 66b.**

**Field-notes** — Stilt-roots (once recorded). Branches drooping. Bark brown, shallowly fissured, or grey mottled, blaze pinkish, with or without red exudate; wood straw-coloured or white. Leaves very pale, silvery-grey below. Flowers greenish white. Immature fruits rufous-brown.

**Distribution** — *Malesia*: Papua New Guinea (West New Britain: known only from the Kandrian subdistrict).

**Habitat & Ecology** — Riverside forest; red soil over limestone; 0–200 m altitude; fl. Mar., Apr.; fr. Oct.

### **11. Myristica bifurcata** (J. Sinclair) W.J. de Wilde

*Myristica bifurcata* (J. Sinclair) W.J. de Wilde, *Blumea* 35 (1990) 239, f. 1: 2; 40 (1995) 266; 42 (1997) 153. — *Myristica lancifolia* Poir. var. *bifurcata* J. Sinclair, *Gard. Bull. Sing.* 23 (1968) 460 (key p. 81), f. 80. — Type: *Kostermans 944*, Morotai.

Tree 10–40 m. *Twigs* subterete or  $\pm$  angular, 1–2(–2.5) mm diameter, early glabrescent, hairs 0.1–0.5(–1) mm; older twigs sometimes becoming longitudinally cracked or slightly flaking; lenticels not conspicuous. *Leaves* chartaceous, ovate-oblong to oblong-lanceolate, 8–20 by 2.5–7 cm, base cuneate or  $\pm$  rounded, apex acute-acuminate (very tip often  $\pm$  blunt); upper surface olivaceous or brown, lower surface pale, glabrous; papillose;



dots absent; midrib somewhat raised above, lateral nerves 8–14 per side, at 60–70° to the midrib, flat or sunken above, not much raised and sometimes hardly visible below, lines of interarching faint, venation little raised, faint or contrasting below; petiole 8–15 by 1–2 mm; leaf bud 8–12 by 2–3 mm, hairs 0.1–0.5 mm. *Inflorescences* sometimes below the leaves, glabrescent; in male: either (sub)sessile (as in *Knema*) or peduncle slender to 18 mm, ending in a single or forked scar-covered brachyblast, 1–5 mm, with clusters of 5–10 flowers, buds subequal in size; female inflorescences: similar, sessile or peduncle to 10 mm, 1–5-flowered; flowers with short or long hairs. *Male flowers*: pedicel shorter than the perianth, 2–3 mm, bracteole (sub)persistent or caducous; buds cleft 1/3–1/2; androphore (sub)glabrous or thinly pubescent, shorter than the synandrium; thecae 12–16; see further under the subspecies. *Female flowers*: pedicel shorter or longer than the perianth, 1.5–4 mm; buds ovoid(–ellipsoid), 3–4.5 by 2–3 mm, apex narrowly rounded, cleft 1/3–1/2, lobes 0.3 mm thick; ovary ovoid-oblong, 2–2.5 by 1(–1.5) mm, pubescent, hairs 0.1–0.2 or 0.5–0.8 mm. *Fruits* solitary or paired, ovoid-ellipsoid, 3–4 cm long, hairs ± long or short, brown; pericarp 3–5 mm thick; seeds not seen; fruiting pedicel 2–4 mm.

Distribution — *Malesia*: northern Moluccas and Papua Barat (Bird's Head); two subspecies.

Notes — 1. The variable nature of the inflorescences is noteworthy on account of its scar-covered short-shoot of the *Knema*-type, and usually distinctly pedunculate.

2. Specimens with (almost) sessile inflorescences may be confused with, e.g., *M. impressinervia* and *M. lancifolia*. *Myristica bifurcata* is distinguishable by its mostly conspicuously pedunculate inflorescences, papillose lower leaf surface, flat nerves and venation of the lower leaf surface, and fairly large fruits.

#### KEY TO THE SUBSPECIES

- 1a. Leaf bud, flowers including ovary, and fruits with hairs 0.5–0.8(–1) mm. Male buds 4–5 mm; androphore sparsely or densely minutely pubescent . **a. subsp. bifurcata**  
 b. Leaf bud with long or short hairs, those of flowers including ovary and fruits short, 0.1–0.2 mm. Male buds 2.5 mm; androphore (sub)glabrous . . . **b. subsp. sulaica**

#### **a. subsp. bifurcata**

Tree to 20 m. Leaf bud, (immature) twig apex, inflorescences and flowers with hairs 0.5(–1) mm; sometimes similar hairs remaining for some time on the midrib. Peduncles of male inflorescences up to 18 mm. *Male flowers*: pedicel 3 mm, bracteole ovate, subacute, 2–2.5 mm, ± persistent; buds 4–5 by 2.5 mm. Androecium 2.5–3.5 mm; androphore 0.5–1 by 0.4 mm, with a few scattered pale brown hairs 0.1–0.2 mm; synandrium 2–2.5 by 0.5–0.8 mm, thecae 12–16, sterile apex ± acute or blunt, 0.1–0.2 mm. *Female flowers*: pedicel 2–4 mm, bracteole minute, 0.5–1 mm, ± caducous; buds (narrowly) ovoid, 4.5 by 3 mm, ovary 2–2.5 by 1.5 mm, with dense hairs 0.5–0.8 mm. *Fruits* (ovoid-) ellipsoid, 3–3.5 by 2–2.5 cm, with dark rusty hairs 0.5(–1) mm. — **Fig. 64b.**

Field-notes — Fairly common. Flowers and fruits rusty brown.

Distribution — *Malesia*: N Moluccas (Morotai); Papua Barat (Bird's Head).

Habitat & Ecology — Locally common in forest on Morotai; forest along rivulet; 30–500 m altitude; fl. Apr.–May; fr. June–Aug.

**b. subsp. sulaica** W.J. de Wilde .

*Myristica bifurcata* (J. Sinclair) W.J. de Wilde subsp. *sulaica* W.J. de Wilde, *Blumea* 35 (1990) 241.  
— Type: *bb 28880*, Sula Is.

Tree 10–40 m. Leaf bud and twig apex with hairs short or long, 0.1–0.5(–1) mm, those of inflorescences and flowers only 0.1–0.2 mm. *Leaves* early glabrescent. Peduncle of male inflorescences up to 5 mm. *Male flowers*: pedicel 2–2.5 mm, bracteole ovate, 1 mm, persistent; buds (slightly immature) 2.5 by 1.5 mm. Androecium 1.8–2 mm; androphore short, 0.5 by 0.4 mm, glabrous or almost so; synandrium 1.5 by 0.7 mm, thecae c. 14, sterile apex minute, 0.1 mm. *Female flowers*: pedicel 2–4 mm, bracteole minute, ± caducous; buds ovoid-oblong, 3–3.5 by 2(–2.5) mm; ovary 2 by 1 mm, with hairs 0.1(–0.2) mm. *Fruits* subglobose or ovoid to ellipsoid(-oblong), 3–4 by 2.5 cm, with scurfy hairs 0.2 mm.

Field-notes — Straight tree. Bark blackish or grey, strongly fissured, not peeling off. Trunk with or without buttresses, core solid; outer bark 0.6–1 mm thick, inner bark 6–7 mm thick, reddish or orange, turning brown, granular; not much exudate; sapwood creamy or reddish yellow, gradually passing into the slightly more reddish heartwood. Flowers greenish. Fruits yellow or brown(-yellow); seeds dark brown.

Distribution — *Malesia*: N Moluccas (E Sula Is., Halmahera, Obi).

Habitat & Ecology — Well drained ridge forest and sloping forest; on stony, volcanic, clayey, or serpentine-derived soils; locally abundant; 0–600 m altitude; fl. & fr. mainly Aug.–Dec.

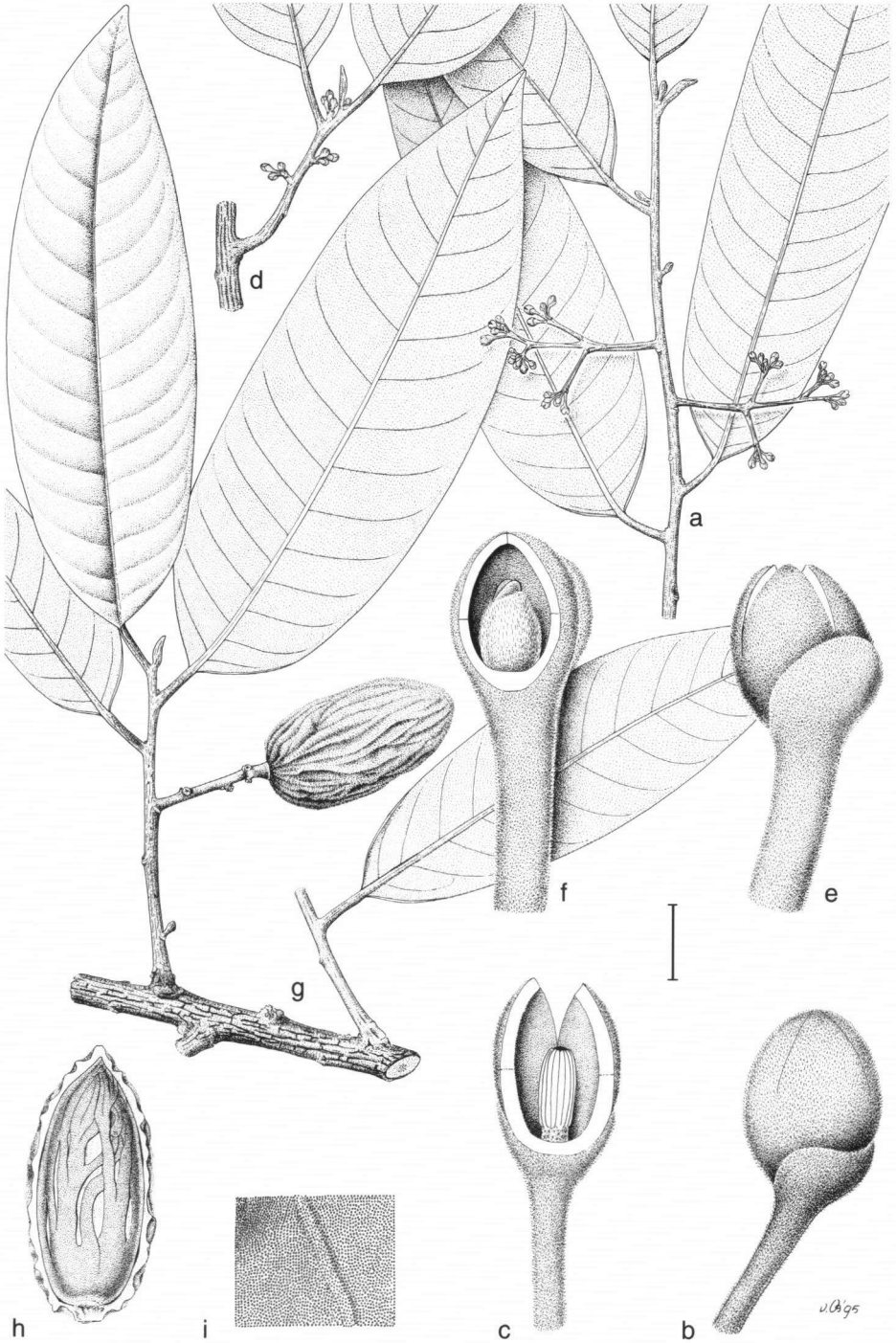
Uses — Bark boiled in water and exudate drunk by young women with yellow faces (?anaemia) (*de Vogel 4455*). Wood used for house construction.

Note — Subsp. *sulaica* is exceptionally variable in the length of the hairs on the leaf bud, 0.1–1 mm.

**12. Myristica borneensis** Warb.

*Myristica borneensis* Warb., *Mon. Myrist.* (1897) 401, t. 14 [non *Myristica borneensis* Gandoger (1919) = *Myristica villosa* Warb.]; Merr., *J. Straits Branch Roy. Asiat. Soc.* (1921) 269; W.J. de Wilde, *Blumea* 42 (1997) 154; *Tree Fl. Sabah & Sarawak* 3 (2000) 454. — Lectotype: *Beccari 1574*, Sarawak.

Tree 6–20 m. *Twigs* 2.5–5 mm diameter, sometimes yellowish, glabrescent; hairs pale, 0.1(–0.3) mm; older twigs brownish black, longitudinally cracking, frequently flaking; lenticels not apparent. *Leaves* membranous, chartaceous, or thinly coriaceous, elliptic-oblong or oblong-lanceolate, 11–30 by 3.5–10 cm, base rounded or short-acute, apex acute or acute-acuminate; upper surface olivaceous (greenish), lower surface grey or pale cinnamon, early glabrescent or with (sub)persistent dispersed greyish and pale brown hairs less than 0.1(–0.3) mm; conspicuously papillose; dots absent; midrib ± flat above, lateral nerves 13–20 per side, at 80–60° to the midrib, sunken above, lines of interarching and venation indistinct; petiole 12–28 by 1.5–3 mm; leaf bud 8–12 by 2.5–3 mm, hairs greyish or pale brown, appressed, 0.1(–0.3) mm or less. *Inflorescences* among the leaves, pedunculate, branched; in male: slender or broad, 2–6 by 2–4.5 cm, peduncle (5–)10–20 mm, lowest branches 10–20 mm, central axis short or long, with 1–3 (sub)sessile laterals, with clusters of 5–10 flowers, buds of different sizes; bracts 3 mm, short-pubescent,



caducous; female inflorescences: as in male but smaller, 1.5–2.5 cm, few-flowered, peduncle 5–10 mm; flowers drying yellow-brown or orange, hairs sparse, grey-brown, 0.1(–0.3, see note 2) mm or less. *Male flowers*: pedicel 3–6 by 0.5 mm, bracteoles rounded or irregularly 3-topped, 1.5–2(–3) mm; buds (broadly) ellipsoid, 3–4 by 2.5–3.5 mm, apex broadly rounded and slightly 3-angled, cleft 1/2–2/3, lobes 0.4–0.5 mm thick, at anthesis ± curved outwards. Androecium ellipsoid-cylindrical, 1.5–3 mm; androphore 0.2–1 mm long, about as broad as the androecium, hairs light brown, 0.1 mm or less; synandrium 1.5–2 by 0.8–1.2 mm, thecae 14–20, sterile apex broad and flat or irregularly truncate, 0.1–0.3 mm, or absent. *Female flowers*: pedicel 2–3 mm; buds 4(–4.5) by 3.5–4 mm, cleft 1/2; ovary ovoid, hairs dense, minute, brown. *Fruits* 1 or 2 per infructescence, ± ellipsoid, (4.5–)5–7.5 by 3–4.5 cm, indumentum persistent or late glabrescent, hairs dark cinnamon, mealy, 0.1(–0.3, see note 2) mm; pericarp 5(–8) mm thick; seeds (3.5–)4–4.5 cm; fruiting pedicel smooth, ± tapering, 5–9 mm, bracteole scar somewhat below the fruit. — Fig. 68.

Field-notes — Buttresses small or none. Bark dark brown or blackish, smooth or rough, shallowly flaking and minutely (and narrowly) fissured, or longitudinally striate, not furrowed; outer bark thin, brittle; inner bark 2.5 cm thick, soft, red-brown, exudate pale to dark red, copious or not, watery; sapwood also exuding red sap, soft. Leaves glossy above, dull-glaucous below. Flowers pale cream-brown or (greenish) yellow. Fruits (greenish) yellow, with short (orange-)brown indumentum.

Distribution — *Malesia*: Borneo (Sarawak; Brunei; Sabah, rare; W & C Kalimantan).

Habitat & Ecology — Primary lowland dipterocarp forest, ridge or hill forest, closed heath forest in valleys; usually on sandy clay (on igneous rock) or yellow soil, sandy slope near stream, also kerangas; 0–500(–1000) m altitude; fl. Apr.–June; fr. mainly Aug.–Nov.

Notes — 1. *Myristica borneensis* may be confused with *M. malaccensis* which differs in its olivaceous-brown leaves on drying, subcircular bracteoles with ciliate margin, (subglobose-)ovoid glabrescent male buds, cleft 1/4–1/3, with thin lobes, 0.3 mm thick, androecium consisting almost entirely of the synandrium with a sterile apex lacking or with the apex of the synandrium hollowed, glabrous androphore, and (almost) glabrous fruits.

2. Two forms of indumentum can be distinguished, one with very short hairs, 0.1 mm, on apical bud, inflorescences and flowers and with the lower leaf surface early glabrescent (most of the specimens), and another form with the indumentum more conspicuous and persistent, with dark brown hairs, 0.1–0.3 mm. In most collections the fruits have scurfy hairs 0.1 mm long or less, but in very immature fruits the indumentum may be longer, 0.2–0.4 mm (longer hairs later on apparently shed). The infructescence is short, 1–2 (–3.5) cm long.

Fig. 68. *Myristica borneensis* Warb. a. Leafy twig with male inflorescences; b. male bud; note persistent bracteole; c. ditto, opened, showing androecium; d. twig with female inflorescences; e. female bud; f. ditto, opened, showing pistil; g. part of branch with infructescence, bearing a single fruit; h. dry fruit, opened, showing arillate seed; i. detail of papillose lower leaf surface [a: S 17939; b, c: S 36582; d–f: S 36089; g, i: S 37147; h: S 35852]. — Scale bar for a, g, d, h = 2 cm; for b, c, e, f = 1.65 mm; for i = 0.4 mm.

3. The specimen *BRUN 577* (*Ashton*) has a not or but indistinctly papillose lower leaf surface, but there are many minute, scattered, dark brown dots, possibly cork-warts, absent in other specimens. *SAN 36839* (Beaufort Dist., Sabah) has stout twigs and broad fruits, 5 by 4 cm; the twigs dry blackish brown; the leaves are chartaceous, with acute-acuminate base, the lower surface not very distinctly papillose, and small scattered scale-like hairs virtually absent; this specimen may have to be excluded from *M. borneensis*.

### 13. *Myristica brachypoda* W.J. de Wilde

*Myristica brachypoda* W.J. de Wilde, *Blumea* 40 (1995) 266, f. 3a. — Type: *NGF 8079* (*Gray, Floyd & Middleton*), Papua New Guinea, Gulf Prov.

Tree 8–10 m. *Twigs* 1–1.5 mm diameter, brown-yellow, early glabrescent, hairs greyish, less than 0.1 mm; older twigs brown blackish, striate and fissured, and thinly flaking, with small inconspicuous lenticels. *Leaves* membranous or thinly chartaceous, elliptic-oblong, 10–13 by 3.5–4 cm, base cuneate, apex acute-acuminate; upper surface (cinnamon-)olivaceous, lower surface pale greyish cinnamon; papillose; dots absent; midrib raised above, lateral nerves 14–16 per side, at 70–80° to the midrib, flat or sunken above, bright brown and contrasting in colour below, lines of interarching distinct, venation fine, faint; petiole 10–14 by 1(–1.5) mm; leaf bud 6–7 by 1 mm, hairs inconspicuous, brown-grey, appressed, less than 0.1 mm. *Male inflorescences, male and female flowers* not seen. *Female inflorescences* (from the infructescences) axillary to a leaf scar just below the leaves, of the *Knema*-type, a minute sessile knob, bearing 1 (or 2) flowers. *Fruits* solitary, ovoid or slightly ellipsoid-fusiform, 3 by 1.7 cm, base and apex narrowly rounded or ± tapered, indumentum thin, felty, inconspicuous, hairs interwoven, scale-like, 0.1(–0.2) mm, partly glabrescent; pericarp yellowish brown, 2(?) mm thick; seeds not seen; fruiting pedicel 1–2 by 2 mm, glabrescent, cracked and flaking. — **Fig. 63a.**

Field-notes — Small tree, dbh c. 25 cm. Leaves dark green above, glaucous below. Fruits axillary, ovoid, shortly pedicellate, with a fawn close indumentum.

Distribution — *Malesia*: Papua New Guinea (Kikori subprov., Gulf Prov., Seribi River near Middletown); known only from the type.

Habitat & Ecology — Logged forest at sea level; fr. July.

Note — *Myristica brachypoda* readily keys out beside *M. insipida*, but is especially distinguishable by the leaves and the subsessile, very short-haired fruits. The seemingly glabrous (glabrescent) fruits are reminiscent of those of *M. tubiflora*, and the type specimen on which the present species, *M. brachypoda*, is based was named as such by Sinclair [Gard. Bull. Sing. 23 (1968) 342]. The leaves of *M. brachypoda* are very like those of *M. pumila*, but that species differs in its fruits.

### 14. *Myristica brassii* A.C. Sm.

*Myristica brassii* A.C. Sm., *J. Arnold Arbor.* 22 (1941) 72 (for male fl. specimen only, excl. *Brass & Versteegh 12547 = M. sphaerosperma*); J. Sinclair, *Gard. Bull. Sing.* 23 (1968) 245, f. 22; W.J. de Wilde, *Blumea* 40 (1995) 267. — Type: *Brass 12254*, Irian Jaya.

Tree 6 m. *Twigs* 3–4 mm diameter, early glabrescent, hairs 0.1 mm or less; older twigs coarsely striate with a few inconspicuous lenticels. *Leaves* thinly coriaceous, ovate-oblong or elliptic(-oblong), 19–25 by 9–12 cm, base (broadly) rounded, apex bluntly

acute or short acute-acuminate; the upper surface dark brown, lower surface somewhat paler, (greyish) brown, glabrous (or possibly early glabrescent, hairs minute, scale-like);  $\pm$  papillose (but not conspicuously so); dark (red-)brown dots present, just visible to the naked eye; midrib moderately raised above, lateral nerves 12–14(–17) per side, at 45–60° to the midrib, slender, sunken above, nerves below bright brown and contrasting in colour, lines of interarching indistinct, venation coarsely reticulate, thin, impressed above (and rendering the blade faintly bullate), hardly visible below; petiole 20 by 4 mm; leaf bud 15 by 3 mm, hairs inconspicuous, appressed, dull brown, scale-like, 0.1 mm or less. *Inflorescences* among the leaves, sessile, of the *Knema*-type; in male: brachyblast scar-covered, 3–4 mm, glabrescent, peduncle less than 1 mm; bracts broadly ovate, 3 mm, acute, caducous; flowers (1–)2–5 in a cluster, buds almost equal in size, with sparse grey-brown hairs 0.1 mm or less. *Male flowers*: pedicel (5–)9–10 by 1.5(–2) mm, bracteole not seen, caducous, the scar subapical; buds (ellipsoid-)oblong, 10–12 by 5 mm, apex bluntish, cleft c. 1/5, lobes  $\pm$  coriaceous, 2–2.5 mm long, 0.5 mm thick, at anthesis  $\pm$  curved outwards. Androecium (broad-)cylindrical, 8 by 1.5(–2) mm; androphore 3.5 by 1.5(–2) mm, dark brown appressed-pubescent in the lower half, hairs 0.3–0.4 mm; synandrium 4 by 1.5(–2) mm, tapering to the apex into the 0.5 mm long acute sterile apex, thecae c. 20. *Female flowers* and *fruits* not seen.

Field-notes — Leaves brownish below. Flowers cream-coloured, fragrant.

Distribution — *Malesia*: Papua Barat (Idenburg River, 15 km SW of Bernhard Camp); known only from the type.

Habitat & Ecology — Rain forest or gully; 1700 m altitude; fl. Jan.

Note — *Myristica brassii* was treated under *M. sphaerosperma* by Foreman [Contr. Herb. Austral. no. 9 (1974) 43; Handb. Fl. Papua New Guinea 1 (1978) 210]. The two may be related, but *M. brassii* is quite distinguishable in details. A good differentiating character is the absence of dots on the lower leaf surface in *M. sphaerosperma*, a character which holds true on the species level for all *Myristicas*. *Myristica brassii* also seems closely related to *M. cucullata* (see there).

## 15. *Myristica brevistipes* W.J. de Wilde

*Myristica brevistipes* W.J. de Wilde, Blumea 40 (1995) 267, f. 3b. — Type: *Darbyshire 929*, Papua New Guinea, Central Prov.

Treelet c. 5 m. *Twigs* 1.5–2 mm diameter, early glabrescent, hairs appressed, 0.1–0.2 mm, brownish yellow; older twigs brown-black, coarsely striate or finely longitudinally fissured; lenticels not apparent. *Leaves* membranous, (oblong-)lanceolate, 7–17 by 2–4 (–5) cm, base short-attenuate or narrowly rounded, apex (long-)acute-acuminate; upper surface green-olivaceous, lower surface pale greenish brown, glabrous (indumentum of immature leaves not seen); not papillose; dots absent; midrib raised above, lateral nerves 10–15 per side, at 70–80° to the midrib, slender, slightly sunken and inconspicuous above, not much contrasting below, lines of interarching and venation (fine) indistinct; petiole brown-yellow, 7–10 by 1.5 mm; leaf bud 5–7 by 2 mm, hairs  $\pm$  rough, 0.3–0.5 mm. *Male inflorescences*, *male* and *female flowers* not seen. *Female inflorescences* (from infructescences): between the lower leaves, of the *Knema*-type, a (sub)sessile, scar-covered brachyblast, 3 mm diameter, few-flowered, hairs rough, rusty, 0.5 mm; bracts not seen. *Fruits* 1 or 2 per infructescence, ellipsoid-oblong,  $\pm$  fusiform, 2.5–3 by 1.5 cm,

apex acute, base somewhat tapered, hairs thin, woolly, light brown or rusty, 0.3 mm, towards the base stouter, 0.5 mm; pericarp 1–2 mm thick; immature seeds ellipsoid-oblong, 1.5 cm; fruiting pedicel 2(–3) by 1.5–2 mm, hairs rough, 0.5 mm, bracteole scar  $\pm$  median. — Fig. 63b.

Field-notes — Tree c. 5 m tall, bole c. 2 m, dbh c. 5 cm. Leaves bright green above, pale below. Fruits green with rusty-brown bloom.

Distribution — *Malesia*: Papua New Guinea (Central Prov, Kairuku subprov., about 1 mile NW of Maipa village); known only from the type.

Habitat & Ecology — On summit of small hill in tall foothill forest; c. 150 m altitude; fr. Sept.

Note — The fruits of *M. brevistipes* are very similar to those of *M. pygmaea* which differs in vegetative characters and (shortly) pedunculate inflorescences. *Myristica brevistipes* appears particularly close to certain specimens of *M. concinna*, a species that differs in smaller fruits and a more or less distinctly papillose lower leaf surface. Finally also some specimens of the New Guinea form of *M. insipida* are very similar to *M. brevistipes* and generally have fruits with more conspicuous, woolly, longer hairs, and leaves which are papillose below. In New Guinea, however, specimens linking up with *M. insipida* often have leaves with a less distinct papillation. This may suggest that the demarcation between *M. brevistipes* and *M. insipida* is indistinct, but the type of *M. brevistipes* is so different in general appearance from the majority of *M. insipida* specimens that its distinction seems warranted.

## 16. *Myristica buchneriana* Warb.

*Myristica buchneriana* Warb., Bot. Jahrb. Syst. 13 (1891) 311; Mon. Myrist. (1897) 498, t. 19; J. Sinclair, Gard. Bull. Sing. 23 (1968) 321, f. 44 (p.p., see the note); Foreman, Handb. Fl. Papua New Guinea 1 (1978) 187 (p.p., see the note); W.J. de Wilde, Blumea 40 (1995) 268. — Type: Warburg 20714, Papua New Guinea.

Tree (5–)10–35 m. Twigs angled or subterete, 1.5–3.5(–4) mm diameter, late glabrescent, hairs yellowish brown or rufous, 0.3(–0.5) mm; older twigs grey-brown or blackish,  $\pm$  transversely cracked, not flaking; lenticels small, indistinct. *Leaves* (membranous or) thinly chartaceous, elliptic-oblong or oblong-lanceolate, 9–22(–28) by 3.5–7(–10.5) cm, base short attenuate or rounded, apex acute(–acuminate); upper surface (blackish) brown, lower surface grey(–brown), hairs usually persistent on or near the midrib, especially towards the base, just or hardly touching each other, not densely interwoven, scale-like, grey or pale brown, 0.1(–0.2) mm or smaller; not or but faintly papillose; dots absent; midrib hardly raised above, lateral nerves 10–20 per side, at 50–80° to the midrib, flat and faint above, lines of interarching and venation indistinct; petiole 8–13 by 1.5–2.5(–3) mm, late glabrescent; leaf bud 10–15 by 2–3 mm, hairs 0.2–0.3(–0.5) mm. *Inflorescences* among the leaves or below, of the *Knema*-type: peduncle to 3 mm, ending in a simple or forked, scar-covered, flower-bearing brachyblast to 5 mm, late glabrescent; in male: with a cluster of 5–15 flowers, buds of  $\pm$  variable sizes; female inflorescences similar, 1–3(–5)-flowered; flowers with dense rufous hairs 0.2–0.3 mm. *Male flowers*: pedicel 2–3 by 1 mm, bracteole small, caducous; submature buds obovoid-oblong, (4–) 5–6 by 2.5–3 mm, apex rounded, cleft c. 1/4, lobes 1.5 mm long, 0.3–0.5 mm thick. Androecium short-cylindrical, 3–4 mm; androphore 0.5–0.6 by 0.5 mm, largely gla-

brous, towards the base a collar of sparse or dense erect reddish brown hairs 0.4–0.5 mm; synandrium (2–)3 by 1 mm, thecae 14–16, sterile apex blunt, 0.2–0.5 mm. *Female flowers*: pedicel 4 by 1.5–2 mm; buds ovoid, 6(–7) by 4.5(–5) mm, cleft c. 1/4, lobes 1.5 mm long; ovary ovoid, 4 by 3 mm, brown pubescent. *Fruits* solitary, or 2 or 3 together, ellipsoid-oblong, 3–4.5(–6) by 2.5(–3) cm, apex rounded, base rounded or somewhat narrowed, hairs dense, bright (dark) rusty, 0.5–1 mm, rough especially towards the base of the fruit; pericarp 2–3 mm thick; seeds ellipsoid, 2–2.5 cm; fruiting pedicel 4–8 by (3–)4–5 mm, late glabrescent or with persistent indumentum, fissured.

Field-notes — No buttresses. Crown deep and narrow. Branches horizontal, or somewhat drooping. Bark rather smooth, longitudinally fissured or finely tessellated, dark (grey-)brown; outer bark reddish brown; inner bark light brown or reddish; sap watery, red; blaze red-brown; wood white, of medium density; sapwood (cream-)pink; heartwood (dark) salmon. Leaves grey or glaucous below. Flowers dark brown, inside creamy-white. Fruits rusty hairy.

Distribution — *Malesia*: northern and eastern New Guinea (NE Papua Barat; Papua New Guinea: Sepik, Morobe, Madang Provinces).

Habitat & Ecology — Primary and degraded forest; levee, hill, or ridge forest; forests with or dominated by *Lithocarpus*, *Pometia*, *Intsia*, *Pandanus*, *Celtis*, or *Anisoptera*; 10–350 m altitude; fl. & fr. throughout the year. Locally common.

Note — Foreman (1978), following Sinclair (1968), described the male flowers with perianths 8–10 by 4–5 mm, possibly based on *Brass* 28894, a collection here placed in *M. simulans*. The perianth of this collection (in L) measures 8 by 4.5 mm; the androphore is glabrous. Sinclair noted that *Brass* 28894 had a deviating indumentum. The caption under Sinclair's figure 44 seems to be either erroneous, or the specimen drawn does not belong to *M. buchneriana*.

## 17. *Myristica byssacea* W.J. de Wilde

*Myristica byssacea* W.J. de Wilde, *Blumea* 40 (1995) 269. — Type *Carr 15549*, Papua New Guinea, Northern Prov.

*Myristica flosculosa* auct. non J. Sinclair, p.p.: J. Sinclair, *Gard. Bull. Sing.* 23 (1968) 359, excl. type, for female fl. and fr. specimens only, f. 59.

Tree 6–7 m. *Twigs* 1.5–2(–2.5) mm diameter, ± angular and with two sharp ridges, glabrescent, hairs pale brown, scale-like, less than 0.1 mm; older twigs neither cracking nor flaking; lenticels not apparent. *Leaves* subchartaceous, elliptic-oblong, 10–16 by 3–5.5 cm, base attenuate to nearly rounded, apex acute-acuminate with conspicuous acumen up to 2.5 cm; upper surface olivaceous, glabrescent with some minute scale-like hairs remaining on the midrib towards the base, lower surface pale, grey-olivaceous or yellowish, late glabrescent or with subsistent dense pale (grey-)brown scale-like hairs 0.1 mm or less; not papillose; dots absent; the midrib flat or somewhat raised above, lateral nerves 10–15 per side, at 45–60° to the midrib, curving, sunken above, below bright brown, contrasting in colour, lines of interarching very distinct; venation ± scalariform; petiole 10–15 by 1.5–2.5 mm; leaf bud 10–15 by 1.5–2 mm, hairs appressed, 0.1 mm. *Inflorescences* (known only from female inflorescences and infructescence): sessile or peduncle to 1.5 mm, among the leaves, of the *Knema*-type, pubescent or late glabrescent, brachyblast 1 mm, with 1–3 flowers; bracts caducous. *Male flowers* not



seen. *Female flowers*: pubescent, hairs 0.1 mm or less, pedicel 6–9 by 1–1.5 mm, bracteole caducous, its scar 2–4 mm below the apex; buds ovoid-oblong, slightly narrowed in the upper half, 6–7 by 3.5 mm, apex narrowly rounded or subacute, base rounded, cleft 1/4–1/6, lobes 1(–1.5) mm long, 0.3 mm thick; ovary ovoid-oblong, hairs golden brown, appressed, 0.1–0.2 mm, including stigma 3–3.5 by 2 mm. *Fruits* single or in pairs, broadly ovoid-ellipsoid, 2.5–3 by 2–2.3 cm, apex rounded with apiculum 1.5 mm, base broadly rounded and contracted into 3 mm long pseudostalk, hairs dull brown, scurfy, 0.1 mm or less; pericarp 2–2.5 mm thick; seeds (immature) ellipsoid, 1.5 by 0.8 cm; fruiting pedicel  $\pm$  stout, straight, striate, 9–10 by 3.5–4 mm, bracteole scar faint,  $\pm$  median.

Field-note — Fruits yellow-brown.

Distribution — *Malesia*: Papua New Guinea (Northern Prov. at Isuarava); known only from two collections.

Habitat & Ecology — Montane forest at 1600–1700 m altitude; fl. & fr. Feb.

Notes — 1. Female flowering and fruiting specimens are well depicted by Sinclair (l. c.: f. 59) under *M. flosculosa*.

2. The epithet alludes to the cottony appearance of especially the lower leaf surface, which is covered by a dull, yellowish brown, very thin indumentum. Other characteristic features are the angular twigs, and the scalariform tertiary venation of the leaves.

## 18. *Myristica cagayanensis* Merr.

*Myristica cagayanensis* Merr., Philipp. J. Sci. 17, 3 ('Sept. 1920', Jan. 1921) 255; Enum. Philipp. Flow. Pl. 2 (1923) 178; Kaneh., Formos. Trees, rev. edit. (1936) 193, f. 141; Hui-Lin Li & H. Keng, Taiwania 1 (1950) 112; J. Sinclair, Gard. Bull. Sing. 18 (1961) 226; Hui-Lin Li, Woody Fl. Taiwan (1963) 193, f. 72; Fl. Taiwan 2 (1976) 396, pl. 349; Ying & Li, Fl. Reip. Pop. Sinicae 30, 2 (1979) 190, f. 86; W. J. de Wilde, Blumea 42 (1997) 154. — *Myristica ceylanica* A. DC. var. *cagayanensis* (Merr.) J. Sinclair, Gard. Bull. Sing. 23 (1968) 442, 444; Liao, Fl. Taiwan, ed. 2, vol. 2 (1996) 420, pl. 195, photo 160. — Type: *Bernardo* 24277 (PNH, lost), Luzon, Prov. Cagayan.

*Myristica laurifolia* auct. non Hook. f. & Thomson: Hayata, Mat. Fl. Form., repr. from J. Coll. Sc. Imp. Univ. Tokyo 30, 1 (1911) 236.

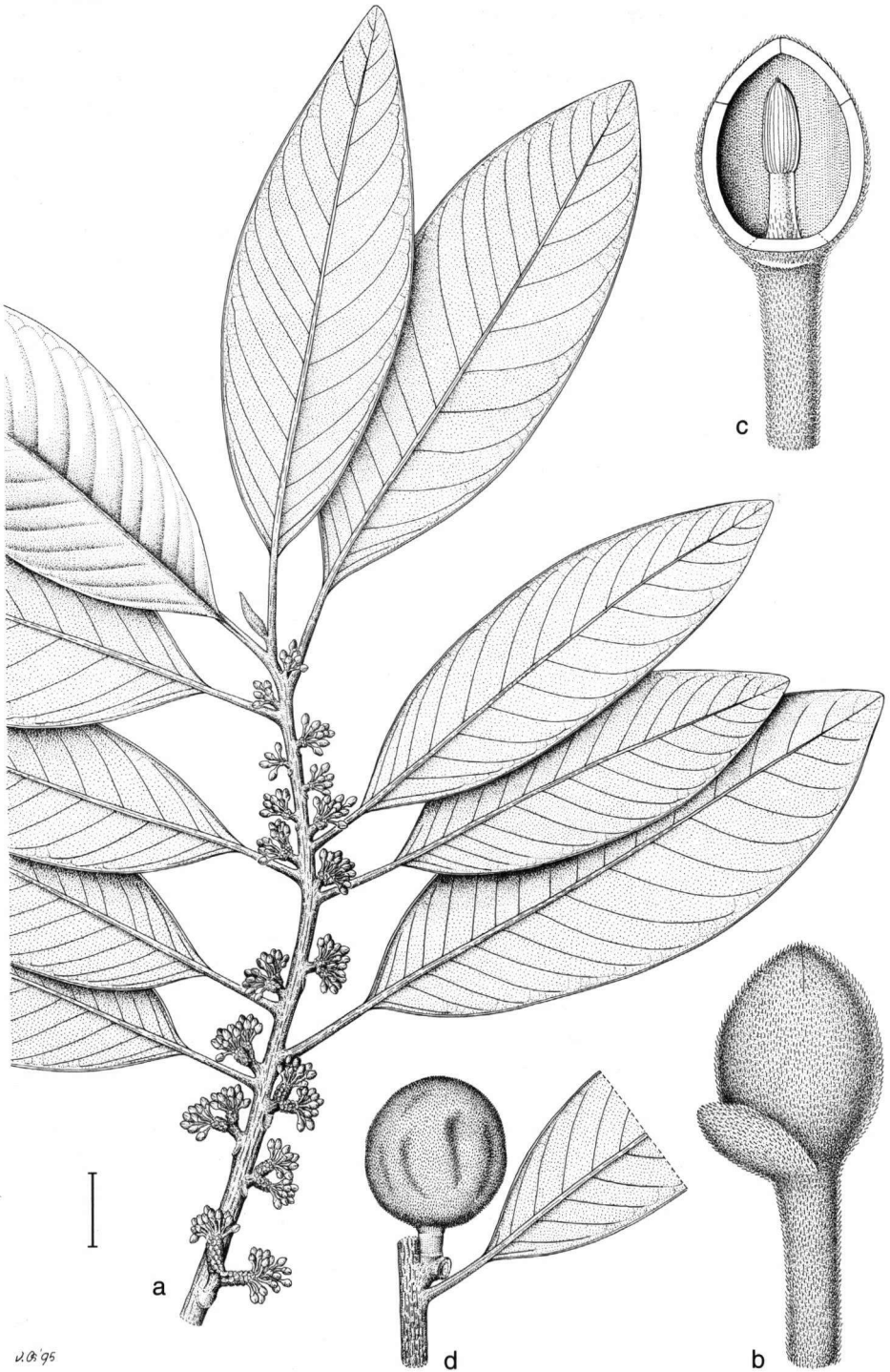
*Myristica heterophylla* auct. non Fern.-Vill.: Hayata, Gen. Index Fl. Form. (1917) 61.

*Myristica glomerata* auct. non Blanco: Kudo & Masam., Ann. Rep. Taihoku Bot. Gard. 2 (1932) 89.

*Myristica philippensis* auct. non Lam.: Kaneh. & Sasaki, J. Soc. Trop. Agr. 5 (1933) 307.

Tree 8–20 m. *Twigs* 3–4(–6) mm diameter, early glabrescent, hairs greyish, 0.1 mm or less; older twigs coarsely striate, tending to crack, often with scattered conspicuous lenticels. *Leaves* coriaceous, (obovate-)oblong, 9–20 by 3.5–7.5 cm, base (short-)cuneate, apex acute or  $\pm$  blunt; upper surface olivaceous brown, lower surface glabrescent, hairs interwoven, scale-like, 0.1 mm; possibly papillose, papillae irregularly shaped; dots absent; midrib above somewhat raised, lateral nerves 15–20 per side, at 45–60° to the midrib, sunken above, lines of interarching and venation distinct; petiole comparatively long, 15–30 by 2–3(–3.5) mm; leaf bud 8–15 by 3–4 mm, hairs grey-brown, 0.1 mm.

Fig. 69. *Myristica cagayanensis* Merr. a. Leafy twig with male inflorescences; b. male bud; c. ditto, opened, showing androecium; d. twig with infructescence and one fruit [a–c: Liao FN 10579; d: Huang c. s. FN 10526]. — Scale bar for a, d = 2 cm; for b, c = 1.5 mm.



*Inflorescences* among the leaves or below, of the *Knema*-type; in male: simple, or 2- or 3-furcate scar-covered brachyblasts to 15 mm, peduncle absent or up to 5 mm, sometimes with a central axis to 4 mm,  $\pm$  glabrescent, hairs sparse, 0.1–0.2 mm, with subumbels of 5–10(–20) flowers, buds of various sizes; female inflorescences: smaller, few-flowered; flowers with rusty hairs 0.1(–0.3) mm. *Male flowers*: pedicel  $\pm$  stout, 2.5–4.5 mm, bracteole ovate, 2–2.5 mm, caducous; buds ovoid, 4–5(–6) by 3(–4) mm, cleft c. 1/3, lobes  $\pm$  pergamentaceous, 0.2–0.3 mm thick, at anthesis suberect or  $\pm$  curved outwards. Androecium 3–3.5 mm; androphore 1.5(–1.7) by 0.5 mm, hairs sparse, in the lower half pale brown, 0.3–0.4 mm; synandrium 1.5–1.7 by 0.6 mm, thecae 10–20, when old slightly projecting at apex, sterile apex blunt or acute, 0.1–0.3 mm, glabrous. *Female flowers* (seen only in one female flower amongst male flowers in *Liao Taiwan FN 10579*): buds subsessile, 3.5 by 3 mm; ovary ovoid, 2 mm diameter, with dense golden brown hairs 0.2 mm. *Fruits* single or 2 per infructescence, broadly ellipsoid to nearly globose, 3–4 by 2.5–4 cm, hairs dense, rust-coloured, mealy, 0.1–0.2 mm; pericarp 4–10 mm thick; seeds 2.5 cm; fruiting pedicel 2–5 mm. — **Fig. 69.**

Field-note — Trunk to 1 m diameter.

Distribution — Southern tip of Taiwan mainland, and Lanyu & Lutao Is.; *Malesia*: Philippines (islands in the extreme north, and Luzon: Cagayan Prov.).

Habitat & Ecology — Forest of mountain slopes in coastal areas; fl. & fr. throughout the year.

Note — Sinclair (l.c.) included this species as a variety of his broad concept of *M. ceylanica*, which is according to him a species distributed in Sri Lanka as well as in the Philippines. *Myristica cagayanensis* resembles *M. ceylanica* s. s., but the latter differs in the more slender twigs lacking lenticels, less coriaceous leaves, androphore glabrous at base, and ellipsoid fruits with short-haired indumentum.

### 19. *Myristica carrii* J. Sinclair

*Myristica carrii* J. Sinclair, Gard. Bull. Sing. 23 (1968) 160, f. 8; W.J. de Wilde, Blumea 40 (1995) 270. — Type: *Hoogland 3521*, Papua New Guinea.

Tree 3–7 m. *Twigs* 3–4 mm diameter, early glabrescent, hairs 0.1 mm long or less; older twigs ashy-brown or grey-black, coarsely striate, tending to crack and flake; lenticels small, sporadic, not apparent. *Leaves* membranous, oblong(-lanceolate) or lower half sometimes  $\pm$  tapering, 25–45 by 5–13 cm, base narrowly rounded or (long-)cuneate, apex acute-acuminate; upper surface olivaceous or brown, lower surface dull (brownish) grey, glabrescent, hairs widely scattered, appressed, pale brown, less than 0.1 mm; not papillose; dots absent; midrib raised above, lateral nerves 16–20 per side, at 45–60° to the midrib, flat above, bright brown, contrasting in colour below, lines of interarching and (coarse) venation distinct,  $\pm$  flat above, obscure or invisible below; petiole dark brown, 12–25 by 2.5–4 mm, contrasting in colour with the grey twig; leaf bud 10–15 by 3 mm, with appressed hairs (0.3–)0.5 mm. *Inflorescences* in male: several crowded at the end or along lateral short-shoots 1–3 cm long (always?), with caducous cataphylls, and with apical leaf bud, below the leaves, peduncle 5–10 by 1–2 mm,  $\pm$  flattened, hairs dense, pale brown, appressed, 0.1 mm or less; flowers 2 or 3 at the end of the peduncles; bracts caducous; female inflorescences (from infructescences): similar. *Male flowers*: pedicel slender, 8–10 mm, bracteole  $\pm$  small, ovate, acute, (sub)apical; buds  $\pm$  ellipsoid,

8–10 by 4 mm, apex and base (sub)acute, glabrescent, hairs dense, pale brown, appressed, 0.1 mm or less, cleft c. 1/2, lobes 4–5 mm, thin; perianth inside finely verruculose. Androecium 4–5 mm; androphore slender, 0.5–1 mm, hairs short, pale brown, 0.2 mm at very base only; synandrium subcylindrical, 4 by 1.5 mm, thecae 24–28, sterile apex absent or slender, 0.5 mm. *Female flowers* not seen. *Fruits* 1 or 2 together, sometimes crowded and then infructescence appearing more-fruited, (ellipsoid-)oblong, 4–5 by 1.5–2 cm, ± fusiform, apex and base narrowed into 3 mm beak and pseudostalk, hairs dense, rusty, (0.2–)0.5 mm; pericarp 2(–5) mm thick, seeds 3 cm by 8–10 mm; fruiting pedicel terete, 6–8 by 1.5–2.5 mm, minutely pubescent, bracteole scar subapically.

*Field-notes* — Low tree, stem to 10 cm diameter. Bark dark brown, longitudinally fissured, with colourless exudate turning red; wood creamy-straw. Leaves glossy green above, glaucous below. Flowers cream. Fruits pale red-brown or orange; seeds black.

*Distribution* — *Malesia*: Papua New Guinea (Morobe & Northern Prov.); a local endemic.

*Habitat & Ecology* — Well drained tall lowland or open forest, forest along riverbanks; 0–350 m altitude; fl. & fr. throughout the year.

*Note* — May be confused with *M. hooglandii* from the same area, but the latter differs in its slightly thicker leaves, weaker (obscure) lateral nerves and veins, broader and larger male flowers, rounded at the apex (not acute), and the much larger glabrescent yellow fruits.

## 20. *Myristica chrysophylla* J. Sinclair

*Myristica chrysophylla* J. Sinclair, Gard. Bull. Sing. 23 (1968) 254, f. 26; Foreman, Handb. Fl. Papua New Guinea 1 (1978) 187; W.J. de Wilde, Blumea 40 (1995) 270. — Type: *Hoogland 3642*, Papua New Guinea, Northern Prov.

Tree 7–25(–30) m. *Twigs* 2–6 mm diameter, (late) glabrescent, hairs dense, woolly, golden or rust-coloured, 1–2 mm; older twigs grey-brown or blackish, finely longitudinally cracking, often thinly flaking; lenticels not apparent. *Leaves* chartaceous or (thinly) coriaceous, ovate-elliptic (rarely obovate-elliptic) to oblong-lanceolate, 10–32(–42) by 2.5–14(–18) cm, base shortly cuneate to narrowly or broadly rounded, or shallowly cordate, apex acute-acuminate; upper surface yellowish-olivaceous or brown, lower surface grey-brown or glaucous, indumentum persistent, or late or early glabrescent (in subsp. *entrecasteauxensis*), hairs dense, light brown, 0.2–0.3 mm, with a varying amount of scattered dendroid or almost unbranched shaggy hairs up to 1.5 mm; not or indistinctly papillose; dots absent; midrib raised above, glabrescent, lateral nerves 10–23 per side, at (50–)60–80° to the midrib, flat or sunken above (leaves in subsp. *chrysophylla* ± bullate), lines of interarching generally distinct, venation reticulate, ± indistinct; petiole short, 5–12 by 2–5 mm, late glabrescent as the twig apices; leaf bud 5–10(–15) by 3–4 mm, acute or blunt, hairs (1–)1.5 mm. *Inflorescences* as in *Knema*: sessile, simple or 2-fid scar-covered wart-like or vermiform brachyblasts; in male: to 10 mm, late glabrescent or hairs persistent, woolly, 1 mm; flowers in clusters of 3–15, buds almost similar in size; bracts (late) caducous, 2 mm, pubescent; female inflorescences shorter, few-flowered; flowers with dense woolly yellow-brown hairs 0.5–1.5 mm. *Male flowers*: pedicel 1–2 by 1–1.5 mm, bracteole 2–3 mm, persistent; buds ovoid-oblong or nearly tubiform, 5–8 by 2.5–3 mm, apex blunt, cleft 1/4–1/3, lobes 1.5–2 mm long, 0.2 mm thick.

Androecium slender, 4–5 mm; androphore about as long as or slightly shorter than the synandrium, 1–3(–4) by 0.4 mm, towards the base with dense yellow-brown straight hairs 0.5–1 mm; synandrium 2–2.2 by 0.4–0.5 mm, thecae 8–12, sterile apex 0.2–0.3 mm. *Female flowers*: pedicel 0.5(–1) mm; buds  $\pm$  ovoid, 5–6 by 4.5–5 mm, cleft c. 1/3, lobes 1.5–2 mm, at anthesis curved outwards; ovary broadly ovoid or subglobose, 2–2.5 mm diameter, hairs dense, woolly, pale brown, 1 mm, style 1 mm long, stigma 1 mm long, 2- or 3-lobulate. Infructescences much reduced. *Fruits* subsessile, solitary or 2 (or 3) together, subglobose or ovoid, 2–2.5 cm diameter, or ovoid-oblong, up to 4.5 cm, apex rounded or narrowed, hairs conspicuous, yellow-brown, dense, woolly, 2–4(–5) mm; pericarp 2 mm thick; seeds ellipsoid, 1.5–2.5 cm; fruiting pedicel 1–3 mm.

Distribution — In *Malesia* a lowland species with two closely related subspecies in Papua New Guinea.

Notes — 1. The inflorescences with (sub)sessile densely woolly flowers look like irregularly knobby woolly clusters, somewhat of the same colour and general appearance as immature fruits. Possibly in connection with the dense and long hairiness of the ovary, the style (with stigma lobes) is distinct; in most species of *Myristica* the stigma lobes are (almost) sessile.

2. The two subspecies have adjoining geographical distributions, with a slight overlap in SE Morobe Province.

#### KEY TO THE SUBSPECIES

- 1a. Lower leaf surface (at least partly) with persistent indumentum. Male buds 7–8 mm. Fruits subglobose or broadly ovoid, 2–2.5(–3) cm diameter, hairs 3–5 mm. — Morobe Prov., Northern Prov. (Kokoda) . . . . . **a. subsp. chrysophylla**
- b. Lower leaf surface glabrescent. Male buds 5–6 mm. Fruits (ovoid-)ellipsoid, 2.5–4.5 cm, hairs 1.5–3 mm. — SE Morobe, Central, and Milne Bay Prov. . . . . **b. subsp. entrecasteauxensis**

#### **a. subsp. chrysophylla**

*Twigs* 2–6 mm diameter. *Leaves* chartaceous, rarely coriaceous, small or large, to 14 (–18) cm wide, base short-attenuate, rounded, or shallowly cordate; upper surface generally faintly or distinctly bullate, lower surface grey-brown, with (at least partly) persistent indumentum. *Male buds* oblong-tubiform, 7–9 mm, cleft (1/5–)1/4. *Fruits* subglobose or broadly ovoid, 2–2.5(–3) cm diameter, hairs woolly, 3–5 mm. — **Fig. 61b.**

Field-notes — Straight-boled, horizontal branching tree. Bark grey-brown or almost black, usually shallowly fissured; inner bark (blaze)  $\pm$  pink; exudate red, watery, or clear and rapidly turning orange-brown; middle bark (dark) red; inner bark red; wood reddish straw or pinkish, turning orange-brown, wood hard or soft. Leaves with nerves deeply impressed above. Flowers (golden-)brown tomentose, inside creamy; male flowers in axillary clusters. Fruits rusty or golden brown tomentose.

Distribution — *Malesia*: Papua New Guinea (Morobe Prov.: Lae subprov.; Northern Prov.: Kokoda).

Habitat & Ecology — Locally frequent in lowland and lower foothill forest of slopes, ridges, or edge of grassland; forests with *Anisoptera*, *Quercus*, and *Calophyllum* on ridge-crests; 15–500 m altitude; fl. Mar., Oct.; fr. throughout the year.

Note — The specimen *LAE 52029* (Lae subprov.) approaches subsp. *entrecasteauxensis* in its narrow, coriaceous leaves.

**b. subsp. *entrecasteauxensis* (J. Sinclair) W.J. de Wilde**

*Myristica chrysophylla* J. Sinclair subsp. *entrecasteauxensis* (J. Sinclair) W.J. de Wilde, *Blumea* 40 (1995) 270. — *Myristica chrysophylla* J. Sinclair var. *entrecasteauxensis* J. Sinclair, *Gard. Bull. Sing.* 23 (1968) 257, f. 27; Foreman, *Contr. Herb. Austral.* no. 9 (1974) 35; *Handb. Fl. Papua New Guinea* 1 (1978) 189. — Type: *Brass 25893*, Normanby Island.

*Myristica fatua* Houtt. var. *morobensis* J. Sinclair, *Gard. Bull. Sing.* 23 (1968) 289, f. 35. — Type: *NGF 3142 (Womersley)*, Papua New Guinea, Morobe Prov.

*Twigs* 2–4 mm diameter. *Leaves* chartaceous or coriaceous, small or large, ± lanceolate or ovate-elliptic, or (ovate-)oblong, narrower than in subsp. *chrysophylla*, 2.5–9.5 cm wide, base short-attenuate or narrowly or broadly rounded, not cordate; upper surface not or but faintly bullate, lower leaf surface glaucous (indumentum brown underneath), (early) glabrescent, the hairs dense to ± sparse, brown. *Male buds* 5–6 mm, cleft c. 1/3. *Fruits* (ovoid-)oblong, (2.5–)3–4.5 by 2 cm, with woolly hairs 2–3 mm.

*Field-notes* — Stem with or without buttresses or spurs. Crown open; branches horizontal. Bark small-flaky, brown or grey-black; bark slash (inner bark) orange-straw, with red-brown exudate, free flowing; wood white or straw, hard. Leaves dull green, pale green, glaucous, or brownish below. Flowers yellow or brown hairy. Fruits brown hairy, or furry-red brown; seeds black.

*Distribution* — *Malesia*: eastern Papua New Guinea (SE Morobe, Northern, Central & Milne Bay Provinces; also Papuan Islands).

*Habitat & Ecology* — Forest of slopes and ridges; once recorded from forest over limestone; also alluvial lowland forest; advanced regrowth forest; up to 430 m altitude; fl. May, July; fr. throughout the year.

*Notes* — 1. Subsp. *entrecasteauxensis* is variable in general habit, and possibly should be divided. Specimens with small, almost lanceolate leaves include *NGF 38578 (Henty)* and *NGF 3142 (Womersley)* (the type of *M. fatua* var. *morobensis*). Comparatively large and broad-leaved specimens include *Brass 25986* and *Saunders 57* (from Tufi subdistrict); this latter specimen was discussed by Sinclair (1958: 259) as being intermediate to var. *chrysophylla*.

2. The dense long hairs of flowers and fruits are somewhat reminiscent of those of *M. inopinata*.

**21. *Myristica cinnamomea* King**

*Myristica cinnamomea* King, *Ann. Roy. Bot. Gard. Calc.* 3 (1891) 292, pl. 116; *Warb., Mon. Myrist.* (1897) 445; J. Sinclair, *Gard. Bull. Sing.* 16 (1958) 358, f. 28, pl. VII A; 28 (1968) 210; W.J. de Wilde, *Blumea* 42 (1997) 156; *Tree Fl. Sabah & Sarawak* 3 (2000) 456. — Lectotype: *King's coll. 7474* (male fl.), Peninsular Malaysia.

Tree (7–)10–30 m. *Twigs* 1.5–2.5(–4) mm diameter, glabrescent, hairs 0.1 mm; older twigs dark grey-brown to blackish, coarsely striate, not or but rarely flaking; lenticels absent. *Leaves* chartaceous or thinly coriaceous, elliptic-oblong to oblong-lanceolate, 8–22 by 2–8 cm, base broadly acute or attenuate, apex acute(-acuminate); upper surface olivaceous, ± glossy, lower surface grey- or silvery-brown, sometimes late glabrescent,

hairs dense, inconspicuous, 0.1 mm, with scattered brown hairs to 0.2 mm; not obviously papillose; dots absent; midrib above flat or somewhat raised, in a groove, lateral nerves 10–17 per side, at 45–60° to the midrib,  $\pm$  sunken, indistinct above, lines of interarching and venation indistinct; petiole 12–22 by 1.5–3 mm; leaf bud 10–15 by 2–3 mm, hairs 0.1 mm. *Inflorescences* among the leaves, pedunculate, with mealy hairs, 0.1–0.2 mm; bracts ovate, 2–3 mm, caducous; in male: 1–2.5 cm long, peduncle 5–15 mm; lateral branches up to 5 mm, central axis to 10 mm or absent (or reduced to one flower), with subumbels of 5–8(–10) flowers, buds of various sizes; female inflorescence: an up to 3 mm pedunculate wart (rarely  $\pm$  forked), with 2–4-flowered subumbel; flowers with hairs 0.1(–0.3) mm. *Male flowers*: pedicel 3–6 by 0.5 mm, bracteole 1(–2) mm, (sub)apical, (late) caducous; buds ellipsoid-oblong,  $\pm$  cylindrical or  $\pm$  contracted in the middle, 5–7 by 2–3 mm, apex  $\pm$  angled, cleft 1/3–1/2, lobes 2–3 mm long, 0.5(–1) mm thick, at anthesis  $\pm$  curved outwards. Androecium 3.5–4.5 mm; androphore 1.5–2(–2.5) by (0.6–)0.8–1 mm, hairs pale, 0.1 mm or less; synandrium ellipsoid-oblong, 1.8–2 by 0.6–0.8 mm, thecae 12–16, sterile apex blunt, 0.2–0.3 mm, minutely pubescent (Peninsular Malaysia, Borneo) or  $\pm$  acute, (sub)glabrous (Sumatra). *Female flowers*: pedicel 2.5–4 mm; buds ovoid-ellipsoid, angled at apex, 5–6 by 2.5–3 mm, cleft 1/3–1/2; ovary ovoid-conical, 2.5 by 1.5–2 mm, with dense hairs 0.1 mm or less. Infructescence 0.5–2 cm. *Fruits* solitary or 2 (or 3), broadly ellipsoid or oblong, or  $\pm$  pear-shaped, 5–9 by 2.5–5 cm, base rounded or subattenuate, hairs dense, mealy, rusty, 0.1(–0.2) mm; pericarp (5–)8–15 mm thick; seeds ellipsoid, 3.5–5.5 cm; fruiting pedicel rather stout, 5–10 mm.

*Field-notes* — Crown dense. Trunk at base often  $\pm$  fluted or with low buttresses, or with a few small stilt-roots (often recorded); bark blackish brown (chocolate, dark grey), brittle, with fine close vertical fissures, sometimes also with fine horizontal cracks, sometimes thinly flaking with appressed flakes; inner bark 5 mm thick, brown to pinkish, soft,  $\pm$  laminated; exuding red watery sap slow to appear; cambium reddish; sapwood soft, pale yellowish to brownish, often reddish speckled. Leaves dark green, glossy above, midrib pale, in a furrow; lower leaf surface with coppery, golden, or silvery brown indumentum. Flowers greenish to yellow with yellow-brown indumentum; scent not pleasant; tepals bright red inside. Fruits to 10 cm, yellow-brown to apricot, with apricot or rusty mealy indumentum; aril compact, bright or dark red; seeds blackish.

*Distribution* — *Malesia*: Sumatra, Peninsular Malaysia, Singapore, Borneo, rare in the Philippines (Mindanao, no material seen).

*Habitat & Ecology* — Locally common or scattered in various types of primary forest: lowland and hill mixed dipterocarp forest, ridge forest, (hilly) kerangas, forest transitional to submontane forest; on a variety of soil types: sandy soils, sandy loam, red soil, mor soil, brownish clay-loam soil, silty sand, stony granitic soil, igneous-derived soil, wet ground, sandstone; on hillsides, crests, undulating land; also in peat swamp forest; 0–1000(–1400) m altitude; fl. & fr. throughout the year, but fl. predominantly Mar.–June in all areas.

*Notes* — 1. *Myristica cinnamomea* is characterized by the persistent inconspicuous hairs on the lower leaf surface, the short hairs on the leaf bud and twig apices, the angular apex of flower buds, and the fruits with mealy indumentum. *Myristica beccarii* and *M. smythiesii* are superficially similar species but they have different inflorescences.

2. The pubescent sterile apex of the androecium in the material from Peninsular Malaysia and Borneo is noteworthy.

## 22. *Myristica clemensii* A. C. Sm.

*Myristica clemensii* A. C. Sm., J. Arnold Arbor. 22 (1941) 78; W. J. de Wilde, Blumea 40 (1995) 270. — *Myristica lancifolia* Poir. var. *clemensii* (A. C. Sm.) J. Sinclair, Gard. Bull. Sing. 23 (1968) 463, f. 81; Foreman, Handb. Fl. Papua New Guinea 1 (1978) 204. — Type: *Clemens 1668*, Papua New Guinea.

Tree 8–25 m. Twigs (1–)1.5–2 mm diameter, sometimes faintly angular, early glabrescent, hairs 0.1–0.2 mm; older twigs (blackish) brown; lenticels few, sometimes distinct; axillary buds sometimes conspicuous. *Leaves* chartaceous, (ovate-)oblong-lanceolate, 8–16 by 1.5–4.2 cm, base shortly attenuate, apex acutish, sometimes ± rounded, or with blunt tip; upper surface olivaceous or dark brown, lower surface brown-grey, early glabrescent, hairs sparse, whitish, less than 0.1 mm; papillose; dots absent; midrib flat or sunken above, lateral nerves 15–20 per side and with additional smaller intersecondary ones often present, at 45–60° to the midrib, sunken above, indistinct below, lines of interarching and venation indistinct; petioles 10–20 by 1–2 mm; leaf bud 10–12 by 1.5–2 mm, with golden hairs 0.3–0.5 mm. *Inflorescences* among the leaves or below, with short peduncle, approaching the *Knema*-type, short-pubescent, bracts small, caducous; in male: peduncle (1–)2–4 by 1–1.5 mm, brachyblast scar-covered, simple or forked, thickish, to 3 mm, with fascicles of (1–)2–6 flowers, buds of various sizes; female inflorescence similar, 1–4-flowered; flowers with hairs 0.1–0.2 mm. *Male flowers*: pedicel 3–5 by 0.4–0.6 mm, bracteole ± ovate, 1.5–2 mm, subpersistent; buds ± carnosous, ellipsoid(-oblong), 4–5 by 2–3 mm, rounded at both ends, apical part ± angled, cleft c. 1/3, lobes 1.5–2 mm long. Androecium 3–4 mm; androphore 1–1.5 by 0.8–1 mm, the lower half with dense appressed brown hairs less than 0.1 mm; synandrium ellipsoid-oblong, 2–2.2 by 1–1.2 mm, thecae c. 16, sterile apex blunt, 0.2–0.3 mm. *Female flowers* not seen. *Fruits* solitary, ellipsoid, 4–5.5 by 2.5–4.5 cm, apex ± rounded, faintly beaked, base ± attenuate, hairs dense 0.1 mm; pericarp 5–8 mm thick, woody, often ridged at one side, somewhat warty or not; seeds ellipsoid, 2.5 cm; fruiting pedicel woody, straight or curved, 5–10 by 2.5–5 mm, cracked, sometimes with some lenticels.

Field-notes — Without buttresses. Bark ± smooth with only shallow longitudinal fissures, brown or grey; inner bark straw(-red), reddish brown or with red watery sap; wood pinkish or straw; heartwood dark. Leaves glaucous below. Flower buds with golden bloom; perianth yellow with rusty indumentum. Fruits orange or brown, up to 7 cm, pyriform with prominent ridge, rugose or bark-like.

Distribution — *Malesia*: Papua New Guinea (Morobe, Northern, S Highlands Prov., E & W New Britain).

Habitat & Ecology — Montane forest, *Castanopsis*-dominated forest, on ridges and slopes; (20–)250–900 m altitude; fl. Jan.–May; fr. throughout the year. *NGF 31707 (Ridsdale)* (somewhat deviating by smaller, but possibly immature fruit) is from microphyllous vegetation at only 20 m altitude.

Notes — 1. *Myristica clemensii* has distinctive smallish narrow leaves with papillate undersurface; it superficially resembles *M. lancifolia*, which has sessile inflorescences, smaller fruits, broader leaves, etc., and it has the distinct papillate undersurface of the leaves in common with *M. clemensii*.

2. Specimens from New Britain differ from those of Morobe Province in having larger fruits, 5–5.5 cm, with thick, relatively short fruiting pedicel.



### 23. *Myristica coacta* W.J. de Wilde

*Myristica coacta* W.J. de Wilde, Blumea 40 (1995) 270. — Type: *NGF 41553 (Henty et al.)*, Papua New Guinea, West Sepik Prov.

Tree c. 10 m. *Twigs* 2(–3) mm diameter, early glabrescent, hairs 0.1 mm; older twigs somewhat longitudinally cracking (not flaking), with numerous small lenticels. *Leaves* (thinly) coriaceous, elliptic-oblong, 14–16 by 5–7 cm, base cuneate, apex (long-)acute-acuminate; upper surface olivaceous(–brown), lower surface bright yellowish brown or cinnamon by persistent dense, felty, interwoven scale-like and flocculose hairs 0.2–0.3 mm; not papillose; dots absent; midrib slightly raised above, lateral nerves 12–14 per side, at c. 60° to the midrib, slender and flat above, little raised and faint below, lines of interarching and venation indistinct at both surfaces; petiole 15–20 by 2–2.5 mm; leaf bud 10–15 by 2 mm, hairs 0.2–0.3 mm. *Female inflorescences* (from infructescences) (sub)sessile, ± below the leaves, of the *Knema*-type, apparently few-flowered. *Male and female flowers* not seen. *Fruits* (slightly immature) single, ovoid-ellipsoid, 3.5–4 by 2 cm, apex subacute, base narrowed or narrowly rounded, hairs dense, dark rust-coloured, scurfy, 0.1(–0.2) mm; pericarp 3–4 mm thick; seeds not seen; fruiting pedicel 8–10 by 3.5–4 mm, short-pubescent, densely and conspicuously lenticellate, bracteole scar faint, 1–3 mm below the apex.

Field-notes — Leaves dark green above, brown tomentose below.

Distribution — *Malesia*: Papua New Guinea (West Sepik Prov. at Oksapmin; possibly *Takeuchi 4136* also belongs here, from Morobe Prov., Kuper Range).

Habitat & Ecology — Degraded fagaceous forest; altitude c. 2000 m; fr. Oct.

Note — *Myristica coacta* is distinguishable by its leaves with felty indumentum and flocculose hairs; it keys out beside *M. inutilis* subsp. *papuana* and *M. tenuivenia*, species with (partly) small leaves with persistent dense, short indumentum below.

### 24. *Myristica colinridsdalei* W.J. de Wilde

*Myristica colinridsdalei* W.J. de Wilde, Blumea 42 (1997) 156. — Type: *Ridsdale c. s. ISU 499*, NE Luzon.

Tree 18–40 m, dbh 40–50 cm. *Twigs* (when fertile several pseudowhorled from near the apex of orthotropic main stem) 4–5(–6) mm diameter, blackish, early glabrescent, hairs pale, less than 0.1 mm, smooth or striate, cataphylls (bud scales) leaving half-circular scars; older twigs faintly cracking, with scattered coarse lenticels. *Leaves* coriaceous, ± crowded; blades (elliptic-oblong or) oblong-lanceolate, 11–30 by 3–6 cm, base cuneate or narrowly rounded, apex acute(–acuminate) or ± blunt; upper surface olivaceous-brown, lower surface grey-brown, with subpersistent grey-brown dense interwoven hairs 0.1 mm or less; midrib slightly raised above, lateral nerves 15–22 per side, at 45–60° to the midrib, flat or sunken above, purplish brown, contrasting in colour below, lines of interarching and venation indistinct; petiole 20–35 by 2.5–3.5(–5) mm; leaf bud 15–20 by 3–4 mm, hairs appressed, 0.1(–0.2) mm. *Inflorescences* ± crowded, between or below the leaves, peduncle absent as in *Knema*, brachyblast scar-covered, simple or usually forked, to 10 mm, short-pubescent, glabrescent; bracts small, caducous; in male with 2–10 flowers, buds of various sizes; flowers with dense, dark rust-coloured hairs, 0.1–0.3 mm. *Male flowers*: pedicel 1.5–3 by 1–1.5 mm, bracteole small, 2 mm, persist-

ent or caducous; buds firm but thin, ovoid-ellipsoid, 4–5 by 3–3.5 mm, apex rounded, cleft c. 1/2, lobes 2 mm long, at anthesis suberect. Androecium 4 mm; androphore ± tapering, 1–1.5 by 1 mm, in the lower half or almost completely with dense pale brown hairs 0.1 mm or less; synandrium 2–2.5 by 1–1.5 mm, thecae 20, sterile apex ± blunt or broad conical, 0.2–0.3 mm. *Female inflorescences* and *flowers* not seen. *Infructescences* small. *Fruits* (measurements of material in spirit) single (or 2) per infructescence, subglobose or ovoid(-ellipsoid-)oblong, 6–7 by 4–5 cm, hairs dense, short, dark brown, 0.1–0.2 mm (hence ovary pubescent); pericarp 10–12 mm thick; seeds ellipsoid, 3.5 cm; fruiting pedicel 5–10 by 8 mm.

*Field-notes* — Buttresses to 1 m, or with flying buttresses. Bark blackish, flaky or scaly; inner bark wine red with watery sap, or streaky red with red sap. Leaves clustered at the end of a branch, glaucous below. Flowers small, brownish. Fruits brown.

*Distribution* — *Malesia*: Philippines (NE Luzon, Isabela Prov.; endemic to the Palanan area).

*Habitat & Ecology* — On ultrabasic: low stature forest with many large-girth trees, streamside forest, or high canopy forest on low coastal hills; locally common in flat, riverine areas; c. 50 m altitude; fl. & fr. Apr.

*Note* — The almost whorled lateral branching, and leaves that are somewhat clustered near the apex of the orthotropic main shoot, are possibly typical for the species. All collections were made in areas with ultrabasic bedrock.

## 25. *Myristica concinna* J. Sinclair

*Myristica concinna* J. Sinclair, Gard. Bull. Sing. 23 (1968) 375, f. 62; Foreman, Handb. Fl. Papua New Guinea 1 (1978) 189; W.J. de Wilde, Blumea 40 (1995) 271. — Type: *Saunders* 28, Papua New Guinea.

Tree 3–22 m. *Twigs* 1–1.5 mm diameter, subangular, yellowish or reddish brown, early glabrescent, hairs 0.1 mm or less; older twigs neither cracking nor flaking; lenticels absent or small and indistinct. *Leaves* membranous or thinly coriaceous, elliptic-oblong to oblong-lanceolate, 5–16 by 1.2–4.2(–4.5) cm, base attenuate, apex acute-acuminate; upper surface olivaceous or brown, lower surface pale grey-brown, late glabrescent, hairs sparse, scattered, pale, less than 0.1 mm; ± papillose, but this sometimes not very distinct, or only in old leaves (lens!); dots absent; midrib raised above, lateral nerves 7–14 per side, at 60–80° to the midrib, flat above, (little) raised below, lines of interarching and venation indistinct; petiole 7–12 by 0.7–1.2 mm; leaf bud 6–8 by 1 mm, hairs 0.1 mm or less. *Inflorescences* between and below the leaves, peduncle absent; in male: simple or 2-armed scar-covered brachyblasts to 5 mm, early glabrescent; bracts ± round, 0.5 mm, hairs coarse, caducous; flowers 1–10 in a subumbel, buds of slightly variable sizes; female inflorescences 1–3-flowered; flowers with minute (blackish) brown hairs 0.1(–0.2) mm. *Male flowers*: pedicel 1–1.5 mm, bracteole 0.5–1 mm, persistent; buds almost tubular, 3.5–5 by 1.5–2 mm, apex rounded or subacute, base (shortly) attenuate, cleft 1/5–1/4, lobes 1 mm long, 0.1–0.2 mm thick, at anthesis suberect. Androecium slender, 3.2–5 mm, included or shortly exerted; androphore 1–2 by 0.4–0.5 mm, pubescent for lower 1/2–2/3, hairs pale, 0.1–0.3 mm, longest towards the base; synandrium 1.7–3 by 0.5–0.6 mm, thecae 6–8, ± spaced, with a minutely 3-lobed sterile apex 0.1–0.3 mm. *Female flowers*: 3- or 4-lobed, pedicel 1–2 mm, bracteole 0.5 mm, ± apical; buds

ovoid, 4 by 2.5 mm, cleft 1/4, lobes 1 mm long, at anthesis somewhat curved outwards; ovary ovoid, 2.5 by 1.8 mm, hairs 0.2–0.3 mm. *Fruits* solitary or 2 or 3 together, ellipsoid, 1.5–2.5 by 1.2–1.5 cm, apex rounded or shortly acute, at base  $\pm$  contracted into an up to 4 mm long pseudostalk; hairs mealy, 0.1–0.3 mm, longest on the pseudostalk; pericarp 2 mm thick; seeds broadly ellipsoid, 1.2–1.7 cm; fruiting pedicel slender, (1–) 2–4 mm, bracteole scar slightly below the apex.

*Field-notes* — Branches horizontal spreading. Outer bark 7 mm thick, (blackish) brown, slightly longitudinally or finely fissured, with patches of brown and grey; blaze straw to pale brown; sap colourless turning pink or (red-)brown; wood hard, straw, exudate turning red. Leaves glossy dark green above, dull glaucous or dull grey-green below. Flowers (creamy-)yellow, orange, or brown, with brown hairs. Fruits (olive-)brown with light brown hairs.

*Distribution* — *Malesia*: Papua New Guinea (Morobe, Northern, Central, and Milne Bay Provinces, incl. Goodenough I.).

*Habitat & Ecology* — In primary, regrowth, and degraded forest, coastal, swamp, and dry-land forest on ridges and slopes; *Octomeles*-forest on alluvial deposits; forest dominated by *Lithocarpus*, *Anisoptera*, and *Hopea*; locally common; 0–500 m altitude; fl. May–Aug.; fr. May–Nov.

*Notes* — 1. *Myristica concinna* is recorded by Foreman from the Gulf Province, but I did not see any material from that area.

2. Sinclair, l. c., considered *M. globosa* to be the closest relative of *M. concinna*. However, it is closely related to *M. insipida* of which it can be regarded as a more delicate edition. The two share short-pedicelled flowers and ellipsoid fruits (which, however, are smaller and with shorter indumentum in *M. concinna*); special distinguishing features of *M. concinna* are the slender twigs, small and narrow leaves, small, narrow and short-pedicelled male flowers, and small fruits. The synandrium is made up of only 3 (possibly sometimes 4) anthers, hence with 6(–8) thecae, distinctly spaced before sporulation. The short sterile apex of the synandrium is formed by the sterile apical parts of the anthers, not by the central column as in most species of *Myristica*. The small, slender flowers are reminiscent of those of *M. lepidota*; *M. concinna* may also be confused with *M. lancifolia*, mainly on account of the small fruits; however, the latter species has male flowers usually with longer pedicels, more anthers in the synandrium, a glabrous androphore, and more closely set lateral nerves, fainter on the lower leaf surface.

## 26. *Myristica conspersa* W.J. de Wilde

*Myristica conspersa* W.J. de Wilde, Blumea 40 (1995) 272. — Type: BW 7964 (*Schram*), Irian Jaya, Kebar Valley, Bird's Head.

Tree 20–35 m. *Twigs* 1–2 mm diameter, early glabrescent, hairs sparse, 1 mm or less; older twigs coarsely striate or finely fissured, but not cracking nor flaking; without or with small inconspicuous lenticels. *Leaves* (thinly) chartaceous, (elliptic-)oblong or oblong-lanceolate, 5–10 by 2–2.5(–3) cm, base attenuate or cuneate, apex subacute or blunt, or narrowly rounded; upper surface olivaceous, lower surface grey-brown or pale brown, indumentum (sub)persistent, or early or late glabrescent, hairs dense or remote, scale-like, 0.1 mm or less; not or faintly papillose; dots and dashes present; midrib (flat or) raised above, lateral nerves 15–22 per side, at (70–)80° to the midrib, flat and incon-

spicuous above, lines of interarching faint, venation faint or invisible; petiole 7–12 by 1(–1.5) mm, leaf bud 7–10 by 1.5(–2) mm, hairs 1 mm or less. *Inflorescences* among the leaves or below, of the *Knema*-type: sessile or subsessile, simple (or 2-fid), scar-covered, slender, wart- or worm-like brachyblasts to 5 by 1–1.5 mm, glabrescent, peduncle to 2 mm; in male with a subumbel of (2–)4–6 flowers, buds of various sizes; female inflorescences 2(–4)-flowered; flowers with minute brown hairs 0.1–0.2 mm. *Male flowers*: pedicel slender, 3 by 0.5 mm, bracteole 1 mm, persistent or caducous; buds oblong(-tubiform), 3.5 by 1–1.5 mm, apex narrowly rounded, base rounded, cleft c. 1/3, lobes 1(–1.5) mm long, (0.1–)0.2 mm thick. Androecium slender, 2.5 mm; androphore 1 by 0.3 mm, glabrous; synandrium 1.5 by 0.3–0.4 mm, thecae 12–14, sterile apex bluntish, 0.1–0.2 mm. *Female flowers*: pedicel 3 by 0.6 mm, bracteole caducous; buds (submature) 3 by 2 mm; ovary not seen. *Fruits* solitary, subsessile, ellipsoid(-fusiform), (2–)2.5 by 1.4 mm, apex acute with minute pointed style-remnant, base contracted into 3 mm long pseudostalk, hairs scurfy, rust-brown, 0.1 mm or less; pericarp 2 mm thick; seeds ellipsoid, 1.5 cm; fruiting pedicel slender, 5 by 1 mm, indumentum minute, glabrescent, bracteole scar nearly 1 mm below the fruit.

Field-notes — Bole not buttressed. Bark with shallow fissures or not fissured, not peeling, or strongly flaking; inner bark with red or orange milky exudate; wood pink or reddish brown, no heartwood. Flowers (yellow-)brown. Fruits light brown.

Distribution — *Malesia*: Papua Barat (Bird's Head).

Habitat & Ecology — Rather common in primary forest on sandy clay; from low altitudes up to c. 900 m; fl. May, Nov.; fr. May.

Notes — 1. The three known specimens of *M. conspersa* are heterogeneous, and provisionally placed here, also for convenience's sake. None of the three fit in any other known species, but when more material becomes available they may be found to represent more than one taxon. Brief notes on the specimens are given by De Wilde (l.c.).

2. *Myristica conspersa* seems closely related to *M. arfakensis*, from the same area, both having small male flowers with a similar androecium; the latter differs in its stalked inflorescences, slightly larger fruit, and dotted (not dashed) lower leaf surface. *Myristica conspersa* has the faint, closely set lateral nerves in common with *M. lancifolia*.

*Myristica scripta*, occurring in most of New Guinea (except Bird's Head), is another closely related species; it differs in its generally stouter habit, leaves with acute apex and usually drying darker brown, generally larger flowers, and fruits lacking a pseudostalk; its flowers (incl. the androecium), however, are very similar.

## 27. *Myristica cornutiflora* J. Sinclair

*Myristica cornutiflora* J. Sinclair, Gard. Bull. Sing. 23 (1968) 348, f. 53, 54; Foreman, Handb. Fl. Papua New Guinea 1 (1978) 190, f. 87 (excl. *M. gracilipes*); W.J. de Wilde, Blumea 40 (1995) 273. — Type: BW 6413 (*Kalkman*), Irian Jaya.

Shrub or small tree, 1–20 m. *Twigs* 1.5–4 mm diameter, yellowish brown or dark brown, very early glabrescent, hairs 0.1 mm or less; older twigs tending to crack longitudinally; lenticels not conspicuous. *Leaves* membranous or subcoriaceous, elliptic-oblong to oblong-lanceolate, 8–24 by 3.5–10 cm, base (short-)cuneate or rounded, apex acute-acuminate, margin ± revolute on drying; upper surface olivaceous, lower surface grey- or pale brown, early glabrescent, or extremely small whitish stellate scale-like

hairs persistent, but leaves appearing glabrous; not papillose; sparse or dense dots and dashes present (lens!); midrib flat or slightly raised above, lateral nerves 10–16 per side, at 60–80° to the midrib, lines of interarching distinct or not, sunken above, venation forming a coarse network, faint at both surfaces; petiole 12–25 by 1.5–3 mm; leaf bud 10–15 by 1.5–3 mm, hairs 0.1 mm. *Inflorescences* among the leaves or rarely below, pedunculate, indumentum very minute; in male: 1.5–4 cm, with flattened peduncle 5–30 (–35) mm, with 2 or 3 up to 10 mm long scar-covered brachyblasts, with or without a short smooth basal part, each arm with a subumbel of 3–10 flowers, buds subequal in size, the central axis sometimes reduced to (the scar of) one flower; female inflorescences much smaller, peduncle 5–10(–20) mm, with (1 or) 2–4 flowers, but sometimes along short leafless shoots suggesting larger inflorescences; bracts minute, caducous; flowers largely glabrescent, hairs appressed, 0.1 mm or less. *Male flowers*: pedicel 5–15 by 0.5–1 mm, bracteole 1–1.5 mm, caducous, apical or up to 2 mm below; buds membranous or horny, (ovoid-)oblong, sometimes ± tubiform, much narrowed towards the apex, 10–20 by 2–3.5 mm, the apical part ± triangular in cross section, base narrowly rounded, cleft at the apex only, lobes ± thin, 0.2–0.5 mm thick, (1–)1.5 mm long, at anthesis not recurved. Androecium slender, 6–9 mm; androphore slender, 2.5–4.5 by 0.4–0.6 mm, minutely appressed-pubescent in the lower 3/4; synandrium 3.5–4.5 by 0.6–1 mm, thecae 10–12, gradually passing into the androphore, sterile apex 0.2–0.4 mm, blunt (sometimes irregular). *Female flowers*: pedicel slender, 6–12 mm, bracteole caducous, close to the apex; buds ± flask-shaped, narrowed towards the apex, 10–12 by 3–4 mm, lobes 1–1.5 mm long; ovary ovoid-oblong, 4–5 by 2.5–3 mm, hairs dense, appressed, less than 0.1 mm. *Fruits* usually solitary, ± ellipsoid(-oblong), 4.5–6.5 cm, pubescent or glabrescent, style-remnant persistent; seeds 3 cm; fruiting pedicel straight, slender, 1–2 cm.

Distribution — Two subspecies, one mainly in the southern, the other in the northern part of New Guinea.

#### KEY TO THE SUBSPECIES

- 1a. Male inflorescences rather stout, peduncle broadly flattened, 1.5–2 mm wide. Fruits ± ellipsoid(-oblong), 4.5–6.5 by 2.5–3.5 cm, apex blunt, pseudostalk absent . . . . .  
 . . . . . **a. subsp. *cornutiflora***
- b. Male inflorescences elegant, peduncle more slender, 1–1.5 mm wide. Fruits ± fusiform, 4.5–5.5 by 2(–2.5) cm, apex acute, pseudostalk present . . **b. subsp. *elegans***

#### **a. subsp. *cornutiflora***

Small tree. *Male inflorescences* rather stout, peduncle broadly flattened, 1.5–2 mm wide. *Male flowers*: pedicel 5–6 mm, bracteole scar apical; buds 10–13 by 3–3.5 mm, at apex sharply angled, lobes horny, 0.5 mm thick; androphore 2.5–3.5 mm, as long as or shorter than the synandrium. *Fruits* ± ellipsoid(-oblong), 4.5–6.5 by 2.5–3.5 cm, apex blunt, pseudostalk absent, suture deeply grooved, glabrescent, hairs minute, greyish; pericarp 10 mm thick, woody. — **Fig. 59c.**

Field-notes — Buttresses up to 0.5 m, up to 3/4 m out. Outer bark shallowly fissured, rather strongly peeling with small scales; inner bark with red opaque exudate. Flowers greenish yellow. Fruits green-yellow or sordid yellow.

Distribution — *Malesia*: southern Central New Guinea (Papua Barat: Southern Division); Papua New Guinea (Western & Southern Highlands Prov.).

Habitat & Ecology — Dryland forest and marshy forest edges, also degraded forest; limestone country; occasionally flooded; 25–800 m altitude; fl. & fr. throughout the year.

**b. subsp. *elegans* W.J. de Wilde**

*Myristica cornutiflora* J. Sinclair subsp. *elegans* W.J. de Wilde, *Blumea* 40 (1995) 273. — Type: NGF 48167 (Foreman & Kumul), Papua New Guinea.

Shrub 1–2 m, or low tree to 10 m. *Male inflorescences* elegant, peduncle slender, 1–1.5 mm wide. *Male flowers*: pedicel slender, 8–15 mm, bracteole scar up to 2 mm below the apex; buds elongate, 12–20 by 2–3 mm, at apex  $\pm$  triangular in section, but not with sharp edges, lobes membranous, 0.2–0.3 mm thick; androphore 3–4.5 mm, as long as synandrium. *Fruits* (somewhat immature)  $\pm$  fusiform, 4.5–5.5 by 2(–2.5) cm, apex acute, at base with tapering pseudostalk, hairs dense, very minute, brown, scurfy, less than 0.1 mm; pericarp less than 10 mm thick.

Field-notes — Outer bark smooth, grey or dark brown; inner bark cream; sap from bark watery, red; wood soft, straw or light brown. Leaves glossy. Flowers creamy with waxy appearance, to 25 mm long. Fruits green- or orange-yellow, or orange-brown.

Distribution — *Malesia*: northern Papua New Guinea (West & East Sepik Prov.).

Habitat & Ecology — *Hopea-Anisoptera* forest, lowland rain forest beside rivers, flood plains, mid-montane forest, or forest on low ridges; 200–1050 m altitude; fl. & fr. Mar., June, Sept.

**28. *Myristica corticata* W.J. de Wilde**

*Myristica corticata* W.J. de Wilde, *Blumea* 42 (1997) 157; *Tree Fl. Sabah & Sarawak* 3 (2000) 457. — Type: SAN 87293 (*Krispinus*), Sabah.

Tree 10–25 m. *Twigs* stout, angular, (4–)5–6 mm diameter, indumentum minute, early glabrescent, hairs 1 mm; older twigs pale, later on blackish, usually coarsely irregularly longitudinally cracking and flaking; lenticels absent. *Leaves* chartaceous or thinly coriaceous, elliptic-oblong or oblong(-lanceolate), 15–35 by 6–11.5 cm, base broadly rounded or subcordate, apex acute-acuminate; upper surface olivaceous brown, lower surface dull, concolorous, glabrous; not obviously papillose; dots absent; midrib flat or slightly raised above, lateral nerves 17–24 per side, at 60–80° to the midrib, above (flat or) sunken, lines of interarching usually distinct, venation  $\pm$  indistinct on both surfaces; petiole 15–25 by 2.5–4 mm; leaf bud 10–15 by (4–)5–6 mm, hairs rough, 1 mm. *Inflorescences* among the leaves and below, pedunculate, branched, hairs dense, woolly, rust-coloured, 1(–1.5) mm; in male: 2–4.5 by 2–3 cm, peduncle flattened, 4–6 mm, lower branches 5–7 mm, ending in a flower cluster, central axis 20–40 mm, with 1–3 clusters, each with 5–10 flowers, buds of various sizes; bracts caducous, pubescent; flowers with woolly rust-coloured hairs 0.3(–0.5) mm. *Male flowers*: pedicel slender, 4–6 mm, bracteole 3.5 mm, persistent; buds ovoid, 5–5.5 by 4–4.5 mm, apex (narrowly) rounded, base rounded, cleft c. 1/2, lobes 0.2 mm thick, at anthesis suberect. Androecium slender, 4.5 mm; androphore 1.5 by 0.7 mm, hairs conspicuous, brown, 0.2–0.3 mm; synandrium

3 by 0.8 mm, thecae 14–16, sterile apex  $\pm$  blunt, 0.2 mm, glabrous. *Female flowers* not seen. Infructescences little-branched, 1.5–2 cm, glabrescent. *Fruits* 1 (or 2) per infructescence, ellipsoid-oblong, 7.5–9.5 by 4–5 cm, early glabrescent, hairs dense, scurfy, less than 0.1 mm long, glossy dark brown; pericarp 15(–20) mm thick; seeds ellipsoid-oblong, 4.5–5.5 cm; fruiting pedicel (2–)5 mm.

*Field-notes* — Buttresses to 1 m or with flying buttresses, 1 by 1 m. Bole straight; bark brown or blackish, cracked, coming off in small longitudinal thin flakes; outer bark hard and brittle, 2.5 mm; inner bark 6 mm, hard, orange-brown, reddish, or yellowish; sapwood pink, red, or light brown; cambium reddish. Flowers yellowish. Fruits ochre; seed-coat black.

*Distribution* — *Malesia*: Borneo (Brunei, Sabah).

*Habitat & Ecology* — Primary and logged-over lowland forest, low undulating country, hillsides; sandstone ridges with sandy clay soil; 0–500 m altitude; fl. July; fr. May, Aug., Nov.

*Notes* — 1. *Myristica corticata* is closely allied to the variable *M. iners*; both have the same smooth, non-papillose structure of the lower leaf surface (lens!), which is of almost the same colour as the upper surface. *Myristica corticata* may be confused with stout specimens of *M. iners* from northeastern Borneo. The differences between these species have been discussed in detail by De Wilde (l.c.: 158).

2. In *M. corticata* the distinct marginal arches of the leaf venation are like those of certain forms of *M. extensa* and *M. malaccensis*, and the stout twigs with conspicuously cracking bark are like those of *M. papyracea* (but here the lower leaf surface is strongly papillose).

## 29. *Myristica crassa* King

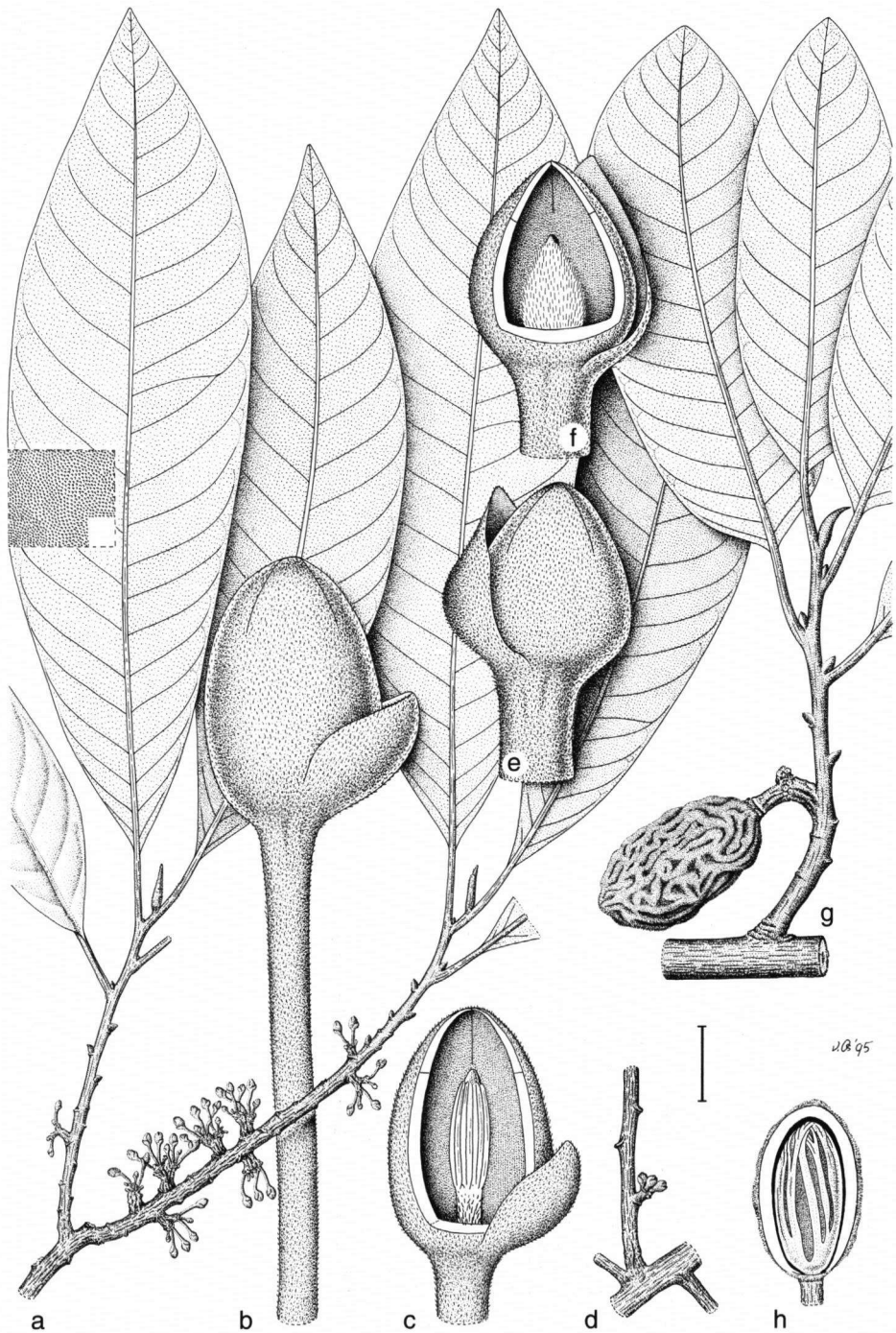
*Myristica crassa* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 293, pl. 117; Warb., Mon. Myrist. (1897) 495; J. Sinclair, Gard. Bull. Sing. 16 (1958) 366, f. 31, pl. VIII A; 23 (1968) 435; W. J. de Wilde, Blumea 42 (1997) 159; Tree Fl. Sabah & Sarawak 3 (2000) 458. — Lectotype: *King 5065*, Peninsular Malaysia, Perak.

*Myristica suavis* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 295, pl. 121; Warb., Mon. Myrist. (1897) 441. — Type: *Cantley s.n.*, Peninsular Malaysia.

*Myristica lowiana* auct. non King, p. p.: King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 293, pl. 120 f. 1, 5, 6, 7, flowering material (*King 5537, 7258*).

Tree 10–25 m. *Twigs* 3–7 mm diameter, dark brown or blackish, very early glabrescent, indumentum minute; older twigs not flaking; lenticels sometimes present, indistinct. *Leaves* chartaceous or thinly coriaceous, elliptic-oblong to oblong-lanceolate, (13–)17–40 by 4.5–13 cm, base rounded or cuneate, apex acute-acuminate, margin often somewhat revolute on drying; upper surface dark olivaceous, lower surface greyish (purplish)

Fig. 70. *Myristica crassa* King. a. Leafy twig with male inflorescences; inset: papillate lower leaf surface; b. male bud with persistent bracteole; c. ditto, opened, showing androecium; d. twig with female inflorescence; e. female bud; f. ditto, opened, showing pistil; g. leafy twig with inflorescence bearing a single fruit; h. opened fruit showing thick pericarp and arillate seed [a: *S 28098*; b, c: *FRI 13537*; d–f: *SF 39490*; g, h: *FRI 8981*]. — Scale bar for a, d, g, h = 2 cm; for b, c, e, f = 2 mm; for inset a = 0.4 mm.





brown, glabrous or hairs scattered, scale-like, 0.1 mm or less; papillose; dots absent; midrib flat or slightly raised above, lateral nerves 13–18(–22) per side, at 45–80° to the midrib, sunken above, lines of interarching and venation indistinct; petiole 20–30 by 2–4 mm; leaf bud 8–14 by 3–4 mm, hairs appressed, 0.1 mm or less. *Inflorescences* 1–2 cm, among the leaves or below, hairs 0.1 mm or less,  $\pm$  of the *Knema*-type: sessile or pedunculate to 6 mm, stout, with 1–3 woody brachyblasts, rarely with a lateral branch to 5 mm; in male: with 10–30 flowers, buds of various sizes; bracts 1–1.5 mm, finely pubescent, late caducous; female inflorescences short, 2–5-flowered; flowers  $\pm$  coriaceous, hairs less than 0.1 mm, sometimes late glabrescent. *Male flowers*: pedicel 5–12(–15) mm, bracteole (sub)persistent, sometimes  $\pm$  lobed at apex, (2–)3–4 mm; buds ovoid or urceolate-oblong, 4.5–6 by 2.5–5 mm, apex narrowly rounded, base broadly rounded to subtruncate, not or but slightly angled at apex, cleft c. 1/3, lobes 0.3 mm thick. Androecium slender, 3–3.5 mm; androphore 0.7–2 by 0.3–0.5 mm, minutely pubescent in the lower 2/3 or towards the base only; synandrium ellipsoid-oblong 2 by 0.5 mm, thecae 6–10, sterile apex narrow, rather blunt or very faintly lobed, 0.3 mm. *Female flowers*: pedicel  $\pm$  stout, 2 mm, bracteole caducous; buds  $\pm$  ovoid, 4–5 by 3–4 mm, cleft c. 1/3, at anthesis curved outwards; ovary 3(–4) by 2–2.5 mm, minutely pubescent. Infructescences short. *Fruits* 1 or 2 per infructescence, broadly ellipsoid, 3.5–5.5(–6) by 3–4 cm, hairs rust-coloured, powdery (easily rubbed off), 0.1–0.3 mm; pericarp (7–)10 mm thick; seeds ellipsoid, 3–3.5 cm; fruiting pedicel stout, 5(–10) mm. — **Fig. 70.**

**Field-notes** — Tall tree, branches spreading, a few weak stilt-roots present. Bark brown, slightly and shallowly fissured longitudinally, or smooth, with horizontal fissures and vertical cracks; inner bark red; wood white. Leaves dull dark green above, glaucous below. Flowers pale green to yellow, with faint sweet odour. Fruits pale yellow or orange, with orange-brown scurf; aril (light) yellow, fragrant, edible.

**Distribution** — *Malesia*: Sumatra, Peninsular Malaysia, Singapore, Borneo. Not in Thailand (the record by Sinclair, l. c., applies to *M. maingayi*).

**Habitat & Ecology** — Primary forest on hillsides, along rivers, (preference for) swamp forest, rocky granite river valley; in Borneo in peat swamp and kerangas; 0–600 m altitude; fl. & fr. throughout the year. Apparently not a common species.

**Notes** — 1. According to Sinclair (l. c.) *M. crassa* is sometimes monoecious, with male and female flowers in the same inflorescence. In synonymous *M. suavis*, King recorded rudimentary anthers present in female flowers.

2. *Myristica crassa* is related to *M. teijsmannii* (Java) and *M. andamanica* (Andaman Is.). Sinclair (1968: 434) tabulated a comparison between these species.

### 30. *Myristica crassipes* Warb.

*Myristica crassipes* Warb. in K. Schum. & Laut., Fl. Schutzgeb. Südsee (1901) 326. — Type: *Bamler 50*, Papua New Guinea.

Tree 4–30 m. *Twigs* bluntly angled or subterete, 1.5–3 mm diameter, early glabrescent, hairs 0.1 mm or less; older twigs sometimes tending to crack longitudinally, not flaking; lenticels often numerous, rather small but distinct. *Leaves* membranous, chartaceous, or coriaceous, elliptic-oblong to (oblong-)lanceolate, 7–20 by 2.5–6.5 cm, base attenuate or rounded, apex acute-acuminate, sometimes with blunt tip; upper surface olivaceous-

brown, lower surface grey-brown, with sparse or dense subsistent pale brown scale-like hairs 0.1 mm or less, sometimes (late) glabrescent; not papillose; dots absent; midrib flat or raised above, lateral nerves 15–20(–24) per side, at (50–)70–85° to the midrib, flat or sunken above, little raised, purplish and contrasting below, lines of interarching indistinct, venation usually  $\pm$  contrasting in colour below; petiole 8–16 by 1.5–3 mm; leaf bud straight or curved, 7–16 by 1.5–2 mm, hairs 0.1 mm or less. *Inflorescences* between the older leaves, essentially of the *Knema*-type: sessile or to 2(–4) mm pedunculate (in female), simple or forked, scar-covered, brachyblasts 1–5(–20) mm, minutely pubescent, glabrescent; bracts small, caducous; in male: with 3–7 flowers in a loose cluster, buds somewhat variable in size; female inflorescences 1- or 2- (or 3-)flowered; flowers with minute appressed hairs 0.1 mm or less, sometimes late glabrescent. *Male flowers*: pedicel 5–7 by 0.8(–1.5) mm, bracteoles small, caducous, 1–2 mm below the apex; buds (elliptic-)oblong, sometimes narrowed in the lower half, 7–9 by 2–3 mm, apex (narrowly) rounded or  $\pm$  blunt, perianth lobes thicker lower down, inside with warty-bullate surface, possibly reddish when fresh; cleft c. 1/4, lobes thinly carnosous, 2–2.5 mm long, 0.2–0.3 mm thick. Androecium 7–9 mm; androphore 3.5–4 by 0.5–1 mm, largely with appressed hairs 0.1–0.2 mm; synandrium elongate, 4–5 by 0.8–1 mm, thecae c. 16, sterile apex  $\pm$  acute, 0.2–0.5 mm. *Female flowers*: pedicel 2.5–6 by 1–1.5 mm, bracteole caducous, 0.5–2 mm below the apex; buds ovoid(-oblong), narrowed towards the apex, 5–6.5 by 3–4 mm, lobes 1.5 mm long; ovary ovoid-oblong, including stigma 3–4.5 by 2(–2.5) mm, hairs 0.1–0.2 mm. *Fruits* solitary or paired, ovoid or oblong, or  $\pm$  fusiform, sometimes asymmetrical, 3.5–5.5 by 2–3(–4) cm, apex narrowly rounded, blunt, or (sub-)acute-apiculate, base rounded, pseudostalk absent or broad, to 3 mm, hairs dense, scurfy, 0.1–0.2 mm or less, or wholly or partly (early) glabrescent; pericarp  $\pm$  woody, (3–)4–8 mm thick, smooth or rugose; seeds ellipsoid, 2–3 cm; fruiting pedicel (rather) stout, 4–17 by 3–5(–6) mm, striate or often lenticellate and rugose, bracteole scar up to 7 mm below apex.

Field-notes — Bole straight, or bole and crown irregular, but not buttressed. Bark dark brown-black or grey-brown, finely grooved, with small flakes; outer bark reddish, orange, or straw but darkening rapidly; exudate slight, watery, reddish, turning brown; wood pale brown, or pinkish, developing brown stains when cut, gummy red exudate from bark and wood; sapwood concentrically layered; heartwood pale brown. Leaves below grey or glaucous, once reported as scaly. Flowers cream, pale brown, or orange. Fruits yellowish green; seeds light or black brown.

Distribution — *Malesia*: New Guinea, with three subspecies.

Habitat & Ecology — Canopy or subcanopy tree of (sub)montane areas; mixed montane forest, *Araucaria*–*Anisoptera*, fagaceous, or *Castanopsis*-dominated forest, forest on ridges; sandy-clayey soil, or once from dark brown loam soil over limestone; (600–)700–2100 m altitude; fl & fr. throughout the year.

Notes — 1. The holotype, *Bamler 50*, has been destroyed in B; an isotype in WRSL is a poor specimen. According to Warburg (l. c.) and Markgraf (l. c.) *Bamler 50* was collected at c. 700 m, rather low for the species. It has comparatively thin, membranous leaves, but generally it agrees well with the rest of the material seen. Warburg mentioned the fruiting pedicel as conspicuously thick, 8 mm, but in the isotype in WRSL this is only 5 mm thick.

2. *Myristica crassipes* has largely the same circumscription here as that adopted by Sinclair (1968: 353), although several specimens now in *M. crassipes* were named by Sinclair *M. longipes*, *M. gracilipes*, and *M. cucullata* (with the leaves dotted below). Foreman (1978: 190) included *M. firmipes* under *M. crassipes* and Sinclair (l.c.) included some specimens with stalked inflorescences, but their views are not followed here.

3. *Myristica crassipes* resembles both *M. tubiflora* and *M. laevifolia* in general habit (the latter from the same montane habitat), and also *M. vinkii*. *Myristica crassipes* also resembles the lowland species *M. flosculosa*, both in general habit and in the presence of the distinctive warty structure of the inner surface of the basal part of the male perianth, also found in *M. pumila*, and they seem taxonomically related.

4. Sinclair (l.c.) cited and depicted a richly flowering male specimen, *Robbins 1155* (CANB, not seen).

#### KEY TO THE SUBSPECIES

- 1a. Fruits with dull rust-coloured or greyish brown mealy hairs 0.1 mm or less, or (early) glabrescent ..... 2  
 b. Fruits with bright dark-chestnut or chocolate hairs 0.1–0.2 mm, apparently persistent. —E Papua New Guinea, Milne Bay Prov. .... **c. subsp. marronia**
- 2a. Fruits with (sub)persistent indumentum (but hairs minute!); fruiting pedicel stout, 4–10 by 4–5(–7) mm, often longitudinally cracked with age, bracteole scar up to 3 mm below the fruit. — Papua New Guinea; (500–)700–1500(–2000) m .....  
 ..... **a. subsp. crassipes**
- b. Fruits glabrescent; fruiting pedicel more slender, 6–17 by 3–4 mm, smooth or fissured, bracteole scar 2–7 mm below the fruit. — West and East New Guinea; (1250–)1500–2000 m ..... **b. subsp. altemontana**

#### **a. subsp. crassipes**

*Myristica crassipes* Warb. in K. Schum. & Laut., Fl. Schutzgeb. Südsee (1901) 326; Markgr., Bot. Jahrb. Syst. 67, 2 (1935) 162; J. Sinclair, Gard. Bull. Sing. 23 (1968) 353, f. 55; Foreman, Handb. Fl. Papua New Guinea 1 (1978) 190, p.p.; W.J. de Wilde, Blumea 40 (1995) 274, f. 6d.

Twigs at apex 1.5–2(–3) mm diameter. *Leaves* chartaceous. *Fruits* with (sub)persistent indumentum (but hairs minute!); fruiting pedicel stout, 4–10 by 4–5(–6) mm, often longitudinally cracked with age, bracteole scar up to 3 mm below the fruit. — **Fig. 62g, 83d.**

Distribution — *Malesia*: Papua New Guinea.

Habitat & Ecology — Lower montane forest; (500–)700–1500(–2000) m altitude.

Notes — 1. I have seen two duplicates of *Carr 15509*: that in K, with male flowers, easily keys out to *M. crassipes* (subsp. *crassipes*); that in L is vegetatively identical, but has male inflorescences without flowers and a 1–4 mm long peduncle ending in a worm-like brachyblast up to 20 mm. Therefore *M. crassipes* also keys out to species with stalked inflorescences, in particular *M. fugax* and *M. sogeriensis*. These species have similar male flowers, but are much more delicate in habit.

2. *Jacobs 8818-B* has detached fruits which may belong to *M. crassipes*, but they are larger, c. 6.5 cm long, and pointed at the apex, narrowed at the base.

**b. subsp. *altemontana* W.J. de Wilde**

*Myristica crassipes* Warb. subsp. *altemontana* W.J. de Wilde, *Blumea* 40 (1995) 274. — Type: *NGF 41681* (*Henty, Isgar & Galore*), Papua New Guinea.

*Twigs* at apex (1.5–)2–3 mm diameter. *Leaves* generally (chartaceous-)coriaceous, nerves impressed above, rendering the blade sometimes almost bullate. *Fruits* ellipsoid or broadly fusiform, early glabrescent; fruiting pedicel more slender, 6–17 by 3–4 mm, smooth or fissured, bracteole scar 2–7 mm below the fruit.

*Distribution* — *Malesia*: New Guinea (eastern Papua Barat and Papua New Guinea). *Habitat & Ecology* — Montane forest; (1250–)1500–2000 m altitude.

**c. subsp. *marronia* W.J. de Wilde**

*Myristica crassipes* Warb. subsp. *marronia* W.J. de Wilde, *Blumea* 40 (1995) 275. — Type: *LAE 54345* (*Stevens & Veldkamp*), Papua New Guinea, Milne Bay Prov., Mt Suckling.

Tree 10–15 m. *Leaves* membranous-chartaceous. *Fruits* with persistent, bright dark-chestnut or chocolate hairs, 0.1–0.2 mm.

*Field-notes* — Bark brown with shallow fissures; inner bark reddish; wood pale straw with ± orange markings. Leaves glossy above, glaucous below. Flowers brownish outside, green inside. Fruits brown.

*Distribution* — *Malesia*: Papua New Guinea (Milne Bay Prov., Mt Suckling; known from two collections).

*Habitat & Ecology* — Montane forest near river, banks of rivulet in open *Araucaria* forest; 1700–1800 m altitude; fl. & fr. June, July.

**31. *Myristica cucullata* Markgr.**

*Myristica cucullata* Markgr., *Bot. Jahrb. Syst.* 67 (1935) 166; J. Sinclair, *Gard. Bull. Sing.* 23 (1968) 364, p.p., for the type only, f. 60G; Foreman, *Handb. Fl. Papua New Guinea* 1 (1978) 192, p.p.; W.J. de Wilde, *Blumea* 40 (1995) 275. — Type: *Ledermann 10131*, Papua New Guinea.

Tree 6–8(–30, see note 1) m. *Twigs* terete or faintly angular, (2–)3–4 mm diameter, early glabrescent, hairs greyish, less than 0.1 mm; older twigs coarsely striate (but neither cracking nor flaking), with inconspicuous small brown lenticels. *Leaves* chartaceous or subcoriaceous, oblong-lanceolate, 14–18(–23) by 4–6(–6.5) cm, base attenuate or narrowly rounded, apex acute-acuminate; upper surface dark brown, lower surface grey-brown, early glabrescent, hairs scattered, less than 0.1 mm; not papillose; dots present, sometimes only few; midrib flat or raised above, lateral nerves 20–30 per side, at 70–80° to the midrib, flat and inconspicuous above, hardly visible below, lines of interarching and venation indistinct; petiole 10–20 by 2–2.5 mm; leaf bud 10 by 2 mm, hairs less than 0.1 mm. *Inflorescences* among the leaves and below, of the *Knema*-type: sessile, scar-covered, subglabrous, brachyblasts to 5 mm diameter; bracts 1.5 mm, hairs rough, 0.2 mm, caducous; in male: a subumbel of 2–4 flowers, buds of slightly variable size; female inflorescences (from the infructescences, see note 1) few-flowered, similar to male; flowers with ± scattered hairs less than 0.1 mm. *Male flowers*: pedicel 3–4 by 1–1.5 mm, bracteole large, deeply cucullate, 8–9 by 6 mm, with short-fimbriate margin, at first completely enveloping the perianth, caducous; buds (slightly immature) coriaceous,

ovoid-ellipsoid, 8 by (5–)6 mm, apex rounded or subacute, base rounded, cleft c. 1/3, lobes 2(–2.5) mm long, 0.5–0.6 mm thick. Androecium  $\pm$  stout, 7 mm; androphore 1(–2) by 2 mm, glabrous; synandrium broad-cylindrical, 6 by 2.5(–3) mm, narrowed to the apex, thecae c. 40, narrow and tightly contiguous, sterile apex minute, 0.1 mm. *Female flowers* not seen. Infructescence just below the leaves. *Fruits* (LAE 61173) (somewhat immature) solitary, sessile, coarsely wrinkled, ovoid-ellipsoid, 4 by 2.5 cm, apex narrowly rounded and with short pointed style-remnant, base narrowed into a short pseudostalk 3 mm, hairs rather pale grey-brown, scale-like, 0.1 mm or less; pericarp 5–7 mm thick, with faintly warted surface; seeds not seen; fruiting pedicel 10 by 5 mm, with few fissures and lenticels, bracteole scar 4 mm below the apex.

Field-notes — Tree 30 m tall (LAE 61173). Outer bark rusty brown; inner bark straw with rusty brown exudate; wood straw. Leaves midgreen below. Fruits green brown.

Distribution — *Malesia*: Papua New Guinea; known only from the type (male flowers), a sterile specimen from East Sepik, and a fruiting collection from Gulf Prov. (see note 1).

Habitat & Ecology — Submontane, mossy forest with much moss in the tree crowns, and foothill rain forest; (250–)800–1000 m altitude; fl. Dec.; fr. Mar.

Notes — 1. Markgraf described *Myristica cucullata* in 1912 based on two collections from E Sepik Province, *Ledermann 10131* (Lordberg, 1000 m, male fl., type) and *Ledermann 9110* (Etappenberg, 850 m, sterile). The original specimens were lost in B, but there are duplicates in L. Only the type is fertile. Its somewhat immature male flowers have a very characteristic hooded bracteole, apparently caducous at anthesis. Both Sinclair (1968) and Foreman (1978) accepted the species, and included numerous later collections, but here the species is restricted to the original specimens, with only one additional collection, LAE 61173 (*Croft et al.*), with somewhat immature fruit. This specimen agrees vegetatively in details with the isotype at L, and the fruits differ from those of all other *Myristica* species from New Guinea. The only suspicious fact may be that LAE 61173, a 30 m tall tree, was collected at a much lower altitude (240 m) in Gulf Province, above Purari R., far from the type locality, in rain forest, on steep terrain.

2. The male flowers of *M. cucullata* have a coriaceous perianth, a stout androecium acute at the apex, and a short androphore. This supports the view that *M. cucullata* is related to *M. brassii*, in the group of species with leaves that have dark brown dots below; the type of *M. brassii* differs in general aspect, and the male flower has a hairy androphore and fewer anthers.

### 32. *Myristica cumingii* Warb.

*Myristica cumingii* Warb., Mon. Myrist. (1897) 442, t. 13; Merr., Bull. Bur. For. Philipp. 1 (1903) 21; Enum. Philipp. Flow. Pl. 2 (1923) 178; W.J. de Wilde, Blumea 42 (1997) 154. — Syntypes: *Cuming 903, 1570; Vidal 854* (excl. *Vidal 1679 = M. agusanensis*; the FI and L duplicates = *Knema glomerata*), Philippines.

?*Myristica spuria* Blume, Rumphia 1 (1837) 181, nom. nud. [For explanation see J. Sinclair, Gard. Bull. Sing. 23 (1968) 437.]

*Gymnacranthera negrosensis* Elmer, Leafl. Philipp. Bot. 2 (1909) 576; (1911) 1057. — Type: *Elmer 10133*, Philippines.

*Gymnacranthera urdanetensis* Elmer, Leafl. Philipp. Bot. 8 (1915) 2773. — Syntypes: *Elmer 13294, 13295*, Philippines.

*Myristica mindorensis* Merr., Philipp. J. Sci., Bot. 13 (1918) 281; Enum. Philipp. Flow. Pl. 2 (1923) 179. — Type: Merritt 3698, Philippines.

*Myristica nitida* Merr., Philipp. J. Sci., Bot. 13 (1918) 282; Enum. Philipp. Flow. Pl. 2 (1923) 179 = *Myristica alvarezii* Merr., nom. ined. — Type: FB 22199 (Alvarez), Philippines.

*Myristica ceylanica* A.DC. var. *ceylanica* auct. non A.DC., p. p.: J. Sinclair, Gard. Bull. Sing. 23 (1968) 437, f. 77, for the Philippine material.

Tree 6–20 m. Twigs 1.5–2 mm diameter, yellowish brown, early glabrescent, indumentum minute; older twigs sometimes faintly longitudinally cracking; lenticels few, small and inconspicuous. Leaves membranous or chartaceous, elliptic-oblong to oblong-lanceolate, 8.5–28 by 2.5–9 cm, base cuneate, apex subacute to acute-acuminate; upper surface (olivaceous-)brown, lower surface greyish brown with contrasting bright brown nerves, early glabrescent, hairs weak, scale-like, less than 0.1 mm; faintly papillose; dots absent; midrib above flat or slightly raised, lateral nerves (6–)10–20 per side, at 45–70° to the midrib, slightly raised or sunken above, lines of interarching  $\pm$  distinct, venation sometimes indistinct; petiole 10–22 by 1.5–3 mm; leaf bud 7–12 by 1.5–2 mm, hairs less than 0.1 mm. Inflorescences among the leaves or below,  $\pm$  as in *Knema*; in male: subsessile or with a peduncle to 15 mm, with at apex an usually bifurcate, scar-covered brachyblast to 5 mm, with 5–10 flowers in a subumbel, buds of various sizes; female inflorescences smaller than males, (sub)sessile, few-flowered; flowers late glabrescent, hairs sparse, grey-brown to dark brown, 0.1 mm. Male flowers: pedicel (2–)3–6 mm, bracteole 1.5–2 mm, (sub)persistent; buds ovoid-oblong, 4.5–7 by 3–4 mm, apex  $\pm$  blunt or subacute,  $\pm$  angled, base broadly rounded, cleft c. (1/3–)1/2, lobes membranous, (0.2–)0.3–0.4 mm thick, erect or reflexed at anthesis. Androecium 4–5.5 mm; androphore 1.5–2 by 0.6–1 mm, minutely pubescent (hairs 0.1 mm or less) in the lower 2/3; synandrium 2.5–3 by 0.6–1.2 mm, thecae 10–14, not tightly contiguous, sterile apex blunt, 0.3–0.5 mm. Female flowers: pedicel 2–3 mm, bracteole 2 mm, persistent; buds ovoid-oblong, (4–)5–6.5 by 3–4 mm, narrowed and triangular in the upper 2/3, lobes reflexed at anthesis; ovary ovoid, hairs dense, 0.1 mm. Fruits 1 or 2 per infructescence, broadly ovoid, subglobose, or ellipsoid, 3–5(–5.5) by 2.5–4.5 cm, hairs dense, rusty-brown,  $\pm$  mealy, 0.1–0.2(–0.3) mm; pericarp 4–6(–10) mm thick; seeds broad-ellipsoid, 2.5–3.8 cm; fruiting pedicel 3–5 mm.

Field-notes — Flowers yellow. Fruits golden.

Distribution — *Malesia*: Philippines (Luzon, Mindoro, Sibuyan, Ticao, Samar, Leyte, Bililar, Negros, Mindanao).

Habitat & Ecology — Common in lowland forest, rocky slope forest; 0–850 m altitude; fl. mainly May to Aug.; fr. throughout the year.

Uses — Wood used for firewood and house construction. According to Sulit (PNH 17645) the bark is boiled and the decoction drunk to prevent the spitting of blood.

Notes — 1. Although much resembling *M. ceylanica* from Sri Lanka in appearance, I cannot agree with Sinclair (l.c.), who considered *M. cumingii* as identical. Differences are, for instance, the possibly yellow aril of *M. ceylanica*, and the not at all angular perianth in that species.

The widespread *M. iners* and the Palawan-endemic *M. umbellata* much resemble *M. cumingii*; *M. iners* differs in paniculate inflorescences and early glabrescent fruits while in *M. cumingii* the inflorescences are usually subsessile brachyblasts. *Myristica umbellata*, with rather small glabrescent fruits, at first with minute hairs, may be very similar to *M.*

*cumingii*. The former differs in its more delicate appearance, smaller fruits, a male inflorescence presumably lasting but one flowering season, more delicately built male flowers with relatively long and slender pedicel, and especially in the distinctive papillae on the lower leaf surface, and bracteole borne well below the perianth in female flowers.

2. *Myristica cumingii* is variable in its fruits: shape and size, thickness of the pericarp, and the length of the hairs; their shapes range from ellipsoid to nearly globose.

3. Most (but not all) specimens from Mindoro differ from the remainder of the material from all over the Philippines in a more delicate habit, a thinner leaf blade, drying more greenish above and paler below (possibly caused by the presence of scattered papillae), 6–13 pairs of lateral nerves, male inflorescences with slender peduncles (5–15 mm), and relatively small, ellipsoid fruits 3–4 cm long and a 3–4 mm thick pericarp. Whether these collections represent a separate taxon remains as yet uncertain, but it is noted that one of the syntypes of *M. cumingii*, *Cuming 1570* (male, also depicted by Warburg, l. c.: t. 3), represents this different form, and possibly the type of synonymous *M. mindorensis*, *Merritt 3698*, as well.

### 33. *Myristica cylindrocarpa* J. Sinclair

*Myristica cylindrocarpa* J. Sinclair, Gard. Bull. Sing. 23 (1968) 337, f. 50, p.p.; Foreman, Handb. Fl. Papua New Guinea 1 (1978) 192, p.p.; W.J. de Wilde, Blumea 40 (1995) 275. — Type: *NGF 10288* (*K.J. White*), Papua New Guinea, 'Josephstaal', Madang Prov.

Tree 6–7 m. Twigs 1.5 mm diameter,  $\pm$  angular, reddish brown, early glabrescent, hairs densely set, greyish, scale-like, less than 0.1 mm; older twigs blackish; lenticels not apparent. Leaves thinly chartaceous, elliptic-oblong, 7–16 by 2.5–6 cm, base short-attenuate, apex faintly acute-acuminate; upper surface olivaceous-brown, lower surface silvery grey, glabrescent, hairs scattered, pale, scale-like, less than 0.1 mm; partly minutely papillose; dots absent; midrib  $\pm$  flat to raised above, lateral nerves 8–10 per side, at 70–80° to the midrib, sunken above, raised, red-brown and contrasting below, lines of interarching distinct, venation finely reticulate, not very distinct; petiole 7–13 by 1–1.5 mm; leaf bud 5 by 1 mm, hairs 0.1 mm or less. Male inflorescences, male and female flowers not seen. Female inflorescences (from infructescences): among the leaves, supra-axillary (see note 2), peduncle 2–6 by 1–1.5 mm, early glabrescent, with few lenticels, ending in a short scar-covered brachyblast 2–3 mm, with (presumably) 1 or 2 flowers. Fruits 1 or 2 per infructescence, (ovoid- or) ellipsoid-oblong, 2.7–2.8 by 1.2–1.3 cm, apex acute, base rounded, pseudostalk absent, hairs dense, mealy, bright brown, 0.1 mm; pericarp 1 mm thick; seeds ellipsoid-oblong, 2.3 cm; fruiting pedicel 3–4 mm, with fine hairs 0.1 mm, late glabrescent, the scar of the bracteole almost at the apex.

Field-notes — Fruits cylindrical, orange-brown. According to Sinclair (l. c.: 339) there may be up to 4 fruits per infructescence, the seeds measure 20 by 8 mm, are dark brown, glossy, the aril red and divided into four main segments.

Distribution — *Malesia*: Papua New Guinea (Madang Prov.); known only from the type.

Habitat & Ecology — Common on slight rise in a seasonally inundated forest; altitude c. 75 m; fr. Sept.

Notes — 1. Sinclair (l. c.) cited three specimens; besides the type also *Robbins 1567* (not seen), and *Darbyshire 929* (Central Prov.), recently described as *M. brevistipes*.

2. The inflorescences (infructescences) are concaulescent with the main stem for up to 10 mm, i. e. nearly the length of an internode, so that they are inserted nearly opposite the leaf of the following node; to check the consistency of this singular character more material is needed.

### 34. *Myristica dasycarpa* W.J. de Wilde

*Myristica dasycarpa* W.J. de Wilde, Blumea 43 (1998) 171, f. 2. — Type: *Regalado & Takeuchi 1520*, Papua New Guinea.

Tree c. 10 m. *Twigs* with 2 conspicuous wings 2(–3) mm high joining the bases of the petioles, 8–10 mm diameter, bright brown, partially somewhat swollen and hollow, ant-hole present; older twigs becoming coarsely rectangular cracked and flaking; lenticels slightly concolorous. *Leaves* membranous or thinly chartaceous, oblong, 32–47 by 13–19 cm, base (narrowly) cordate, apex broadly acute-acuminate; upper surface olivaceous(-brown), lower surface with dense cinnamon hairs 0.1(–0.3) mm; not or indistinctly papillose; dots absent; midrib slender, flat or slightly raised above, lateral nerves 20–25 per side, at 70–80° to the midrib, flat, lines of interarching ± distinct, venation finely scalariform, indistinct; petiole short, almost pulvinate, 15–20 by 8 mm, glabrous; leaf bud not seen. *Male inflorescences* not seen (but see note 2). *Female inflorescences* (from infructescences): of the *Knema*-type, sessile, woody brachyblasts 5 mm diameter; *female flowers* not known. *Fruits* subsessile, 2 or 3 per sessile knotty infructescence, on older twigs below the leaves, ovoid-ellipsoid, 3.5–4 by 2 cm, apex narrowly rounded or (sub)acute, base broadly rounded, velutinous, with rufous-rusty hairs 0.5–1 mm; the pericarp wrinkled and apparently much shrunken on drying, 3 mm thick; seeds oblong, 2.5 cm, grey, the aril impressed into the seed; fruiting pedicel rather stout, 2(–3) mm. — **Fig. 71.**

**Field-notes** — Myrmecophilous. Leaves brown tomentose below. Fruits rich brown to orange-brown; crushed dried fruit strongly smelling of nutmeg.

**Distribution** — *Malesia*: northern Papua New Guinea (East Sepik Prov., Ambunti subprov., Waskuk Hills, area around Langu and Garuka villages); known only from the type.

**Habitat & Ecology** — Subcanopy tree; on ridge; 50–70 m altitude; fr. July.

**Notes** — 1. *Myristica dasycarpa* is readily distinguishable among the New Guinean myrmecophilous *Myristicas* by its thick alate twigs and large leaves, and its subsessile fruits, 3.5–4 cm long, with velvety hairs to 1 mm, forming the most conspicuous indumentum of the group.

2. Male flowers of this species are not known with certainty. *Brass 13706* (Papua Barat, Idenburg River, in flood plain forest at 850 m) possibly belongs here; in L it has inflorescences with immature male flowers and separate fruits, the latter obviously belonging to *M. subalulata*. The male inflorescence is a wart-like brachyblast, 3–4 mm, pubescent, glabrescent, bracts 1.5 mm, subumbel of 5 or 6 flowers, buds of variable sizes; male flowers: pedicel slender, 6 mm, bracteole 2 mm; buds (immature) ellipsoid, 5–6 by 3.5 mm, not collapsing on drying, cleft c. 1/3?, lobes 0.5 mm thick; androecium 4 mm; androphore narrow, 1 mm, almost glabrous; synandrium 3 by 1 mm, acute, thecae c. 28, sterile apex ± absent.



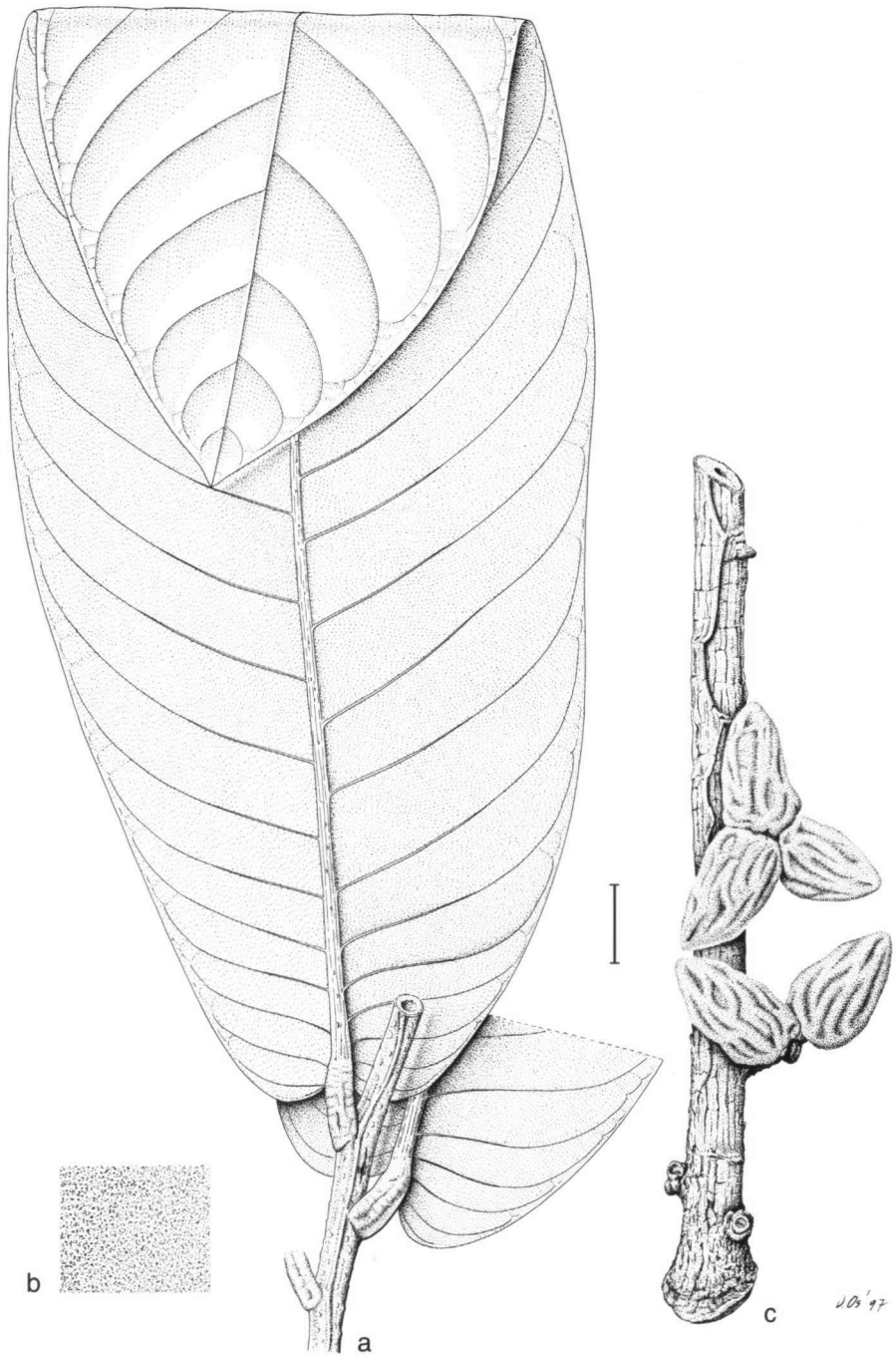


Fig. 71. *Myristica dasycarpa* W.J. de Wilde. a. Part of leafy twig; b. detail of indumentum of lower leaf surface; c. lower part of older twig with ramiflorous infructescences [Regalado & Takeuchi 1520]. — Scale bar for a, c = 2 cm; for b = 0.5 mm.

**35. *Myristica depressa* W.J. de Wilde**

*Myristica depressa* W.J. de Wilde, *Blumea* 42 (1997) 161; *Tree Fl. Sabah & Sarawak* 3 (2000) 459.  
— Type: S 39018, Sarawak.

Tree 10–30(–40) m. *Twigs* 2–3 mm diameter, early glabrescent, hairs 0.1 mm or less, sometimes yellowish; older twigs dark brown or blackish, coarsely striate, sometimes flaking; lenticels absent. *Leaves* membranous or thinly chartaceous, oblong(-lanceolate), 15–30 by 4–9 cm, base short-cuneate or rounded, apex acute-acuminate; upper surface olivaceous(-brown), lower surface grey-brown, with persistent dense but thin felty or arachnoid covering of intricate greyish brown hairs 0.1 mm or less, hardly to be felt with the finger (lens!); not obviously papillose; dots absent; midrib above flat or  $\pm$  raised, lateral nerves 16–23 per side, flat or sunken above, sometimes indistinct, at 45–80° to the midrib, lines of interarching distinct or not, venation faint on both surfaces (distinct, scalariform in *Zainal Abidih* 23, from Nunukan I.); petiole 10–25 by 1.5–3 mm; leaf bud 10–15 by 1.5–3 mm, hairs 0.1–0.2 mm. *Inflorescences* between the lower leaves, pedunculate, slender, hairs woolly, 0.1–0.3 mm; in male: 2–3.5 cm, peduncle 5–10 mm, slightly flattened, lowest branches (sub)opposite, to 5 mm, ending in a subumbel of flowers, central axis 20–30 mm, with 2–4 sessile subumbels, each with 4–8 flowers, buds of strongly variable sizes, hairs persistent, woolly, (0.1–)0.2–0.3 mm; bracts broadly rounded, 1.5–2 mm, pubescent, caducous; female inflorescences as males but smaller. *Male flowers*: pedicel 3–3.5 mm, bracteole often  $\pm$  2-topped, 2 mm; buds firm, ovoid or ellipsoid, 3–4 by 2.5–3 mm, apex  $\pm$  rounded, not or hardly angled, cleft 3/4–4/5, lobes 0.5–0.8 mm thick. Androecium short and broad, somewhat club-shaped, 1.5 mm; androphore 0.3–0.5 by 0.8 mm, minutely pubescent (apparently glabrous in immature flowers of *bb* 27505 from Sumatra); synandrium broadly ellipsoid, 1–1.3 by 1–1.2 mm, the sterile apex absent, the apex truncate and  $\pm$  hollowed for up to 0.3 mm, the edge  $\pm$  lobed corresponding with the anthers, thecae 12–16(–20), 1 mm long, not tightly contiguous. *Female flowers* not seen. Infructescence 0.5–2 cm, with 1 or 2 fruits. *Fruits* ellipsoid (-oblong), 5–7 by 3–4.5 cm, apex and base broadly rounded, hairs dense, scurfy, 0.1 (–0.2) mm; pericarp (2–)3–6(–10) mm thick; seeds ellipsoid, 4–5 cm; fruiting pedicel  $\pm$  stout, roughly fissured or cracked, 3–5 mm.

*Field-notes* — With or without buttresses and stilt-roots; bole straight; outer bark brittle, fissured or flaky, blackish; inner bark brownish; sapwood white or brownish. Twigs blackish. Flowers yellowish (grey). Fruits fawn, light brown, or apricot, aril pink.

*Distribution* — *Malesia*: Sumatra (one collection, Indragiri, and one deviating specimen, see note 2), Peninsular Malaysia, Borneo (C Kalimantan).

*Habitat & Ecology* — Primary mixed dipterocarp forest, on various soil types: occasionally inundated riverbanks, sandstone and diorite screes, hillsides, stony soils, yellow loamy soil; 0–300 m altitude; fl. & fr. throughout the year.

*Notes* — 1. *Myristica depressa* is close to *M. borneensis*, *M. malaccensis*, and *M. wyatt-smithii*, but differs in its persistent indumentum on the lower leaf surface. The androecium is distinctly short and broad, resembling that of *M. borneensis* and especially that of *M. malaccensis* in which the sterile apex also is absent. Fruits and male flowers of *M. malaccensis* are glabrous (early glabrescent), the latter cleft to only 1/3. *Myristica borneensis* has fruits similar to those of the present species, but differs in lacking a dense indumentum on the lower leaf surface, the male flowers which are cleft to only about halfway,

and the androecium with a short and broad sterile apex. Other apparently related species are *M. agusanensis* and *M. guatterifolia*, both with a persistent indumentum on the lower leaf surface, and both with an androecium sometimes hollowed at the apex.

2. The specimen *Kostermans s. n.* (Sumatra, Palembang) has leaves that dry more brownish above, the lateral nerves are indistinct, and the blade base is conspicuously acute-attenuate; the (almost mature) fruit is only 4.5 cm long when dry. The specimen may represent a separate taxon.

### 36. *Myristica devogelii* W.J. de Wilde

*Myristica devogelii* W.J. de Wilde, Blumea 42 (1997) 163. — Type: *de Vogel 6083*, C Sulawesi.

Tree 20 m. *Twigs* 4–5 mm diameter, early glabrescent, hairs rusty or greyish, less than 0.1 mm; older twigs coarsely striate and somewhat fissured; lenticels small, not contrasting. *Leaves* coriaceous, oblong or oblong(-lanceolate), 20–30 by 6–10 cm, base short-cuneate or nearly rounded, apex acute or subacute-acuminate, or rather blunt; upper surface olivaceous(-brown), lower surface glabrous (early glabrescent), brown; not papillose; dots absent; midrib above flat, lateral nerves (12–)15–20 per side, at (45–)60° to the midrib, slender, flat and faint above, faint below, lines of interarching and venation indistinct; petiole 15–20 by 5 mm; leaf bud 15–20 by 4–5 mm, hairs scale-like, grey(-brown), less than 0.1 mm. *Inflorescences* among the leaves or just below, of the *Knema*-type, a sessile scar-covered brachyblast 3–5 mm diameter, rusty-greyish short pubescent; bracts small, caducous; in female: with 1–3 small flowers or 1 or 2 flowers together with a submature fruit; flowers with short appressed brown hairs 0.1 mm. *Male inflorescences* and *male flowers* not seen. *Female flowers*: pedicel short, less than 0.5 mm, bracteole ± saucer-shaped, 1.5 mm, (sub)persistent; buds ± ovoid, 5 by 3 mm, lobes not seen; ovary ovoid, 3–3.5 by 2.5 mm, hairs dense, rusty, appressed, 0.1(–0.2) mm. *Fruits* usually solitary, sessile, subglobose, (4–)5 cm diameter, hairs scurfy, rust-coloured, 0.1 mm or less; pericarp woody, (6–)8–10 mm thick; seeds not seen; fruiting pedicel (almost) absent.

*Field-notes* — Straight tree, bole with or without buttresses, prop-roots spreading to 1.20 m. Bark fissured, not peeling; exudate red watery and gum-like.

*Distribution* — *Malesia*: Central Sulawesi (N side Lake Matano).

*Habitat & Ecology* — Forest on alluvial flat on conglomeratic soil, and on ultrabasic bedrock; 400–450 m altitude; fr. June, July.

*Note* — *Myristica devogelii* is readily distinguishable by its glabrous, coriaceous leaves and sessile, globose fruits of 5 cm diameter.

### 37. *Myristica duplopunctata* W.J. de Wilde

*Myristica duplopunctata* W.J. de Wilde, Blumea 40 (1995) 275. — Type: *BW 9041 (Iwanggin)*, West Irian.

Tree 10–25 m. *Twigs* subterete or ± angular and grooved, 3–6 mm diameter, early glabrescent, indumentum minute; bark smooth or fissured; with or without lenticels. *Leaves* chartaceous or (thinly) coriaceous, (elliptic-)oblong, 15–23 by 5–8 cm, lower surface with dense interwoven scale-like hairs 0.1 mm (lens!), seemingly ± glabrous, or late glabrescent; not papillose; upper and lower surface at least towards the margin with

scattered small dots (lens!), sometimes obscured by the indumentum; midrib raised above, lateral nerves 20–30 per side, at 70–80° to the midrib, flat or sunken above, faint below, venation invisible. *Inflorescences* between the (lower) leaves, almost as in *Knema*, but pedunculate, in male peduncle (3–)10 mm, in female 5 mm, ending in a small scar-covered part with a cluster of few flowers. *Male flowers* presumably resembling those of *M. brassii* and *M. neglecta*; known at anthesis only in subsp. *duplopunctata*. *Fruits* solitary, 4–5 cm, known only in subsp. *versteeghii*.

Distribution — Incompletely known taxon from the mountains of NW Papua Barat and northern W Papua New Guinea; the rather heterogeneous material is placed in two subspecies.

Notes — 1. *Myristica duplopunctata* is similar to *M. millepunctata* and *M. neglecta*, but differs in smaller leaves with small scattered dots on both surfaces.

2. The male flowers of *M. brassii*, *M. duplopunctata*, and *M. neglecta* are all very similar. However, the staminal column is hairy along its entire length in *M. neglecta*, only in the lower half in *M. brassii*, and very inconspicuously hairy, with pale hairs less than 0.1 mm, in *M. duplopunctata*.

#### KEY TO THE SUBSPECIES

- 1a. Twigs 5 mm diameter. Leaves (thinly) coriaceous. — Papua Barat/Papua New Guinea, northern side of Central Range, 1500–2100 m . . . . . **b. subsp. versteeghii**  
 b. Twigs 3 mm diameter. Leaves ± chartaceous. — Papua Barat, northern coastal mountains, 500–700 m . . . . . **a. subsp. duplopunctata**

#### **a. subsp. duplopunctata**

Tree c. 25 m. *Twigs* terete, 3 mm diameter, early or late glabrescent, hairs 0.1 mm; older twigs (coarsely) striate; lenticels few or numerous. *Leaves* ± chartaceous; blades (oblong-)lanceolate, 15–23 by 5–8 cm, base (short-)cuneate, apex acute(-acuminate); upper surface olivaceous or brown; lower surface pale brown with dense layer of interwoven scale-like hairs 0.1 mm or less, or late glabrescent; midrib raised above, lateral nerves (20–)25–30 per side; petiole 15–20 by (2–)2.5 mm; leaf bud 10–15 by 2 mm, with hairs 0.1–0.2 mm. *Inflorescences* in male: peduncle 5–10 mm, slightly flattened, finely pubescent or glabrescent, ending in a minute scar-covered part with 2 or 3 flowers, buds subequal in size; flowers with minute rusty hairs 0.1 mm or less. *Male flowers*: pedicel 13–14 by 1.5 mm, bracteole caducous, its scar 3–3.5 mm below the apex; buds (ellipsoid-)oblong, 10 by 4.5 mm, apex and base narrowly rounded, cleft 1/5, lobes 2 mm long, 0.5 mm thick; androecium stout, tapered to the apex, 8 mm, synandrium 4 by 1.5(–)2 mm; thecae 16–20, sterile apex acute, 0.7–1 mm, androphore stout, 3(–3.5) by 1.5–2 mm, in the lower half with minute whitish hairs less than 0.1 mm. *Female flowers* and *fruits* not seen.

Field-notes — In young tree: bark black, slightly flaking and with some watery sap; sapwood pinkish, heartwood brown; adult tree: outer bark grey; inner bark white within, with little red exudate, slash light brown; sapwood white. Flowers light brown.

Distribution — *Malesia*: N Papua Barat (known from three collections).

Habitat & Ecology — Coastal mountains; 500–700 m altitude.

Note — May resemble *M. mediobibex*, which is more delicate, with leaves not dotted.

**b. subsp. *versteeghii* W.J. de Wilde**

*Myristica duplopunctata* W.J. de Wilde subsp. *versteeghii* W.J. de Wilde, *Blumea* 40 (1995) 277.

— Type: *Brass & Versteegh 12512*, West Irian.

*Myristica cucullata* auct. non Markgr., p.p.: J. Sinclair, *Gard. Bull. Sing.* 23 (1968) 364, f. 60D–F.

Tree 10–25 m. *Twigs* ± angular or deeply grooved, 5 mm diameter, early glabrescent, hairs less than 0.1 mm, dark brown; older twigs coarsely striate; lenticels few. *Leaves* (thinly) coriaceous, (elliptic-)oblong, 15–20 by 5–8 cm, base (broadly) rounded, apex ± blunt or acute-acuminate; upper surface dark olivaceous, lower surface grey-brown, with thin greyish felty interwoven scale-like hairs 0.1 mm or less; midrib flat or somewhat raised above, lateral nerves 22–30 per side (with in addition numerous intersecondary ones); petiole 15–20 by 4–5 mm; leaf bud 15 by 3–4 mm, with appressed hairs less than 0.1 mm, looking as if glabrous. *Inflorescences* incompletely known, finely pubescent. *Male and female flowers* not seen (see note). Infructescence with a stout short peduncle, 5–10 mm. *Fruits* solitary, ± ellipsoid, 4–5 by 3.5–4 cm, hairs dense, mealy, rust-coloured, 0.1 mm; pericarp hard, (5–)10 mm thick; seeds ellipsoid, 2.5 cm; fruiting pedicel 6–8 mm, ± stout, bracteole scar at c. 1/3 below the apex.

Field-notes — Outer bark brown or black; inner bark light brown; wood whitish brown with brown or pink sap. Fruits orange-brown or red-brown, with yellow sap; seed brown.

Distribution — *Malesia*: Papua Barat (mountains on the north side of the Main Range) and adjoining W Papua New Guinea (W Sepik).

Habitat & Ecology — Frequent in primary forest on slope of ridge; montane forest on top of ridge with small trees, shrubs and dense moss dominating the understorey; altitude 900–2100 m; fr. Feb.–Apr.

Note — Subsp. *versteeghii* may merit the status of a separate species; its inclusion in *M. duplopunctata* is provisional, until more and especially (male) flowering material becomes available.

**38. *Myristica elliptica* Wall. ex Hook. f. & Thomson**

*Myristica elliptica* Wall. ex Hook. f. & Thomson, *Fl. Ind.* (1855) 162; *King, Ann. Roy. Bot. Gard.*

*Calc.* 3 (1891) 295, pl. 113; *Warb., Mon. Myrist.* (1897) 435, t. 16; J. Sinclair, *Gard. Bull. Sing.* 16 (1958) 353; 23 (1968) 188; W.J. de Wilde, *Blumea* 42 (1997) 164; *Tree Fl. Sabah & Sarawak* 3 (2000) 460. — *Myristica elliptica* var. *elliptica*: J. Sinclair, *Gard. Bull. Sing.* 16 (1958) 353, f. 26, pl. VI A, B; 23 (1968) 188, f. 12 G, H. — Type: *Porter in Wallich Cat. 6798a*, Penang.

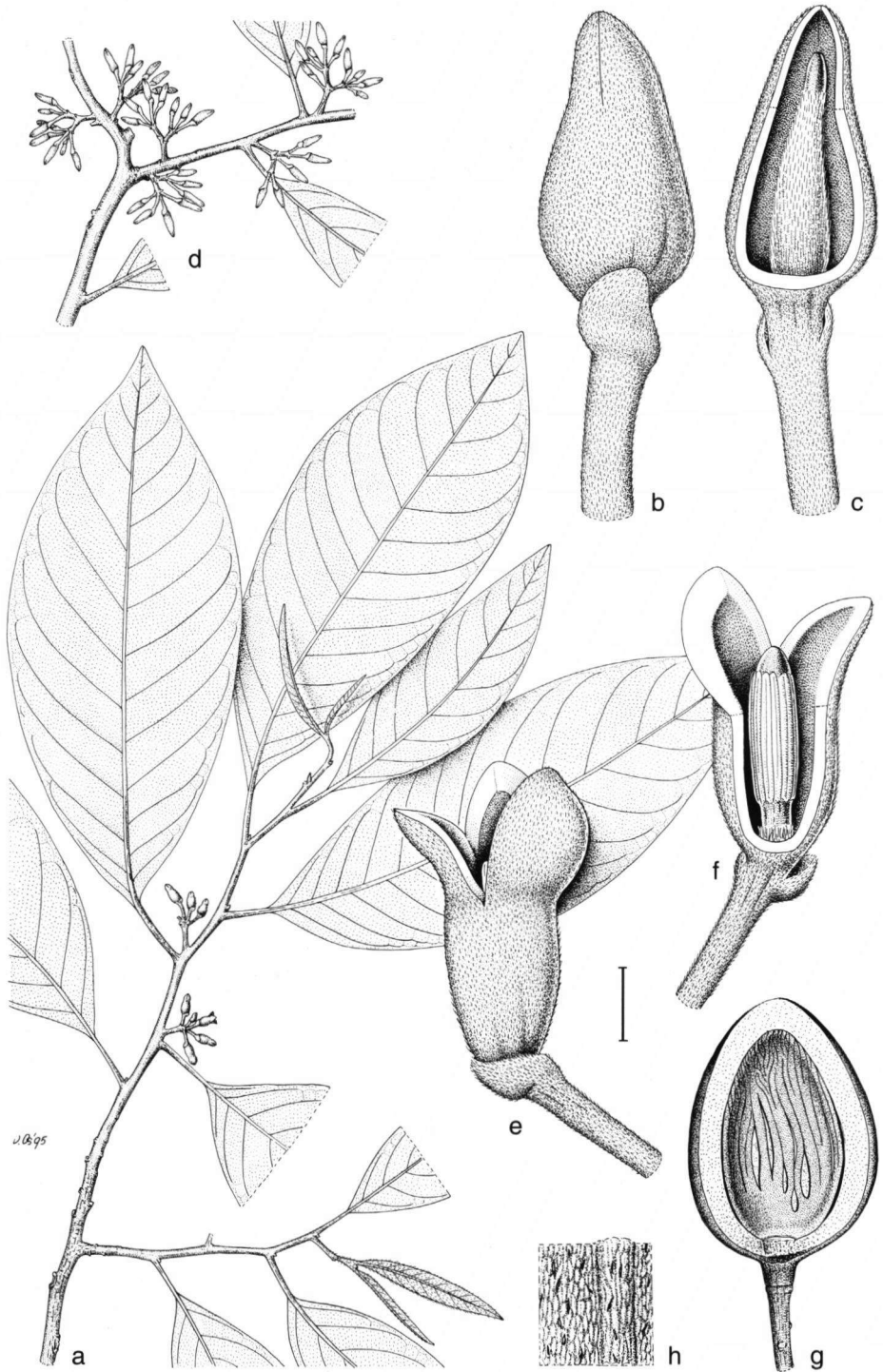
*Myristica macrocarpa* Wall., *Cat.* (1832) n. 6798b (for the fruit; herbarium sheet only), nom. nud.

*Myristica calocarpa* Miq., *Fl. Ind. Bat.* 1, 2 (1858) 71; *Suppl.* (1860) 156; (1861) 383; *Ann. Mus.*

*Bot. Lugd.-Bat.* 2 (1865) 48. — Type: *Teijsmann 477*, Sumatra.

*Myristica sycocarpa* Miq., *Fl. Ind. Bat.* 1, 2 (1858) 68; *Suppl.* (1860) 156. — Type: *Diepenhorst & Teijsmann 482*, Sumatra.

Fig. 72. *Myristica elliptica* Wall. ex Hook. f. & Thomson. a. Branch with female inflorescences; b. female bud with persistent bracteole; c. ditto, opened, showing pistil; d. branch with male inflorescences; e. male flower at anthesis; f. ditto, opened, showing androecium; g. part of infructescence with one fruit, opened, showing arillate seed; h. lower leaf surface with papilla-like structures and scattered appressed faint hairs [a–c, h: *de Wilde/Duyffes 16544*; d–f: *de Wilde/Duyffes 16452*; g: *de Wilde/Duyffes 18882*]. — Scale bar for a, d, g = 2 cm; for b, c, e, f = 1.65 mm; for h = 0.4 mm.



Tree 6–40 m. Twigs 2–4 mm diameter, pale, grey or yellowish, early glabrescent, hairs greyish, 0.1–0.3 mm; older twigs straw or (brown) yellow to greenish yellow, not longitudinally cracking; sometimes with a few pale brown lenticels. *Leaves* chartaceous, elliptic or oblong, 9–21(–32) by 3–9(–12) cm, base narrowly rounded or acute, apex acute-acuminate; upper surface yellowish or olivaceous, lower surface greyish or pale olivaceous,  $\pm$  glabrous (early glabrescent), hairs scattered, appressed, greyish or pale brown, 0.1 mm or less, surface minutely pustulate; papillae not obvious; dots sometimes present, scattered, faint; midrib above flat or slightly raised, lateral nerves 8–13(–15) per side, at 45–60(–70) $^{\circ}$  to the midrib, faint, flat or slightly raised above, distinct on lower leaf surface, lines of interarching sometimes distinct, venation faint on both surfaces; petiole 10–20(–30) by 1.5–2.5 mm, drying the same colour as the twigs; leaf bud (10–)15–20 by 1–1.5 mm, hairs glossy, light brown, 0.1–0.3 mm. *Inflorescences* among the leaves, pedunculate,  $\pm$  glabrescent, hairs (sparse) pale, appressed, 0.1 mm or less; bracts minute, subpersistent; in male: 1–2.5 by 1–1.5 cm, few-flowered, peduncle slightly flattened, 5–12 mm, branches simple, up to 5 mm, central axis similar, sometimes absent or with but a single flower; flowers in loose subumbels of 3–5; buds of various sizes; female inflorescences like the male, flowers only 1–3; flowers angled, hairs sparse, appressed, pale, 0.1 mm. *Male flowers*: pedicel 3–5 by 1–1.5 mm, bracteole  $\pm$  reniform, often  $\pm$  truncate or faintly  $\pm$  3-topped, 0.5–1(–2) mm, persistent, apical or rarely to 1 mm below; buds elliptic-oblong, sometimes slightly contracted below the lobes, 7–8(–9) by 2.5–3.5 mm, apex subacute, 3-angled, cleft c. 1/3, lobes 0.5–0.8 mm thick, perianth lower down thinner. Androecium 5–7 mm; androphore slightly tapering, 2(–2.5) mm, glabrous or at base thinly minutely pubescent; synandrium 4–4.5 by (1–)1.5 mm, thecae 10–12,  $\pm$  appressed, sterile apex  $\pm$  blunt, 0.5 mm. *Female flowers*: pedicel 3 mm; buds ovoid-oblong,  $\pm$  urceolate, inflated, 6–8 by 3–4 mm, apex acute, angled, cleft c. 1/2, lobes at anthesis reflexed; ovary long-conical (including style) 5 by 1 mm, hairs dense, appressed, 0.1 mm. *Infructescences* often conspicuously lenticellate. *Fruits* 1 or 2, ovoid or ellipsoid(–oblong), 4.5–7.5 by (2–)2.5–4 cm, apex rounded or bluntly narrowed or somewhat beaked, base often narrowed into 4–12 mm long pseudostalk, early glabrescent, hairs 0.1 mm; pericarp dull dark brown, 5(–10) mm thick; seeds ellipsoid, 4–5 cm; fruiting pedicel slender, 5–10 mm. — **Fig. 72.**

**Field-notes** — Low or tall tree with dense or loose crown, sometimes branched from the base; bole tapering or not, sometimes fluted or buttressed up to 1 m high, in marshy forest with spreading stilt-roots. Bark smooth or finely fissured or scaly, sometimes lenticellate, grey to dark brown or blackish; inner bark soft, red-brown to pink, sap watery, pink or red; (sap) wood white to pale yellow. Twigs pale, straw-coloured. Leaves dark glossy green above, glaucous green or very pale with yellow-green midrib below. Flowers cream-white or (reddish) yellow, fragrant when crushed. Fruits greenish yellow turning bright orange or apricot, sometimes with irregular swellings; seeds olive-brown.

**Distribution** — Peninsular Thailand; *Malesia*: Peninsular Malaysia, Sumatra, Borneo, possibly also the Philippines.

**Habitat & Ecology** — Primarily in swamp and peat swamp forest (Swamp Nutmeg); also in disturbed forest and belukar; alluvial forest; degraded forest, along rivers; clayey or (poor) sandy soils, also on red soil; rocky streamsides; 0–500 m altitude; fl. & fr. throughout the year. According to Sinclair (l.c. 1958: 214; 1968: 190) the seeds float, a fact possibly related to the wet habitats favoured by the species.

Uses — Seeds once reported as combustible, containing starch and fat.

Notes — 1. A widespread species of peat swamp forest of W Malesia; not in Java.

2. Sinclair (l. c.) included the varieties *celebica* and *simiarum* in this species, both here included in the related *M. simiarum* which differs mainly in its inflorescences terminally with perennial brachyblasts, not few-flowered clusters lasting but one season.

3. Frequently a yellowish exudate of unknown origin has been found on dry specimens, especially on the fruits.

### 39. *Myristica ensifolia* J. Sinclair

*Myristica ensifolia* J. Sinclair, Gard. Bull. Sing. 23 (1968) 332, f. 48; Foreman, Handb. Fl. Papua New Guinea 1 (1978) 193; W.J. de Wilde, Blumea 40 (1995) 278. — Type: Brass 6857, Papua New Guinea, Fly River.

Slender treelet, 1.5 m. Twigs bluntly 2- or 3-angular, (1–)1.5–2 mm diameter, somewhat reddish brown, early glabrescent, hairs appressed, greyish, 0.1 mm or less, smooth; older twigs not seen. Leaves membranous (or chartaceous), lanceolate, parallel-sided, 12–22 by 1.5–3 cm, base attenuate, apex long acute(-acuminate); upper surface glabrous, dark brown, lower surface grey(-brown), early glabrescent, hairs minute, scattered, grey, 0.1 mm or less; not clearly papillose but stomata or hair bases(?) look like minute pustules with a dark-coloured centre (lens!); dots absent; midrib slender, raised above, lateral nerves 16–20 per side, at 45–60° to the midrib, slender, flat or slightly sunken above, light brown, contrasting below, lines of interarching distinct, venation faint; petiole dark (reddish) brown, 8–10 by 1–2 mm; leaf bud 7 by (1–)1.5 mm, hairs dense, appressed, bright brown, 0.2(–0.3) mm. Male inflorescences, male and female flowers not known. Female inflorescences (from imperfect broken infructescence) among the leaves, peduncle 2 by 1.5 mm, smooth, partly glabrescent, hairs grey-brown, appressed, 0.2 mm, continuing in the fruiting pedicel (broken away in the only known specimen). Fruits (immature) solitary, oblong-fusiform, base narrowed (pseudostalk), apex acute, (4–)4.5 by 1.3(–1.5) cm, hairs dense, rust-coloured, scurfy, 0.1–0.2 mm; pericarp 2 mm thick; seeds not seen; fruiting pedicel not seen, probably slender, c. 10 mm.

Distribution — Malesia: Papua New Guinea (Western Prov., Fly River, 528 mile Camp); known only from the type.

Habitat & Ecology — In ridge forest undergrowth; 80 m altitude; nearly mature fr. May.

Note — Despite the numerous recent collections made in New Guinea, this species remains known only from the type specimen. The fragmentary infructescence shows that the female inflorescence has a short, 2 mm long peduncle, and therefore it is keyed out in the group of species with a pedunculate inflorescence; however, specimens with male inflorescences are needed to confirm this. *Myristica ensifolia* is readily recognizable since it is a dwarf tree with ensiform leaves which suggests it to be a rheophyte, but actually it was collected in ridge forest undergrowth. Microscopically the fine crater-like markings on the lower leaf surface are characteristic.

### 40. *Myristica extensa* W.J. de Wilde

*Myristica extensa* W.J. de Wilde, Blumea 42 (1997) 164; Tree Fl. Sabah & Sarawak 3 (2000) 461. — Type: S 25678 (*Ilias Paie*), Sarawak.



Tree 15–25 m. *Twigs* subterete or angular, 2.5–5 mm diameter, yellowish or blackish brown, very early glabrescent, hairs pale, 0.1 mm or less; older twigs irregularly (longitudinally) cracking; lenticels few and indistinct, or absent. *Leaves* membranous or thinly chartaceous, (elliptic-)oblong(-lanceolate), (16–)24–35 by (5–)8–13.5 cm, base attenuate or acute, or narrowly rounded, apex acute-acuminate; upper surface olivaceous (-brown), lower surface grey-brown, glabrescent, indumentum minute, flat-lying, open cobweb-like, silvery; not obviously papillose; dots absent; midrib above flat, lateral nerves 16–24 per side, at (45–)60–80° to the midrib, slender, indistinct and flat or  $\pm$  sunken above, much raised below, lines of interarching and venation indistinct on both surfaces; petiole 15–30 by 2.5–5 mm; leaf bud 10–15 by 2.5–3 mm, hairs appressed, 0.1 mm. *Inflorescences* among the leaves or just below, pedunculate, slender, almost glabrous, hairs scattered, 0.1 mm or less; in male: widely paniculate, 10–15 by 6–10 cm, peduncle 20–45 mm, somewhat flattened, lower branches subopposite, 10–35 mm, central axis with 3 or 4 branches, 15 mm or less; flowers in subumbels of 5–10, buds strongly varying in size; bracts caducous, not seen, their scars dislocated upwards along the branches; female inflorescences (from infructescences): smaller and fewer flowered, (1.5–)5–8 cm, including the 30–40 mm long peduncle. *Male flowers*: pedicel slender, 9–12 mm, bracteole broadly rounded-reniform, 2–2.5 mm, persistent; buds membranous, ovoid, 4(–4.5) by 3–3.5 mm, hairs sparse, grey-brown, 0.1(–0.2) mm, cleft nearly 2/3, lobes 3 mm long, 0.3 mm thick. Androecium club-shaped, 3–3.5 mm; androphore somewhat tapering, 1 by 1 mm, glabrous; synandrium ellipsoid(-oblong), 2 by 1–1.2 mm, thecae 16 (anthers rather spaced), sterile apex 0.2–0.3 mm,  $\pm$  blunt. *Female flowers* not seen. *Fruits* 1 or 2 per infructescence, (elliptic-)oblong, 6–7 by 3–3.5 cm, rounded at both ends, with dense minute scurf of hairs 0.1 mm or less; pericarp 3–6 mm thick, dull brown; seeds 5–5.5 cm; fruiting pedicel 6–15 mm.

*Field-notes* — Medium-sized tree; without buttresses, or stem fluted, with spreading buttresses, or with stilt-roots 80 cm high, 80 cm out. Bark smooth or scaly, hard, 1 mm thick, cracked, grey to blackish, at the base of the bole peeling off in strips, brittle, dark brown or blackish; living bark 5(–10) mm, brown; wood brown; sap blood-red or pink, rarely absent. Leaves below glaucous or whitish. Flower (buds) yellowish green. Fruits cream, yellow, greenish brown, or yellowish brown, with short brown indumentum; seeds blackish.

*Distribution* — *Malesia*: Borneo (Sarawak, Brunei, C & E Kalimantan).

*Habitat & Ecology* — Primary lowland forest; at top of spur; steep slope, hill forest near summit; undulating land; rich clayey or sandy yellow loam (along rivulet), yellow clayey soil; 0–800 m altitude; fl. June; fr. mainly Mar., Aug., Sept.

*Notes* — 1. *Myristica extensa* is similar to *M. corticata* and *M. iners* in leaf and inflorescence features, and to *M. malaccensis* in the club-shaped androecium. The species is also close to *M. maxima*, with widely branched paniculate inflorescences (and infructescences), stouter twigs, and larger leaves and male flowers. The leaves of *M. maxima* have more lateral nerves, a more distinct venation, a well-marked marginal nerve, and a greyish lower leaf surface with minute pale hairs (glabrescent) and distinct papillae. Its male flowers are larger, with a cylindrical, not club-shaped androecium and with some indumentum on the androphore. For differences with the other species mentioned above, see the keys. Fruiting specimens of *M. extensa* may resemble *M. frugifera* from the Philippines.

2. Some deviating specimens from Sarawak and Sabah (see De Wilde l. c.) may represent an as yet undescribed species. They key out to fruiting specimens besides *M. iners* and *M. wyatt-smithii*, but differ in general aspect. More material, including flowers, is needed to solve this problem.

#### 41. *Myristica fallax* Warb.

*Myristica fallax* Warb., Mon. Myrist. (1897) 410; Merr., Enum. Born. (1921) 269; W.J. de Wilde, Blumea 42 (1997) 166; Tree Fl. Sabah & Sarawak 3 (2000) 461. — Type: *Beccari 1590*, Sarawak.

Tree 15–20 m. Twigs 1–1.5 mm diameter, (yellow-)brown, early glabrescent, hairs scattered, less than 0.1 mm; older twigs brown, coarsely striate or faintly longitudinally cracking; lenticels inconspicuous or absent. *Leaves* thinly membranous, (oblong-)lanceolate, 7–14 by 2–4 cm, base cuneate, apex acute-acuminate; upper surface olivaceous or (dark) brown, lower surface slightly paler, greyish brown, early glabrescent, hairs scattered, pale grey-brown, stellate, less than 0.1 mm; not papillose; dots absent; midrib  $\pm$  flat or slightly raised above, lateral nerves 12–16 per side, at 60–80° to the midrib, flat or sunken above, slender and little conspicuous below, lines of interarching and venation indistinct; petiole 10–20 by 1(–1.5) mm; leaf bud 10 by 1–1.5 mm, hairs 0.1 mm or less. *Male inflorescences* 2 or 3 times as long as the petioles, 4 cm, with slender peduncle, 10 by 1 mm, higher up once or twice forked, and with few flowers at the ends of short branches, 2 mm long. *Male flowers*: pedicel slender, 8 by 0.3 mm, bracteole persistent, 0.5 mm; buds urceolate, 3 mm, at the base 2 mm wide. Androecium 2.3 mm; androphore 1 mm, subpuberulous; synandrium 1.2–1.3 mm, sterile apex obtuse, thecae c. 10. *Female inflorescences* and *flowers* not seen. Infructescences in the apical part of the twigs, among the leaves, peduncle slender, 10–25 by 1.5 mm, with or without a branch up to 10 mm, with a few scars of fallen flowers, glabrous (early glabrescent). *Fruits* solitary, ovoid-ellipsoid, 3.5–4(–4.5) by 2–2.7 cm, apex rounded, base broadly rounded, glabrous (when immature with pale rusty scurf of scale-like hairs less than 0.1 mm, soon glabrescent), rusty brown; pericarp 3–4 mm thick; seeds ellipsoid, 2–2.5 cm; fruiting pedicel 5–10 mm, bracteole scar subapical.

Field-notes — Erect tree; buttresses out to 1 m. Bark of trunk smooth or slightly flaky, chocolate, with paler patches or whitish flakes; sap reddish, watery. Lower leaf surface glaucous. Fruits light cream or yellow, with loose, thin, brown indumentum.

Distribution — *Malesia*: Borneo (Sarawak, E Kalimantan).

Habitat & Ecology — Ridge (hill) forest, mixed dipterocarp forest; yellow sandy loam, tuff-plateau; 100–600 m altitude; fr. Aug., Oct., Nov.

Notes — 1. *Myristica fallax* is a satellite species of the variable *M. iners* and comes close to the type of *M. vordermannii*, which goes as a delicate form under *M. iners*. *Myristica fallax* is distinguishable by its slender twigs and small, thin, membranous, dark-coloured leaves. Infructescences are long with a slender peduncle, fruits are small, 3.5–4 cm, and early glabrescent. Specimens of *M. fallax* are reminiscent of *M. fragrans*.

2. I have not seen the type of *M. fallax*, *Beccari 1590* (Sarawak, Mt Mattang) in FI; the description of the male inflorescences and flowers above is based on Warburg (l. c.).

3. Several tiny, slenderly built specimens (including some with immature male flowers and inflorescences with comparatively long peduncles) now inserted under *M. iners*, link up with *M. fallax*; this should be given attention during future investigations.

**42. *Myristica fasciculata* W.J. de Wilde**

*Myristica fasciculata* W.J. de Wilde, *Blumea* 40 (1995) 278; 43 (1998) 173. — Type: *Hoogland & Craven 10400*, Papua New Guinea.

Tree 5–9 m. *Twigs* subterete or 2-angled, with lines or wings to 1 mm high joining the bases of the petioles, (4–)5–7 mm diameter, early glabrescent, hairs to 0.1 mm, hollow and faintly swollen, in places with slit-like perforation, inhabited by ants; older twigs not flaking, with small conspicuous lenticels. *Leaves* membranous, oblong, 20–35 by 7.5–14 cm, base (short-)cuneate, rounded, or shallowly cordate, apex acute-acuminate; upper surface olivaceous, lower surface greyish; papillose or not (see note); dots absent; midrib slightly raised towards the apex, lateral nerves 17–30 per side, at 60–80° to the midrib, flat or impressed above, lines of interarching and venation distinct; petiole 15–25 by 2–3 mm; leaf bud 10–15 by 2–3 mm, hairs scale-like, 0.1 mm. *Inflorescences* between the leaves or below, of the *Knema*-type, (sub)sessile, scar-covered brachyblasts, simple or forked, to 7 by 4 mm, finely brown pubescent; bracts small, caducous; in male with subumbels of 8–15 flowers, buds about equal in size; female inflorescences with 6–10 flowers, buds equal in size, sometimes present together with fruits of previous season; flowers with dense or sparse brown hairs 0.1 mm or less, sometimes glabrescent. *Male flowers* (immature): pedicel 10–11 by 1(–1.5) mm, bracteole sometimes  $\pm$  3-topped, 3.5 mm, subpersistent; buds ellipsoid(-oblong), 4.5 by 3 mm, cleft 1/4–1/3, lobes 1(–1.5) mm long, 0.3(–0.4) mm thick. Androecium 3 mm; androphore 0.3 by 0.5 mm, hairs scattered, pale, less than 0.1 mm long; synandrium 2.5–2.8 by 1 mm, apex rounded, thecae 16–20, sterile apex absent. *Female flowers*: pedicel 7–9 mm, bracteole caducous; buds ovoid-oblong,  $\pm$  tapering towards apex, 6–8(–9) by 3–5(–6) mm, lobes 2–3 mm; ovary ovoid-oblong, 4.5–6 by 2–3 mm, hairs scale-like, less than 0.1 mm. *Fruits* in fascicles of (2–)4–7, ovoid-oblong, 3–3.5 by 1(–1.5) cm, narrowed from the middle into a narrow beak 2–3 mm (stigma remnant), base rounded, hairs dense, (red-)brown, scale-like, less than 0.1 mm; pericarp 1 mm thick; seeds ellipsoid-oblong, 2 cm; fruiting pedicel slender, 12–15 by 1(–1.5) mm, with few conspicuous wart-like mealy lenticels towards the apex.

*Field-notes* — Slender tree. Leaves glaucous or grey-white below. Flowers cream or whitish. Fruit orange-brown, c. 3 cm long.

*Distribution* — *Malesia*: NW Papua New Guinea (endemic to the upper Sepik River area, Sepik Prov.).

*Habitat & Ecology* — Locally common myrmecophilous tree, in primary and degraded forest; forest of river flats; 50–150 m altitude; fl. & fr. Mar., June, July.

*Note* — The feature of a papillose lower leaf surface can be a character for species delimitation, but is possibly not valid for *M. fasciculata*; cf. De Wilde l.c.

**43. *Myristica fatua* Houtt.**

*Myristica fatua* Houtt., *Nat. Hist. Pl.* 2 (3) (1774) 337; Miq., *Ann. Mus. Bot. Lugd.-Bat.* 2 (1864) 205, p.p., incl. var. *macrocarpa*; Warb., *Mon. Myrist.* (1897) 425, t. 11; Backer & Bakh. f., *Fl. Java* 1 (1964) 139; J. Sinclair, *Gard. Bull. Sing.* 23 (1968) 268, p.p. (see note 1); W.J. de Wilde, *Blumea* 35 (1990) 242, f. 1: 3; 40 (1995) 279; 42 (1997) 166. — Lectotype: Clusius, *Tab.* 14 (see De Wilde 1990: 243).

For more references and synonyms see the subspecies.

Tree 10–25 m. *Twigs* 3–4(–6) mm diameter, terete or faintly 2-ridged (Halmahera, Ternate, Bacan), glabrescent, hairs (0.1–)0.2–0.4 mm; older twigs coarsely striate or longitudinally cracked; lenticels copious. *Leaves* membranous or chartaceous, elliptic (–oblong) to (oblong-)lanceolate, 15–40(–50) by 4.5–15(–18) cm, base cuneate to slightly rounded, apex acute(–acuminate); upper surface olivaceous-brown, lower surface felty with pale brown or greyish interwoven scale-like hairs 0.2–0.3 mm, in juvenile leaves occasionally some emergent hairs to 0.4 mm (subsp. *fatua*), or scattered flat-lying long hairs (subsp. *affinis*); papillae not obvious; dots absent; midrib slightly raised above, lateral nerves 17–27(–30) per side, at 50–70° to the midrib, ± sunken above, lines of interarching distinct or not, venation indistinct; petiole 15–25 by 2.5–4 mm; leaf bud 12–20 by 3–4 mm, hairs 0.1–0.6 mm. *Inflorescences* between the leaves or below, of the *Knema*-type; in male: sessile or to 15 mm pedunculate, wart- or worm-like, scar-covered, simple or forked brachyblasts, rarely 3-furcate (type of *M. plumeriifolia*), 5 to 15 (–20) mm long, with subumbel(s) of 5–10 flowers, buds of variable sizes, pedicels ± curved upward; bracts early caducous; female inflorescences shorter; flowers with rust-coloured hairs 0.3–0.6 mm. *Male flowers*: pedicel 5–8 mm, bracteole subpersistent or caducous, 2–3 mm; buds ellipsoid or obovoid, (4–)4.5–6 by (3–)3.5–4 mm, cleft about 1/2, lobes 0.3–0.8 mm thick. Androeceum ± cylindrical, 2.5–4.5 mm; androphore 1–1.5 by 0.6–0.7 mm, subglabrous (hairs scattered, 0.3 mm) to densely pubescent; synandrium 2–3 by 0.8–1.2 mm, thecae 12–20, sterile apex absent or to 0.5 mm. *Female flowers*: pedicel 4 mm; buds ovoid, 4–5 by 3.5–4 mm, cleft 1/2; ovary broadly ovoid, 2.5 mm long, brown pubescent. Infructescence short. *Fruits* solitary or 2 together, broadly ellipsoid or ellipsoid(–oblong), 4–7 by 3–5.5 cm, hairs dense, velvety, rust-coloured, 0.5–1 mm; pericarp (3–)4–12 mm thick; seeds ellipsoid to oblong, 3–3.5 cm; fruiting pedicel slender or stout, 3–10 mm long.

Distribution — *Malesia*: SE Borneo (occasional), Sulawesi, S Philippines, Moluccas, and W New Guinea. There are two subspecies which resemble each other in general appearance.

Notes — 1. Sinclair accepted *M. fatua* in a very broad sense, including the Indian *M. magnifica* as one of the many varieties, and several varieties in New Guinea. Here *M. fatua* is accepted to be confined to the Moluccas, Sulawesi, and the Philippines. It is allied to *M. mindanaensis* and *M. sangowoensis*, both with different distributional areas.

2. *Myristica fatua* is taxonomically close to *M. inutilis* and *M. subcordata* (both common in New Guinea), the latter with two subspecies. *Myristica inutilis* differs in smaller and narrower male buds, only shallowly cleft into lobes. *Myristica subcordata* var. *morindiifolia* is similar to *M. fatua*, but has a narrow male bud with early falling bracteole; the male flowers of *M. subcordata* var. *subcordata* are as yet unknown.

#### KEY TO THE SUBSPECIES

- 1a. Lower leaf surface with intricate scale-like hairs 0.2–0.3 mm long, sometimes mixed with emergent dendroid hairs 0.4 mm long. Thecae 12–16, sterile apex 0.3–0.5 mm, or absent, androphore long or short, 1–1.5 mm, nearly glabrous or slightly pubescent. Fruits with persistent indumentum; pericarp 3–5 mm thick. — Philippines (Mindanao), Moluccas; SE Kalimantan (rare), West New Guinea (rare) . . . . .  
 . . . . . a. subsp. *fatua*

- b. Lower leaf surface with dense hairs 0.2–0.4 mm, and with late caducous, scattered, flat-lying glossy hairs 1 mm long. Thecae c. 20, androecium truncate, sterile apex (almost) absent, androphore short, to 0.5 mm, largely pubescent. Fruits late glabrescent; pericarp 7–12 mm thick. — Sulawesi . . . . . **b. subsp. affinis**

**a. subsp. fatua**

*Myristica fatua* Houtt. var. *fatua*; J. Sinclair, Gard. Bull. Sing. 23 (1968) 269, f. 30.

*Myristica tomentosa* Thunb., Act. Holm. Kongl. Vet. Acad. Nya Handl. 3 (1782) 49, t. 1, f. 2, 5, 6.  
— Type: probably *Smith 300*, from Banda (see Sinclair, l.c.: 272).

*Myristica spadicea* Blume, Bijdr. (1826) 277. — Type: *Reinwardt s.n.*, culta.

*Myristica macrophylla* Roxb., Fl. Ind. 3 (1832) 846 (non Spruce, nec A. Gray, nec Zippelius). —  
Syntypes: *Smith s.n.*, 2640, Banda.

*Myristica mascula* Reinw. ex de Vriese, Pl. Ind. Bat. Orient. (Pl. Reinw.) (1857) 93; nom. nud. —  
Vouchers: *Reinwardt s.n.* (67), 1371 (L), culta.

*Myristica fatua* Houtt. var. *macrocarpa* Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1864) 205. — Type:  
*Teijsmann 5148*, Amboina.

*Myristica plumeriifolia* Elmer, Leafl. Philipp. Bot. 3 (1911) 1063; Merr., Enum. Philipp. Flow. Pl. 2  
(1923) 180. — Type: *Elmer 11063*, Mindanao.

Twigs early glabrescent. *Leaf blades* (elliptic-)oblong, often broadest at or above the middle, apex mostly acute-acuminate; midrib 1–3 mm wide, lateral nerves 17–25 per side. Indumentum of lower leaf surface dense, hairs interwoven, scale-like, 0.2–0.3 mm, sometimes mixed with dendroid erect emergent hairs 0.4 mm long. *Inflorescences* to 10 mm pedunculate. Male perianth lobes rather membranous, 0.3–0.5 mm thick; thecae 12–16, sterile apex (sub)acute, 0.3–0.5 mm long, androphore slender, 1–1.5 mm, nearly glabrous or with some short hairs towards the base. *Fruits* ellipsoid, 4–6.5 cm, velvety-tomentose, hairs 0.5–1 mm long; pericarp (3–)4–5 mm thick; seeds ellipsoid. — **Fig. 61d, 64c, d.**

Field-notes — Bole straight, with low buttresses and prop-roots. Living bark 0.3–1 mm, rather smooth, fissured, not peeling off; inner bark 3–8 mm thick, yellowish tinged pink, beafy red, or brown, turning chocolate on exposure; sapwood pale yellow, reddish yellow, whitish or brown, gradually passing into slightly darker, brown(-yellow) heartwood; sap little, watery, pale reddish to red-brown. Fruits brown; seeds blackish brown or chocolate.

Distribution—*Malesia*: SE Kalimantan, S Philippines (Mindanao), Moluccas, W New Guinea (see note 2).

Habitat & Ecology — Hillside forest, tall forest on black porous volcanic soil or rock, with boulders and little undergrowth; red clay soil in rugged terrain; 0–500 m altitude; fl. throughout the year; fr. mainly Aug.–Oct.

Notes — 1. Specimens from Halmahera (*Pleyte 175, de Vogel 3301, 3431, 3495, 3497*, and possibly *bb 23201* from Bacan) differ from *M. fatua* subsp. *fatua* in the indumentum of their flowers with relatively rough and long hairs, in the 2-angled twigs, in smaller 3.5–4 cm long fruits, with short 2–3 mm long fruiting pedicels, and in a short androphore that is short-hairy (more slender and almost glabrous in the plants from the rest of the Moluccas).

2. Two collections from western New Guinea (Papua Barat) key out to *M. fatua* subsp. *fatua*: *Docters van Leeuwen 9856* with immature male flowers, and *Kloss s.n.* with fruits,

4(–4.5) cm, fruiting pedicels 10 mm long, and short hairs 0.2–0.3 mm only. Both specimens may represent a separate taxon within *M. fatua*. The Kloss specimen approaches *M. ingrata* subsp. *velata*, which differs in ant-swellings in the twigs and in smaller fruits.

3. The only collection from Borneo (*Kuswata 886*, male fl., SE Kalimantan, from limestone near Jaro) is far outside the main distributional area of subsp. *fatua*. It has a stout habit, with  $\pm$  coriaceous leaves, broadly rounded at the base, and its flowers agree with those from the Moluccas. Study of more specimens may reveal that it represents a separate taxon.

4. Sinclair (l.c.) included in var. *fatua* both *M. mindanaensis* and *M. nivea*, but these are here restored as separate species, e.g. distinguishable by their less hairy or almost glabrous lower leaf blades and smaller fruits.

#### b. subsp. *affinis* (Warb.) W.J. de Wilde

*Myristica fatua* Houtt subsp. *affinis* (Warb.) W.J. de Wilde, *Blumea* 42 (1997) 166. — *Myristica affinis* Warb., *Mon. Myrist.* (1897) 422; Burkill, *Dict. Econ. Prod. Malay Penins.* (1935) 1523. — *Myristica fatua* Houtt. var. *affinis* (Warb.) J. Sinclair, *Gard. Bull. Sing.* 23 (1968) 275, f. 31. — Syntypes: *de Vriese s.n.* (L, lecto, here designated); *Beccari s.n.*, 1876, 7668, a; *Treub s.n.*, Bogor, culta.

*Myristica fatua* auct. non Houtt.: Miq., *Ann. Mus. Bot. Lugd.-Bat.* 2 (1864) 205 (excl. var. *macrocarpa*); Koord., *Meded. Lands Pl. Tuin* 19 (1898) 570.

*Myristica celebica* Gand., *Bull. Soc. Bot. France* 66 (1919) 225, in clavi [non *Myristica celebica* Miq. (1865)]. — Type: *Teijsmann s.n.*, Sulawesi.

*Twigs* late glabrescent. *Leaf blades* broadly elliptic to nearly lanceolate, frequently broadest below the middle, generally tapering to above; midrib flat, broad, to 5 mm wide towards the base, lateral nerves 20–30 per side. Indumentum of lower leaf surface in addition to dense layer of scale-like interwoven hairs, usually also with scattered flat-lying much longer glossy hairs, to 1 mm long, the latter fallen off in old leaves. *Inflorescences* subsessile or to 15 mm pedunculate. Male perianth lobes coriaceous, 0.5–0.8 mm thick. Androecium truncate at apex; androphore short, 0.2–0.5 mm long, broad, disc-like, densely brown pubescent towards the base; thecae c. 20, sterile apex absent or less than 0.1 mm. *Fruits* broadly ellipsoid, 5–7 by 3.5–5.5 cm, hairs velvety to coarse, 0.5–1 mm long, late glabrescent (usually some hairs remaining towards insertion of the stalk); pericarp 7–12 mm thick; seeds oblong.

*Field-notes* — Straight bole, many prop-roots. Outer bark 0.3 mm thick, brown or greyish, fissured, peeling off strongly or not; inner bark 3–7 mm thick, reddish on section, exuding much reddish sap; sapwood pale reddish yellow, gradually passing into the slightly darker heartwood. Mature fruits brown.

*Distribution* — *Malesia*: Sulawesi.

*Habitat & Ecology* — Primary lowland and lower montane forest, swamp forest, primary tall dense forest with little undergrowth; deep sand-clay soil, bedrock metamorphic schists; 0–700 m altitude; fl. & fr. throughout the year.

#### 44. *Myristica filipes* W.J. de Wilde

*Myristica filipes* W.J. de Wilde, *Blumea* 40 (1995) 280. — Type: LAE 52061 (*Foreman*), Papua New Guinea, Morobe Prov.

Tree 2.5–9 m tall. *Twigs* 1–1.5 mm diameter, faintly angular, very early glabrescent, hairs less than 0.1 mm; older bark neither cracking nor flaking; lenticels inconspicuous or absent. *Leaves* chartaceous, (elliptic-)oblong, 6–14(–18) by 2–4.5(–7.5) cm, base short to long attenuate, apex acute-acuminate; upper surface dark brown, lower surface medium brown, very early glabrescent, hairs less than 0.1 mm; not papillose; dots absent; midrib (flat to) raised above, lateral nerves 11–16 per side, at 70(–80)° to the midrib, sunken above, lateral nerves on lower surface comparatively strong, raised, yellowish brown and contrasting, lines of interarching and venation indistinct; petiole 6–10(–16) by 1–1.5(–2.5) mm; leaf bud 4–6 by 1 mm, hairs less than 0.1 mm. *Inflorescences* between the leaves and below, sessile, of the *Knema*-type; in male: a simple or sometimes 2- (or 3-)forked, scar-covered slender brachyblast to 6 mm long, glabrescent, with 1–4 flowers in a cluster, buds of slightly variable sizes; bracts minute, caducous; female inflorescence (from infructescence): a small brachyblast, 1 mm long, single-flowered; flowers glabrous, except for a few scattered scale-like hairs less than 0.1 mm. *Male flowers*: pedicel slender, 9–11 by 0.4–0.5 mm, bracteole caducous, scar 4–4.5 mm below the apex; buds elongate, ± tubiform, somewhat narrowed below the middle, 7 by 1.5 mm, apex ± blunt (to subacute), somewhat angled, base short-attenuate, cleft c. 1/4, lobes membranous, 2 mm long, 0.2 mm thick, at anthesis suberect, inside at base (where contiguous with the androphore) thickened with irregular warty appendages. Androecium 6–6.5 mm; androphore 3.5 by 0.4 mm, glabrous; synandrium 2.8 by 0.5–0.6 mm, thecae c. 15, sterile apex subacute, 0.2 mm. *Female flowers* (from remnant under the fruit, *Conn c. s.* 281): perianth tubiform, 7 by (1.5–)2 mm, lobes 1.8 mm long, slightly curved outwards. *Fruits* solitary, ± oblong, 3.5–4.5 by 1.2–1.5 cm, apex acute (with minute apiculum), the basal 1.5–2 cm narrowed into a slender pseudostalk, hairs dense, greyish brown, less than 0.1 mm; pericarp 1 mm thick; seeds ellipsoid, 2 cm long; fruiting pedicel slender, 25–30 mm long, 0.5 mm thick, bracteole scar ± median.

*Field-notes* — Low bushy or straight tree, bole dbh to 15 cm. Bark light grey or brown, more or less smooth; inner bark reddish or orange, exudate watery, reddish; wood white, soft. Leaves silvery green below. Flowers yellow. Fruits yellow, orange, or rust-coloured; seeds black.

*Distribution* — *Malesia*: eastern Papua New Guinea (Morobe Prov., a local endemic, several collections from Buso River area).

*Habitat & Ecology* — Coastal swamp forest (with *Pandanus*), forest on low ridges; also degraded forest; 0–15 m altitude; fl. Aug.; fr. May–Aug.

*Note* — *Myristica filipes* belongs with *M. flosculosa* and *M. pumila* to a coherent group which is characterized by tubiform male flowers. The lower half of the perianth inside (where contiguous with the androphore) is conspicuously thickened by irregular warty ridges. As in *M. pumila* the fruiting pedicel of *M. filipes* is distinctively long and slender.

#### 45. *Myristica firmipes* J. Sinclair

*Myristica firmipes* J. Sinclair, Gard. Bull. Sing. 23 (1968) 355, f. 56; W.J. de Wilde, Blumea 40 (1995) 281. — Type: *Brass 7181*, Papua New Guinea, Western Prov.

Tree 4–30 m. *Twigs* 1–2 mm diameter, early glabrescent, hairs less than 0.1 mm; older twigs striate, thinly flaking or not; lenticels distinct. *Leaves* chartaceous (or thinly

coriaceous), (elliptic-)oblong, 6–14 by 1.5–4.5 cm, base attenuate, apex acute(-acuminate); upper surface olivaceous-brown, lower surface with indumentum subpersistent or late glabrescent, hairs pale silvery brown, scale-like, less than 0.1 mm; papillae and dots absent; midrib somewhat raised above, lateral nerves 10–15 per side, at 60(–70)° to the midrib, flat or sunken above, lines of interarching and venation indistinct on both surfaces; petiole 8–14 by 1–2 mm; leaf bud 6–11 by 1.5–2 mm, hairs appressed, less than 0.1 mm. *Inflorescences* (known only from infructescences) of the *Knema*-type. *Male* and *female flowers* not seen. Infructescences with a single fruit below the leaves; peduncle absent. *Fruits* elliptic-oblong or ± pear-shaped, 6–7 by 3–4 cm, apex rounded, with short distinctly oblique apiculum, basal part somewhat contracted into a short thick pseudostalk or not, hairs mealy, dull brown, 0.1 mm or less; pericarp with a marked ridge, ± woody, 10–15 mm thick; seeds (± immature) ellipsoid, (2–)2.5 cm; fruiting pedicel thick, 4–10 by 5–9 mm, fissured and somewhat lenticellate.

Field-notes — Small tree (NGF 41064, at c. 1300 m alt.) or tall forest canopy tree (two records). Bole straight, spur-buttressed; crown rounded, compact. Bark brown; inner bark dull pinkish brown; exudate little, reddish; wood white. Leaves greyish bronze below. Fruits brown or brownish (green). Seeds dark brown.

Distribution — *Malesia*: W Papua New Guinea (possibly endemic to W Sepik, Western Highlands, and Western Prov.).

Habitat & Ecology — Primary and degraded forest, ridge forest; copper-rich soil (once); 100–1300 m altitude; fr. June, July, Nov.

Notes — 1. The specimens BW 10655 & 10698, from Wandammen Peninsula, Papua Barat, consist of leafy twigs with short, thickened infructescences, but fruits are lacking; the leaves, however, are very distinctly reticulate above, but the specimens still may belong to *M. firmipes*.

2. The fruits of *Brass* 7181 are, judged from the position of the line-shaped ridge, situated transversely in relation to the twig; in two other specimens (NGF 41064, 42527) the fruits are situated in a median position, turned 90°, compared to those in *Brass* 7181. The leaves in the latter collection are comparatively small and I do not know whether these differences have taxonomic consequences.

3. Sinclair described and figured the fruiting stalk as being 1–1.5 cm long, but in fact he measured this including a part of the branches taken with the fruit; actually the fruiting pedicel in the type is only some 5 mm long.

#### 46. *Myristica fissiflora* W.J. de Wilde

*Myristica fissiflora* W.J. de Wilde, *Blumea* 40 (1995) 281; 43 (1998) 173. — Type: NGF 28041 (*Henty*), Papua New Guinea, Madang Dist.

Shrub or tree 3–10 m. *Twigs* subterete or somewhat flattened, (4–)5–10 mm diameter, with distinct, raised lines or narrow wings 1(–2) mm high, joining the petioles, glabrescent, hairs 0.1–0.2 mm, hollow, and with ant-swelling similar to those in *M. subalulata*; older twigs sometimes with conspicuous lenticels. *Leaves* membranous or chartaceous, obovate-elliptic or oblong, 22–35 by 7–16 cm, base short-cuneate, rounded, or shallowly cordate, apex (acute-)acuminate; upper surface olivaceous, lower surface greyish (green), glabrous or glabrescent, hairs scale-like, 0.1 mm or less, lower surface either ± papillose (subsp. *fissiflora*) or not (subsp. *kostermansii*); dots absent; midrib flat or slightly raised



above, lateral nerves 18–23 per side, at 45–80° to the midrib, flat or sunken above, lines of interarching and venation distinct; petiole 15–25 by 2–4 mm; leaf bud 15 by 4 mm, hairs 0.1 mm. *Inflorescences* between the leaves, of the *Knema*-type, a (sub)sessile scar-covered brachyblast, minutely pubescent; in male: to 10 mm long, 4–6 mm wide, subumbel of 2–8 flowers, buds of various sizes; bracts minute, caducous; flowers with sparse or dense dark brown hairs 0.1–0.2 mm. *Male flowers*: pedicel distinct, bracteole large or small, caducous; buds ± broadly fusiform or obovate-oblong, 8–12 mm long, cleft to over 1/2; see further under the subspecies. *Female flowers* and *fruits* not known with certainty, see note.

Distribution — *Malesia*: northern New Guinea (with two subspecies).

Note — *Myristica fissiflora* is mainly characterized by its deeply lobed male flowers, and vegetatively only by a strong reticulate venation of the leaves. Specimens with female flowers or fruits may have been treated under the vegetatively similar *M. subalulata*. The following three fruiting collections possibly belong to *M. fissiflora*: *Warburg 20704*, *Lauterbach 2865*, and *NGF 46688 (Katik)*, all from about the distributional area of *M. fissiflora*. If these specimens indeed belong to *M. fissiflora* then the description of the fruits should be: small, 1.5 by 1 cm, with a 4 mm long fruiting pedicel, much resembling small-fruited *M. subalulata*.

#### KEY TO THE SUBSPECIES

- 1a. Lower leaf surface papillose (or not, see note 1). Male buds ± fusiform, 10–12 mm long; synandrium at apex narrowed into distinct acute sterile apex (0.5–)1 mm long. Bracteole (5–)6–8 mm long. — Papua New Guinea (Madang Prov. and possibly Morobe Prov.) . . . . . **a. subsp. fissiflora**
- b. Lower leaf surface not or indistinctly papillose. Male buds ± obovoid-oblong, 8–9 mm long, apex ± blunt; synandrium at apex ± rounded, sterile apex absent or to 0.2 mm long. Bracteole 2–3 mm long. — NE Papua Barat (vicinity of Jayapura) . . . . . **b. subsp. kostermansii**

#### **a. subsp. fissiflora**

Tree 6–8 m. *Leaves* (thinly) chartaceous, 25–35 by 7–16 cm, lower surface papillose. *Male flowers*: pedicel 7–18 by 1–1.5 mm, bracteole (ovate-)oblong, (5–)7–8 mm long; buds leathery, ellipsoid-oblong, fusiform, 10–12 by 3.5–5(–6) mm, base and apex narrowed, apex acute, the apical part ± triangular, inner surface of lower part finely papillose, cleft for c. 2/3, lobes 6–8 by 0.4–0.5 mm. Androecium stout, 8–9.5 mm; androphore 2.5–3(–4) by 1(–1.5) mm, ± completely pubescent, hairs bright- or yellow-brown, 0.1–0.2 mm; synandrium ± fusiform, faintly angular, 5.5–6 by 1.5(–2) mm, thecae 16–25, sterile apex ± acute, 1 mm.

Field-notes — Small tree. Stem hollow, full of ants. Bark brown; wood white. Leaves light green above, glaucous below. Flowers orange, (dull) brownish cream, or yellow, pinkish at lobe apices. Fruit brownish orange.

Distribution — *Malesia*: northern Papua New Guinea (Madang Prov.; see note 1).

Habitat & Ecology — Primary and old degraded (regrowth) forest, advanced regrowth in *Pometia* forest; 100–400(–1000?; see note 2) m altitude; fl. Mar., May, Aug.

Notes — 1. Specimens of subsp. *fissiflora* have a papillose lower leaf surface. *Takeuchi & Soejarto 6987* (immature male fl.) and *Hoogland 8944* (immature female fl. & fr; but fruits not seen), both from Morobe Province, have an indistinct papillation, but are related to subsp. *fissiflora*, sharing the large bracteole. The leaves in *Takeuchi & Soejarto 6987* are almost glabrous below, *Hoogland 8944* has rather persistent pale cinnamon minute scale-like hairs, and (female) inflorescences with an up 7 mm long peduncle. Female flowers: pedicel 7 mm long, bracteole hooded, 8(–9) mm long, apparently caducous at anthesis; buds 7 mm long, cleft c. 1/3. The field-note mentions mature fruits 47 by 34 mm, but such fruits have not been observed. Pending more material the status of the specimens mentioned above is uncertain.

*NGF 49251 (Henty)*, from the type locality and vegetatively similar to the type, has female inflorescences: flowers (immature) in subumbels of c. 5, pedicel and bracteole 3 mm long. Mature female flowers probably do not differ significantly from those of the related *M. subalulata*.

2. *Schlechter 17749* (in L, male, c. 1000 m) belongs to subsp. *fissiflora*. However, the duplicate in K, also male, with the same herbarium label, is different and belongs to *M. subalulata*.

#### b. subsp. *kostermansii* W.J. de Wilde

*Myristica fissiflora* W.J. de Wilde subsp. *kostermansii* W.J. de Wilde, *Blumea* 40 (1995) 283; 43 (1998) 173. — *Myristica subalulata* auct. non Miq.: J. Sinclair, *Gard. Bull. Sing.* 23 (1968) 385, f. 64D. — Type: *Kostermans & Soegeng 392*, NE Irian Jaya, vicinity of Jayapura.

Shrub or treelet 3–10 m. *Leaves* membranous or subchartaceous, lower surface slightly papillose or not. *Male flowers*: pedicel slender, 8–14 by 0.5(–1) mm, bracteole 2–3 mm long; buds membranous, ± obovate-oblong, narrowed towards base, 8–9 by 3.5–4(–4.5) mm, apical part faintly triangular, apex bluntish, cleft for over 1/2, lobes 5 mm long, 0.3 mm thick. Androecium slender, 6.5–8 mm; androphore 2.5–4 by 1 mm, (almost) completely pubescent, hairs rather pale, 0.1(–0.2) mm or less; synandrium faintly triangular, 4–5 by 1–1.5 mm, the apex bluntish, thecae 14–20(–24), sterile apex absent or only 0.2 mm. *Female flowers* and *fruit* not seen.

Field-notes — Bark smooth. Flowers yellowish brown, inside of lobes white, of corolla tube pinkish.

Distribution — *Malesia*: NE Papua Barat (vicinity of Jayapura).

Habitat & Ecology — Forest, in valley; 50–60 m altitude; fl. July, Aug

#### 47. *Myristica fissurata* W.J. de Wilde

*Myristica fissurata* W.J. de Wilde, *Blumea* 35 (1990) 243; 42 (1997) 166. — Type: *de Vogel 3836*, N Moluccas.

Tree 25–50 m. *Twigs* 4–7(–10) mm diameter, early glabrescent, hairs 0.2 mm; older twigs brown or blackish, coarsely longitudinally fissured or cracked, tending to flake; lenticels absent. *Leaves* thinly coriaceous, oblong-lanceolate, 25–45 by 8–12 cm, base narrowly rounded to cuneate, apex short acute(–acuminate); upper surface olivaceous, sometimes red-brown tinged, lower surface greyish olivaceous, almost glabrous, hairs few, scattered, scale-like, pale brown, 0.1–0.2 mm; distinctly papillose (lens!); dots ab-

sent; midrib above slightly raised, lateral nerves 25–30 per side, at 60–80° to the midrib, sunken above, lines of interarching and (coarsely reticulate) venation indistinct; petiole 20–35 by 3–5.5 mm; leaf bud 15–25 by 3–5 mm, hairs 0.2–0.5(–1) mm. *Inflorescences* between the leaves, with shaggy woolly hairs, 1 mm; in male: peduncle somewhat flattened, 15–25 mm long (as in panicle-like inflorescence), ending in a (*Knema*-like) scar-covered brachyblast 3–6 mm long, with a subumbel of 2–5 flowers, buds strongly varying in size; bracts minute, caducous; female (from infructescences): 5 mm long, few-flowered; flowers with dense rusty hairs 0.5–1 mm. *Male flowers*: pedicel 6 mm long, bracteole ovate-elliptic, c. 5 mm, subpersistent; buds hard-carnose, obovoid-ellipsoid, 7 by 4.5(–5) mm, apex broadly rounded, cleft nearly halfway, lobes 0.8 mm thick. Androecium 4–4.3 mm; androphore 0.8–1 by 1 mm, with hairs 0.5 mm; synandrium faintly triangular, 3 by 2 mm, thecae c. 20, sterile apex ± flat and somewhat hollowed in the centre, with shallowly lobulate edge (the lobules corresponding with the anthers). *Female flowers* not seen. *Fruits* solitary on short infructescences 0.5–1 cm long, broadly ellipsoid, 6.5–7 by 5 cm, hairs ± persistent, dense, scurfy, 0.1–0.2 mm, in immature fruits somewhat longer, 0.5(–1) mm (breaking off at maturity?); pericarp 10–15 mm thick; seeds broadly ellipsoid, 3.5 cm; fruiting pedicel thick, 2–3 mm long, 5 mm diameter. — **Fig. 64e.**

**Field-notes** — Solitary tree, emergent or not, with buttresses only or with prop-roots and buttresses, up to 1.5 m high, to 2 m out, 3–5 cm thick; clear bole to 30 m, straight, dbh 50 cm, with hollow core or not; outer bark 1–3 mm thick, (grey-)brown, very fissured, peeling off slightly or not; inner bark 6 mm thick, on section reddish, with little or much watery brownish red exudate; sapwood yellowish tinged red or pale reddish cream, gradually passing into slightly darker heartwood. Flowers brown, inside pale yellow, anthers brownish yellow. Fruits yellow, with brown indumentum.

**Distribution** — *Malesia*: N Moluccas (Bacan: Mt Tuara, near Amasing Kali).

**Habitat & Ecology** — Disturbed primary tall forest, c. 50 m high, with little undergrowth. Sloping dry hill ridge or hillsides, with little humus, soil loamy, with stones; 100–200 m altitude; fl & fr. Nov.

**Note** — *Myristica fissurata* seems closest related to *M. philippensis*, which differs in having up to 50 mm long pedunculate male inflorescences lacking brachyblasts, a less fleshy male perianth, a faintly triangular synandrium, and vegetatively in lacking the cracked bark of the twigs.

#### 48. *Myristica flavovirens* W.J. de Wilde

*Myristica flavovirens* W.J. de Wilde, Blumea 40 (1995) 283. — Type: BW 10337 (*Versteegh*), West New Guinea, Bird's Head.

Tree 12 m. *Twigs* 2–3 mm diameter, brown-black, glabrescent, hairs 0.1(–0.2) mm; older twigs coarsely striate and somewhat cracking, not flaking; lenticels absent. *Leaves* coriaceous, oblong-lanceolate, 9–11 by 2–3 cm, base short-attenuate or narrowly rounded, apex blunt or narrowly rounded; upper surface dark olivaceous-green, lower surface orange-brown, early glabrescent, hairs scattered, light brown, scale-like, less than 0.1 mm; densely papillose (lens!); dots and dashes present; midrib slightly raised above, lateral nerves 20–22 per side, at 70–80° to the midrib, sunken above, lines of interarching and venation faint; petiole 10–15 by 1.5–2 mm; leaf bud 10 by 1.5 mm, hairs dense,

golden rusty-red, appressed, 0.1(–0.3) mm. *Inflorescences* between the leaves and just below, of the *Knema*-type, simple or bifid scar-covered brachyblasts to 5 mm long, sessile or to 2 mm pedunculate; bracts small, caducous; in male: flowers in clusters of (5–)10–15, buds of variable sizes; female inflorescences and flowers not seen. *Male flowers*: with dense rusty or dark brown hairs, 0.1–0.2 mm, pedicel 3–4 by 1(–1.5) mm, bracteole broadly rounded, 1 mm, persistent; buds  $\pm$  firm, (ellipsoid-)oblong, 5 by 2.5 mm, apex and base rounded, cleft c. 1/3, lobes 1.5(–2) mm long, 0.3 mm thick;. Androecium slender, 3.5 mm; androphore 1.5 by 0.5 mm, glabrous except for a few hairs less than 0.1 mm at base; synandrium 2 by 0.8 mm, thecae (12–)14–16, sterile apex  $\pm$  blunt, 0.2 mm. *Fruits* not seen.

Field-notes — Scarce; young tree c. 12 m high. Flowers yellowish.

Distribution — *Malesia*: W New Guinea (Bird's Head, Kebar Valley); known only from the type.

Habitat & Ecology — Primary forest on clay soil; 1200 m altitude; fl. Nov.

Notes — 1. *Myristica flavovirescens* is related to *M. arfakensis*, and *M. conspersa*, and *M. scripta*, species with similarly dotted and dashed leaves and with a comparatively long androphore, not much shorter than the synandrium. *Myristica arfakensis* is distinguishable by stalked inflorescences and smaller flowers; *M. conspersa* has much smaller (male) flowers; *M. scripta* is rather variable in its flower size and its leaves are generally brown on drying, with an acute apex, but the species occurs in New Guinea outside Bird's Head.

2. The twigs of *M. flavovirens* are conspicuously blackish; the leaves are coriaceous, drying a strange green colour above, (orange-)yellow below, and are distinctly densely papillose (lens!). The texture of its leaves and its drying colour are suggestive of a species from ultrabasic soil.

#### 49. *Myristica flosculosa* J. Sinclair

*Myristica flosculosa* J. Sinclair, Gard. Bull. Sing. 23 (1968) 359, f. 58 (excl. fruiting specimens, excl. f. 59); Foreman, Handb. Fl. Papua New Guinea 1 (1978) 197, p.p.; W.J. de Wilde, Blumea 40 (1995) 284. — Type: *Hoogland 3717*, Papua New Guinea.

Tree 15–20 m. *Twigs* bluntly angled, 2–3 mm diameter, (bright) brown or reddish brown, early glabrescent, hairs scale-like, 0.1 mm long or less; older bark striate, neither cracking nor flaking; lenticels not apparent. *Leaves* chartaceous or coriaceous, elliptic-oblong to oblanceolate, base attenuate or nearly rounded, apex acute-acuminate, 8–23 by 3–8 cm; upper surface olivaceous, lower surface pale grey-brown, late glabrescent, hairs scattered, scale-like, 0.1 mm or less; faintly papillose; dots absent; midrib flat above, lateral nerves 13–17 per side, at 50–80° to the midrib, sunken above, lines of interarching indistinct, venation invisible above, faint or distinct below; petiole 12–15 by 1.5–3.5 mm; leaf bud 10 by 1.5 mm, hairs 0.1 mm or less. *Inflorescences* between the leaves or below, of the *Knema*-type; in male: a (sub)sessile, simple, scar-covered brachyblast to 5 by 3 mm, glabrescent, with (1–)2–7 flowers, buds of various sizes; bracts broad-triangular, pubescent, 0.5(–1) mm, caducous; female inflorescence a few-flowered sessile wart-like brachyblast, 1–2 mm diameter; flowers with hairs 0.1 mm. *Male flowers*: pedicel slender, 5–7 mm long, bracteole small, caducous, scar thickened, apical or to 2.5 mm below; buds firm, elongate-tubular, 8–8.5(–9) by 2 mm, apex narrowly

rounded, base shortly attenuate, inside glabrous, smooth, but in the lower 3–3.5 mm, the part facing the androphore, conspicuously thickened with irregular wart-like structures, cleft nearly 1/4, lobes 1.5–2 mm long, 0.3–0.4 mm thick, at anthesis curved outwards, exposing the apical part of the synandrium. Androecium slender, 8–8.5 mm; androphore slightly widened above, 3–3.5 by 0.7–1 mm, minutely pubescent in the lower 1/2–2/3, gradually passing into the synandrium; synandrium 5–5.5 by 0.8–1.2 mm, narrowed in the upper half, thecae 6 or 7, widely spaced (i. e. anthers 3; or 6?), sterile apex acute, 0.1–0.4 mm. *Female flowers* not seen. *Fruits* 1 or 2 (or 3) per infructescence, fusiform or obovoid-oblong, (4–)4.5 by (1–)1.3 cm, apex subacute or narrowly rounded, base narrowed into a 10 mm long pseudostalk, hairs dense, scale-like, less than 0.1 mm; pericarp less than 1 mm thick; mature seeds not known; fruiting pedicel slender, 30–35 by 0.8 mm, bracteole scar at c. 2/3 below the apex. — **Fig. 63c, 83e.**

*Field-notes* — Medium-sized tree to 20 m. Bark pale brown or grey-brown, flaky, shallowly longitudinally fissured, 8 mm thick; outer bark 2.5 mm; inner bark pale red-brown; exudate colourless turning deep brown; sapwood pale brown; heartwood dark brown or wood pinkish straw turning brown mottled. Leaves ashy green below. Flowers yellow with fine brown dots, androphore off white, anthers pale brown.

*Distribution* — *Malesia*: eastern Papua New Guinea (Northern and Milne Bay Prov.; known only from a few specimens).

*Habitat & Ecology* — Gently sloping lowland with low rain forest, at 60 m altitude, and foothill forest at 300–350 m altitude; fl. Aug., Sept.

*Notes* — 1. Both Sinclair and Foreman (l. c.) included some fruiting specimens from montane altitudes in *M. flosculosa*, specimens which are transferred here to different taxa. However, the fruiting collection *Giulianetti s. n.* (1896; comm. W. MacGregor) in K belongs to the present species. In *M. flosculosa* the fruits have characteristically a long pseudostalk and a long and slender fruiting pedicel, suggesting a close relationship to species like *M. filipes*, *M. gracilipes*, *M. nana*, and *M. pumila*, all species with similar slender pedicels.

2. The basal inner surface of the perianth, facing the androphore, is conspicuously swollen and has an irregularly warted surface. In boiled-up herbarium specimens it has a dark, reddish brown colour, but it is possibly differently coloured when fresh.

3. *Myristica flosculosa* is a characteristic species with conspicuously tubiform male flowers. Vegetatively the ashy green undersurface of the leaves is remarkable. At anthesis the outwards curved perianth lobes expose the acute, almost acuminate apical part of the synandrium.

## 50. *Myristica fragrans* Houtt.

*Myristica fragrans* Houtt., Nat. Hist. Pl. 2 (3) (1774) 333; Blume, Rumphia 1 (1835) 180, t. 55; Warb., Die Muskatnuss (1897) 1–628; Mon. Myrist. (1897) 458; J. Sinclair, Gard. Bull. Sing. 16 (1958) 361, f. 29, pl. VII B; 23 (1968) 225; Flach & Tjeenk Willink in Plant Resources of South-East Asia, A selection (1989) 192; W. J. de Wilde, Blumea 35 (1990) 244; 40 (1997) 166. — Lectotype: *J. W. Weinmann*, Taalrijk Register 7 (1748) pl. 760a.

*Myristica officinalis* L. f., Suppl. Pl. (1781) 265.

*Myristica moschata* Thunb., Act. Holm. Kongl. Vet. Acad. Nya Handl. 3 (1782) 49, t. 1, f. 1.

*Myristica aromatica* Lam., Act. Paris (1788) 155, t. 5–7.

*Myristica amboinensis* Gand., Bull. Soc. Bot. France 66 (1919) 225, in clavi.

*Myristica laurella* Gand., Bull. Soc. Bot. France 66 (1919) 226, in clavi.

*Myristica philippinensis* Gand., Bull. Soc. Bot. France 66 (1919) 226, in clavi.

For more synonyms, references, and typifications see Sinclair, l.c. (1958) 363; (1968) 226, 231; for pre-Linnean names and literature see Warburg, Mon. Myrist. (1897) 459–467.

Tree 4–10 m. Twigs 1–2 mm diameter, yellowish brown, early glabrescent, hairs pale, 0.1 mm or less; older twigs grey-brown, striate; lenticels inconspicuous. Leaves chartaceous or thinly coriaceous, (ovate-)elliptic to oblong, 6–13 by 3.5–6.5 cm, base attenuate, apex acute-acuminate; upper surface olivaceous, lower surface pale, olivaceous or greyish white, early glabrescent, hairs 0.1 mm; not conspicuously papillose; dots absent; midrib raised above, lateral nerves 6–12 per side, at 60–80° to the midrib, flat or sunken above, lines of interarching usually not distinct, venation faint or distinct below, contrasting in colour or not; petiole 7–12 by 0.7–1.5 mm; leaf bud 5–10 by 1 mm, hairs 0.1 mm or less. Inflorescences between the leaves, axillary or sometimes a few mm supra-axillary, essentially paniculate; in male: peduncle slender, 5–20 mm (with an apical flower or not) and with one or two opposite, slender (but thicker than the peduncle), scar-covered (scars spirally arranged and rather widely spaced) brachyblasts, to 20 mm long, up to 5-flowered at apex, buds usually very variable in size, sometimes male inflorescences reduced to 1–3 almost sessile long-pedicelled flowers; female inflorescences: peduncle

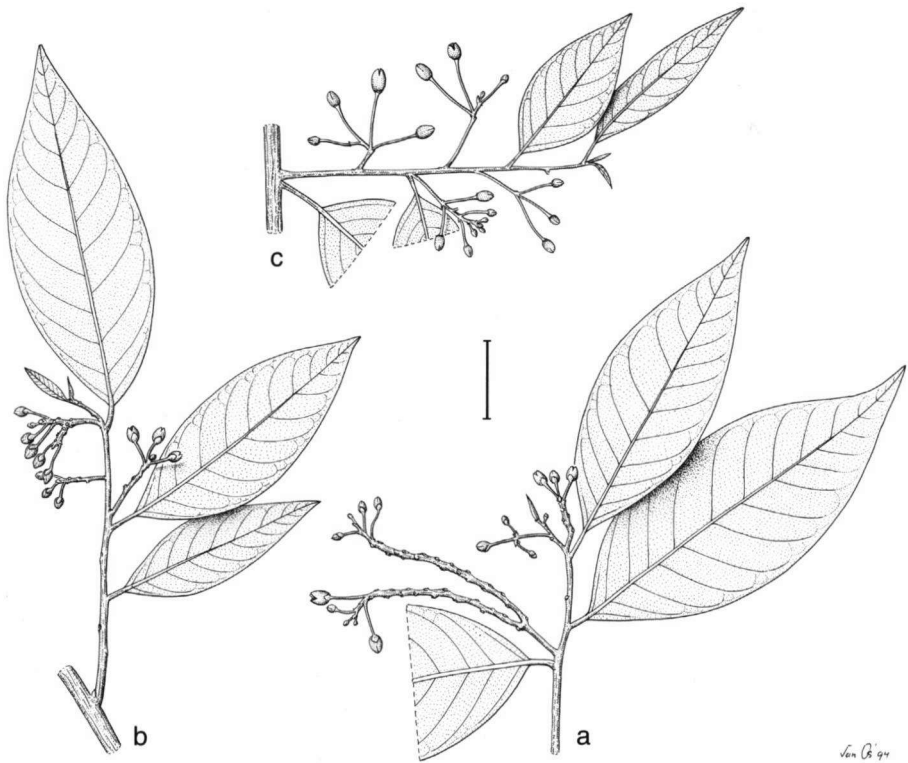


Fig. 73. *Myristica fragrans* Houtt. Male inflorescences [a & b: C. K. Ruffo 247, cult., Tanzania; c: NGF 36217 (Zieck), cult., New Ireland / Papua New Guinea]. — Scale bar = 2 cm.

slender, up to 5 mm, 1(–3)-flowered; bracts minute, caducous. Inflorescences and flowers with widely spaced, appressed, pale brown hairs, 0.1 mm or less, partly glabrescent. *Male flowers*: pedicel slender, 10–15 mm long; bracteole broadly ovate or semi-circular, c. 2 mm,  $\pm$  caducous; buds ellipsoid-oblong, 7–8 by 4–5 mm, apex and base rounded, cleft c. 1/5, lobes 0.3 mm thick, at anthesis somewhat spreading. Androecium slender or broad, 5–6 mm; androphore 2–2.5 by 1 mm, hairs 0.1 mm or less, or nearly glabrous; synandrium 3 by 1–1.2(–1.5) mm, thecae 14–20(–24), sterile apex subacute, 0.5 mm. *Female flowers*: stouter than male flowers, pedicel 8–12 mm long, bracteole caducous, apical or up to 2.5 mm below; buds  $\pm$  ovoid, apex narrow, base broadly rounded, 7–8 by 5 mm, cleft c. 1/5, lobes at anthesis curved outward; ovary ovoid, 5 by 3 mm, hairs less than 0.1 mm. *Fruits* solitary, pendent, broadly pear-shaped or almost globose, 4–6 cm long (6–9 cm diameter when fresh), early glabrescent, hairs widely spaced, dull brown, 0.1 mm; pericarp 10–15 mm thick; seeds broad-ellipsoid, 3 cm; fruiting pedicel 10–15 mm,  $\pm$  widened towards the fruit. — Fig. 59b, 64f, 73.

**Field-notes** — Slenderly conical trees, all parts aromatic; sometimes male and female flowers on the same tree, but usually dioecious. Bark greyish black, slightly fissured longitudinally in older trees. Flowers to 1 cm long, fragrant, creamy yellow, waxy. Fruits drooping, 6–9 cm long and nearly as broad, almost globose, with a circumferential longitudinal groove and persistent remains of the stigma, with a pseudostalk, yellow, glabrous (early glabrescent); fruit stalk thickest towards the base of the fruit; pericarp yellow, succulent; aril strongly lacinate; seeds broadly ellipsoid-ovoid, purplish brown.

**Distribution** — *Malesia*: Banda Islands; widely cultivated in the Moluccas, and in many suitable localities in the tropics all over the world; locally seemingly wild in abandoned or neglected plantations, or where intentionally planted in wild forest.

Supposedly all collections of *M. fragrans*, also those from the southern Moluccas (including those from Ambon and Banda), are from cultivated or running wild specimens. According to Rumphius (Herb. Amb. 2, 1741, 14, t. 4) the species was at the time already amply cultivated in Banda.

**Habitat & Ecology** — Lowland forest, apparently preferably under rather strong seasonal conditions.

**Notes** — 1. Sinclair (1968) listed *M. fragrans* with *M. argentea*, *M. succedanea*, and *M. impressinervia* in his series *Fragrantes* (i.e., series *Speciosae* and *Fragrans* of Warburg, l.c.: 378). Indeed, the first two species seem related to *M. fragrans*, but *M. impressinervia* has far more remote affinities.

2. *Myristica fragrans* is a homogeneous species, readily distinguishable from *M. argentea* and *M. succedanea* by its small, glabrous (early glabrescent) leaves with few nerves, in combination with its typical slender inflorescences. Rumphius (l.c.) distinguished five varieties.

## 51. *Myristica frugifera* W.J. de Wilde

*Myristica frugifera* W.J. de Wilde, Blumea 42 (1997) 166. — Type: *Ridsdale 1219*, Philippines, Mindoro.

Tree 10–20 m. *Twigs* 4–6 mm diameter, blackish brown, glabrous or very early glabrescent, hairs 0.1 mm; older twigs sometimes  $\pm$  cracking and flaking; lenticels small and inconspicuous. *Leaves* chartaceous or thinly coriaceous, elliptic(-oblong) or oblong-

lanceolate, 18–30(–35) by 6–11(–13) cm, base (attenuate or) rounded, or cordate, apex (sub)acute(–acuminate); upper surface olivaceous or brown, lower surface grey-brown with  $\pm$  persistent indumentum or late glabrescent, hairs sparse, scale-like, 0.1 mm or less; distinctly papillose; dots absent; midrib above flat, lateral nerves 20–30 per side, at (45–)60–80° to the midrib, slender,  $\pm$  sunken above, faint, lines of interarching and venation  $\pm$  indistinct; petiole 15–30 by 3–4 mm; leaf bud 12–18 by 4–5 mm, hairs 0.1–0.2(–0.5) mm. *Inflorescences* pedunculate, between the leaves or below, with sparse hairs 0.1 mm or less, glabrescent; bracts small, caducous; in male: 8–10 by 2–4 cm, peduncle 40–50 mm, branches to 15 mm, central axis 20–30 mm long, with 2–4 subumbels, the latter with 5–10 flowers; buds of variable sizes; in female (from infructescences): 1–8 cm, peduncle 3–50 mm, lower branches opposite, to 10 mm long, central axis to 20 mm long, sometimes several  $\pm$  crowded in condensed twigs, forming compound infructescences with apical leaf bud. *Male flowers*: pedicel (6–)8 mm long, bracteole broadly ovate, 3 mm,  $\pm$  caducous; buds ovoid, 6.5–5.7 by 5 mm, cleft 1/3 to (nearly) 1/2, lobes 0.5–1 mm thick. Androecium cylindrical, 4 mm long,  $\pm$  truncate; androphore 0.7 mm long, the lower 4/5 with dense hairs less than 0.1 mm; synandrium 3 by 1 mm, thecae 12–15, sterile apex shaped irregularly, blunt, 0.3 mm long. *Female flowers* not known. *Fruits* 1–3 per infructescence, broadly ellipsoid to ellipsoid-oblong, 5–7.2 by 3–4.5 cm, hairs light to dark brown, scurfy, 0.1 mm, partially glabrescent; pericarp 5–8 mm thick; seeds (ellipsoid-)oblong, 4.5–5 cm; fruiting pedicel 3–6 mm, coarsely fissured, scar of bracteole (sub)apical.

Field-notes — Leaves above medium green, slightly glossy with paler midrib and veins, below pale green or glaucous with yellowish green midrib and veins. Not yet ripe fruits glabrous, ripe fruits brown.

Distribution — *Malesia*: Philippines (Luzon, Leyte, Mindoro).

Habitat & Ecology — Understorey tree of primary and disturbed lowland forest; 0–500 m altitude; fr. Feb., June.

Notes — 1. The material of this species is slightly heterogeneous, according to the islands of provenance. *Sinclair & Edaño 9595* (Luzon) has glabrous immature fruits, olivaceous leaves, drying grey below, with 25–30 pairs of lateral nerves, and links up very well with *FB 12783* (Leyte) also with immature fruits. The three collections from Mindoro, *Ridsdale 803, 1175* and *1219* (type), all in fruit, are almost identical and differ from the Luzon and Leyte specimens in the twigs rather brown on drying instead of blackish brown, and bright brown subcoriaceous leaves with fewer (20–25) pairs of nerves. The infructescences are either sessile (e.g. *Ridsdale 803*, in part) or up to 5 cm pedunculate (*Ridsdale 1175*).

2. *Myristica frugifera* seems related to *M. extensa* (Borneo), *M. maxima* (West Malaysia), and *M. philippensis* (Philippines). *Myristica extensa* has an indistinct papillation on the lower leaf surface. *Myristica maxima* is quite distinguishable by its generally denser indumentum on the lower leaf surface and a blackish drying colour of the leaves. *Myristica philippensis* differs in its roughly pubescent leaf bud, hairs 1(–2) mm.

## 52. *Myristica fugax* W.J. de Wilde

*Myristica fugax* W.J. de Wilde, *Blumea* 40 (1995) 284. — Type: *Carr 15501*, Papua New Guinea, Central Prov.



Treelet 4–5 m tall. *Twigs* (1–)1.5–2 mm diameter, glabrescent, hairs scale-like, 0.1 mm or less; older twigs not cracking nor flaking; lenticels not apparent. *Leaves* membranous, (elliptic-)oblong, 5–12 by 2–3.5(–4.5) cm, base broadly rounded or attenuate, apex to 1.5 cm acute-acuminate; upper surface brown (greyish), lower surface pale, glabrous or with a few scattered scale-like hairs less than 0.1 mm; not papillose; dots absent; midrib raised above; lateral nerves 6–12(–14) per side, at 50–70° to the midrib, flat or ± sunken above, indistinct, on lower surface brown, ± contrasting, lines of interarching and venation indistinct; petiole 7–12 by 0.5–1(–2) mm; leaf bud 7–12 by 1 mm, hairs 0.1 mm or less. *Inflorescences* pedunculate, between the leaves, axillary or to 3 mm supra-axillary, glabrescent, indumentum minute, grey-brown; bracts subtriangular, less than 1 mm long, caducous; in male: peduncle (1–)2–5 by 0.5–1 mm, ending in a to 1.5 cm long scar-covered brachyblast with a subumbel of 2–5 flowers, buds of various sizes; female inflorescences with 1 or 2 flowers, without or with peduncle to 5 mm long; flowers thin with hairs less than 0.1 mm. *Male flowers*: pedicel slender, 3.5–6 by 0.4–0.5 mm, bracteole minute, caducous, scar apical or 1–2 mm below; perianth inside in the lower half with longitudinal irregular furrows and rows of minute wart-like excrescences, buds ellipsoid-oblong, 4.5–6.5 by 1.2–2 mm, apex ± blunt or subacute, base narrowly rounded, cleft c. 1/5, lobes membranous, 0.7–1–1.5 mm long. Androecium slender, 3.5–6.5 mm; androphore grooved or not, 2.5–4 mm, hairs less than 0.1 mm; synandrium 1.8–2 by 0.5–0.7 mm, thecae 8–12, sterile apex acute, 0.1–0.7 mm. *Female flowers*: pedicel 2.5 mm, bracteole scar 1 mm below apex; buds ovoid-oblong, narrowed to apex, 7 by 2.5 mm, lobes 1 mm long; ovary including stigma 5 mm. *Fruits* solitary, ellipsoid-oblong, 3.7–4.5 by 1.4–1.5 cm, apical part contracted into a ± curved beak 4–7 mm, base narrowed into a 4–5 mm long pseudostalk, hairs dense, scurfy scale-like, less than 0.1 mm; pericarp 1 mm thick; seeds oblong, 2.8 cm; stalk (peduncle and fruiting pedicel) slender, nearly 1 cm long, fruiting pedicel 5 mm, bracteole scar 1.5 mm below the fruit.

Distribution — *Malesia*: Papua New Guinea (E Sepik, Gulf, Madang, and Central Prov.); see also under the subspecies.

Habitat & Ecology — Montane forest; (400–)1200–1600 m altitude.

Note — The irregular warty inner surface of the male perianth is also found in the obviously related species *M. pumila* and *M. sogeriensis*.

#### KEY TO THE SUBSPECIES

- 1a. Bracteole scar in male (1–)2 mm below the perianth; androphore 4 mm long, nearly twice as long as the synandrium. Fruits (incl. pseudostalk) 4.5 cm    **a. subsp. fugax**  
 b. Bracteole scar in male apical; androphore (1.8–)2.5–3 mm long, about as long as the synandrium. Fruits (including pseudostalk) 3.7 cm    . . .    **b. subsp. septentrionalis**

#### **a. subsp. fugax**

*Twigs* slender, 1–1.5 mm diameter. *Leaves* above drying dull brown-grey; lateral nerves 8–10 pairs. *Male inflorescences* slender, peduncle 0.5 mm thick. *Male flowers*: pedicel 5–6 mm long, bracteole scar (1–)2 mm below the apex; buds 6.5 mm long, lobes 1.5 mm long; androphore 4 mm long; synandrium 2 mm long, sterile apex 0.4 mm long. *Fruits* including pseudostalk 4.5 cm long.

Field-notes — Flowers green, cream, or cream-tipped greenish. Fruits ochre.

Distribution — *Malesia*: Papua New Guinea (Central Prov.: near Isuarava, and Lala).

Habitat & Ecology — Primary and degraded montane forest; 1200–1600 m altitude; fl. & fr. Jan.–Feb.

Note — May be confused with the related *M. pumila*, a species generally with non-pedunculate male inflorescences.

**b. subsp. septentrionalis** W.J. de Wilde

*Myristica fugax* W.J. de Wilde subsp. *septentrionalis* W.J. de Wilde, *Blumea* 40 (1995) 286. — Type: *Schlechter 18670* (male fl.), Papua New Guinea.

*Twigs* 1.5 mm diameter. *Leaves* above drying dark brown; lateral nerves 8–12(–14) pairs. *Male inflorescences* stouter than those in subsp. *fugax*, peduncle 1 mm thick. *Male flowers*: pedicel 4 mm long, bracteole scar apical; buds 6 mm long, lobes 1 mm long; androphore 2.5–3 mm long; synandrium 2.5 mm long, sterile apex 0.5 mm long. *Fruits* including pseudostalk 3.7 cm long.

Distribution — *Malesia*: Papua New Guinea (E Sepik, Gulf, and Madang Prov., Bismarck Mts).

Habitat & Ecology — Montane forest; 300–1200 m altitude; fl. Mar., Nov.

Note — Some slightly deviating collections are discussed by De Wilde (l.c.).

**53. *Myristica fusca* Markgr.**

*Myristica fusca* Markgr., *Bot. Jahrb. Syst.* 67 (1935) 158; A.C. Sm., *J. Arnold Arbor.* 22 (1941) 67; J. Sinclair, *Gard. Bull. Sing.* 23 (1968) 252, f. 25; Foreman, *Handb. Fl. Papua New Guinea* 1 (1978) 198; W.J. de Wilde, *Blumea* 40 (1995) 286. — Type: *Schlechter 16848*, Papua New Guinea, West Sepik.

Tree 20–30 m. *Twigs* 2.5–6 mm diameter, late glabrescent, hairs red-brown, coarse, ± erect, 1(–1.5) mm; older twigs dark grey-brown, not cracking; not or inconspicuously lenticellate. *Leaves* chartaceous or subcoriaceous, ovate-oblong or oblong-lanceolate, 14–33 by 5–12 cm, base cuneate, rounded, or subcordate, apex acute(–acuminate); upper surface olivaceous-brown, lower surface greyish (brown), hairs (especially on the veins) persistent, conspicuous, spaced, 0.1–1.5 mm, with view on papillose lower leaf surface; dots absent; midrib slightly raised above, lateral nerves 20–25(–30) per side, at 60–90° to the midrib, ± sunken above, lines of interarching distinct, venation coarsely netted, sunken above and rendering the leaf bullate; petiole pubescent or late glabrescent, 10–17 by 3–5 mm; leaf bud 10–15 by 4–5 mm, hairs dense, ± rough, rust-coloured, 1–1.5 mm long. *Inflorescences* between the leaves or below, of the *Knema*-type, sessile or pedunculate; in male a to 6 (by 4) mm pedunculate, ± woody, scar-covered brachyblast, simple or bifid, to 1 cm long; flowers in a loose cluster of (2–)4–6; buds of almost equal size; female inflorescence not seen, presumably 1–3-flowered only. Inflorescence and flowers with persistent rough dense rusty hairs 1–1.5 mm; bracts 2 mm, late caducous. *Male flowers*: stout, pedicel 10–14 by 2–2.5 mm, bracteole broadly rounded, 1 mm long, (late) caducous; buds (ovoid-)oblong or (long-)fusiform, 14–16(–17) by 5–6 mm, apex subacute, cleft 1/8–1/10, lobes leathery, 1.5(–2) mm long, 0.5–0.6 mm thick. Androecium 12–14 mm; androphore 3–4 by (1.5–)2 mm, in the lower half with stiff rufous hairs, 1–1.5 mm; synandrium 7–8 by 1.5–2 mm, thecae c. 20, sterile apex broad or narrow, conical, subacute, 2 mm long. *Female flowers* (Markgraf, Sinclair, Foreman,

l.c.): pedicel 3–8 by 2 mm; buds broadly ovoid, 10 by 5–7 mm, cleft 1/4; ovary nearly as long as the perianth, ovoid-conical, densely setose, stigma substipitate. *Fruits* single, (ellipsoid-)oblong, 6–7 by 3.5–4 cm, apex narrowed, (sub)acute or shortly beaked, base  $\pm$  narrowed, hairs dense, rust-coloured, 1–1.5 mm long; pericarp 4–5 mm thick; seeds ellipsoid-oblong, 2.5–3.5 cm, dark brown; fruiting pedicel stout, 10–12 by 5–6 mm, late glabrescent, bracteole scar  $\pm$  apical.

Field-notes — Branching horizontally. Buttresses to 1 m out. Bark brown or black, scaly; inner bark reddish; exudate red; wood red-brown, heartwood pink. Leaves pale or glaucous below. Flowers brown hairy, or yellow. Fruits rust-coloured.

Distribution — *Malesia*: New Guinea (a limited number of collections known from a restricted area in NE Papua Barat and Papua New Guinea: W Sepik & Madang Prov.).

Habitat & Ecology — Subcanopy tree of hillside or foothill forest; also on copper-rich soil; 100–850 m altitude; fl. & fr. throughout the year.

Notes — 1. *Myristica fusca* is close to *M. sphaerosperma* and *M. womersleyi*; for differences, see the key to the species.

2. *Myristica fusca* is readily recognizable by its somewhat bullate leaves with coarse dark rust-coloured indumentum below and its comparatively large flowers.

#### 54. *Myristica fusiformis* W.J. de Wilde

*Myristica fusiformis* W.J. de Wilde, *Blumea* 40 (1995) 287, f. 3d. — Type: *Milliken 1408*, W Irian Jaya.

Treelet c. 3 m tall. *Twigs* 1–1.5 mm diameter, early glabrescent, hairs very minute; older twigs coarsely striate or slightly flaking, with few inconspicuous lenticels. *Leaves* membranous or chartaceous, elliptic-oblong, 9.5–15(–17) by 3.5–6 cm, base attenuate, apex acute-acuminate; upper surface olivaceous or brown, lower surface brown-grey, glabrous, with some scattered whitish scale-like hairs less than 0.1 mm; inconspicuously densely fine-papillose; dots absent; midrib slightly raised above, lateral nerves 10–15 per side, at 60–70° to the midrib, flat or sunken above, on lower surface brownish and  $\pm$  contrasting, lines of interarching  $\pm$  distinct, venation fine, faint or distinct below; petiole 8–15 by 0.8–1.5 mm; leaf bud 10 by 1–1.5 mm, hairs 0.1 mm or less. *Male inflorescences*, *male* and *female flowers* not seen. *Female inflorescences* (from infructescences) sessile, of the *Knema*-type, small, consisting of a single axillary flower. *Fruits* solitary,  $\pm$  narrowly fusiform, 7–8.5 cm, apex acute, with or without pseudostalk, hairs inconspicuous, pale rust-coloured, mealy, interwoven, scale-like, 0.1 mm or less, (partly) glabrescent; pericarp (1–)2 mm thick; seeds oblong, 3 cm; fruiting pedicel slender or thickish, 9–10 mm, fissured and transversely cracked, glabrous (hence flowers possibly glabrescent), bracteole scar obscure, 2.5 mm below the apex.

Distribution — *Malesia*: SW Papua Barat (known only from the type specimens of the two subspecies).

#### KEY TO THE SUBSPECIES

- 1a. Fruits 7.5 cm long, tapering at base, but without pseudostalk. — Montane, at 1700 m ..... **a. subsp. fusiformis**  
 b. Fruits 7.5–8 cm long, tapering at base into a narrow pseudostalk 15–20 mm long. — Lowland ..... **b. subsp. pseudostipitata**

**a. subsp. fusiformis**

Treelet 3 m. *Twigs* 1–1.5 mm diameter. *Leaves* chartaceous, 10–17 by 4.5–6 cm, apex narrowly acuminate; upper surface dark brown, lower surface grey-brown, venation faint, lateral nerves 10–15 per side; petiole (10–)15 by 1–1.5 mm. *Fruits* ± fusiform, 7.5 by 2 cm, the basal part gradually narrowed but pseudostalk absent; pericarp largely glabrescent; fruiting pedicel 10 by 3–4 mm, fissured, with a few lenticels. — **Fig. 63d.**

Field-notes — Leaf underside pale. Fruits ochre.

Distribution — *Malesia*: W Papua Barat (Kurima, close to Ilamik village).

Habitat & Ecology — *Nothofagus*-dominated forest; 1700 m altitude; fr. Oct.

Note — Related to *M. tubiflora* (a lowland species with smaller fruits) on account of the sessile, elongate fruits.

**b. subsp. pseudostipitata** W.J. de Wilde

*Myristica fusiformis* W.J. de Wilde subsp. *pseudostipitata* W.J. de Wilde, *Blumea* 40 (1995) 287, f. 3e. — Type: *von Römer 304*, West Irian.

Possibly a small tree, size not known. *Twigs* 1 mm diameter. *Leaves* thinly membranous, 9–10 by 3.5 cm, apex shortly acute-acuminate; upper surface rather pale brown-olivaceous, lower surface grey, venation distinct, lateral nerves c. 10 per side; petiole 8 by 0.8 mm. *Fruits* long-fusiform, 8–8.5 by 1.5 cm including the basal part contracted into a narrow pseudostalk 15–20 mm long; pericarp largely minutely pubescent, partly glabrescent; fruiting pedicel 9 by 1.5 mm. — **Fig. 62d, 63e.**

Distribution — SW Papua Barat (lower Lorentz River, 'Noord River').

Habitat & Ecology — Presumably collected in forest at low altitude; fr. Sept.

Notes — 1. Known only by its fragmentary type specimen, which is readily distinguishable from the type subspecies and all known *Myristicas* in New Guinea by its elongate solitary fruit with long pseudostalk, and long fruiting pedicel, in the axil of a leaf scar. Vegetatively it is similar to *M. brachypoda* from S Papua New Guinea, but in that species the papillation on the lower leaf surface is more pronounced, and the fruits, although with a similar indumentum, are smaller, almost sessile, and lack a pseudostalk.

2. The distinct reticulation of the lower leaf surface is reminiscent of *M. globosa*, a species differing in its (sub)globose fruits.

**55. Myristica garciniifolia** Warb.

*Myristica garciniifolia* Warb., *Mon. Myrist.* (1897) 525, t. 19; Markgr., *Bot. Jahrb. Syst.* 67 (1935) 169; J. Sinclair, *Gard. Bull. Sing.* 23 (1968) 196, f. 13; Foreman, *Handb. Fl. Papua New Guinea* 1 (1978) 198; W.J. de Wilde, *Blumea* 40 (1995) 288. — Type: *Beccari Fl acc. nos. 7735, a*, northern West Irian, Humboldt Bay.

Tree 10–30 m. *Twigs* 2.5–4(–5) mm diameter, yellowish or reddish brown, early glabrescent, hairs grey, 0.1 mm or less; older twigs sometimes ± fissured or flaking, sometimes with few lenticels. *Leaves* chartaceous or subcoriaceous, elliptic-oblong, 12–30 by 5–11 cm, base ± cuneate or (narrowly) rounded, apex acute-acuminate; upper surface olivaceous or brown, lower surface almost concolorous, glabrous; not papillose; dots absent; midrib flat or somewhat raised above, lateral nerves 17–25 per side, at 45–80° to the midrib, flat, faint above, faint and little raised below, lines of interarching and

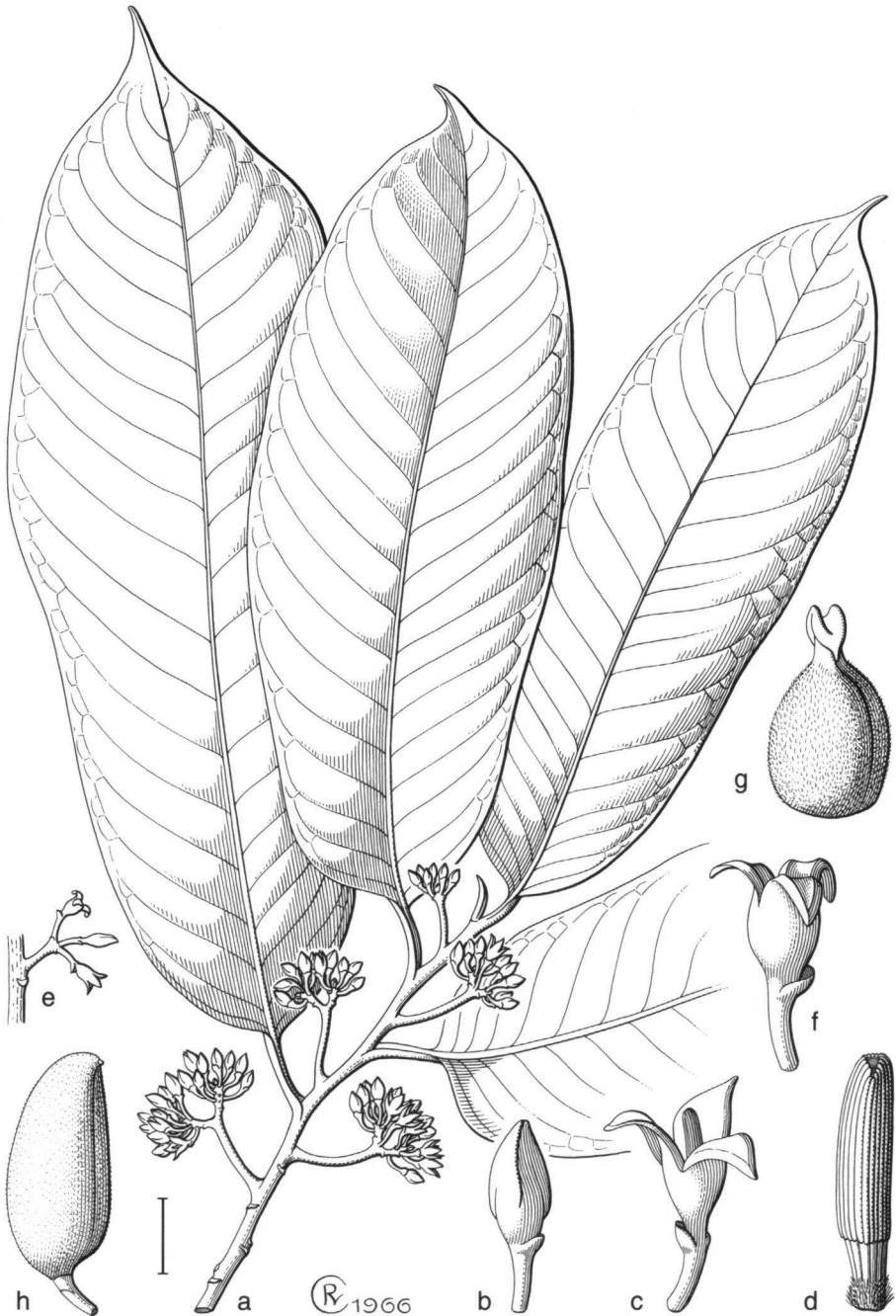


Fig. 74. *Myristica garciniifolia* Warb. a. Leafy twig with male inflorescences; b. male bud; c. male flower at anthesis; d. androecium; e. female inflorescence; f. female flower at anthesis; g. pistil; h. fruit [a: *Atasrip* 79; b–d: *BW* 3326 (*Runtuboy*); e–h: *BW* 4320 (*Koster*)]. — Scale bar for a, e, h = 2 cm; for b, c, f = 5 mm; for d, g = 2 mm.

venation indistinct; petiole 15–25 by 2.5–4 mm; leaf bud 15–20 by 3–4 mm, hairs less than 0.1 mm. *Inflorescence* between the leaves or below, pedunculate, glabrescent, indumentum minute; bracts small, caducous; in male: 3–5 by 2–3.5 cm, peduncle flattened, 10–23 by 2–4 mm, ending in a single (somewhat adaxial) flower and with (1) 2 (or 3) branches, (1–)2–5(–15) mm,  $\pm$  flattened (occasionally the middle branch once more forked), with to 10 mm long scar-covered brachyblasts with subumbels of (5–)10–15 flowers; buds of almost equal sizes; female like male, but much reduced, peduncle 10–15 mm, generally 3-flowered; flowers  $\pm$  coriaceous, appearing as if glabrous, but hairs widely spaced, 0.1 mm or less, or glabrescent. *Male flowers*: pedicel  $\pm$  flattened, 5–8 by 1.5 mm, bracteole 2 mm, persistent, (sub)apical; buds ovate-ellipsoid, 7–8.5 by (3–)4–5 mm, base  $\pm$  attenuate or rounded,  $\pm$  narrowed to the subacute apex, angled, cleft 2/3–3/4, lobes (4–)5–6 mm long, 0.3(–0.5) mm thick. Androecium slender, 5–6.5 mm; androphore 1–1.5 by 0.8 mm, in the lower half with brownish hairs, 0.2 mm; synandrium sometimes blunt triangular, 4–5 by 1 mm, thecae 14–20, sterile apex absent or irregularly shaped, to 0.2 mm. *Female flowers*: pedicel 6–8 by 2 mm, bracteole subapical; buds ovoid-oblong, narrowed to the apex, angled, 8–9 by (4–)5 mm, lobes 4 mm; ovary ovoid, 4 by (3–)3.5 mm, hairs 0.2–0.3 mm. *Fruits* 1–3 per infructescence, (ovoid-)oblong, 4.5–5.5(–6) by (2.5–)3 cm, apex narrowly rounded with stigma remnant, base rounded or  $\pm$  attenuate, hairs brown powdery, 0.5 mm long, partly glabrescent; pericarp 3 mm thick; seeds ellipsoid-oblong, 3–3.5 cm; fruiting pedicel 10–17 by 3 mm, glabrous, bracteole scar 3–4(–10) mm below the apex. — **Fig. 74.**

*Field-notes* — Medium tree with small buttresses. Bark smooth, rarely scaly, brown or blackish; slash red; exudate orange or red; sapwood pale, no heartwood. Leaves light green below. Flowers yellow or creamy yellow. Fruits brown hairy.

*Distribution* — *Malesia*: NW Papua Barat (in a rather restricted area in the Jayapura region, also Japen I.); not yet recorded from NW Papua New Guinea where it can be expected in the adjoining NW Sepik Province.

*Habitat & Ecology* — Coastal rain forest; not rare in the lower Cyclops Mts; clayey soils; up to c. 350 m altitude; fl. & fr. throughout the year.

*Notes* — 1. *Myristica garciniifolia* seems related to the West Malesian *M. elliptica*, with similar inflorescences and conspicuously angled buds. It also resembles the Papuan *M. schleinitzii* which differs in its non-angular buds and smaller glabrescent fruits.

2. By its very short, inconspicuous indumentum of leaf bud and innovations, and its early glabrescence, *M. garciniifolia* makes a completely glabrous impression; it is further distinguishable by its faint leaf venation.

## 56. *Myristica gigantea* King

*Myristica gigantea* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 288, pl. 110; Warb., Mon. Myrist. (1897) 400; J. Sinclair, Gard. Bull. Sing. 16 (1958) 343, f. 22; 28 (1968) 163; W.J. de Wilde, Blumea 42 (1997) 167; Tree Fl. Sabah & Sarawak 3 (2000) 462. — *Lectotype*: King's coll. 6050, Peninsular Malaysia.

*Myristica motleyi* Warb., Mon. Myrist. (1897) 400 & 684, t. 14, f. 1, nom. nud., p. p. quoad *Motley* 145 (Labuan).

Tree 17–40 m. *Twigs* 1.5–2.5(–3) mm diameter, late glabrescent, hairs either short, 0.1–0.2 mm, or hairs conspicuous, rust-coloured, 0.5–1 mm mixed with emergent hairs

1–1.5 mm (see note 2); older twigs (coarsely) flaking; lenticels inconspicuous or absent. *Leaves* chartaceous or thinly coriaceous, elliptic-oblong or  $\pm$  lanceolate, 7–15 by 2–4 cm (to 22 by 8 cm of sapling shoots), base rounded or attenuate, apex rounded, rather blunt, or acute; upper surface olivaceous or brown, lower surface greyish brown, glabrescent, hairs scattered, 0.1 mm or less; distinctly papillose; dots absent; midrib above slightly raised, lateral nerves 10–15(–18) per side, at 45–70° to the midrib, lines of interarching and venation indistinct on both surfaces; petiole 12–25 by 1–2 mm; leaf bud 10–15 by 1.5–2.5 mm, hairs 0.1–0.5 mm. *Inflorescences* generally below the leaves, pedunculate, with shaggy hairs (0.2–)0.5–1 mm, sometimes glabrescent; in male: 2.5–3.5 by 2.5–3 cm, peduncle 6–10 mm, lower branches 10–15 mm, central axis 10–20 mm long, with 1 or 2 subsessile subumbels, the latter with 6–12 flowers, buds of variable sizes; bracts caducous, 4 mm; in female: 1.5 cm long,  $\pm$  branched, few-flowered; flowers and inflorescences with hairs (0.2–)0.5 mm. *Male flowers*: pedicel 4–8 by 0.5 mm, bracteole 2 mm, caducous; buds ovoid-ellipsoid, 4–4.5 by 3(–3.5) mm, cleft 1/5–1/4, lobes membranous, (0.2–)0.3 mm thick. Androecium slender, 3.5 mm; androphore 1.5 by 1 mm, with hairs 0.3 mm in the lower 2/3; synandrium 2 by 0.8–1 mm, apex  $\pm$  acute, thecae 14–16(?), sterile apex absent. *Female flowers* not seen (young fruits densely pubescent). Infructescence 1–1.5 cm long. *Fruits* 1 or 2, broadly ovoid, 5–8 by 4.5–5 cm, early or late glabrescent, hairs mealy, 0.2–0.3 mm, persistent at the base; pericarp 15–20 mm thick; seeds ellipsoid, 3–3.5 cm; fruiting pedicel  $\pm$  stout, 5–9 mm.

*Field-notes* — Frequently with (low) buttresses or (few) stilt-roots, up to 2 m high, slender or thick, round. Bark generally blackish (charcoal), longitudinally fissured, or often flaking in strips or pieces, 1 cm wide, brittle; inner bark 10–12 mm thick, brown or red; sap red, sometimes sticky; sapwood white-yellow; heartwood brown. Leaves dull pale green below. Flower buds brown. Fruits yellow or orange, with minute brown hairs. *Torquebiau c. s. ET 751* suggested the beautiful tree to be tried in plantations.

*Distribution* — *Malesia*: Sumatra, Peninsular Malaysia, Singapore, Borneo (Sarawak, Sabah, W, E & NE Kalimantan, Labuan, Nunukan).

*Habitat & Ecology* — Lowland dipterocarp forest; sandy (loam) soil; 0–100(–450) m altitude; fl. & fr. possibly throughout the year.

*Notes* — 1. Strange enough, of this apparently fairly common tree, only *Scortechini 1949*, and one recent collection (Borneo), bear well-developed male flowers. Female flowers have never been collected.

2. Variable in length of the hairs on the sterile leaf bud, either 0.1–0.2 mm only or up to 2 mm long; because of this, *M. gigantea* appears twice in the keys. Whether this difference has taxonomic implications is not known.

3. Related to *M. maingayi*, but with smaller inflorescences, flowers and fruits. It reaches a large size as a tree, and is known as the tallest Malayan *Myristica*. *Myristica maingayi* has a lower stature, stouter twigs, larger leaves with acute apex, larger male inflorescences and flowers, androecium with sterile apex, and slightly longer glabrescent fruits.

### 57. *Myristica globosa* Warb.

*Myristica globosa* Warb., Mon. Myrist. (1897) 540, t. 19 — Type: *Forbes 212* (*Chalmers 10* in B, lost), Papua New Guinea.

For more references and synonyms see the subspecies.

Tree 5–30 m. *Twigs* subterete or angular, 1–2(–2.5) mm diameter, early glabrescent, hairs 0.1 mm or less; older twigs not or but finely cracking or flaking; small lenticels usually present. *Leaves* membranous or thinly coriaceous, elliptic-oblong to oblong-lanceolate, 7–16(–21) by 2–7(–8) cm, base attenuate, apex acute-acuminate (the very tip sometimes rather blunt); upper surface olivaceous or brown, lower surface greyish, early glabrescent, hairs sparse, less than 0.1 mm; not or indistinctly papillose; dots absent; midrib slightly raised or sunken above, lateral nerves 8–14(–17) per side, at 45–80° to the midrib, flat or sunken (and sometimes very faint) above, lines of interarching not distinct, venation reddish brown, mostly conspicuously contrasting with the lower leaf surface; petiole (5–)8–12(–15) by 0.8–2(–2.5) mm; leaf bud 5–10(–13) by (0.5–)1–2 mm, hairs 0.1 mm or less. *Inflorescences* between the leaves and below, of the *Knema*-type, sessile; in male: a simple or 2- or 3-armed scar-covered brachyblast, to 4 mm long, with a subumbel of up to 15(–30) flowers, buds of various sizes, short pubescent; in female: to 1 mm long, with 1–5 flowers (rarely more); flowers with appressed (dark) brown hairs 0.1–0.2 mm, sometimes glabrescent, bracteole 1(–2) mm, caducous, (sub)apical. *Male flowers*: pedicel 4–6(–7) by 0.4–0.6 mm; buds membranous, ovoid-oblong or ellipsoid-oblong, (4–)5–6.5 by 2–3(–4) mm, apex rather blunt or subacute, cleft 1/3 to (nearly) 1/2, the lobes 1.5–2.5(–3) mm long. Androecium 3–4(–5.5) mm; androphore 1.5–2 by 0.4–0.6 mm, hairs 0.1–0.3 mm in the lower 2/3–1/3, rarely glabrous; synandrium (2–)2.5–4 by 0.6–0.8(–1) mm, thecae 10–16(–20?), sterile apex more or less acute to flat, 0.2–0.3 mm or less, minutely lobed. *Female flowers*: pedicel 2–2.5 mm; buds ovoid, 4 by 3–3.5 mm, the lobes 1.5(–2) mm; ovary ovoid, 2.5–3 by 2–2.5 mm, hairs 0.2 mm. *Fruits* 1–3(–5) per infructescence, (sub)globose, 1.5–3.2(–4) by 1.5–2.5(–3) cm, with scurfy hairs, (0.1–)0.3 mm; the pericarp (1–)2–5 mm thick; seeds subglobose or broadly ellipsoid, 1–2(–2.2) cm; fruiting pedicel slender or rather thick, 2–5(–7) mm.

Field-note — Pericarp ± juicy.

Distribution — Solomon Islands; *Malesia*: NE Papua Barat (Jayapura region) and the whole of Papua New Guinea (incl. New Britain). Two subspecies.

Habitat & Ecology — Usually in lowland, more rarely in submontane everwet or rather seasonal forest.

Notes — 1. *Myristica globosa* is a widespread variable species. The two subspecies, both also variable, are arbitrary. Frequently specimens are difficult to place in a subspecies, especially those from the Solomon Islands. A few specimens obviously belonging to *M. globosa* s.l., but not readily fitting in one of the subspecies, are separately discussed in the notes to the subspecies.

2. *Myristica globosa* s.l. is closely related to *M. muelleri* (S Solomon Is., NE Queensland) and *M. tristis* (NW Papua Barat, including Bird's Head, and the Moluccas). The latter species differs in a brown, not pale greyish lower leaf surface, without papillae, a persistent bracteole, and subglobose fruits with thick pericarp. Although *M. muelleri* is not known from Papua New Guinea, it may be found there as well, and therefore it appears in the key to the subspecies. It is distinguishable by the male flower buds, cleft 1/4 to slightly over 1/3, broadly ellipsoid fruits with hairs up to 0.8 mm long [see W.J. de Wilde, *Blumea* 36 (1991) 185; 42 (1997) 122, 132].



## KEY TO THE SUBSPECIES

(based on fruiting material, and also including *M. muelleri*)

- 1a. Fruits 1.5–2.2(–2.4) cm long, (sub)globose, hairs 0.1–0.3 mm; pericarp (1–)2–3 mm thick. — New Guinea (incl. New Britain), Solomon Islands . **b. subsp. *chalmersii***  
 b. Fruits (2–)2.5–3(–4) cm long (if 2–2.5 cm, then fruits rather ellipsoid) . . . . . 2  
 2a. Fruits (broadly) ellipsoid, 2–3 cm long, hairs (0.1–)0.2–0.5(–0.8) mm; pericarp 2–3 mm thick. — S Solomon Islands, Australia (Queensland) . . . . ***M. muelleri*** Warb.  
 b. Fruits (sub)globose, 2.5–3(–4) cm long, hairs 0.1–0.3 mm; pericarp 3–5 mm thick. — New Guinea (incl. New Britain) . . . . . **a. subsp. *globosa***

**a. subsp. *globosa***

*Myristica globosa* Warb., Mon. Myrist. (1897) 540, t. 19; J. Sinclair, Gard. Bull. Sing. 23 (1968) 378, p. p., f. 63, p. p. (excl. *van Royen 3579*); Foreman, Handb. Fl. Papua New Guinea 1 (1978) 199, p. p.; W. J. de Wilde, Blumea 38 (1994) 364, f. 5; 40 (1995) 288.

Male buds at anthesis cleft 1/3 to nearly halfway. *Fruits* (sub)globose, 2.5–3(–4) cm long, hairs 0.1–0.3 mm; pericarp 3–5 mm thick; fruiting pedicel mostly short and thick, up to 4 mm thick, coarsely fissured.

Field-notes — Tree to 30 m tall, rarely with small stilt-roots. Bark smooth or shallowly fissured; outer bark (red-)brown; inner bark pink; wood white or yellowish with a red tinge; exudate red. Flowers cream, yellow, golden, or brown; scented or not. Seeds brown.

Distribution — *Malesia*: Papua New Guinea (incl. New Britain).

Habitat & Ecology — Lowland, (degraded) rain forest on volcanic ash soil, forest over limestone, *Castanopsis*-forest, and montane forest; 30–1220 m altitude; fl. & fr. throughout the year.

Note — *Carr 12890* has a stout habit and large male flowers, buds 6.5 by 4 mm; *LAE 58538 (Stevens & Lelean)* (New Britain) has conspicuously rich-flowered male inflorescences (c. 30 flowers per cluster), and further deviates in the warty inner surface of the perianth; *NGF 33284 (Leach)*, and *NGF 46929 (Katik)* from the foothills of Mt Suckling (Milne Bay Prov., 350–400 m), have exceptionally large fruits, 4 cm long.

**b. subsp. *chalmersii*** (Warb.) W. J. de Wilde

*Myristica globosa* Warb. subsp. *chalmersii* W. J. de Wilde, Blumea 38 (1994) 366; 40 (1995) 288. *Myristica chalmersii* Warb., Mon. Myrist. (1897) 519, t. 19. — Type: *Chalmers 5* (B, lost; iso MEL, n.v.), Papua New Guinea.

*Myristica bäuerlenii* Warb., Mon. Myrist. (1897) 541, t. 19; Markgr., Bot. Jahrb. Syst. 67 (1935) 168. — Type: *Bäuerlen 1* (B, lost; iso MEL, n.v.), Papua New Guinea.

*Myristica schumanniana* Warb. in K. Schum. & Lauterb., Fl. Schutzgeb. Südsee (1900) 328. — Type: *Rodatz & Klink (Tappenbeck) 70* (B, lost; iso BRSL, n.v.), Papua New Guinea.

Male buds at anthesis cleft 1/3 to nearly halfway. *Fruits* (sub)globose, 1.5–2.2(–2.4) cm long, hairs 0.1–0.3 mm; pericarp (1–)2–3 mm thick; fruiting pedicel either rather long and slender or short and thickish with fissured surface.

Field-notes — Small or medium-sized tree to c. 33 m; bole straight, sometimes with small buttresses; branches often ± horizontal, ± whorled. Bark brown, 5 mm thick, smooth or mostly finely longitudinally fissured or furrowed, often scaly (flaky); inner bark pink,

straw, or orange-brown, wood soft, cream or straw, staining reddish or orange-brown on exposure; exudate red, watery, odourless, sometimes appearing in separate drops, rarely sticky. Leaves mostly glaucous, greyish, or pale green below. Flowers (golden) yellow or brown. Fruits (orange-)brown or red-brown; pericarp firm but fleshy, with a strong spicy smell; seed brown, glossy.

Distribution — Solomon Islands; *Malesia*: NE Papua Barat (Jayapura area) and the whole of Papua New Guinea (incl. New Britain).

Habitat & Ecology — Usually in (degraded) dry-land forest of flat land, slopes and ridges, also in alluvial and bogged forest; red clay soil, volcanic soil, limestone, and well-weathered soil; associated with *Dracontomelum*, *Buchanania*, *Alstonia*, with *Celtis*, *Vitex*, or with *Pometia*, *Spondias*, and *Canarium*; 10–650(–1500) m altitude; fl. & fr. throughout the year.

### 58. *Myristica gracilipes* J. Sinclair

*Myristica gracilipes* J. Sinclair, Gard. Bull. Sing. 23 (1968) 334, p.p. (excl. *Schodde* 2291 = *M. warburgii*), f. 49; W.J. de Wilde, Blumea 40 (1995) 288. — Type: *Kanehira & Hatusima* 12277, Irian Jaya.

Tree 6 m tall. Twigs faintly blunt-angular, 2–2.5 mm diameter, early glabrescent, hairs minute, greyish; older twigs incidentally thinly flaking, with some small lenticels. Leaves (thinly) chartaceous,  $\pm$  obovate-oblong, 16–19 by 5.5–6.5 cm, base short-attenuate or nearly rounded, apex acute-acuminate; upper surface blackish brown, lower surface brown-grey, glabrous (or glabrescent, hairs few, minute, scattered, whitish, appressed); not papillose; dots absent; midrib flat above, lateral nerves 12–16 per side, at 45–60° to the midrib, sunken above, bright reddish brown below, contrasting, lines of interarching and venation distinct; petiole 8–15 by (2–)3–3.5 mm; leaf bud 7–8 by 2 mm, hairs 0.2–0.3 mm. Inflorescences (from infructescences) between the apical leaves, presumably of the *Knema*-type: 1- (or 2-)flowered, peduncle 1.5–2 mm long (see note 2). Male and female flowers not seen. Fruits solitary, somewhat immature: elliptic(-oblong), 2.5 by 1.5 cm, apex 2 mm beaked, base contracted into  $\pm$  broad 4–5 mm long pseudostalk, hairs thinly set, mealy, dull rust-coloured, 0.1 mm or less; pericarp 2 mm thick; seeds not seen; fruiting pedicel 2.7–3.5 cm by 1 mm, bracteole scar 10 mm below the apex.

Distribution — *Malesia*: N Papua Barat (Dalman, 45 km inland from Nabire); known only from the type.

Habitat & Ecology — In fringing rain forest; 500 m altitude; fr. Mar.

Notes — 1. *Myristica gracilipes* is close to *M. warburgii* subsp. *hybrida*, but the latter has smaller leaves, fruits lower on the twigs, and shorter fruiting pedicels.

2. If male inflorescences of *M. gracilipes* appear to be pedunculate, the species keys out in the vicinity of *M. cylindrocarpa*.

### 59. *Myristica guatteriifolia* A. DC.

*Myristica guatteriifolia* A. DC., Ann. Sc. Nat. 4, 4 (1855) 20, t. 4 (*guatteriaefolia*); Prodr. 14, 1 (1856) 193; Warb., Mon. Myrist. (1897) 412, t. 13; J. Sinclair, Gard. Bull. Sing. 16 (1958) 350, f. 25; 23 (1968) 213; Backer & Bakh. f., Fl. Java 1 (1964) 139; W.J. de Wilde, Blumea 42 (1997) 168; Tree Fl. Sabah & Sarawak 3 (2000) 463. — Type: *Cuming* 1582, Luzon, Prov. Batangas.

- Myristica littoralis* Miq., Fl. Ind. Bat. 1, 2 (1858) 57; Koord. & Valetton, Bijdr. Booms. Java 4 (1896) 173; Warb., Mon. Myrist. (1897) 418; Koord., Exk. Fl. Java 2 (1912) 257; K. Heyne, Nutt. Pl. Ned. Indië (1927) 647. — Type: *Teijsmann s.n.*, Java.
- Myristica cookii* Warb., Mon. Myrist. (1897) 414, t. 15; Lecomte, Not. Syst. 1, 4 (1909) 98; Fl. Gén. Indo-Chine 5 (1914) 97. — Syntypes: *Phillips s.n.*; *Hb. Pierre 5433*, S Vietnam, Pulau Condor.
- Myristica riedelii* Warb., Mon. Myrist. (1897) 417, t. 15. — Types: *Beccari FI acc. no. 7749* (Riedel), cultivated in Hort. Bogor., orig. Billiton, and *Beccari FI acc. no. 7750*, orig. Singapore.
- Myristica palawanensis* Merr., Philipp. J. Sci., Bot. 13 (1918) 283; Enum. Philipp. Flow. Pl. 2 (1923) 179. — Type: *Merrill 9253*, Philippines, Palawan.

Tree 10–25 m. Twigs 3–5(–10) mm diameter, hairs rust-coloured, 0.2–0.5 mm; older twigs glabrescent, smooth or rarely flaking, usually without lenticels. *Leaves* chartaceous, elliptic-oblong to oblong-lanceolate, (12–)15–35 by 3–12 cm, base rounded or attenuate, apex acute-acuminate; upper surface olivaceous(–brown), lower surface grey-brown or cinnamon, pubescent or late glabrescent, hairs dense, 0.2–0.3 mm, with scattered emergents 0.5(–2) mm; not papillose; dots absent; midrib  $\pm$  raised above, lateral nerves 15–19(–25) per side, at about 45° to the midrib, flat or slightly sunken, lines of interarching and venation distinct or faint; petiole 15–30 by 2–4 mm; leaf bud 10–20 by 2.5–4 mm, hairs 0.2–1 mm. *Inflorescences* paniculate, between the leaves or sometimes axillary to reduced leaves in short-shoots, with dense hairs 0.2–0.6 mm; bracts caducous, 2 mm long; in male: 2–8 cm long, once or twice branched, peduncle (0–)4–20 mm, flowers in clusters of (1–)2–10, buds of variable sizes; female inflorescences similar but shorter and fewer flowered, simple or little-branched, 0.5–2 by 0.5–1 cm, peduncle to 7 mm; flowers with hairs 0.3–0.6 mm. *Male flowers*: pedicel 3–6 mm, bracteole (2–)2.5–3 mm, caducous; buds ovoid or ellipsoid, (4–)5–7 by 3.5–5 mm, cleft 1/4–1/3, lobes 0.3–0.5 mm thick. Androecium 3–5 mm; androphore 1.5–2 mm long, the basal (1/2–)2/3–3/4 with pale hairs 0.4–0.7 mm; synandrium 2–3 by 0.8–1.8 mm, thecae 16–24, sterile apex up to 0.2 mm, glabrous or rarely with few hairs 0.2–0.3 mm, or apex of synandrium  $\pm$  truncate, rounded, or to 0.3 mm hollowed. *Female flowers*: pedicel 1–2(–4) mm long; buds broadly ovoid, 4–6 by 3.5–6 mm; ovary broadly ovoid, 2.5–3.5 mm diameter, hairs dense, 0.5 mm long, stigma lobes oblique, faintly lobulate or not. *Fruits* up to 3 per infructescence (sometimes seemingly more-fruited when infructescences are  $\pm$  clustered), short ellipsoid or subglobose, 2.5–4(–4.5) by (2–)2.5–3 cm, hairs dense, velvety or shaggy, 0.5–1(–2) mm; pericarp 3–5(–8) mm thick (not woody); seeds 2–2.5(–3) cm long; fruiting pedicel 1.5–5 mm long.

*Field-notes* — Sometimes buttresses 20(–200) cm high, 30(–150) cm out. Outer bark chocolate, 2–4 mm thick, smooth or  $\pm$  rough, rarely fissured, usually cracked or scaly, with irregular to  $\pm$  rectangular flakes, 2 by 4 cm, adherent; cambium white to yellow or red; inner bark 5–10 mm thick, soft, fibrous, pinkish to beefy red; exudate watery, (pale) red; sapwood usually pale, whitish to yellow, streaked with red; heartwood reddish. Leaves below cinnamon, aureous, or rusty, which can be seen from a distance. Flowers outside yellow-brown or rusty tomentose, perianth inside smooth, yellowish or sometimes partly purple-red. Fruits to 5 cm long; seeds to 3 cm.

*Distribution* — Burma, possibly Thailand (no specimens known), Indochina (P. Condor); *Malesia*: Peninsular Malaysia (East Coast, according to Sinclair never found on the West Coast), through Malesia east to Bali and the Philippines; not yet in Sulawesi.

**Habitat & Ecology** — Mainly but not always coastal; in primary conditions on coastal rock, forest behind beach, e.g. in *Oncosperma filamentosa* forest near the sea (Nunukan), or behind the *Casuarina equisetifolia* belt (especially in Brunei); also more inland at riversides, hill slopes; mainly on sandy or rocky soils, white or granitic sand, etc., but sometimes red earth, or black soil over sandstone, limestone, ultrabasic, rarely in degraded forest or belukar, once from (disturbed) peat swamp forest in Brunei; 0–200 m altitude; fl. & fr. throughout the year.

**Notes** — 1. Specimens from black soil over sandstone in Sabah have conspicuously small flowers. In several specimens from Brunei and Sabah the inflorescences are small (reduced) and grouped in short-shoots, axillary to fallen leaves, giving the impression of one compound inflorescence, mostly with an apical vegetative bud. *PNH 117198* (Samar) deviates in having rather thick blackish twigs with distinct contrasting lenticels; its fruits have a thick pericarp, 6–8 mm.

2. *Myristica guatteriifolia* is mainly a coastal species, well characterized by essentially paniculate inflorescences, and leaves pubescent below (hairs of mixed sizes). It is related to *M. agusanensis* from the Philippines, which is a smaller and more delicate version of the present species. Small-leaved inland specimens from Borneo may resemble *M. beccarii*.

## 60. *Myristica hollrungii* Warb.

*Myristica hollrungii* Warb., Mon. Myrist. (1897) 490, t. 19; K. Schum. & Lauterb., Fl. Schutzgeb. Südsee (1900) 328, p.p. (excl. syn. *Myristica heterophylla*, p.p.); A.C. Sm., J. Arnold Arbor. 22 (1941) 67; J. Sinclair, Gard. Bull. Sing. 23 (1968) 405, f. 68, 69; Foreman, Handb. Fl. Papua New Guinea 1 (1978) 199; W.J. de Wilde, Blumea 40 (1995) 289; 43 (1998) 180. — Type: *Hollrung 701*, Papua New Guinea.

*Myristica heterophylla* K. Schum. in K. Schum. & Hollrung, Fl. Kaiser Wilhelmsland (1889) 45, p.p. — Type: *Hollrung 648* (B, lost; iso BO, n.v.) (see Sinclair, l.c.: 410), Papua New Guinea.

*Myristica albertisii* Warb., Mon. Myrist. (1897) 532, t. 19. — Type: *d'Albertis 9* (B, lost; iso FI, MEL, n.v.), Papua New Guinea.

*Myristica euryocarpa* Warb. in K. Schum. & Lauterb., Fl. Schutzgeb. Südsee (1900) 327. — Type: *Rodatz & Klink (Tappenbeck) 33* (B, lost; BRSL, n.v.), Papua New Guinea.

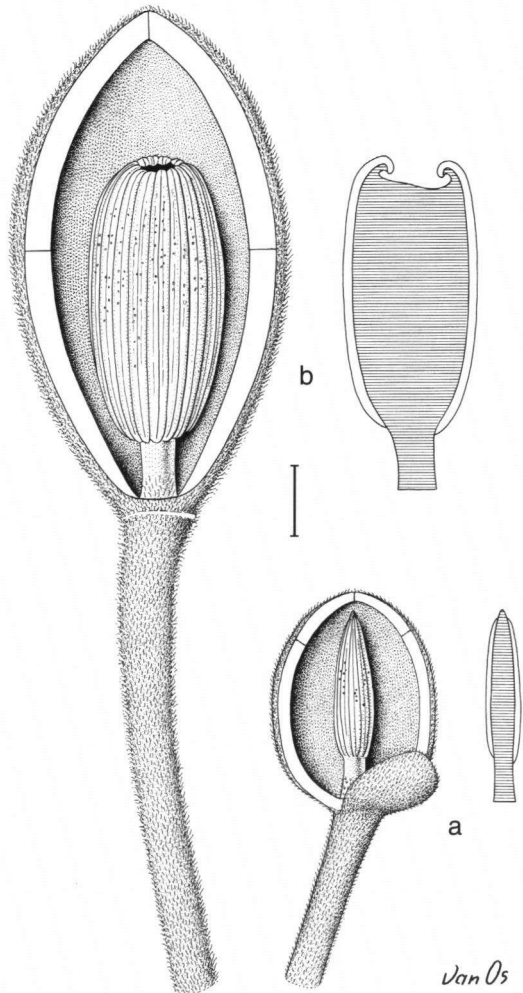
Tree 6–36 m. Twigs 2–5(–10) mm diameter, usually subangular with two raised lines joining the petioles, but not winged, frequently ± hollow, but without ant-swellings; (early) glabrescent, hairs palish, less than 0.1 mm; older twigs with small, ± concolorous lenticels. Leaves chartaceous, elliptic-oblong or oblong-lanceolate, 15–35(–40) by 4–12 (–15) cm, base cuneate, rounded, or shallowly cordate, apex acute-acuminate; upper surface olivaceous, lower surface olivaceous or pale brownish, early or late glabrescent, hairs weak, dense or scattered, stellate, 0.1 mm or less; not or ± papillose; dots absent; midrib flat above, lateral nerves 15–25 per side, flat, at 45–60° to the midrib, lines of interarching and venation indistinct; petiole 15–25 by 2–5 mm; leaf bud 10–15 by 2–4 mm, hairs 0.1(–0.2) mm. Inflorescences between the lower leaves or below, as in *Knema*; in male: a simple or up to 4-branched, to 1 cm (rarely to 3 cm) long, scar-covered, glabrescent brachyblast, rarely to 5 mm pedunculate, with subumbel(s) of 5–10 flowers, buds of various sizes; in female similar, short, (sub)sessile, with a 5–10-flowered cluster; flowers with mealy hairs 0.1(–0.2) mm. Male flowers: pedicel 4–6 by 1 mm, bracteole rounded, 2(–3) mm, (sub)persistent; buds thinly leathery, (subglobose), broadly ellip-

soid, or ovoid, 4–6.5 by 4–5 mm, cleft 1/4(–1/3), lobes 1.5–2 mm long, (0.3–)0.5 mm thick. Androecium 3–4(–5) mm; androphore (0.5–)1(–1.5) by 0.5–0.6 mm, hairs minute, in lower 1/4 or lower; synandrium ovoid-oblong, 2–4 by 1 mm, thecae c. 16, the sterile apex  $\pm$  acute, 0.1–0.3 mm. *Female flowers*: pedicel 2–3(–4) by 2 mm, bracteole 2 mm; buds ovoid, 5–6 by 4–5 mm, lobes 1 mm long, ovary ovoid-oblong, 4 by 3 mm, minutely pale brown pubescent, stigma 2(–4)-lobed, 1 mm. *Fruits* subsessile, 1–4(–5) per infructescence, (subglobose-)ellipsoid, 2.5–4.5(–5, see note 2) by 2–3 cm, the apex often shortly pointed, hairs thinly set, mealy, brown, 0.1(–0.3) mm,  $\pm$  glabrescent, with some indumentum remaining near the base and in depressions; pericarp 3–5(–7) mm thick; seeds (broadly) ellipsoid, 2–3 cm; fruiting pedicel 3–7(–10) mm, smooth or with few lenticels, bracteole scar subapical. — **Fig. 59a, 75a.**

**Field-notes** — Usually a tall tree, locally common; branches  $\pm$  whorled, often  $\pm$  horizontal; crown narrow; buttresses, prop-roots, or usually stilt-roots present. Bark smooth, or mostly finely longitudinally fissured or flaky (scaly), or faintly peeling, dark (grey-)brown or blackish, or bark with raised horizontal lenticels; inner bark reddish; exudate  $\pm$  colourless turning reddish; blaze dark chestnut; sapwood straw, dark brown on exposure; heartwood absent or but little differentiated in colour. Leaves grey-green or glaucous below. Flowers sometimes on the older wood; perianth pale yellow or cream, the tips flushed pink, inside yellowish; anthers straw. Fruits yellow(-brown) or pale brown, aril thick, fatty.

**Distribution** — *Malesia*: throughout New Guinea, including the Bismarck Archipelago (New Ireland, W New Britain).

**Habitat & Ecology** — Lowland marshy forest; less frequently in dry-land forest or lower montane and ridge forest; alluvial forest (with *Barringtonia*), periodically inun-



**Fig. 75.** a. *Myristica hollrungii* Warb. Opened male bud and schematic longitudinal section of androecium [*Demoulin 5958*]. — b. *M. hooglandii* J. Sinclair. Opened male bud (note scar of bracteole) and schematic longitudinal section of androecium [*Brass 25471*]. — Scale bar = 2 mm.

dated or marshy forest, close to mangrove; occasionally in sago-swamp woodland, or forest on (deep) volcanic soil; also from regrowth forest. According to *Brass 8008* characteristic of tall forest of low flood plains of the Fly River; in some places overhanging the rivers; 0–500(–1000) m altitude; fl. & fr. throughout the year.

Notes — 1. A homogeneous species, distinct in the (seemingly) glabrous lower leaf surface, the often lined twigs, the seemingly (very short-pubescent) glabrous flowers, and sessile infructescences with short-stalked glabrescent fruit.

2. Larger fruits, 4.5–5 cm long, are found among smaller-fruited specimens on Bagabag and Umboi Is. (*LAE 66001*, *NGF 43453*); the latter specimen is somewhat approaching *M. bialata* from the Bismarck Archipelago.

3. *Myristica rumphii*, based on a sterile collection originally described in *Lauraceae*, does not belong to *M. hollrungii* as suggested by Kostermans; *M. rumphii* (see there) is an older name of *M. spanogheana*.

4. Sometimes the lower leaves of a flush are retarded in growth and are cataphyll-like, as is normally found in *M. subcordata* var. *morindiifolia*.

5. The lined twigs are often narrowly hollow inside, and sometimes a small hole is present, obviously related to inhabitation by ants; however, conspicuous ant-swellings in the twigs, as characteristic for, e.g., *M. subalulata*, are never present.

### 61. *Myristica hooglandii* J. Sinclair

*Myristica hooglandii* J. Sinclair, Gard. Bull. Sing. 23 (1968) 156, f. 7; Foreman, Contr. Herb. Austral. no. 9 (1974) 39; Handb. Fl. Papua New Guinea 1 (1978) 200, f. 89 (excl. syn. *M. carrii*); W.J. de Wilde, Blumea 39 (1994) 347, f. 1e, e'; 40 (1995) 289. — Type: *Hoogland 4206*, Papua New Guinea.

Tree 8–27 m tall. *Twigs* (2–)3–5 mm diameter, early glabrescent, hairs appressed, glossy, 0.1 mm or less; older twigs blackish, cracking, indistinctly lenticellate. *Leaves* (thickly) membranous, (elliptic-)oblong, (12–)15–35 by 3–10 cm, base attenuate or narrowly rounded, apex acute(-acuminate); upper surface brown, lower surface (brownish) grey, early glabrescent, hairs 0.1 mm or less; not papillose; dots absent; midrib (flat or) raised above, lateral nerves (10–)13–17 per side, at 45–70° to the midrib, ± flat, inconspicuous above, more or less raised below, often with intersecondary nerves, lines of interarching and venation indistinct on both surfaces; petiole 15–20 by 2–4 mm; leaf bud 10–15 by 2–3 mm, hairs 0.5–0.8 mm long. *Inflorescences* between the leaves or (as in the type) below the leaves, arranged in 1–1.5 cm long brachyblasts ending in a small sterile leaf bud, pedunculate, glabrescent, indumentum minute; bracts caducous; in male: peduncle of partial inflorescence 10–30 by 2–3 mm, with a subumbel of 4–7 flowers, buds of almost equal sizes; in female: peduncle 5–10(–15) mm, one- or few-flowered; flowers coriaceous, glabrescent, hairs appressed, silky, 0.1 mm. *Male flowers*: pedicel 10–16 by 1.5–2 mm, bracteole (?broadly rounded), caducous, scar conspicuous; buds (broadly) ellipsoid, 9–16 by 6–9 mm, hardly collapsing on drying, cleft c. 1/2, lobes 5–7 mm long, 1 mm thick. Androecium (broadly) obconical or cylindrical, 5–10 mm long; androphore 1–2 by 0.8–1 mm, (sub)glabrous (hairs 0.1–0.2 mm); synandrium 4–8 by 3–4 mm, apex rounded or ± truncate, sometimes ± triangular, thecae 30–40, sterile apex absent, or apex sometimes shallowly hollowed. *Female flowers*: pedicel 5 mm long; buds ovoid, 8 by 6 mm; ovary ovoid, 6 by 4.5–5 mm, hairs (0.5–)1(–2) mm.

Infructescences: peduncle smooth or flaky. *Fruits* generally single, (broadly) ellipsoid or oblong, 6–8 by 4–5 cm, apex (sub)obtuse, (late) glabrescent, hairs mealy, rust-coloured, 0.5–1(–2) mm long; pericarp 5(–10) mm thick; seeds ellipsoid or oblong, 3.5 cm; fruiting pedicel 5–8 by 3–5 mm, striate, glabrescent. — **Fig. 75b.**

Field-notes — Small or medium-sized straight-boled tree. Bark grey-brown or blackish, longitudinally fissured and flaky; inner bark red-brown, or red on exposure; exudate red or colourless, sticky or resinous; blaze red; wood cream or straw, tinged reddish brown, of medium hardness. Leaves pale, dull, whitish or glaucous below, shiny dark green above. Flowers (cream-)yellow, fragrant. Fruits ovoid or almond-shaped, lemon-green, or (orange-)yellow, with brown indumentum; seeds grey.

Distribution — *Malesia*: a local endemic species of Papua New Guinea, known from Morobe, Northern, Central and Milne Bay Provinces (also Normanby Is.).

Habitat & Ecology — Lowland rain forest, often fairly wet or swampy, also on lower slopes of hills on skeletal soils, coastal forest; found associated with *Mastixiodendron*, *Maniltoa*, and *Tristaniopsis*, or in *Eucalyptopsis*-dominated forest (at c. 450 m); altitude 0–450 m; fl. Apr.–July; fr. May–Dec.

Note — *LAE 62150 (Katik)* from Central Province has exceedingly small leaves, 12–15 cm long only.

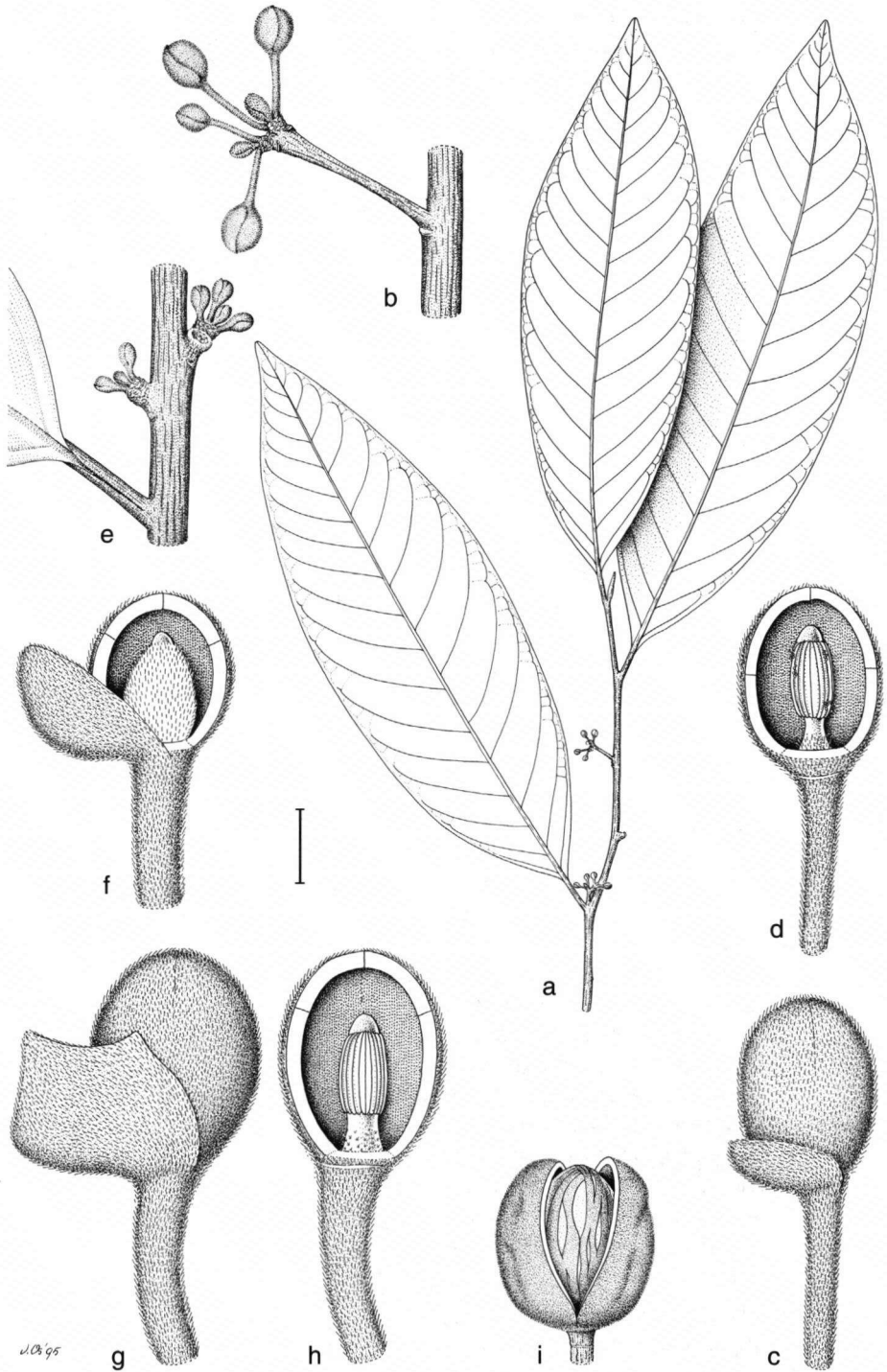
## 62. *Myristica impressa* Warb.

*Myristica impressa* Warb., Mon. Myrist. (1897) 537, t. 15; J. Sinclair, Gard. Bull. Sing. 23 (1968) 235, 481 (as doubtful species; see note 1); W.J. de Wilde, Blumea 42 (1997) 168. — Type: *Warburg 16716* (B, lost), Sulawesi, southwestern arm.

*Myristica koordersii* auct. non Warb.: J. Sinclair, Gard. Bull. Sing. 23 (1968) 262, f. 28, p.p., excl. *Kjellberg 2962* (= *Myristica kjellbergii*), excl. specimens from Moluccas and NE arm of Sulawesi (= *Myristica koordersii*).

Tree 10–25 m. *Twigs* 2–4(–5) mm diameter, early glabrescent, hairs 0.1 mm or less; older twigs with or without few inconspicuous lenticels. *Leaves* thinly chartaceous or subcoriaceous, elliptic-oblong or oblong(-lanceolate), 14–27 by 4–9 cm, base cuneate (or nearly rounded), apex acute(-acuminate); upper surface olivaceous or dark brown, lower surface conspicuously grey-brown or whitish, (late) glabrescent, with scale-like widely spaced hairs 0.1 mm or less, and with scattered contrasting points (possibly scars of fallen stouter hairs) (lens!); papillation not apparent; dots absent; midrib above little raised, lateral nerves (13–)15–20 per side, at 40–50° to the midrib, ± sunken (and faint) above, nerves below purple or brown, sometimes contrasting in colour, lines of inter-arching and venation indistinct; petiole 12–20 by 2.5–3 mm; leaf bud 10–15 by 2–3 mm, with (appressed) hairs 0.1(–0.2) mm. *Inflorescences* between the leaves or below, of the *Knema*-type, a (sub)sessile, simple or bifurcate scar-covered brachyblast to 7 mm, pubescent or glabrescent; in male: with a cluster of 4–8 flowers, buds of variable sizes; in

Fig. 76. *Myristica impressinervia* J. Sinclair. a. Leafy twig with male inflorescences; b. male inflorescence; c. male bud; d. ditto, opened, showing androecium. — *M. impressa* Warb. e. Twig with female inflorescences; f. female bud, opened, showing pistil; g. male bud; h. ditto, opened, showing androecium; i. fruit [a–d: *Kjellberg 2427*; e, f: *bb Cel. 1-403*; g, h: *Elbert 3025*; i: *Meijer 10061*]. — Scale bar for a, i = 2 cm; for b = 3.3 mm; for c, d = 1.5 mm; for e = 6.5 mm; for f–h = 2 mm.



10995



female similar, fewer-flowered; flowers with hairs 0.2–0.4 mm. *Male flowers* (submature): pedicel 4–5 mm long, bracteole ovate or  $\pm$  triangular, 3.5 mm, late caducous; buds ellipsoid, (4–)4.5–5 by 3–3.5 mm, cleft c. 1/3, lobes 0.3 mm thick. Androecium (3–)3.5 mm; androphore 1 by 0.8 mm, hairs less than 0.1 mm; synandrium 2 by 1 mm, thecae 16–20, sterile apex hemiglobose, 0.5 mm, glabrous. *Female flowers*: pedicel 4(–5) mm, bracteole 3 mm, caducous; buds (immature) ovoid, 3.5(–5) by 3(–4) mm, cleft c. 1/3; ovary ovoid, 2.5 by 2 mm, hairs less than 0.1 mm. *Fruits* solitary or 2 per infructescence, broadly ellipsoid, 3–4.2 by 2–3 cm, hairs dense, mealy, 0.1 mm; pericarp 2–4(–5) mm thick; seeds subglobose or ellipsoid, 2–3 cm; fruiting pedicel slender or  $\pm$  stout, 2–4(–7) mm long. — **Fig. 76e–i.**

Field-notes — Sap deep red. Fruit with golden or yellow indumentum; seed reddish brown.

Distribution — *Malesia*: Sulawesi (Minahasa?, N Central, Central, SW, SE).

Habitat & Ecology — Hill or montane forest, moderately dry forest; also on ultrabasic; 200–1500 m altitude; fl. July, Sept.; fr. throughout the year.

Notes — 1. *Myristica impressa* (type lost) was regarded by Sinclair (l.c.) as a doubtful species, possibly based on an atypical specimen of *M. koordersii*, which was accepted by him as a very variable entity. However, *M. koordersii* can best be regarded as a related local species of NE Sulawesi (Minahasa). The type of *M. impressa* was collected in the southwestern arm; preferably a neotype should be chosen from that area. *Myristica koordersii* differs in its more slender twigs, smaller leaves, longer and more coarsely hairy fruiting pedicel (possibly the indumentum of the flowers is longer as well), and fruits with a thicker pericarp. Other species with which *M. impressa* may be confused are *M. agusanensis* (Philippines; resembling in the leaves but differing in paniculate inflorescences and more conspicuously hairy fruits), *M. kjellbergii* (Sulawesi; see De Wilde, l.c.: 170), and *M. pilosigemma* (Philippines; with conspicuous long-haired indumentum on terminal leaf bud and fruits).

2. *Milliken 989* (male) and *1091* (sterile) (N Sulawesi, 1500 m) probably belong to *M. impressa*, but deviate in the 2 mm long pedunculate male inflorescence, the slightly larger, 5 mm long male perianth, the shorter pedicel, 1.5 mm only, and the shorter bracteole, 2 mm; the androecium is  $\pm$  club-shaped, the androphore fine-pubescent, the synandrium about as long as the androphore, both c. 1.5 mm long, anthers (?) 10, sterile apex absent. The collection was annotated as a tall tree, 24 cm in diameter, with conspicuous stilt-roots. More fertile material of *M. impressa* is needed to understand its variability. *Kjellberg 2990*, a fruiting collection from C(–SW) Sulawesi, may represent an undescribed species. It resembles *M. impressa*, but differs in a more tiny habit, with smaller leaves which are not whitish below.

### 63. *Myristica impressinervia* J. Sinclair

*Myristica impressinervia* J. Sinclair, Gard. Bull. Sing. 23 (1968) 232, f. 19; W.J. de Wilde, Blumea 42 (1997) 168. — Type: *Kjellberg 2427*, Sulawesi.

Tree 6–15 m. *Twigs* 0.7–1.5(–3) mm diameter, early glabrescent, hairs 0.2–0.3(–0.5) mm; older twigs not flaking, without or with few indistinct lenticels. *Leaves* membranous or thinly chartaceous, 9–19 by 4–6.5 cm, elliptic(-oblong), base (short) cuneate, apex acute(-acuminate); upper surface dark brown, below greyish, seemingly glabrous,

but hairs grey-brown, scale-like, scattered, 0.1 mm or less; not papillose; dots absent; midrib above sunken, lateral nerves 6–13 per side, at 45(–60)° to the midrib, slender, and sunken above, nerves below brown, contrasting in colour, lines of interarching and venation indistinct; petiole 5–12 by 1(–1.5) mm; leaf bud 6–9 by 1–1.5(–2) mm, hairs rough, 0.3(–0.5) mm. *Inflorescences* between the leaves or below, approaching the *Knema*-type; in male: peduncle slender, (3–)5–10 mm, pubescent, ending in 1–3 slender scar-bearing brachyblasts to 5 mm long, each with a loose subumbel of 2–4 flowers, buds of various sizes; female inflorescence not known; flowers with rough hairs 0.2–0.3 mm. *Male flowers*: pedicel slender, 4–5 mm long, bracteole broadly reniform, 2 mm long, persistent; buds ovoid(–oblong), 3.5–4 by 2.5 mm, cleft nearly 1/2, lobes 0.2(–0.3) mm thick. Androecium 2.5 mm long; androphore well-demarcated from synandrium, 0.5–0.6 by 0.3–0.4 mm, with hairs 0.2 mm in the lower half; synandrium ovoid-ellipsoid, 2 by 1–1.2 mm, thecae c. 16, 1.5 mm long, the sterile apex comparatively large, blunt, 0.5 mm. *Female flowers* and *fruits* not seen. — **Fig. 76a–d.**

Field-notes — Richly branched small tree, stem dbh up to 25 cm. Leaf undersurface silvery white. Flowers outside brown or yellow, inside yellowish white.

Distribution — *Malesia*: S Central and SE Sulawesi.

Habitat & Ecology — Primary forest, forest on limestone: 0–100 m altitude; fl. Oct.

Note — *Myristica impressinervia* is characterized by its delicate slender habit, slender pedunculate (male) inflorescences, and rather small thin leaves with a whitish lower surface and nerves sunken above.

#### 64. *Myristica inaequalis* W.J. de Wilde

*Myristica inaequalis* W.J. de Wilde, *Blumea* 43 (1998) 252, f. 2. — Type: *R. J. Johns* 7699, Irian Jaya, Bird's Head.

Tree to 20 m. *Twigs* 2.5–3 mm diameter, late glabrescent, hairs rusty, 0.5(–1) mm; older twigs blackish brown, finely striate, neither cracking nor flaking, with scattered inconspicuous lenticels. *Leaves* chartaceous or coriaceous, elliptic-oblong, (13–)15–19 by 3–5.5 cm, base cuneate, apex acute-acuminate; upper surface dark brown, lower surface light brown, hairs (sub)persistent, widely spaced, mixed: 0.1 mm and 1 mm long; papillose surface clearly visible (lens!); dots absent; midrib raised above, lateral nerves 16–20 per side, at 70–80° to the midrib, flat and inconspicuous above, lines of interarching thin though distinct below, venation indistinct; petiole 8–15 by 2–2.5 mm, late glabrescent; leaf bud 15 by 2–2.5 mm, hairs 0.5–1 mm. *Male inflorescences* unknown; female inflorescences (known from a single specimen) between the leaves, almost of the *Knema*-type, a scar-covered brachyblast 3 mm diameter, 1- or 2-flowered, peduncle subterete, 1–4 by 2 mm, hairs 0.5(–1) mm; bracts minute, caducous; flowers with bright brown hairs, 0.5–1 mm. *Male flowers* unknown. *Female flowers*: pedicel 10 by (1.5–)2 mm, bracteole about median, caducous, scar inconspicuous; buds ovoid-oblong, 12–13 by 5–6 mm, much narrowed in the upper half, cleft c. 1/5, lobes 2.5–3 mm long, 0.5 mm thick, at anthesis curved outwards; ovary c. 7 mm long, the hairs dense, golden brown, 1 mm. *Fruits* not seen, but see field-notes. — **Fig. 77.**

Field-notes — Young stems densely covered with ferruginous hairs. Leaves borne horizontally to the stem, to 18 by 3.5 cm, petiole to 1.5 cm. Fruits (immature) to 7 by 5 cm, ferruginous.



Fig. 77. *Myristica inaequalis* W.J. de Wilde. Habit of leafy twig with one-flowered female inflorescence [R.J. Johns 7699]. — Scale bar = 2 cm.

Distribution — *Malesia*: Papua Barat (NE Bird's Head, Arfak Mts, track from Wamare to Mokwam); known only from the type.

Habitat & Ecology — Ridge forest; 800–850 m altitude; fl. & fr. Mar.

Note — *Myristica inaequalis* is provisionally reckoned to the group with larger leaves (blade length 15 cm or more) and subsessile or short-stalked inflorescences (as in *Knema*). It keys out next to *M. fusca* (to which it is closely related). The caducous bracteole, situated about halfway on the pedicel, is reminiscent of that of *M. mediobibex* from about the same area.

**65. *Myristica incredibilis* W.J. de Wilde**

*Myristica incredibilis* W.J. de Wilde, *Blumea* 40 (1995) 289. — Type: LAE 70971 (*Katik*) (male flowering element), Papua New Guinea, Rossel I.

Tree 8 m. Twigs 3–4 mm diameter, late glabrescent, hairs conspicuous, brown, 0.5 mm long; older twigs and lenticels not seen. *Leaves* chartaceous, (ovate-)elliptic, 12–17 by 6–8.5 cm, base (shallowly) cordate, the blade  $\pm$  narrowed towards the blunt apex; upper and lower surface of recently full grown leaf with dense brown hairs of mixed sizes, 0.1–0.6 mm, upper surface glabrescent, olivaceous, lower surface with persistent conspicuous indumentum, partly late glabrescent; not papillose; dots absent; midrib raised above, lateral nerves 9–13 per side, at 45–70° to the midrib, flat or  $\pm$  sunken above, lines of interarching and venation indistinct; petiole late glabrescent, 12–15 by 3 mm; leaf bud 12 by 3 mm, hairs 0.5(–1) mm. *Inflorescences* between the leaves, densely pubescent, as in *Knema* but pedunculate; in male: peduncle 5–10 by 2–3 mm, ending in 2 (or 3) scar-covered brachyblasts to 5 mm long, flowers in loose clusters of 5–10, buds not much variable in size; female inflorescences not seen; flowers with hairs 0.5 mm. *Male flowers*: pedicel 2–2.5 by 1–1.5 mm, bracteole rounded, 1 mm, caducous; buds ellipsoid-oblong, 8 by 4 mm, cleft c. 1/3, lobes 2.5–3 mm long, 0.3 mm thick. Androecium 6.5–7 mm; androphore 3 by 1 mm, at base with dense rufous hairs 0.5 mm long; synandrium 3.5(–4) by (1–)1.5 mm, thecae 14–16, sterile apex consisting of minute excrescences 0.1 mm corresponding with the anthers. *Female flowers* not seen. *Fruits* (doubtful, see note 1) ovoid, 2 by 1.5 cm, apex rounded, base (broadly) rounded, hairs dense, 1 mm; pericarp 1(–1.5) mm thick; seeds ellipsoid, 1.5 cm; fruiting pedicel not known.

Field-notes — Medium-sized tree; bole 5 m, dbh 14 cm. Bark grey-brown; underbark brown; inner bark red; sap red; wood creamy straw. Leaves dark glossy green above, light green and brown hairy below. Flowers creamy yellow. Fruits orange.

Distribution — *Malesia*: E Papua New Guinea (Louisiade Archipelago: Rossel I.); known only from the type.

Habitat & Ecology — Hill forest; c. 10 m altitude; fl. & fr. Mar.

Notes — 1. The species is described from a single male flowering collection. According to the herbarium label the fruit is orange. The specimen in L has a separate single mature fruit which, by necessity, was collected from another tree and hence may belong to a different species. It cannot be matched with fruits of a known species; it approaches that of *M. chrysophylla*, but is smaller and has shorter hairs.

2. *Myristica incredibilis* is, particularly in habit, reminiscent of *M. schleinitzii*, mainly on account of the resembling leaves with cordate base and rounded apex. It has the general features of male inflorescences and flowers in common with *M. inopinata*, but the latter differs markedly in the distinct, acute, sterile apex of the synandrium. *Myristica schleinitzii* differs in its (nearly) glabrous papillose leaves, smaller flowers, and the glabrous or finely stellate-hairy androphore. Possibly *M. incredibilis* is of a hybrid origin, both species occurring in the same region.

**66. *Myristica iners* Blume**

*Myristica iners* Blume, *Bijdr.* (1826) 575; *Rumphia* 1 (1837) 184, t. 58; J. Sinclair, *Gard. Bull. Sing.* 16 (1958) 363, f. 30; 23 (1968) 177; Backer & Bakh. f., *Fl. Java* 1 (1964) 139; W.J. de Wilde, *Blumea* 42 (1997) 168; *Tree Fl. Sabah & Sarawak* 3 (2000) 464. — Type: *Blume s. n.*, W Java.

- Myristica sublanceolata* Miq., Fl. Ind. Bat. 1, 2 (1858) 58. — Type: *Horsfield s.n.* (K sheet 683), C Java.
- Myristica vordermanii* Warb., Mon. Myrist. (1897) 525, t. 14, 'vordermanni'. — Type: *Vorderman s.n.*, Pulau Mendanau, near Belitung.
- Myristica heritierifolia* Pierre ex Lecomte, Not. Syst. 1, 4 (1909) 99; Fl. Gén. Indo-Chine 5 (1914) 98. — Type: *Pierre 5435*, Indochina.
- Myristica cumingii* Warb. var. *floribunda* Airy Shaw, Kew Bull. 1939, no. 10 (1940) 539. — Type: *Richards 1615*, Sarawak.

Tree 5–40 m. Twigs 1.5–3 mm diameter, early glabrescent, hairs greyish, less than 0.1 mm (in NE Borneo to 0.5 mm); older twigs (blackish) brown, ± flaking, sporadically with a few lenticels. *Leaves* membranous or chartaceous, rarely (at c. 1000 m) subcoriaceous, elliptic-oblong to oblong-lanceolate, 7–24 by 1.5–8(–10) cm, base rounded or attenuate, apex acute-acuminate; upper surface olivaceous(-brown), lower surface early glabrescent, hairs scale-like, less than 0.1 mm; not papillose; dots absent; midrib slightly raised above, lateral nerves 11–16 per side, at (30–)45(–80)° to the midrib, above flat to sunken, below rather flat or raised, lines of interarching and venation indistinct; petiole 11–25 by (0.5–)1–2 mm; leaf bud 7–12 by 1–2 mm, hairs 0.2(–0.5) mm. *Inflorescences* between the leaves or below, paniculate, pedunculate, glabrescent; in male: 2–8 cm long, peduncle slender or stout, 2–30(–40, see note 1) mm long, branches to 20 mm, central axis absent or up to 40 mm, with 1 or 2 subumbels of 5–15 flowers, buds of various sizes; bracts 3–4 mm, caducous; female inflorescences: reduced, sometimes ± sessile, 1–6-flowered; flowers glabrescent, hairs ± woolly, 0.1–0.3 mm. *Male flowers*: pedicel slender, 4–12 mm, bracteole 1.5–3 mm, subsistent or caducous; buds ovoid (-ellipsoid), 4–6(–7) by 2–4(–6) mm, cleft (1/4–)1/3–1/2, lobes membranous or pergamentaceous, 0.2–0.3 mm thick. Androecium 3(–6) mm; androphore cylindrical or somewhat swollen, about as broad as the synandrium, 1.2–2(–3) mm long, with hairs 0.1–0.2 mm in the lower half; synandrium ellipsoid-lanceolate, 2–3 by 0.6–1 mm, thecae 10–16, ± contiguous, sterile apex 0.1–0.3 mm, entire or shallowly lobed, glabrous. *Female flowers*: pedicel 1–2 or 3–7 mm long (see note 1); buds ovoid, 4–4.5 by 3.5–4 mm (in galled flowers larger); ovary long-ovoid, 3 by (1–)1.5 mm, hairs dense 0.1 mm or less. *Fruits* usually single, ellipsoid or ovoid-ellipsoid, 3.5–6(–8) by 2.5–3.5(–4.5) cm, glabrescent, hairs dense, mealy, grey-brown, 0.2 mm; pericarp (4–)5–10 mm thick; seeds ellipsoid, 2–4(–5) by 1–2(–2.3) cm; fruiting pedicel either short and thick, 1–3 mm long (Java), or slender, 5–15 mm long (Borneo) (see note 1). — **Fig. 60d.**

**Field-notes** — Tree with stilt-roots or buttresses, or without stilt-roots. Bark rough, (deeply) fissured (strips 10 cm long, wavy, 3 mm thick) and flaky, dark brown, grey, and blackish; outer bark 3–5 mm thick; inner bark 10 mm thick, soft, laminated, pinkish or brown; slash wood white or pale, sometimes red streaked; exudate clear, reddish, sometimes copious. Flowers yellow, sometimes recorded as scented. Fruits subglobose or ellipsoid, 4–8 cm long, green- or pale yellow, ± glossy, early glabrescent, hairs minute, brown; aril orange to red; seeds (glossy) brown or black.

**Distribution** — Cambodia, Thailand; *Malesia*: Sumatra, Peninsular Malaysia, Java, Borneo, possibly Philippines (see note 4).

**Habitat & Ecology** — Forest on flats, slopes and ridges; evergreen forest; peat swamp forest (Thailand); on sandstone and sandy-loam soils or tuff soil; 0–1200 (in Aceh to 1800) m altitude; fl. & fr. throughout the year.

Notes — 1. *Myristica iners* is variable especially in the shape and texture of leaves, the flower size, and the fruits. Leaves may be thinly chartaceous or subcoriaceous, especially in Java, with relatively distinct venation on the upper surface. Also in Java the inflorescences are generally compact and with a short peduncle, occasionally sessile. In Borneo slender elongate and delicate (from sandy soils?) as well as stout, much-branched inflorescences exist, e.g. in *Hose 392* (Sarawak), *SAN 19541* (Sabah), or *Kostermans 6789* (E Kalimantan), sometimes with  $\pm$  woolly hairs 0.3–0.5 mm long (e.g. *SAN 21323*). Delicate specimens link up with the much related *M. fallax* from Borneo. Some specimens from Sumatra (Palembang) are distinguishable by exceedingly long peduncles of the male inflorescences, c. 40 mm, and these also link up with the related *M. fallax*.

2. Fruits are variable in size; smallest in Java (c. 4 cm long), largest in Peninsular Malaysia (7–8 cm long). Specimens from Java and the islands west of Sumatra generally have short fruiting pedicels (1–3 mm long), in most specimens from Borneo the fruiting pedicels are long and slender, to 15 mm long.

3. Superficially resembling species are *M. malaccensis*, *M. umbellata*, and *M. wyatt-smithii*; taxonomically related are *M. corticata*, *M. fallax*, and *M. umbellata*.

4. *Wenzel 3537* (K, immature fr.), from the Philippines (Mindanao: Surigao), with a comparatively long and slender fruiting pedicel, and long hairs on the leaf bud, agrees with specimens from NE Borneo, but its locality is remarkable, far from the main distributional area of the species.

## 67. *Myristica ingens* (Foreman) W.J. de Wilde

*Myristica ingens* (Foreman) W.J. de Wilde, *Blumea* 40 (1995) 290. — *Myristica fatua* Houtt. var. *ingens* Foreman, *Contr. Herb. Austral.* no. 9 (1974) 37, f. 1; *Handb. Fl. Papua New Guinea* 1 (1978) 193. — Type: *Brass 31999*, Papua New Guinea.

Tree 10–30 m. *Twigs* 4–8 mm diameter, glabrescent, hairs 0.1(–0.2) mm or less; older twigs not cracking nor flaking; finely lenticellate. *Leaves* chartaceous or coriaceous, (elliptic-)oblong, (22–)25–40 by 5–15 cm, base (short-cuneate or) broadly rounded, apex acute-acuminate; upper surface olivaceous or brown, lower surface cinnamon, hairs interwoven, scale-like, 0.1 mm; not papillose; dots absent; midrib flat above, lateral nerves 20–25(–30) per side, at (60–)70–80° to the midrib, lines of interarching and venation indistinct; petiole 20–35 by 4–6 mm; leaf bud 20–30 by 3–4 mm, hairs 0.1 mm or less. *Inflorescences* between the lower leaves, or below; of the *Knema*-type: a  $\pm$  woody scar-covered simple (not forked) brachyblast to 5 mm long, sessile or to 5 mm pedunculate, glabrescent; bracts 2–3 mm long, caducous; in male: with a cluster of 2–7 flowers, buds of variable sizes; in female: 1–2(–4)-flowered; flowers with flocculose appressed dense hairs 0.1–0.2(–0.3) mm. *Male flowers* (*LAE 51941*): hard leathery, stout, pedicel 10–12 by 2–3 mm, bracteole  $\pm$  boat-shaped, 6–7 mm long, caducous; buds (almost mature)  $\pm$  ellipsoid-obovoid, 8 by 5 mm, cleft c. 1/4, the lobes 1 mm thick. Androecium broad,  $\pm$  fusiform, 6 mm long; androphore 1 by 1 mm, almost glabrous (hairs scattered, pale, less than 0.1 mm); synandrium 5 by 1.5(–2) mm, apex acute, thecae c. 20, sterile apex 0.1 mm or absent. *Female flowers* (*NGF 38940*, slightly immature): pedicel 5 by 4 mm, bracteole broadly ovate, 4 by 5 mm; buds subglobose, 5 mm; ovary not seen. *Fruit* solitary, subglobose or broadly ovoid(–ellipsoid), 7–10 by 6–8 cm, apex rounded or rather

acute, hairs dense, mealy, yellow-brown or rust-coloured; pericarp 10–20 mm thick (with thin woody endocarp 0.1–0.2 mm); seeds broadly ovoid(-subglobose), 3.5–5 cm, arillobes reaching only to 1/5–1/3 of the seed; fruiting pedicel stout, 15–20 by 6–10 mm, tomentose, bracteole scar at c. 1/3 below the apex.

Field-notes — Straight boled tree, sometimes emergent from the canopy; crown small or narrow; branches horizontal; no or but slight buttresses. Bark grey-brown or dark brown, vertically shallowly fissured, or peeling with small flakes; underbark orange-brown, wood pale, rapidly staining on exposure; slash bark exuding copious (pale) red sticky or watery sap. Leaves with brown or rufous indumentum below. Flowers brownish, stamens cream. Fruits 9–11 by 7–8.5 cm, reddish brown or rust-coloured; aril small; seeds glossy dark brown or black.

Distribution — *Malesia*: mountains of Central Papua New Guinea (Western, Southern, and Eastern Highlands Prov.).

Habitat & Ecology — Locally frequent in montane forest; sometimes emergent from the canopy; degraded forest, forest remnants, and advanced regrowth; gullies in *Lithocarpus*–*Castanopsis*-forest; forest flats, near gullies in limestone area; 1200–1800 m altitude; fl. Sept.–Oct.; fr. July–Jan.

Notes — 1. According to Foreman (1978) this is the *Myristica* with the largest fruits in New Guinea. It is distinguishable by the stout habit of all parts, the large leathery flowers, the large fruits with thick pericarp, and the arillobes only covering the basal part of the seed.

2. *Myristica ingens* is the only species in the genus *Myristica* with a reduced aril; in all other species the lacinae of the aril cover the seed over its entire length.

## 68. *Myristica ingrata* W.J. de Wilde

*Myristica ingrata* W.J. de Wilde, *Blumea* 40 (1995) 290, f. 2c; 43 (1998) 175. — Type: *bb 30596*, Irian Jaya, Jayapura.

Tree 5–20 m. Twigs subterete or ± flattened, 4–10 mm diameter, with wings 1–2 mm high, early glabrescent, hairs 0.1 mm, hollow, and usually with ant-swellings with longitudinal slit-like opening; older twigs with scattered lenticels. *Leaves* (sub)chartaceous or subcoriaceous, (ob)ovate-oblong or oblong(-lanceolate), 15–40 by 5–14 cm, base cuneate, rounded, or subcordate, apex acute-acuminate; upper surface olivaceous or brown, lower surface grey(-brown), glabrescent, hairs scale-like, scattered, less than 0.1 mm, or indumentum dense, short (subsp. *velata*); conspicuously irregularly papillose; dots absent; midrib faintly raised above, lateral nerves 20–25 per side, at 50–70° to the midrib, flat or sunken, lines of interarching and venation not prominent; petiole 15 by 3–4 mm; leaf bud 10–15 by 2–3 mm, hairs 0.1 mm. *Inflorescences* of the *Knema*-type, (sub)sessile scar-covered brachyblasts, subglabrous, to 10 mm long, simple or 2-branched; in male: with subumbels of (5–)10–15 flowers, buds unequal in size; in female: 5–8-flowered, sometimes bearing some fruits of a previous season; flowers with hairs 0.1 mm or less. *Male flowers*: pedicel (7–)10–12 by (0.6–)1 mm, bracteole ± 3-topped, 2–3 by 2–3 mm, persistent; buds ovoid-oblong, 6.5–7.5 by 3.5–4 mm, apex blunt and faintly triangular or not, base (broadly) rounded, cleft 1/4–1/3, lobes 1.5–2.5(–3) mm long, 0.2–0.3 mm thick. Androecium 5.5–6.5 mm; androphore (1–)1.5–2 by 0.5–0.8 mm, hairs 0.1 or less ± in the lower half, sometimes only at the base; synandrium 4–5 by 0.8–1

mm, rather acute, thecae 12–14, sterile apex 0.2–0.3 mm. *Female flowers*: pedicel 3–5 mm, bracteole 2 mm, buds  $\pm$  ovoid, 5 by 3.5 mm, lobes 1.5 mm; ovary  $\pm$  ovoid, 3 mm, finely pubescent. *Fruits* solitary or 2–4 per infructescence; (broadly) ovoid(-ellipsoid), 2.5–3.5 by (1.5–)2(–2.5) cm, apex  $\pm$  rounded and short-apiculate, hairs rust-coloured, 0.1(–0.2) mm; pericarp 2 mm thick; seeds ellipsoid, 2 cm; fruiting pedicel  $\pm$  stout, short or long, 3–10 by 3–4 mm, with a few lenticels.

Distribution — *Malesia*: lowland and lower montane forest of Papua Barat and Papua New Guinea; with two subspecies.

#### KEY TO THE SUBSPECIES

- 1a. Leaves thinly chartaceous; lower surface (sub)glabrescent, hairs sparse, greyish, scale-like, less than 0.1 mm. Fruits broadly ovoid(ellipsoid), 2.5 cm long . . . . .  
 . . . . . a. subsp. **ingrata**
- b. Leaves subcoriaceous; lower surface with dense pale brown scale-like hairs, 0.1 mm. Fruits  $\pm$  (long-)ellipsoid, 3 cm long . . . . . b. subsp. **velata**

#### a. subsp. **ingrata**

Tree 5–20 m. *Twigs* brown, distinctly 2-winged,  $\pm$  fissured and lenticellate. *Leaves* thinly chartaceous; lower surface (sub)glabrescent, hairs sparse, greyish, scale-like, less than 0.1 mm. *Fruits* broadly (ovoid-)ellipsoid, 2.5 cm long. — **Fig. 66c.**

Field-notes — Slender tree. Bark brown, smooth or with sparse fine pustules or finely fissured; blaze with watery clear sap turning brown or (chestnut-)red; wood cream, straw, or orange; heartwood dark brown. Leaves grey, glaucous or silvery below. Flowers cream or (yellow-)brown. Fruits brown, globose.

Distribution — *Malesia*: northern E Papua Barat, northern and southern Papua New Guinea.

Habitat & Ecology — Lower montane forest, ridge forest, and lowland (alluvial) forest; 20–1250 m altitude; fl. & fr. throughout the year. Twigs myrmecophilous, with small black ants; sometimes with galls, resembling fruits.

Notes — 1. *NGF 48095 (Foreman)* has mature fruits among flowers in the same inflorescence.

2. *Myristica ingrata* can be confused with *M. subalulata* but is clearly distinguishable by the ovoid male perianth, persistent bracteole, and generally larger fruits with stout fruiting pedicel. Male flowers of *M. ingrata* are rather similar to those of the related *M. hollrungii*.

#### b. subsp. **velata** W.J. de Wilde

*Myristica ingrata* W.J. de Wilde subsp. *velata* W.J. de Wilde, *Blumea* 40 (1995) 292; 43 (1998) 175. — Type: *Jacobs 9127*, Papua New Guinea.

Tree 10–20 m. *Twigs* dark brown or blackish, faintly ridged, coarsely fissured, lenticellate. *Leaves* subcoriaceous, greyish or grey-brown below, hairs persistent, interwoven, scale-like, 0.1 mm. *Flowers* not seen. *Fruits* 1–4 per infructescence, (ovoid-)oblong, (2.5–)3–3.5 by 2 cm, with minute scurfy rust-coloured indumentum; fruiting pedicel  $\pm$  stout, 3–5(–10?) by 3–5 mm.



Field-notes — Branches spreading, inhabited by ants. Bark with sticky red exudate. Fruits cinnamon or brownish orange.

Distribution — *Malesia*: submontane areas of Central Papua New Guinea (West Sepik and Eastern Highlands Prov.); possibly also in West New Guinea (De Wilde l.c.).

Habitat & Ecology — Ridge forest and forest over limestone; 500–800 m altitude; fr. June, Sept., Oct.

Notes — 1. *Myristica ingrata* subsp. *velata* may merit the status of a separate species; its inclusion in *M. ingrata* is provisional, until more and (male) flowering material becomes available.

2. This subspecies may be close to *M. velutina*, a species without ant-swellings.

### 69. *Myristica inopinata* J. Sinclair

*Myristica inopinata* J. Sinclair, Gard. Bull. Sing. 23 (1968) 199, f. 14; Foreman, Handb. Fl. Papua New Guinea 1 (1978) 200; W.J. de Wilde, Blumea 40 (1995) 292. — Type: *Brass 28055*, Papua New Guinea, Tagula I.

Tree 8–20 m. Twigs 4–5 mm diameter, late glabrescent, hairs copious, 0.5–1 mm; older twigs not seen. Leaves (thinly) chartaceous, (elliptic-)oblong, 12–24(–27) by 5–8(–10) cm, base (broadly) rounded, apex (subacute or) blunt; upper surface bright (olivaceous-)brown, glabrescent, hairs dense, mealy, pale brown, 0.3 mm, lower surface late glabrescent, hairs dense, much-branched, of mixed sizes, up to 1 mm long, persisting on and near the base of the midrib; not papillose; dots absent; midrib raised above; lateral nerves 12–18 per side, at 50–80° to the midrib, flat, lines of interarching and venation indistinct; petiole 15–20 by 3(–4) mm, late glabrescent; leaf bud 10–15 by 3–4 mm, hairs (0.5–)1 mm. Inflorescences as in *Knema* but pedunculate, between the leaves, peduncle with persistent hairs 0.5–1 mm, or late glabrescent; in male: peduncle 5–10(–20) mm long, ending in 1–3 short scar-covered flower-bearing brachyblasts, each inflorescence with 10–15 flowers, buds of various sizes; in female: peduncle up to 5 mm long, 1–3-flowered; flowers with dense hairs 0.5(–1) mm. Male flowers: pedicel 3–5 by 1–1.5 mm, bracteole 1 mm long, caducous, (sub)apical; buds ellipsoid-oblong, 9–10 by (4–)4.5–5 mm, apex rounded, not angled (see note 1), cleft 1/4–1/3, lobes 2.5–3 mm long, 0.3 mm thick. Androecium slender, 8 mm; androphore 3 by 1(–1.5) mm, in basal (1/2–)1/3 with dense setose yellow-brown hairs 1 mm; synandrium 3.5–4 by 1.5 mm, thecae c. 12, sterile apex rather acute, 1 mm. Female flowers: pedicel 3 mm long, bracteole caducous, subapical; buds ovoid, 7(–9) by 5(–7) mm, lobes 3 mm long; ovary ovoid, 4–5 mm, hairs 1 mm. Fruits (submature) solitary or paired, subsessile, ovoid(–ellipsoid), 3 by 2–2.5 cm, apex (narrowly) rounded, hairs dense, rust-coloured, 2(–3) mm; pericarp 5–6 mm thick; seeds not known; fruiting pedicel 4–5 by 3 mm, pubescent.

Field-note — Subcanopy tree c. 20 m tall, stem 25 cm in diameter.

Distribution — *Malesia*: Papua New Guinea (Papuan Islands: known from 2 collections from Tagula I., at Rambuso).

Habitat & Ecology — Ridges in rain forest; 30–150 m altitude; fl. & fr. Sept.

Notes — 1. Sinclair (l.c.: 202) mentioned that the male perianth towards the apex is triangular in cross section, to be seen when the dense indumentum is removed, but I think that this observation rests on an artefact caused by drying; in fact, the bud is not or only faintly angled at the apex.

2. *Myristica inopinata* is related to *M. incredibilis* and *M. schleinitzii*. It may be confused with *M. chrysophylla* by the conspicuous indumentum of flowers and fruits, but *M. chrysophylla* has (sub)sessile inflorescences, short pedicelled smaller flowers, and fruits with a thin pericarp.

## 70. *Myristica insipida* R. Br.

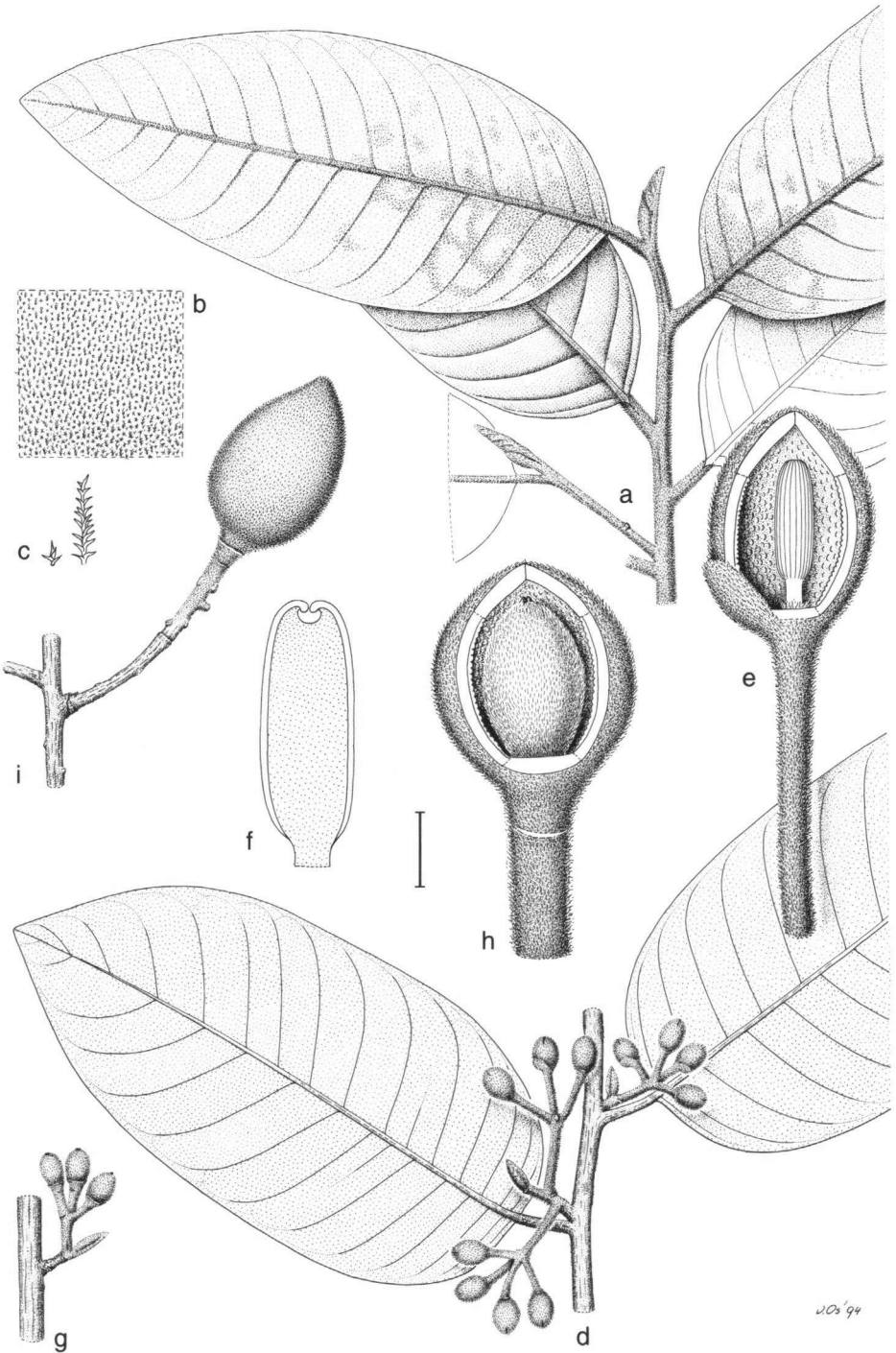
*Myristica insipida* R. Br., Prod. Fl. Nov. Holl. ed. 1 (1810) 400; ed. 2 (1827) 256; Benth., Fl. Austral. 5 (1870) 281; Blake, Austral. J. Bot. 2, 1 (1954) 124; J. Sinclair, Gard. Bull. Sing. 23 (1968) 369, f. 61 (excl. syn. *M. muelleri*); Foreman, Handb. Fl. Papua New Guinea 1 (1978) 200; W.J. de Wilde, Blumea 35 (1990) 245, f. 1: 6; 36 (1991) 187, f. 2; 40 (1995) 292; 42 (1997) 168. — *Myristica cimicifera* R. Br. var. *insipida* (R. Br.) Warb., Mon. Myrist. (1897) 501. — Type: *Brown 25*, N Australia.

*Myristica cimicifera* Soland. ex R. Br., Prod. Fl. Nov. Holl. ed. 1 (1810) 400; ed. 2 (1827) 256; Warb., Mon. Myrist. (1897) 499, t. 18 f. 1–6 (incl. var. *typica*). — Type: *Banks & Solander s.n.*, 1770, Queensland.

*Myristica cimicifera* R. Br. var. *acutifolia* Warb., Mon. Myrist. (1897) 502 (= var. *kingii* Warb., msc., nom. nud. in sched.). — Type: *King s.n.*, W Australia.

*Myristica macgregorii* Warb., Mon. Myrist. (1897) 479. — Type: *MacGregor 12*, Papua New Guinea, Barawara, Milne Bay Prov.

Shrub or tree (4–)6–25 m. Twigs 1–2 mm diameter, early glabrescent, hairs woolly, 0.2–0.5 mm; older twigs sometimes blackish, longitudinally cracked; lenticels inconspicuous or absent. *Leaves* membranous or chartaceous, elliptic-oblong or oblong-lanceolate, 7–20(–24) by 2–6(–8) cm, base rounded or cuneate, apex acute(–acuminate), the very tip often ± blunt; upper surface olivaceous, lower surface greyish, indumentum subpersistent or late glabrescent, hairs inconspicuous, scattered, 0.1 mm or less; papillae distinct (specimens from Tanimbar Is.) or inconspicuous (part of New Guinea material); dots absent; midrib above flat or sunken, lateral nerves 6–12 per side, at 45–80° to the midrib, far apart, flat or sunken, (much) raised below, lines of interarching not distinct, venation (not always) raised below; petiole 9–14 by 1–2 mm; leaf bud 7–12 by 1–2 mm, hairs woolly, or appressed, 0.2–0.5 mm. *Inflorescences* between the leaves, axillary or up to 2 mm supra-axillary, as in *Knema*: sessile or up to 2–4 mm pedunculate, 1–3-branched scar-covered brachyblasts, 2–5(–7) mm long, short-pubescent, glabrescent; in male: with subumbels of 5–15 flowers, buds of various sizes; bracts minute, caducous; in female: sessile, few-flowered; flowers with woolly hairs (0.1–)0.2–0.4 mm, towards the apex often darker coloured. *Male flowers*: pedicel 2–3(–4) mm (shorter than perianth), bracteole (0.5–)1–1.5 mm, persistent or late caducous; buds ellipsoid-oblong, 4.5–6 by 2–3 mm, cleft c. 1/4, lobes 0.2–0.3 mm thick. Androecium 3.5–4.5 mm; androphore (1.5–)1.8–2 by 0.4–0.8(–1) mm, glabrous or (New Guinea) in the lower half with scattered hairs 0.1–0.2 mm; synandrium 2–2.5 by 0.6–1.2 mm, thecae 12–16, sterile apex ± absent or irregularly lobulate by short processes from the anthers, or rather blunt to subacute, (0.1–)0.2–0.3 mm. *Female flowers* (from *Specht 666*): pedicel 0.5(–1) mm; buds ovoid, 4 by 3 mm, cleft c. 1/4; ovary ovoid, 3 by 2 mm, hairs 0.3–0.4 mm. *Fruits* 1 or 2 per infructescence, subsessile, ovoid-ellipsoid or ellipsoid-oblong, 2.5–3.8 by 1.5–2 cm, apex acute or with short beak 1–2.5 mm, base rounded or cuneate or ± narrowed, hairs dense, pale or dark brown, woolly, 0.3–1 mm, glabrescent, but hairs remaining in



the depressions left after drying and towards the base of the fruit; pericarp 2–3 mm thick, seeds ellipsoid-oblong, 2–2.5 cm, bright brown; fruiting pedicel 1–3 mm. — Fig. 64g, 78.

Field-notes — Shrub or medium-sized (understorey) tree. Bark (grey-)brown or blackish, usually shallowly fissured or finely scaly; inner bark 4–12 mm thick, pinkish, sap reddish; sapwood straw or light brown, undefined; true wood light brown or pale red-brown, rather soft. Leaves pale green or glaucous below. Flowers yellow green, pale yellow, or brown-yellow, androphore white, anthers light brown, pollen cream. Fruits (greenish) brown, golden, or rust-coloured; seeds brown.

Distribution — N Australia (N Western Australia, E to N Queensland); *Malesia*: SE Moluccas (Tanimbar Is.), S New Guinea.

Habitat & Ecology — Coastal or cliff forest, rain forest behind dunes, deciduous vine thickets, monsoon forest and scrub, riparian, gallery, or gully forest (in gorges in sandstone, Australia), fringing forest of savanna woodland; generally not too far from the coast; sandstone, sandy soil, lateritic or coral sand; locally common; 0–200 m altitude; fl. & fr. throughout the year.

Notes — 1. In *M. insipida* three groups can be recognized: 1) Material from the Tanimbar Islands, characterized by well-developed papillae on the lower leaf surface (lens!), glabrous androphore, and rather elongate fruits with dark rust-coloured comparatively short hairs, up to 0.5 mm long only. 2) Material from New Guinea with scattered pale brown hairs on the lower half of the androphore; some collections with the venation on the lower leaf surface either raised and distinct or  $\pm$  flat and indistinct (e.g. *Brass* 6430), and the bracteoles persistent or late caducous (e.g. *Brass* 6505). 3) Material from northern Australia, containing the type specimens of *M. insipida* and most of its synonyms, characterized by a distinct venation of the lower leaf surface, persistent bracteole, glabrous androphore, and fruits with pale or bright brown hairs to 1 mm long.

2. *Branderhorst* 294 (L) (two separate branches, one with male flowers, one with fruits) from S Papua Barat, agrees with *M. insipida* vegetatively and also in the shape of the male flowers with thickish woolly indumentum, but differs markedly in its androphore with dense conspicuous brown hairs 0.2–0.4 mm. *UPNG* 645A (*Frodin c.s.*) differs in male inflorescences with the peduncles up to 4 mm long.

3. *Myristica insipida* is characterized by subpersistent  $\pm$  scattered hairs and usually distinct papillation on the lower leaf surface, widely spaced lateral nerves, woolly-haired flowers, usually glabrous androphore (partly pubescent in part of the material from New Guinea), and fruits with woolly hairs to 1 mm. The species is related to *M. globosa* subsp. *muelleri* from the Pacific (Solomon Islands); the basionym *M. muelleri* was included by Sinclair (l.c.) in *M. insipida*.

Fig. 78. *Myristica insipida* R. Br. a. Leafy twig with male inflorescences; b. male bud with persistent bracteole; c. ditto, opened, showing androecium; d. twig with female inflorescences; e. female bud; f. ditto, opened, showing pistil; g. twig with infructescences, each bearing one or two fruits; h. dry fruit, opened, showing arillate seed (a–c: *Telford & Wringly* 7825 (Australia); d–f: *Specht* 666 (Australia); g, h: *Darbyshire* 710 (Papua New Guinea)]. — Scale bar for a, d, g = 2 cm; for b, c, e, f = 1.7 mm; for h = 1 cm.

### 71. *Myristica inundata* W.J. de Wilde

*Myristica inundata* W.J. de Wilde, *Blumea* 40 (1995) 292. — Type: *NGF 18331 Streimann & Lelean*, Papua New Guinea, Western Prov.

Tree 25–30 m. *Twigs* faintly angular, 2(–3) mm diameter, sometimes blackish, with small, scattered, pale lenticels, early glabrescent, hairs less than 0.1 mm; older twigs (blackish) brown, ± fissured, densely lenticellate. *Leaves* (thickly) chartaceous, (elliptic-)oblong, 10–16 by 4–6 cm, base short-cuneate or narrowly rounded, apex (short) acute-acuminate; upper surface brown, lower surface brown-grey, late glabrescent, hairs dense, scale-like, less than 0.1 mm; indistinctly papillose; dots absent; midrib ± flat above, lateral nerves 10–15 per side, at (50–)60–70° to the midrib, flat and inconspicuous above, little raised and ± contrasting in colour below, lines of interarching and venation faint; petiole 20–25 by 2.5 mm; leaf bud 12 by 2.5 mm, hairs greyish, scale-like, less than 0.1 mm. *Inflorescences* between the lower leaves and below, of the *Knema*-type; in male: a pubescent scar-covered brachyblast, 1–2 mm, sessile or to 2 mm pedunculate, with a cluster of 10–15 flowers, buds of variable sizes; bracts not seen; flowers with bright yellowish brown hairs 0.3 mm. *Male flowers*: pedicel 8–10 by 0.5(–1) mm, bracteole 4 by 4 mm, (sub)persistent; buds ovoid-ellipsoid, 4.5 by 3.5 mm, cleft c. 1/3, lobes 1.5 mm long, 0.2–0.3 mm thick. *Androecium* 4 mm; *androphore* 1–1.5 by 1 mm, with few hairs at the base, pale, 0.1 mm; *synandrium* 3 by 1–1.2 mm, *thecae* c. 16, subcontiguous, sterile apex 0.2 mm. *Female inflorescences* and *flowers*, and *fruits* not seen.

*Field-notes* — Tree c. 25 m tall, bole 20 m, straight, dbh 40 cm, with stilt-roots; crown open, spreading. Leaves dull dark green above, bronze below. Flower buds brownish yellow.

*Distribution* — *Malesia*: Papua New Guinea (Western Prov., Kiunga subprov., Tuide-masuk Road); known only from the type.

*Habitat & Ecology* — Seasonally inundated swamp forest; at about 25 m altitude; fl. Sept.

*Notes* — 1. *Myristica inundata* is similar to *M. atrocorticata* from the same area; the latter is distinguishable by narrower leaves, a male bracteole that is much shorter than the perianth, shorter indumentum, and prop-roots. *Myristica inundata* was collected in seasonally inundated swamp forest, and recorded as having stilt-roots. Prop-roots have been recorded for *M. atrocorticata*.

2. Because of the (sub)persistent, short and dense indumentum of the lower leaf surface, this species may be confused with *M. inutilis*. The male flowers have some resemblance with those of *M. hollrungii*, a species not closely related.

### 72. *Myristica inutilis* Rich. ex A. Gray

*Myristica inutilis* Rich. ex A. Gray in Wilkes, U.S. Explor. Exped. 1 (1854) 34; *Warb.*, *Monogr. Myrist.* (1987) 481; W.J. de Wilde, *Blumea* 38 (1994) 357, f. 3, 4; 40 (1995) 293.

This species reaches far into the Pacific; there are three subspecies of which one, subsp. *papuana*, occurs in the Malesian area.

subsp. **papuana** (Markgr.) W.J. de Wilde

*Myristica inutilis* Rich. ex A. Gray subsp. *papuana* (Markgr.) W.J. de Wilde, *Blumea* 40 (1995) 293; 42 (1997) 169; 43 (1998) 180. — *Myristica fatua* Houltt. var. *papuana* Markgr., *J. Arnold Arbor.* 10 (1929) 77, 214; *Bot. Jahrb. Syst.* 67 (1935) 160, p.p.; J. Sinclair, *Gard. Bull. Sing.* 23 (1968) 294, p.p., excl. f. 37 which depicts *M. subcordata* var. *morindiifolia*; Foreman, *Contr. Herb. Austral. no. 9* (1974) 39; *Handb. Fl. Papua New Guinea* 1 (1978) 194, p.p. — Type: *Brass* 1070, Papua New Guinea.

*Myristica finschii* Warb., *Mon. Myrist.* (1897) 534, t. 19, p.p. — Type: *Warburg* 20715 (B, lost), Papua New Guinea, 'Sattelberg'.

*Myristica sericea* Warb., *Mon. Myrist.* (1897) 521. — Type: *Warburg* 20722 (B, lost), New Ireland.

*Myristica wallacea* Warb., *Mon. Myrist.* (1897) 530, t. 19. — Syntypes: *Beccari FI acc. nos.* 7707, A, B, n.v.; *Warburg* 20721 (B, lost), Aru Islands.

Tree 7–25(–40) m. *Twigs* (1.5–)2–3(–3.5) mm (in var. *foremaniana* c. 5 mm) diameter, faintly angled, glabrescent, hairs 0.1 mm or less; older twigs not flaking, finely lenticellate. *Leaves* (thickly) chartaceous, elliptic-oblong to oblong-lanceolate, 12–30 by 3.5–7.5(–9) cm, base attenuate or narrowly rounded, apex acute-acuminate; upper surface olivaceous or brown, indumentum of lower surface persistent or sometimes late glabrescent, hairs pale (yellowish) brown or greyish, densely interwoven, scale-like, 0.1 (–0.2) mm; not papillose nor dotted; midrib above  $\pm$  flat, lateral nerves 18–25 per side, at 40–75° to the midrib, lines of interarching and venation indistinct; petiole 10–20 by 1.5–3 mm; leaf bud 10–15 by 1.5–2.5 mm, hairs woolly, 0.1(–0.2) mm. *Inflorescences* between the leaves or below, (supra-)axillary, of the *Knema*-type: simple or 2- (or 3-) branched, woody, wart-like or vermiform, scar-covered brachyblasts to 15 mm long, sessile or to 3(–5?) mm pedunculate, short pubescent, glabrescent; in male: with subumbels of 5–10(–20) flowers, buds of various sizes; bracts minute; in female fewer flowered; flowers with hairs 0.1–0.5 mm. *Male flowers*: pedicel 2–5 by 0.5–0.7 mm, bracteole acute or blunt, (1–)1.5–2(–2.5) mm, persistent; buds ellipsoid-oblong, 3–4.5 by 1.5–2 mm, cleft (1/4–)1/3(–c. 1/2), lobes 1.5–2 mm long, 0.2–0.3 mm thick. Androecium 3–4.2 mm; androphore slender, 1.5–2 mm long, glabrous, or with few hairs at base or almost completely minutely hairy; synandrium 2–2.4 by 0.4–0.6 mm, thecae (6–)10,  $\pm$  contiguous, sterile apex 0.1–0.2 mm, blunt. *Female flowers*: pedicel 1–2 mm long, bracteole 2 mm long; buds ovoid, 2.5 mm long; ovary ovoid, 2 mm, densely fine pubescent. Inflorescence with 1–5 fruits in a cluster. *Fruits* broadly obovoid(-ellipsoid), apex rounded or pointed, variable in size, 2.5–5(–6) by 1.8–3.5 cm, hairs grey-brown or rusty, 0.1–0.5(–1) mm; pericarp (1–)2–5 mm (8–10 mm in var. *foremaniana*) thick; seeds ellipsoid, 2–2.5 cm; fruiting pedicel 1–3 mm long, glabrescent, bracteole scar  $\pm$  apical.

*Field-notes* — Slender tree, bole straight, with or without buttresses, sometimes with (flattened) stilt-roots. Bark smooth or rough, fissured, rarely flaking, brown, grey, or black; slash bark (blaze) red; wood white, pinkish, or orange; no heartwood, central rot 10 cm diameter. Leaves bronze, cinnamon, or orange (tinged) below. Flowers golden, rust-coloured, cream, or greenish inside. Fruits usually (orange-)brown or ferruginous. Seeds brown to almost black.

*Distribution* — *Malesia*: Moluccas (Aru Islands); throughout New Guinea, including Papuan Islands, Bismarck Archipelago.

*Habitat & Ecology* — Flat, colline, or ridge forest on a variety of soil types; 0–800 m altitude; fl. & fr. throughout the year.

Note — 1. Subspecies *papuana* is the westernmost subspecies of the widespread *M. inutilis*; two more subspecies occur in the Pacific, subsp. *inutilis* (Samoan Islands) and subsp. *platyphylla* (Samoan Islands and New Hebrides), the latter erroneously mentioned for New Guinea by De Wilde (1994). The three subspecies can be separated on characters of the male flowers. Fruits are strongly variable in size, shape and indumentum, and cannot be used to corroborate the subspecies. Variety *foremaniana* is accepted within subsp. *papuana* on account of a remarkably distinct collection, with large leaves and large globose fruit.

2. *Myristica inutilis* is related to *M. fatua* and *M. subcordata*; for delimitation see the key to the species.

#### KEY TO THE VARIETIES

- 1a. Leaves 12–24 by 3.5–7 cm. Fruits obovoid-ellipsoid, 2.5–5(–6) cm long, hairs 0.1–0.5(–1) mm; pericarp (1–)2–5 mm thick . . . . . **a. var. papuana**  
 b. Leaves larger, up to 30 by 9 cm. Fruits subglobose, 5–5.5 by 5 cm, hairs minute, mealy, 0.1(–0.2) mm; pericarp 10 mm thick . . . . . **b. var. foremaniana**

#### **a. var. papuana**

Distribution — Widespread, as the subspecies.

Note — Highly variable in leaf size, some flower characters, and fruits. The androphore is usually hairy towards the base, but in some (not all) specimens from the Bismarck Archipelago (almost) glabrous. Fruits vary from 2.5 to 5 cm in length, with 0.1–0.5 mm long hairs; *Ridsdale NGF 33918* is one of the extremes, with fruits 5 by 3.5 cm, rough hairs, 0.5 mm long, and pericarp 3–5 mm thick.

#### **b. var. foremaniana** W.J. de Wilde

*Myristica inutilis* Rich. ex A. Gray subsp. *papuana* (Markgr.) W.J. de Wilde var. *foremaniana* W.J. de Wilde, *Blumea* 40 (1995) 294. — Type: *LAE 52230 (Foreman)*, Papua New Guinea.

Tree 18 m. *Twigs* 5 mm diameter. *Leaves* up to 30 by 9 cm, densely grey-cinnamon felty pubescent below. *Fruits* sessile, subglobose, not wrinkled, 5–5.5 by 5 cm, hairs light dull brown, mealy, 0.1(–0.2) mm; pericarp 10 mm thick; fruiting pedicel 2–3 mm long.

Field-notes — Bark slightly fissured; underbark reddish; sap slight, reddish; wood light brown. Leaves dark green above, covered with cinnamon-brown scale-like hairs below. Fruits brown.

Distribution — *Malesia*: Papua New Guinea (Madang Prov., S of Dumpu); known only from the type.

Habitat & Ecology — Forest of saddle between two ridges; 730 m altitude; fr. Mar.

Note — Known only in fruit. When flowers become available this taxon may appear to represent a species of its own, characterized by the conspicuous (sub)globose sessile fruits. It can be confused with *M. sphaerosperma*, which differs among others in a much longer fruiting pedicel, and also with *M. pachycarpidia* which has a much longer fruiting pedicel and a (sub)glabrous lower leaf surface.

**73. *Myristica kalkmanii* W.J. de Wilde**

*Myristica kalkmanii* W.J. de Wilde, Blumea 40 (1995) 294. — Type: *BW 8522 (Kalkman)*, SE Irian Jaya.

Tree 15(–20) m. *Twigs* sometimes  $\pm$  angular, 2.5–5 mm diameter, early glabrescent, hairs 0.1(–0.2) mm or less; older twigs blackish, longitudinally cracking and flaking; lenticels absent. *Leaves* (thinly) chartaceous, oblong-lanceolate, 15–32 by 5–11 cm, base cuneate or (narrowly) rounded, apex acute-acuminate; upper surface brown, lower surface grey(–brown), glabrous; papillose; dots absent; midrib nearly flat above, lateral nerves 14–20 per side, at 50–70° to the midrib, flat or sunken, lines of interarching distinct or not, venation indistinct; petioles 18–38 by 2.5–4.5 mm, leaf bud 10(–15) by 4(–5) mm,  $\pm$  longitudinally cracked on drying, hairs 0.1–0.2 mm. *Inflorescences* between the lower leaves or (just) below, of the *Knema*-type: sessile, simple or 2- or 3-branched scar-covered brachyblasts; bracts not seen; in female (from infructescences): branches 5–8 mm long, glabrescent, hairs yellow-rufous, 0.2–0.3 mm. *Male and female flowers* not seen. *Fruits* 1(–3?) per infructescence,  $\pm$  ellipsoid-fusiform, 3.5–4 by (2–) 2.5–3 cm, apex narrowly rounded or somewhat acute, base rounded or slightly narrowed, glabrescent, hairs mealy or powdery, rust-coloured, 0.3(–0.5) mm; pericarp 5 mm thick, light (yellowish or orange-)brown; seeds ellipsoid, 2 by 1.2–1.3 cm, the aril deeply impressed into the seed; fruiting pedicel  $\pm$  slender, 5–8 by 2–3 mm, yellow-brown pubescent, glabrescent, bracteole apparently small, scar apical, or up to 1.5 mm below the apex.

Field-notes — Small, straight, slender tree, bole 10–15 m, dbh 10–18 cm, without or with stilt-roots up to 20 cm high; branches few; crown small, open. Leaves light blue-green below. Fruits 4 by 3 cm; pericarp and pulp yellowish white; seeds brown; immature fruits red brown or light rusty brown.

Distribution — *Malesia*: southern (SE Papua Barat; Papua New Guinea: Western Prov.) and possibly (see note 2) northern New Guinea (W Sepik Prov.).

Habitat & Ecology — Lowland forest on clayey soil, on slight ridge, or on sloping ground; 25–120 m altitude; fr. Mar., Sept.

Notes — 1. *Myristica kalkmanii* is close to *M. sulcata*, with similar dark brown drying colour of the leaves. *Myristica sulcata* differs in its non-papillose lower leaf surface, thinly ridged (lined) or angular twigs, and subglobose fruits. Flowers of *M. kalkmanii* are not known. The species somewhat resembles *M. ornata*, with which it has the markedly papillose lower leaf surface in common, but *M. ornata* differs in its fainter nerves, stalked infructescences, and larger fruits.

2. *NGF 3931 (Womersley)* (K, in fr.) from W Sepik probably belongs here; the specimen agrees with the material from southern New Guinea in twig structure, leaf shape, and fruits, but it differs in the non-papillose lower leaf surface.

**74. *Myristica kjellbergii* W.J. de Wilde**

*Myristica kjellbergii* W.J. de Wilde, Blumea 42 (1997) 169. — Type: *Kjellberg 2962*, Sulawesi.

Tree 4–15 m. *Twigs* 2.5–3(–5) mm diameter, late glabrescent, hairs 0.1 mm; older twigs coarsely striate, with scattered not contrasting lenticels. *Leaves* chartaceous or subcoriaceous, broadly ellipsoid-oblong, 15–24 by 5–10 cm, base attenuate, apex short



acute-acuminate; upper surface brown, lower surface greyish, glabrescent, hairs interwoven, soft, stellate, 0.1–0.2 mm, the larger hairs leaving point-like scars; distinctly papillose or not; dots absent; midrib almost flat above, lateral nerves 10–16 per side, at 45–60° to the midrib, flat or sunken, indistinct above, on lower surface purple-brown contrasting, lines of interarching and venation indistinct; petiole 10–15 by 3–4 mm; leaf bud 15 by 3 mm, hairs woolly, 0.2–0.5 mm. *Female inflorescences* between the leaves and below, of the *Knema*-type: sessile wart-like brachyblasts, 2–3 mm long, finely woolly pubescent, with 2–5 flowers, buds almost equal in size. *Male flowers* not known. *Female flowers* (Meijer 9363) with dense bright golden-rusty hairs 0.2 mm, pedicel 0.5 mm, bracteole ovate, 3 mm, persistent; buds ovoid, narrowed towards the blunt or subacute apex, 5.5 by 3.5(–4) mm, cleft into 3 or 4 lobes for c. 1/3 to nearly 1/2, lobes 0.3 mm thick; ovary ovoid, 3 by 2 mm, hairs golden brown 0.2(–0.3) mm. *Fruits* in sessile clusters of 2 per infructescence, subsessile, (sub)globose, 2–2.2 by 2 cm, apex sometimes with beak 1.5(–2) mm, hairs dense, 0.1–0.2 mm; pericarp woody-pergamentaceous, 1–2 mm thick; seeds ellipsoid, 16–18 mm, with thick aril; fruiting pedicel 1–1.5 mm.

*Field-notes* — Low tree, branches horizontal, 3–5 from the same spot. Bark dark grey-brown, finely flaking. Leaves silvery white below. Fruits globose, 2.5 cm diameter; yellow or brown felty or rusty brown.

*Distribution* — *Malesia*: N, C and SW Sulawesi, known from a few collections. Deviating collections from SW Peninsula, with rather small subglobose fruits, are discussed by De Wilde (l. c.: 170).

*Habitat & Ecology* — Primary rain forest, ridges at 500–800 m altitude; female fl. Apr., Aug.; fr. Aug.–Dec., Mar.

*Note* — *Myristica kjellbergii* is characterized by its pale, greyish or whitish lower leaf surfaces, with conspicuously contrasting brown nerves, a feature shared with *M. koordersii*, *M. impressa*, and *M. impressinervia*; it differs from the first two species in the extremely faint nerves on the upper leaf surface, the papillae on the lower surface (always?), and smaller fruits with thin pericarp. *Myristica impressinervia*, known only from male flowers, has a much more tiny habit, smaller and thinner leaves, lower surface apparently not papillose, and distinctly pedunculate inflorescences.

## 75. *Myristica koordersii* Warb.

*Myristica koordersii* Warb., Mon. Myrist. (1897) 619; Koord., Meded. Lands Pl. Tuin 19 (1898) 572; J. Sinclair, Gard. Bull. Sing. 23 (1968) 262, p.p., for the specimens from NE Sulawesi (Minahasa) only, excl. f. 28 (= *Myristica impressa*); W.J. de Wilde, Blumea 42 (1997) 170. — *Syntypes*: *Koorders 18128* (L, lecto, here designated), *18129* (immature fr.), *18144* (BO, n.v.), all NE Sulawesi.

Tree 20–50 m. *Twigs* 1.5–3 mm diameter, early glabrescent, hairs 0.2 mm; older twigs sometimes cracking; lenticels present but inconspicuous. *Leaves* (thinly) chartaceous, (elliptic-)oblong or lanceolate, 13–20 by 3–5(–6) cm, apex acute or shortly acute-acuminate, base attenuate, upper surface olivaceous, lower surface pale greyish, glabrescent, hairs ± widely spaced, appressed, of mixed sizes, 0.1(–0.3) mm, the stouter ones leaving dark points; papillae not obvious but possibly present (causing the whitish surface); dots absent; midrib above slightly raised, lateral nerves 13–16 per side, at 45–60° to the

midrib, faint and flat above, lines of interarching and venation indistinct (the latter sometimes distinct towards the margin); petiole 15–30 by 2–3 mm; leaf bud 12–15 by 1.5–3 mm, hairs (0.1–)0.2–0.3 mm. *Inflorescences*, male and mature female flowers not seen; infructescences of the *Knema*-type: peduncle up to 2 mm long, hairs dense, shaggy, yellowish brown 0.5–1 mm. *Female flowers* (Foreman 262, immature) with dense shaggy hairs 0.5–1 mm, pedicel at least 3 mm long, bracteole caducous. *Fruits* 1 or 2 per infructescence, broadly ovoid-ellipsoid, 3–3.5 by 2.5–3 cm, apex with 1 mm long style remnant, hairs mealy, 0.1 mm, and with longer sparse hairs towards the base of the fruit; pericarp 6–8 mm thick; seeds not seen; fruiting pedicel 6–10 mm long, slender, subglabrescent or with persistent shaggy hairs (0.5–)1 mm, bracteole scar 1–2 mm below the apex.

*Field-notes* — Solitary emergent tree. Prop-roots few, covering an area of 3 m in diameter. Clear bole very straight, 20 m. Outer bark 0.3 mm thick, dark brown, rather fissured, peeling off strongly; inner bark 8 mm thick, on section yellowish, out ± reddish, with little watery red exudate. Sapwood pale yellowish tinged red. Leaves glaucous below. Fruits green (somewhat immature), with golden brown indumentum.

*Distribution* — *Malesia*: Sulawesi (eastern part of NE arm, Minahasa).

*Habitat & Ecology* — Hillside forest; deep sandy-clayey volcanic soil; 500–1000 m altitude; fr. Jan., Feb., June, Oct.

*Notes* — 1. Sinclair accepted *M. koordersii* in a wider sense than is done here, including specimens now transferred to *M. impressa* (type lost). The latter occurs almost throughout Sulawesi (except the Minahasa), but was by Sinclair (l.c.: 235, 481) considered to be a dubious species based on a possible atypical specimen of *M. koordersii*.

2. *Myristica koordersii* resembles *M. impressa* and *M. kjellbergii*; for differences see the keys.

## 76. *Myristica laevifolia* W.J. de Wilde

*Myristica laevifolia* W.J. de Wilde, Blumea 40 (1995) 295, f. 3f. — Type: NGF 23957 (Streimann), Papua New Guinea.

Tree 6–30 m. *Twigs* 1–2 mm diameter, glabrescent, hairs greyish, less than 0.1 mm; older twigs smooth with indistinct lenticels. *Leaves* (thinly) coriaceous, (ovate-)elliptic or oblong-lanceolate, 6–15 by 2–6 cm, base ± attenuate, apex acute-acuminate; upper surface olivaceous or brown, lower surface light brown, glabrescent, hairs sparse, greyish, less than 0.1 mm; not papillose; dots absent; midrib raised above; lateral nerves 8–14 per side, at 45–70° to the midrib, flat or sunken and indistinct at both surfaces, not really contrasting in colour, lines of interarching and venation faint on both surfaces; petioles 10–15 by 1.5–2 mm; leaf bud 8–12 by 1.5–2 mm, hairs less than 0.1 mm. *Inflorescences* between the leaves or below, largely of the *Knema*-type: a sessile sometimes up to 2.5 mm pedunculate, scar-covered brachyblast to 7 mm long, glabrescent; in male: with 2–6 (rarely more) flowers, buds somewhat variable in size; in female: with 1–3 buds about equal in size; flowers partly glabrescent, hairs scattered, 0.1 mm or less, and appearing glabrous. *Male flowers*: pedicel slender, (4–)5–8 mm, bracteole 0.5 mm or less, caducous, apical or up to 2 mm below; buds elliptic-oblong, 6(–6.5) by 2–2.2(–3) mm, apex broadly rounded, base rounded or attenuate, cleft c. 1/3, lobes 2 mm long,

0.2–0.3 mm thick. Androecium 5–6.5 mm; androphore 2–2.3 mm long, glabrous or hairs pale, less than 0.1 mm at the base; synandrium 2.2–3 by 0.7–1.5 mm, thecae 12–14, sterile apex 0.3–0.5 mm. *Female flowers* rather stout, pedicel 9–15 by 1 mm, bracteole scar 2–3 mm below the apex; buds ovoid-ellipsoid, 5–5.5 by 3 mm, cleft 1/4(–1/3), lobes 1.5–1.7 mm; ovary ovoid-oblong, including stigma 4–4.5 by 2 mm, hairs less than 0.1 mm, or partly glabrous. *Fruits* solitary or 2 or 3, ellipsoid-oblong, ± fusiform, 4–5.5 by (1.7–)2–2.5 cm, apex narrowly rounded or subacute, base narrowed into a pseudostalk up to 3 mm, glabrescent, hairs scurfy, 0.1 mm or less; pericarp 2–3 mm thick; seeds ellipsoid, 2–2.5 cm; fruiting pedicel ± stout, 10–15(–18) mm long, 2 mm thick, bracteole scar 2–5 mm below the apex. — **Fig. 62f, 63f.**

**Field-notes** — Tree without buttresses, straight-boled or crooked. Bark smooth, rough, or fissured, not flaking off, grey-brown or dark brown; underbark pinkish or salmon; exudate watery or sticky, red; wood cream or straw, staining brown on exposure. Leaves dull green below. Flowers cream, yellowish, or whitish. Fruits brown, orange, or green with brown tinge.

**Distribution** — *Malesia*: Papua New Guinea (Sepik, Morobe, Eastern Highlands, Central, and Milne Bay Prov.).

**Habitat & Ecology** — Mid-mountain mixed rain forest; oak-forest, *Castanopsis*-dominated forest, mixed forest with *Kibara*, *Lithocarpus* (*Pasania*), *Elaeocarpus*, *Elmerrillia*; 1000–1800 m altitude; fl. & fr. throughout the year.

**Note** — This species is close to *M. crassipes* subsp. *altemontana* and *M. tubiflora* (for discussion, see De Wilde l.c.: 296).

## 77. *Myristica laevis* W.J. de Wilde

*Myristica laevis* W.J. de Wilde, *Blumea* 42 (1997) 170. — Type: *PNH 118091* (*Gutierrez*), Philippines, Samar.

Tree 4–20 m. *Twigs* 2–3 mm diameter, early glabrescent, hairs 0.1 mm or less; older twigs brown or rather pale; lenticels indistinct or absent. *Leaves* thinly chartaceous, lanceolate, 9–22 by 2–4.5 cm, base cuneate or (sub)rounded, apex acute(–acuminate) or ± blunt; upper surface olivaceous or brown, lower surface pale grey-brown, early glabrescent; densely papillose; dots absent; midrib above flat, much raised below, yellow-brown, lateral nerves 20–30 per side, at 60–80° to the midrib, flat, hardly visible above, slightly raised below, lines of interarching and venation indistinct; petiole 10–20 by 1.5–2.5 mm; leaf bud 7–16 by 3–4 mm, hairs 0.1–0.5 mm. *Inflorescences* between the leaves and below, pedunculate, ending in a subumbel of flowers (but brachyblast absent); bracts minute, caducous; in male (*PNH 118091*, ± immature): peduncle 5–8 mm, subumbel with 3–6(–10) flowers, buds of various sizes; female similar, peduncle up to 25 mm, fewer flowered; inflorescences and flowers with rusty hairs 0.2–0.3(–0.5) mm. *Male flowers*: pedicel rather stout, 5–7 mm, bracteole 4 mm long, caducous; buds woody-coriaceous, ovoid or ellipsoid(-oblong), apex narrowly rounded, 6–6.5 by 4(–4.5) mm, cleft to over 1/2 (possibly nearly to the base), lobes 0.8 mm thick. Androecium broadly cylindrical, 2.5–3 mm; androphore 0.2 mm long, and broad, like a disc at the base of the synandrium, with sparse erect hairs 0.1–0.2 mm; synandrium 2–2.3 by 1 mm, thecae 16–18, sterile apex blunt, 0.2–0.4(–0.5) mm. *Female flowers* not seen; pedicel variable in length (see the subspecies). *Infructescences*: peduncle conspicuously longitudinally

cracked. *Fruits* single or up to 3, subglobose or ellipsoid, (3.6–)4–5.5 cm long, hairs brown, scurfy, 0.1–0.2 mm; pericarp 7–10 mm thick, seeds not seen; fruiting pedicel glabrous.

Distribution — *Malesia*: E Philippines, with two subspecies.

Note — *Myristica laevis* is distinguishable from all other Philippine *Myristica* species by the glabrous, lanceolate, faintly but many-nerved leaves, large ± coriaceous male flowers with almost sessile synandrium, and fruits with thick pericarp. Dry leaves are exceedingly brittle. With *M. umbellata* it has the distinct papillose lower leaf surface and the pedunculate, somewhat umbellate non-branched inflorescences in common.

#### KEY TO THE SUBSPECIES

- 1a. Peduncle of infructescence 3–10 mm long; fruiting pedicel 2–3 mm long; fruits subglobose, 3.8–4.2 cm long, with cinnamon-rusty scurfy hairs 0.1 mm, easily rubbed off ..... a. subsp. **laevis**  
 b. Peduncle of infructescence 15–25(–30) mm long; fruiting pedicel more slender, 13–18 mm long, [bracteole scar 2–4 mm below the fruit;] fruits (slightly immature) ellipsoid-oblong, 5–5.5 cm long, with persistent dark chocolate-coloured hairs 0.1–0.2 mm ..... b. subsp. **badia**

#### a. subsp. **laevis**

Tree 4–20 m. *Male inflorescences* and *flowers* as the species. *Female flowers*: pedicel short. *Fruits* solitary, subglobose, 3.6–4.2 by 3.3–4 cm, indumentum cinnamon or rust-coloured, rather easily rubbed off, hairs scurfy, 0.1 mm; pericarp 7–9 mm thick; peduncle of infructescence 3–10 mm long; fruiting pedicel 2–3 mm long.

Field-notes — Small tree, dbh 8–60 cm. Flowers yellow-green, fruits (slightly immature) brown.

Distribution — *Malesia*: E Philippines (Samar).

Habitat & Ecology — Forest of Mt Sohoton, altitude not recorded; fl. & fr. Apr.

#### b. subsp. **badia** W.J. de Wilde

*Myristica laevis* W.J. de Wilde subsp. *badia* W.J. de Wilde, *Blumea* 42 (1997) 172. — Type: *Rojo 159*, NE Mindanao.

Tree c. 5 m. *Male* and *female flowers* not seen. *Fruits* (slightly immature) 1–3 per infructescence, ellipsoid-oblong, 5–5.5 by 3 cm, apex rounded with short apiculum, base rounded, hairs persistent, dark chocolate, scurfy, 0.1–0.2 mm; pericarp hard, 10 mm thick; peduncle of infructescence 15–25(–30) mm long; fruiting pedicel rather slender, glabrous, 13–18 mm long, bracteole scar 2–4 mm below the fruit.

Field-notes — Low tree, dbh 10 cm, twigs and leaves rather brittle. Bark blackish; wood soft. Infructescences among the leaves, with one or usually three fruits per peduncle; fruits ovate, ferruginous to chocolate brown hairy, with mucro at apex and two shallow longitudinal depressions.

Distribution — *Malesia*: E Philippines (NE Mindanao, S Surigao), known only from the type.

Habitat & Ecology — Hillside forest; 400 m altitude; fr. Nov.

**78. *Myristica lancifolia* Poir.**

*Myristica lancifolia* Poir. in Lam., Encycl. Méth. Bot., Suppl. 4, 1 (= 12) (1816) 35 [non *Myristica lancifolia* Poepp. ex Warb. (1897), nec *Myristica lancifolia* Merr. (1923)]; W.J. de Wilde, *Blumea* 35 (1990) 246; Jessup & W.J. de Wilde, *Blumea* 38 (1993) 39; W.J. de Wilde, *Blumea* 40 (1995) 297; 42 (1997) 172.

For more references and synonyms see the subspecies.

Tree 4–20(–30) m. *Twigs* subterete or ± angular, 1–2 mm diameter, early glabrescent, hairs 0.1(–0.3) mm; older twigs with small lenticels. *Leaves* chartaceous or thinly coriaceous, ovate-elliptic or lanceolate, (4–)7–17(–21) by (1.5–)2–6(–9) cm, base cuneate, apex acute-acuminate, the very apex sometimes ± blunt; upper surface olivaceous or brown, lower surface pale greyish brown, glabrescent, hairs 0.1–0.2 mm or less, or persistent, sparse (lens!); usually distinctly papillose; dots absent; midrib above somewhat raised, lateral nerves 8–20 per side, at 45–80° to the midrib, rather closely set, flat and faint above, little raised, sometimes hardly visible below, lines of interarching and venation indistinct; petioles 5–15 by 1–2(–2.5) mm; leaf bud 6–12 by 1–2 mm, hairs (0.1–)0.2(–0.3) mm. *Inflorescences* between the leaves and/or below, ± pubescent, of the *Knema*-type; in male: (sub)sessile (exceptionally peduncle up to 2 mm long), simple or 2–4-branched tubercle-like, scar-covered brachyblasts to 4(–10) mm, flowers in subumbels of (2–)5–10(–15), buds usually of variable sizes; bracts minute, early caducous; in female: brachyblasts 1(–2) mm long, few-flowered; flowers with (sparse) hairs 0.1 mm. *Male flowers*: pedicel slender, 1–7 mm long, bracteole 1–1.5 mm, persistent; buds long-ellipsoid to oblong, 4–6 by 1.5–2.5 mm, somewhat narrowed towards the blunt apex, cleft c. 1/4–1/3, lobes 0.2(–0.3) mm thick. Androecium slender, 3.5–5 mm; androphore 1.5–2 by 0.4–0.5 mm, glabrous; synandrium 1.8–2.5(–0.3) by 0.5–0.8 mm, thecae 10–14, (sub)contiguous, sterile apex ± blunt, 0.1–0.2 mm. *Female flowers*: pedicel 1–2 mm long; buds ovoid or conical, narrowed towards the apex, 3–4.5 by 2–3 mm, cleft c. 1/3; ovary narrowly ovoid, 2.5–3.5 by 1.5–2 mm, hairs less than 0.1 mm, stigma 1 mm, deeply and broadly 2-lobed. *Fruits* 1–3 per infructescence, short- or long-ellipsoid, 1.3–2.6(–3) by 0.9–1.3 cm, apex rounded or subacute, usually to 1 mm beaked, hairs scurfy, c. 0.2 mm or less (largely glabrescent in subsp. *australiana*); pericarp 1–2(–3) mm thick; seeds 11–20 mm long; fruiting pedicel slender, 1–5 mm long.

*Distribution* — *Malesia*: Moluccas, W Papua Barat (Waigeo, Bird's Head), and Papua New Guinea (east to Madang Prov.), with three subspecies; a fourth, subsp. *australiana* Jessup & W.J. de Wilde, occurs in N Australia (Jessup & De Wilde 1993: 41).

**KEY TO THE SUBSPECIES**

- 1a. Leaves elliptic-oblong to lanceolate. Male buds 4–4.5 by 1.5–1.8 mm, pedicel 1–3.5 mm long. Fruits small, 1.3–1.6(–2) cm long. — Papua Barat (Obi, Waigeo, Bird's Head), Papua New Guinea (E to Madang Prov.) . . . . . **a. subsp. *lancifolia***
- b. Leaves variable but not lanceolate. Male buds somewhat larger, (4–)4.5–6 by 1.8–2.5 mm, pedicel longer. Fruits 2.2–2.6(–3) cm long. — Moluccas and W Papua Barat (Adi Is., see note) . . . . . **c. subsp. *montana***
- c. Leaves ellipsoid-oblong, small, 4–10 cm long. Male flowers not known. Fruits ovoid-ellipsoid, 2 by 1.5 cm. — Papua New Guinea (Southern Highlands Prov., 500–600 m) . . . . . **b. subsp. *kutubuensis***

**a. subsp. lancifolia**

*Myristica lancifolia* Poir. in Lam., Encycl. Méth. Bot., Suppl. 4, 1 (= 12) (1816) 35; Warb., Mon. Myrist. (1897) 519, t. 19; J. Sinclair, Gard. Bull. Sing. 23 (1968) 456, f. 79 (var. *lancifolia*, see note), p.p.; W.J. de Wilde, Blumea 35 (1990) 246; Jessup & W.J. de Wilde, Blumea 38 (1993) 39. — Type: *Labillardière s.n.*, W Irian Jaya, Pulau Waigeo.

*Myristica papuana* Scheff., Ann. Jard. Bot. Buitenzorg 1 (1876) 47; F. Muell., Descr. Notes Papuan Pl. 1, 5 (1877) 96. — *Myristica montana* Roxb. var. *papuana* (Scheff.) Warb., Mon. Myrist. (1897) 514. — Type: *Teijsmann 7585*, Irian Jaya, Bird's Head.

Tree 15 m. *Leaves* variable in shape, elliptic-oblong to lanceolate, lateral nerves 8–14 per side, comparatively rather far apart, sometimes very faint below. *Male flowers*: pedicel 1–3.5 mm long; buds 4–4.5 by 1.5–1.8 mm. *Fruits* (short-)ellipsoid, small, 1.3–1.6(–2) by 0.9–1.1 cm, indumentum persistent; fruiting pedicel 1–3 mm. — **Fig. 64h.**

Field-notes — Small to rather large and straight tree, stem somewhat fluted. Bark brown with numerous longitudinal fissures, not peeling off, 0.4 mm thick; inner bark 5 mm thick, pale ochre-red; exudate little, watery, dull brown or red; sapwood cream, faintly reddish, gradually passing into the slightly more reddish heartwood. Flowers yellowish. Fruits light brown or ochre; aril (immature?) yellow.

Distribution — *Malesia*: NE Moluccas (Obi), NW Papua Barat (Waigeo, Bird's Head); Papua New Guinea (E to Madang Prov.).

Habitat & Ecology — Hillside and riverine forest; humus soil over limestone, sandy clay on limestone; in Waigeo I. common along many creeks; 0–650 m altitude; fl. Oct.–Jan.; fr. May, Nov., Jan.

Note — *Myristica lancifolia* var. *lancifolia*, as accepted by Sinclair, l.c., has a wider concept than the present subsp. *lancifolia*. Most of the material cited by Sinclair for New Guinea (including the Aru Islands), has now been transferred to other taxa.

**b. subsp. kutubuensis** W.J. de Wilde

*Myristica lancifolia* Poir. subsp. *kutubuensis* W.J. de Wilde, Blumea 40 (1995) 297. — Type: *Jacobs 9280*, Papua New Guinea.

Tree 25 m. Innovations, leaf bud, lower surface of immature leaves and flowers with minute rust-coloured stellate hairs 0.1–0.3 mm. *Leaves* thinly chartaceous, elliptic-oblong, 4–10 by 1.5–3.5 cm, papillose below, lateral nerves 10–15 per side, faint, venation almost invisible. *Male flowers* not seen. *Female flowers*: pedicel 3 mm, bracteole broadly rounded, caducous, apical; buds ovoid, 3.5 mm long. *Fruits* solitary or paired, ovoid-ellipsoid, 2 by 1.5 cm, hairs bright rust-coloured, mealy, 0.1–0.2 mm; pericarp ± woody, 2–3 mm thick; seeds 1.5 cm long; fruiting pedicel 5 by 3 mm, bracteole scar subapical.

Field-notes — Innovations olive-green. Flowers white. Fruits dull brown, rather hard.

Distribution — *Malesia*: Papua New Guinea (Southern Highlands Prov., near Waro Airstrip, 20 km SSW of Kutubu, known only from the type).

Habitat & Ecology — Primary forest of limestone area; 500–600 m altitude; fl. & fr. Oct.

Note — The status of subsp. *kutubuensis* is uncertain as it is as yet known only from one female flowering and fruiting specimen. It is tentatively described as a subspecies under *M. lancifolia*, as it keys out to that species. Its distinctness is possibly related to its habitat in forest over limestone at quite a distance from the area of the type subspecies.

**c. subsp. *montana* (Roxb.) W.J. de Wilde**

*Myristica lancifolia* Poir. subsp. *montana* (Roxb.) W.J. de Wilde, *Blumea* 35 (1990) 247, f. 1: 7b; 40 (1995) 298. — *Myristica montana* Roxb., [Hort. Beng. (1814) 105, nom. nud.] *Fl. Ind.* 3 (1832) 846; *Warb.*, *Mon. Myrist.* (1897) 512, t. 15. — *Myristica lancifolia* Poir. var. *montana* (Roxb.) J. Sinclair, *Gard. Bull. Sing.* 23 (1968) 467, f. 82. — Syntypes: *Wallich Cat.* 6792, *Smith s.n.* in *Herb. Roxb.*, Banda I.

*Myristica diversifolia* Miq., *Ann. Mus. Bot. Lugd.-Bat.* 2 (1864) 205. — Syntypes: *Teijsmann 1951* (Seram), 1964, 5057 (Ambon); *de Vriese s.n.* (Ambon).

Medium-sized or low tree. *Leaves* variable in shape, ovate-elliptic to oblong, not lanceolate, lateral nerves 12–20 per side, generally rather closely parallel, faint or rather distinct below. *Male flowers*: pedicel 2.5–7 mm long; buds (broader than in subsp. *lancifolia*) 4.5–6 by 1.8–2.5 mm. *Fruits* ellipsoid-oblong, 2.2–2.6(–3) by 1–1.3 cm, apex narrowly rounded or subacute, indumentum persistent; fruiting pedicel 1–3(–5) mm. — **Fig. 64i.**

Field-notes — Bole straight, without or with only a few buttresses (0.5 by 1 m). Bark (blackish) brown, either smooth or slightly longitudinally cracked, fissured, flaky, or (strongly) peeling off or not; outer bark 0.5 mm thick; inner bark 4–8 mm thick, on section outside reddish, inside (reddish) ochre or brown; exudate little, (yellow- or red-) brown; sapwood yellowish (tinged red), the transition to brown heartwood gradual or well marked off. Flowers cream, or (greenish) yellow, fragrant (once recorded). Fruits (brownish) yellow; seeds dark or (blackish) brown.

Distribution — Moluccas (Halmahera, Bacan, Obi, Buru, Seram, Ambon, Banda: no material seen, Tanimbar I.), and W Papua Barat (Adi I.).

Habitat & Ecology — Forest on clay and loam soil, with or without humus layer, over grey schist or limestone; alluvial or porous, stony or rocky soils; 0–900 m altitude; fl. & fr. mainly Nov.–Jan.

Note — The only specimens seen from W Papua Barat are from lowland forest, sterile or with very immature flowers. Vegetatively they agree except for comparatively indistinct papillae on the lower leaf surface (*BW 9860, 11532*).

**79. *Myristica lasiocarpa* W.J. de Wilde**

*Myristica lasiocarpa* W.J. de Wilde, *Blumea* 40 (1995) 298. — Type: *Kairo 401*, Papua New Guinea.

Tree 10–12 m. *Twigs* 1.5–2(–3) mm diameter, late glabrescent, hairs ± rough, 0.2–0.3(–0.5) mm; older twigs ± longitudinally cracking, with scattered faint lenticels. *Leaves* chartaceous or coriaceous, oblong-lanceolate, 10–16 by 3–5 cm, base attenuate, apex acute-acuminate; upper surface dark-olivaceous or brown, lower surface brown-grey with (sub)persistent dense felty pale brown scale-like hairs 0.1–0.2 mm and scattered emergent bright brown dendroid hairs 0.3–0.5 mm; indistinctly papillose; dots absent; midrib (flat or) raised above, lateral nerves 13–17 per side, at 45–60(–70)° to the midrib, (flat or) sunken above, lines of interarching and venation faint but visible in old leaves; petiole 13–20 by 1.5–2 mm; leaf bud 15 by 2–2.5 mm, hairs 0.2–0.3 mm long. *Inflorescences* (from infructescences) between the leaves, of the *Knema*-type; in female: a few-flowered, sessile, scar-covered wart-like brachyblast, 2–3 mm diameter, short-pubes-

cent, glabrescent. *Male inflorescences*, male and female flowers not seen. *Fruits* solitary, ellipsoid, 4.5 by 3.5 cm, base slightly attenuate, hairs conspicuous,  $\pm$  thick and shaggy, rust-coloured 2(–3) mm; pericarp 3 mm thick; seeds ellipsoid, 2.5 cm; fruiting pedicel 10(–12) by 4(–5) mm, late glabrescent,  $\pm$  cracking, bracteole scar 2 mm below the apex.

Field-notes — Fruits reddish brown or orange.

Distribution — *Malesia*: Papua New Guinea (Morobe Prov., Kuper Range area); known only from the type.

Habitat & Ecology — Subcanopy layer of (mossy) *Nothofagus*-forest, with multiple-tiered and congested canopy, understorey open, moist, dimly lit, in broad gully; 1600–2000 m altitude; fr. Oct.–Nov.

Note — *Myristica lasiocarpa* is similar to *M. chrysophylla* mainly in its conspicuously shaggy-pubescent fruits, but it differs markedly from the latter in its long fruiting pedicel. *Myristica chrysophylla* is a lowland species with a wider distribution in about the same area.

### 80. *Myristica lepidota* Blume

*Myristica lepidota* Blume, Rumphia 1 (1837) 183, t. 57; W.J. de Wilde, Blumea 35 (1990) 247. —

Type: *Zippelius 159a*, SW Irian Jaya.

For more references and synonyms see the subspecies.

Tree 10–35 m. *Twigs* 1–2 mm diameter, glabrescent, hairs 0.1 mm or less; older twigs with numerous small pale lenticels, contrasting or not. *Leaves* membranous or thinly coriaceous, elliptic-oblong, 4.5–15 by 1.5–5(–6) cm, base narrowly rounded or cuneate, apex up to 20 mm acute-acuminate; upper surface olivaceous or blackish brown, lower surface early glabrescent (subsp. *montanoides*) or with persistent indumentum (subsp. *lepidota*), hairs interwoven, pale cinnamon or greyish, 0.1–0.2 mm; papillation indistinct; dots absent; midrib slightly raised above, lateral nerves 6–14 per side, at 45(–60)° to the midrib, flat or sunken above, brown and contrasting below, lines of interarching distinct or not, venation clearly visible below; petiole (5–)10–17 by 1–1.5 mm; leaf bud 7–10 by 1 mm, hairs 0.1(–0.2) mm. *Inflorescences* between the leaves or below; of the *Knema*-type: sessile or up to 1(–2) mm pedunculate, simple or branched scar-covered brachyblasts to 4 mm long, 1.5 mm wide, minutely woolly brown pubescent; in male: with clusters of 4–8 flowers, buds of strongly variable sizes; bracts minute; in female: smaller, 2–5-flowered; flowers with hairs 0.1–0.2(–0.3) mm. *Male flowers*: pedicel 1–2 mm long, bracteole 0.5(–1) mm, (late) caducous; buds ellipsoid-oblong, apex and base truncately broadly rounded, 2.5–3(–4) by 1–1.4 mm, cleft 1/3–1/4, lobes 0.2 mm thick. Androecium slender, 2–2.6 mm long; androphore 1–1.2 by 0.4–0.5 mm, glabrous or with hairs less than 0.1 mm in the lower half; synandrium 1.2–1.5 by 0.4–0.5 mm, thecae 10–12, sterile apex absent or  $\pm$  acute, to 0.2 mm. *Female flowers*: pedicel 1.5 mm; buds ovoid, 2.5 by (1.5–)2 mm; ovary ovoid-oblong, 1.5–2 mm, hairs 0.1 mm, style and stigma 0.3 mm. *Fruits* solitary or paired, subsessile,  $\pm$  ellipsoid-oblong, 2–3 by 1.2–1.8 cm, apex blunt or (sub)acute, or 1(–2) mm beaked, base  $\pm$  rounded or narrowed into the stalk, hairs scurfy, 0.1(–0.2) mm; pericarp 2–3 mm thick; seeds ellipsoid(-oblong), 2 cm; fruiting pedicel stout, 3–4 mm long and broad.

Distribution — *Malesia*: E Moluccas and W & SW New Guinea; with two subspecies.



## KEY TO THE SUBSPECIES

- 1a. Lower leaf surface with dense persistent indumentum. Androphore minutely pubescent in the lower half . . . . . **a. subsp. *lepidota***  
 b. Lower leaf surface early glabrescent, indumentum scarce, minute. Androphore glabrous or at base with few pale hairs less than 0.1 mm . . . . . **b. subsp. *montanoides***

**a. subsp. *lepidota***

*Myristica lepidota* Blume, Rumphia 1 (1837) 183, t. 57; Warb., Mon. Myrist. (1897) 434, t. 19, p.p.; Markgr., Bot. Jahrb. Syst. 67 (1935) 161, p.p.; J. Sinclair, Gard. Bull. Sing. 23 (1968) 265, f. 29; W.J. de Wilde, Blumea 35 (1990) 248, f. 1: 8a. — [*Myristica microcarpa* Zipp., nom. nud. in sched.]

*Leaves* below rather woolly-pubescent, hairs pale cinnamon or grey-brown, interwoven, 0.1–0.2 mm. *Male flowers*: buds 2–2.5 mm long; thecae 10, lower half of androphore with minute grey-white hairs 0.1 mm or less. — **Fig. 64j.**

Field-notes — Tall tree, to 35 m, dbh c. 50 cm. Flowers yellow. Fruits yellow.

Distribution — *Malesia*: Moluccas (Aru Islands), SW Papua Barat (also Bird's Head).

Habitat & Ecology — Lowland rain forest; flat country; sandy and clayey alluvial soils; 0–150 m altitude; fl. May–June, Dec.; fr. May–June.

Note — Distinguishable by slender twigs and small leaves with short but dense persistent indumentum on lower surface. Both male and female flowers are small, 2–2.5 mm long, with short pedicels. The fruits are sessile, ellipsoid-oblong, pear-shaped, or obovoid, with comparatively short thick stalks.

**b. subsp. *montanoides* (Warb.) W.J. de Wilde**

*Myristica lepidota* Blume subsp. *montanoides* (Warb.) W.J. de Wilde, Blumea 35 (1990) 248, f. 1: 8b; 40 (1995) 299; 42 (1997) 173. — *Myristica montanoides* Warb., Mon. Myrist. (1897) 514. — *Myristica globosa* auct. non Warb.: J. Sinclair, Gard. Bull. Sing. 23 (1968) 378, p.p., as for the synonym *M. montanoides* only. — Type: *Beccari FI 7756*, NE Moluccas.

*Leaves* below early glabrescent, hairs dispersed, pale, less than 0.1 mm. *Male flowers*: buds 3(–4) mm long; thecae 10 or 12, androphore somewhat grooved corresponding to the anthers, glabrous or nearly so, with at base a few pale hairs less than 0.1 mm. — **Fig. 64k.**

Field-notes — Buttresses few, to 50 cm high and out. Bark of trunk fissured, not peeling off, or scaly; outer bark 0.3 mm thick, dark grey to light brown; inner bark 4 mm thick, pinkish; sap reddish; slash wood pink or pale yellowish tinged reddish, gradually passing into slightly darker heartwood, or heartwood absent. Flowers yellowish. Fruits orange, light brown, or pale brown, with abundant ochre or clear exudate.

Distribution — *Malesia*: NE Moluccas (Ternate, Obi, Bacan), Papua Barat (Bird's Head).

Habitat & Ecology — Primary and disturbed forest, hill ridge forest; loamy soil with stones; 50–600 m altitude; fl. Feb.; fr. Sept.–Nov.

Note — Resembles *M. tristis* from the same area, which differs in its larger and differently shaped male flowers and larger, almost globose fruits with thick pericarp.

**81. *Myristica leptophylla* W.J. de Wilde**

*Myristica leptophylla* W.J. de Wilde, *Blumea* 40 (1995) 299. — Type: LAE 67023 (Vinas), Papua New Guinea.

Tree 10–12 m. *Twigs* (1.5–)2.5 mm diameter, early glabrescent, hairs less than 0.1 mm; older twigs with few inconspicuous lenticels. *Leaves* membranous or (thinly) chartaceous, oblong-lanceolate, 14–20 by 3.5–5 cm, base short-attenuate or narrowly rounded, apex acute-acuminate; upper surface olivaceous-brown, lower surface grey-brown, early glabrescent, hairs less than 0.1 mm; not papillose; dots present (lens!); midrib raised above, lateral nerves 20(–25) per side, at 60–80° to the midrib, thin and sunken above, brown and contrasting in colour below, lines of interarching and venation inconspicuous; petiole 10–20 by 2–2.5 mm; leaf bud 10–12 by 2 mm, hairs less than 0.1 mm. *Inflorescences* (from incomplete female and fruiting specimens): of the *Knema*-type: a sessile or 2(–3) mm pedunculate, scar-covered brachyblast 2 mm long, with 2 or 3 flowers (according to their scars), minutely pubescent; bracts not seen. *Male inflorescences, male and female flowers* not seen. *Infructescence* below the leaves, sessile or with peduncle to 3 mm long. *Fruits* (somewhat immature) solitary, broadly fusiform, 4.5 by 2.5 cm, apex acute with 3 mm long beak formed by style-remnant, base ± narrowed into a 3 mm long pseudostalk, hairs dense, rust-coloured, scurfy, 0.1 mm; pericarp 3–4 mm thick; seeds not seen; fruiting pedicel 10–12 by 4(–5) mm, bright brown, finely fissured and with small contrasting lenticels, bracteole scar ± median.

Field-notes — Tree 10–12 m, bole 8 m, dbh 10–20 cm. Bark finely fissured, outer bark grey or brown, inner bark orange-straw, with red sap; wood straw or whitish brown, turning orange on exposure, or with red sap. Leaves glossy dark green above, light green below. Fruit with orange-brown scurf; aril of immature seeds with watery liquid.

Distribution — *Malesia*: Papua New Guinea (W Sepik Prov., Telefomin subprov., near Busilmin); known only from the type area.

Habitat & Ecology — Secondary regrowth of submontane forest; 1500 m altitude; fr. Mar.

Note — This species keys out beside *M. pachyphylla* to which it is similar and closely related. The two specimens now known of *M. leptophylla* differ in larger and thinner leaf blades, and in slightly larger fruits with stouter fruiting pedicel, sessile or on a short peduncle. *Myristica tamrauensis*, from Bird's Head, is similar too.

**82. *Myristica longepetiolata* W.J. de Wilde**

*Myristica longepetiolata* W.J. de Wilde, *Blumea* 42 (1997) 173. — Type: PNH 21548 (Sulit), Philippines, Biliran Is., northern slope of Mt Suiro.

Tree 17 m. *Twigs* 2–4 mm diameter, faintly angular, early glabrescent, hairs scattered, greyish, less than 0.1 mm; older twigs with scattered conspicuous lenticels. *Leaves* (thinly) chartaceous, (ellipsoid-)oblong, sometimes narrowed in the upper half, 10–15 by 2.5–6 cm, base cuneate, apex blunt to acute-acuminate; upper surface glossy, olivaceous or bright brown, lower surface grey-brown, glabrous; not or indistinctly papillose; dots absent; midrib flat or slightly raised above, lateral nerves (10–)12–15 per side, at 45(–60)° to the midrib, flat and faint above, lines of interarching indistinct, venation coarsely reticulate, not very distinct; petiole comparatively long, bright reddish or yellowish brown

(the same colour as the twigs), 20–35 by 1.5–2 mm; leaf bud 10 by 1.5–2 mm, hairs inconspicuous, appressed, greyish or brown, 0.1 mm or less. *Inflorescences* (known only from infructescences) subsessile, peduncle 1–2 mm long, one-fruited, with a few scars of abortive flowers. *Male* and *female flowers* not seen. *Fruits* subglobose or broadly (ovoid-)ellipsoid, 5–6 by 4–4.5 cm, hairs dense, dark rusty, 0.1(–0.2) mm; pericarp 10 mm thick; seeds ellipsoid, 3.5–4 cm; fruiting pedicel short (see note).

Field-notes — Tree, dbh 50 cm. Fruits large, brown.

Distribution — *Malesia*: Philippines (Luzon: Sorsogon and Camarines Prov.; Biliran).

Habitat & Ecology — Sloping forests; c. 800 m altitude; fr. Apr.–May, July–Aug., Dec.

Note — The subsessile infructescences with rather stout, short, 1–2 mm long peduncle suggest that male inflorescences may be (short) paniculate, with a more or less distinct peduncle, pointing to a relationship with *M. agusanensis*. The latter species differs in the minute indumentum on its lower leaf surface ( $\pm$  glabrescent), and in its smaller fruits.

### 83. *Myristica longipes* Warb.

*Myristica longipes* Warb., Mon. Myrist. (1897) 535; Markgr., Bot. Jahrb. Syst. 67 (1935) 163 (p. p., for the type only); J. Sinclair, Gard. Bull. Sing. 23 (1968) 343, f. 52C, D, F (p. p., for part of the specimens from Central Prov., PNG, only); Foreman, Handb. Fl. Papua New Guinea 1 (1978) 205, p. p.; W. J. de Wilde, Blumea 40 (1995) 300. — Type: *MacGregor s.n.* (B, lost), Papua New Guinea, Central Prov., Mt Yule. Neotype: *Forbes 647* (L, iso K), Papua New Guinea.

Tree 7–20 m. *Twigs* 1.5–2.5 mm diameter, somewhat angular, glabrescent, hairs 0.1–0.2 mm; older twigs with inconspicuous scattered lenticels. *Leaves*  $\pm$  membranous, elliptic-oblong, 9–17 by 4–6.5 cm, base narrowly rounded or cuneate, apex acute(-acuminate), upper surface dark brown, lower surface silvery-grey, early or late glabrescent, hairs sparse, scale-like, 0.1 mm or less; indistinctly papillose; dots absent; midrib slightly raised above, below chestnut-coloured, contrasting in colour, lateral nerves 10–15 per side, at 40–50° to the midrib, flat or sunken, indistinct above and below, lines of interarching and venation faint; petiole 10–20 by 2 mm, leaf bud 8–15 by 2 mm, hairs 0.1–0.2 mm. *Inflorescences* pedunculate, between the leaves or just below, with two short branches, and one central flower (or this abortive), flowers in small subumbels, hairs sparse, shaggy, 0.1 mm; bracts minute, pubescent, caducous; in male: peduncle 5–15 mm, lateral branches 15 mm with up to 2 mm long sterile basal part proceeding in a scar-covered slender brachyblast; flowers 2 or 3, buds of various sizes; female inflorescences: similar, peduncle 5–10 mm, few-flowered. *Male flowers*: pedicel 5–6 by 0.6–0.7 mm, bracteole caducous, minute; buds subcoriaceous, oblong-lanceolate, 10 by 3 mm, apex acute, base subacute, cleft c. 1/10, lobes 1 mm long, 0.7 mm thick. Androecium slender, 9–10 mm; androphore cylindrical, 4 by 0.7 mm, hairs sparse, less than 0.1 mm; synandrium 4 by 0.7–0.8 mm, thecae c. 14, sterile apex slenderly acute, 1.5 mm, glabrous. *Female flowers*: pedicel 14–15 mm, bracteole caducous, 4 mm below the apex; buds ovoid, apex acute, 5.5 by 3 mm, cleft c. 1/3; ovary 3.5 mm, minutely pubescent. *Infructescences*: peduncle  $\pm$  slender, 10–15 mm long. *Fruits* single, 4.5–6 by 2–2.5 cm, fusiform, apex acute, beaked by style-remnant, base narrowed into a 5–7 mm long pseudo-stalk, hairs dense, mealy, dark-brown, 0.1 mm; pericarp  $\pm$  woody, (3–)4–5 mm thick, the

suture distinctly sunken at one side; seeds (somewhat immature) elliptic-oblong, 3 cm; fruiting pedicel 15–17 by 2–3 mm, glabrescent, bracteole scar 5 mm below the apex. — Fig. 63g.

Field-notes — Bark smooth, mottled grey outside, inside straw turning brown on exposure. Leaves dark green glossy above, pale dull grey-green or glaucous below; dry leaves extremely brittle. Fruits rufescent orange, brown, or brownish ochre; seeds black.

Distribution — *Malesia*: Papua New Guinea (Central Prov., Sogeri & Kotaki region); possibly C Papua Barat (but see note 2); a locally endemic species.

Habitat & Ecology — Mixed hill rain forest, foothill forest; (300–)500–750 m altitude (but see note 2); fl. June; fr. June, Sept.

Notes — 1. *Myristica longipes* was described after a single fruiting collection, later on lost in Berlin. When revising the Papuasian *Myristicas* Markgraf (1936) added a few collections, but *Ledermann 9728*, on which he described the male flowers, was (is) considered by Sinclair and me to belong to a different species. *Myristica longipes*, moreover, contains in Sinclair's (1968) and Foreman's (1978) treatments many specimens which at present are transferred to various other species. The present species is now restricted to five collections and *Forbes 647* (with almost mature fruit) is herewith designated as neotype.

2. *Brass & Versteegh 12574* (Central Papua Barat, 1300 m altitude), with dark orange fruits, keys out to *M. longipes*. It is possible that it is a species of its own. The specimen differs from *M. longipes* (Papua New Guinea) in shorter and less slender fruiting pedicel, 10 by 4–5 mm, with the bracteole scar 4 mm below the apex; the fruit is comparatively slightly broader, 4–4.5 by 2 cm, with short and broad pseudostalk, but is somewhat immature. The collecting locality is far apart from that of *M. longipes*, and at a higher altitude. More (preferably male flowering) material from Papua Barat should elucidate its status. The specimen is also close to *M. laevifolia* and *M. vinkii*, both (generally) with sessile inflorescences.

#### 84. *Myristica lowiana* King

*Myristica lowiana* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 293, p.p., pl. 120 f. 2–4 (f. 1, 5–7 = *Myristica crassa*); Warb., Mon. Myrist. (1897) 496, p.p.; J. Sinclair, Gard. Bull. Sing. 16 (1958) 345, f. 23, pl. IV B; 23 (1968) 164; W.J. de Wilde, Blumea 42 (1997) 174; Tree Fl. Sabah & Sarawak 3 (2000) 465. — Lectotype (Sinclair 1958): *Scortechini 1851*, Peninsular Malaysia.

*Myristica hackenbergii* Diels, Bot. Jahrb. Syst. 60 (1926) 308. — Syntypes: *Hackenberg 86* (male), *86a* (female) (B, both lost), S Kalimantan.

Tree 7–25 m. Twigs 3–6 mm diameter, late glabrescent, hairs rough-woolly, rufous, 1–1.5 mm; older twigs blackish, cracking and flaking; lenticels indistinct or absent. Leaves coriaceous, oblong(-lanceolate), 14–35 by (3.5–)9–11.5 cm, base rounded or short-cuneate, apex acute-acuminate; upper surface glossy, olivaceous or brown, lower surface grey-brown, early glabrescent, hairs mealy, rust-coloured, 0.1–0.2 mm; distinctly papillose; dots absent; midrib raised above, glabrescent, lateral nerves 15–22 per side, at (45–)60–70° to the midrib, usually (not always, see note 1) sunken above, lines of inter-arching indistinct, venation sunken above, rendering the blade somewhat bullate; petiole 25–50 by 2.5–5 mm, late glabrescent; leaf bud 10–15 by 4–5 mm, hairs 1–1.5 mm. Inflorescences between the lower leaves or below, pedunculate, branched, with rough-

woolly hairs 1–1.5 mm; bracts 3–5 mm, late caducous; in male: 2.5–5.5 by 2–3 cm, peduncle (10–)15–30 mm, basal branches 5–10 mm long, central axis 5–25 mm, each branch with 1 or 2 (or 3) (sub)sessile brachyblasts, each with a subumbel of 5–10 flowers, buds of various sizes; in female: 1–1.5 cm long, hardly branched, rather thick, 3–5-flowered; flowers with hairs 0.5–1 mm long. *Male flowers*: pedicel 2–3(–5) by 1 mm, bracteole 3 mm diameter (apex sometimes subtruncate), late caducous; buds ellipsoid (–oblong), 4–4.5 by 3 mm, apex narrowly rounded, cleft 1/4(–1/3), lobes 0.3(–0.4) mm thick. Androecium (3–)3.5–4 mm long; androphore 1.5–2 by 0.8–1 mm, with dense hairs 0.5 mm in the lower 4/5; synandrium oblong, 2–2.2 by 0.8 mm, thecae 10–14, sometimes at apex loosely coalescent and proceeding into a (0.1–)0.2–0.3 mm long, lobed, sterile apex. *Female flowers*: pedicel short; buds ovoid, 5 by 4 mm, cleft c. 1/4; ovary rusty tomentose. Infructescence 1–1.5 cm. *Fruits* generally solitary, ellipsoid, (5–)6–7 by 3.5–4 cm, hairs velvety, 1–2.5 mm; pericarp (5–)10(–15) mm thick; seeds ellipsoid, 4–5 cm; fruiting pedicel rather thick, 2–5 mm long.

Field-notes — Usually with stilt-roots or with (flying) buttresses (to 4 ft tall); also in drier situations. Bark chocolate or blackish, hard, brittle, longitudinally fissured (or ridged), or scaly, 6 mm deep; outer bark blackish; inner bark slightly laminated, (pink or) brown; exudate watery, red; cambium white; sapwood white turning brownish. Flowers fragrant, cream, rusty tomentose on outside; once (*Lörzing 14260*) pink, fragrant like *Mimusops elengi*; perianth teeth at anthesis slightly reflexed. Fruits with brown furry indumentum; seeds glossy dark brown.

Distribution — *Malesia*: Sumatra (incl. Bangka), Peninsular Malaysia, Singapore, Borneo.

Habitat & Ecology — Fresh water peat swamp forest and kerangas; also riverine forest, *Dryobalanops rappa*-forest, ridge forest (on yellow soil) and undulating hills (on yellow sandy soils); 0–200(–800) m altitude; fl. & fr. throughout the year.

Notes — 1. Usually the nerves are clearly sunken above, but in some specimens from the East Coast of Sumatra, Bangka, and many from Borneo, (in older leaves) they may be raised above.

2. *Myristica lowiana* is related to *M. maingayi* which differs in less stout twigs, less coriaceous leaves, slightly larger flowers with less thickly pubescent androphore, and less thickly tomentose fruits; apparently *M. lowiana* is largely confined to forest on poorer soils, like swamp forest, kerangas, and ridge forest.

3. Variation mainly concerns the thickness of the indumentum of the fruits, especially in Borneo, where it may vary between 1 and 3 mm; in *S 16509* the hairs are dense and shaggy, 2–3 mm long. In Sumatran and Malayan specimens the hairs are shorter, 1–2 mm. *FRI 7734 (Cockburn)* from Peninsular Malaysia (G. Panti) deviates from other Malayan material by its stout habit, rather small fruits (6 cm) with very thick fur-like indumentum, hairs 3–4 mm long; possibly this specimen represents a separate variety.

## 85. *Myristica maingayi* Hook. f.

*Myristica maingayi* Hook. f., Fl. Brit. India 5 (1886) 104; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 294, pl. 114 (excl. *Curtis 2455*); Warb., Mon. Myrist. (1897) 398; J. Sinclair, Gard. Bull. Sing. 16 (1958) 348, f. 24, plate V B; 23 (1968) 166; W. J. de Wilde, Blumea 42 (1997) 175. — Type: *Maingay 1289*, Peninsular Malaysia.

Tree 10–40 m. *Twigs* (2–)2.5–4 mm diameter, (late) glabrescent, hairs rusty, woolly, 0.2–0.5 mm; older twigs blackish, longitudinally and transversely cracking, or coarsely flaking; lenticels inconspicuous. *Leaves* chartaceous or (thinly) coriaceous, elliptic-oblong or oblong-lanceolate (rarely linear-oblong), 12–28 by 4–8.5 cm, base rounded or short-attenuate, apex acute-acuminate; upper surface olivaceous-brown, glossy, lower surface grey-brown, early glabrescent, hairs 0.1–0.3 mm, often with hair scars; distinctly papillose; dots absent; midrib ± raised above; lateral nerves 13–20 per side, at 45–80° to the midrib, sunken, lines of interarching indistinct, venation sometimes visible; petiole 15–30 by 1.5–3 mm, glabrescent; leaf bud 8–15 by 2.5–4 mm, hairs shaggy or appressed 0.5–1(–1.5) mm. *Inflorescences* between the leaves or below, pedunculate, with hairs 1(–1.5) mm; in male: 1.5–2 by 1.5–2 cm, peduncle 5–12 mm long, branches to 4 mm, central axis absent or to 6 mm, simple (or bifid), apical subumbel(s) of 5–15(–20) flowers, buds of various sizes; bracts 4 mm, caducous; female inflorescences like the males, but shorter and stouter, 1–4-flowered; flowers with shaggy hairs 0.5–1 mm. *Male flowers*: pedicel 5–6(–9) mm, bracteole 4–5 mm, rounded, or truncate or faintly angular (3-topped), subsistent; buds ovoid-ellipsoid, 6–7 by 4.5–5 mm, cleft 1/5–1/4, lobes 0.3–0.4 mm thick. Androecium 5–5.5 mm; androphore 1.2–2 by 1–1.2 mm, hairs 0.5 mm in the lower 3/4; synandrium 2.8–3.5 by 1 mm, thecae 12–16, sterile apex ± acute, 0.5(–1) mm. *Female flowers*: pedicel 3 mm, bracteole 5 mm, caducous; buds ovoid (–ellipsoid), 6 by 4.5 mm, cleft c. 1/4; ovary 3.5(–4) by 3 mm, hairs 0.5 mm, stigma 0.5(–1) mm long. *Fruits* 1 or 2 per infructescence, broadly ovoid-ellipsoid, 7–9 by 5–6 cm (but see note 2), glabrescent, hairs rust-coloured, mealy, 0.5 mm; pericarp 15–20 mm thick; seeds ellipsoid, 4–5 cm; fruiting pedicel short, stout, 4–11 by 5–7 mm.

Field-notes — Bark much fissured longitudinally or with adherent scales, greyish or blackish, brittle; inner bark reddish; sap pink, watery, copious; wood white or reddish. Flowers rusty-tomentose, perianth inside (female) creamy-yellow. Fruits 10.5 by 6–6.5 cm, pale yellow with some reddish brown scurf, soon becoming entirely glabrous; aril scarlet; seeds 6 cm long, blackish brown, glossy, smooth.

Distribution — Thailand; *Malesia*: Peninsular Malaysia, Singapore; possibly Sumatra (see note 2).

Habitat & Ecology — Hillside forest (near river), ridge forest; sandstone ridge; altitude 0–700 m; fl. & fr. throughout the year.

Notes — 1. Related to *M. gigantea* and *M. lowiana* (series *Maingayae* of Sinclair, l.c.); for differences see the keys.

2. This species is variable especially in the size of the leaves. *FRI 17603* (Chan) and *KEP 77818* (Jabil), both from Peninsular Malaysia, differ from the rest of the material of *M. maingayi* in stouter twigs with coarsely striate older bark, neither cracking nor flaking, in slightly broader leaves, and mainly in the smaller fruits, 4.5–5 by 3.5 cm, with subsistent mealy light brown indumentum. Possibly these two specimens represent a separate taxon, but more fruiting and flowering material is needed to make a decision. *Krukoff 4384* (Sumatra, East Coast) differs in its smaller fruits, 6.5 by 4 cm, with a spongy-woody pericarp, so that it did not dry coarsely wrinkled as in the Malaysian specimens. It is the only collection of *M. maingayi* known from Sumatra. This specimen was also discussed separately by Sinclair (1968: 166).

**86. *Myristica malaccensis* Hook. f.**

*Myristica malaccensis* Hook. f., Fl. Brit. India 5 (1886) 104; W. J. de Wilde, Blumea 42 (1997) 177;

Tree Fl. Sabah & Sarawak 3 (2000) 466. — Type: *Maingay 1305*, Peninsular Malaysia.

For more references see under the subspecies.

Tree 7–35 m. Twigs 2–4 mm diameter, ± angular, early glabrescent, hairs less than 0.1 mm; older twigs often blackish, longitudinally cracking and moderately flaking; lenticels absent. *Leaves* thinly chartaceous, (elliptic-)oblong, sometimes contracted below the middle, 10–30 by 4–10 cm, base rounded or cuneate, apex acute-acuminate; upper surface olivaceous-brown, lower surface greyish brown, early glabrescent; papillation either not obvious or distinct (subsp. *papillosa*); dots absent; midrib raised above, lateral nerves 14–20 per side, at 60–80° to the midrib, flat or sunken above, contrasting below, lines of interarching and venation distinct; petiole 12–24 by 2–3 mm, leaf bud 7–12 by 1.5–3 mm, hairs 0.1 mm or less. *Inflorescences* between the leaves or below, early glabrescent, hairs less than 0.1 mm; in male: narrowly paniculate, many-flowered, 7–10 by 3–4 cm, peduncle 20–30 mm, basal branches 10–20 mm, ± branched, central axis with up to 13 side branches 10 mm long or less, subumbels of 5–15 flowers, buds of various sizes; bracts 2–3 mm, caducous; female inflorescences smaller than male, 1.5–2.5 cm long; flowers early glabrescent, hairs 0.1 mm or less. *Male flowers*: pedicel 3–5 mm, bracteole 1.5 mm, subcircular, glabrescent, margin ciliate, caducous or persistent; buds (subglobose-)ovoid, 3–3.5 by 2–3(–3.5) mm, cleft 1/4–1/3, lobes 0.3 mm thick. Androecium 1.5(–2) by 0.8(–1) mm, consisting almost entirely of the synandrium; androphore 0.2–0.5 mm long, glabrous; thecae 12–16, anthers 1.5 mm long, with free apices 0.1–0.2 mm, sterile apex absent or apex of synandrium shallowly hollowed. *Female flowers*: pedicel 2 mm long, bracteole (1–)1.5 mm, margin ciliate, persistent; buds broadly ellipsoid, 2–2.5 by 1.5 mm, cleft 1/4–1/3; ovary conical-ovoid, 1.3 by 1 mm, almost glabrous. Infructescence 1–2 cm long, with few flower scars, 1- or 2-fruited. *Fruits* ellipsoid-oblong, 4–6 by 2.5–4 cm, glabrous, but with minute indumentum in grooves near the fruiting pedicel; pericarp 5–10 mm thick; seeds 3.5–4.5 cm; fruiting pedicel 5–8 mm long.

Field-notes — Tree with buttresses 1–3 m high. Bark smooth, greenish grey to dark brown, with narrow furrows, or with narrow square sections, fissures and ridges with small flat adherent scales; outer bark thin, soft; inner bark pale yellow, soft; exudate clear, watery, faintly red, slow to appear; sapwood white or brown. Flowers yellowish. Fruits ellipsoid or oblong and slightly tapered, large, pale green, yellow-cream, or pink.

Distribution — *Malesia*: Sumatra, Peninsular Malaysia, Borneo.

Habitat & Ecology — Primary forest on hillsides; also disturbed forest; stony soil, undulating land near stream with rich clay soil; 0–700 m altitude; fl. June; fr. Nov.–Mar.

Note — After flowering, the female perianth breaks off, leaving a singular, persistent, small disc-like collar around the base of the young fruit.

## KEY TO THE SUBSPECIES

- 1a. Lower leaf surface distinctly and regularly fine-papillose (lens!). — Sarawak . . . . .  
 . . . . . **b. subsp. *papillosa***  
 b. Lower leaf surface not, or very irregularly and faintly papillose. — Sumatra, Penin-  
 sular Malaysia, Borneo . . . . . **a. subsp. *malaccensis***

**a. subsp. malaccensis**

*Myristica malaccensis* Hook. f., Fl. Brit. India 5 (1886) 104; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 287, pl. 107 bis; Warb., Mon. Myrist. (1897) 411; J. Sinclair, Gard. Bull. Sing. 16 (1958) 356, f. 27; 23 (1968) 184, p.p., excl. most of Borneo [non *Myristica malaccensis* Gand. (1919) = *Ardisia teijsmanniana* Scheff.]; W. J. de Wilde, Blumea 42 (1997) 177; Tree Fl. Sabah & Sarawak 3 (2000) 467.

*Myristica pandurifolia* H. J. P. Winkler, Bot. Jahrb. Syst. 49 (1913) 367; Merr., Enum. Born. (1921) 269. — Type: *Winkler 2405*, Kalimantan.

Leaf blades large or small; venation faint or distinct; lower surface not or very irregularly and faintly papillose.

Distribution — *Malesia*: Sumatra, Peninsular Malaysia, Borneo

**b. subsp. papillosa** W. J. de Wilde

*Myristica malaccensis* Hook. f. subsp. *papillosa* W. J. de Wilde, Blumea 42 (1997) 177; Tree Fl. Sabah & Sarawak 3 (2000) 467. — Type: *S 36528 (Ilias Paie)*, Sarawak.

Leaf blades comparatively large, 15–28 by 7–10 cm, veins strongly reticulate; lower surface distinctly and regularly fine-papillose (lens!).

Distribution — *Malesia*: Borneo (Sarawak).

Note — The presence of papillae on the lower leaf surface is an important taxonomic character in *Myristica*. Specimens of subsp. *papillosa* are generally stouter than those of subsp. *malaccensis*. Possibly the male flowers are identical in both subspecies. To judge the definite status of subspecies *papillosa* more material (with fruits), is needed.

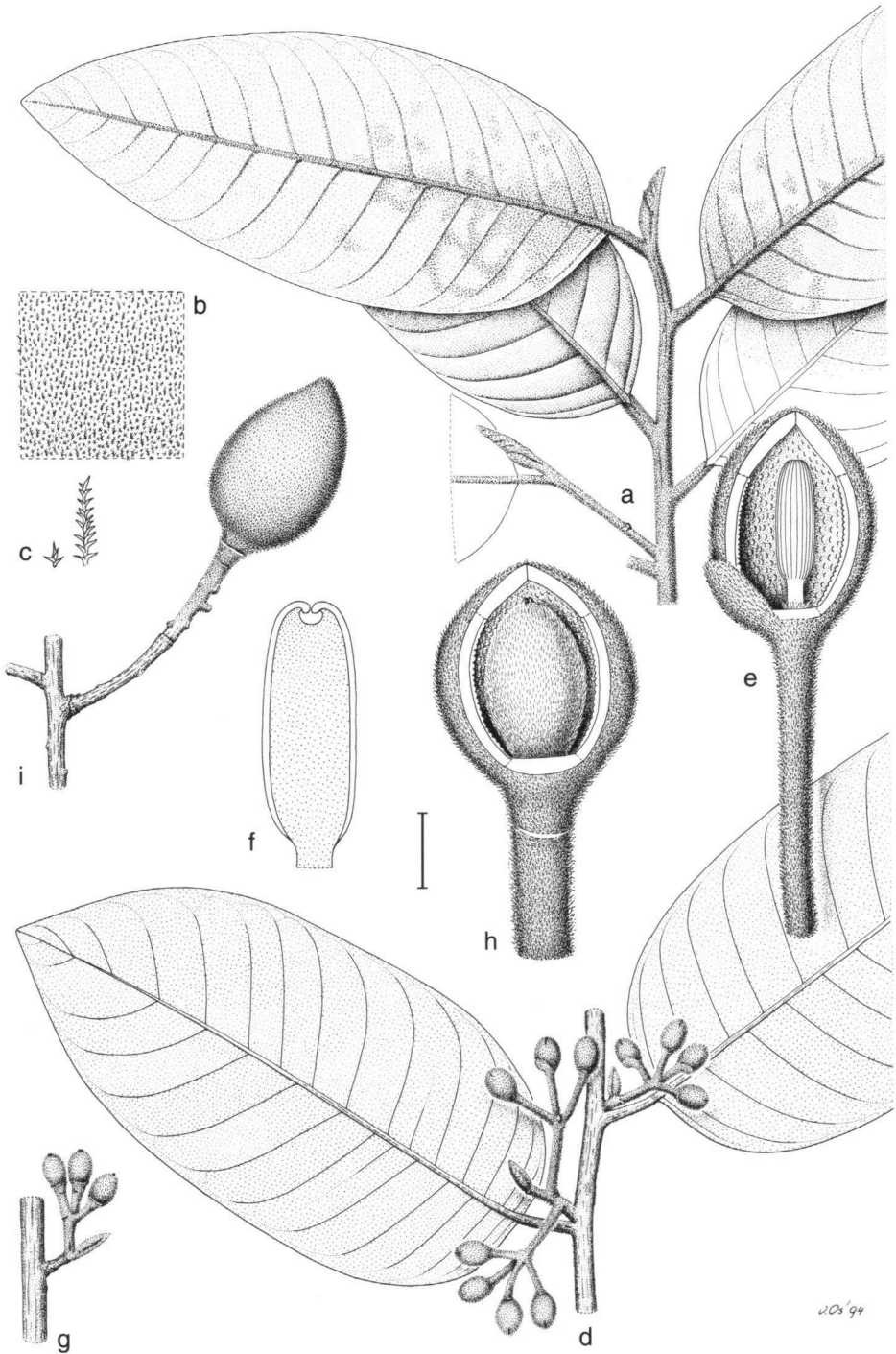
**87. Myristica markgraviana** A. C. Sm.

*Myristica markgraviana* A. C. Sm., J. Arnold Arbor. 22 (1941) 66; J. Sinclair, Gard. Bull. Sing. 23 (1968) 221, f. 18; W. J. de Wilde, Blumea 40 (1995) 300, f. 4. — Type: *Clemens 1142*, Papua New Guinea.

*Myristica philippensis* auct. non Lam.: Markgr., Bot. Jahrb. Syst. 67 (1935) 158 (based on *Schlechter 16789*).

Tree 5–30 m. *Twigs* 1.5–3(–5) mm diameter, faintly triangular, ± late glabrescent, hairs rusty to blackish brown, mealy, 0.5–1 mm; older twigs sometimes flaking; lenticels absent. *Leaves* membranous or chartaceous, (elliptic-)oblong, 8–23 by 3–10 cm, base attenuate or (broadly) rounded, apex acute-acuminate (or ± blunt); upper surface greenish or (dark) brown, lower surface grey, late glabrescent or hairs (sub)persistent, dense, interwoven, brown or grey, stellate, 0.1–0.2 mm, mixed with scattered brown dendroid hairs 0.5(–0.7) mm rendering the surface with a powdery appearance; not papillose; dots absent; midrib flat, glabrescent above, lateral nerves (6–)10–15 per side, at c. 60° to the midrib, sunken below, lines of interarching ± distinct, venation faint or invisible; petiole 10–22 by 2–3 mm; leaf bud 6–16 by 2–5 mm, hairs shaggy, 0.5–1 mm. *Inflorescences* with rust-coloured hairs 1 mm, pedunculate, in male 1–7, each axillary to caducous cataphylls along short-shoots 1–5 cm long, in female fewer; short-shoots to 1 cm long and ending in a reduced leaf bud, axillary to foliage leaves; bracts 3–4 mm, caducous; male: peduncle 8–20 mm, with (sub)opposite wart-like lateral branches, each with a fascicle of 1–3 flowers, and with or without an apical central flower, buds ± equal in





size; in female: smaller, peduncle 5–10 mm, apically 1–3-flowered; flowers easily disarticulating, with shaggy hairs 0.5–1.5 mm. *Male flowers*: pedicel 7–12 mm long, bracteole subcircular to broadly ovate, 3–4 mm; buds ellipsoid or obovoid, inside towards base verrucose, 7–9 by 5–8 mm, not collapsing on drying, cleft 1/5–1/3, lobes 0.5 mm thick. Androecium (3–)4–5 mm; synandrium 3–4.5 by 1–1.5(–2) mm, at apex shallowly hollowed to 0.5 mm, thecae (14–)20–26, at apex incurved, at base contracted into slender androphore, 0.5–1 mm, glabrous, but usually with frill of dense hairs 0.5–1 mm at the bottom of the perianth. *Female flowers*: pedicel thickened towards apex, 6–10 mm long, bracteole caducous, 1–4 mm below apex; buds ovoid, 7 by 7 mm; ovary ovoid, 4 mm long, with lanose hairs 2(–3) mm; style including stigmas 1.5–2 mm, lobes shallowly lobulate. *Fruits* 1(–3) per (partial) infructescence, subglobose or ellipsoid, apex usually  $\pm$  hooked, 3–5.5 by 2.5–3 cm, hairs dense, shaggy, (red-)brown, (0.5–)1–1.5(–3) mm; pericarp 4–9 mm thick; seeds ellipsoid, 2 cm; fruiting pedicel 6–12 mm long. — **Fig. 79.**

**Field-notes** — Medium-sized understory tree; bole straight, when old fluted to 2 m or with small buttresses up to 1 by 0.3 m; branches nearly horizontal. Bark 6 mm thick, dark grey brown, smooth or usually longitudinally fissured or with longitudinal cracks, when old flaking in nearly rectangular strips; inner bark concentrically layered, red-brown or brown; exudate watery or thickish, pink to red (also in the wood); blaze (sapwood) white or straw, cream, or pinkish; heartwood pink. Twig apices, young leaves and flower buds golden-brown hairy. Leaves below silvery or ashy, with brown scattered hairs emerging from paler dense layer of scale-like hairs. Immature aril white.

**Distribution** — *Malesia*: Papua New Guinea (Eastern, Milne Bay, Morobe, Madang, Northern Provinces).

**Habitat & Ecology** — Lowland and submontane rain forest, (oak) forest on ridges; clay soil (once recorded); to c. 950 m altitude; fl. mainly June–Dec.; fr. Jan., Mar.–June.

**Note** — The inner surface of the tubular part of the male perianth is conspicuously verrucose, i. e., with (densely set) irregular wart-like appendages, irregularly scattered or sometimes arranged in  $\pm$  horizontal structures, the warts 0.2–0.4 mm high, possibly purplish or reddish when fresh; inner surface of the perianth lobes completely glabrous.

## 88. *Myristica maxima* Warb.

*Myristica maxima* Warb., Mon. Myrist. (1897) 385; J. Sinclair, Gard. Bull. Sing. 16 (1958) 339, f. 20, 21, pl. III–IV A; 23 (1968) 131; W. J. de Wilde, Blumea 42 (1997) 178; Tree Fl. Sabah & Sarawak 3 (2000) 467. — Lectotype: *King's coll. 5513*, Peninsular Malaysia.

*Myristica bracteata* auct. non A. DC.: King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 286, pl. 107 (excl. pl. 106 = *Myristica philippensis* Lam.).

**Fig. 79.** *Myristica markgraviana* A. C. Sm. a. Apical part of leafy twig; b. detail of indumentum of lower leaf surface; c. short and long dendroid hair of indumentum of lower leaf surface; d. twig with male inflorescences arranged along axillary short-shoots each ending in a vegetative bud; e. male bud, opened, showing androecium; note finely warty inner surface of perianth; f. androecium in section, schematic; note shallowly impressed apex; g. part of twig with lateral short-shoot with one female inflorescence; h. female bud, opened, showing pistil; note bracteole scar, perianth minutely warty-bullate inside; i. older twig with one-fruited infructescence at the end of lateral short-shoot [a–c: *NGF 46566*; d–f: *NGF 14828*; g, h: *Saunders 426*; i: *NGF 45898*]. — Scale bar for a, d, g, i = 2 cm; for b = 0.83 mm; for c = 0.2 mm; for e, h = 3.3 mm; for f = 1.65 mm.

Tree 15–35 m. *Twigs* (4–)5–8 mm diameter, early glabrescent, indumentum minute; older twigs becoming rough and scaly, not longitudinally cracking; lenticels often present but indistinct. *Leaves* membranous, chartaceous or (thinly) coriaceous, elliptic or oblong-lanceolate, 16–40 by (6–)10–20 cm, base rounded or shallowly cordate, sometimes attenuate, apex acute-acuminate; upper surface (blackish) brown, sometimes bullate, lower surface (brownish) grey, seemingly glabrous, but actually minutely pubescent, or glabrescent, hairs interwoven or sparse, grey-brown, scale-like, 0.1(–0.2) mm or less; usually papillose; dots absent; midrib flat or raised above, lateral nerves 23–33 per side, at 60–70° to the midrib, flat or impressed above, lines of interarching and venation distinct (or indistinct) on both surfaces; petiole 25–35 by 2.5–4 mm; leaf bud 15–20 by (3–)4–5 mm, hairs 0.1 mm or less. *Inflorescences* usually between the leaves, subglabrescent, indumentum minute, grey-villous, essentially paniculate, stout, the peduncle distinctly flattened, sometimes lenticellate; in male: 6–12(–18) by 3–8 cm, peduncle 20–45 by 4–6 mm; lower branches up to 3 cm, central axis 4–8 cm long, with up to 6 side branches, subumbels shortly stalked or sessile, each with 5–10 flowers, buds of various sizes; bracts caducous; female inflorescences smaller, 5–9 cm long, subumbels 1–5-flowered; flowers coriaceous, thinly with brown-grey hairs less than 0.1 mm. *Male flowers*: pedicel 3–10 mm long, bracteole broadly reniform, angular, or 2- to 3-topped, subumbels 1.5–2 mm, with ciliate margin, persistent; buds (ovoid-)ellipsoid, 5–7 by 4–5 mm, cleft c. 1/2 or slightly over, lobes 0.7 mm thick. Androecium 3–4.5(–5) mm; androphore 0.5–0.8(–1) by 0.8–1 mm, finely pubescent in the lower half; synandrium ± cylindrical, 2–2.5 by 1–1.2 mm, thecae 16–24, sterile apex ± blunt, 0.3–0.5 mm. *Female flowers*: pedicel stout, 1–3(–4) mm long, bracteole broadly rounded, 2(–3) mm, persistent; buds ovoid, 5–7 by 4–6 mm, cleft 1/3 to halfway; ovary ovoid, 3–4 mm, hairs appressed, 0.2–0.4 mm, stigma lobes (0.5–)1 mm long. *Fruits* 1–4 per infructescence, ellipsoid-oblong, (4.5–)6–9 by 3.5–5 cm, base sometimes narrowed, hairs mealy, dark brown, 0.1 mm or less, sometimes late glabrescent; pericarp 10–15 mm thick; seeds ellipsoid-oblong, (4–)4.5–6 cm, aril in lower 1/4 sometimes undivided; fruiting pedicel stout, 3–10 mm long. — **Fig. 60a, b, 62c.**

**Field-notes** — Large tree, with or without buttresses, sometimes with stilt-roots or with stilt-roots and buttresses; buttresses variable, up to 3 m out and high, ± narrow; crown deep and dense, pyramidal in outline, with numerous horizontal and descending branches; twigs deep green. Bark smooth or rather rough, hard, shallowly scaly, dippled, or shallowly fissured, grey-brown or chocolate; living bark 10–20 mm, usually reddish brown, laminated, soft, with clear light to dark red exudate, copious or not; cambium whitish; sapwood pale brown to whitish, also with red exudate; heartwood brown. Leaves glossy dark green above, glaucous-grey or whitish below; Sinclair (l.c.: 133) measured in a cultivated female tree leaves up to 54 cm long. Flowers (pale) yellow, in male pale flesh-coloured (once), male may reach 8 mm, female 8–9 mm, ovary 5 mm long, fragrant or not. Fruits 9 cm long, (yellow-)brown or rusty brown; aril first yellow, then red.

**Distribution** — S Peninsular Thailand; *Malesia*: Sumatra, Peninsular Malaysia, Singapore, whole of Borneo.

**Habitat & Ecology** — Primary forest; seasonal swamp forest, forest along rocky *Saraca* streams (granite rock); ridges; sandy loam, yellow clay loam, sandy and black soils, shales, loam soil containing limestone, volcanic rock; 0–700 m altitude; fl. & fr. throughout the year.

Note — Herbarium specimens generally have a markedly dark drying colour. The leaves seem glabrous below but actually have a very minute indumentum of  $\pm$  scattered very small scale-like grey or pale brown hairs, glabrescent or not.

### 89. *Myristica mediovibex* W. J. de Wilde

*Myristica mediovibex* W. J. de Wilde, *Blumea* 40 (1995) 301. — Type: *Brass & Versteegh 13573*, Irian Jaya.

Tree 18–30 m. *Twigs* 1.5–3 mm diameter, somewhat angular, late glabrescent, hairs shaggy, up to 0.5 mm long; older twigs sometimes blistering or flaking; lenticels small, many or few. *Leaves* chartaceous, elliptic-oblong or oblong-lanceolate, (7–)9–17 by 2.5–7.5 cm, base rounded or attenuate, apex acute-acuminate; upper surface dark brown, lower surface brown-greyish, indumentum persistent (or late glabrescent), hairs mealy, stellate scale-like, 0.2 mm or less; not papillose; dots absent; midrib raised above, lateral nerves 13–17 per side, at c. 60° to the midrib, flat or sunken above, little raised below, lines of interarching and venation not distinct; petiole 12–15 by 2–3 mm; leaf bud 8–18 by 1.5–3 mm, hairs rufous, 1–1.5 mm long,  $\pm$  erect or appressed, brownish grey, 0.1 mm (var. *kosteriana*) or longer. *Inflorescences* pedunculate, between the leaves or just below, hairs 0.1–0.2 mm, male not seen; in female: peduncle 4–8 by 2 mm (to 4 mm wide in infructescences), ending in 1 or 2 knob-like scar-covered brachyblasts 2 mm long, each with 1–3 flowers, buds of slightly various sizes; bracts small, pubescent, caducous; flowers subcoriaceous, with shaggy hairs of mixed sizes, (0.1–)0.2–0.3 mm. *Male flowers* not seen. *Female flowers* (slightly immature): pedicel 7–8 by 1.5–2 mm, broadening distally and  $\pm$  gradually passing into the perianth; bracteole 1 mm or less, caducous, scar nearly ring-shaped,  $\pm$  median; buds subellipsoid, broadest below the middle, 4–4.5 by 2.5(–3) mm, cleft c. 1/6, lobes 0.5(–1) mm long, 0.5 mm thick; ovary ovoid-oblong, 3.5 by 1.5 mm, hairs 1–1.5 mm long. *Fruits* solitary or 2 or 3, ellipsoid-oblong, (2.5–)4 by 2 cm, apex  $\pm$  acute, base contracted into a rather stout pseudostalk or not, hairs dense, mealy, brown, 0.1(–1) mm; pericarp  $\pm$  woody, 4 mm thick; seeds ellipsoid-oblong, 2.2 cm (var. *mediovibex*); stipe (peduncle and fruiting pedicel)  $\pm$  stout, 1.5 cm long, nearly 5 mm wide at base, striate,  $\pm$  lenticellate, bracteole scar slender, ring-shaped, 5 mm below the fruit.

Distribution — *Malesia*: northern Papua Barat, locally with two varieties.

Note — The almost ring-shaped bracteole scar at about halfway female pedicel and fruiting pedicel is characteristic.

#### KEY TO THE VARIETIES

- 1a. Leaves below  $\pm$  late glabrescent . . . . . **a. var. *mediovibex***  
 b. Leaves below with persistent indumentum . . . . . **b. var. *kosteriana***

#### **a. var. *mediovibex***

Tree 20–27 m. *Leaves* below  $\pm$  late glabrescent; leaf bud with hairs up to 0.5 mm long. *Fruits* 4 by 2 cm, apex acute and narrowly, 1.5 mm beaked, basal part contracted into a rather stout pseudostalk 5 mm long; indumentum short, with the strong conspicuous hairs as found on the ovary remaining on the apex and the base (pseudostalk).

Field-notes — Medium-sized tree, dbh of bole c. 58 cm; buttresses to 1 m high, 20 cm out, 3 cm thick, or not buttressed. Bark 14 mm thick, black, scaly, or not peeling or fissured; exudate little, light red; slash dark red; wood red-brown; sapwood white. Fruits (green-)brown.

Distribution — *Malesia*: Papua Barat (Idenburg River; Japen I.).

Habitat & Ecology — Locally frequent in primary forest on sandy soil; forest on ridges; 130–550 m altitude; fl. & fr. Apr., Sept.–Oct.

Note — May be confounded with *M. longipes*, a local endemic of SE Papua New Guinea, differing in short-haired indumentum of the leaf bud. *Myristica mediovibex* var. *mediovibex* is characterized by long-haired leaf bud, conspicuous short-felty subpersistent indumentum on the lower leaf surface, coriaceous (female) flowers and hard, woody fruits.

**b. var. kosteriana** W. J. de Wilde

*Myristica mediovibex* W. J. de Wilde var. *kosteriana* W. J. de Wilde, *Blumea* 40 (1995) 303. — Type: BW 8084 (*Ch. Koster*), Irian Jaya.

Tree 18 m. *Leaves* below with persistent indumentum; leaf bud with hairs 0.1 mm or less. *Fruits* (somewhat immature) ± ovoid, 2.5 by 2 cm, apex ± blunt, base without pseudostalk, hairs at base shorter than in the typical variety.

Field-notes — Small to medium-sized tree, bole 15 m, dbh 45 cm, buttresses up to 1.5 m high, 1 m wide, thick 10 cm. Outer bark dark brown, not fissured, faintly peeling with large scales; inner bark with much scarlet milky exudate, brown within; slash dark brown; heartwood dark brown. Young fruits brown.

Distribution — *Malesia*: Papua Barat (Jayapura, 60 km SE of Sarmi, Bodem River), Papua New Guinea (E Sepik).

Habitat & Ecology — Locally common in primary forest on clayey soil; 70–200 m altitude; fr. Feb.

**90. *Myristica mediterranea*** W. J. de Wilde

*Myristica mediterranea* W. J. de Wilde, *Blumea* 40 (1995) 304. — Type: Soegeng Reksodihardjo 328, SW Irian Jaya.

Tree 5–8 m. *Twigs* (1.5–)2–3 mm diameter, early glabrescent, hairs grey-brown, scale-like, less than 0.1 mm; older twigs corky, dark grey-brown, with longitudinal and transverse cracks, but not much flaking; lenticels inconspicuous. *Leaves* membranous, (elliptic-)oblong, 9–18(–20) by 2.5–6(–7) cm, base attenuate, apex acute-acuminate; upper surface (blackish) brown, lower surface conspicuously pale, greyish, sometimes with a yellow-brown discoloration, early glabrescent, indumentum minute; papillae present, dense, but inconspicuous, unequal in size and irregularly spaced; dots absent; midrib raised above, lateral nerves 13–20 per side, at c. 60° to the midrib, flat and faint above and below, lines of interarching and venation indistinct; petiole short, 5–10 by 1.5–3 mm; leaf bud 5–10 by 1.5–2 mm, hairs grey-brown, less than 0.1 mm. *Inflorescences* (from female inflorescences and infructescences): short-pubescent, between the leaves, of the *Knema*-type: sessile, tubercle-like brachyblast, 1–1.5 mm, 1–3-flowered; flowers with dark brown hairs 0.1(–0.2) mm. *Male flowers* not seen. *Female flowers* (somewhat

immature): pedicel 1.5 by 1 mm, bracteole broadly rounded, 1 mm, (sub)apical, (sub)-persistent; buds membranous, ovoid(-oblong), 3 by 1.8–2 mm, lobes 0.8 mm; ovary ovoid, (including stigma) 2 by 1.5 mm, hairs less than 0.1 mm. *Fruits* single (or paired), ellipsoid-oblong, 2.2–2.5 by 1–1.4 cm, apex short-acute, somewhat oblique, base (narrowly) rounded, hairs dense, mealy (scurfy), rust-coloured, less than 0.1 mm; pericarp 1 mm thick; seeds ellipsoid-oblong, 2 cm; fruiting pedicel short, striate, 1.5–2 by 2 mm.

Field-notes — Small tree, dbh c. 5 cm; branches horizontal, verticillate. Bark smooth, dark brown; inner bark aromatic. Leaves very pale green below. Fruits orange(-brown).

Distribution — *Malesia*: New Guinea; known only from three collections from the southern border area between Papua Barat and Papua New Guinea, at Ingambit.

Habitat & Ecology — Disturbed forest on flat well-drained land, valley forest with semi-swamp near Sagu patches; c. 150 m altitude; fl. & fr. June, July.

Notes — 1. *Myristica mediterranea* is characterized by the corky, deeply fissured bark of the older twigs, the membranous leaves with very pale, whitish lower surface, and the ellipsoid-oblong, short-stiped fruits.

2. *Myristica mediterranea* seems close to *M. lancifolia*, a species also with rather closely set, faint, lateral nerves. *Myristica lancifolia* has smaller fruits, and the lower leaf surface is more distinctly and regularly papillose, with the papillae equal in size.

## 91. *Myristica millepunctata* W.J. de Wilde

*Myristica millepunctata* W.J. de Wilde, *Blumea* 40 (1995) 305, f. 5. — Type: *Soengeng Reksodihardjo* 545, E Irian Jaya.

Tree 30–40 m. *Twigs* sometimes subangular, (4–)5–7 mm diameter, early glabrescent, hairs 0.1 mm or less; older twigs somewhat cracking, coarsely lenticellate. *Leaves* (thinly) coriaceous (but brittle), (oblong-)lanceolate, 25–40 by 7–11 cm, base short-cuneate or narrowly rounded, apex acute(-acuminate); upper surface olivaceous or blackish brown, finely wrinkled, lower surface pale, grey-brown, late glabrescent, hairs dense, greyish, scale-like, less than 0.1 mm; not papillose; dots present; midrib raised above, lateral nerves 28–40 per side, at 70–80° to the midrib, usually interspaced by intersecondary nerves, lines of interarching and venation indistinct or invisible; petiole 25–40 by 4–7 mm; leaf bud 20–25 by 4–5 mm, the hairs 0.1 mm or less. *Inflorescences* incompletely known (from infructescences): peduncle short; *male* and *female flowers* not seen. Infructescence below the leaves, short, ± woody, nearly 1 cm long, peduncle 5 by 8 mm, cracked and lenticellate, and with some old flower scars at apex. *Fruits* solitary, rather stout, broadly ovoid or subglobose, 5.5–6 by 4.5–5 cm, shortly narrowed at apex and base, hairs fine, brown, mealy, 0.1 mm; pericarp hard, woody, 10–12 mm thick, outer layer with scattered stone-cell-like concretions visible on section; seeds broadly ovoid-ellipsoid, 2 cm; fruiting pedicel not discernible. — **Fig. 80.**

Field-notes — Tree with narrow crown. Bark fissured, 2 mm thick, dark brown; inner (live) bark 15 mm, light brown or pinkish; wood pinkish straw; exudate red, sticky. Leaves dull green above, pale bronze-green or glaucous below. Fruits brown.

Distribution — *Malesia*: central part of New Guinea (E Papua Barat, in the head-water area of Ok Denim River and Oksibul River).

Habitat & Ecology — Montane and ridge forest; 1400–1600 m altitude; fr. June.

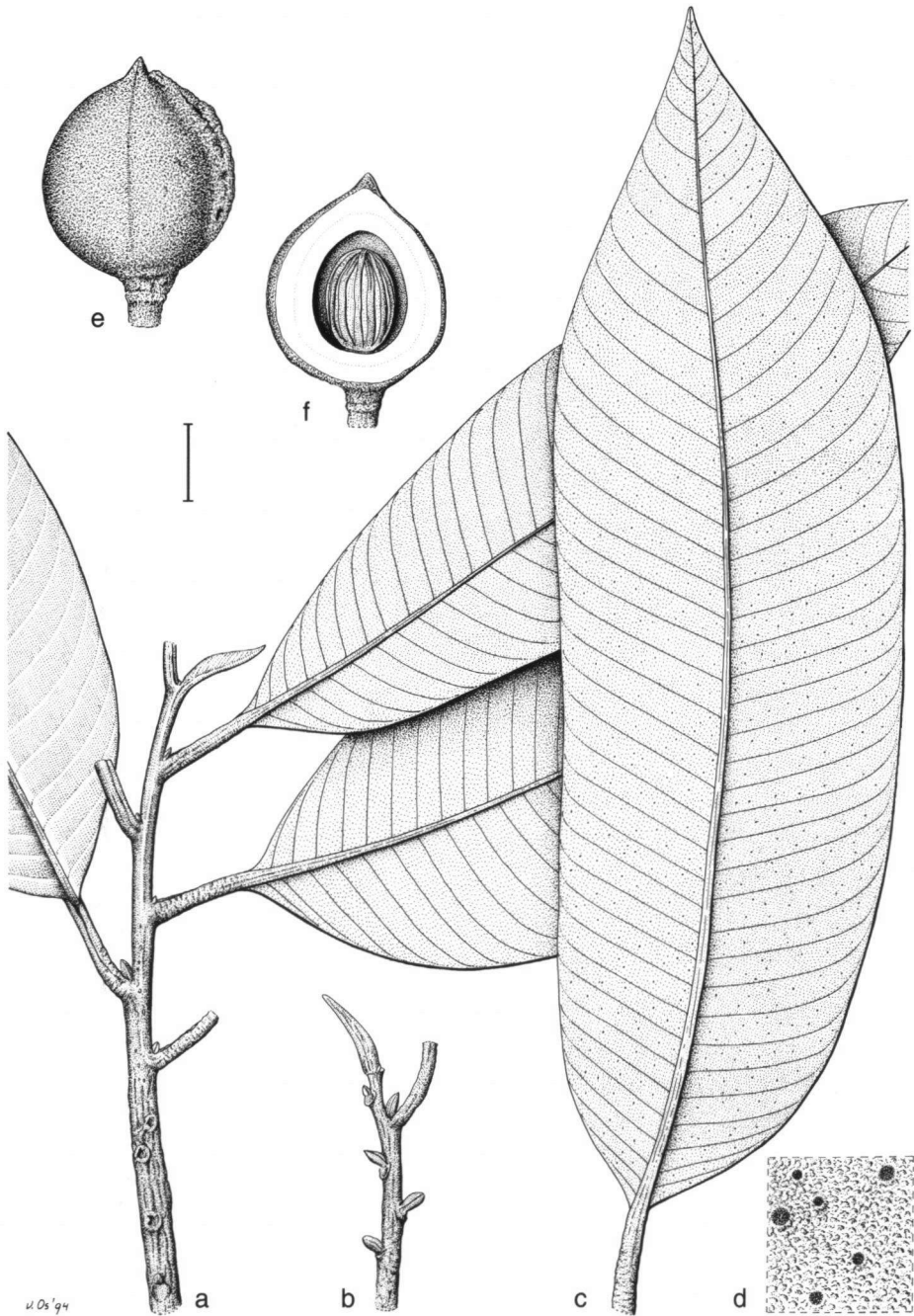


Fig. 80. *Myristica millepunctata* W.J. de Wilde. a & b. Leafy twig and part of apex with sterile terminal leaf buds and axillary buds; c. leaf seen from below; d. detail of lower leaf surface with scattered dots; e & f. fruit from outside and longitudinally opened [all *NGF 33212*]. — Scale bar for a–c, e, f = 2 cm; for d = 0.4 mm.

Note — Related to *M. neglecta*. Mature fruits of *M. neglecta* are not known, the immature fruit closely resembles that of *M. millepunctata*. Differences are found in the appearance of the dried leaves and the quite different habitat, *M. neglecta* being a species of lowland areas in Bird's Head.

## 92. *Myristica mindanaensis* Warb.

*Myristica mindanaensis* Warb., Mon. Myrist. (1897) 497, t. 13; W.J. de Wilde, Blumea 35 (1990) 249, f. 1: 9; 42 (1997) 178. — Type: Warburg 13300, Mindanao.

*Myristica fatua* Houtt. var. *morotaiensis* J. Sinclair, Gard. Bull. Sing. 23 (1968) 292, f. 36A. — Type: Kostermans 771, Morotai.

Tree 10–20 m. Twigs angular and 2-ridged, 2–2.5(–3) mm diameter, early glabrescent, hairs less than 0.1 mm; older twigs sometimes faintly cracking; lenticels scattered. Leaves membranous or chartaceous, (obovate-)elliptic or oblong-lanceolate, 14–35 by 6.5–16 cm, base narrowly rounded or cuneate, apex acute-acuminate; upper surface olivaceous or brown, lower surface greyish, glabrescent, hairs scattered or touching, scale-like, 0.1 mm or less, but leaving the surface visible; distinctly papillose or not; dots absent; midrib slightly raised above, lateral nerves 17–27 per side, at 45–70° to the midrib, flat or sunken, lines of interarching and venation visible; petiole 15–25 by 2–4 mm; leaf bud 10–16 by 2–3 mm, hairs 0.1 mm. Inflorescences between the leaves or below, of the *Knema*-type: sessile, simple or forked, woody, tubercle-like scar-covered brachyblast up to 12 mm long, minutely pubescent; in male: with 6–20 flowers in subumbels, buds unequal in size; in female: smaller, with 1 or 2(–4) flowers; flowers with hairs 0.2–0.3 mm long. Male flowers: pedicel 4–6 mm long, bracteole ± acute, 2.5–3.5 mm, subpersistent; buds ovoid(-oblong), apex subacute, 5–5.5 by 3–4 mm, cleft c. 1/4 to nearly halfway (see note 2), lobes 0.2–0.3 mm thick. Androecium 4–4.5 mm; androphore 1(–1.5) mm, glabrous or with few minute hairs towards base; synandrium 2.5 by 0.6–0.7 mm, thecae 12–14, sterile apex 0.2(–0.3) mm, irregular in shape, rather blunt. Female flowers (*Binnendijk s.n.*, Buru): pedicel 1–1.5 mm long, bracteole caducous; buds ovoid, 4 by 3–3.5 mm, cleft 1/4–1/3; ovary ovoid, 2.5 mm. Fruits solitary or paired, ovoid-ellipsoid, (2.5–)3–3.5(–4.5) by 2–2.5(–3) cm, apex often shortly beaked, hairs scurfy, pale or dark brown, 0.1–0.2 mm, partly (late) glabrescent; pericarp 2–3(–5) mm thick; seeds ellipsoid, 2–2.5 cm; fruiting pedicel glabrescent, 2–6 mm long. — Fig. 64 l.

Field-notes — Erect tree; buttresses inconspicuous, prop-roots terete, c. 70 cm high (once recorded). Bark blackish brown; outer bark 0.5–1.5 mm thick, longitudinally fissured or cracked, or very fissured, not peeling off; inner bark 2.5–5 mm thick, beefy red, turning brown(-red) on exposure; exudate clear, reddish; sapwood cream or yellowish, gradually passing into slightly darker heartwood. Flowers fascicled, rust-coloured. Fruits pale ochre or brown; seeds brown.

Distribution — *Malesia*: Philippines (Mindanao); Moluccas.

Habitat & Ecology — Lowland primary and degraded forest, tall forest with little undergrowth, hill slopes; alluvial soil (inundated after heavy rains), sandy clay or deep clayey soil (bedrock grey schists); 0–250(–700) m altitude; fl. & fr. throughout the year.

Notes — 1. A lowland species, differing from *M. fatua* in usually distinctly ridged twig apices, much less developed indumentum on flowers and lower leaf surface (old leaves glabrescent), short indumentum on leaf bud (hairs 0.1 mm long or less), smaller



fruits with very short indumentum, and somewhat smaller flowers, opening at anthesis to only c. 1/3 (but see note 2).

2. The male buds in the type and in other specimens from Mindanao are cleft as deep as nearly halfway, in other material (e.g. *Kuswata & Soepadmo 57*, Seram) the buds are more slender, opening at anthesis only to 1/4–1/3.

3. The papillose lower surface of the leaves is especially apparent in Moluccan specimens from Bacan, Obi, Halmahera, and Seram.

### 93. *Myristica nana* W.J. de Wilde

*Myristica nana* W.J. de Wilde, *Blumea* 40 (1995) 307. — Type: LAE 50348 (*P.F. Stevens*), Papua New Guinea.

Treelet, 1.5–8 m. Twigs 1–1.5 mm diameter, early glabrescent, hairs less than 0.1 mm; older twigs neither cracking nor flaking; lenticels inconspicuous or absent. Leaves membranous, (elliptic-)oblong or lanceolate, 6–14 by 1.5–4 cm, base attenuate, apex acute-acuminate, the very tip often rather blunt; upper surface olivaceous or brown, lower surface grey-brown, (late) glabrescent, hairs scattered, less than 0.1 mm; not distinctly papillose; dots absent; midrib slightly raised above, lateral nerves 11–17 per side, at c. 70° to the midrib, flat, indistinct above, below reddish brown, indistinct, lines of interarching and venation indistinct; petiole 7–12 by 1(–1.5) mm; leaf bud 5–6 by (0.5–)1 mm, hairs 0.1 mm or less. Inflorescences between the leaves, of the *Knemate*-type: sessile or to 1.5 mm pedunculate, slender, simple or forked scar-covered brachyblasts to 6 mm long, glabrescent; in male: ending in 1 or 2 loose clusters each with 1–3 flowers, buds of various sizes; bracts 0.5 mm, short-pubescent, caducous; female inflorescences consisting of merely one axillary flower; flowers with hairs 0.1 mm or less. Male flowers: pedicel 3–4.5 by 0.4 mm, bracteole 1 mm, persistent, 1–2 mm below apex; buds (submature) ovoid-oblong, 3.5(–4) by 1 mm, apex narrowly rounded, cleft c. 1/4, lobes membranous, 1 mm long, 0.2 mm thick. Androecium 3.5 mm; androphore 1.7 by 0.3 mm, with hairs 0.1 mm all over; synandrium 1.8 by 0.4 mm, thecae 6, sterile apex 0.1 mm. Female flowers: pedicel slender, 5 mm long, bracteole scar about halfway; buds ovoid-oblong, 3.5 by 1.5(–2) mm, lobes 0.7 mm; ovary 2.5 by 1(–1.5) mm, minutely pubescent. Fruits solitary, ± ellipsoid-oblong, 3–3.5 by 1–1.3 cm, apex subacute with minute apiculum (stigma remnant), the basal part contracted into a narrow pseudostalk, 10 mm long, hairs dull brown, 0.1 mm or less; pericarp 1 mm thick or less; seeds ellipsoid, 1.7–2 cm; fruiting pedicel slender, 8–12 by 0.5 mm, bracteole scar at or below the middle.

Field-notes — Treelet, dbh c. 4 cm. Bark smooth, finely fissured, dark brown, grey, or blackish; inner bark straw; sap dark red; wood whitish. Leaves glaucous below. Flowers cream or greenish white; female flower buds cream, pale green at tip. Fruits (mature) greenish with brown scurf or olive-green; seeds brown.

Distribution — *Malesia*: eastern Papua New Guinea (Central and Milne Bay Prov.); locally endemic.

Habitat & Ecology — Flat-land and sloping forest, ridge or level forest; 400–750 m altitude; fl. & fr. July, Aug.

Notes — 1. *Myristica nana* resembles *M. pumila*, but is distinguished by smaller male flowers and a shorter fruiting pedicel.

2. *Myristica nana* is also superficially similar and possibly related to *M. ensifolia* (from Western Province) in its narrow leaves. The latter, known only from one fruiting specimen, differs in the still more elongate leaves, the venation and lower leaf surface texture (lens!), and in the infructescence with stouter stalk, including a short peduncle.

#### 94. *Myristica neglecta* Warb.

*Myristica neglecta* Warb., Mon. Myrist. (1897) 542, t. 17; Markgr., Bot. Jahrb. Syst. 67 (1935) 170; J. Sinclair, Gard. Bull. Sing. 23 (1968) 154, f. 6; Foreman, Contr. Herb. Austral. no. 9 (1974) 40; Handb. Fl. Papua New Guinea 1 (1978) 206, p.p., excl. fruiting material; W.J. de Wilde, Blumea 40 (1995) 309. — Syntypes: *Beccari Fl acc. nos. 7702, 7703* (female), *7704* (male), Bird's Head.

Tree 25 m. *Twigs* stout, 5–7 mm diameter, early glabrescent, hairs less than 0.1 mm; older twigs incompletely known, possibly somewhat fissured but not distinctly flaking, with a few lenticels. *Leaves* (thinly) coriaceous (but very brittle), 21–40 by 6–12 cm, base narrowly rounded, apex acute; upper surface brown, smooth, lower surface slightly paler, glabrous; not papillose; dots present (lens!); midrib slightly raised above, lateral nerves 20–40 per side, at 60–70° to the midrib, flat and faint above, hardly visible below, lines of interarching and venation invisible; petiole 30 by 4–5 mm; leaf bud 10 by 4 mm, hairs appressed, grey-brown, less than 0.1 mm. *Inflorescences* between the leaves, minutely brown pubescent, late glabrescent, with pedunculate (surface may be fissured) brachyblast; bracts 2–2.5 mm, caducous; in male (*van Royen 3498*): peduncle 5–15 mm, with transverse lenticels, scar-covered brachyblast to 10 mm, with subumbel of 3–6 flowers, buds of various sizes; female inflorescences (incompletely known, *Beccari 7703*): peduncle 5 mm long, brachyblast to 10 mm long, ending in a subumbel of 2 or 3(–5) flowers; flowers leathery with hairs 0.1–0.2 mm. *Male flowers*: pedicel 10–15 by 1.5–2.5 mm, bracteole scar conspicuous, 2–3 mm below the apex; buds ellipsoid-oblong, 9–11 by 4–5 mm (according to Warburg and Sinclair 13–14 by 6–8 mm), cleft c. 1/5, lobes 2–2.5 mm long, 0.5 mm thick. Androecium ± stout, broad-cylindrical, 7 mm long; androphore 2–2.5 by 1.5–2(–2.5) mm, entirely with hairs 0.3–0.5 mm; synandrium 2.5–2.5 by 1.5–2 mm, gradually narrowed into acute sterile apex, 1–1.5 mm, thecae c. 20. *Female flowers*: pedicel stout, 5–6 mm long, bracteole scar 1–2 mm below the apex; buds ovoid(-oblong), narrowed towards the apex, 9 by 5 mm, lobes 2(–2.5) mm; ovary ovoid-oblong, tapering, 7 by 3.5 mm, hairs 0.5 mm. *Fruits* (immature, see note 2) broadly fusiform, 3 by 2 cm, hairs mealy, 0.3(–0.5) mm; pericarp hard, 8(–10) mm thick; seeds not seen; fruiting pedicel (immature) 7 by 3 mm.

Field-notes — Bark brown, with long flakes; wood reddish brown, with a soft acid smell. Leaves dark green above, greyish green below. Flower buds yellow-brown.

Distribution — *Malesia*: Papua Barat (Bird's Head).

Habitat & Ecology — Primary forest dominated by *Quercus* and *Canarium*; c. 15 m altitude; fl. Apr.

Notes — 1. The name *M. neglecta* should be restricted to plants from the lowland area of Bird's Head, i.e., the syntypes and one additional collection, *van Royen 3498*. This means that the description of the fruit by Foreman (1974: 40; 1978: 206) is excluded; this fruiting material is transferred to *M. millepunctata*. Other related species are *M. brassii*, *M. duplopunctata*, and *M. tamrauensis*.

2. *Van Royen 3498* (L), with male flowers, has mounted on the sheet an envelope containing a loose female inflorescence and three immature fruits, 3 cm long, which must have been taken from a different tree.

### 95. *Myristica nivea* Merr.

*Myristica nivea* Merr., Philipp. J. Sci. 1, Suppl. (1906) 191; Enum. Philipp. Flow. Pl. 2 (1923) 179; W.J. de Wilde, Blumea 42 (1997) 178. — Type: *FB 3454* (*Hutchinson*), Philippines, Basilan.

Tree 10–15 m. *Twigs* 2–3(–4) mm diameter, glabrescent, hairs greyish, 0.1(–0.2) mm; older twigs (coarsely) striate; lenticels few, inconspicuous. *Leaves* chartaceous, elliptic-oblong or oblong-lanceolate, 15–43 by 4.5–13 cm, base narrowly to broadly rounded, apex acute or acuminate; upper surface olivaceous or (blackish) brown, lower surface grey-white (possibly by dense irregular papillae), glabrescent, hairs scale-like, 0.1(–0.2) mm, stouter hairs leaving point-like scars; (larger) dots absent; midrib above slightly raised, lateral nerves 13–20 per side, at 45–70° to the midrib, sunken above, dark brown, much contrasting in colour below, lines of interarching and venation faint; petiole 10–20 by 2–4 mm; leaf bud 10–15 by 1.5–3 mm, hairs appressed, 0.1 mm. *Inflorescences* ± below the leaves, of the *Knema*-type: sessile, simple or forked, scar-covered, woody, brachyblasts up to 4 mm, with short brown hairs; in male: with 2–5 flowers, buds of various sizes; in female (from infructescences, *BS 37070*): similar to male, few-flowered; flowers with hairs 0.1–0.2 mm. *Male flowers*: pedicel 2.5–3 mm, bracteole 2–2.5 mm, persistent; buds ovoid-ellipsoid, 6 by 4 mm, apex narrowly rounded or subacute, cleft (1/4–)1/3, lobes (0.2–)0.3 mm thick. Androecium broad, 4–4.5 mm; androphore 1.5 by 0.6–0.7 mm, with few pale brown hairs 0.1–0.2 mm towards the base; synandrium 2.5–3 by 1.3–1.5 mm, thecae c. 20, sterile apex ± blunt, glabrous, 0.3 mm. *Female flowers* not seen. *Fruits* solitary, subsessile, ellipsoid, 3.5–4 by 2.5–3 cm, hairs dense, dark rust-coloured, scurfy, 0.1 mm or less; pericarp 4 mm thick; submature seeds ellipsoid, 2.5–3 cm; fruiting pedicel rather stout, 4 mm long.

Distribution — *Malesia*: Philippines (Mindanao: Zamboanga Prov.; Basilan I.); Moluccas (Talaud Is.).

Habitat & Ecology — Forest at low altitude; fl. Dec.; fr. Oct.–Nov., Mar.

Note — Sinclair [Gard. Bull. Sing. 23 (1968) 268, 273] included *M. nivea* in *M. fatua*, the latter from the same area in the Philippines. However, *M. nivea* differs in the structure of the lower leaf surface (in *M. fatua* with dense and more woolly persistent indumentum, not leaving scattered dark point-like hair scars), and the indumentum of the fruits (in *M. fatua* dense, velvety, hairs 0.5–1 mm). *Myristica nivea* seems also close to *M. impressa* and *M. koordersii*, two species with the leaves below whitish as well.

### 96. *Myristica olivacea* W. J. de Wilde

*Myristica olivacea* W. J. de Wilde, Blumea 40 (1995) 309. — Type: *Pullen 7663*, Papua New Guinea, Central Prov.

Small undergrowth tree, 2.5–4.5 m. *Twigs* 1–2 mm diameter, early glabrescent, smooth, hairs 0.2 mm; older twigs yellowish brown, not or only faintly cracking or flaking; lenticels not seen. *Leaves* membranous, oblong-lanceolate, 10–30 by 2.5–7.5 cm, base attenuate, apex acute-acuminate or ± blunt; upper surface conspicuously olive-green, lower sur-

face early glabrescent, hairs minute, scale-like, leaving minute crater-like scars; not papillose; dots absent; midrib yellowish, slightly raised above, much raised below, lateral nerves 10–15 per side, at 60–80° to the midrib, faint above, lines of interarching and venation faint or absent; petiole 20–30 by 1.5–2.5 mm; leaf bud 5–10 by 1 mm, hairs appressed, 0.2(–0.3) mm. *Inflorescences* between the leaves, axillary or to 7 mm supra-axillary, ± paniculate, with slender peduncle, early glabrescent; in male 6–10 cm long, peduncle 3–5 cm, lower branches 1–2.5 cm, central axis 1–3 cm, with 1–3 side branches to 1 cm long, all branches ending in scar-covered brachyblasts to 5 mm, each with a subumbel of 4–10 flowers, buds of various sizes; bracts small, 1–2 mm, late caducous; in female: peduncle 2.5–3 cm, shorter and less branched than the male, subumbels 2–4-flowered; flowers with sparse, dark-brown, appressed hairs, partly glabrescent. *Male flowers*: pedicel 10–12 by 0.4–0.6 mm, bracteole 0.5–1 mm, half-circular, persistent, subapical; buds membranous, elongate, almost tubiform, narrowed to both ends, especially towards the apex, 12–13 by 2.5(–3) mm, cleft c. 1/10, lobes 1–1.5 mm, erect, 0.2 mm thick. Androecium slender, 8–9 mm long; androphore 3–3.5 by 0.5 mm, hairs less than 0.1 mm; synandrium 4.5–5.5 by 0.6–0.8 mm, thecae 10–12, sterile apex 0.2–0.3 mm, with 5 or 6 lobules corresponding with the anthers. *Female flowers*: pedicel rather stout, 18–20 mm, bracteole 2–5 mm below the apex; buds ovoid-oblong, narrowed towards the apex, 9 by 3–3.5 mm, lobes 1 mm long; ovary ovoid-oblong, 6–7 by 2–3 mm (including the 1 mm long deeply 2-lobed stigma), hairs dense, pale brown, less than 0.1 mm. *Fruits* single, oblong, 3–3.5 by 1–1.3 cm, top acute, base ± narrowed into 3–5 mm long pseudostalk, hairs scale-like, 0.1 mm; pericarp 1 mm thick; seeds 2–2.5 cm.

Field-notes — Undergrowth tree, dbh c. 4 cm. Bark shallowly fissured, dark grey or black; blaze with red exudate. Leaves green, midrib yellowish. Inflorescence ± pendent; flowers cream.

Distribution — *Malesia*: Papua New Guinea (Central Prov.); known from three collections.

Habitat & Ecology — Rain forest on low hills; clayey soil; 75–120 m altitude; fl. June.

Notes — 1. *Myristica olivacea* is close to *M. cornutiflora* from which it differs chiefly by its more slender habit. The twigs dry yellowish, the leaves conspicuously olivaceous-green. The flowers are similar to those of *M. cornutiflora* subsp. *elegans*, but differ in the persistent bracteole and longer androecium in proportion to the perianth. The leaves below apparently lack the small dark brown dashes and dots, but possibly the latter are represented as very small scattered points, only visible here and there (lens!).

2. The stomata on the lower leaf surface are deeply sunken in the surrounding tissue, which apparently is not papillose.

### 97. *Myristica ornata* W. J. de Wilde

*Myristica ornata* W. J. de Wilde, *Blumea* 40 (1995) 310. — Type: LAE 51752 (*Streimann & Katik*), Papua New Guinea.

Tree 25–30 m. *Twigs* almost angled, ± yellowish brown, 2.5(–3) mm diameter, very early glabrescent, hairs scattered, scale-like, less than 0.1 mm; older twigs tending to flake, with few brownish lenticels. *Leaves* subcoriaceous, (elliptic-)oblong, 15–20 by 3.5–6.5 cm, base cuneate, apex acute; upper surface olivaceous or yellowish brown,

lower surface slightly paler, glabrous; papillose (lens!); dots absent; midrib slightly raised above, lateral nerves 15–20 per side, at 45–60° to the midrib, slender, flat and faint above, faint below, lines of interarching and venation inconspicuous; petiole 15–20 (–25) by 2.5–3 mm, early glabrescent; leaf bud 15 by 3–4 mm, longitudinally cracked on drying, hairs dense, yellow-brown, appressed, (0.1–)0.3 mm. *Inflorescences* known only from the infructescences. *Male* and *female* flowers not seen. *Infructescences* below the leaves, peduncle 5–10 by (4–)5–6 mm, glabrescent, with coarsely flaking bark, ending in one or two fruiting pedicel(s). *Fruits* (immature) solitary or paired, broadly fusiform, 5–6 by 3–3.5 cm, base narrowed into 5(–7) mm long pseudostalk, apex ± gradually tapered, acute, hairs light brown, mealy, 0.3(–0.4) mm; pericarp 10 mm thick; seeds not seen; fruiting pedicel 10 mm, fissured and with lenticels or coarsely flaking, bracteole scar about median.

Field-notes — Bole straight, slender, 23 m, dbh 50 cm. Bark dark grey, slightly vertically cracked; middle bark deep red; inner reddish; exudate red; wood of moderate weight and hardness; sapwood straw; heartwood reddish, stained by sap. Leaves with thick margin slightly curved inwards, dull dark green above, green below. Fruits rusty brown.

Distribution — *Malesia*: Papua New Guinea (Western Prov., Kiunga area); known only from the type.

Habitat & Ecology — Lowland rain forest flats, c. 50 m altitude; fr. Aug.

Notes — 1. Keys out beside *M. schleinitzii* on account of pedunculate inflorescences and papillate lower leaf surface, but otherwise quite different.

2. *Myristica ornata* is reminiscent of *M. mediobibex* (also with the scar of the bracteole ± halfway the fruiting pedicel), and especially of *M. millepunctata* and *M. neglecta*; these latter, however, with the lower leaf surface non-papillose and with scattered dots.

## 98. *Myristica ovcarpa* W.J. de Wilde

*Myristica ovcarpa* W.J. de Wilde, *Blumea* 40 (1995) 311. — Type: LAE 74587 (*Damas & Katik*), Papua New Guinea, Rossel I.

Tree 25 m. *Twigs* 1–2(–2.5) mm diameter, early glabrescent, hairs greyish, less than 0.1 mm; older twigs neither cracking nor flaking; lenticels inconspicuous or absent. *Leaves* membranous, (elliptic-)oblong, 6–10.5 by 2.5–4 cm, base broadly attenuate, apex subacute or acute-acuminate; upper surface blackish brown, lower surface brown, early glabrescent, hairs less than 0.1 mm; not papillose; dots absent; midrib almost flat above, lateral nerves 25–30 per side, at 70–80° to the midrib, slender, flat and faint above, faint below, lines of interarching and venation indistinct; petiole 10–18 by 1–1.5 mm; leaf bud 6–10 by 1 mm, hairs less than 0.1 mm. *Inflorescences* (from infructescence): sessile, short, of the *Knema*-type, possibly a single axillary flower only, with the pedicel 4 mm long or less. *Male* and *female* flowers not seen. *Fruits* (apparently of mature size, but seeds not yet fully developed, i.e. shrunken within the aril): axillary to a lower leaf, solitary, ovoid-ellipsoid, 7 by 5 cm, apex and base rounded, glabrous, except for some minute appressed brownish hairs less than 0.1 mm (hence ovary minutely pubescent) towards the insertion of the fruiting pedicel; pericarp 2–2.5 cm thick; seeds (immature) ellipsoid, 2 cm; fruiting pedicel short, rather thick, 4 mm long, 5 mm thick, brown, longitudinally cracked.

Field-notes — Large tree, bole 20 m, dbh 50 cm. Outer bark greenish black; inner reddish, fibrous or slightly corky, exudate red on exposure; wood cream. Leaves glabrous, dark green above, light green below, growing tips rusty brown. Fruits axial, solitary, large, egg-shaped, light green-yellow.

Distribution — *Malesia*: E Papua New Guinea (Rossel I.: Mt Dom, Pambwa); known only from the type.

Habitat & Ecology — Lowland hill forest; c. 200 m altitude; fr. Mar.

Note — This species can be distinguished from other small-leaved *Myristicas* in the area by the glabrous nature of all parts, the many-nerved leaves, and the large short-stiped glabrescent fruits with very thick pericarp.

### 99. *Myristica pachycarpidia* W.J. de Wilde

*Myristica pachycarpidia* W.J. de Wilde, *Blumea* 40 (1995) 312; 43 (1998) 180. — Type: *Brass* 23293, Papua New Guinea, Mt Dayman.

Tree c. 25 m. *Twigs* with two low wings or sharp ridges between the petioles, 4–5 mm diameter, early glabrescent, hairs less than 0.1 mm; older twigs tending to crack and flake; lenticels inconspicuous. *Leaves* thinly chartaceous, elliptic-oblong or oblong-lanceolate, 12–25 by 4.5–10 cm, base rounded, apex  $\pm$  blunt or subacute; upper surface (blackish) brown, lower surface grey-brown, seemingly glabrous, hairs scattered, whitish, scale-like, less than 0.1 mm; not papillose, dots absent; midrib slightly raised above, lateral nerves 20–30 per side, faint and flat above, lines of interarching and venation indistinct, somewhat impressed above, and rendering the blade slightly bullate; petiole 15–20 by 2.5–4 mm; leaf bud 10 by 2 mm, seemingly glabrous, but hairs appressed, grey-white, less than 0.1 mm. *Inflorescences* (from infructescences): just below the leaves, of the *Knema*-type: sessile, small, glabrous. *Male and female flowers* not known. *Fruits* (somewhat immature) solitary, subglobose, 5(–6) by 4–5 cm, strongly wrinkled, apex  $\pm$  acute, hairs  $\pm$  sparse, dull brown, less than 0.1 mm, with a tendency to become glabrous; pericarp 2 cm thick; seeds (immature) subglobose or broadly ellipsoid, 2 cm; fruiting pedicel stout, straight, 10–20 by 4–6 mm, glabrescent, hairs minute, scattered, and scale-like,  $\pm$  warty or lenticellate, bracteole scar at 1/3 to halfway below the apex, perianth scar conspicuous, apical.

Field-notes — Leaves grey below. Unripe fruits subglobose, 5–6 cm diameter.

Distribution — *Malesia*: Papua New Guinea (Milne Bay Prov., Mt Dayman); known only from the type.

Habitat & Ecology — Occasional in oak forest of north slopes; 1550 m altitude; fr. July.

Note — Ignoring its provenance from 1550 m altitude, *M. pachycarpidia* may key out beside *M. sulcata*, a lowland species with smaller fruits. Similar also is *M. bialata* from lowland areas in the Bismarck Archipelago but that species has twigs with ant-swellings.

The (immature) fruits of *M. pachycarpidia* may resemble those of *M. sphaerosperma*, also a montane species, with terete twigs and a much more conspicuous indumentum on the lower leaf surface.

**100. *Myristica pachyphylla* A.C. Sm.**

*Myristica pachyphylla* A.C. Sm., J. Arnold Arbor. 22 (1941) 69; W.J. de Wilde, Blumea 40 (1995) 313. — Type: *Brass 12173*, Papua New Guinea.

Tree 5–22 m. *Twigs* (1–)1.5–2.5 mm diameter, glabrescent, hairs 0.1 mm or less; older twigs neither cracking nor flaking; lenticels small, indistinct. *Leaves* chartaceous or subcoriaceous, ovate- or elliptic-oblong, (4–)6–14 by (1.5–)2–5.5 cm, base (short) attenuate, apex to 2 cm acute-acuminate; upper surface olivaceous or brown, lower surface somewhat paler, glabrescent, hairs sparse, cobweb-like, greyish, less than 0.1 mm; not papillose; dots present, of various sizes; midrib raised above, lateral nerves 10–16 per side, at 60–80° to the midrib, interspaced by intersecondary nerves, fine, sunken above, ± flat and faint below, lines of interarching and venation thin, sunken above, indistinct; petiole 7–15 by 1–2 mm; leaf bud 10 by 1.5 mm, hairs 0.1 mm or less. *Inflorescences* between the leaves, minutely pubescent, pedunculate (sometimes sessile in female), ending in a simple or forked scar-covered brachyblast; in male: peduncle 3–8 by 1 mm, brachyblast up to 5 mm with a subumbel of 2–5 flowers, buds of various sizes; bracts 1 mm, rusty-pubescent, late caducous; in female: sessile or to 10 mm pedunculate, ending in 1 (or 2) flower(s); flowers with sparse hairs 0.1 mm or less. *Male flowers*: pedicel 2–4 by 0.5–0.7 mm, bracteole ovate, 0.5–1 mm, caducous, subapical; buds carnosose, oblong-cylindrical, 6–8 by 2(–2.5) mm, apex (sub)acute, base shortly narrowed, cleft 1/4–1/5, lobes 1.5 mm long, 0.3 mm thick. Androecium slender, 4–4.5 mm; androphore 2.5 by 0.6(–0.7) mm, with few hairs less than 0.1 mm at base; synandrium 1.5 by 0.7 mm, thecae 10–12, sterile apex 0.1–0.2 mm long, blunt. *Female flowers*: pedicel 7–10 mm, bracteole caducous, scar distinct, 2–3 mm below the apex, the part above the scar thickened; buds elongate, larger than in male, 7–10 by 2.5–3 mm, narrowed towards the apex, cleft 1/6(–1/8), lobes 1–1.5 mm long; ovary elongate, 6 by 2 mm, with silky hairs 0.3 mm. *Fruits* single (rarely 2), ± ellipsoid, 3.5–4(–4.5) by 2(–2.2) cm, apex ± acute or somewhat beaked, base narrowed into a broad pseudostalk 5 mm long, hairs rust-coloured, scurfy, 0.1 mm or less; pericarp 2–3 mm thick; seeds ellipsoid(-oblong), 2.5 cm; stipe (including fruiting pedicel) straight, 20–25 by 1–2 mm, with scars of bract, bracteole, and perianth visible.

Field-notes — Slender trees. Outer bark black; inner bark pale, cream; wood white. Leaves glossy green above. Flowers cream-green. Fruits distinctly beaked or with acute apex, orange(-red) or fawn.

Distribution — *Malesia*: montane areas of Central West and East New Guinea.

Habitat & Ecology — Montane forest, on slopes and ridges; laurel ridge or oak forest; steep limestone hillsides with *Nothofagus* forest; mossy forest with *Myrtaceae*, *Papuacedrus*, *Podocarpaceae*; 1400–2000 m altitude; fl. & fr. July–Nov., Jan.

Notes — 1. *Myristica pachyphylla* is similar to *M. arfakensis*, both with characteristic scattered dots on the lower leaf surface. May also be confused with *M. longipes*.

2. A deviating specimen is *BW 13780 (Koster)* (with fruits, in L broken off and lacking) from Wandammen Peninsula, at 920 m altitude. In the absence of fruits it keys out near *M. pachyphylla* or *M. arfakensis* and is characterized by: twigs slender, leaves narrow, 10 cm, long-acuminate, conspicuously greenish, dotted below, and peduncle of infructescence slender, 15–20 mm long. It may represent an as yet undescribed species, but more material is needed.

**101. *Myristica papillatifolia* W.J. de Wilde**

*Myristica papillatifolia* W.J. de Wilde, *Blumea* 40 (1995) 313. — Type: NGF 33366 (*Ridsdale & Galore*), Papua New Guinea, Western Prov.

Small tree c. 4 m. *Twigs* triangular, 1.5–2(–3) mm diameter, early glabrescent, hairs dense, less than 0.1 mm; older twigs neither cracking nor flaking; lenticels inconspicuous or absent. *Leaves* membranous, elliptic-oblong, 6–11 by 1.5–3 cm, base long-attenuate, apex acute(-acuminate); upper surface (blackish) brown, lower surface light brown or greyish, very early glabrescent, hairs few, scattered, whitish, less than 0.1 mm; papillose (lens!); dots absent; midrib slightly raised above, lateral nerves 10–13 per side, at c. 45° to the midrib, fine, ± sunken above, on lower surface brownish, lines of interarching indistinct, nerves and venation in old leaves contrasting in colour; petiole 7–10 by 1–1.5 mm; leaf bud 6–10 by 1.5(–2) mm, hairs less than 0.1 mm. *Inflorescences* (from infructescence) of the *Knema*-type: a sessile, simple, short tubercle-like brachyblast. *Male and female flowers* not seen. *Fruits* axillary to leaf scars below the leaves, solitary, ellipsoid-fusiform, 3–3.3 by 1.5–1.7 cm, apex narrowly 2(–3) mm beaked, base narrowed into a slender 5(–7) mm long pseudostalk, hairs dull, mealy, grey-brown, interwoven, less than 0.1 mm, appearing as if glabrous; pericarp 1(–2) mm thick; seeds broad-ellipsoid, blackish brown, 1.5–1.7 cm; fruiting pedicel slender, 15–17 by 1.5 mm, bracteole scar at (4–)5 mm below the apex, part above the scar smooth, below coarsely striate or cracked.

Field-notes — Small tree. Mature fruit orange-brown.

Distribution — *Malesia*: Central Papua New Guinea (Western Province, Kiunga subprov., near Ingembit (Ingambet, border area); known only from the type.

Habitat & Ecology — Valley forest, semi-swamp with sago patches; c. 130 m altitude; mature fr. July.

Note — Distinguishable among the smaller-leaved New Guinean *Myristicas* with *Knema*-type inflorescences by the leaves with lateral nerves steeply running from the midrib (c. 45°), the distinctly papillose lower surface, and the delicately built, broadly fusiform fruits, conspicuously narrowed at both ends, with a thin pericarp bearing a very thin indumentum, almost as if it is glabrous.

**102. *Myristica papyracea* J. Sinclair**

*Myristica papyracea* J. Sinclair, *Gard. Bull. Sing.* 23 (1968) 133, f. 1; W.J. de Wilde, *Blumea* 42 (1997) 178; *Tree Fl. Sabah & Sarawak* 3 (2000) 468. — Type: SANA 4775 (*Wood*), Sabah.

Tree 20–40 m. *Twigs* somewhat angular, 4–8 mm diameter, early to late glabrescent, hairs 0.1 mm or less; older twigs coarsely flaking; with or without lenticels. *Leaves* (thinly) coriaceous, elliptic-oblong or oblong-oblongate, 16–44 by 8–14.5(–18) cm, base narrowly rounded or subcordate, apex ± blunt (rounded) or acute; upper surface olivaceous(-brown); lower surface yellowish, glabrous; papillose; dots absent; midrib above slightly raised, lateral nerves (16–)20–28 per side, at 45–60° to the midrib, sunken or flat above, lines of interarching sometimes distinct, venation fine-scalariform, distinct or not; petiole 20–50 by 3.5–5 mm; leaf bud 15–25 by 3.5–5 mm, hairs 0.1 mm or less. *Inflorescences* between the leaves or below, paniculate, pedunculate, hairs mealy, 0.1–0.2(–0.3) mm; in male: rather stout, 2–5 by 2–4 cm, peduncle 8–20 mm, lower



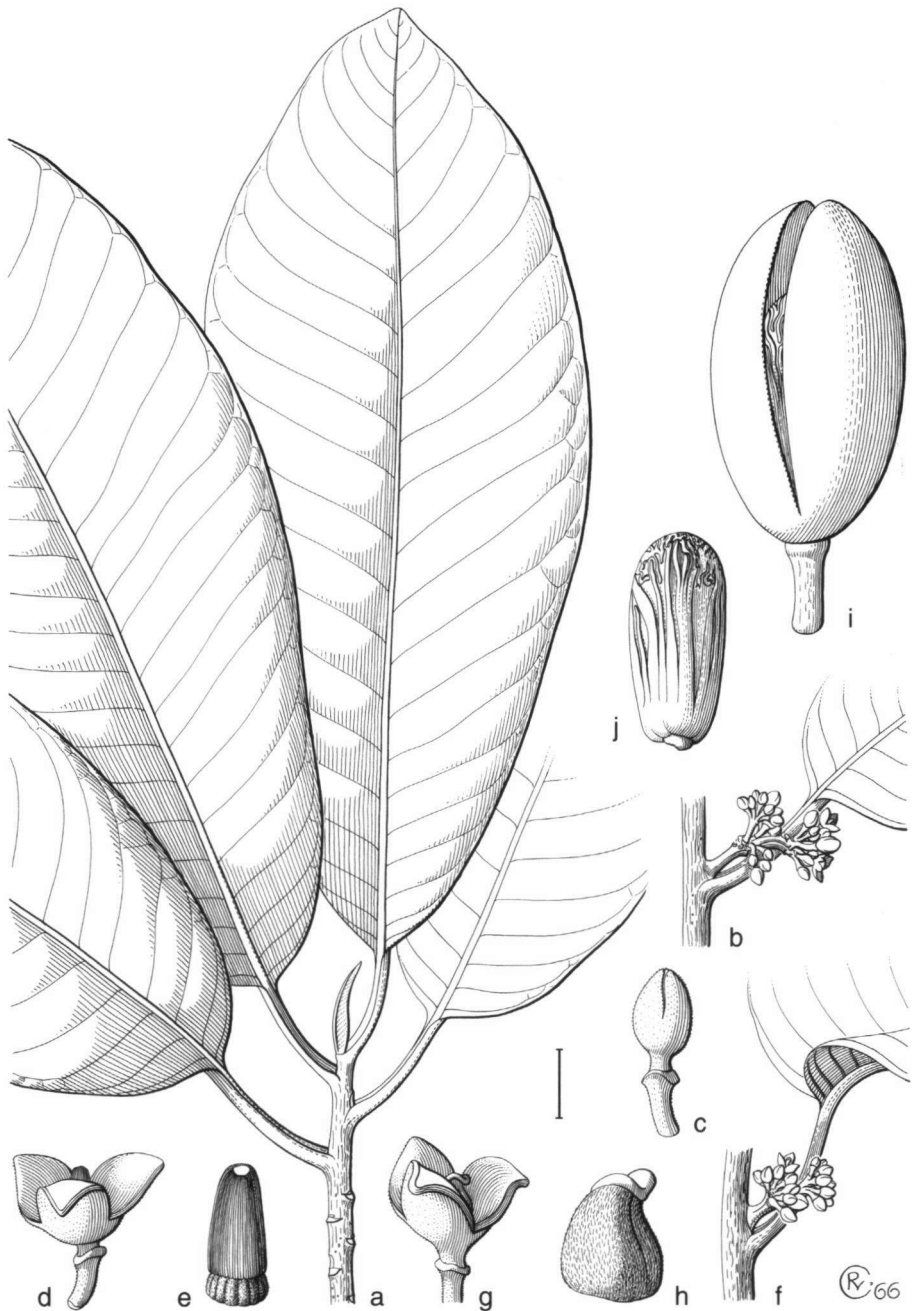


Fig. 81. *Myristica papyracea* J. Sinclair. a. Leafy twig; b. twig with male inflorescence; c. male bud; note bracteole scar; d. male flower at anthesis; e. androecium (sterile apex not drawn); f. twig with female inflorescence; g. female flower at anthesis; note bracteole scar; h. pistil; i. fruit; j. long-ellipsoid seed with aril (a, i: *S* 18329 (*Ashton*); b–e: *SAN* 31080 (*J. Singh*); f–h: *Cult. Hort. Bog. XF* 55 (n.v.); j: *Kostermans* 5732]. — Scale bar for a, b, f, i, j = 2 cm; for c, d, g = 5 mm; for e, h = 2 mm.

branches to 15 mm, central axis similar, unbranched, each branch ending in a short brachyblast, with few flowers, size of buds strongly variable, in older inflorescences with dispersed scars of fallen flowers; bracts 2–3(–4) mm, caducous; female inflorescences like male but smaller; flowers coriaceous, with hairs 0.1 mm, sometimes late glabrescent. *Male flowers*: pedicel 5–8 mm, bracteole broadly reniform, 1.5–2 mm, caducous, apical or to 2 mm below; buds ellipsoid, 6–8 by 4–5 mm, cleft 2/3–3/4, lobes 0.5–1 mm thick. Androecium (4–)5–6 mm; androphore somewhat tapering, 1–2 by 1.5 (–2) mm, hairs dense, 0.1 mm; synandrium oblong, (2–)2.5–3 by 1.5 mm, thecae 18–24, sterile apex ± blunt or subacute, 0.3–0.6 mm. *Female flowers*: pedicel 2–4 mm, bracteole scar apical; buds ovoid, 6 by 4 mm, cleft 2/3–3/4; ovary (3–)4.5 by 3–3.5 mm, hairs 0.1 mm or less, stigma lobes sessile. Infructescences 1–3 cm long. *Fruits* 1 or 2, ellipsoid, 7–9 by 4.5–6 cm, with the style remnant ± lateral (always?), glabrescent, indumentum mealy, dark brown, hairs 0.1 mm (persistent at the very base); pericarp glossy blackish brown, 10–20 mm thick; seeds long-ellipsoid, 5–6 cm; fruiting pedicel stout, short, 4–10 mm long. — **Fig. 81.**

Field-notes — Large tree, often flanged and/or with conspicuous (laterally compressed) stilt-roots to 2 m high. Bark dark grey or blackish brown, ± cracked, in old trees flaking in thin papery strips; sap pink, not copious; living bark 8–13 mm thick, red-brown; wood pale (red-)brown, or white streaked with red. Leaves dark green glossy above, conspicuously pale, yellowish green below. Flowers (pale) yellow. Fruits on twigs and branches, yellow or pale apricot-coloured, glabrescent from minute powdery indumentum.

Distribution — *Malesia*: Borneo (Sarawak, E & NE Kalimantan). No recent collections known.

Habitat & Ecology — A species of tall mixed dipterocarp forest on better soils; yellow clayey soil, loamsoil with coral limestone; along rivulet, wooded hillside, foot of hill; 0–300 m altitude; fl. & fr. throughout the year.

Note — A lofty tree, apparently related to *M. maxima*, the latter differing in the lower leaf surfaces which are (brownish) grey on drying, with subsistent very thin indumentum, not obviously papillose, larger inflorescences, somewhat more delicate flowers, the androphore pubescent only in the lower half, and indumentum of the fruits longer persistent.

### 103. *Myristica pedicellata* J. Sinclair

*Myristica pedicellata* J. Sinclair, Gard. Bull. Sing. 23 (1968) 324, f. 45; Foreman, Handb. Fl. Papua New Guinea 1 (1978) 206; W. J. de Wilde, Blumea 40 (1995) 314. — Type: *Pullen 944*, Papua New Guinea.

Tree c. 30 m tall. *Twigs* 2–3(–5) mm diameter, glabrescent, hairs 0.1 mm or less; older twigs brown, coarsely striate, with small paler lenticels. *Leaves* chartaceous, oblong-lanceolate, 12–21 by 3–6 cm, base short-attenuate, apex acute-acuminate; upper surface brown, lower surface dull cinnamon or light brown, hairs persistent, dense, pale brown (greyish when older), scale-like, 0.1 mm or less; not papillose; dots absent; midrib flat above, lateral nerves 20–28 per side, at 50–70° to the midrib, slightly sunken above, faint below, lines of interarching and venation indistinct; petiole 20–25 by 2–2.5 mm; leaf bud 12–15 by 2–2.5 mm, hairs appressed, 0.1 mm. *Inflorescences* (from infructes-

cences): between the leaves and below, of the *Knema*-type: sessile knob-like woody scar-covered 1–3 topped brachyblasts 2–3(–5) mm long, minutely brown pubescent. *Male* and *female flowers* not known. *Fruits* 1 or 2 (or 3) per infructescence; (broadly) ovoid-ellipsoid, 2–2.3 by 1.5–1.7 cm, beaked for 1 mm by style-remnant, hairs fine, mealy, rust-coloured, 0.1 mm; pericarp 1(–2) mm thick, seeds (not fully mature) ellipsoid, 1.5 cm; fruiting pedicel slender, (13–)15–18 by 1.5–2 mm, bracteole scar 1(–1.5) mm below the apex, perianth scar clearly visible.

Field-notes — Bole 25 m, with low buttresses, the whole base on short stilt-roots. Bark short flaky, with slight acrid smell; blaze pink turning brown; sapwood cream, on exposure quickly deepening in colour.

Distribution — *Malesia*: Papua New Guinea (Madang Prov.); known only from the type.

Habitat & Ecology — On river terrace, in *Pometia*–*Celtis* forest; at c. 115 m altitude; fr. Aug.

#### 104. *Myristica perlaevis* W.J. de Wilde

*Myristica perlaevis* W.J. de Wilde, *Blumea* 42 (1997) 178. — Type: *Burley, Tukirin & Ismail 4330*, Seram.

Tree 20 m. *Twigs* 3(–4) mm diameter, slightly angular, glabrous; older twigs pale grey-brown, coarsely longitudinally cracking; lenticels not apparent. *Leaves* thinly membranous, elliptic-oblong, 16–23 by 6–9 cm, base cuneate or nearly rounded, apex abruptly acute-acuminate; upper surface dark olivaceous, glossy, lower surface bright or light brown or olivaceous, glabrous; not papillose; dots absent; midrib flat above, lateral nerves 13–15 per side, at (50–)60–70° to the midrib, faint, flat above, not contrasting in colour below, lines of interarching and venation (fine) indistinct; petiole 20–25 by 1.5–2 mm, brown blackish, rather contrasting in colour with the twig; leaf bud 10 by 1–1.5 mm, hairs powdery, 0.1 mm. *Male inflorescences* and *flowers* not seen. *Female inflorescences* glabrous, peduncle 6(–10) mm long, ending in one flower. *Female flowers*: glabrous, pedicel 12 mm, bracteole scar 3 mm below the apex; buds carnose, 9 by 7 mm, cleft c. 1/2, lobes 4–4.5 mm long; ovary 7 by 4.5 mm, minutely pubescent. Infructescence short pedunculate. *Fruits* solitary, ellipsoid-oblong, 8–8.5 by 3–3.5 cm, base and apex ± blunt or narrowly rounded, glabrous; pericarp 8–10(–15) mm thick, finely wrinkled, brown, glabrous; seeds elongate-ellipsoid, 4.5–5 cm; fruiting pedicel not seen.

Field-notes — Tree 20 m, dbh 20 cm. Bark grey, deeply grooved and longitudinally fissured; inner bark orange-red; sap red, watery. Flowers waxy, yellow. Fruits greenish yellow.

Distribution — *Malesia*: Moluccas (Seram, c. 40 km E of Masohi); known only from the type.

Habitat & Ecology — Natural forest with *Myristicaceae*, *Fagaceae*, *Myrtaceae* and *Dipterocarpaceae*; on steeply dissected ridge; reddish clay soil on grey shale and quartzite bedrock; 275 m altitude; fl. & fr. Dec.

Note — This species is glabrous in all parts, except for a fine indumentum on leaf bud and ovaries; some minute stellate scattered hairs may be seen at the base of the fruit (lens!).

**105. Myristica philippensis Lam.**

*Myristica philippensis* Lam., Hist. Acad. Roy. Sc. Paris (for 1788) (1791) 161; Encycl. Méth. Bot. 4 (1797) 387; Warb., Mon. Myrist. (1897) 386, t. 12; Merr., Philipp. J. Sci., Suppl. 1 (1906) 55; Sp. Blanc. (1918) 151; Enum. Philipp. Flow. Pl. 2 (1923) 179; J. Sinclair, Gard. Bull. Sing. 23 (1968) 138, f. 3, 4; W. J. de Wilde, Blumea 42 (1997) 179. — Type: *Sonnerat s.n.*, Philippines.

*Myristica commersonii* Blume, Rumphia 1 (1837) 181; A.DC., Prodr. 14, 1 (1856) 193; Miq., Fl. Ind. Bat. 1, 2 (1858) 61. — Type: *Commerson s.n.*, Mauritius, culta.

*Myristica macrocarpa* Blume, Rumphia 1 (1837) (= *Nux moschata quarta* ... in Ray, Hist. Pl. 3, App. 58, sine descr.); A.DC., Prodr. 14, 1 (1856) 207; Fern.-Vill., Nov. App. (1880) 178; Vidal, Fl. For. Fil. Atlas (1883) (excl. pl. 57A 1, 2 & 3 = *Knema glomerata*) — Type: not preserved (Sinclair, l.c.: 144).

*Myristica luzonica* Blanco, Fl. Filip. (1837) 664; ed. 2 (1845) 462, 463; ed. 3, 3 (1879) 69, 70; A.DC., Prodr. 14, 1 (1856) 207; Miq., Fl. Ind. Bat. 1, 2 (1858) 72. — Type: no specimens preserved (Sinclair, l.c.: 144).

*Myristica bracteata* A.DC., Prodr. 14, 1 (1856) 192 (incl. var. *longifolia* A.DC., l.c.: 193); Fern.-Vill., Nov. App. (1880) 177; Vidal, Phan. Cuming. (1885) 139; Rev. Pl. Vasc. Filip. (1886) 221. — Syntypes: *Bojer s.n.*, 1833; *Callery 33*; *Cuming 1481*; *Wallich Cat. n. 6800*; *DuPetit Thouars s.n.*; *Sieber 365*; etc. — Type of var. *longifolia*: *Cuming 829* (see Sinclair, l.c.).

*Myristica grandiflora* Wall., Cat. (1832) n. 6800b, nomen (K, herb. sheet, not in the Wallich Catalogue).

*Myristica madagascariensis* auct. non Lam.: Bojer, Hort. Maurit. (1837) 275; Vent. ex A.DC., Prodr. 14, 1 (1856) 192 (in syn. *Myristica bracteata*).

*Myristica sylvestris* auct. non Houtt.: Sieber ex A.DC., Prodr. 14, 1 (1856) 192 (in syn. *Myristica bracteata*).

Tree 6–15 m. Twigs 3–5(–7) mm diameter, early glabrescent, hairs 0.5–1 mm; older twigs sometimes fissured; lenticels many, few, or absent. *Leaves* chartaceous or thinly coriaceous, (obovate-oblong or) elliptic-oblong, or oblong-lanceolate, 15–45(–50) by 5–14(–15) cm, base cuneate or (broadly) rounded, apex acute (with ± blunt tip) or acute-acuminate; upper surface olivaceous-brown, lower surface grey-brown, glabrescent, indumentum cobweb-like, hairs scale-like, 0.1 mm, mixed with few dendroid hairs 0.2 mm, in old leaves a faint cobweb-like covering remaining; distinctly or faintly papillose; dots absent; midrib above flat, lateral nerves 18–30 per side, at 40–80° to the midrib, flat above, brown and contrasting in colour below, lines of interarching and venation distinct above, indistinct below; petiole 20–40 by 2–5 mm; leaf bud 6–10 by 3 mm, hairs 1–2 mm long. *Inflorescences* pedunculate, between the leaves or below, or frequently axillary to (fallen) reduced leaves at the twig apex, with shaggy rusty hairs 1–2 mm; bracts 5–10(–20) mm, pubescent, caducous; in male: 4–9 by 3–4(–5) cm, peduncle 10–50 mm, branches to 20 mm, central axis (10–)20–50 mm long, with 1 or 2 (or 3) dense clusters of (3–)5–10 flowers, buds of various sizes; in female: smaller, 2–3 cm long, fewer flowered; flowers ± coriaceous, with woolly hairs 0.2–0.5 mm, sometimes subglabrescent. *Male flowers*: pedicel 5–8 mm, bracteole 4–6 by 6–8 mm, apex subacute or ± 3-topped, late caducous; buds ovoid, 5–8 by 5–7 mm, apex ± blunt, base broadly rounded, cleft 1/3–1/2, lobes 3 or 4, at sutures 0.5–1 mm thick. Androecium cylindrical or ± club-shaped, 4–6 mm, subtruncate; androphore broadly cylindrical, (1–)1.5–2 by 1–1.2 mm, with hairs 0.2–0.4 mm long in the lower 2/3; synandrium 3–4 (–5) by 1.2–1.5 mm, thecae 12–16, sterile apex to 0.2–0.3 mm. *Female flowers*: pedicel

1–2 mm long, bracteole caducous; buds ovoid, apex subacute, 7–8(–9) by 6–7 mm, cleft nearly 1/2; ovary conical-ovoid, (3–)4 by 3–3.5 mm, hairs 0.3(–0.4) mm, stigma 1 mm. *Fruits* usually solitary (seemingly more-fruited in aggregated inflorescences), broadly ellipsoid, (4–)5–8 by 3–4.5 cm, hairs dense, rust-coloured,  $\pm$  mealy, 0.3–0.5 mm, sometimes  $\pm$  glabrescent; pericarp 7–10 mm thick; seeds not seen; fruiting pedicel 3–5 mm.

*Field-notes* — Bark blackish brown, longitudinally fissured. Seeds narrowly oblong, conform to the fruits, dark brown and slightly glossy when dry. Sinclair (l.c.: 140) reported a fresh fruit, cultivated in Madagascar, as large as 12 cm long.

*Distribution* — Cultivated in Mauritius, Madagascar, Martinique, and India (Calcutta); *Malesia*: throughout the Philippines (except Palawan); no recent collections known.

*Habitat & Ecology* — Formerly a common understorey tree in primary lowland forest, up to c. 400 m altitude; fl. & fr. possibly throughout the year.

*Note* — Inflorescences of *M. philippinensis* appear frequently before the leaves, probably in relation to the seasonal climate in the Philippines, and are often axillary to reduced leaves and somewhat crowded at the apex of the twigs, with a vegetative bud at the end, reminiscent of a compound apical inflorescence. The species is distinguishable by its stout habit, paniculate inflorescences, and glabrescent leaves.

### 106. *Myristica pilosella* W. J. de Wilde

*Myristica pilosella* W. J. de Wilde, Blumea 40 (1995) 314. — Type: NGF 28986 (*Streimann & Katik*), Papua New Guinea.

Treelet 5 m. *Twigs* 1–1.5 mm diameter,  $\pm$  angular, late glabrescent, hairs shaggy, 0.5 (–1) mm; older twigs yellowish brown, longitudinal cracks and lenticels not apparent. *Leaves* thinly chartaceous,  $\pm$  oblong-lanceolate, 8–13 by 1.5–3.5 cm, base short-attenuate, apical part narrowed into long acute-acuminate apex; upper surface dark brown, lower surface grey-brown, glabrescent, hairs scattered, less than 0.1 mm (lens!), subpersistent and stouter on the midrib; not papillose; dots absent; midrib raised above (but in a groove), lateral nerves 14–16 per side, at 60–70° to the midrib, sunken above, lines of interarching and venation distinct on both surfaces; petiole 7–15 by 1–1.5 mm, glabrescent, hairs pilose, to 1 mm; leaf bud 6–12 by 1.5–2 mm, hairs 1 mm. *Inflorescences* between the leaves, with slender peduncle, paniculate, late glabrescent, hairs woolly, 0.5 mm long or less; *male inflorescences* not known, but likely resembling those of *M. cornutiflora* subsp. *elegans* and *M. olivacea*; *female inflorescences*: peduncle 15–25 by 0.5–1 mm, ending in a scar-covered brachyblast up to 5 mm long, with one flower (bud), with or without the initiation of a next bud; flowers with woolly light brown hairs 0.5 mm or less. *Female flowers*: pedicel 6 by 0.7(–1) mm, bracteole ovate, 0.5–1 by 1 mm, subpersistent, apical; buds (submature) ovoid-oblong, narrowed in the apical half, 8 by 3 (–3.5) mm, apex subacute, cleft c. 1/8, lobes 0.7(–1) mm long; ovary (from the perianth and immature fruit) ovoid-oblong, 6–6.5 by 2.5 mm, hairs 0.5–1 mm. *Fruits* solitary, on long slender stalk, presumably pendulous, fusiform, 5–5.5 by 1.5(–2) cm, apex  $\pm$  beaked, base narrowed into a 5–10 mm long pseudostalk, hairs dense, yellow-rusty, pilose, 0.2–0.4 mm and stouter straight hairs towards the apex and at the base of the pseudostalk; pericarp 1 mm thick; seeds not seen but presumably (ellipsoid-)oblong, 3–3.5 cm; fruiting pedicel 7–9 mm long, pubescent, with the (sub)persistent bracteole 1–2 mm below the apex.

Field-notes — Small tree, bole 3 m, dbh 5 cm. Leaves dull dark green above, green below; soft reddish scale-like hairs on midrib and new growth. Flower buds reddish brown. Fruits reddish brown.

Distribution — *Malesia*: Papua New Guinea (Milne Bay Prov., Ruba Ruba subprov., at the junction of Ugat and Mayu Rivers, near Mayu I.); known only from the type.

Habitat & Ecology — In *Castanopsis*-dominated forest; 1000 m altitude; fl. & fr. July.

Note — According to the inflorescences *M. pilosella* links up with *M. cornutiflora* and *M. olivacea*. It is similar to *M. cylindrocarpa*, a lowland species also known only from a single fruiting specimen which differs in the shorter indumentum, leaf venation, shorter infructescences, and smaller fruits.

### 107. *Myristica pilosigemma* W.J. de Wilde

*Myristica pilosigemma* W.J. de Wilde, Blumea 42 (1997) 179. — Type: PNH 118078 (Gutierrez), Philippines, Samar I.

Tree 12 m. Twigs 1.5–2(–2.5) mm diameter, early glabrescent, inconspicuously, minutely pubescent; older twigs finely fissured or thinly flaky; lenticels small. Leaves chartaceous or thinly coriaceous, elliptic-oblong or oblong-lanceolate, 10–24 by 3–6 cm, base  $\pm$  cuneate or (narrowly) rounded, apex acute(-acuminate), the very tip acute or  $\pm$  blunt; upper surface olivaceous, lower surface  $\pm$  grey, late glabrescent, hairs pale brown, dense, felty, appressed, of mixed sizes, 0.1–0.4 mm, the larger hairs leaving minute dark point-like scars; somewhat papillose; dots absent; midrib above slightly raised, lateral nerves 14–17 per side, at 40–60° to the midrib, brown below, contrasting in colour, lines of interarching and venation indistinct; petiole 12–18 by 2–2.5 mm; leaf bud 15–20 by 2–3.5 mm, hairs rough, bright brown,  $\pm$  appressed, 1 mm. Inflorescences minutely rusty pubescent, glabrescent, between the leaves, as in *Knema*; in male: a simple sessile (peduncle 1 mm or less), worm-like scar-covered brachyblast to 13 mm long, with a subumbel of 1–5 flowers, buds of various sizes; bracts small, caducous; female inflorescences not known; flowers with dense red-brown hairs 0.2 mm. Male flowers: pedicel slender, 3 mm, bracteole ovoid-oblong, 3 mm, late caducous or subpersistent; buds ellipsoid-oblong, 4–4.5 by 2(–2.5) mm, cleft c. 1/2, lobes 1.5–2 mm long, 0.2 mm thick. Androecium 3 mm; androphore 1.5 by 0.4 mm, with hairs 0.2–0.3 mm in lower 1/4 only; synandrium 1.5 by 0.5 mm, thecae 14, sterile apex shallowly lobulate at apex, (0.2–)0.3 mm. Female flowers not known. Infructescences sessile, wart-like, 5 mm long. Fruits solitary, sessile, ellipsoid, (3–)3.5 by 2.5–3 cm, hairs woolly, 0.5–1 mm; pericarp 4–5 mm thick; seeds ellipsoid, (2.5–)3 cm; fruiting pedicel short, 2–3 mm long.

Field-notes — Tree dbh c. 15 cm. Flowers yellow-brown.

Distribution — *Malesia*: Philippines (Samar, Mindanao).

Habitat & Ecology — Along trail; c. 600 m altitude; fl. Apr.; fr. June–July.

Notes — 1. Species of similar general habit in the Philippines are e.g. *M. agusanensis* and *M. cumingii* (with  $\pm$  pedunculate inflorescences), but the present species differs in the more conspicuous indumentum (hairs to 1 mm long) of leaf bud and fruits.

2. *Myristica pilosigemma* has the whitish lower leaf surface with minute punctation caused by scars of fallen larger hairs in common with several species outside the Philippines, e.g. with *M. impressa* from Sulawesi.

**108. *Myristica polyantha* W.J. de Wilde**

*Myristica polyantha* W.J. de Wilde, *Blumea* 40 (1995) 315. — Type: *Brass* 24772, Papuan Islands (Goodenough I.).

Tree 25–30 m. *Twigs* (1.5–)2–3 mm diameter, early glabrescent, hairs less than 0.1 mm; older twigs ± longitudinally fissured, not flaking; lenticels scarce. *Leaves* coriaceous, ellipsoid-oblong or obovoid-oblong, 7–17 by 3–9 cm, base (short-)attenuate, apex acute-acuminate, the very tip rather blunt; upper surface brown, lower surface brown-grey, glabrescent, hairs widely spaced, scale-like, less than 0.1 mm; not papillose; dots absent; midrib slightly raised above, lateral nerves 12–15 per side, at 45–60° to the midrib, flat or sunken above, lines of interarching indistinct, venation distinct or not; petioles 12–15 by 2–3.5 mm; leaf bud 10–15 by 2–3 mm, hairs 0.1 mm or less. *Inflorescences* of the *Knema*-type: sessile wart-like simple or somewhat forked woody scar-covered brachyblasts to 5 mm diameter, rusty short-pubescent; in male: flowers in dense clusters of 10–20, buds subequal in size; female inflorescences not seen; flowers with hairs 0.1–0.2 mm. *Male flowers*: pedicel 4–6 by (0.6–)0.8 mm; bracteole sometimes ± 3-topped, 2.5–3 mm long, caducous, (sub)apical; buds (ellipsoid-)oblong, 4–6 by 2–2.5(–3) mm, base ± rounded or tapering, cleft c. 1/4, lobes (1–)1.5 mm long, (0.1–)0.2 mm thick. Androecium broad-cylindrical, (3.5–)4–4.5 mm; androphore 2 by 0.8–1.2 mm, glabrous or with scattered pale hairs less than 0.1 mm only; synandrium oblong, ± truncate, 1.8–2.5 by 1–1.5 mm, thecae 10–12, not tightly contiguous, sterile apex ± absent. *Female flowers* not seen. *Infructescences* sessile, minute. *Fruits* (immature) 1 or 2 per infructescence, globose, 2.5(–3) cm diameter, hairs (grey-)rusty, mealy, 0.1 mm; pericarp 7 mm thick; seeds not seen; fruiting pedicel 5–8 by 3.5–5 mm, with coarse lenticels, bracteole scar apical.

Field-notes — Diameter of trunk to 35 cm. Leaves grey below.

Distribution — *Malesia*: Papua New Guinea (Milne Bay Prov., Goodenough I. and possibly Tagula I., but see note 2).

Habitat & Ecology — Canopy or subcanopy tree of montane oak forest and foothill forest, heavily mossed forest of ravine; c. 1600 m altitude (but see note 2); fl. & fr. Aug., Oct.

Notes — 1. Related to the variable *M. globosa* and to *M. laevifolia*. The former is mainly a lowland species, with thinner leaves and flowers with thinner perianth, narrower androecium, smaller bracteole, and fruits with thinner pericarp; *M. laevifolia* has very similar male flowers, with extremely thin indumentum, but the fruits differ in their elongate shape.

2. *Brass* 27918 (male, Tagula I., 300 m altitude) differs in its non-contrasting veins.

3. *Myristica polyantha* may be related to *M. tenuivenia* subsp. *lignosa*, with similar globose, thick-walled fruits, but the latter differs in the (±) persistent indumentum of the lower leaf surface and a more conspicuous fruit coat, with hairs (0.2–)0.5 mm. The taxonomic status of *M. polyantha* needs confirmation by more field study.

**109. *Myristica psilocarpa* W.J. de Wilde**

*Myristica psilocarpa* W.J. de Wilde, *Blumea* 40 (1995) 317. — Type: *LAE* 52394 (*Foreman*), Papua New Guinea, Manus I.

Tree 18–22 m. *Twigs* 3 mm diameter, early glabrescent, hairs less than 0.1 mm; older twigs not seen. *Leaves* thinly chartaceous, oblong-lanceolate, 14–24 by 4–7 cm, base subcuneate or narrowly rounded, apex blunt or subacute; upper surface olivaceous or brown, lower surface grey- or pale greenish brown, glabrescent, hairs widely scattered, scale-like, less than 0.1 mm; not papillose; dots absent; midrib  $\pm$  flat above, lateral nerves 15–20 per side, at 45–70° to the midrib, flat or sunken, little raised below, reddish brown, contrasting, lines of interarching indistinct, venation sunken and faint above, reddish brown, contrasting below; petiole 15–25 by 2–2.5 mm; leaf bud 15 by 2.5–3 mm, hairs 0.1(–0.3) mm. *Inflorescences* pedunculate, between the leaves, (early) glabrescent, hairs scattered, pale, 0.1 mm, like on the flowers; bracts 2 mm, caducous; in male: peduncle (15–)20 mm long, ending in one or two (sub)sessile scar-covered brachyblasts to 5 mm long, each with a subumbel of (2–)3–5 flowers, buds of various sizes; in female (from infructescences): 5–12 mm pedunculate, 1-flowered. *Male flowers*: pedicel 6–7 by 1.5–2 mm, bracteole 3–3.5 mm, caducous, scar conspicuous; buds leathery, ovoid-ellipsoid, 7–7.5 by 6 mm, cleft c. 1/2, lobes 3.5 mm long, 0.5 mm thick. Androecium 5.5 mm; androphore (1–)1.5 by 0.4 mm, glabrous; synandrium 4 by 1.2–1.4 mm, thecae 16–18, sterile apex  $\pm$  cushion-shaped, impressed in the centre, 0.3(–0.4) mm high. *Female flowers* not known. *Fruits* single, obovoid-oblong, 5–5.5 by 3 cm, apex  $\pm$  blunt or subacute, basal part narrowed, early glabrescent, hairs  $\pm$  scattered, appressed, rather pale, less than 0.1 mm; pericarp hard, 5(–7) mm thick; seeds ellipsoid-oblong, 2.5(–3) cm, with hard, bony, yellowish brown testa; peduncle of infructescence 5–12 by 3–4 mm, fissured, with scattered small lenticels, passing into fruiting pedicel, 5–7 by 3 mm, striate.

*Field-notes* — Small buttresses, or with stilt-roots at base. Bark dark brown, scaly; sap reddish; wood white or brown flecked, with red sap. Leaves shiny, dark green above, whitish below. Flowers white. Fruits (mature) green,  $\pm$  obovoid; seeds brown.

*Distribution* — *Malesia*: Papua New Guinea (endemic to Manus I.).

*Habitat & Ecology* — Lowland rain forest, at 150–180 m altitude; fl. June; fr. July.

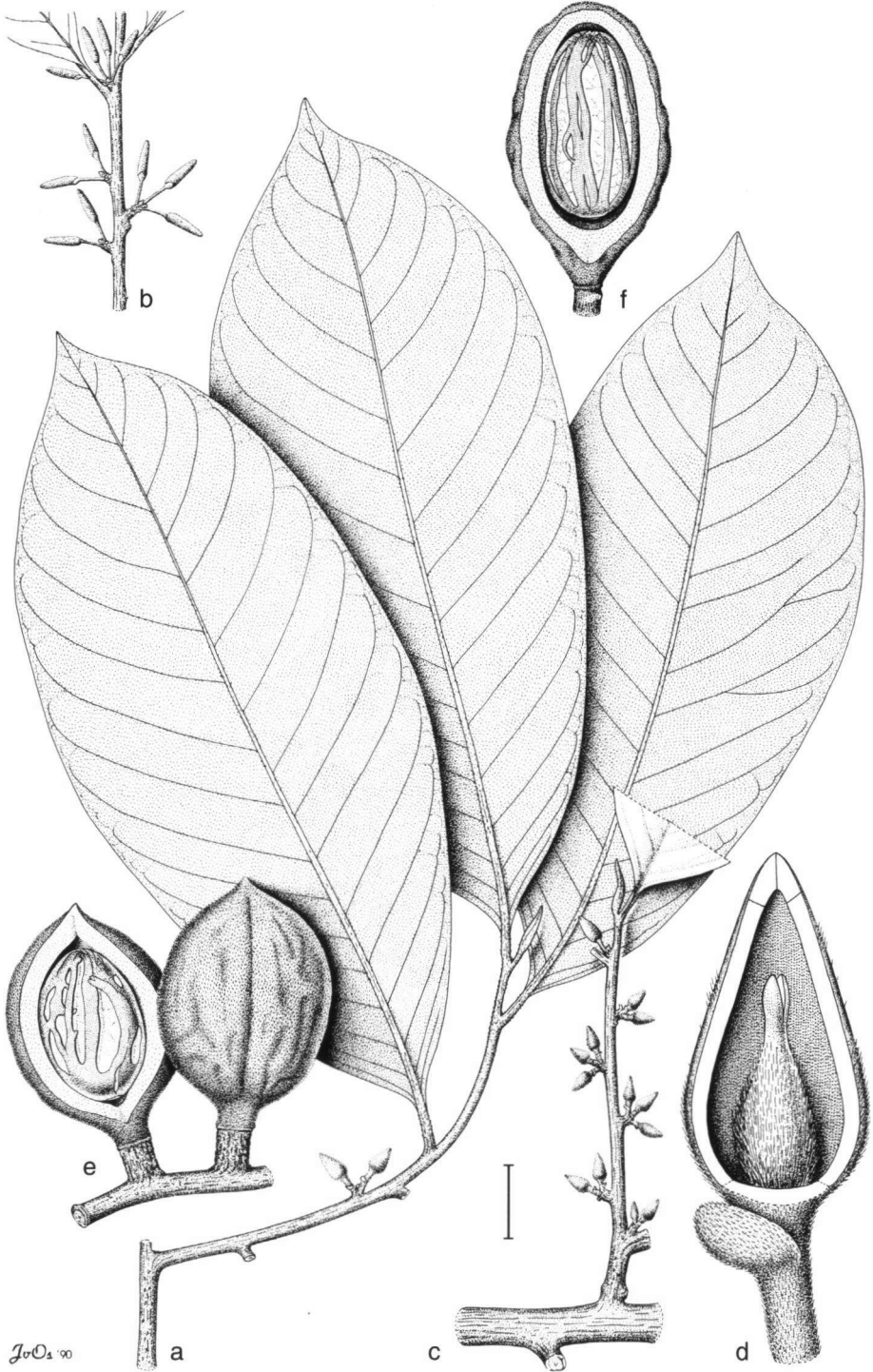
*Note* — *Myristica psilocarpa* is similar and related to *M. hooglandii*, but the latter is distinguishable by a stouter habit, leaves with faint or invisible venation, much larger male flowers (synandrium without sterile apex) and fruits with less woody and less hard pericarp, at first with a thin mealy indumentum, glabrescent.

### 110. *Myristica pubicarpa* W. J. de Wilde

*Myristica pubicarpa* W. J. de Wilde, Blumea 35 (1990) 251, f. 2 (10) & 3a–e; 42 (1997) 180. —  
Type: *Pleyte 310*, Halmahera.

Tree 10–25 m. *Twigs* 1.5–2(–3) mm diameter, early glabrescent, hairs 0.5–1 mm long; older twigs distinctly lenticellate. *Leaves* membranous or chartaceous, (elliptic-)oblong, 15–26 by 5–11.5 cm, base short-attenuate or narrowly rounded, apex acute-acuminate; upper surface brown, lower surface grey-brown, seemingly glabrous but late glabrescent, hairs thin, widely spaced, scale-like, 0.1 mm, mixed with few pale brown larger ones, 0.2 mm, the larger hairs leaving point-like scars; not obviously papillose; dots absent; midrib slightly raised above, lateral nerves 12–16 per side, at 45(–60)° to the midrib, flat or sunken above, on lower surface bright brown, contrasting in colour, lines of interarching distinct, venation faint or hardly visible; petioles 10–22 by 1.5–4 mm; leaf bud





10–15(–20) by 2–3 mm, hairs silky, yellow-brown, (0.5–)1 mm long. *Inflorescences* between the leaves and below, of the *Knema*-type: sessile, simple or forked ± woody scar-covered brachyblasts, with rusty hairs 1 mm; bracts caducous; in male: brachyblasts up to 5 mm, at apex with up to 5 flowers, buds not much variable in size; in female: brachyblasts smaller, 2 mm, 1–3-flowered; flowers ± glabrescent except at apex, hairs (0.2–)0.3 mm. *Male flowers*: pedicel 8–10 mm, bracteole ovoid, subacute, 2–3 mm, caducous; buds subcylindrical, somewhat angled, (10–)13–15 by 2.5–3(–3.5) mm, apex (sub)acute, base narrowly rounded, cleft 1/15–1/20, the lobes 0.5 mm long, 0.3–0.4 mm thick. Androecium elongate, 9–12 mm; androphore slender, (3–)3.5–4 mm, with dense hairs 0.5 mm; synandrium 6.5–7.5 by 0.4–0.5 mm, thecae 14–16, ± contiguous, sterile apex ± acute, (0.5–)1 mm, glabrous. *Female flowers*: pedicel 4–6 by 1.5(–2) mm, bracteole 1.5–2 mm, caducous, scar about median; buds ovoid-oblong, 8–10 by 4–5 mm, narrowed towards subacute apex, apical part ± angled, base ± rounded, cleft 1/8, lobes 0.5 mm thick; ovary ovoid-oblong, 4 by 2–2.3 mm, with dense hairs 0.5–1 mm, style and stigma slender, 1.5–2 mm long, deeply 2-lobed. *Fruits* solitary, sometimes several together (on short-shoots with several inflorescences), subglobose or broadly ellipsoid, 5–6 by 3.5–4.5 cm, apex ± rounded or shortly beaked, base narrowly rounded and narrowed into a pseudostalk up to 5 mm, indumentum coarse-mealy, hairs dense, dark rust-coloured, 0.2–0.3 mm; pericarp hard-leathery or woody, often wrinkled or bullate on drying, 5–10 mm thick; seeds broadly or narrowly ovoid-ellipsoid, 2.5–3 cm, aril thick, fatty, deeply sunken into the seed leaving deep grooves when removed; fruiting pedicel stout, 10 mm long. — Fig. 65a, 82a–e.

*Field-notes* — Bole very straight, up to 25 cm dbh, buttresses to 40 cm high and out, 2 cm thick, or with low stilt-roots, c. 50 cm high, covering an area of about one square metre. Outer bark 0.2–0.3 mm thick, (grey-)brown, not fissured, slightly peeling off or not; inner bark 2.5–5 mm thick, pale red on section; exudate little, watery, (orange-)brown; sapwood cream turning reddish (cream). Flowers yellow. Fruits with dark brown indumentum.

*Distribution* — *Malesia*: N Moluccas (endemic to Halmahera and Obi).

*Habitat & Ecology* — Solitary, locally common tree. Primary open or rather dense foothill forest, with little or dense undergrowth; clayey soil; rather level terrain or hillside; along small stream; 500–600 m altitude; fl. & fr. Nov.

*Note* — This species, readily distinguishable by its large, elongate, male flowers and sessile inflorescences, is related to *M. succedanea* from nearby Ternate, Tidore and Bacan. The latter differs in its dense (but low) subsistent indumentum on the lower leaf surface, usually distinctly pedunculate inflorescences, persistent or late-falling apical bracteole, shorter indumentum of twig apex, leaf bud and flowers, larger glabrescent fruits, and a thinner aril.

Fig. 82. *Myristica pubicarpa* W.J. de Wilde. a. Leafy twig with female inflorescence; b. twig with male inflorescences; c. twig with female inflorescences; d. female bud, opened, cleft at anthesis to the depth as indicated at the apex; e. twig with two infructescences, each with one fruit, one opened, showing subglobose seed with thick aril. — *M. succedanea* Blume. f. Fruit, opened, showing ellipsoid seed with thin dried aril [a: *de Vogel* 3979; b: *de Vogel* 4000; c–f: *de Vogel* 4092]. — Scale bar for a–c, e, f = 2 cm; for d = 2 mm.



**111. *Myristica pumila* W. J. de Wilde**

*Myristica pumila* W. J. de Wilde, *Blumea* 40 (1995) 319, f. 6a–c. — Type: *Hoogland 3935*, East Papua New Guinea.

Shrub or treelet, 1.5–7 m tall. *Twigs* (faintly) angular, (0.5–)1–1.5 mm diameter, early glabrescent, hairs less than 0.1 mm; older twigs neither cracking nor flaking; lenticels inconspicuous. *Leaves* membranous, (elliptic-)oblong, 6–15.5 by 2–5 cm, base attenuate, apex acute-acuminate; upper surface olivaceous-brown, lower surface ± pale greyish brown (rather concolorous with upper surface), early glabrescent, hairs less than 0.1 mm; not papillose; dots absent; midrib raised above, lateral nerves 9–16 per side, at 60–80° to the midrib, sunken (and indistinct) above, brown and contrasting in colour below, lines of interarching distinct, venation distinct or not; petiole 7–15 by 1–1.5 mm; leaf bud 5 by 0.5–1 mm, hairs less than 0.1 mm. *Inflorescences* between the leaves, of the *Knema*-type: a sessile or up to 1 mm pedunculate, scar-covered brachyblast; in male: simple or forked, up to 5 mm long, ending in a cluster of 1–4 flowers, buds of various sizes; female with a single flower, sessile; flowers thinly or scarcely with hairs less than 0.1 mm, looking as if glabrous. *Male flowers*: pedicel 6.5–10 by 0.4(–0.5) mm, bracteole ± ovate, caducous, scar 2–4 mm below the apex; buds elongate, tubiform, (6–)7–9.5 by 1.8–2 mm, slightly narrowed or not in the lower half, apex ± blunt, base ± rounded-attenuate, inner surface in basal part minutely verrucose; cleft c. 1/6, lobes membranous, 1–1.7 mm long, 0.2 mm thick. Androecium slender, 6–9 mm; androphore 3–4.5 by (0.3–)0.4–0.5 mm, with hairs 0.1 mm or less in the lower 1/2–2/3; synandrium 2.4–4.2 by 0.6–0.7 mm, thecae c. 12, subacute, sterile apex 0.3(–0.4) mm. *Female flowers* (submature) solitary, pedicel thread-like, at least 14 mm long, bracteole scar about median; buds (narrowly) ellipsoid-oblong, at least 5 by 1.5–2 mm, lobes 1 mm; ovary not seen. *Fruits* solitary, oblong, 5 by 1.5 cm, apex ± blunt, base gradually contracted into a narrow pseudostalk for nearly half of the total length of the fruit, hairs sparse, greyish brown, appressed scale-like, less than 0.1 mm; pericarp 1 mm thick; seeds ellipsoid, c. 2 cm long; fruiting pedicel filiform, 20–25 by 0.5 mm, bracteole scar below the middle. — **Fig. 62e, 83a–c.**

**Field-notes** — Stem to 10 cm diameter. Bark (grey-)brown, faintly longitudinally fissured; inner bark pale brown; exudate colourless turning red; wood straw(-brown). Leaves slightly glaucous below. Flowers pale yellow or greenish. Fruits pale rusty brown; seeds dark brown.

**Distribution** — *Malesia*: Papua New Guinea (Northern Prov., Milne Bay Prov.: Fergusson I.).

**Habitat & Ecology** — Primary and degraded forest; rather open tall forest, lowland forest by river, fairly dense c. 10 m tall forest; 170–400 m altitude; fl. Mar., Sept., Nov.; fr. Sept.

**Fig. 83.** Three related small-leaved *Myristica* species with the perianth finely warty inside. — *M. pumila* W. J. de Wilde. a. Male flowering twig; b. male bud, opened, bracteole caducous; c. apex of leafy twig with one-fruited infructescence. — *M. crassipes* Warb. subsp. *crassipes*. d. Male bud, opened, with caducous bracteole. — *M. flosculosa* J. Sinclair. e. Male flower, opened [a, b: *Hoogland 3935*; c: *Hoogland 3971*; d: *Carr 16091*; e: *Saunders 175*]. — Scale bar for a, c = 2 cm; for b, d, e = 1.5 mm.

Notes — 1. Obviously close to *M. tubiflora*, and especially to *M. filipes* and *M. flosculosa*; with the latter two it shares the warty-fleshy inner surface of the lower half of the perianth. *Myristica pumila* can be regarded as a delicate edition of *M. flosculosa*. Another much resembling species is *M. sogeriensis*.

2. *Myristica pumila* keys out beside species with a sessile, non-pedunculate inflorescence; however, some of the inflorescences have a short peduncle, to 1 mm long, usually in specimens in which the majority of the inflorescences is completely sessile.

### 112. *Myristica pygmaea* W. J. de Wilde

*Myristica pygmaea* W. J. de Wilde, Blumea 40 (1995) 320. — Type: LAE 66758 (*Barker & Katik*), Papua New Guinea.

Treelet 2–4 m. Twigs subangular, 1.5(–2) mm diameter, early or rather late glabrescent, hairs 0.3–0.5 mm; older twigs striate; lenticels small and inconspicuous. Leaves membranous or thinly chartaceous, oblong, 8–15(–17.5) by 3–5(–6.5) cm, base short-attenuate or rounded, apex acute-acuminate, often with ± blunt tip; upper surface olivaceous-brown, lower surface grey-brown or cinnamon, late glabrescent, hairs weak, flossy, 0.1(–0.2) mm; indistinctly papillose; dots absent; midrib slightly raised above, lateral nerves (4–)7–14 per side, at 45–60° to the midrib, the lower nerves sometimes steeper, (flat or) sunken above, (light) brown and contrasting in colour below, lines of interarching and venation indistinct; petioles 10–12 by 1.5–2(–2.5) mm; leaf bud 10 by 2.5 mm, hairs ± rough, 0.3–0.5 mm. Inflorescences (from infructescences) between the (lower) leaves, axillary or up to 3 mm supra-axillary, ± paniculate, peduncle 3–4 mm long, ending in a small, scar-covered brachyblast with few flowers, partly late glabrescent, hairs dark brown (rusty), 0.3–0.5 mm; male inflorescences, male and female flowers not seen. Infructescences: peduncle 3–4 by 2 mm, ± pubescent. Fruits (slightly immature) solitary, ± ellipsoid, 2.5–2.7 by 1.5 cm, apex subacute, narrowed towards the base, hairs powdery, rust-coloured, 0.3–0.4 mm; pericarp ± 2 mm thick; seeds not seen; fruiting pedicel 2–4 by 2–2.5 mm, hairs woolly, 0.2 mm, bracteole scar near the apex.

Field-notes — Outer bark grey; inner bark reddish brown; wood whitish brown. Leaves dull dark green or ± shiny light green above, hairy below. Fruits (orange-)yellow, with brown indumentum.

Distribution — *Malesia*: Papua New Guinea (Morobe Prov., Mumeng & Lae subprov.); locally endemic to that area.

Habitat & Ecology — Lowland rain forest, logged forest; c. 120 m altitude; fr. Nov.

Note — Distinguishable by its small stature, 2–4 m. Superficially resembling other small-statured species of Papua New Guinea and possibly most related to *M. cylindrocarpa* or to the montane *M. sinclairii*, all with pedunculate inflorescences, partly supra-axillary to the leaves, but *M. pygmaea* is different in indumentum and fruits. The species is known only with fruits; female flowers apparently have a comparatively short pedicel.

### 113. *Myristica quercicarpa* (J. Sinclair) W. J. de Wilde

*Myristica quercicarpa* (J. Sinclair) W. J. de Wilde, Blumea 40 (1995) 321. — *Myristica fatua* Houtt. var. *quercicarpa* J. Sinclair, Gard. Bull. Sing. 23 (1968) 302, f. 38D–F; Foreman, Contr. Herb. Austral. no. 9 (1974) 37 (key); Handb. Fl. Papua New Guinea 1 (1978) 196. — Type: NGF 1270 (*L. S. Smith*), Papua New Guinea.

Tree 20–40 m. *Twigs* 2–4 mm diameter, glabrescent, hairs 0.5(–1) mm long; older twigs somewhat longitudinally cracking, probably later on  $\pm$  flaking; lenticels absent. *Leaves* thinly chartaceous, elliptic- or obovate-oblong, 15–21 by 4.5–10 cm, base cuneate, rounded, or subcordate, apex acute-acuminate; upper surface olivaceous(-brown), lower surface yellowish brown, hairs persistent, dense, pale, floccose, interwoven, 0.1–0.2 mm with numerous emergent brown or yellowish hairs of varying length, up to 1 mm; not papillose; dots absent; midrib slightly raised above, with some indumentum remaining in younger leaves, lateral nerves 13–23 per side, at 60–80° to the midrib, lines of interarching distinct, venation distinct or faint; petiole late glabrescent, 12–20 by 2.5–3.5 mm; leaf bud 10–15 by 2–3 mm, hairs 0.5–1 mm long. *Inflorescences* (from infructescences) of the *Knema*-type: in female a sessile, wart-like brachyblast, few-flowered, between the leaves (or below), or rarely a few in a lateral short-shoot. *Male and female flowers* not known. Infructescences very short. *Fruits*: subsessile, single or 2–4 in a cluster, acorn-shaped, about as broad as long or broader than long,  $\pm$  broadly ovoid, 1.3–2.3 by 1.8–2.7 cm, apex (broadly) rounded with short pointed tip, base broadly truncate, flat, or depressed, hairs dark (yellow-)brown, floccose, 0.5–1 mm long; pericarp 2(–3) mm thick; seeds broadly ellipsoid, broadly rounded at both ends, 1.5 cm; fruiting pedicel slender, 5–10 by 2–3 mm, pubescent, bracteole scar apical. — **Fig. 61e.**

**Field-notes** — Bole straight, sometimes channelled at base, not buttressed. Branches horizontal. Bark blackish, with fine longitudinal fissures or wrinkled and with less distinct horizontal grooves, or peeling off in rectangular flakes; inner bark red-brown, concentrically layered; wood pale, red-brown, staining on exposure; exudate red, watery. Leaves brown-green below, or with brown hairs. Fruits (pale) reddish brown.

**Distribution** — *Malesia*: Papua New Guinea (endemic to Northern and Milne Bay Prov.).

**Habitat & Ecology** — Lowland forest on flats; 50–100 m altitude; fr. Mar., June.

**Note** — Known only from fruiting specimens. The indumentum of the lower leaf surface with long, emergent hairs, rather than only a thin felt-like covering, makes the species quite distinguishable from the *M. fatua*-species group, even in the sterile state.

#### 114. *Myristica robusta* W. J. de Wilde

*Myristica robusta* W. J. de Wilde, *Blumea* 35 (1990) 253, f. 2: 11; 42 (1997) 180. — Type: *de Vogel 3918*, Moluccas (Bacan).

Tree c. 15 m. *Twigs* 5–10 mm diameter,  $\pm$  hollow, early glabrescent, hairs scurfy, less than 0.1 mm; older twigs soon finely longitudinally cracking, thinly scaly; lenticels grey-brown, abundant, but not conspicuous. *Leaves* thinly coriaceous, elliptic-oblong, 30–40 by 14–20 cm, base rounded or somewhat cordate, apex subacute; upper surface olivaceous-brown, lower surface pale brown,  $\pm$  glabrescent, hairs scurfy, less than 0.1 mm; not papillose; dots absent; midrib slightly raised above, lateral nerves 18–23 per side, at 60–80° to the midrib, flat or sunken, lines of interarching distinct, venation  $\pm$  trabeculate, faint at both surfaces; petiole 26–40 by 4–6 mm (in vigorous sapling shoots  $\pm$  alate); leaf bud 25 mm long, hairs 0.1(–0.2) mm or less. *Inflorescences* between the leaves and below, of the *Knema*-type, in male: peduncle up to 6 mm long, with a simple or a 2–4-fid woody, scar-covered brachyblast (5–)10–20 by 4–7 mm, with  $\pm$  woolly hairs 0.2–0.3 mm, ending with clusters of 3–6 (or more) flowers, buds of various sizes; bracts minute, caducous;

flowers with woolly hairs 0.2–0.3 mm. *Male flowers*: pedicel (10–)14 by 1.5(–2) mm, bracteole (sub)persistent, 4.5–5 mm long; buds ellipsoid(–oblong), 8–8.5 by 4–4.5 mm, apex narrowly rounded, cleft c. 1/5, lobes (0.4–)0.5 mm thick. Androecium 7 mm; androphore 2.5 by (1–)1.5 mm, with a few scattered pale hairs 0.1 mm; synandrium 4.5 by 1.5(–2) mm, thecae c. 20, sterile apex 0.1 mm, rather flat with lobed edge. *Female flowers and fruits* not seen. — **Fig. 65b.**

Field-notes — Solitary tree, clear bole 8 m, dbh 13 cm, straight with solid core. Outer bark 0.4 mm thick, fissured, not peeling off; inner bark 2.5 mm thick, on section pale red-brown; exudate little, watery, pale reddish brown; sapwood light yellowish, gradually passing into the slightly red-tinged heartwood. Flowers yellowish, brown by indumentum.

Distribution — *Malesia*: N Moluccas (Bacan); known only from the type.

Habitat & Ecology — Disturbed, tall, 50 m high forest with little undergrowth; alluvial flat, with in places stagnant water at c. 5 m altitude; fl. Nov.

Note — *Myristica robusta* is distinguishable by its stout twigs and leaves, stout inflorescences of the *Knema*-type, and the comparatively large male flowers, 8 mm long. The species seems closely related to the widespread *M. fatua* which readily differs in leaves that are pubescent below, and smaller male flowers. Also close to *M. frugifera* from the Philippines, a species known only in fruit, noticeable for its paniculate, pedunculate inflorescences.

### 115. *Myristica rosselensis* J. Sinclair

*Myristica rosselensis* J. Sinclair, Gard. Bull. Sing. 23 (1968) 205, f. 16; Foreman, Handb. Fl. Papua New Guinea 1 (1978) 207; W. J. de Wilde, Blumea 40 (1995) 32. — Type: *Brass* 27447, Papua New Guinea, Misima I.

Tree 7–25 m. *Twigs* faintly angular, 1.5–2.5 mm diameter, early glabrescent, indumentum minute; older twigs finely longitudinally cracking; lenticels not obvious. *Leaves* membranous or (thinly) chartaceous, oblong or lanceolate, 6–16 by 2–3.5(–4) cm, base narrowly rounded or acute, apex subacute or blunt; upper surface olivaceous brown, lower surface grey-brown, seemingly glabrous, but hairs (sub)persistent, scattered, less than 0.1 mm; papillose (lens!); dots absent; midrib above flat or slightly raised, on lower surface yellowish or reddish brown, contrasting in colour, lateral nerves 15–22 per side, at 60–70° to the midrib, above and below flat or sunken and faint, lines of interarching and venation faint or invisible; petiole 10–15 by 1.5–2 mm; leaf bud 5–10 by 1–1.5 mm, hairs 0.1 mm. *Inflorescences* between the leaves or below, pedunculate, early glabrescent, the lateral branches with sessile, slender, scar-covered brachyblasts, central axis short or reduced to one flower; bracts ± acute, caducous, 1–1.5 mm long; male inflorescence: 4–7 cm long, peduncle flattened, 25–40 by 2–2.5 mm, lateral brachyblasts to 20 mm (subsp. *minutiflora*), flowers in subumbels of 2–4(–5), buds subequal in size; female like male, shorter (20–30 mm), 2–4-flowered, the central axis short or absent, each subumbel reduced to a single flower; flowers membranous, hairs 0.1 mm (densest at apex and base). *Male flowers* variable in size; pedicel slender, bracteole apical; buds cleft 1/5–1/4; androecium slender, the apical half fertile with 8–14 thecae, sterile apex absent or to 0.2 mm. *Female flowers*: buds urceolate, 4.5 mm long; ovary pubescent (see subsp. *minutiflora*). *Fruits* not seen.

Distribution — *Malesia*: Papua New Guinea (Louisiade Archipelago). With two subspecies.

Note — Closely allied to *M. schleinitzii*, the latter with a widespread distributional range; *M. rosselensis* differs in the more narrow leaves with acute base, and faint venation, and inflorescences with sessile lateral slender brachyblasts. Sinclair (1968) mentioned the glabrous androphore for *M. rosselensis*, but in *M. schleinitzii* the androphore may be ± glabrous as well. The leaves of *M. rosselensis* resemble those of *M. clemensii*.

#### KEY TO THE SUBSPECIES

- 1a. Male buds 5.5 mm long, pedicel 5 mm long, about as long as the bud . . . . .  
 . . . . . a. subsp. *rosselensis*  
 b. Male buds 3.5 mm long, pedicel 1 mm long, much shorter than the bud . . . . .  
 . . . . . b. subsp. *minutiflora*

#### a. subsp. *rosselensis*

Tree c. 25 m tall. *Leaves* 6–16 cm long. Male inflorescences with distinct central axis with flower clusters on 2 (or 3?) levels, the clusters subsessile (short, but possibly later on growing out into scar-covered brachyblasts). *Male flowers*: pedicel 5 mm long; buds ovoid-oblong, 5–5.5 by 2.5 mm, cleft c. 1/5, lobes 1 mm long. Androecium 5 mm; androphore about as wide as the synandrium, 2.5 mm long, glabrous; synandrium 2.5 by 1.2 mm, thecae 8–10, with broad connectives, sterile apex almost absent. *Female flowers* and *fruits* not seen.

Field-notes — Leaves glaucous below. Flowers yellow, fragrant.

Distribution — *Malesia*: Papua New Guinea (Louisiade Archipelago: Misima I., Mt Sisa); known only from the type.

Habitat & Ecology — In forest associated with oaks, on north slopes at c. 300 m altitude; fl. Sept.

Note — The male flowers are almost identical with those of *M. schleinitzii*, including the androecium with 8–10 thecae (with broad connectives) as against 12–16 in *M. schleinitzii*.

#### b. subsp. *minutiflora* W.J. de Wilde

*Myristica rosselensis* J. Sinclair subsp. *minutiflora* W.J. de Wilde, Blumea 43 (1998) 254. — Type: Brass 28245, male fl., Rossel I.

Tree 7–25 m tall. *Leaves* 6–10 cm long. Male inflorescences with two opposite sessile scar-covered slender brachyblasts 10–20 mm long, the central axis reduced to one flower or absent. *Male flowers*: pedicel 1 mm long; buds (ellipsoid-)oblong, 3.5 by 1.5 mm, cleft c. 1/4, lobes 0.8 mm long. Androecium 2.8–3 mm; androphore about as wide as the synandrium, 1.5 mm long, glabrous; synandrium 1.5 by 0.7 mm, thecae 10–12, sterile apex blunt, 0.2 mm. *Female flowers*: pedicel 1–2 mm long, bracteole scar subapical; buds ovoid-oblong, 4.5 by 2.5–3 mm, somewhat narrowed to the apex, cleft c. 1/5, lobes 1 mm long; ovary ovoid-oblong, 3.5 by 2 mm, narrowed into 0.4 mm long stigma, hairs dense, 0.1 mm. *Fruits* not seen.



Field-notes — Substage tree or lesser canopy tree. Leaves grey below. Flowers yellow.

Distribution — *Malesia*: Papua New Guinea (Louisiade Archipelago: Rossel and Tagula I.); known from two collections.

Habitat & Ecology — Rain forest of ridge crests at 100–300 m altitude; fl. Sept.

### 116. *Myristica rubrinervis* W. J. de Wilde

*Myristica rubrinervis* W. J. de Wilde, Blumea 42 (1997) 180. — Type: *Ridsdale SMHI 258*, Philippines, Palawan.

Tree 8–30 m. *Twigs* somewhat angular or not, 2–3 mm diameter, early glabrescent, hairs grey or orange-brown, 0.1 mm; older twigs with inconspicuous lenticels. *Leaves* chartaceous or (sub)coriaceous, elliptic-oblong or (obong-)lanceolate, 8–16 by 1.8–4.5 (–6) cm, base cuneate, apex acute-acuminate, the very tip (subacute or)  $\pm$  blunt; upper surface olivaceous or brown, lower surface greyish, subsistent or glabrescent, hairs dense, woolly, 0.1–0.2(–0.3) mm; papillose (lens!); dots absent; midrib above somewhat raised, purplish brown, lateral nerves 11–15 per side, at c. 45° to the midrib, above flat or sunken, thin, below distinct, conspicuously purplish brown (or yellow when fresh), contrasting in colour, lines of interarching and venation distinct; petiole 12–30(–40) by 1.5–2.5 mm; leaf bud 8–15 by 2–4 mm, hairs 0.1–0.2 mm. *Inflorescences* pedunculate, between the leaves, with rufous hairs 0.1–0.3 mm; in male: 1.5–2.5 cm long, peduncle 10 mm, flattened, proceeding into a branch 5–10(–20) mm, with 1–4 (sub)sessile or short-stalked lateral clusters each of 5(–10) flowers, buds of various sizes; bracts ovate, 3 mm long, caducous; female inflorescences (from infructescences): glabrescent, (1–) 1.5–3 cm long; flowers densely pubescent. *Male flowers* (Soejarto *c.s.* 8079): pedicel 2–4 mm, slender, bracteole small, caducous; buds oblong, 3–4.5 by 2–2.5 mm, cleft c. 1/3, lobes 1–1.5 mm long, c. 0.3 mm thick. Androecium 3.5 mm; androphore 2 mm, for the larger part minutely pubescent; synandrium 1.5 mm, thecae c. 12, sterile apex (almost absent) consisting of 5 or 6 protrusions of the anthers, 0.1 mm long or less. *Female flowers* not seen. *Fruits* 1 or 2 (or 3) per infructescence, ovoid-ellipsoid to ellipsoid(–oblong), 3–7 by 2.5–3.5 cm, apex and base (narrowly) rounded, hairs scurfy, orange-brown or rusty, 0.1–0.2 mm; pericarp 2–6 mm thick; seeds ellipsoid, 2–4.5 cm; fruiting pedicel 2–4 mm.

Distribution — *Malesia*: Philippines (Palawan, Mindoro, Leyte). There are two varieties.

Note — Known mostly from fruiting specimens, all quite distinct from the related *M. agusanensis* in more coriaceous leaves, with contrasting purplish or reddish brown midrib below. *Myristica rubrinervis* may be confused with *M. laevis*.

#### KEY TO THE VARIETIES

- 1a. Lower leaf surface with rather persistent dense indumentum. Fruits 3–4 cm long, pericarp 2–3 mm thick . . . . . **a. var. rubrinervis**  
 b. Lower leaf surface glabrescent. Fruits 5–7 cm long, pericarp 5–6 mm thick . . . . .  
 . . . . . **b. var. duplex**

**a. var. rubrinervis**

Tree 8–15 m. Lower leaf surface with subpersistent, rather dense pale brownish or greyish stellate hairs 0.1–0.3 mm, sometimes partially glabrescent. Petiole 1.5–2.5 cm long. *Fruits* ovoid(-ellipsoid), 3–4 by 2.5–3 cm, hairs persistent, dense, scurfy, dark rusty, 0.1–0.2 mm; pericarp 2–3 mm; seeds 2–3 cm long.

Field-notes — Bark blackish, shallowly fissured; inner bark reddish purple; exudate red. Fruits brown.

Distribution — *Malesia*: Philippines (Palawan).

Habitat & Ecology — Stunted montane rain forest with many epiphytes but little moss; closed broad-leaved rain forest on ultrabasic rock; 450–900 m altitude; fr. Mar., May.

**b. var. duplex** W. J. de Wilde

*Myristica rubrinervis* W. J. de Wilde var. *duplex* W. J. de Wilde, *Blumea* 42 (1997) 182. — Type: *Ridsdale SMHI 1528*, Philippines, Palawan.

Tree 20–30 m. Lower leaf surface (late) glabrescent, hairs rather sparse, 0.1–0.2 mm. Petiole 2–4 cm long. *Fruits* ovoid-oblong or ellipsoid-oblong, 5–7 by 3–3.5 cm, apex ± narrowly rounded, hairs persistent, scurfy, bright rust-coloured, 0.1–0.2 mm; pericarp 5–6 mm; seeds 3.5–4.5 cm long.

Field-notes — Large canopy trees. Bark blackish brown, pustular, flaky, or vertically finely cracked; inner bark red or pinkish brown, sap reddish, watery; wood pale. Leaves very pale or glaucous below with yellow nerves. Fruits and seeds brown.

Distribution — *Malesia*: Philippines (Palawan, Mindoro, Leyte); on Leyte one slightly deviating specimen occurs (*Soejarto c. s. 8079*), in leaves approaching *M. agusanensis*.

Habitat & Ecology — Rain forest (with *Dipterocarpus*), montane and ridge forest (with *Agathis*); 40–900 m altitude; fl. (immature) & fr. Feb.–Apr.

Note — The species is named after the purplish red contrasting colour of midrib and nerves on the lower leaf surface; for fresh leaves the nerves were mentioned as being yellow on the otherwise glaucous lower leaf surface.

**117. Myristica rumphii** (Blume) Kosterm.

*Myristica rumphii* (Blume) Kosterm., *Gard. Bull. Sing.* 22 (1968) 446; W. J. de Wilde, *Blumea* 42 (1997) 182. — *Tetranthera rumphii* Blume, *Mus. Bot. Lugd. Bat.* 1 (1851) 382. — *Litsea rumphii* (Blume) Fern.-Vill. in Blanco, *Fl. Filip. Nov. App.* ed. 3 (1880) 180 (cf. Kosterm., *Bibl. Laur.* 874, no. 402). — Type: *Spanoghe s. n.* (L, HLB 905234-28), Timor, annotated as originating from the Moluccas.

Tree 12–25(–30) m. *Twigs* terete or faintly 2-angled, 2.5–4(–6) mm diameter, yellowish or reddish brown, or blackish, early glabrescent, hairs 0.1 mm or less; older twigs with scattered concolorous lenticels. *Leaves* chartaceous or (sub)coriaceous, (elliptic-)oblong, base cuneate, rounded, or (sub)cordate, apex acute (with ± blunt tip) or acute-acuminate, 17–30 by 5–10 cm; upper surface olivaceous or brown, lower surface greyish, (sub)glabrescent, indumentum variable, hairs scale-like, ± touching, but surface visible, 0.1 mm long or less, sometimes mixed with few scattered emergents; ± papillose; dots absent; midrib above slightly raised, lateral nerves 16–28 per side, at 45–60° to the

midrib, sunken above, lines of interarching and venation faint or distinct; petiole 12–25 by 2–4 mm; leaf bud 10–15 by 2–3 mm, hairs appressed, 0.2–0.5 mm. *Inflorescences* between the leaves or below, of the *Knema*-type; male inflorescences not seen; female: (sub)sessile, simple or 2- to 3-armed, or irregularly shaped, scar-covered, brachyblasts to 8 mm long, short-woolly rust pubescent, with clusters of 2–4 flowers, buds of various sizes. *Male flowers* not seen. *Female flowers*: with hairs 0.2–0.4 mm; pedicel 0.5–1 mm, bracteole ovate, 2–2.5 mm, subacute, late caducous, apical; buds ovoid, apex subacute, base broadly rounded, 5 by 3.5–4 mm, cleft c. 1/3; ovary ovoid, 3 mm long, pubescent. *Fruits* usually single, subsessile, ovoid-ellipsoid, 2.5–4 by 2–2.5 cm, hairs dense, velvety, (dark) rust-coloured, 0.3–1 mm; pericarp 2–4.5 mm thick; seeds 2.5 cm; fruiting pedicel 1–3 mm long.

Distribution — *Malesia*: Lesser Sunda Islands (except Bali and Lombok). There are two varieties.

Note — A homogeneous species, characterized by the weak minute indumentum on the lower leaf surface, the rather small fruits (2.5–4 cm long) with persistent short indumentum, and the ± sessile inflorescences. The species resembles *M. fatua*, which has a densely interwoven indumentum on the lower leaf surface.

#### KEY TO THE VARIETIES

- 1a. Twigs 2.5–3.5 mm diameter, yellowish or reddish brown. Leaves (thinly) chartaceous, base cuneate or (narrowly) rounded. Fruits 2.5–3.5(–4) cm long, hairs bright brown, 0.5–1 mm. — Lesser Sunda Islands ..... **a. var. *rumphii***  
 b. Twigs 3–4 mm diameter, blackish brown. Leaves coriaceous, base broadly rounded or subcordate, sometimes short-cuneate. Fruits 4 cm long, hairs (very) dark brown, 0.3 mm. — Flores, 600–1400 m ..... **b. var. *florentis***

#### **a. var. *rumphii***

*Myristica rumphii* (Blume) Kosterm., Gard. Bull. Sing. 22 (1968) 446; W.J. de Wilde, Blumea 42 (1997) 182. — *Tetranthera rumphii* Blume, Mus. Bot. Lugd. Bat. 1 (1851) 382. — *Litsea rumphii* (Blume) Fern.-Vill. in Blanco, Fl. Filip. Nov. App. ed. 3 (1880) 180 (cf. Kosterm., Bibl. Laur. 874, no. 402).

*Myristica spanogheana* Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 47; Warb., Mon. Myrist. (1897) 531, t. 15. — *Myristica glauca* auct. non Blume: Span., Linnaea 15 (1841) 346. — *Myristica fatua* Hoult. var. *spanogheana* (Miq.) J. Sinclair, Gard. Bull. Sing. 23 (1968) 304, f. 39, p.p. (excl. *M. sumbawana*). — Type: *Spanoghe s.n.*, Timor.

Twigs 2.5–3.5 mm diameter, yellowish to reddish brown. *Leaves* (thinly) chartaceous, (elliptic-)oblong, base rounded or cuneate, lateral nerves 22–28 pairs; lower leaf surface usually greyish, (sub)glabrescent, hairs scattered, pale, greyish brown, scale-like, 0.1 mm. Leaf bud with appressed hairs 0.3–0.5 mm. *Fruits* 2.5–4 cm long, hairs bright brown, 0.5–1 mm; pericarp 2–4.5 mm thick.

Field-notes — Tree c. 10 m tall (may be up to 30 m). Bark black. Fruits rusty.

Distribution — *Malesia*: Lesser Sunda Islands (Sumbawa, Sumba, Flores, Timor, Wetar, Damar).

Habitat & Ecology — Lowland and montane forest; scattered in wet forest; altitude 100–800 m; fl. & fr. throughout the year.

Notes — 1. Var. *rumphii* is identical with Sinclair's *Myristica fatua* var. *spanogheana*, one of the 14 varieties recognized by Sinclair (1968) in his large concept of *M. fatua*; however, the East Malesian varieties are treated now as four related species, each with its own distributional area, viz. *M. fatua*, *M. mindanaensis*, *M. rumphii*, and *M. sangowoensis*.

2. *Schmutz 4013* (W Flores, at 300 m alt.), with female flowers, keys out to *Myristica rumphii* on account of its almost glabrous lower leaf surface, with only a very faint and fine arachnoid covering. It differs from the remainder of the material of var. *rumphii* in the more glossy upper leaf surface, and particularly in the larger female flowers (6 by 4.5–5 mm), with large late caducous bracteole, 5 mm long, and distinctly longer hairs, 0.5–1 mm. More complete material from the area is needed to assess the status of this deviating specimen.

#### b. var. *florentis* W. J. de Wilde

*Myristica rumphii* (Blume) Kosterm. var. *florentis* W. J. de Wilde, *Blumea* 42 (1997) 183. — Type: *Kostermans & Wirawan 728*, Lesser Sunda Islands, Flores.

Twigs 3–4 mm diameter, blackish brown. *Leaves* coriaceous, elliptic-oblong, broadly rounded or subcordate at base, rarely narrowly rounded, lateral nerves 15–22 pairs; lower leaf surface pale greyish brown, late glabrescent, hairs dense or scattered, brownish, scale-like, 0.1 mm, sometimes with a few scattered longer appressed hairs. Leaf bud with dense hairs 0.2 mm. *Fruits* 4 cm long, hairs dense, dark brown, 0.2–0.3 mm; pericarp 4–4.5 mm thick.

Field-notes — Bark ± rough, 2 mm, dark brown, peeling off in small particles. Living bark light brown. Sap red. Fruits rusty.

Distribution — *Malesia*: Lesser Sunda Islands (Flores).

Habitat & Ecology — Montane forest, 600–1400 m altitude; fr. Apr.–May, Nov.

### 118. *Myristica sangowoensis* (J. Sinclair) W. J. de Wilde

*Myristica sangowoensis* (J. Sinclair) W. J. de Wilde, *Blumea* 35 (1990) 254, f. 2 (12); 42 (1997) 183. — *Myristica fatua* Houtt. var. *sangowoensis* J. Sinclair, *Gard. Bull. Sing.* 23 (1968) 304, f. 36B, C. — Type: *Kostermans 1039*, N Moluccas.

Tree 10–15 m. Twigs sometimes faintly ridged, 3.5–4(–5) mm diameter, early glabrescent, hairs 0.1 mm; older twigs conspicuously lenticellate. *Leaves* chartaceous or thinly coriaceous, oblong or (ob)lanceolate, 20–35 by 7–12 cm, base rounded or short-attenuate, apex acute-acuminate; upper surface olivaceous or brown, lower surface cinnamon by dense persistent indumentum of stellate(-dendroid) hairs 0.1–0.2(–0.3) mm, mixed with few appressed longer hairs; not papillose; dots absent; midrib above slightly raised, lateral nerves 20–25 per side, at 50–70° to the midrib, flat or sunken, lines of interarching and venation indistinct or invisible; petiole 18–25 by 3.5–5 mm; leaf bud 15 by 3.5 mm, hairs 0.1(–0.2) mm. *Inflorescences* between the leaves or below, of the *Knema*-type: sessile, single or forked, woody, scar-covered brachyblasts to 5 mm long, with hairs 0.1–0.2 mm; bracts caducous; in male: with subumbels of 3–7 flowers, buds of various sizes; female similar, fewer-flowered; flowers with dense hairs (0.3–)0.5 mm long. *Male flow-*

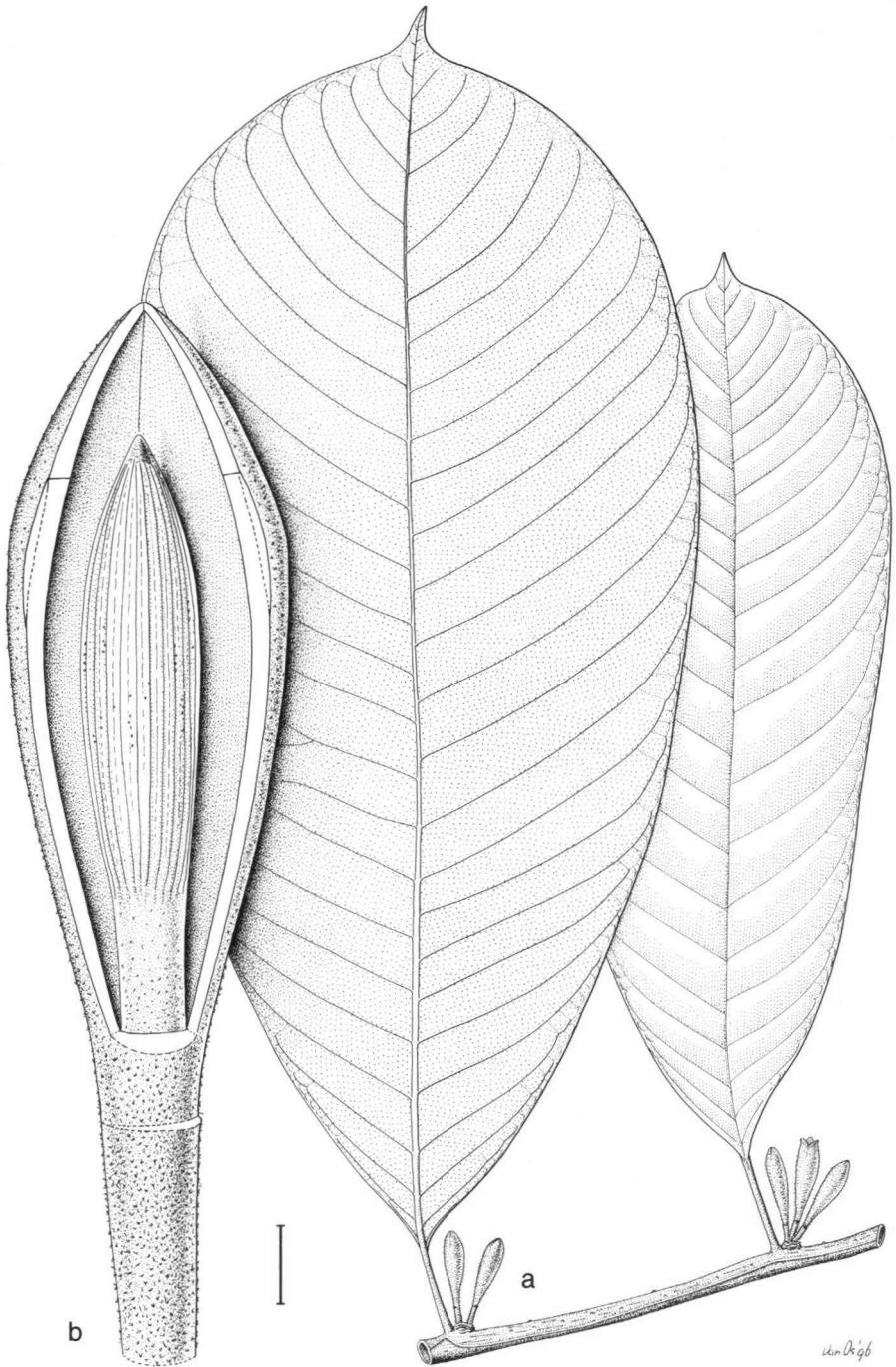


Fig. 84. *Myristica sarcantha* W.J. de Wilde. a. Leafy twig; b. male flower, opened; note scar of caducous bracteole [both: McDonald & Ismail 3800]. — Scale bar for a = 2 cm, for b = 1.65 mm.

*ers* (Whitmore c.s. TCW 3608): pedicel (upcurved when young) 4–5 mm, bracteole  $\pm$  obovate-elliptic, 5 mm, (sub)persistent; buds (ob)ovoid-ellipsoid, 6 by 3–4 mm, cleft c. 1/3, lobes 0.5 mm thick, perianth inside somewhat callose and bullate (always?). Androecium small, 4 mm; androphore 1 by 0.7 mm, at base with few hairs, dark brown, 0.2–0.3 mm; synandrium 2.5 by 0.8(–1) mm, thecae 16–20, sterile apex more or less acute, 0.5–0.7 mm long, glabrous. *Female flowers* not seen. *Fruits* solitary, sessile, (broadly) ellipsoid (immature fruit subglobose in *Kostermans 1039*), 5.5–8.5 by 4–5 cm, base rounded or  $\pm$  attenuate, hairs cinnamon, scurfy, 0.1–0.2 mm; pericarp 10–15 mm thick; seeds ellipsoid(–oblong), 4.5 cm; fruiting peduncle including pedicel thick, 8 by 8 mm. — **Fig. 65c.**

Field-notes — Small tree. Bark dark brown; inner bark red brown, fibrous. Leaves golden brown below, becoming grey. Flowers golden yellow in bud. Fruits red.

Distribution — *Malesia*: Moluccas (Morotai, Halmahera, Bacan).

Habitat & Ecology — Submontane and lower montane forest; forest on ridge with abundant *Fagaceae*; volcanic soil; on G. Sango(a)wo (Morotai) many specimens seen; 400–800 m altitude; fl. Sept.; fr. May, Aug.

Note — May be confused with *M. fatua* which has smaller fruits with thinner pericarp, and longer hairs, 0.5–1 mm long; the pericarp of *M. fatua* subsp. *affinis* (Sulawesi) has also a thick pericarp but differs in the much more conspicuous indumentum; male flowers of subsp. *fatua* generally are smaller and those of subsp. *affinis* lack a sterile apex on the synandrium.

### 119. *Myristica sarcantha* W. J. de Wilde

*Myristica sarcantha* W. J. de Wilde, Blumea 43 (1998) 175, f. 3. — Type: McDonald & Ismail 3800, male fl., northern Irian Jaya.

Treelet 4 m. Twigs 5–6 mm diameter, smooth, hardly striate, bright brown, subterete with shallow lines from petiole to petiole, partially hollow (see field-notes) but ant-holes not seen, glabrous (glabrescent, but twig apex not seen); older twigs not seen; lenticels small, scattered, inconspicuous. *Leaves* membranous, obovate-oblong, 22–32 by 8–15 cm, base cuneate, apex broadly rounded with acute-acuminate tip; upper surface green-olivaceous, lower surface pale, subglabrous, hairs extremely minute, scattered, whitish, appressed; minutely irregularly papillose; dots absent; midrib almost flat above, lateral nerves 20–22 per side, at 70–80° to the midrib, flat, lines of interarching and venation slender, distinct at both surfaces; petiole 25–30 by 3 mm, glabrous; leaf bud not seen. *Male inflorescences* between the leaves, of the *Knema*-type: sessile, scar-covered brachyblasts to 5 mm diameter, the flowers in subumbels of 2–5, buds slightly variable in size, with  $\pm$  scattered mealy stellate hairs (less than) 0.1–0.2 mm. *Male flowers*: pedicel 7–8.5 by 2.5(–3) mm, bracteole scar at about 1/3–1/2 from the apex; buds firm, oblong-fusiform, 15–16 by (4–)5–6 mm, broadest above the middle, apex acute, base tapered, apical part triangular with lines of lobe sutures clearly marked, cleft c. 1/3, lobes (4–)5 mm long, 0.6–0.8 mm thick. Androecium 12–13 mm; androphore 4 by 1.5–2 mm, appearing to be glabrous but with very minute (less than 0.1 mm) pale stellate hairs in the lower 2/3; synandrium oblong, acute, 8 by 3 mm, thecae 24–26, sterile apex 0.5–1 mm long. *Female flowers* and *fruits* not seen. — **Fig. 84.**

Field-notes — Understorey tree, trunk straight, cylindrical, 3 cm diameter, branching above and below; lateral branches whorled and covered with muricate bodies that attract aggressive ants. Flowers pale yellow and green, lobes reflexed.

Distribution — *Malesia*: northern Papua Barat (Sarmi); known only from the type.

Habitat & Ecology — Coastal plain, mixed lowland forest, canopy 25–45 m high; 10–20 m altitude; fl. June.

Notes — 1. This species, belonging to the group of ant-inhabited species, is readily distinguishable by the large, robust, carnosé flowers. In general habit *M. sarcantha* is close to *M. fissiflora* (with deeper lobed less thick-fleshy male perianth, and the bracteole apical) and to *M. fasciculata* (mature male flowers not known, but immature flowers very different). It also resembles *M. verruculosa*, which has larger flowers with a longer pedicel.

2. The nature of the muricate bodies mentioned in the field-notes is unknown.

## 120. *Myristica schlechterii* W.J. de Wilde

*Myristica schlechteri* W.J. de Wilde, *Blumea* 40 (1995) 322. — Type: *Schlechter 17461*, Papua New Guinea.

Small tree. *Twigs* 1(–1.5) mm diameter, glabrescent; hairs 0.5–1 mm long; older twigs without lenticels. *Leaves* membranous, oblong-lanceolate, 6–10 by 2–3 cm, base attenuate, apex acute-acuminate, with ± blunt tip; upper surface (blackish) brown, lower surface grey, early glabrescent, hairs 0.5–1 mm; irregularly densely grey-white papillose, appearing non-papillose; dots absent; midrib flat or sunken above; lateral nerves 6–10 per side, at 70–80° to the midrib, far apart, brown and contrasting in colour below, lines of interarching and venation faint; petiole 6–8 by 0.8(–1) mm; leaf bud rather blunt, 4–5 by 1.5–2 mm, hairs dense, rough-woolly, 0.5–1 mm long. *Inflorescences* between the leaves, in the basal part of innovations, of the *Knema*-type; in male: consisting of 2 or 3 flowers at the end of a 1.5 mm long peduncle; bracts not seen. Whole inflorescence, including flowers, densely clothed in reddish brown rough-woolly hairs 0.5–1 mm. Female inflorescences not seen. *Male flowers*: pedicel 7 by 0.7–0.8 mm, bracteole less than 1 mm, caducous, scar 0.5(–1) mm below the apex; buds (ovoid-)oblong, apex subacute or ± blunt, base ± rounded, (8–)9 by 3 mm, cleft c. 1/4, lobes 2(–2.5) mm long, 0.1–0.2 mm thick, perianth inside fine-warty. Androecium tapering towards the apex, largely consisting of the synandrium; androphore (0.1–)0.2 mm long, 1 mm wide, at very base with a collar of minute reddish brown hairs 0.1–0.2 mm; synandrium (5.5–)6 by 1.2(–1.5) mm, thecae 12–14, ± contiguous, sterile apex narrow, ± blunt, (0.3–)0.4 mm. *Female flowers* and *fruits* not seen.

Distribution — *Malesia*: Papua New Guinea (Morobe Prov., Waria area, near Pema); known only from the type, in K.

Habitat & Ecology — Understorey treelet; c. 350 m altitude; fl. Mar.

Note — This species is characterized by a small stature, with slender twigs and small herbaceous leaves, the innovations, inflorescences, and flowers densely clothed in rufous rusty rough-woolly indumentum with hairs 0.5–1 mm long, and by the unique almost sessile synandrium. By the small stature and the finely verrucose inner surface of the perianth *M. schlechteri* seems related to species like *M. crassipes*, *M. filipes*, *M. flosculosa*, *M. pumila*, and *M. sogeriensis*.

**121. Myristica schleinitzii** Engl.

*Myristica schleinitzii* Engl., Bot. Jahrb. Syst. 7 (1886) 455; Warb., Mon. Myrist. (1897) 392, t. 19; A.C. Sm., J. Arnold Arbor. 22 (1941) 74; J. Sinclair, Gard. Bull. Sing. 23 (1968) 202, f. 15; Foreman, Handb. Fl. Papua New Guinea 1 (1978) 207, f. 91; W.J. de Wilde, Blumea 38 (1994) 367, f. 6; 40 (1995) 322. — Type: *Naumann s.n.*, 20 July 1875 (B, lost), New Hanover.

*Myristica mas* (non Rumph.) Labill., Rélat. du Voy. à la Rech. de la Pérouse 1 (1799) 237. — *Myristica spanogheana* auct. non Miq.: K. Schum. Bot. Jahrb. Syst. 9 (1887) 200. — *Myristica faroensis* Hemsl., Ann. Bot. 5 (1891) 506. — Type: *Guppy 209*, Santa Isabel I.

Tree 5–15(–20) m. *Twigs* 1.5–3 mm diameter, (pale) reddish or yellowish brown, glabrescent, hairs 0.1 mm; older twigs ± fissured or cracking; lenticels inconspicuous. *Leaves* membranous or thinly chartaceous, elliptic(-oblong), 7–27 by 2.5–12 cm, base rounded or shallowly cordate, sometimes subacute, apex narrowed with blunt tip; upper surface olivaceous, lower surface grey-olivaceous, seemingly glabrous, but hairs sparse, 0.1 mm or less; distinctly papillose; dots absent; midrib slightly raised above; lateral nerves 8–13(–20) per side, at 50–70(–80)° to the midrib, flat or slightly sunken above, lines of interarching and venation (usually) indistinct; petiole 6–20 by 1.5–3 mm, glabrescent; leaf bud 5–12(–15) by 1.5–3 mm, hairs 0.1–0.3 mm. *Inflorescences* between the leaves and below, glabrescent, paniculate, with flattened peduncle; in male: (1–)2–7 cm long, peduncle 10–40 by 1.5–3.5 mm, lower lateral branches to 20(–25) mm, central axis absent or to 30 mm long, with 1–4 lateral branches, each branch with a scar-covered brachyblast to 15 mm, with a subumbel of 3–10 flowers, buds of various sizes; female as male but shorter, subumbels of 2–6 flowers; bracts 1–1.5 mm, pubescent, caducous, the scars sometimes higher up on the branches; flowers with thick perianth, hairs 0.1 mm, partly glabrescent. *Male flowers*: pedicel 3.5–5 by 0.5–0.7 mm; bracteole ovate, 1–1.5 mm, persistent, (sub)apical; buds ovoid-oblong, 5.5–6.5 by 2.5–3.5 mm, sometimes faintly angular, apex subacute or ± blunt, cleft 1/5–1/3, lobes 1.5–2 mm long. Androecium 5–6 mm; androphore about as wide as the synandrium, 2–2.5 mm long, glabrous or hairs sparse, 0.1 mm or less; synandrium 2.5–4 by 0.7–1 mm, apex blunt, thecae 10–15, often with short sterile apical appendages 0.1 mm, sterile apex 0.2 mm or absent. *Female flowers*: pedicel slender, 2–5 mm; buds ovoid-oblong, 4.5–5.5 by 2.5–3 mm, apex ± acute, cleft c. 1/3; ovary ovoid-ellipsoid, 3.5 by 2 mm, hairs less than 0.1 mm. *Fruits* solitary or 2–6 per infructescence, ellipsoid or oblong, 2–3.5(–4) by 1–1.7 cm, apex (sub)acute, base (sub)acute or narrowed into an up to 5 mm long pseudo-stalk, hairs mealy, pale brown, 0.1–0.2 mm, glabrescent except very base and apex; pericarp 0.5–1 mm thick, brown, wrinkled or ± longitudinally striate; seeds ellipsoid, 2–2.5(–3) cm, (blackish or) dark brown; aril deeply slenderly lacinate; fruiting pedicel 3–7 mm. — **Fig. 85.**

**Field-notes** — Erect or bushy trees, largely glabrous, but growing twigs with developing leaves and inflorescences with dense short brown-yellow indumentum. Stem crooked or not, mostly without buttresses, stilt-roots occasionally present; branches sometimes whorled, horizontal (*Terminalia*-branching). Bark soft, brown-red, when old grey-brown to blackish, longitudinally fissured and/or flaking (scaly); slash bark banded or not, straw turning pink(-brown); exudate pinkish, watery or opaque; wood rather hard, pale, straw or orange, discolouring to brown; heartwood reddish. Leaves glossy (blue-) green above, pale green to glaucous below, midrib ± yellow. Flowers cream or (green-) yellow, scented or not, sometimes not opening. Fruits green-yellow or orange, partly



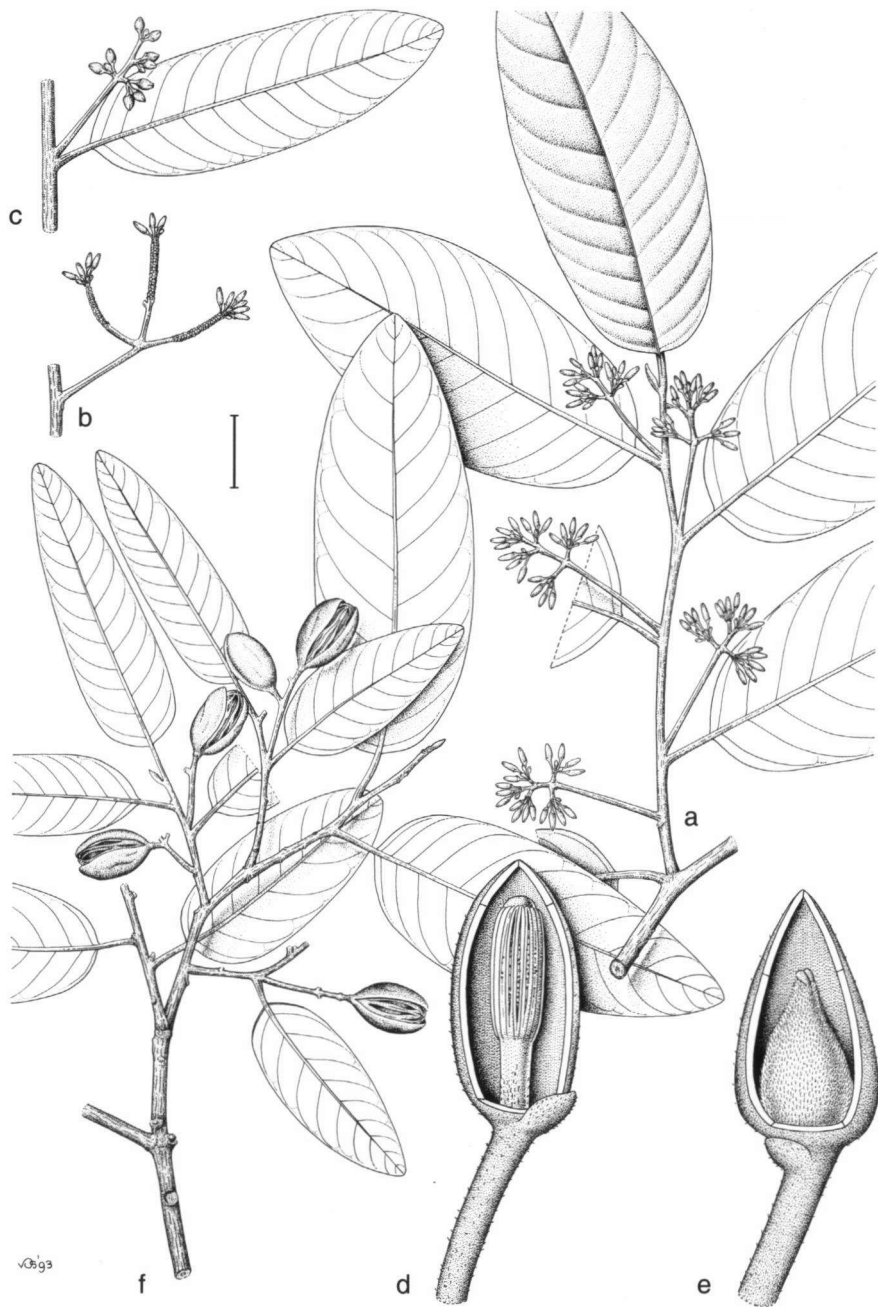


Fig. 85. *Myristica schleinitzii* Engl. a. Twig with male inflorescences; b. ditto, aged, axillary to leaf scar, with distinct scar-covered flower-bearing brachyblasts; c. female inflorescence; d. male bud, opened, showing androecium; e. opened female bud just before anthesis, showing pistil; f. branch with infructescences and mature fruits [a, d: *Goetghebeur 3379*; b: *Brass 3288*; c, e: *Lauterbach 1492*; f: *NGF 15512 (Croft & Katik)*]. — Scale bar for a–c, f = 2 cm, for d, e = 1.65 mm.

with thin golden indumentum; seeds dark brown to black, glossy, slightly aromatic, in mature fruit white with yellow-green aril (once recorded)

Distribution — *Malesia*: northern part of Papua New Guinea, (W & E Sepik, Madang, Morobe, Northern?, Milne Bay, and Central Prov.: one collection); Papuan Islands (d'Entrecasteaux); Bismarck Archipelago (New Hanover, New Ireland, New Britain); Solomon Islands (Bougainville, Santa Isabel, Novatana, New Georgia Group).

Habitat & Ecology — Coastal. Forest on cliffs and crests, well-drained; sand dunes, on coral beach, forest in and behind mangrove; also inland but not too far from the sea; in New Britain common in the *Calophyllum*, *Intsia*, and *Terminalia* association; also on limestone. In Milne Bay Prov., Dugumunu I., in forest on coral debris with *Eugenia*; 0–200(–350) m altitude; fl. & fr. throughout the year.

Uses — Aril used for nail varnish.

Note — Related to *M. rosselensis*, *M. garciniifolia* (habitat similar, Papua Barat), and *M. inopinata*, the latter two with stouter leaves. *Myristica schleinitzii* is a homogeneous species, characterized by paniculate inflorescences with flattened peduncle, elegant yellowish twigs with small- or medium-sized leaves, often with subcordate base, greenish on drying, papillose on lower surface (lens!), and by rather small subglabrous fruits in pedunculate infructescences.

## 122. *Myristica scripta* W. J. de Wilde

*Myristica scripta* W. J. de Wilde, *Blumea* 40 (1995) 323; 42 (1997) 183. — Type: *Pullen 7185*, Papua New Guinea.

Tree 4–30 m. Twigs terete or faintly angular, (1.5–)2–3 mm diameter, glabrescent, hairs 0.1(–0.2) mm; older twigs faintly fissured but neither cracking nor flaking; lenticels not conspicuous. Leaves thinly coriaceous (but brittle), ovate-elliptic or ovate-lanceolate, 6–17(–25) by 2.5–6(–9) cm, base short-attenuate or broadly rounded, apex ± blunt or short-acuminate, often with blunt tip; upper surface dark brown, lower surface pale brown, glabrescent, hairs sparse, 0.1 mm or less; inconspicuously papillose; dots and dashes present, best to be seen towards the margin (lens!); midrib usually raised above; lateral nerves 12–20(–30) per side, at 50–80° to the midrib, closely set, flat and hardly visible above, almost flat and faint below, lines of interarching and venation faint or invisible; petiole 8–15 by 1.5–3 mm; leaf bud 8–15 by 2–2.5 mm, hairs 0.1–0.2 mm. Inflorescences between the leaves and below, of the *Knema*-type: up to 1 mm pedunculate, woody, simple or 2- to 3-armed, scar-covered brachyblasts to 5 mm long, ending in subumbels of flowers, brown pubescent or glabrescent; in male: with (5–)10–40 flowers, buds of various sizes; in female: with (1–)2–5 flowers, buds about equal in size; flowers with hairs 0.1–0.2 mm, sometimes partly glabrescent. Male flowers: pedicel 2–4 by 0.6–0.8 mm, bracteole rounded, 0.5–1 mm, caducous, (sub)apical; buds (ellipsoid-)oblong, 3.5–5 by 2–2.5 mm, faintly triangular, cleft c. 1/3, lobes 1.5–1.7 mm long, 0.3 mm thick. Androecium subcylindrical, 2.5–4.2 mm; androphore shallowly grooved, 1–1.7 by 0.4–0.6 mm, glabrous or with few minute hairs in the lower half; synandrium narrowly oblong, 1.5–2.5 by 0.7–0.8 mm, thecae c. 12, contiguous or not, sterile apex irregularly rounded, 0.2–0.4 mm. Female flowers: pedicel 4–8 by 1–1.5 mm, bracteole scar 0.5–2 mm below the apex; buds ovoid(-oblong), narrowed to the apex, 4.5–5.5 by 3–4 mm, lobes 1.5–2 mm long; ovary ovoid(-oblong), 3.5–4 by 2–2.5 mm, hairs 0.2

mm. *Fruits* solitary or 2–5 in a cluster, ovoid, (broadly) ellipsoid, or subglobose, (1.5–) 2–2.5 by 1.5–2 cm, apex rounded or slightly narrowed, sometimes minutely beaked, hairs rusty, mealy, 0.1(–0.2) mm; pericarp 2(–3) mm thick; seeds ellipsoid, 1.5 cm; fruiting pedicel slender or ± thick, 5–10 mm long, bracteole scar 1–3 mm below the apex.

Distribution — *Malesia*: Moluccas (Aru Is., type variety); W, C, & E New Guinea. There are two varieties consisting of specimens with conspicuously different fruiting pedicels, but similar in vegetative and flower characters.

Habitat & Ecology — Lowland forest up to 700 m altitude.

Note — Vegetatively *M. scripta* resembles *M. lancifolia* from the Moluccas and the western part of New Guinea in the similar leaves (same size and venation). *Myristica scripta* is readily distinguishable by the conspicuous dots on the lower leaf surface.

#### KEY TO THE VARIETIES

- 1a. Fruiting pedicel 2–3 mm thick ..... **a. var. *scripta***  
 b. Fruiting pedicel stout, 5–7 mm thick ..... **b. var. *incrassata***

#### **a. var. *scripta***

Tree up to 30 m. *Flowers* minutely appressed-pubescent, hairs 0.1–0.2 mm. Fruiting pedicel ± slender, 2–3 mm thick, smooth or finely striate, sometimes with minute lenticels.

Field-notes — Bark without or (rarely) with buttresses to 1.5 m high and out, smooth, or finely, irregularly or deeply fissured, often peeling or flaking; outer bark thin, dark brown; inner bark (slash bark) reddish, with wavy appearance, exudate reddish, watery or sticky; wood white or (pale) brown, sometimes mottled; heartwood rich red. Leaves grey-green below. Flowers cream, yellow, or brown; ovary pale green. Fruits yellow, orange, or brown.

Distribution — *Malesia*: Moluccas (Aru Is.); Papua Barat (Biak, Japen I., Jayapura area); Papua New Guinea (W Sepik, Western, Gulf Prov.).

Habitat & Ecology — Primary or disturbed dryland forest, on clay or volcanic soil, limestone; also from forest along dry creeks, streamside forest, stony riverbanks; altitude 0–500 m; fl. & fr. mainly June–Dec. Locally common.

#### **b. var. *incrassata* W.J. de Wilde**

*Myristica scripta* W.J. de Wilde var. *incrassata* W.J. de Wilde, Blumea 40 (1995) 324. — Type: NGF 18306 (*Streimann & Lelean*), Papua New Guinea.

Tree up to 30 m. *Flowers* rather roughly tomentose, hairs 0.2 mm. Fruiting pedicel stout, 5–7 mm thick, conspicuously lengthwise fissured, sometimes with coarse lenticels.

Field-notes — Bole slender, without buttresses; branches verticillate, horizontal. Bark smooth or finely fissured; live bark light brown; underbark reddish; wood white; exudate red, sticky. Leaves greyish green below. Flowers yellow. Fruits yellow-brown.

Distribution — *Malesia*: S Central New Guinea: SE Papua Barat; Papua New Guinea (Western Prov., W Sepik Prov.).

Habitat & Ecology — Primary and degraded dryland forest (on volcanic soil) and swamp forest; 25–600 m altitude; fl. & fr. June–Sept.

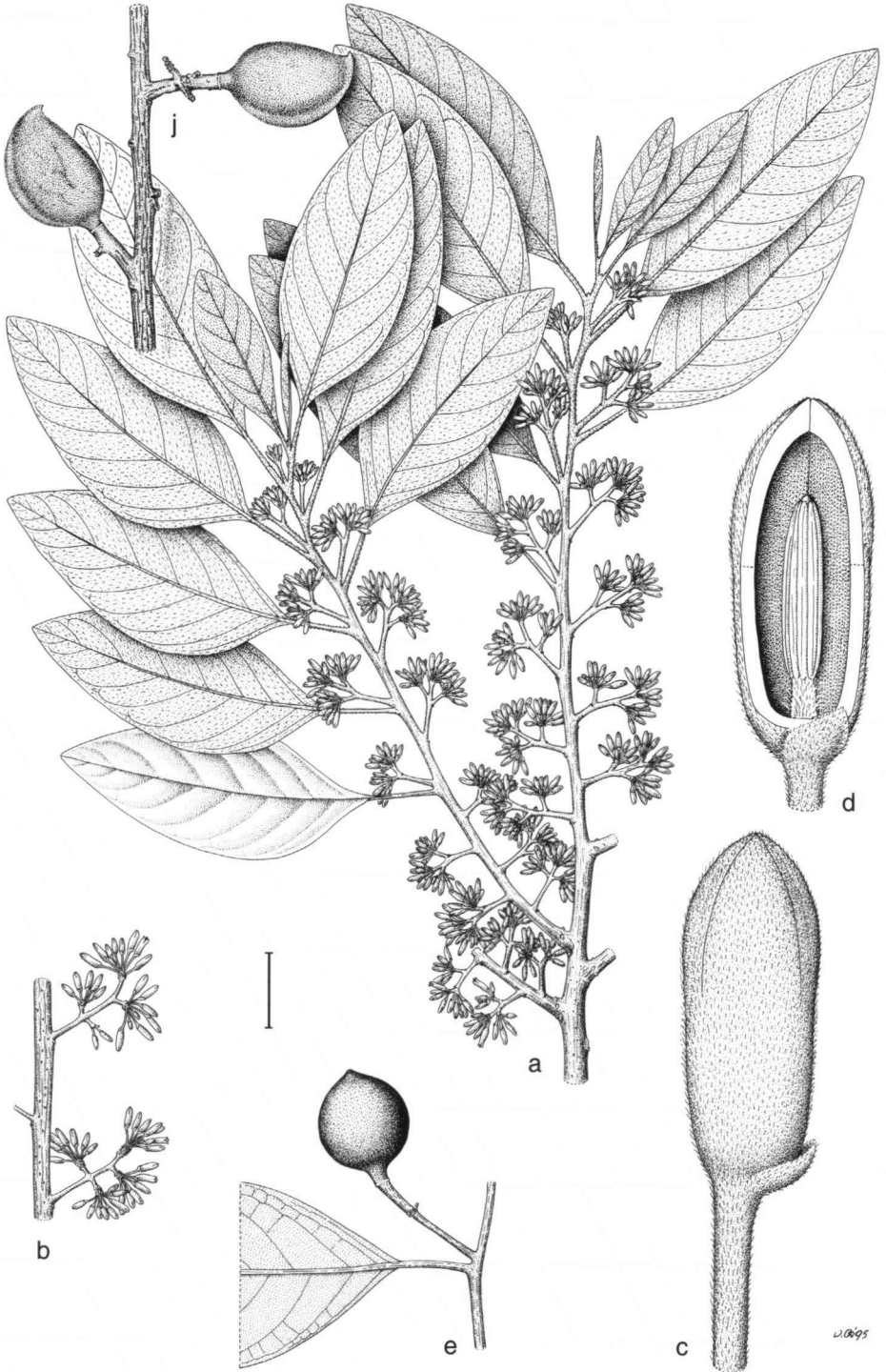
### 123. *Myristica simiarum* A. DC.

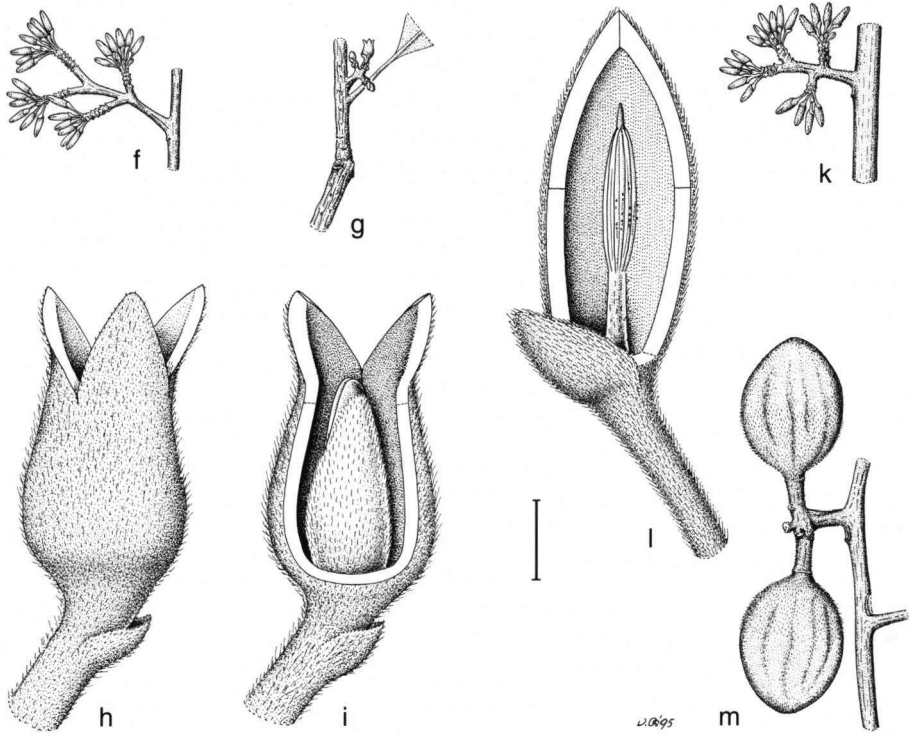
*Myristica simiarum* A. DC., Ann. Sc. Nat. 4, 4 (1855) 29; Prodr. 14, 1 (1856) 192; W. J. de Wilde, Blumea 35 (1990) 254; 42 (1997) 184; Tree Fl. Sabah & Sarawak 3 (2000) 469. — *Myristica elliptica* Wall. ex Hook. f. & Thomson var. *simiarum* (A. DC.) J. Sinclair, Gard. Bull. Sing. 16 (1958) 356; 23 (1968) 62 (key), 190, f. 12. — Type: *Callery* 34, Philippines, Luzon, Manilla. For more references and synonyms see the subspecies.

Tree 5–36 m. Twigs 1.5–3(–3.5) mm diameter, whitish or pale brown (or dark brown), early glabrescent, hairs 0.1–0.2(–0.4) mm; older twigs without or with few to many small paler coloured lenticels. *Leaves* membranous or thinly chartaceous, very brittle, ovate-elliptic or oblong(-lanceolate), 11–18(–32) by 3–7(–12) cm, base acute or nearly rounded, apex acute-acuminate; upper surface light or blackish brown, sometimes scabrous, lower surface grey(-brown), pubescent or (late) glabrescent, hairs appressed, silky, (0.1–)0.3–0.5 mm; papillation present, absent, or indistinct; dots absent; midrib slightly raised above; lateral nerves 10–14(–18) per side, at 45–60° to the midrib, flat and faint above, lines of interarching distinct or not, venation faint; petiole 14–25(–35) by 1–2(–2.5) mm; leaf bud 12–25 by 1–2.5 mm, hairs appressed, pale or (reddish) brown, 0.5–1 mm. *Inflorescences* pedunculate, between the leaves (rarely ± below), late glabrescent, hairs scattered, 0.5(–1) mm; in male: ± slender, 1.5–4 by 1.5–3.5 cm, peduncle 7–15(–17) by 1–2 mm, basal branches rectangular to the peduncle, to 7 mm long, central axis simple, or with 2 or 3 sessile or short-stalked, scar-covered brachyblasts to 10 mm long (rarely absent), flowers in clusters of 3–12, buds of ± variable sizes; bracts ± triangular, 1–1.5 mm, ± pubescent, subpersistent or caducous; female as male, but smaller and fewer flowered; flowers with hairs 0.2–0.3(–0.5) mm. *Male flowers*: pedicel (2–)3–5 mm, slender, bracteole ± triangular, 1–2 mm, pubescent, persistent; buds ± ellipsoid-oblong, ± triangular, 4.5–8 by 2–3 mm, apex ± acute, cleft c. 1/2, the sutures thicker than rest of perianth. Androecium slender, 4–5.5 mm; androphore (0.5–)1–1.5 mm, hairs sparse or dense, 0.3–1 mm; synandrium (2.5–)3–3.5 by 0.8–1 mm, thecae 12–16(?), sterile apex irregularly blunt, 0.3–0.5 mm long, or shallowly hollowed. *Female flowers*: pedicel 1.5–2(–2.5) mm long, bracteole 1–1.5 mm long, persistent; buds ovoid, 5–6 by 3–3.5 mm, ± angled, cleft c. 1/3 (to nearly 1/2); ovary (narrowly) ovoid, 3 by 1.5–2 mm, hairs 0.5 mm, stigma broadly 2-lipped, 0.3–0.5 mm long. *Fruits* (variable according to the subspecies), solitary or 2 or 3 per infructescence, subglobose or broadly ellipsoid or ovoid-ellipsoid, 2–4 by 2–3 cm, apex rounded or shortly beaked, base rounded or shortly contracted, glabrescent or thinly pubescent, hairs inconspicuous, grey-brown, silky, (0.3–)0.5 mm; pericarp 2–5 mm thick, (blackish) brown, seeds broad-ellipsoid; fruiting pedicel slender or stout, 3–6 mm long. — **Fig. 86.**

**Distribution** — *Malesia*: Borneo (W & NE Kalimantan, W Sarawak), Philippines, Sulawesi, Moluccas (Bacan, Sula Is.).

**Note** — A variable species in which, according to the area of distribution and based on rather weak differences in the fruits, three subspecies are recognized. Further variation is noteworthy in subsp. *simiarum* and briefly discussed there. Sinclair (1968) included the species in the related *M. elliptica*, but *M. simiarum* differs in its inflorescences and its smaller fruits. Both species have the markedly triangular upper part of the buds in common. *Myristica elliptica*, the swamp nutmeg, is a species mostly from marshy forest, frequently with stilt-roots which have never been recorded for *M. simiarum*.





←  
 Fig. 86. *Myristica simiarum* A.DC. subsp. *simiarum*. a. Male flowering twig; b. part of male flowering twig, inflorescences in an advanced stage, with scar-covered brachyblasts; c. male bud; d. ditto, opened, showing androecium; perianth triangular in apical part; e. twig with infructescence with one fruit. — *M. simiarum* subsp. *celebica* (Miq.) W.J. de Wilde. f. Twig with male inflorescence; g. twig with female inflorescence; h. female flower at anthesis; i. ditto, opened, showing pistil; j. part of older twig with two infructescences, each with one fruit. — *M. simiarum* subsp. *calcarea* W.J. de Wilde. k. Part of twig with male inflorescence; l. male bud, opened, showing androecium; m. twig with infructescence with two fruits [a: BS 80173 (Ramos); b–d: PNH 91851 (Lagrimas); e: Vidal 3570; f: Koorders 18161; g–j: Whitmore c. s. TCW 3436; k: Kostermans 13772; l: Kostermans 13866; m: S 34468]. — Scale bars for a, b, e–g, j, k, m = 2 cm; c, d, h, i, l = 1.7 mm.

#### KEY TO THE SUBSPECIES

- 1a. Fruits globose or broadly ellipsoid, 1.5–2.5(–3) cm long, pseudostalk ± absent or short and 2–4 mm broad; pericarp 2–4 mm thick. Leaves glabrescent below. — Philippines [& S Taiwan: Botel Tobago Is.] . . . . . **a. subsp. *simiarum***
- b. Fruits (broadly) ellipsoid or ovoid, 3–3.5 cm long, pseudostalk stout, 4–5 mm broad; pericarp 4–5 mm thick. Leaves glabrescent below, or with dispersed hairs. — Sulawesi, Bacan, Sula I., Philippines (Zamboanga) . . . . . **c. subsp. *celebica***
- c. Fruits ellipsoid, 3.5–4 cm long, pseudostalk 3–4 mm broad; pericarp 3 mm thick (apparently much thicker when fresh). Leaves with persistent dense bright brown indumentum below. — W & NE Kalimantan, W Sarawak . . . . . **b. subsp. *calcarea***

a. subsp. *simiarum*

*Myristica simiarum* A. DC., Ann. Sc. Nat. 4, 4 (1855) 29; Prodr. 14, 1 (1856) 192; Warb., Mon. Myrist. (1897) 397, t. 13; Hayata, Icon. Pl. Formos. 3 (1913) 156; Gen. Index Fl. Formos. (1917) 61; Merr., Enum. Philipp. Flow. Pl. 2 (1923) 180; Kudo & Masam., Ann. Rep. Taihoku Bot. Gard. 2 (1932) 89; Kaneh., Formos. Trees, rev. ed. (1936) 194; Hui-Lin Li, Woody Flora Taiwan (1963) 195; W. J. de Wilde, Blumea 42 (1997) 184. — *Myristica elliptica* Wall. ex Hook. f. & Thomson var. *simiarum* (A. DC.) J. Sinclair, Gard. Bull. Sing. 16 (1958) 356; 23 (1968) 62 (key) 190, f. 12A–E, I–J.

*Myristica discolor* Merr., Philipp. J. Sci., Bot. 13 (1918) 218. — Type: *Curran 13155*, Philippines. *Gymnacranthera sulphurascens* Elmer, nom. nud. in sched.; Merr., Enum. Philipp. Flow. Pl. 2 (1923) 180 in note sub *Myristica simiarum* (*Elmer 7377*). — *Myristica sulphurascens* Elmer, Leaf. Philipp. Bot. 10 (1939) 3809, nom. nud. sub *Myristica simiarum*; Index Kew. Suppl. 10 (1947) 149 (*Ramos 1609*).

*Myristica elliptilimba* Merr., nom. nud. in sched. (*Ramos & Edaño 31173*).

*Myristica merrillii* Warb., in sched. (*Elmer 6357*).

*Myristica verrucosula* Merr., nom. nud. in sched. (*de Mesa 27584*; *Ramos & Edaño 29206*; *Ramos & Pascasio 34469*).

Tree 5–15 m. *Leaves*: upper surface olivaceous-brown or blackish (when blackish usually grey or whitish below, sometimes scabrous, see note 2), lower surface glabrescent, hairs scattered; (in)distinctly papillose or not. *Male flowers*: buds variable in size, 4.5–8 mm long, thinly pubescent. *Female flowers* as in the species. *Fruits* globose or broadly ellipsoid, (1.5–)2–2.5(–3) by 1.5–2(–2.5) cm, apex rounded or up to 1.5 mm long beaked, base rounded or contracted into a pseudostalk up to 2 mm long and 2–4 mm broad; pericarp brown or blackish, 2–4 mm thick. — **Fig. 86a–e.**

*Field-notes* — Tree, dbh to 30 cm, without stilt-roots, sometimes with buttresses. Bark slightly rough, reddish brown; sap dark red. Leaves glossy, medium green above; glaucous with yellowish green midrib and nerves below. Flowers yellow or brown. Fruits green, then orange. Testa mottled brown.

*Distribution* — Taiwan (Botel Tobago Is., no specimens seen); *Malesia*: Philippines (Luzon, Samar, Mindanao, Batan).

*Habitat & Ecology* — Forest, also on slopes, rough country; 0–600 m altitude; fl. & fr. throughout the year.

*Uses* — Bark applied for internal pains (Mindanao).

*Notes* — 1. Anthers possibly 6–10; the thecae are narrow and closely appressed so that the number of anthers is difficult to count.

2. The type subspecies, occurring throughout the Philippines, is remarkably variable, whereas the other two subspecies seem rather uniform.

The leaves of many specimens from Luzon dry conspicuously blackish above, and grey or almost whitish below. Some specimens have relatively large male flowers, while others have remarkably small flowers on slender inflorescences. The fruits dry blackish as well. The leaves of specimens from Samar and Mindanao are (olivaceous) brown above and grey-brown beneath; possibly these specimens always have brown fruits when dry. In some collections the leaves have minute whitish dots beneath, in others these are lacking. In some specimens from Luzon the leaves (drying blackish or olivaceous) are verruculose or scabrous, caused by crustations in the leaf tissue, but possibly this feature has little taxonomic merit.

**b. subsp. calcarea** W. J. de Wilde

*Myristica simiarum* A. DC. subsp. *calcarea* W. J. de Wilde, *Blumea* 42 (1997) 184. — Type: *Koster-mans 13866*. E Kalimantan, Berouw.

Tree 20–36 m. *Leaves*: upper surface olivaceous-brown, lower surface (grey-)brown, indumentum dense, persistent, hairs flat-lying, brown; indistinctly papillose or not. *Male flowers* bright rusty brown pubescent; buds 7–8 mm long. *Female flowers* not seen. *Fruits* broad-ellipsoid, 3.5(–4) by 2.5–3 cm, apex blunt-acute, at base contracted into a pseudostalk 2–4 mm long, 3–4 mm broad; pericarp dull brown, 3 mm thick (possibly very much thicker when fresh). — **Fig. 86k–m.**

Field-notes — Bole to 15 m long, up to 80 cm diameter, buttresses low, to 1 m high. Bark superficially fissured or very rough and deeply fissured, hard, dark brown, red-brown, or black, pitted, 5 mm thick, peeling off in irregular strips 2–3 cm wide, 2–3 mm thick; living bark 10–15 mm thick, undulate, yellowish brown, red-brown or dark red; sap pale red, watery; cambium brown-yellow; sapwood 8 cm thick, dirty white or yellowish white; heartwood dark brown. Lower leaf surface brown or golden. Flowers (brown-)yellow. Fruits yellow or orange-red; seed coat brown with yellow streaks.

Distribution — *Malesia*: Borneo (W & NE Kalimantan, W Sarawak).

Habitat & Ecology — Forest on (old coral) limestone or sandstone, yellow sandy soils, hilly country and low mountains, shallow clay soil; 25–700 m altitude; fl. Sept.; fr. June–Sept.

Note — Almost all collections are from limestone or lime-containing soils; once from sandy clay derived from granite. Distinguished by the large, brown-yellow flowers and large fruits, and the leaves with persistent, dense, golden indumentum on the lower surface. The fruits may recall those of small-fruited *M. elliptica*.

**c. subsp. celebica** (Miq.) W. J. de Wilde

*Myristica simiarum* A. DC. subsp. *celebica* (Miq.) W. J. de Wilde, *Blumea* 35 (1990) 255, f. 2 (13); 42 (1997) 185. — *Myristica celebica* Miq., *Ann. Mus. Bot. Lugd.-Bat.* 2, 1 (1865) 47; *Warb., Mon. Myrist.* (1897) 395, t. 15; *Koord., Fl. N.O. Celebes* (1898) 570 (not *M. celebica* Gand., 1919 = *M. fatua* Houtt.). — *Myristica elliptica* Hook. f. & Thomson var. *celebica* (Miq.) J. Sinclair, *Gard. Bull. Sing.* 16 (1958) 356; 23 (1968) 194, f. 12F. — Syntypes: Sulawesi: *Forsten s.n.*, *Teijsmann 5801* (U, lecto, here designated); Bacan: *de Vriese s.n.* (*Myristica fallax* Miq., in sched.); Buru: *de Vriese s.n.* (no specimens seen).

*Myristica fragrans* auct. non Houtt. forma *sylvestris* Miq., *Ann. Mus. Bot. Lugd.-Bat.* 2 (1864) 205; *Ann.* 2 (1865) 48 (sub *Myristica celebica* Miq.). — Type: *Teijsmann 5872*, Moluccas.

Tree 10–30 m. *Leaves*: upper surface olivaceous brown or dark brown, lower surface grey-brown, indumentum thin, (late) glabrescent, or subpersistent, hairs ± scattered, appressed, grey(-brown), of varying sizes; distinctly or indistinctly papillose. *Male flowers*: moderately or densely (grey-)brown pubescent; buds 6–7 mm long. *Female flowers* as in the species. *Fruits* ellipsoid or ovoid, 3–3.5 by 2.5 cm, apex ± blunt or 1–2 mm beaked, base contracted into a stout pseudostalk 2–4 mm long, 4–5 mm broad, pericarp dull greyish brown to dark brown, 4–5 mm thick. — **Fig. 65d, 86f–j.**

Field-notes — Tree, dbh c. 40 cm, without buttresses. Outer bark brownish, 0.3–0.4 mm thick, much fissured, peeling off or not; inner bark 7–9 mm, cream or reddish, sap reddish, clear; middle bark yellow, fibrous. Leaves whitish below. Flowers (female) golden



yellow. Fruits green with brown indumentum when immature, when ripe orange-yellow, orange-brown or golden.

Distribution — *Malesia*: Sulawesi (incl. Moena I.); Moluccas (Bacan, Sula Is., Buru); Philippines (Zamboanga).

Habitat & Ecology — Forest (disturbed) on alluvial flatland; 10–900 m altitude; fl. Jan.–Sept.; fr. June–July.

Note — Subsp. *celebica* is close to the two other subspecies. It has larger fruits than subsp. *simiarum* and from subsp. *calcareia* it differs in the less densely pubescent leaves.

#### 124. *Myristica simulans* W.J. de Wilde

*Myristica simulans* W.J. de Wilde, Blumea 40 (1995) 325. — Type: Brass 28894, E Papua New Guinea.

Tree 15 m. Twigs 3 mm diameter, rather late glabrescent, hairs shaggy, 1 mm long; older twigs not flaking, with many small lenticels. Leaves chartaceous or thinly coriaceous, (ovate-)oblong, 15–22 by 6–8.5 cm, base short-cuneate or broadly rounded, apex acute-acuminate, upper surface olivaceous, glabrescent, indumentum minute, greyish, lower surface pale greyish brown, persistent or late glabrescent, hairs interwoven, scale-like, (brown-)grey, 0.1 mm; not papillose; dots absent; midrib slightly raised above, lateral nerves 16–20 per side, at 60–70° to the midrib, lines of interarching and venation faint; petiole 10–15 by 2.5–3.5 mm, late glabrescent, hairs shaggy, 1 mm; leaf bud 15 by 4 mm, hairs dense, woolly, rufous, 1(–1.5) mm. Inflorescences between the leaves, of the *Knema*-type: in male a sessile or to 2 mm pedunculate, scar-covered brachyblast 2–5 mm, with (1 or) 2–10 flowers, buds almost equal in size, all parts late glabrescent or hairs shaggy, rufous, 1 mm. Male flowers: pedicel 4 by 1 mm, bracteole rounded, 1 mm, caducous, (sub)apical; buds ellipsoid-oblong, 8(–10) by 4.5(–5) mm, apex blunt, cleft c. 1/4, lobes 2 mm long, 0.3 mm thick. Androecium 7 mm; androphore 2 by 1 mm, glabrous; synandrium 5 by 1.5 mm, thecae 14–16, sterile apex broadly rounded, 0.2–0.3 mm long. Female flowers and fruits not seen.

Field-notes — Leaves below at first brown, later grey. Flowers fragrant.

Distribution — *Malesia*: E Papua New Guinea (Milne Bay Prov., Modewa Bay, Gara River); known only from the type.

Habitat & Ecology — Riverine rain forest; sealevel; fl. Dec.

Note — *Myristica simulans* was formerly confused with *M. buchneriana* that differs in shorter hairs on twig apex and inflorescences, smaller male flowers (5–6 mm long) with shorter hairs, and weaker hairs on the lower leaf surface. In appearance and male flowers the species also looks like *M. inopinata*, but in that species the synandrium has a distinct, acute, sterile apex, and the androphore a collar of dense hairs at the base.

#### 125. *Myristica sinclairii* W.J. de Wilde

*Myristica sinclairii* W.J. de Wilde, Blumea 40 (1995) 327, f. 7. — Type: NGF 44076 (*Kairo*), Papua New Guinea.

Tree 4–5 m. Twigs 1–1.5(–2) mm diameter, glabrescent, hairs shaggy, 1 mm long; older twigs neither fissuring nor flaking; lenticels not apparent. Leaves (thinly) chartaceous, (elliptic-)oblong, 6–12 by 2–4 cm, base attenuate, apex (acute-)acuminate; upper

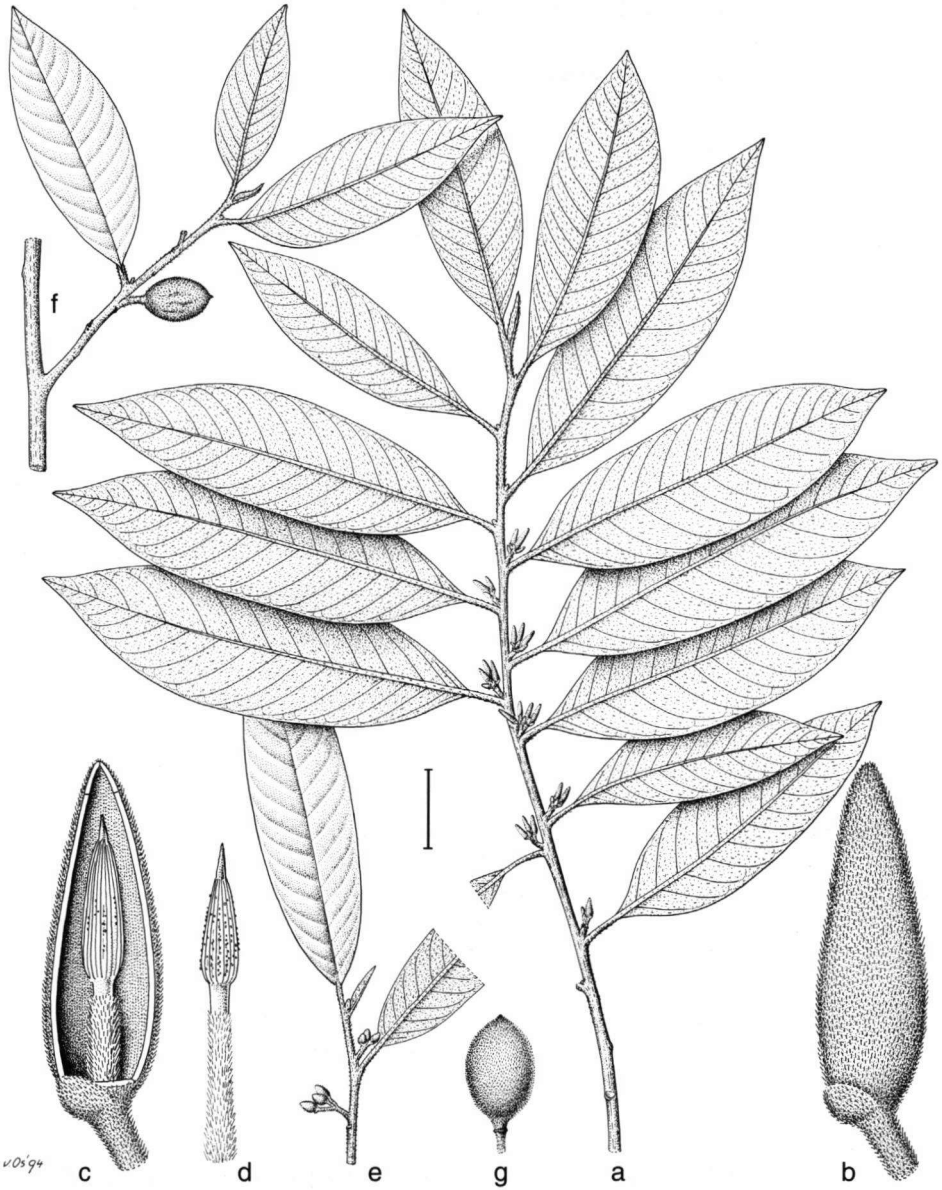


Fig. 87. *Myristica sinclairii* W.J. de Wilde. a. Leafy twig with male inflorescences; b. (sub)mature male bud shortly before anthesis; c. ditto, opened, showing androecium; note persistent bracteole; d. androecium taken from flower at anthesis; note largely pubescent androphore which is longer than synandrium, and conspicuous sterile apex; e. apex of female flowering twig (flowers submature); f. branched twig with submature fruit; g. mature fruit [a-d: NGF 44076 (Kairo); e, g: NGF 29302 (Henty & Vandenberg); f: Stauffer, Whitmore & Pennington 5552]. — Scale bar for a, e-g = 2 cm; b-d = 1.65 mm.

surface olivaceous or brown, lower surface yellowish brown by persistent fine felty hairs mixed with appressed stouter hairs 0.5 mm, partially late glabrescent leaving a grey undersurface; not papillose; dots absent; midrib flat above; lateral nerves 10–15 per side, at 45(–60)° to the midrib, flat and indistinct above, lines of interarching and venation indistinct on both surfaces; petiole 0.6–1.5 by 1–2 mm; leaf bud 8–13 by (1.5–)2–2.5 mm, hairs conspicuous, 1 mm long. *Inflorescences* between the leaves, axillary or to 1.5 mm supra-axillary, ± rusty pubescent, mostly to 3 mm pedunculate, almost sessile, ending in a simple or forked scar-covered brachyblast to 5 mm long; in male: with clusters of 3–5 flowers, buds of various sizes; bracts 1 mm or less, pubescent, caducous; in female (from infructescences): peduncle short, 1–3-flowered; flowers with scurfy hairs 0.1–0.4 mm. *Male flowers*: pedicel often ± curved, 1.5–3(–3.5) mm long, bracteole ovate, (0.5–)1–1.5 mm long, persistent or late caducous; buds (ovoid-)oblong, 7–8 by 1.5–2(–2.5) mm, narrowed from the middle to the apex, base broadly rounded, cleft c. 1/7, lobes membranous, 0.7–1 mm, c. 0.3 mm thick, perianth inside smooth or in the lower half finely warty-bullate. Androecium slender, 6–6.5 mm; androphore 3–4 by 0.4–0.5 mm, hairs dense, 0.5–0.8 mm; synandrium 2–3.5 by 0.5–0.6 mm, thecae 8–10(–12), sterile apex ± slender, ± acute, 0.6 mm, reaching the base of the perianth lobes. *Female flowers* (from perianth remnants under immature fruit, *Stauffer c.s.* 5552): pedicel 3 mm long; buds 6 mm, lobes 1 mm long. *Fruits* solitary, ellipsoid, 2.5 by 2 cm, hairs dense, rusty, scurfy, 0.2–0.4 mm, stouter (0.5 mm) towards the base and apex; pericarp 1–1.5 mm thick, seeds not seen (probably 1.5–2 cm); fruiting pedicel slender, 5 mm long. — **Fig. 87.**

**Field-notes** — Slender tree, branches horizontal, exudate from twigs colourless; older twigs smooth, brown; exudate reddish; wood pinkish straw. Leaves yellowish brownish, or ± glaucous below (with thin brownish indumentum). Flowers yellowish or brownish. Fruits with bright (yellow-)brown or orange indumentum.

**Distribution** — *Malesia*: Papua New Guinea (endemic to Morobe Prov.: Bulolo).

**Habitat & Ecology** — Understorey tree in *Castanopsis* dominated (ridge) forest; altitude 1000–1600 m; fl. Jan., Aug.; fr. Jan.–Feb.

## 126. *Myristica smythiesii* J. Sinclair

*Myristica smythiesii* J. Sinclair, Gard. Bull. Sing. 23 (1968) 316, f. 42; W. J. de Wilde, Blumea 42 (1997) 185; Tree Fl. Sabah & Sarawak 3 (2000) 470. — Type: SAN 17440 (*Ashton, Smythies & Wood*), Sabah.

Tree 8–25 m. *Twigs* 2–3(–4) mm diameter, glabrescent, hairs 0.3–0.5 mm; older twigs dark brown or blackish, finely longitudinally cracking, sometimes thinly flaking; lenticels absent. *Leaves* (thinly) coriaceous, elliptic-oblong or oblong-lanceolate, 8–20 by 2–6 cm, base rounded or short-acute, apex acute(-acuminate) (sometimes ± blunt); upper surface olivaceous, late glabrescent on midrib towards base, lower surface with persistent indumentum, hairs grey-brown or cinnamon, interwoven, scale-like, 0.1–0.2 mm, mixed with scattered dendroid hairs 0.3–0.4 mm; not obviously papillose; dots absent; midrib little raised above, lateral nerves 12–15(–18) per side, at 60–70° to the midrib, faint, flat or sunken, lines of interarching and venation faint or invisible on both surfaces; petiole 7–15 by 1.5–2.5 mm; leaf bud 10–15 by 2.5–3 mm, hairs coarse, 0.5(–1) mm. *Inflorescences* between the leaves or below, with brown-red hairs 0.5(–1) mm, of

the *Knema*-type: sessile or to 2 mm long pedunculate, single or paired brachyblasts, bracts subsistent, c. 1.5 mm long; in male: to 10 mm long, at apex with some flowers, buds of various sizes; in female 2–3 mm long, with 1–4 flowers; flowers with hairs 0.3–0.5(–1) mm. *Male flowers*: pedicel (2–)3 by 1 mm, bracteole subcircular, entire or faintly 3-topped, 1.5 by 2 mm, subsistent; buds  $\pm$  ovoid to ellipsoid-oblong, 4–5 by 2–2.5 mm, cleft 1/4–1/2, lobes 0.3 mm thick. Androecium 3.5 mm; androphore c. 1 mm, towards base with dense hairs 0.3–0.5 mm; synandrium 2.5 by 0.6 mm, thecae 10–12, sterile apex blunt, 0.2 mm long, glabrous or with few minute hairs 0.1 mm. *Female flowers*: pedicel c. 1 mm long, bracteole minute, buds ovoid, c. 4 mm, ovary ovoid, including short stigma 2.5 mm long, minutely pubescent. *Fruits* solitary, almost sessile, broadly ellipsoid, 2.5–3.5(–3.8) by 2–2.4 cm (remnant of the style  $\pm$  acute, glabrous, blackish brown, 0.5 mm long), hairs mealy, 0.2–0.5 mm; pericarp 1–2 mm thick; seeds (broad-)jellipsoid, 2.5 cm, red-brown, glossy; fruiting pedicel rather stout, 3–6 mm long.

Field-notes — Medium-sized tree, sometimes with small buttresses or stilt-roots. Bark smooth, with fine longitudinal striation, narrowly fissured, or flaky, dark grey or brown-black; outer bark thin; inner bark soft, red-brown; sapwood soft, orange-yellow; heartwood deep red. Flowers brown, cream inside. Fruits pale yellow-green, brown hairy.

Distribution — *Malesia*: Borneo (Brunei; NE Sarawak, 2nd Div.; C & E Kalimantan).

Habitat & Ecology — Primary mixed dipterocarp forest, riverbank forest, hill slopes and heath forest, peat swamp forest; on yellow sandy clay or loam soil, or shallow peat overlying clay; 0–700 m altitude; fl. & fr. Apr.–July, Oct.

Note — *Myristica smythiesii* is close to *M. beccarii* and *M. cinnamomea*, all three species with an indumentum of (pale) cinnamon scale-like hairs on the lower leaf surface. *Myristica beccarii* differs in its usually rounded or emarginate leaf base, coriaceous leaves with stronger and more distinct nerves, and somewhat stouter twigs; *M. cinnamomea* is distinguishable by its longer petioles, a branched-type inflorescence with a peduncle, angular perianth buds, and larger fruits with thick pericarp.

## 127. *Myristica sogeriensis* W. J. de Wilde

*Myristica sogeriensis* W. J. de Wilde, *Blumea* 40 (1995) 328, f. 3h, h'. — Type: *Forbes 396*, E Papua New Guinea, Central Prov., Sogeri region.

Shrub or treelet, 2–3 m tall. *Twigs* 0.5–1(–1.5) mm diameter, bluntly angular, early glabrescent, hairs scale-like, less than 0.1 mm; older twigs neither cracking nor flaking; lenticels inconspicuous or absent. *Leaves* membranous or thinly chartaceous, (elliptic-)oblong, 5–12 by 1.5–4 cm, base attenuate, apex acute-acuminate; upper surface olivaceous or brown, lower surface brownish grey (discolorous), seemingly glabrous, but glabrescent, hairs sparse, less than 0.1 mm; not papillose, dots absent; midrib raised above, lateral nerves 10–15 per side, at 45–80° to the midrib, flat or sunken above, bright brown and contrasting in colour below, lines of interarching and venation distinct; petiole 6–10 by (0.5–)1(–1.5) mm; leaf bud 5–8 by 0.5(–1) mm, hairs less than 0.1 mm. *Inflorescences* between the leaves,  $\pm$  of the *Knema*-type; in male: peduncle slender, 1–2 mm long with small, slender, simple or forked scar-covered, glabrescent brachyblasts 3–4 mm long, ending with 1–3 flowers, buds about equal in size; female: a sessile or to 1 mm peduncu-

late minute wart-like brachyblast, 1–3-flowered; flowers with  $\pm$  sparse hairs less than 0.1 mm, looking as if nearly glabrous. *Male flowers*: pedicel 6(–7) by 0.3–0.4 mm, bracteole 1 mm long, persistent, 1–2 mm below the apex; buds tubiform, 6.5 by 1(–1.5) mm, apex subacute, the basal half somewhat narrowed, cleft c. 1/6, lobes 1 mm long, 0.2 mm thick, perianth inside at base faintly warty-ridged. Androecium slender, 6 mm; androphore 3.5 by 0.3 mm, with minute hairs in the lower half; synandrium 2(–2.2) by 0.5 mm, thecae c. 10, sterile apex subacute, 0.5–0.6 mm. *Female flowers* not seen. *Fruits* 1–3 per infructescence,  $\pm$  fusiform, (3–)3.5 by 1.5 cm, apex acute, basal part tapered into a 5–8 mm long pseudostalk, hairs minute, dull-rusty, mealy, 0.1 mm or less; pericarp 1–1.5 mm thick; seeds ellipsoid, 1.4 cm; fruiting pedicel 3–4 by 2 mm, faintly fissured and lenticellate, bracteole scar about median. — **Fig. 63h.**

**Distribution** — *Malesia*: E Papua New Guinea (endemic to the Sogeri region, Central Prov.); known from two collections.

**Habitat & Ecology** — Foothill forest; c. 400 m altitude; fl. Mar.

**Notes** — 1. Resembling and related to *M. pumila*, a species occurring in the same area and with larger and longer pedicelled male flowers with a caducous bracteole, (sub)sessile male inflorescences, and fruits borne on a 20–25 mm long thread-like pedicel (much shorter in the present species). Recent collecting has shown that the Sogeri region harbours several local endemic species, sometimes with a strikingly similar foliage.

2. Because the (male) inflorescences are short-pedunculate, *M. sogeriensis* has been entered twice in the keys, in the group with sessile inflorescences and in that with stalked inflorescences.

## 128. *Myristica sphaerosperma* A. C. Sm.

*Myristica sphaerosperma* A. C. Sm., J. Arnold Arbor. 22 (1941) 71; J. Sinclair, Gard. Bull. Sing. 23 (1968) 247, f. 23; Foreman, Contr. Herb. Austral. no. 9 (1974) 42, p.p.; Handb. Fl. Papua New Guinea 1 (1978) 210, p.p.; W. J. de Wilde, Blumea 40 (1995) 330. — Type: *Brass 4174*, Papua New Guinea.

Tree 10–30 m. *Twigs* subterete or bluntly angled, (2–)3–5 mm diameter, early or late glabrescent, hairs powdery, 0.5 mm long; older twigs sometimes longitudinally cracking, not flaking; inconspicuously lenticellate. *Leaves* chartaceous or coriaceous, ovate-elliptic to elliptic(-oblong), rarely oblong, 10–25(–32) by 4–9(–10.5) cm, base (short-)cuneate or (broadly) rounded, apex acute-acuminate, upper surface olivaceous or brown, lower surface grey-brown, shaded by cinnamon (sub)persistent indumentum, hairs interwoven or widely spaced, scale-like, grey-brown, 0.1–0.2 mm, mixed with scattered  $\pm$  dendroid brown hairs to 1 mm; irregularly papillose (appearing non-papillose); dots absent; midrib  $\pm$  flat above, at (60–)70–80(–90)° to the midrib, lateral nerves (10–)15–25 per side, flat or sunken, lines of interarching distinct, venation barely visible; petiole 15–25 by 2.5–4 mm; leaf bud 20 by 3–4 mm, hairs rusty 0.5(–1) mm long. *Inflorescences* between the leaves,  $\pm$  of the *Knema*-type: a simple, scar-covered brachyblast 2–3 mm long, sessile or to 5 mm pedunculate, late glabrescent; in male (*Clemens 4527*): with a cluster of 5 or 6 flowers, buds of various sizes; female inflorescences similar to male, 1–3-flowered; flowers with hairs 0.5–1 mm. *Male flowers*: pedicel 8–10 by 1–1.5 mm, bracteole 2 mm, caducous; buds oblong-ellipsoid, 10–11 by 3–4 mm, cleft (1/5–)

1/4. Androecium 6 mm long; androphore 2 mm, finely brown pubescent at base; synandrium 4 mm long, thecae 8–12(?), sterile apex minute. *Female flowers*: pedicel 5–10 by 2 mm; buds ovoid-oblong, 10 by 5 mm, apex subobtusate; ovary ovoid-oblong, 4–6 by 3–4 mm, with stiff hairs (0.5–)1 mm long, stigma 2 mm. *Fruits* single, subglobose or broadly (ob)ovoid, sometimes faintly beaked, or somewhat narrowed towards the base, 6–8 by 5–6.5 cm, hairs dense, mealy, rusty, 0.5(–1) mm long; pericarp 5–12 mm thick; seeds subglobose, 3–3.5 cm diameter; fruiting pedicel ± stout, 7–15 by 5–10 mm, late glabrescent, ± fissured or flaking when old.

Field-notes — Tall tree with horizontal branches. Bark grey-brown or black, not or little fissured or peeling; slash cream; sap red, or clear turning brown on exposure; wood creamy-white. Flowers yellow or brown, inside cream. Leaves greyish below. Fruits 8–9 by 6 cm, brown or brownish green. (Immature) fruits large, pointed at both ends, aril white.

Distribution — *Malesia*: New Guinea (Papua Barat: Bird's Head, Japen I., Wandammen Peninsula, Idenburg R., Cycloop Mts; Papua New Guinea: Morobe Prov.).

Habitat & Ecology — Mountain forest of ridges and slopes; midmontane forest, oak forest; clay-soil; (300–)800–1600(–1800?) m altitude; fl. & fr. throughout the year. Locally common.

Notes — 1. *Myristica sphaerosperma* is related to *M. womersleyi* which is distinguishable by the longer indumentum on the lower leaf surface and fruits with a shorter stalk. Another related species is *M. mediovibex*, in the key placed far apart because of its smaller leaves with short indumentum below without emergent hairs, and its smaller fruits.

2. Some specimens have only a thin indumentum on the lower leaf surface, composed of scattered scale-like hairs; old leaves may become quite glabrous. *Schram BW 13492* (Wandammen Peninsula) has narrower and thinner leaves, and was collected at a rather low altitude for the species, c. 300 m.

## 129. *Myristica subalulata* Miq.

*Myristica subalulata* Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 47. — Type: *Zippelius s.n.*, West New Guinea.

For more references and synonyms see under the varieties.

Tree 3–10(–25) m. *Twigs* ± flattened, with two raised lines or wings to 1(–2) mm high between the petioles, usually hollow and with ant-swellings (these faint or absent in var. *hagensis*), (3–)4–8(–10) mm diameter, glabrescent, hairs 0.1 mm or less; older twigs sometimes shallowly fissured, lenticellate. *Leaves* membranous, chartaceous or (sub)-coriaceous, elliptic(-oblong), 15–40 by 5–13(–16) cm, base cuneate or (narrowly) rounded, sometimes shallowly cordate, apex acute-acuminate; upper surface olivaceous or brown, lower surface grey-brown, glabrous or pubescent; neatly or irregularly papillose or not papillose; dots absent; midrib flat above, lateral nerves (13–)17–25 per side, at 50–80° to the midrib, flat or sunken, lines of interarching and venation distinct or not; petiole (10–)15–25 by (2–)3–5 mm; leaf bud 10–15(–20) by 2–3 mm, hairs 0.1(–0.2) mm. *In-florescences* between the leaves or rarely below, of the *Knema*-type: a sessile or to 4 mm pedunculate (or 5–20 mm in var. *pedunculata*), woody, wart- or worm-like, scar-covered brachyblast, 10(–20) by 5 mm, sometimes 2- or 3-armed, pubescent or glabrescent,



Fig. 88. *Myristica subalulata* Miq. var. *subalulata*. Male twig with immature flowers (bracteoles partly still present), ant-swellings, and ant-openings; stem partly opened to show ant-cavities with two coccids [Polak MP 750]. — Scale bar = 2 cm.

ending in few- or many-flowered subumbels (in male to 20-flowered, in female 1–3-flowered), the buds either  $\pm$  equal in size or of various sizes; flowers with hairs 0.1–0.2 mm, sometimes (sub)glabrous. *Male flowers*: pedicel 8–16 by (0.6–)1 mm, bracteole sometimes  $\pm$  3-topped, 2(–3) mm, persistent or caducous, (sub)apical; buds (mostly) membranous, (ellipsoid-)oblong or  $\pm$  tubiform, 8–15 by (2–)2.5–5 mm, apex  $\pm$  obtuse or subacute, not or faintly angled, cleft 1/6 or less, lobes 1.5–2 mm long, 0.2–0.5 mm thick. Androecium slender or  $\pm$  stout, 7–12 mm; androphore 2–6 by 0.4–1 mm, subglabrous or variable with scattered hairs less than 0.1 mm, either only at the base or in the lower half; synandrium (4–)5–7 by 0.5–1.5 mm, tapering into acute sterile apex 0.5–1 mm long, thecae 8–24. *Female flowers*: pedicel 1–5(–7) mm, bracteole 2–3 mm, (sub)apical; buds ovoid-oblong, narrowed to the apex, 4–7(–8) by 2.5–3.5 mm, lobes 1–1.5 mm; ovary narrowed to the apex, 3–3.5 mm long, minutely pubescent, stigma 1.5(–2) mm. *Fruits* solitary or in clusters of up to 6, subglobose, ellipsoid or broadly ovoid, 1.5–2 (–2.5) by 1–1.5 cm, narrowed to the apex, with the style-remnant remaining as a short apiculum, (fruits 1–3 per cluster, 2.5–3 cm long, with pedicel to 10 mm long in var. *paucifructa*), hairs persistent, mealy, rusty, 0.1–0.3(–0.4) mm, rarely glabrescent, sometimes lenticels in the basal part; pericarp 2(–3) mm thick; seeds (broadly) ovoid or ellipsoid, 1.5(–2) cm; fruiting pedicel 2–5(–10) by 1–2(–2.5) mm, generally with conspicuous raised lenticels. — **Fig. 88.**

Distribution — *Malesia*: Moluccas (Aru and Kai Islands), throughout New Guinea (incl. Misool; excl. Bismarck Archipelago). There are five varieties.

Habitat & Ecology — Altitude 0–2000 m.

Note — Widely distributed, with a large altitudinal range, characterized by the (sub-)alulate twigs mostly with ant-swellings. Much of the variation, e.g. in the leaf texture, presence or absence of papillation on the lower leaf surface, stoutness, and length of flower pedicel, seems gradual, and the subdivision of this species into varieties is arbitrary.

#### KEY TO THE VARIETIES

- 1a. Twigs with faint swellings or without; ridges faint or fairly distinct. Leaves and flowers coriaceous. — Papua New Guinea (Western Highlands Prov.: Mt Hagen and vicinity; c. 2000 m) ..... **b. var. hagensis**
- b. Twigs with ant-swellings, generally with an opening ..... 2
- 2a. Male buds not particularly narrow, 8–14 by (3–)4–5 mm; bracteole generally caducous; androphore about half as long as the synandrium; anthers 7–12. — Lowland to 2000 m altitude ..... 3
- b. Male buds slender, tubiform, 12–15 by (2–)2.5–3.5 mm; bracteole persistent or caducous; androecium slender, androphore (much) longer than half the length of the synandrium; anthers 4–6. [Fruits not known, possibly 1.5–2 cm long.] — Lowland and lower montane areas ..... 4
- 3a. Fruits 2.5–3 cm long. [Flowers not known with certainty, possibly similar to type variety.] — Montane areas ..... **d. var. paucifructa**
- b. Fruits 1.5–2(–2.5) cm long. — Lowland and montane areas ... **a. var. subalulata**
- 4a. Male inflorescences sessile ..... **c. var. leptantha**
- b. Male inflorescences 5–20 mm long pedunculate ..... **e. var. pedunculata**



**a. var. subalulata**

*Myristica subalulata* Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 47; Warb., Mon. Myrist. (1897) 484, t. 19; Markgr., J. Arnold Arbor. 10 (1929) 214; Bot. Jahrb. Syst. 67 (1935) 163; J. Sinclair, Gard. Bull. Sing. 23 (1968) 385, f. 64, 65; Foreman, Handb. Fl. Papua New Guinea 1 (1978) 210; W.J. de Wilde, Blumea 35 (1990) 255, f. 2: 14; 40 (1995) 330; 43 (1998) 176, f. 1.

*Myristica macrophylla* Zipp. ex Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 47, nom. nud.

*Myristica myrmecophila* Becc., Malesia 2 (1884) 37, t. 1. — Syntypes: several *Beccari* numbers (FI), West New Guinea.

*Myristica heterophylla* K. Schum. in K. Schum. & Hollr., Fl. Kaiser Wilhelmsland (1889) 45, p. p., nom. inval. [non *Myristica heterophylla* Fern.-Vill. (1880) = *Knema glomerata*].

Doubtful synonym: *Myristica costata* Warb., Bot. Jahrb. Syst. 18 (1893) 191; Mon. Myrist. (1897) 487, t. 19; K. Schum. & Lauterb., Fl. Schutzgeb. Südsee (1900) 327; Markgr., Bot. Jahrb. Syst. 67 (1935) 166. — Type: *Hellwig 247* (B, lost), Sattelberg near Finschhafen.

Tree 3–10(–25) m. *Twigs* as those of the species, perforated ant-swellings always present. *Leaves* membranous, chartaceous, or (sub)coriaceous, lower surface distinctly papillose (lens!), or not. Flower buds of various sizes within one inflorescence, bracteole sometimes persistent (see note). *Male flowers*: buds 8–14 by (3–)4–5 mm. Androecium 7–10 mm; androphore shorter than the synandrium, 2–2.5 mm, subglabrous or minutely pubescent to various degrees; synandrium (3.5–)5–6 by 1–1.5 mm, thecae 14–24, sterile apex 0.5–1 mm long. *Fruits* solitary or in clusters of up to 6, subglobose or ovoid 1.5–2(–2.5) by 1–1.5 cm, apex narrowed or rounded, style-remnant persistent as a 1–3 mm long beak; fruiting pedicel 2–9 mm long. — **Fig. 59d, e, 61a, 65e, 66d, 88.**

Field-notes — Shrub or small erect tree of lowest or middle layer of the forest, rarely with stilt-roots, branches sometimes tiered, horizontal, often drooping. Bark (dark) brown, smooth or finely vertically fissured, or finely tessellated, sometimes with pustulate lenticels or circular raised ridges; inner bark orange-brown or salmon; exudate clear, sometimes resinous, turning (pink-)brown on exposure; wood straw or cream, turning (salmon-)brown, often pinkish mottled by exudate (vessels standing out pinkish against a white background). Leaves grey or glaucous below. Flowers succulent, cream or yellow(-brown), cream inside. Fruits either brown, orange- or yellow-brown, or (pale) chestnut.

Distribution — *Malesia*: as the species.

Habitat & Ecology — Lowland, (sub)montane forest on flatland, slopes, and ridges; in riverside forest, bamboo regrowth, and *Araucaria*- and *Nothofagus*-*Castanopsis*-dominated forest; also in secondary regrowth; on clayey soils, soils over limestone, volcanic and peaty soils; most commonly on well-drained soil, occasionally in temporarily inundated or swampy locations; 0–2100 m altitude; fl. & fr. throughout the year.

Characteristically the twigs are hollow and have swollen parts with small round or slit-like perforations, the swellings inhabited by small black ants. Occasionally olive-coloured swollen galls are found on the top of the twigs.

Note — *Myristica subalulata* var. *subalulata* comprises most of the material of the common species *M. subalulata*. The type variety is variable in itself: — *Twigs* with at every 4 or 5 internodes a swollen hollow part, with a characteristic hole or a rough-lined slit, inhabited by small black ants. If ant-swellings are lacking in a specimen, this is possibly due to incomplete sampling of the material. The swellings are presumably initiated and grown by the plant and will be subsequently occupied by the ants (see De Wilde, 1998). — *Leaves*. The texture of the leaves is variable according to the provenance,

(sub)coriaceous in specimens from montane areas. The lower leaf surface is either strongly and regularly, or irregularly whitish papillose, or but faintly or not papillose (lens!). *Myristica subalulata* is one of the few species in which this character is not constant. In non-papillose leaves the papillae may not have been developed (or only insufficiently so); conversely, the papillae may be present so profusely and densely that they entirely cover the lower leaf surface so that this appears to be non-papillose. Distinct regular papillae are most apparent in lowland specimens; irregular papillation is common in lowland and montane material, while leaves that are non-papillose with a smooth surface predominate in specimens from montane and upper montane regions. — *Indumentum*. The indumentum is inconspicuous, and can be seen only with magnification. Developing leaves have sparse or dense, scale-like, pale brown or greyish hairs, 0.1(–0.2) mm or less. They are early shed, especially in lowland specimens. In collections from montane areas the indumentum is densest and often longer persistent as well. — *Flowers*. The pedicels of male flowers, but especially those of female flowers and fruits, tend to be longer towards the east of the distributional area. The flowers of part of the male specimens of an eastern distribution, i.e. Papua New Guinea, are more slender, with smaller perianth and longer pedicels, but this feature seems to intergrade. Plants with conspicuous slender male perianths belong to var. *leptantha*. — *Bracteole*. In most specimens the bracteole is early falling; in a few collections, linking up with the bulk of the material of var. *subalulata*, the bracteole is persistent or late caducous (e.g. *NGF 13207, 48143, Docters van Leeuwen 9181, 11297*, from distant localities, in lowland as well as montane areas). — *Fruits*. Shapes and sizes are variable, but the fruits are always small, 1.5–2(–2.5) cm long. Subglobose, ovoid, and (ovoid-)oblong fruits occur; ovoid fruits, narrowed to the apex and ending in the short beak formed by the style-remnant are most frequent. The fruiting pedicel may be short or long, to 7 mm, mostly slender, but may become quite thick, caused by coarse lenticel-like outgrowths. Specimens with fruits longer than 2.5 cm belong to var. *paucifruca*.

**b. var. hagensis** W.J. de Wilde

*Myristica subalulata* Miq. var. *hagensis* W.J. de Wilde, *Blumea* 40 (1995) 330; 43 (1998) 177, 181.  
— Type: *Hoogland & Pullen 5831*, Papua New Guinea.

Tree 8–15 m. *Twigs* 5–7 mm diameter, ridged or not, always ± angular; ant-swellings faint and without opening, or absent. *Leaves* (thinly) coriaceous, comparatively small, the largest 24 by 7 cm, lower surface subglabrous, not papillose. *Inflorescences*: brachyblast thick, wart-like, to 10 mm long; flower buds rather robust, resembling those of the type variety, slightly differing in size within one cluster, bracteole 2(–4) mm, caducous, perianth leathery. *Male flowers* as the species. *Fruits* solitary or 2 (or 3) together, broadly ellipsoid, 2 by 1.5 cm, apex pointed; fruiting pedicel 5–7 by 2(–3) mm, smooth, not or but little lenticellate.

Field-notes — Bark 3–5 mm thick, dark brown or dark purple-brown, with numerous longitudinal fissures; sap red; underbark purple-brown; inner bark pale brown; blaze straw; wood pink or straw with orange dots, or pale brown, easy to cut. Flowers hard, cream or olivaceous. Fruits reddish brown or light yellow tinged with brown.

Distribution — *Malesia*: Papua New Guinea (Western Highlands Prov.: Mt Hagen and vicinity).

Habitat & Ecology — High mountain forest, *Nothofagus*- or *Castanopsis*-forest; 1800–2150 m altitude; fl. & fr. May, July, Aug.

Notes — 1. The status of var. *hagensis* is provisional. It is close to typical *M. subalulata* as shown by the male flowers. All specimens (restricted to Mt Hagen and vicinity) are distinguishable by the absence of perforated ant-swellings in the twigs and the coriaceous, rather small leaves. Possibly the ant species belonging to *M. subalulata* does not occur at the high altitudes of the present variety.

2. The lower leaf surface which appears to be non-papillose, may be so strongly and densely papillose that the separate papillae are difficult to discern as such.

**c. var. leptantha** W.J. de Wilde

*Myristica subalulata* Miq. var. *leptantha* W.J. de Wilde, Blumea 40 (1995) 331; 43 (1998) 177. — Type: *van Royen & Sleumer 7747*, Irian Jaya, Bird's Head.

Tree 5–7 m. *Twigs* as those of the species. *Leaves* membranous or chartaceous, the lower surface distinctly papillose or not. *Inflorescences* sessile, without peduncle; flower buds slender, of various sizes (according to age) within one inflorescence, bracteole persistent or caducous. *Male flowers*: buds lanceolate-tubiform, 12–15 by 2.5–3(–3.5) mm, apex narrowed,  $\pm$  blunt, lobes 1–1.5 mm long. Androecium slender, 10–12 mm; androphore 4–5 by 0.4–0.6(–0.8) mm, almost completely pubescent, hairs sparse, pale, 0.1 mm or less; synandrium 4–6 by 0.5–1 mm, thecae 8–12, contiguous or rather spaced, sterile apex slender, 1 mm long. *Female flowers* and *fruits* not known.

Field-notes — Slender tree with few, short, excurrent branches. Leaves slightly glaucous below. Flowers cream or white, brown suffused.

Distribution — *Malesia*: New Guinea; known from three male-flowering collections of widely scattered localities in Papua Barat (Bird's Head) and Papua New Guinea (Western Prov., Palmer River, and Sepik Prov.).

Habitat & Ecology — Forest of mountain slope, forest undergrowth on lower ridge, or on steep riverbank; 100–840 m altitude; fl. July, Nov.

Note — Characterized by slender male flowers. The lower leaf surface may be papillose or not. In *Darbyshire & Hoogland 8297* the bracteole is persistent in mature (but not yet open) flowers.

**d. var. paucifruca** W.J. de Wilde

*Myristica subalulata* Miq. var. *paucifruca* W.J. de Wilde, Blumea 40 (1995) 332; 43 (1998) 177. — Type: *BW 11441 (Vink)*, West New Guinea.

Tree 5–15 m. *Twigs* as those of the species. *Leaves* membranous or subchartaceous, the lower surface glabrous or somewhat pubescent, not or but indistinctly papillose. *Inflorescences*: flower buds somewhat variable in size within one inflorescence, bracteole caducous. *Male flowers* not known. *Fruits* 1–3 per infructescence, (ovoid-)ellipsoid, 2.5–3 by 1.7–2 cm; fruiting pedicel 3–9 mm long.

Field-notes — Slender trees, twigs hollow, with many small black ants producing an unpleasant smell. Bark smooth or vertically cracked; exudate red; inner bark (blaze) chestnut or reddish; wood dark cream. Leaves glaucous or coppery green below. Fruits brown, seeds dark brown.

Distribution — *Malesia*: Moluccas (Kai Is.); widely distributed in Papua Barat and Papua New Guinea, including the Papuan Islands.

Habitat & Ecology — Mountain forest of gullies, slopes and ridges; 800–1200 m altitude; fl. & fr. throughout the year. Locally common.

Note — The variety *paucifructa* accommodates specimens with few fruits per infructescence, the fruits being large in comparison to those of the type variety. Vegetatively and in flowers the specimens of the present var. *paucifructa* merge with those of var. *subalulata*. Possibly var. *paucifructa* has developed polytopically. All specimens are from montane areas.

#### e. var. *pedunculata* W. J. de Wilde

*Myristica subalulata* Miq. var. *pedunculata* W. J. de Wilde, *Blumea* 40 (1995) 332, f. 2b; 43 (1998) 177. — Type: *Sands et al.* 1483, Papua New Guinea.

Tree 4 m. *Twigs* as those of the species. *Leaves* thinly chartaceous, lower surface not papillose. *Inflorescences* worm-like, the scar-covered part unbranched, to 4 cm long, peduncle glabrous (glabrescent), somewhat flattened, 5–20 mm long; flower buds slender, of various sizes within one inflorescence, bracteole ± 3-topped, 3 mm long, caducous. *Male flowers*: pedicel 11 by 0.5 mm; buds tubiform, 15 by 2–2.5 mm, apex ± acute, somewhat angled, lobes 1 mm long. Androecium slender, 12 mm; androphore 6 by 0.4 mm, almost completely pubescent, hairs sparse, pale, less than 0.1 mm; synandrium 5 (–6) by 0.7 mm, thecae c. 12, sterile apex 0.3 mm long. *Female flowers* and *fruits* not seen. — **Fig. 66e.**

Field-notes — Bark brown; young wood olive-green. Leaves dark green above, paler below. Inflorescence stiff, pointing downwards from the branches, rachis swollen, coffee-brown; flower buds butter-cream, on pale green pedicel.

Distribution — *Malesia*: Papua New Guinea (Gulf Prov., Kikori subprov., c. 200 km upstream Purari River); known only from the type.

Habitat & Ecology — In lowland rain forest including *Terminalia*, *Elaeocarpus*, *Albizia*, and *Pometia*; growing near small tributary stream; 140 m altitude; fl. Aug.

Note — The present var. *pedunculata* is noticeable for the pedunculate inflorescences, a character mostly used on species level. In this character var. *pedunculata* somewhat resembles *M. cornutiflora*, a species also with long tubiform male flowers.

### 130. *Myristica subcordata* Blume

*Myristica subcordata* Blume, *Rumphia* 1 (1837) 186; W. J. de Wilde, *Blumea* 40 (1995) 333. — Type: *Zippelius s.n.* (4 sheets in L) (*Myristica cordifolia* Zipp. in herb., nom. nud., p.p.), West New Guinea.

For more references and synonyms see the varieties.

Tree (5–)10–30 m. *Twigs* 3–5(–10) mm diameter, glabrescent, hairs 0.1–0.6(–1) mm; older twigs finely or coarsely lenticellate, bark often longitudinally cracking, occasionally flaking; lenticels present. *Leaves* membranous, chartaceous, or subcoriaceous, elliptic-oblong to lanceolate, 12–35(–40) by 4–14 cm, base (short) cuneate, rounded, or shallowly cordate (frequently so in var. *subcordata* and *morindiifolia*), apex acute-acuminate; upper surface olivaceous or brown, lower surface with persistent indumentum, hairs dense,

somewhat powdery, (grey-)brown, 0.1–0.4(–0.6) mm; not papillose; dots absent; midrib flat above (sometimes raised towards the apex), lateral nerves 18–30(–35) per side, at 60–70° to the midrib, in cordate leaves those towards the base frequently at nearly 90° to the midrib, lines of interarching faint or distinct, venation indistinct; petiole 10–25 by 2.5–5 mm; leaf bud 10–30 by 2.5–5 mm, hairs 0.1–0.5(–0.6) mm; cataphyll-like leaves often present on the twig below the normally developed leaves, especially in var. *morindiifolia*. *Inflorescences* between the leaves or below, of the *Knema*-type: a short, simple or forked, scar-covered brachyblast (in male) up to 15 mm long, sessile or to 5 mm long pedunculate, with short rusty indumentum, glabrescent; bracts 1.5 mm, caducous; in male: ending in a cluster of 5–10 flowers, buds of various sizes; female similar to male, fewer flowered; flowers with flocculose hairs 0.2–0.5(–1) mm. *Male flowers*: pedicel 5–12 by 1–1.5 mm, bracteole ± ovate (sometimes faintly 3-topped), 2–2.5 or 4–5 mm long (see note under var. *morindiifolia*), caducous, scar apical or 1–2 mm below; buds (ovoid-)oblong or nearly tubiform, 6.5–8(–10) by 3–4 mm, cleft 1/5–1/4, lobes (1–)1.5–2 mm long, 0.2–0.3 mm thick. *Androecium* slender, (4–)4.5–6.5 or 7.5–8 mm; androphore 2–4 mm long, in the lower 1/3–1/2 with hairs 0.1–0.5 mm; synandrium 2.5–4 by 0.7–1.2 mm, thecae 10–12, sterile apex acute or blunt, sometimes faintly lobed, 0.2–0.4(–1) mm long, or absent. *Female flowers*: pedicel 1 mm long (longer in var. *gigacarpa*), bracteole 3–4 mm, caducous; buds ovoid, 4–5(–6) by 4–5 mm; ovary ovoid, 3.5–4 by 3.5–4 mm, hairs 0.2–0.6 mm. *Fruits* single or in clusters of 2 or 3(–5), (ovoid-)oblong, rarely subglobose, (3.5–)4–5.5 by 2.5–3.5 cm, hairs (dark) rusty, ± flocculose, 0.1–0.5(–1) mm; pericarp leathery, sometimes ± woody, 3–7(–10) mm thick; seeds ellipsoid, 2.5–3 cm; fruiting pedicel (3–)4–10(–20 in var. *gigacarpa*) by 3–5 mm, late glabrescent, bracteole scar usually below the apex.

Field-note — Frequently with stilt-roots.

Distribution — *Malesia*: throughout New Guinea (incl. the Bismarck Archipelago).

Habitat & Ecology — Generally at low altitudes, but var. *morindiifolia* up to 1000 (–1400) m.

Notes — 1. A variable species in which tentatively four varieties are distinguished. The type variety is upheld for those specimens which (almost) match the original type specimens. Provisionally, most material which falls outside var. *subcordata* sensu stricto is merged into the very variable var. *morindiifolia*. Of var. *subcordata* male flowers are still unknown; those described by Sinclair (l.c.: 308) pertain to a specimen now under *M. fatua*. Additional explanatory notes are given under the varieties. *Myristica subcordata* varies in general habit and in details of flowers and fruits, e.g. in length of hairs of indumentum and length of the fruiting pedicel. It has solid twigs, and no ant-inhabitation. Stout specimens, especially of var. *morindiifolia*, may be confused with certain myrmecophilous species. The taxonomic status of var. *gigacarpa* and var. *rimosa* is provisional. Of these two varieties male flowers are lacking, and they may represent separate species; perhaps var. *rimosa* may be a variety of *M. verruculosa*.

2. The varieties *subcordata* and *morindiifolia* were accepted by Sinclair (l.c.) as different varieties under his broad concept of *M. fatua*. From Miquel (1865) onwards, the original two species described by Blume (1837) have been mostly regarded as particularly closely related, and treated under one name, *M. fatua* β *subcordata*. In the present treatment *M. subcordata* is accepted as a distinct species beside *M. fatua*, following Warburg (1897: 420).

## KEY TO THE VARIETIES

- 1a. Pericarp 7(–10) mm thick. — Papua New Guinea; montane . . . . **b. var. *gigacarpa***  
 b. Pericarp 3–6 mm thick. — Lowlands and lower montane areas . . . . . 2  
 2a. Twigs pale brown, bark rough by numerous closely set lenticels. — Papua Barat (Bird's Head) . . . . . **d. var. *rimosa***  
 b. Twigs brown, bark with dispersed lenticels . . . . . 3  
 3a. Leaves subcoriaceous, margin revolute on drying. Indumentum of fruits with woolly hairs 1(–1.5) mm long. Indumentum of leaf bud and innovations with hairs 1 mm long. Fruiting pedicel 1–2(–3) mm. — W & S Papua Barat, SW Papua New Guinea (Western Prov.); lowlands . . . . . **a. var. *subcordata***  
 b. Leaves membranous or chartaceous, margin usually flat. Indumentum of fruits with short or long hairs, 0.1–0.5(–1) mm. Indumentum of leaf bud and innovations with short or rather long hairs, 0.1–0.5 mm. Fruiting pedicel (3–)4–10 mm long. — Throughout New Guinea, incl. Bismarck Archipelago and Papuan Islands; lowlands, up to 1000(–1400) m . . . . . **c. var. *morindiifolia***

**a. var. *subcordata***

*Myristica subcordata* Blume, Rumphia 1 (1837) 186; Warb., Mon. Myrist. (1897) 420, t. 19, p.p.; W.J. de Wilde, Blumea 40 (1995) 333; 43 (1998) 181. — *Myristica fatua* Houtt. var. *subcordata* (Blume) Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 46, p.p.; J. Sinclair, Gard. Bull. Sing. 23 (1968) 307, f. 38A–C (excl. male fl.); Foreman, Contr. Herb. Austral. no. 9 (1974) 37; Handb. Fl. Papua New Guinea 1 (1978) 196.

*Myristica wallacea* Warb. var. *keyensis* Warb., Mon. Myrist. (1897) 531. — Type: *Warburg 20720* (lost).

Tree. *Twigs* (dark) brown; older bark with dispersed lenticels. *Leaves* subcoriaceous, 17–28 by 6–13 cm, base subcordate or rounded, margin revolute, the lowermost nerves often almost rectangular to the midrib, lower surface with dense flocculose indumentum, hairs to 1 mm long; petiole comparatively short, 10 mm long; leaf bud with hairs 1(–1.5) mm long. *Male flowers* not known. *Fruits* ± sessile, 3.5–4 cm long, (broadly) rounded at base, hairs coarse, shaggy, 1–1.5 mm long; fruiting pedicel 1–2(–3) mm long, bracteole scar (sub)apical.

Field-notes — Bark paper-thin, faintly peeling, fissured or not; inner bark pink or blood-red brown; wood straw; sap red, brown on exposure. Leaves glaucous and brown powdery below. Fruits hairy, copper brown.

Distribution — *Malesia*: New Guinea (SW Papua Barat: western part of Bird's Head; Papua New Guinea: Western Prov.).

Habitat & Ecology — Forest on flatland, level land inundated in the wet season, forest on stony clay; 0–200(–300) m altitude; fr. Apr.–July, Nov. Locally common.

Note — *BW 10768* (*Ch. Koster*) from Mt Krabo, S of Manokwari, at 300 m, deviates in its chartaceous (not coriaceous) leaves, at base not cordate; the fruit, however, matches the type. *Soegeng 351* and *LAE 73930* (both S New Guinea) deviate by their more spaced lateral nerves, which are comparatively faint and not much projecting below.

**b. var. *gigacarpa* W.J. de Wilde**

*Myristica subcordata* Blume var. *gigacarpa* W.J. de Wilde, Blumea 40 (1995) 333; 43 (1998) 181. — Type: *Streimann 8548*, Papua New Guinea.

Tree 12–20 m. *Twigs* 5–10 mm diameter, brown. *Leaves* chartaceous or subcoriaceous, 28–32 by 8–12 cm, margin flat, lower surface with dense indumentum, hairs 0.1 mm or less. Leaf bud with hairs 0.1 mm or less. *Flowers* not known. *Fruits* solitary, axillary to lower leaves, ellipsoid, 5.5–6 by 3.5–4 cm, hairs 0.1 mm or less; pericarp  $\pm$  woody, 7(–10) mm thick; fruiting pedicel stout, 15–17(–20) by 6 mm,  $\pm$  lenticellate, bracteole scar 6 mm below apex.

Field-notes — Straight-boled tree. Leaves brown below. Fruits rusty brown.

Distribution — *Malesia*: Papua New Guinea (Eastern Highland Prov.).

Habitat & Ecology — Primary and advanced regrowth forest; along creek, on slope on limestone; 1200–1800 m altitude; fr. Aug., Sept.

Note — Possibly this variety merits the status of a separate species, but more material (including flowers) is needed to make a final decision.

### c. var. *morindiifolia* (Blume) W.J. de Wilde

*Myristica subcordata* Blume var. *morindiifolia* (Blume) W.J. de Wilde, *Blumea* 40 (1995) 334; 43 (1998) 181. — *Myristica morindiifolia* Blume, *Rumphia* 1 (1837) 186, '*morindaefolia*'. — *Myristica fatua* Houtt. var. *morindiifolia* (Blume) J. Sinclair, *Gard. Bull. Sing.* 23 (1968) 286, f. 34. — Type: *Zippelius s. n.* (3 sheets in L = *Myristica cordifolia* Zipp., in herb., nom. nud., p. p., remainder = var. *subcordata*, see the notes by Sinclair, l.c.), New Guinea.

*Myristica multinervia* A. C. Sm., *J. Arnold Arbor.* 22 (1941) 70. — Type: *Brass 3914*, New Guinea.

Tree. *Twigs* brown; older bark with dispersed lenticels. *Leaves* membranous or chartaceous, margin usually flat, lower surface with persistent indumentum, hairs 0.1–0.4(–0.6) mm; petiole 1–2.5 cm long; innovations and leaf bud with hairs 0.1–0.5 mm. *Male flowers* as those of the species. *Fruits* single or in clusters, (ovoid-)oblong, 4–5.5 cm long, hairs to 0.1–0.5(–1) mm; pericarp 3–6 mm thick; fruiting pedicel (3–)4–10 mm long, bracteole scar  $\pm$  below the perianth.

Field-notes — Straight-boled tree with horizontal branches, crown narrow, with or without stilt-roots or buttresses. Bark dark brown or black, smooth, or with lenticels, or with shallow vertical fissures, or rarely with small flakes (faintly peeling); inner bark fibrous, reddish brown; sapwood pale; sap red, sometimes sticky; no heartwood. Flowers with yellowish (brown) indumentum, inside greenish; with fetid smell or sweetly scented. Fruits rusty tomentose; seeds brown-black.

Distribution — *Malesia*: throughout New Guinea, including Bismarck Archipelago and Papuan Islands.

Habitat & Ecology — (Tidal) forest of riversides, (periodically inundated) marsh forest (stout specimens), also dryland forest; on sandy or clayey soil, soil over limestone, or volcanic scoria; also in strand vegetation (smaller-leaved forms); 0–500 m altitude (but *BW 13626*, Wandammen Peninsula, 950 m, *NGF 21540*, Morobe Prov., c. 1400 m); fl. & fr. throughout the year.

Notes — 1. Specimens intermediate with var. *subcordata* occur all over the area, but especially in New Britain (specimens with rather long-haired fruits).

2. The figures in Sinclair (1968: 295, f. 37) for *M. fatua* var. *papuana* all represent specimens now referred to *M. subcordata* var. *morindiifolia*.

3. Male plants of var. *morindiifolia* from western New Guinea (especially Bird's Head) have somewhat shorter perianths, and smaller bracteole as compared to specimens from

eastern localities in Papua New Guinea. Coarse, stout specimens generally originate from wet soils, e.g. riversides, swamp forest, or forest on (periodically) inundated ground. Specimens with small leaves with a cuneate base, from all over the area, including some from Bird's Head, may strongly differ in general habit. Nearly always these small-leaved forms are from well-drained soils, and possibly they represent a separate (subspecific) taxon.

Some specimens from New Britain, e.g. *NGF 6652, 22463, LAE 74233*, have comparatively long petioles; the indumentum of the lower leaf surface and the fruits is particularly flocculose, with hairs to 1 mm long. These specimens are clearly different in general aspect compared to the specimens here treated under var. *subcordata*. Male flowering specimens from the Bismarck Archipelago are unknown.

4. The feature of cataphyll-like little-developed leaves on the twigs below the normal leaves (i.e., of each new shoot the first leaves remain undeveloped), is frequent and characteristic for var. *morindiifolia*.

5. Small-leaved specimens, sterile or with immature fruits, may be difficult to separate from *M. inutilis*.

#### d. var. *rimosa* W.J. de Wilde

*Myristica subcordata* Blume var. *rimosa* W.J. de Wilde, *Blumea* 43 (1998) 181. — Type: *de Vogel 9757*, Irian Jaya, Bird's Head.

*Twigs* terete, 5–8 mm diameter; older twigs at first blackish brown, soon pale and conspicuously rough, flaky, and fissured by numerous elongate lenticels. *Leaves* coriaceous, elliptic-oblong or oblong(-lanceolate), 17–30 by 5–9.5 cm; lower surface with pale yellowish brown dense short-felty hairs 0.1 mm; petiole short, 5(–10) by 3–5 mm, dark brown. *Inflorescences* (female) of the *Knema*-type: sessile, 2- (or 3-)flowered. *Female flowers* ± sessile; buds ovoid-oblong, narrowed towards the apex, hairs 1 mm long. *Fruits* solitary, ellipsoid, 2.5–3.5(–4) by 1.5–2.5 cm, apex subacute, hairs powdery, (light) brown, 0.5 mm; pericarp 3 mm thick; fruiting pedicel thick, 1–2 mm long, c. 5 mm thick, frequently with the perianth persistent under the fruit, bracteole scar not seen.

*Distribution* — *Malesia*: Papua Barat (western Bird's Head).

*Habitat & Ecology* — Forest on sandy or clayey soil, presumably all collections from forest on limestone bedrock; 50–300 m altitude; fl. & fr. May.

*Note* — Var. *rimosa* is clearly distinguishable by the rough, flaky and lenticellate-fissured bark of the twigs. The persistent perianth (with hairs 1 mm long) under the fruit is remarkable.

### 131. *Myristica succedanea* Blume

*Myristica succedanea* Reinw. ex Blume, *Rumphia* 1 (1837) 186; Scheff., *Ann. Jard. Bot. Buitenzorg* 1 (1876) 46, p.p.; *Warb., Ber. Pharm. Ges.* (1892) 219; *Die Muskatnuss* (1897) 369, t. 3 f. 8; *Mon. Myrist.* (1897) 474, t. 17; K. Heyne, *Nutt. Pl. Ned. Indië* (1927) 647; J. Sinclair, *Gard. Bull. Sing.* 23 (1968) 238, f. 21; W.J. de Wilde, *Blumea* 35 (1990) 255, f. 2: 15, 3f, 4; 42 (1997) 185. — Type: *Reinwardt s.n.*, Moluccas.

*Myristica radja* Miq., *Ann. Mus. Bot. Lugd.-Bat.* 2 (1864) 206, p.p. (non Rumph.); *Warb., Mon. Myrist.* (1897) 453, sub syn. *Myristica speciosa* Warb. [*Pala radja* Teijsm., *Natuurk. Tijdschr. Ned. Ind.* 23 (1861) 337]. — Type: *Teijsmann s.n.*, culta Bogor, ex Bacan, p.p.





*Myristica succedanea* Blume var. *brevifolia* Scheff. & Teijsm., Ann. Jard. Bot. Buitenzorg 1 (1876) 61, nom. nud. (*Teijsmann* 7586).

*Myristica speciosa* Warb., [Ber. Pharm. Ges. (1892) 219, t. 11; Die Muskatnuss (1897) 365, t. 3] Mon. Myrist. (1897) 453, t. 17; K. Heyne, Nutt. Pl. Ned. Indië (1927) 647. — Syntypes: *Beccari* *Fl acc. nos.* 7730, 7731; *Warburg* 18297 (B, lost); *Teijsmann s. n.*, Moluccas.

*Myristica schefferi* Warb., [Ber. Pharm. Ges. (1892) 220; Die Muskatnuss (1897) 372;] Mon. Myrist. (1897) 477, t. 17; K. Heyne, Nutt. Pl. Ned. Indië (1927) 647. — Syntypes: *Teijsmann s. n.* (*Palaonin*); *Warburg s. n.* (cult, lost); *Beccari acc. nos.* *Fl* 7694-7698 (cult BO) (see Sinclair: 241).

*Myristica lakilaki* Murata & Nitta, Acta Phytotax. Geobot. 40 (1989) 177. — Type: *de Vogel* 3668, Moluccas, Bacan I.

Tree 8–20 m. *Twigs* 2–3.5 mm diameter, early glabrescent, hairs scattered, 0.1 mm; older twigs somewhat cracking, with many inconspicuous lenticels. *Leaves* chartaceous or usually (sub)coriaceous, elliptic or oblong, 9–22 by 3.5–10(–12) cm, base narrowly rounded or cuneate, apex acute-acuminate; upper surface (olivaceous or yellowish) brown, lower surface greyish, (late) glabrescent, hairs dense, scale-like, 0.1 mm or less, mixed with few brownish hairs 0.1–0.2 mm; papillose or usually not; dots absent; midrib raised above, lateral nerves 8–12(–15) per side, at 45–80° to the midrib, flat or sunken above, lines of interarching and venation indistinct; petiole 10–20 by 1.5–3 mm; leaf bud (5–) 7–15 by 2–3 mm, hairs 0.1 mm. *Inflorescences* with hairs 0.1 mm, between the leaves or below, or sometimes in to 5 cm long short-shoots resembling a compound inflorescence, ending in a vegetative leaf bud; male and female inflorescences somewhat as in *M. fragrans*: short-pedunculate, either simple or at the apex 2- (or 3-)forked, or each of the branches forking again, with age developing into slender or thickish scar-covered up to 15 mm long brachyblasts ending with 1–3 (or 4) flowers, buds almost equal in size; bracts caducous; in male: peduncle 5–15(–20) by 2–2.5 mm, in female (1–)3–10 mm long; flowers with hairs less than 0.1 mm. *Male flowers*: pedicel 7–12(–14) by 1(–1.5) mm, bracteole rounded or reniform, 2–3 mm, persistent or late caducous; buds (ovoid-) oblong, 7–11 by 4–6 mm, the apex rounded, cleft 1/5–1/8, lobes 0.4–0.8 mm thick. *Androecium* 5–8 mm long; androphore 2–2.5 mm long, minutely pubescent or almost glabrous; synandrium somewhat conical, 4–6 by 1.5–2(–2.5) mm, thecae 16–20(–24), sterile apex blunt or irregular in shape, 0.3–0.5(–1) mm. *Female flowers*: pedicel (2–)4–12 by 1.5 mm, bracteole late caducous; buds 7(–10) by 5–6 mm, cleft 1/5–1/4; ovary narrowly ovoid, (3–)4–6 by 2–3(–3.5) mm, hairs sparse or dense, less than 0.1 mm, style slender, 1.5 mm. *Fruits* single or paired, rather stout, ovoid-ellipsoid, coarsely wrinkled on drying, 4.5–8 by 3.5–4.5 cm, apex ± blunt or subacute, (usually) glabrescent, hairs scattered, scale-like, 0.1 mm long or less, usually persistent towards the insertion of the stalk; pericarp 10(–15) mm thick; seeds ellipsoid or oblong, (2–)2.5–3(–4) cm; fruiting pedicel stout, 4–11 mm long. — **Fig. 65f, 82f, 89.**

Fig. 89. *Myristica succedanea* Blume. a. Leafy twig with male inflorescences; b. two male buds with small persistent bracteoles, closed and opened; c. leafy twig with male inflorescences and immature buds; d. opened bud of the same; e. apical part of twig with female inflorescences axillary to reduced leaves; f. two female buds, closed, and opened showing pistil; note thinly hairy ovary; g. apical part of leafy twig with infructescence with two developing fruits; h. mature fruit (dried) [a, b: *de Vogel* 3626; c, d: *de Vogel* 3544; e: *Woerjantoro* 98 (cult); f: *de Vogel* 3642; g, h: *de Vogel* 3628]. — Scale bar for a, c, e, g, h = 2 cm; for b, d, f = 3.3 mm.

Field-notes — Clear bole to 15 m, very straight, without buttresses (but according to Sinclair, l.c.: 239, usually with stilt-roots). Bark smooth or strongly peeling off with  $\pm$  round flakes, or bark with longitudinal cracks 5 mm apart; outer bark 1–2.5 mm thick, dark brown; inner bark 6–7 mm thick, reddish with white rays; sap little, reddish, watery; sapwood pale reddish or yellowish with red rays, gradually passing into the slightly darker heartwood. Young parts of twigs pale green with brown indumentum. Leaves glossy dark green above, silvery below. Flowers (female) cream or yellowish green, with brownish tinge, fragrant; ovary minutely rusty pubescent. Fruits yellowish green.

Distribution — *Malesia*: northern Moluccas (Ternate, Tidore, Bacan).

Habitat & Ecology — Lowland and montane forest; forest with little undergrowth on level places on ridge; deep clayey soil, bedrock grey schists; steep slopes or ravines; 0–1100 m altitude; fl. Oct.; fr. July–Oct.

Uses — Said to be formerly cultivated on a small scale in Halmahera; nuts aromatic.

Note — This species is homogeneous, characterized among other species of the *M. fragrans*-type of inflorescence (*M. argentea*, *M. fragrans*, *M. impressinervia*, partly) by the  $\pm$  stout twigs and large flowers. It is also somewhat similar to *M. pubicarpa* from nearby Halmahera and Obi.

### 132. *Myristica sulcata* Warb.

*Myristica sulcata* Warb., Mon. Myrist. (1897) 538, t. 19; J. Sinclair, Gard. Bull. Sing. 23 (1968) 396, f. 66; Foreman, Contr. Herb. Austral. no. 9 (1974) 42; Handb. Fl. Papua New Guinea 1 (1978) 211 (excl. syn. *Myristica undulatifolia* J. Sinclair); W.J. de Wilde, Blumea 40 (1995) 334; 43 (1998) 182. — Type: *Chalmers s.n.*, Papua New Guinea, Central Prov.

*Myristica anceps* Warb., Mon. Myrist. (1897) 528. — Type: *Beccari 681*, Irian Jaya, Bird's Head.

Tree 10–40 m. Twigs 2–4 mm diameter, usually 2-edged, early glabrescent, hairs less than 0.1 mm, seemingly glabrous; older twigs  $\pm$  fissured and transversely cracking; lenticels small. *Leaves* membranous or chartaceous, ovate-elliptic or elliptic-oblong, 12–27(–30) by 4–12 cm, base attenuate or rounded, apex acute-acuminate; upper surface olivaceous or (dark) brown, lower surface greyish, early glabrescent, hairs inconspicuous, scattered, scale-like, 0.1 mm or less; not papillose; dots absent; midrib  $\pm$  flat or raised above, lateral nerves 15–21 per side, at 45–60(–70) $^\circ$  to the midrib, flat or sunken above, lines of interarching distinct or not, venation  $\pm$  trabeculate, usually distinct below; petiole 15–25 by 2–3 mm; leaf bud 10–15 by (1–)2 mm, hairs 0.1–0.3 mm. *Inflorescences* between the leaves or below, glabrescent, indumentum brown, short; of the *Knema*-type: a simple or bifurcate, scar-covered brachyblast, sessile or 1(–2) mm pedunculate; in male: to 10 mm long, 4–5 mm wide, with flowers in clusters of 5–10 (–15), buds unequal in size; in female shorter, simple or 2-forked, few-flowered; flowers with widely spaced hairs 0.1 mm. *Male flowers*: pedicel slender, (5–)6–8 by 0.6–0.7 mm, bracteole 1.5 mm, subsistent or caducous, (sub)apical; buds ellipsoid-oblong, 4–5 by 1.5–2 mm, apex subacute or obtuse, cleft 1/4–1/3, lobes (1–)1.5 mm long, 0.1–0.2 mm thick. Androecium slender, 3–3.5 mm long; androphore 1.5 by 0.5 mm, with hairs 0.1 mm or less in the lower half; synandrium (1.5–)2 by 0.6(–0.7) mm, thecae 12–18, usually contiguous, sterile apex  $\pm$  blunt, 0.2(–0.3) mm long. *Female flowers*: pedicel 3–5 mm, bracteole scar subapical; buds ovoid, 4.5 mm; ovary ovoid-oblong, hairs 0.2 mm. *Fruits* 1 or 2 (or 3) per infructescence, subsessile, subglobose, short pear-shaped,

ellipsoid, or  $\pm$  depressed-globose, 3–4 by (2.5–)3–4 cm, apex broadly rounded, base rounded or narrowed,  $\pm$  glabrescent, hairs mealy, greyish brown, 0.1–0.2 mm; pericarp 3–5(–8) mm thick; seeds broadly ovoid-ellipsoid or subglobose, 1.5–2(–2.5) cm, with conspicuous impressions left by the aril; fruiting pedicel rather stout or slender, 7–10 by 3–5 mm, bracteole scar subapical.

Field-notes — Bole straight, without or with buttresses up to 1.5 m high and out, 5–10 cm thick; buttresses and many adventitious roots protruding from c. 90 cm above the ground (once recorded). Branches horizontal. Bark (grey-)brown, or blackish, smooth or  $\pm$  longitudinally fissured, or slightly flaky, with lenticels; blaze (slash) purple, pink red, or yellow-brown; inner bark layered pinkish; exudate colourless turning red, sticky or watery. Wood pale, white or straw, turning reddish; no heartwood or heartwood darker. Midnerve yellow-green below. Flowers yellow, or yellow with brown dots, slightly fragrant. Fruits (orange-)brown or red-brown; aril slightly aromatic.

Distribution — *Malesia*: lowland areas of Papua Barat (Bird's Head, Jayapura) and Papua New Guinea (Madang, Morobe, Central, Northern, and Milne Bay Provinces).

Habitat & Ecology — Forest on flats and ridges, dry land forest; on (stony or sandy) clayey soil, also over limestone; 0–450(–700) m altitude; fl. & fr. throughout the year. In Bird's Head locally common.

Notes — 1. *Myristica sulcata* is recognized by its sulcate or angled twigs, especially the apical part, and the on drying conspicuously (dark) brown, seemingly glabrous leaves.

2. *Jacobs 9685* and *LAE 52028* (Morobe Prov.) are mutually similar; they deviate from *M. sulcata* by their faintly angled twigs and ellipsoid (not subglobose) fruits with broadly rounded apex and asymmetrically positioned stigma remnant. Possibly these specimens represent a separate form within *M. sulcata*. The fruits of these specimens have some reminiscence to those of the related *M. undulatifolia*.

3. *Myristica sulcata* may be confused with *M. crassipes* and *M. flosculosa*, two species generally with rather angular twigs and somewhat resembling leaves.

### 133. *Myristica sumbawana* Warb.

*Myristica sumbawana* Warb., Mon. Myrist. (1897) 383 (key), 529, t. 15, 'sumbavana'. — Type: *Warburg 16983* (B, lost); neotype: *Elbert 3809* (L, here designated), Sumbawa.

Tree 10–15 m. *Twigs* 2.5–5 mm diameter, early to late glabrescent, hairs 0.1–0.2 mm; older twigs rather pale and  $\pm$  contrasting with the dark petioles, lenticels distinct or not. *Leaves* chartaceous, elliptic-oblong or (oblong-)lanceolate, 19–38 by 5–12 cm, base rounded or attenuate, apex  $\pm$  acute-acuminate; upper surface dark olivaceous (greenish), lower surface golden(-brown) or greyish brown by interwoven stellate-dendroid hairs 0.1–0.2 mm; not papillose; dots absent; midrib above slightly raised, lateral nerves 20–25 per side, at 40–80° to the midrib, flat or sunken above, lines of interarching and venation faint or invisible; petiole 15–30 by 2.5–4.5 mm; leaf bud 10–20 by 2.5–5 mm, hairs 0.2–0.3 mm. *Inflorescences* between the leaves and below, of the *Knema*-type: without peduncle, single or paired, woody, scar-covered tubercle-like brachyblasts to 5 mm long,  $\pm$  with hairs 0.5 mm; bracts 1–1.5 mm, caducous; in male: with flowers in subumbels of 2–6, buds of various sizes; female similar, 1–3-flowered; flowers with conspicuous hairs 0.4–0.5 mm. *Male flowers*: pedicel to 0.3 mm only, bracteole 4.5 mm long, persistent or late caducous; buds ovoid-ellipsoid, 6 by (3.5–)4 mm, apex narrowly

rounded, cleft c. 1/3, lobes 0.3 mm thick. Androecium  $\pm$  slender, 4.5 mm; androphore 1–1.2 by 0.6 mm, with few pale hairs 0.2–0.3 mm towards the base; synandrium 3–3.2 by 1 mm, thecae 16–20, sterile apex blunt, 0.3 mm. *Female flowers*: sessile, bracteole broadly rounded, 3.5 mm; buds ovoid, 5 by 4 mm; ovary ovoid, 3 by 2.5 mm, pubescent. *Fruits* solitary or 2 per infructescence, subsessile, broadly ovoid or ellipsoid, 2.5–3.5 by 2.5 cm, apex narrowly or broadly rounded, often 1–2 mm beaked, hairs dense, yellow-brown or rusty, shaggy, (1–)1.5 mm; pericarp 2–4 mm thick; seeds (*Schmutz 4277*) ellipsoid, 2.5 cm, aril with laciniae up to 5 mm wide; fruiting pedicel 1–2 mm long.

Field-notes — Bark rough. Fruits brown.

Distribution — *Malesia*: Lesser Sunda Islands (Sumbawa, W Flores).

Habitat & Ecology — (Sub)montane forest, high monsoon forest, on andesit breccia; 250–800 m altitude (the lost type recorded from 1000–1300 m altitude in montane forest); fl. Dec.; fr. Oct.–Apr.

Note — *Myristica sumbawana* is related to *M. rumphii*, with which it has much of the overall habit in common including the sessile flowers and  $\pm$  small sessile fruits. *Myristica rumphii* differs from *M. sumbawana* in the shorter indumentum of the fruits (hairs 0.5 mm long only), glabrescent lower leaf surface, and the inconspicuous, slack hairs. The male flowers of *M. rumphii* are unknown, but possibly they are not very different from those of *M. sumbawana*. Both *M. rumphii* and *M. sumbawana* seem related to *M. fatua*, the latter differing in the persistent dense indumentum on the lower leaf surface, and the larger fruits and pedicellate flowers.

### 134. *Myristica tamrauensis* W.J. de Wilde

*Myristica tamrauensis* W.J. de Wilde, *Blumea* 40 (1995) 334. — Type: *van Royen & Sleumer 7587*, Irian Jaya, Bird's Head.

Tree 6 m. *Twigs* (sub)terete, 2–3 mm diameter, early glabrescent, hairs scale-like, less than 0.1 mm; older twigs sometimes fissured or transversely cracked; lenticels inconspicuous. *Leaves* membranous, brittle, (ellipsoid-)oblong, 15–23 by 6–9 cm, base (short) cuneate, apex acute(-acuminate); upper surface (olivaceous) or dark brown, lower surface grey-brown, glabrous (very early glabrescent); not papillose; dots just visible to the naked eye; midrib raised above, lateral nerves 15–20 per side, at 60–80° to the midrib, inconspicuous above, bright brown and contrasting in colour below, lines of interarching and venation faint; petiole (10–)15 by 3–3.5 mm; leaf bud 10–15 by 2–3 mm, hairs scale-like, 0.1 mm or less. *Inflorescences*, *male* and *female flowers* not seen. Infructescence (*van Royen & Sleumer 7587*) between the lower leaves, peduncle 3–5 mm. *Fruit* solitary, ovoid-ellipsoid, 4.5–5 by 3.5 cm, apex  $\pm$  pointed, hairs dense, mealy, rusty, 0.1 mm; seeds ellipsoid(-oblong), 2 cm; pericarp rather woody, 8(–10) mm thick; fruiting pedicel 4 mm long.

Field-notes — Low tree. Leaves greyish green, or silvery light green below. Fruits orange or light orange-brown.

Distribution — *Malesia*: W Papua Barat (endemic to the mountains of northern Bird's Head: Tamrau Range).

Habitat & Ecology — Oak forest; 500–800 m altitude; fr. Oct.–Nov.

Note — *Myristica tamrauensis* is a species within a group of related species with, e.g., *M. brassii*, *M. duplopunctata*, *M. millepunctata*, *M. neglecta*, and, more remotely,

*M. cucullata*, all characterized by leaves of medium or large size classes, with blackish dots on the lower leaf surface, and by fruits with a thick pericarp. *Myristica tamrauensis* is known only in fruit. Mature male flowers are known only from *M. brassii*, *M. duplo-punctata*, and *M. neglecta*. The present species has the marked, contrasting lateral nerves on the lower leaf surface in common with *M. brassii* (Central New Guinea), but that species has more coriaceous leaves and sessile inflorescences.

### 135. *Myristica teijsmannii* Miq.

*Myristica teijsmannii* Miq., Fl. Ind. Bat. 1, 2 (1858) 57, 'teysmanni'; Koord. & Valeton, Bijdr. Booms. Java 4 (1896) 180; Warb., Mon. Myrist. (1897) 516, t. 16; Koord., Exk. Fl. Java 2 (1912) 257; K. Heyne, Nutt. Pl. Ned. Indië (1927) 648; Backer & Bakh. f., Fl. Java 1 (1964) 139; J. Sinclair, Gard. Bull. Sing. 23 (1968) 430, f. 76; W.J. de Wilde, Blumea 42 (1997) 185. — Type: *Teijsmann s.n.*, Java.

*Myristica hyposticta* Miq., Fl. Ind. Bat. 1, 2 (1858) 55; Koord. & Valeton, Bijdr. Booms. Java 4 (1896) 178. — Type: *Horsfield s.n.*, Java.

Tree 10–20 m. Twigs 2–4(–5) mm diameter, somewhat angular, yellowish or orange brown, soon glabrescent, hairs 0.1 mm; older twigs longitudinally cracking, not flaking; lenticels sometimes present, small. *Leaves* membranous or thinly chartaceous, elliptic-oblong or oblong-lanceolate, 10–30(–34) by 2.5–9 cm, base narrowly rounded or cuneate, apex acute-acuminate; upper surface olivaceous brown, lower surface grey-brown, seemingly glabrous, but hairs scattered, scale-like, less than 0.1 mm; papillose; dots absent; midrib flat above, lateral nerves 14–19 per side, at 45(–60)° to the midrib, flat above, distinct below, lines of interarching and venation indistinct; petiole 10–20(–30) by 1.5–3 mm; leaf bud 8–12 by 2.5 mm, hairs dense, 0.2 mm. *Inflorescences* between the leaves, sometimes on short lateral shoots, short-pedunculate, unbranched, possibly of longer duration, glabrescent, hairs 0.1–0.2 mm; bracts 3–4 mm, caducous; in male: peduncle (1)5–15 mm, at apex with irregularly wart-like brachyblast (central axis usually absent) with a subumbel of (5)10–20 flowers, buds of various sizes; female smaller, peduncle to 3 mm, brachyblast to 10 mm long, few-flowered; flowers with hairs 0.2–0.3 mm. *Male flowers*: pedicel 4–6 mm long, bracteole broadly reniform, 4–6 mm, (sub)-persistent; buds carnose-coriaceous, ovoid-ellipsoid, 7–8 by 4–4.5 mm, apex narrowly rounded, cleft c. 1/3, lobes 0.4 mm thick. Androecium 5–5.5 mm; androphore 2 by 1 mm, with appressed hairs, less than 0.1 mm, in lower 3/4; synandrium (2)2.5 by 1–1.5 mm, thecae 16–24, sterile apex ± blunt, 0.3(–0.5) mm long. *Female flowers*: pedicel stout, 2 mm long; buds ovoid, 4–6(–9) by 4–5(–7) mm, cleft c. 1/3, lobes 0.4–0.5 mm thick; ovary ovoid, 2.5–3.5 by 2–2.5 mm, minutely pubescent. *Fruits* 1 (or 2) per infructescence, subsessile, subglobose or broadly ovoid, 3–4.5 cm diameter, hairs dense, dark rust-coloured, 0.1 mm or less; pericarp 4–8 mm thick; seeds short ellipsoid, 2.5–3 cm; fruiting pedicel 5 mm.

Field-notes — Trunk often with aerial roots or stilt-roots. Outer bark with a few flakes, but no ridges or furrows; living bark reddish brown, 0.7 cm thick; sap copious, red-brown. Flowers yellow brown. Fruits brown.

Distribution — *Malesia*: C & E Java.

Habitat & Ecology — A rare tree of mixed lowland and submontane forest; altitude 50–1000 m; fl. Oct.–May; fr. May–June.

Notes — 1. Close to *M. andamanica* Hook. f. (Andaman Islands) and *M. crassa*, with similar unbranched inflorescences; *M. andamanica* differs in its non-papillose lower leaf surface.

2. In the Teijsmann collections at BM, some (large-sized) female flowers are found mixed with male flowers in one inflorescence.

### 136. *Myristica tenuivenia* J. Sinclair

*Myristica tenuivenia* J. Sinclair, Gard. Bull. Sing. 23 (1968) 327, f. 46; Foreman, Handb. Fl. Papua New Guinea 1 (1978) 211; W.J. de Wilde, Blumea 40 (1995) 335. — Type: *Brass* 27658, Misima I.

Tree 10–30 m. *Twigs* (sub)terete or 2-lined, 2.5–3(–5) mm diameter, early glabrescent, hairs 0.1–0.2 mm; older twigs with few scattered small lenticels. *Leaves* membranous, chartaceous or subcoriaceous, obovate-elliptic or oblong, 8–17 by 3–7 cm, base short-attenuate or rounded, apex (short-)attenuate with blunt tip; upper surface olivaceous or (dark) brown, lower surface greyish cinnamon, indumentum persistent, hairs scale-like, 0.1 mm or less; not papillose; dots absent; midrib above flat or slightly raised, lateral nerves 16–23 per side, at 60–80° to the midrib, thin and sunken above, (hardly) raised below, lines of interarching and venation faint; petioles 16–22 by 2–3.5 mm; leaf bud 15–20 by 2.5 mm, hairs 0.1–0.3 mm. *Inflorescences* (known only from female flowers and infructescences) between the leaves and below, of the *Knema*-type: a sessile, simple or 2–3-forked, scar-covered, woody knob-like brachyblast, 1–3 mm diameter, with hairs 0.2–0.5 mm, with a fascicle of 4–10 flowers, buds of various sizes or almost equal in size. *Male flowers* not seen. *Female flowers*: with hairs 0.2–0.4 mm; pedicel 1–4 mm long, bracteole 1.5 mm long, caducous; buds hard-carnose, ovoid, 3–4 by 2.5–3 mm, lobes 1.5 mm long; ovary ovoid, 2 by 1.5 mm, hairs 0.5 mm or less. *Fruits* 1 or 2 per infructescence, broadly ellipsoid or (sub)globose, 3–4 cm long, hairs rusty, 0.2–0.5 mm, partly glabrescent; pericarp 4–8 mm thick, fleshy or woody, seeds ellipsoid, 1.5–2.5 cm; fruiting pedicel rather stout, 2–7 mm long.

Distribution — *Malesia*: Papua New Guinea (confined to the Papuan Islands). Provisionally with two subspecies.

#### KEY TO THE SUBSPECIES

- 1a. Twigs neither ridged nor lined, pericarp not woody . . . . . a. subsp. **tenuivenia**  
 b. Twigs ridged or 2-lined, pericarp granular-woody . . . . . b. subsp. **lignosa**

#### a. subsp. **tenuivenia**

Canopy tree. *Twigs* neither ridged nor lined. *Leaves* thinly chartaceous or membranous, lateral nerves 15–20 pairs, ± raised below. *Fruits* ellipsoid or subglobose, 3–4 cm diameter, hairs mealy or scurfy, 0.2–0.4 mm, partly glabrescent; pericarp not woody, 4–8 mm thick, apparently juicy and much shrunken on drying; fruiting pedicel 2–4 by 4 mm.

Field-notes — Leaves grey-brown or brownish below. Flowers yellow. Fruits brown pubescent, on the older wood.

Distribution — *Malesia*: Papua New Guinea: Louisiade Archipelago (Misima I., type, and Rossel I., *Brass* 28528).

Habitat & Ecology — Streambank forest; the type from quartz mountain; 10–150 m altitude; fl. Aug.; fr. Aug., Oct.

Note — In the description of *M. tenuivenia* Sinclair (l.c.: 329) suggested a relationship to *M. archboldiana*, *M. pedicellata*, and *M. smythiesii* (from Borneo) on account of the cinnamon or rusty scale-like hairs on the lower leaf surface, but possibly there only is a remote affinity with *M. pedicellata*.

#### b. subsp. *lignosa* W.J. de Wilde

*Myristica tenuivenia* J. Sinclair subsp. *lignosa* W.J. de Wilde, *Blumea* 40 (1995) 335. — Type: LAE 68655 (Croft *et al.*), Papua New Guinea, Fergusson I.

Tree up to 30 m. *Twigs* ridged or 2-lined. Leaves subcoriaceous, lateral nerves 20–28 pairs, faint on both surfaces. *Fruits* subglobose, (2.5–)3 cm diameter, hairs (0.2–)0.5 mm long, persistent; pericarp granular-woody, 5–7 mm thick, not shrunken on drying; fruiting pedicel 5–7 by 5 mm.

Field-notes — Bole 20 m, dbh 35 cm. Bark red-brown or black, fissured and pustular; inner bark red; exudate little, red; wood straw, pink when exposed. Leaves glossy dark green above, dull mid-green below with rust-brown bloom, or rusty-grey. Flowers and fruits rust-brown.

Distribution — *Malesia*: Papua New Guinea (S Fergusson I., type, and Rossel I., LAE 74561, with immature fr.).

Habitat & Ecology — Hill forest; c. 700 m altitude; fl. (female) & fr. Mar.

Note — The two specimens known of subsp. *lignosa* considerably deviate from those of the type subspecies. When more material becomes available it may be found that two separate species are concerned here.

#### 137. *Myristica trianthera* W.J. de Wilde

*Myristica trianthera* W.J. de Wilde, *Blumea* 40 (1995) 335. — Type: BW 39 (Versteegh 58), Irian Jaya, Jayapura area.

Treelet 10–13 m. *Twigs* 1 mm diameter, early glabrescent, hairs setose, 0.5–1 mm long; older twigs ± smooth; lenticels not apparent. *Leaves* membranous, ovate-elliptic or elliptic-oblong, 6–12.5 by 2–5 cm, base ± rounded or attenuate, apex acute-acuminate; upper surface grey-green or brown, lower surface greyish brown, early glabrescent or few rather long widely scattered hairs left; not papillose; dots absent; midrib flat or somewhat raised above, lateral nerves 7–10 per side, at 50–80° to the midrib, flat and faint above, rather faint below, lines of interarching and venation indistinct; petiole 6–10 by 1 mm; leaf bud 6–8 by 1 mm, hairs (0.5–)1 mm long. *Inflorescences* between the leaves or below, paniculate; in male: peduncle 5–20 by 0.5–0.8 mm, ending in a simple or forked, densely scar-covered, ± pubescent brachyblast to 9 mm long, with cluster(s) of 2–5 flowers, buds of various sizes; in female (from infructescence): peduncle 9 mm, one- or few-flowered, unbranched; flowers with shaggy hairs (0.3–)0.5 mm. *Male flowers*: pedicel slender, 3 mm long, bracteole ± ovate, 1(–1.5) mm, persistent, (sub)apical; perianth membranous, inside not warty; buds ellipsoid-oblong, 4–4.2 by 1.5–1.8 mm,



apex and base subacute to obtuse, cleft 1/5–1/4, lobes 0.7–1 mm. Androecium slender, 3.8 mm long; androphore 4 by 0.4 mm, with appressed hairs 0.4 mm long; synandrium 1.8 by 0.5 mm, thecae 6, not closely appressed, sterile apex 0.1 mm. *Female flowers* not seen. Inflorescence simple, peduncle slender, 8–10 mm long, proceeding into a 12–14 mm long pedicel of a single fruit. *Fruits* ± ellipsoid, 2–2.5 by 1–1.3 cm, apex short-apiculate, base contracted into pseudostalk up to 5 mm; hairs dull brown, scurfy, less than 0.1 mm, at apex and base longer and shaggy; pericarp thin, 1 mm thick; seeds ellipsoid, 1.5 cm; fruiting pedicel slender, 14 mm long, bracteole scar 3–4 mm below the apex.

Field-notes — Flower buds green.

Distribution — *Malesia*: NE Papua Barat (endemic to the Jayapura area).

Habitat & Ecology — Lowland riverside or temporarily inundated forest, clayey soil; scattered; 2–50 m altitude; fl. July, Oct.; fr. July.

Note — Resembles *M. fugax* but *M. trianthera* is distinguishable by its pilose leaf bud, smaller flowers and fruits; the synandrium has only 3 anthers, 4–6 in *M. fugax*.

### 138. *Myristica tristis* Warb.

*Myristica tristis* Warb., Mon. Myrist. (1897) 444, t. 19. — Syntypes: *Beccari* 96 (FI acc. nos. 7657, lecto, here designated; 7657a), Bird's Head, Sorong.

For more references see under the subspecies.

Tree (3–)12–30 m. *Twigs* somewhat angular (sometimes with faint ridges between insertions of petioles), 1–2 mm diameter, reddish or yellowish brown, early glabrescent, hairs fine-woolly, (0.1–)0.2 mm; older twigs (faintly) cracking, sometimes flaking; lenticels inconspicuous. *Leaves* membranous or thinly chartaceous, elliptic-oblong or oblong-lanceolate, 8–16 by 2–6 cm, base cuneate, apex acute-acuminate, the tip sometimes ± blunt; upper surface olivaceous or (blackish) brown, lower surface (grey-)brown, early glabrescent, hairs scattered, scale-like, 0.1 mm; not papillose; dots absent; midrib above raised or ± flat, lateral nerves 10–15(–17) per side, at 45–60° to the midrib, flat or sunken (and faint) above, little raised below, lines of interarching and venation indistinct; petiole comparatively long, 12–20 by 1–1.5 mm; leaf bud 6–12 by 1–2 mm, hairs 0.1 mm or less. *Inflorescences* between the leaves and below, of the *Knema*-type: sessile simple or forked brachyblasts, 2–4 mm long, with hairs 0.2 mm; bracts minute; in male: with one or two subumbels of 3–6(–12) flowers, buds of various sizes or almost equal in size; female similar to male, (1–)2–4(–10)-flowered; flowers with hairs 0.1–0.2 mm or less. *Male flowers*: pedicel (4–)6–7 by 0.5 mm, bracteole persistent, ovate, 1–1.5 mm; buds ovoid(-ellipsoid) or ovoid-oblong, (4–)5–6 by 2.5–3 mm, apex ± acute, cleft (1/5–)1/4, lobes 0.2 mm thick. Androecium 3–5.5 mm long; androphore 1–2 by (0.3–)0.4–0.6 mm, with hairs 0.1–0.3 mm in the lower half; synandrium 2–3.5 by 0.6–0.8 mm, apex blunt or acutish, thecae (8–)10–14, sterile apex 0.1 mm. *Female flowers*: pedicel 3–4.5 by 0.7–1 mm, bracteole rounded, 1 mm, caducous, (sub)apical; buds ovoid(-oblong), 4(–4.5) by 2.5–3 mm, apex ± blunt, lobes 1.5–1.7 mm long; ovary ovoid, including short stigma 3–4 by 2.2–2.5 mm, hairs 0.1–0.2 mm. *Fruits* solitary or 2 (or 3) per inflorescence, (broadly) ellipsoid to globose, 2–3.5 by 1.5–3 cm, apex broadly rounded or subacute, hairs brown, scurfy, 0.1–0.2 mm or less, partially (late) glabrescent; pericarp 3–8 mm thick; seeds broad-ellipsoid, 2 cm, blackish, deeply broadly grooved by impression of the aril; fruiting pedicel usually slender, 2–5 mm long.

Field-notes — Trunk incidentally with buttresses to 1 by 1 m, or with buttresses as well as prop-roots. Bark strongly fissured or strongly flaking, flakes 0.5 by 1 cm; outer bark brown, 1 mm thick; inner bark 6–7 mm thick, pale red; exudate little or much, pale red, watery; sapwood cream or light brown, tinged red, the transition to the slightly darker heartwood gradual. Flowers cream. Fruits yellowish, seeds greyish black.

Distribution — *Malesia*: Moluccas, throughout New Guinea; rare in eastern Papua New Guinea, where it is largely replaced by the resembling *M. globosa*. There are five subspecies.

Habitat & Ecology — Locally common as a solitary tree in lowland and submontane forest; forest on limestone, (sandy-)clayey soil over limestone; 0–600 m altitude; fl. May; fr. May–Nov.

Notes — 1. Related to *M. globosa*, but *M. tristis* is distinguishable and chiefly characterized by slender twigs, membranous leaves drying frequently dark brown or blackish above, faint venation on the pale brownish lower leaf surface (generally in *M. globosa* the lower leaf surface much paler, with contrasting venation), persistent bracteole in the male flowers (seen in the few male-flowering collections available), generally almost globose fruits with minute scurfy hairs 0.1 mm or less, and thick pericarp, 3–8 mm thick. *Myristica tristis* also resembles the variable *M. lancifolia* (incl. *M. montana* as a subspecies), a species with thicker and differently shaped leaves, a different venation and papillose lower surface, more cylindric (not ovoid-oblong) male buds, and rather small ellipsoid fruits. For differences with the resembling *M. lepidota* subsp. *montanoides*, see there. Also similar is *M. cumingii* (Philippines) which differs in its male buds, cleft to nearly halfway, and its larger fruits.

2. *Myristica tristis* is highly polymorphic with a vast distributional area. Variation abounds in distinctness of the lateral nerves on the lower leaf surface, the midrib above either raised or flat, and especially in size and shape of the fruits, and thickness of the pericarp. Most variation, especially in the fruits, is correlated with the geography. Male flowering specimens still have been insufficiently collected.

#### KEY TO THE SUBSPECIES

- 1a. Fruits globose, 3 cm diameter; pericarp 5–8 mm thick. — N Moluccas . . . . . **d. subsp. moluccana**
- b. Fruit globose, less than 2.5 cm diameter, or (broadly) ellipsoid; pericarp 5 mm thick or less . . . . . 2
- 2a. Fruits ellipsoid, 3.5 cm long; fruiting pedicel 2 by 2 mm. — N Moluccas, Bacan . . . . . **e. subsp. sessilifructa**
- b. Fruits subglobose or broadly ellipsoid, 1.8–2.3(–2.5) cm long; fruiting pedicel 3–5 mm . . . . . 3
- 3a. Fruits 2 cm long; pericarp (2–)3 mm thick. Lateral nerves on lower leaf surface not much raised but usually distinct; [midrib flat or raised above.] — W and E New Guinea main island (incl. Bird's Head and islands in the Geelvink Baai) . . . . . **a. subsp. tristis**
- b. Fruits slightly larger (longer), 2.3(–2.5) cm long; pericarp (2–)3–5 mm thick. Lateral nerves on lower leaf surface faint . . . . . 4

- 4a. Leaves glossy on drying at both surfaces; midrib raised above. Fruits brightly rusty pubescent. Older twigs blackish, strongly finely flaking. — Central southern New Guinea ..... **b. subsp. ingambitense**
- b. Leaves rather dull on drying; midrib  $\pm$  flat or but slightly raised above. Fruits chocolate or dull brown pubescent. Older twigs grey-brown, striate or slightly cracked, but not flaky. — Louisiade Archipelago ..... **c. subsp. lousiadensis**

**a. subsp. tristis**

*Myristica tristis* Warb., Mon. Myrist. (1897) 444, t. 19. — *Myristica globosa* auct. non. Warb.: J. Sinclair, Gard. Bull. Sing. 23 (1968) 378, f. 63, p.p., for most of the material from the Moluccas, Papua Barat (Bird's Head), and Mios Noem I., incl. f. 63A–C; W.J. de Wilde, Blumea 35 (1990) 258, f. 2 (16); 40 (1995) 336; 42 (1997) 186.

Older twigs grey-brown, striate or longitudinally cracked or but faintly flaky. Midrib flat or raised above. Lateral nerves on lower leaf surface usually clearly visible; venation usually faint or absent. *Male* and *female flowers* as the species. *Fruits* globose or broadly ellipsoid, 1.8–2.2 cm long, hairs dull grey-brown; pericarp (2–)3(–4) mm thick. — **Fig. 61f, 65g.**

Distribution — *Malesia*: throughout New Guinea, including Bird's Head, and islands in the Geelvink Baai; 0–400 m altitude.

**b. subsp. ingambitense** W.J. de Wilde

*Myristica tristis* Warb. subsp. *ingambitense* W.J. de Wilde, Blumea 40 (1995) 336; 42 (1997) 186. — Type: NGF 31816 (*Henty, Ridsdale & Galore*), Papua New Guinea.

Older twigs dark brown, strongly finely flaking. *Leaves* membranous, brown, glossy above; midrib above narrow, raised; lateral nerves flat, narrow, faint on both surfaces, venation almost invisible. *Male* and *female flowers* not seen. *Fruits* solitary or paired, subglobose or broadly ellipsoid, 2.5 cm long, hairs bright rust-coloured; pericarp (2–)3 mm thick.

Field-notes — Small tree about 7 m tall. Bark brown, smooth, aromatic; wood white; exudate red. Fruit with brown indumentum.

Distribution — *Malesia*: New Guinea (SE Papua Barat; SW Papua New Guinea: Western Prov., in the area of Ingambit village).

Habitat & Ecology — Regrowth forest; c. 150 m altitude; fr. June.

**c. subsp. lousiadensis** W.J. de Wilde

*Myristica tristis* Warb. subsp. *lousiadensis* W.J. de Wilde, Blumea 40 (1995) 337; 42 (1997) 186. — Type: LAE 74537 (*Damas & Katik*), Tagula I.

Older twigs dark brown, longitudinally plicate (striate) or fissured, but not flaky. *Leaves* thickly membranous, olivaceous, rather many-nerved but the lateral nerves faint on both surfaces, venation faint; midrib flattish above. *Male* and *female flowers* not seen. *Fruits* solitary, subglobose, 2.5 cm diameter, hairs dull brown, minute; pericarp 4–5 mm thick.

Field-notes — Tree 8–25 m, of subcanopy layer. Bark black, rough outside; inner bark red; wood white with red tinge. Leaves pale green below. Fruit yellow, seed dark brown with strong nutmeg flavour.

Distribution — *Malesia*: Papua New Guinea (Louisiade Archipelago: Tagula I.; possibly Rossel I.).

Habitat & Ecology — Lowland hilly forest subcanopy layer; (50–)100–450 m altitude; fr. Mar., Aug., Oct.

Note — *Brass* 28302 (Rossel I.) vegetatively agrees with the type, but the fruits deviate by a more ellipsoid shape and thinner pericarp.

**d. subsp. *moluccana* W.J. de Wilde**

*Myristica tristis* Warb. subsp. *moluccana* W.J. de Wilde, *Blumea* 42 (1997) 186. — Type: *de Vogel* 4058, Moluccas.

Older *twigs* grey-brown, striate or slightly cracked, but not flaky. Midrib raised above. Lateral nerves on lower leaf surface weak, but clearly visible; venation faint. *Male* and *female flowers* not seen. *Fruits* globose, 3 cm diameter, hairs sparse, greyish; pericarp 5–8 mm thick.

Distribution — *Malesia*: N Moluccas (Obi, Morotai, E Seram); up to 600 m altitude.

**e. subsp. *sessilifruca* W.J. de Wilde**

*Myristica tristis* Warb. subsp. *sessilifruca* W.J. de Wilde, *Blumea* 42 (1997) 186. — Type: *de Vogel* 3858, Moluccas.

Older *twigs* finely striate, not flaking, light brown. *Leaves* membranous, dark (blackish) brown, lateral nerves 10–14 per side, thin and faint, venation faint; midrib ± raised above. *Male* and *female flowers* not seen. *Fruits* solitary, subsessile, axillary to the (lower) leaves, ellipsoid, 3.5 by 1.7 cm, hairs dull brown, 0.1 mm or less; pericarp 2(–3) mm thick.

Field-notes — Solitary tree 12 m, with few small buttresses 50 cm out, clear bole 6 m, dbh 18 cm. Outer bark 0.3 mm thick, dark grey, rather fissured, not peeling off; inner bark 4 mm thick, on section reddish; exudate little, red-brown, watery; sapwood pale yellowish, tinged reddish, gradually passing into the slightly darker heartwood.

Distribution — *Malesia*: N Moluccas (Bacan).

Habitat & Ecology — Tall forest with little undergrowth on sloping hill ridge; soil loamy with stones, with little humus; 100 m altitude; fr. Nov.

Note — The true status of this subspecies is unclear yet (see De Wilde, l.c.).

**139. *Myristica tubiflora* Blume**

*Myristica tubiflora* Blume, *Rumphia* 1 (1837) 182, t. 56; Warb., *Mon. Myrist.* (1897) 436; Pulle, *Nova Guinea* 8 (1912) 636; Markgr., *Bot. Jahrb. Syst.* 67 (1935) 162, p.p.; J. Sinclair, *Gard. Bull. Sing.* 23 (1968) 339, f. 51, p.p. (mixed with *Hoogland* 3971 = *Myristica pumila*); Foreman, *Handb. Fl. Papua New Guinea* 1 (1978) 212, p.p.; W.J. de Wilde, *Blumea* 40 (1995) 337, f. 8. — Type: *Zippelius s.n.*, Irian Jaya, Bird's Head.

Tree 3–24 m. *Twigs* subterete or ± angular, yellowish brown, (0.5–)1–1.5 mm diameter, early glabrescent, hairs less than 0.1 mm; older twigs cracking and flaking; lenticels small, dense on younger twigs, indistinct or absent on the older twigs. *Leaves* membranous or thinly coriaceous, (elliptic-)oblong, 5–14(–16) by 1.5–5.5(–7.5) cm, base at-



tenuate or rarely  $\pm$  rounded, apex acute-acuminate, with  $\pm$  blunt or acute tip; upper surface olivaceous, lower surface pale brown, glabrous; not papillose; dots absent; midrib raised above, lateral nerves 8–13 per side, at 60–70° to the midrib, flat or sunken above, far apart, lines of interarching and venation indistinct; petiole 10–18 by 0.8–1.5 mm; leaf bud conspicuously slender, 5–12 by 0.5–1 mm, hairs less than 0.1 mm. *Inflorescences* between the older leaves or below, of the *Knema*-type: a simple sessile scar-covered brachyblast up to 4 mm long, glabrescent; bracts minute; in male: 1–3(–4)-flowered, buds of slightly variable sizes; in female minute, sessile, 1- (or 2-)flowered; flowers glabrous (or with few scattered appressed hairs less than 0.1 mm). *Male flowers*: pedicel 8–11.5 mm, bracteole ovate-oblong, 1–2 mm, persistent or late caducous, 1–3.5 mm below the apex; buds membranous, oblong-lanceolate, 8.5–11 by 2–3 mm, apex subacute or narrowly rounded,  $\pm$  triangular, base short-attenuate, cleft 1/6–1/8, lobes (1–)1.5(–2) mm long, c. 0.2 mm thick. Androecium slender, 6–8 mm; androphore 2.5–4 by 0.8–1(–1.5) mm, glabrous; synandrium 4–6 by 0.8–1.5 mm, thecae c. 15, sterile apex  $\pm$  acute or lobulate, 0.2–0.3(–0.4) mm long. *Female flowers* (BW 1503): pedicel 2–4 mm long, bracteole  $\pm$  ovate, 1 mm, persistent, 1 mm below the apex; buds ovoid-oblong, apex narrowed, faintly triangular, 6 by 3–3.5 mm, lobes 1.5–2 mm long; ovary ovoid-oblong, 4 mm long, hairs less than 0.1 mm. *Fruits* solitary, oblong, 4.5–6 by 2–2.5 cm, apex  $\pm$  acute, often somewhat oblique, base narrowed into a 1–1.5 cm long pseudostalk, glabrous or glabrescent, hairs (grey-)brown, powdery, 0.1 mm; pericarp bright brown, 2–3 mm thick; seeds ellipsoid-oblong, 3 cm; fruiting pedicel slender, 2–7 mm long, bracteole scar 1–3 mm below the apex. — **Fig. 90.**

*Field-notes* — Understorey tree, dbh to c. 40 cm; branches horizontal, twigs pendulous, spreading; crown dense; without or with small buttresses, up to 30 cm out. Bark dark brown or dark grey-black, strongly flaking; exudate red gum; wood salmon-pink or straw. Flower buds yellow. Fruits green, yellow or pale brown.

*Distribution* — *Malesia*: mainly western half of New Guinea (Papua Barat and SW Papua New Guinea; Western Prov.).

*Habitat & Ecology* — Coastal plain forest, riverine (seasonally inundated) swamp forest, forest on coral limestone; mostly on (sandy) clay soil over limestone; 0–100 (–250) m altitude; fl. throughout the year; fr. mostly July, Aug. Locally common, scattered or a few trees together.

*Note* — *Myristica tubiflora* is a lowland species, characterized by leaves of a small size class, sessile inflorescences, elongate male flowers with long pedicels, with the (sub)persistent bracteole usually at some distance below the perianth (in most *Myristica* species the bracteole is apical) and elongate fruits. Sterile specimens and those with immature fruits may resemble *M. lepidota* subsp. *montanoides*, and some, now treated under *M. tubiflora*, may belong to that taxon or vice versa. This may partly account for the remarkable variation in leaf texture admitted for *M. tubiflora*: the majority of the

Fig. 90. *Myristica tubiflora* Blume. a. Leafy twig with male inflorescences; b. male bud (just before anthesis) opened, showing androecium; c. leafy twig with one-flowered female inflorescences and one developing fruit; d. female bud just before anthesis; note persistent bracteole; e. leafy twig with infructescence with a single fruit [a, b: *Atasrip* 709; c, d: *BW* 1503 (*Schram*); e: *LAE* 51919 (*Streimann et al.*)]. — Scale bar a, c, e = 2 cm; for b, d = 1.65 mm.

specimens have subcoriaceous leaves, but some have brittle membranous leaves, with a more distinct venation, reminiscent of the leaves of *M. lepidota* subsp. *montanoides*. The latter subspecies, however, is distinguishable by its small flowers and fruits.

#### 140. *Myristica ultrabasica* W.J. de Wilde

*Myristica ultrabasica* W.J. de Wilde, Blumea 42 (1997) 187. — Type: *van Balgooy 4064*, C Sulawesi.

Tree 20–30 m. *Twigs* 1–2 mm diameter, early glabrescent, hairs 0.1 mm or less; older twigs coarsely striate; lenticels inconspicuous. *Leaves* thinly coriaceous, elliptic-oblong or oblong(-lanceolate), (2.5–)4–7.5 by (0.8–)1–2 cm, base attenuate, apex subacute or blunt, sometimes narrowly rounded; upper surface olivaceous or blackish brown, lower surface greyish or reddish brown, glabrous; not papillose; dots absent; midrib above  $\pm$  flat, lateral nerves 10–15 per side, at c. 45° to the midrib, rather closely set, thin, hardly visible on both sides, lines of interarching and venation invisible; petiole 4–9 by 1 mm; leaf bud 3–6 by 1 mm, hairs 0.1 mm or less. *Female inflorescences* (from infructescences): between the leaves and below, of the *Knema*-type: a sessile short wart-like 1 mm long short-shoot, few-flowered, short-pubescent. *Male inflorescences*, *male* and *female flowers* not known. *Fruits* solitary, (ovoid-)ellipsoid, 2–2.5 by 1.5–1.9 cm, apex sometimes 1 mm beaked, base narrowly or broadly rounded, hairs persistent, dense, dull or bright rusty, scurfy, 0.1 mm or less; pericarp 1–2 mm thick; seeds 1.7 cm, ellipsoid; fruiting pedicel 1.5–3 mm long.

Field-notes — Crown small, restricted to apical 5 m. Bark purple-grey with fine longitudinal cracks; sap red. Fruits orange or brown.

Distribution — *Malesia*: C Sulawesi.

Habitat & Ecology — Forest on ultrabasic (nickel), shales; 400–750 m altitude; fr. June–Aug.

Note — The small, thinly coriaceous leaves with faint nerves are quite typical. *Myristica ultrabasica* (known only in fruit) is similar to *M. lancifolia* which differs in its papillose lower leaf surface; it is also similar to *M. bifurcata* subsp. *sulaica* (with larger leaves and fruits) and *M. tristis* (with larger, thinner leaves and much larger subglobose fruits).

#### 141. *Myristica umbellata* Elmer

*Myristica umbellata* Elmer, Leafl. Philipp. Bot. 5 (1913) 1816; Merr., Enum. Philipp. Flow. Pl. 2 (1923) 180; J. Sinclair, Gard. Bull. Sing. 23 (1968) 174, f. 10; W.J. de Wilde, Blumea 42 (1997) 188. — Syntypes: *Elmer 12820* (male), *13166* (fr.), Philippines, Palawan.

Tree 10–15 m. *Twigs* slightly angular, 1–2 mm diameter, early glabrescent, hairs less than 0.1 mm; older twigs coarsely striate and longitudinally cracking; lenticels absent. *Leaves* (membranous or) chartaceous, (elliptic-)oblong, 6–19 by 2–6 cm, base  $\pm$  narrowly rounded or (acute-)attenuate, apex (sub)obtuse or (sub)acute; the upper surface olivaceous; lower surface dull (purplish) grey-green, glabrous; obviously papillose; dots absent; midrib flat or above slightly raised, lateral nerves 10–14 per side, at 45–60° to the midrib, flat and indistinct above, indistinct below, lines of interarching and venation indistinct or absent; petiole 9–20 by 1–2 mm; leaf bud 7 by 1–1.5 mm, hairs 0.1 mm or less. *Inflorescences* between the leaves or below, pedunculate, unbranched or nearly so,

early glabrescent, indumentum minute; bracts 0.2 mm, caducous; in male: peduncle slender, 4–10(–20) by 1 mm, with a subumbel of 6–15 flowers, buds nearly equal in size; in female: peduncle (0–)2–4 mm long, 2–5-flowered; flowers with (scattered) pale grey-brown appressed hairs less than 0.1 mm long. *Male flowers*: pedicel slender, 7–10 mm, bracteole 1 mm long, early caducous; buds narrowly ovoid, 5–5.5 by 3–3.5 mm, apex narrowly rounded, cleft 1/4(–1/3), lobes 0.2 mm thick. Androecium slender, 4.5–5 mm; androphore slightly broadened towards the base, 2–2.5 by 0.5–0.7 mm, hairs sparse, pale brown, less than 0.1 mm; synandrium 2–3 by 0.5–0.6 mm, subacute, thecae 14–16 (10 anthers according to Sinclair, l.c.),  $\pm$  contiguous, sterile apex 0.1–0.3 mm. *Female flowers* (Ridsdale SMHI 89): pedicel (6–)10–13 mm long, bracteole caducous, 3–10 mm below the apex; buds ovoid-oblong, narrowed towards the apex, 5–7 by 4–5 mm, cleft c. 1/4, lobes 0.2–0.3 mm thick; ovary ovoid, 3 by 2.5 mm, hairs 0.1 mm or less, pistil 5 mm long, including the 2 mm long stigma. *Fruits* 1(–3) per infructescence, nearly sessile,  $\pm$  ellipsoid, 3.5–4(–5) by 2(–3) cm, minutely pubescent, glabrescent; pericarp 3(–5) mm thick, seeds not seen; fruiting pedicel slender, 8–20 mm long, bracteole scar well below the apex. — **Fig. 60c.**

**Field-notes** — Medium-sized tree with spreading branches, the ultimate numerous, lax, and slender, or tree with high spherical crown. Bark smooth and scaling in thin flakes, or fissured, greyish or blackish brown; inner bark reddish brown, with exudate. Fruits (somewhat immature) ovoid, 5 cm long, yellowish green.

**Distribution** — *Malesia*: Philippines (endemic to Palawan: Mt Pulgar and vicinity).

**Habitat & Ecology** — Low canopy lowland and montane rain forest (with *Agathis dammara*), also on limestone and ultrabasic alluvial deposits; 50–800 m altitude; fl. Mar.; fr. Apr., May.

**Note** — *Myristica umbellata* is similar to certain forms of *M. iners*, a polymorphous species. It differs from *M. iners* in small umbellate inflorescences (the umbel consists of two opposite closely set clusters of flowers; only occasionally the middle branch is slightly developed, 1–2 mm long), in slender pedicels, subglabrous perianth, early fallen bracteole, and subglabrous androphore, and vegetatively in the slender branches with small leaves papillose below (not papillose in *M. iners*), with indistinct nerves, and almost invisible venation. The female flowers are much larger than the male, with the bracteole scar far below the perianth.

#### 142. *Myristica umbrosa* J. Sinclair

*Myristica umbrosa* J. Sinclair, Gard. Bull. Sing. 23 (1968) 147, f. 4; Foreman, Contr. Herb. Austral. no. 9 (1974) 42; Handb. Fl. Papua New Guinea 1 (1978) 212; W.J. de Wilde, Blumea 40 (1995) 337. — Type: Carr 16410, Papua New Guinea.

Tree 5–26 m. *Twigs* 3–4(–5) mm diameter, (early) glabrescent, hairs 0.5(–1) mm; older twigs brown or blackish, often longitudinally cracking; lenticels frequently small but distinct. *Leaves* (thinly) coriaceous, elliptic-oblong or oblong(–lanceolate), 20–50 by 7–15 cm, base short-cuneate or rounded, apex acute-acuminate; upper surface olivaceous or brown, lower surface whitish or greyish, glabrescent, hairs thin, scale-like, less than 0.1 mm; not papillose; dots absent; midrib slightly raised above, lateral nerves 16–20(–22) per side, at 60–80° to the midrib, flat above, brown and contrasting in colour below, lines of interarching and venation indistinct; petiole 15–25(–30) by 3–6 mm; leaf



bud 15–20(–30) by 3–4(–5) mm, hairs 0.3–0.5(–0.6) mm. *Inflorescences* pedunculate, late glabrescent, between the lower leaves or just below, sometimes axillary to cataphylls on 1–3 cm long short-shoots (with apical sterile buds) on older wood; in male: peduncle 10–15 by 3–3.5 mm, striate, ending in a subumbel (composed of two adjacent sessile partial subumbels) of 4–6 flowers, buds nearly equal in size; bracts caducous; in female: peduncle 5–6 mm long, 1–3-flowered; flowers thinly coriaceous, with hairs 0.5 mm long. *Male flowers*: pedicel 8–10 by 1.5(–2) mm, bracteole caducous; buds (immature) ovoid-ellipsoid, 7(–8) by 5 mm, rounded at both ends, cleft nearly 1/2, lobes 3(–4) mm long, 0.5 mm thick. Androecium 4.5 mm; androphore 0.5(–1) by 1 mm, glabrous, with a ring of densely set pale hairs 0.2 mm at base (see also note 1); synandrium 4 by 2 mm, thecae c. 30, sterile apex broadly convex, 0.5 mm. *Female flowers*: see note 1. *Fruits*: peduncle short, fruits solitary or 2 or 3 together, ellipsoid, 5–7 by (3–)4–4.5 cm, apex rounded or subacute, hairs rusty, mealy, (0.3–)0.6–1 mm; pericarp 5–10 mm thick; seeds ellipsoid, 3–3.5 cm; fruiting pedicel 5 mm long,  $\pm$  pubescent.

*Field-notes* — Low or medium-sized tree, branches horizontal, crown open, stilt-roots (once recorded). Bark grey-brown or black, smooth or with longitudinal fissures; inner bark (blaze) brown-orange; exudate red, watery; wood reddish straw. Leaves (dull or) glossy dark green above, (silver-)grey-green or whitish below. Flowers yellowish brown. Fruits reddish brown or brown pubescent, with flesh-coloured mesocarp, seeds black.

*Distribution* — *Malesia*: Papua New Guinea (Morobe and Northern Prov.), a local endemic.

*Habitat & Ecology* — Dryland tall lowland forest, swamp forest, hillside slope with microphyllous vegetation, lowland ridge forest, mangrove-rain forest transition; altitude 0–400 m; fl. Jan., Oct.; fr. throughout the year.

*Notes* — 1. Foreman (1974) described the male flowers as follows: “pedicels 9–10 mm long; bracteole large, surrounding one side of the perianth, 8 mm long, caducous, mid-brown tomentulose; buds mid-brown tomentulose,  $\pm$  subglobose, 10–11 mm long; 3 acute perianth lobes about half as long as perianth; staminal column 6 mm long; stalk 2.5 by 3 mm long, brown tomentose”; and the female flowers as “pedicels 4 mm long; perianth 8 mm long; ovary mid-brown tomentulose, c. 6 mm long.” I have not seen such mature well-developed male flowers. The measure of the stalk of the staminal column seems unexpectedly stout. Foreman (1978: 212) described the peduncle of the male inflorescences as 3.5 cm long, which possibly rests on a mistake; the peduncle actually reaches 10–15 mm, as also stated by him in his 1974 publication.

2. LAE 59184 (Manus I., low altitude) distributed under the name *M. cf. umbrosa* or perhaps *sp. nov.*, comes close to *M. umbrosa* but it differs in general aspect: more slender twigs, thinner and smaller leaves; fruits about identical with those of *M. umbrosa*. Because the collection from Manus I. is so far from the other collections of *M. umbrosa*, all from a restricted area in SE Papua New Guinea, it may represent an undescribed species, but more collections should corroborate this.

### 143. *Myristica uncinata* J. Sinclair

*Myristica uncinata* J. Sinclair, Gard. Bull. Sing. 23 (1968) 150, f. 5; Foreman, Handb. Fl. Papua New Guinea 1 (1978) 212, f. 92; W.J. de Wilde, Blumea 40 (1995) 337. — Type: Carr 14907, Papua New Guinea.

Tree 18–30 m. *Twigs* 2.5–4(–5) mm diameter, late glabrescent, hairs conspicuous, chocolate, flossy, 1–1.5 mm long; older twigs blackish, coarsely striate; lenticels small, scattered. *Leaves* thinly chartaceous, oblong(-lanceolate), 17–27(–30) by 5–9(–10.5) cm, base cuneate, apex acute-acuminate; upper surface olivaceous-brown, lower surface pale brownish grey, ± glabrescent, hairs scattered, appressed, usually some light brown flossy hairs, 0.5–1(–2) mm, persistent on and near the midrib towards the base; not papillose; dots absent (but see note 2); midrib flat or raised above, lateral nerves 14–18 per side, at 45–70° to the midrib, flat, lines of interarching and venation inconspicuous; petiole 15–20 by 2.5–4 mm; leaf bud 15–20 by 3–4 mm, curved (uncinate), hairs 1(–1.5) mm long. *Inflorescences* between the leaves or below; male unknown; in female: peduncle 10–12 mm long, with at the end 1–3 flowers, with bright red-brown flossy hairs 1 mm. *Male flowers* not known. *Female flowers*: see note 1. Infructescences below the leaves: peduncle 10–20 by 4(–5) mm, with at the end 1 or 2 scars of fallen flowers, and mostly with a single fruit. *Fruits* broadly ovoid-subglobose, 6–7 by (4–)5.5 cm, the very apex ± narrowed, often ± hooked, hairs dark brown, 1–1.5 mm; pericarp 10 mm thick; seeds ovoid, 3.5 cm long; fruiting pedicel 10 by 4 mm, bracteole scar invisible or subapical.

*Field-notes* — Medium-sized tree without buttresses. Bark dark brown, finely fissured, ± rough; inner bark red-brown; sap reddish; wood whitish but staining reddish brown. Leaves dark glossy green above, ± white below. Flowers solitary, brown or cream outside, cream inside. Fruits solitary, ± globose, tip uncinat, covered with red-brown hairs.

*Distribution* — *Malesia*: Papua New Guinea (a local endemic of the region of Boridi, Central Prov.).

*Habitat & Ecology* — Lower montane forest, ridge forest; *Terminalia*–*Sloanea* forest; 1300–1400 m altitude; fl. & fr. Sept.–Nov.

*Notes* — 1. Female flowers are known from the descriptions of previous authors only, but it is suspected that these pertain to anomalous forms. Foreman (l.c.) described the female flowers as “pedicel c. 1 cm long, perianth ellipsoid in buds, c. 20 by 5–7 mm, split c. half-way down into 3 lobes which become highly reflexed.” Sinclair (l.c.) described the female inflorescence as “1- or 2-flowered, with a flattened axis c. 1 cm long, pilose or glabrescent, with coriaceous flowers, 2 cm long (being the largest flowers in the genus), the ovary ovoid, 5 mm diam., with bi-lobed stigma (style) 2–3 mm long; the bracteole rigid, early deciduous, leaving a conspicuous scar.” The recent collection *LAE 60175* is annotated with “flowers solitary.” The duplicate in L has a single female flower in the axil of an undeveloped leaf, there is no peduncle and no bracteole scar on the pedicel; however, the single-fruited (immature) infructescences in the same collection do have a peduncle, 1 cm long, but no bracteole scar on the fruiting pedicel. The flower has a woody consistency and the ovary is 5 by 3.5–4 mm, with densely pilose bright (red-)brown hairs 1–2 mm, partly agreeing with the description as given by Sinclair (see above). Possibly these extraordinary large flowers, without a bracteole, may be (partly) diseased or galls, and normal flowers may be smaller, with a bracteole. The fruiting pedicel of *Carr 14908* (at K) has a distinct bracteole scar 2 mm below the fruit. As stated, male inflorescences and male flowers are unknown.

2. Spot characters are the usually uncinat apical leaf bud, and the uncinat apex of the fruits. The leaves are characteristically whitish below. Dots on the lower leaf surface are absent, but blackish dots are present on the upper surface; the exact nature of these dots (traumatic or not) remains to be asserted.

**144. *Myristica undulatifolia* J. Sinclair**

*Myristica undulatifolia* J. Sinclair, Gard. Bull. Sing. 23 (1968) 400, f. 67; W.J. de Wilde, Blumea 40 (1995) 337. — Type: NGF 7173 (Gray & Floyd), Papua New Guinea, Gulf Prov.

Tree 6–30 m. Twigs not or but faintly angled at the very apex, 2–3(–4) mm diameter, early glabrescent, hairs 0.1 mm; older twigs dark brown, longitudinally fissured, cracked, or thinly flaking; lenticels small, pale, contrasting. Leaves membranous or thinly chartaceous, oblong-lanceolate, 12–26 by 4–9.5 cm, base cuneate or (narrowly) rounded, apex acute-acuminate; upper surface olivaceous or brown, lower surface grey-brown or silvery, seemingly glabrous, hairs felty, dense, pale, scale-like, less than 0.1 mm, sometimes late glabrescent; not papillose; dots absent; midrib slightly raised above, lateral nerves 15–25 per side, at 45–80° to the midrib, flat or sunken above, reddish brown and contrasting in colour below, lines of interarching and venation inconspicuous; petiole 15–20 by 2(–3) mm; leaf bud 10–15 by 2 mm, hairs scale-like, 0.1 mm or less. Inflorescences between the lower leaves or below, of the *Knema*-type: a (sub)sessile (to 2 mm pedunculate) simple or forked, scar-covered, pubescent brachyblast 3(–5) mm long; in male: with a subumbel of (5–)10–15 flowers, buds of various sizes; bracts small, caducous; in female: (3–)4–6-flowered; flowers with hairs 0.1–0.2 mm. Male flowers: pedicel 4–5 by 0.6–0.8 mm, bracteole ± boat-shaped, 2.5 by 1.5(–2) mm, persistent; buds obovoid-oblong, 4(–5) by 2 mm, cleft c. 1/4, lobes 1 mm long, 0.1–0.2 mm thick. Androecium 0.5–0.6 mm; androphore (1–)1.2 by 0.4 mm, with hairs less than 0.1 mm in the lower half; synandrium narrowed at apex, 2 by 0.5–0.6 mm, thecae 14–16(–20), sterile apex acute, (0.2–)0.3 mm. Female flowers: pedicel 1.5 mm, bracteole 3.5 mm long; buds ovoid, 5 by 4 mm, the lobes 1.5 mm; ovary ovoid, c. 3 mm long, hairs minute, dense, appressed, pale brown. Fruits solitary or 2 per infructescence, (sub)sessile, ovoid-oblong, 2.5–3.5 by 1.7–2.5 cm, base rounded or subtruncate; hairs dense, very fine, grey-brown or yellowish brown, 0.1 mm or less, old fruits ± glabrescent; pericarp 5 mm thick; seeds ellipsoid, (1.5–)2 cm; fruiting pedicel stout, 3–5 by 4–6 mm, rough by cracks and few lenticels.

Field-notes — Locally tall, canopy-forming trees. Outer bark rough or fissured, not or somewhat peeling; inner bark red; exudate pinkish brown; sapwood cream or brownish pink. Leaves glossy light brown or silvery-rusty below. Flowers (buds) brown. Fruits pale brown or greenish brown.

Distribution — *Malesia*: southern part of West and East New Guinea (also Bird's Head).

Habitat & Ecology — Primary and degraded lowland and lower submontane forest; flatland and ridges, mixed *Castanopsis* forest; moreover in forest inundated in the wet season, forest on clay soil by streams; 100–600 m altitude; fl. Mar., Apr.; fr. Apr., July–Sept.

Notes — 1. In some specimens the thinly chartaceous leaves dry with a more or less undulate margin, giving the leaves sometimes a denticulate appearance; in reality the leaves never are denticulate.

2. The specimen *von Römer* 96 (southern West New Guinea) has the bark of the older twigs as in *M. undulatifolia*, but its very immature fruits have longer and more slender pedicels; possibly it could be referred to *M. fatua* or represents a separate, yet undescribed, new taxon.

**145. Myristica velutina** Markgr.

*Myristica velutina* Markgr., Bot. Jahrb. Syst. 67 (1935) 165; W.J. de Wilde, Blumea 40 (1995) 339.

— Type: *Ledermann 11175* (B, lost); paratypes: *Ledermann 11333a, 11395a, 12802a* (B, lost) (*Ledermann 12802a*, L, lecto, here designated), Papua New Guinea.

Tree 4–10 m. Twigs subterete or bluntly (tri)angular, or mostly with two sharp lines or ridges between the petioles, (2–)3(–4) mm diameter, ant-swellings absent, early glabrescent, hairs 0.1 mm or less; older twigs with non-contrasting lenticels. *Leaves* chartaceous or thinly coriaceous, (obovate-elliptic-)oblong or oblong-lanceolate, 10–23 by 2.5–8 cm, base attenuate or narrowly rounded, apex acute-acuminate; upper surface olivaceous or brown, lower surface grey(-brown), late glabrescent or indumentum (sub)persistent, hairs flocculose, ± scattered, 0.1(–0.3) mm; not distinctly papillose; dots absent; midrib slightly raised above, lateral nerves (15–)18–22(–25) per side, at 60–80° to the midrib, flat or sunken above, lines of interarching rather distinct, venation indistinct; petiole 8–15 by 2–4 mm; leaf bud 10–15 by 2 mm, hairs grey-brown, 0.1 mm. *Inflorescences* between the leaves, ± of the *Knema*-type: a (sub)sessile or to 4 mm pedunculate scar-covered knob-like brachyblast up to 5 mm long, ± glabrescent; bracts 1 mm, caducous; in male: with a subumbel of 3–6 flowers, with buds of ± variable sizes; female as male, buds up to 8 in a cluster, subequal in size; flowers with hairs 0.1 mm. *Male flowers*: pedicel 4–5 mm long, bracteole persistent; buds ellipsoid-oblong or oblong-lanceolate, 6 or 10 mm long; see further under the subspecies. *Female flowers* (*Kalkman 5312*): pedicel 2–3 mm, bracteole minute, ± caducous; buds ovoid(-oblong), 4.5 by 3 mm, lobes 1.5–2 mm; ovary ovoid, including a 3.5 mm long stigma, short-pubescent. *Fruits* solitary or in clusters of up to 5, ovoid(-oblong), 2.5 by 1.5(–2) mm, apex ± acute, often narrowed into 2 mm long style-remnant, base rounded or sometimes shortly narrowed, hairs persistent, mealy, rusty, 0.1(–0.2) mm; pericarp 2–3 mm thick; seeds ellipsoid, 1.5(–2) cm; fruiting pedicel 3–5(–10) by 1.5–2.5 mm, often thickened by numerous irregular wart-like lenticels, bracteole scar apical.

Distribution — *Malesia*: mountains of W Central Papua New Guinea; there are two subspecies.

Note — Resembling *M. subalulata* but differs in the absence of ant-swellings in the twigs, in the short male flower pedicels, and persistent bracteole. *Myristica velutina* is fairly homogeneous in habit, leaf-texture and colour, and general features of the twigs. However, an analysis of the male flowers of *Ledermann 12802a* (in L) and those of the later collections, show rather pregnant differences, a reason to accept two subspecies. Possibly the description by Markgraf (l. c.) was based on specimens belonging to the present subspecies *velutina*, testified e. g. by the mentioned long range in length of the perianth, 6–9 mm. The fruits were described (*Ledermann 11395a*) as globose, diameter 2.5 cm, and possibly fresh fruits are proportionally broader than those found in dried collections.

## KEY TO THE SUBSPECIES

- 1a. Twigs faintly lined or ± angular. Male buds (8–)10 mm long. — E Sepik, Western & Southern Highlands Prov. . . . . **a. subsp. velutina**  
 b. Twigs sharply 2-lined or low-ridged. Male buds (5–)6 mm long. — W Sepik & Western Prov. . . . . **b. subsp. breviflora**

**a. subsp. *velutina***

*Twigs* (sub)angular or with faint lines. *Male flowers*: pedicel slender, 4–5 by 0.5(–1) mm, bracteole ovate(-oblong), 3 mm long, faintly 3-topped, persistent; buds oblong-lanceolate, (8–)10 by 2.5(–3) mm, apex subacute, not angular, base narrowly rounded, cleft c. 1/5, lobes 2 mm long, 0.2(–0.3) mm thick. Androecium slender, 8–9 mm; androphore much shorter than the synandrium, 3 by 0.5 mm, almost completely set with sparse minute appressed red-brown hairs less than 0.1 mm; synandrium fusiform, 5 by 0.8–1 mm, thecae c. 10, sterile apex slender, acute, 1 mm long. *Fruits* as the species.

*Distribution* — *Malesia*: Central Papua New Guinea (East Sepik, Western Highlands & Southern Highlands Prov.).

*Habitat & Ecology* — Mid-mountain forest; 1300–2000 m altitude; fl. & fr. throughout the year.

*Note* — The pale, grey(-white) lower leaf surface (young leaves may be more brownish below because of indumentum) seems to be caused by a very dense whitish papillation, so crowded that the leaf surface appears to be non-papillose, also as seen with magnification. In *Jacobs 8808* the lower surface is distinctly (densely) papillose.

**b. subsp. *breviflora* W.J. de Wilde**

*Myristica velutina* Markgr. subsp. *breviflora* W.J. de Wilde, *Blumea* 40 (1995) 339. — Type: *NGF 41677* (*Henty, Isgar & Galore*), Papua New Guinea.

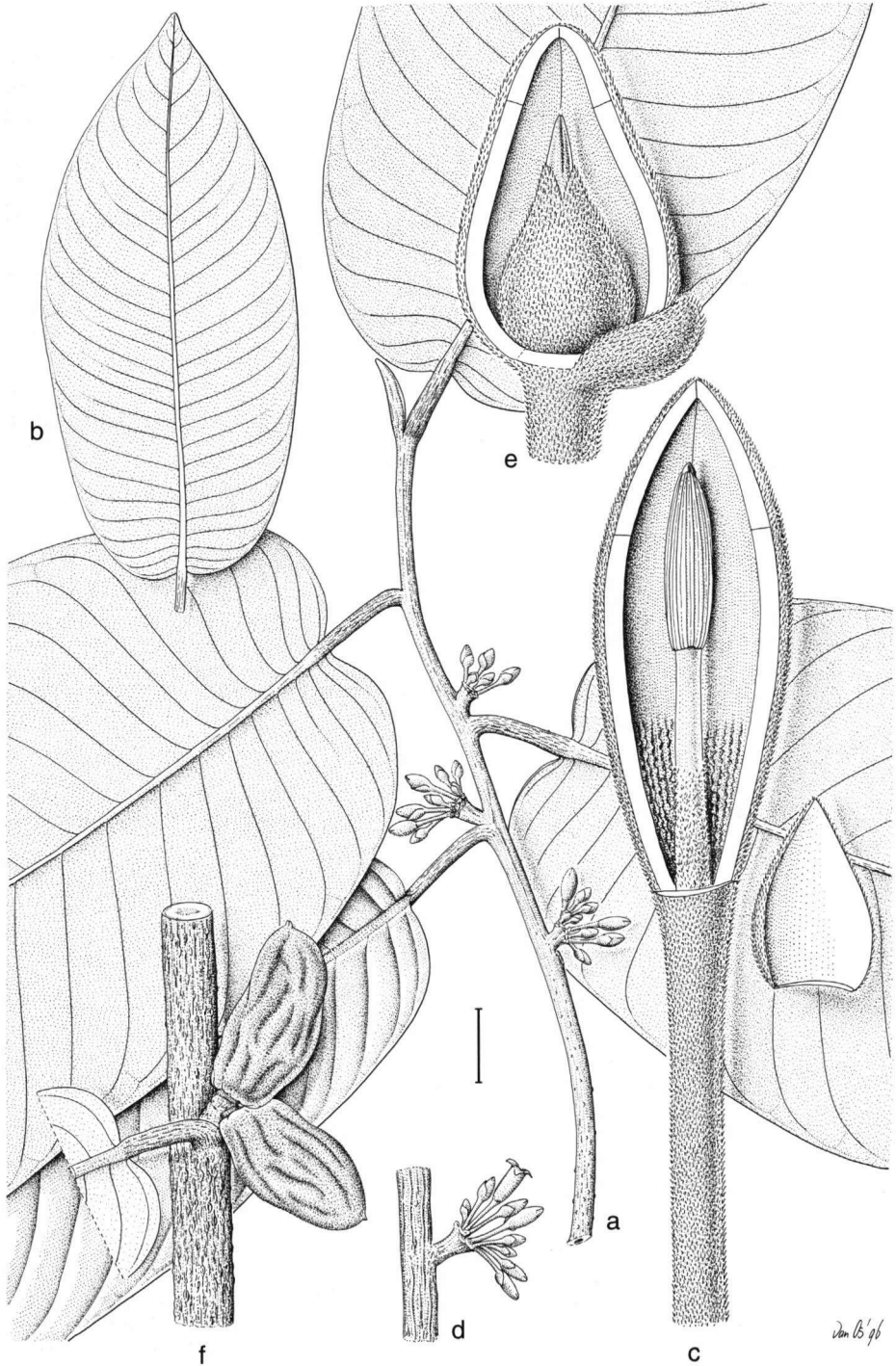
*Twigs* distinctly angular, with two marked lines or low ridges running in between the petioles or the scars of petioles. *Male flowers*: pedicel 4 by 1 mm, bracteole ovate, rounded, 1.5 mm long, persistent; buds ellipsoid-oblong, (5–)6 by 2.5 mm, apex and base ± rounded, not angled, cleft c. 1/4, lobes 1.5 mm long, 0.3 mm thick. Androecium slender, 5–5.5 mm; androphore nearly as long as the synandrium, 2–2.2 by 0.6–0.7 mm, almost completely pubescent, hairs pale, scattered, less than 0.1 mm; synandrium 3 by 0.7–0.8 mm, thecae 10–12, sterile apex ± blunt, 0.3 mm. *Fruits* as the species.

*Field-notes* — Small tree, 4–10 m. Branches short, horizontal. Outer bark dark brown or reddish brown; inner bark pink or yellow; latex red; wood straw, with (little) red latex, or staining reddish after exposure. Leaves whitish below. Flowers brown-cream. Fruits orange-brown or deep brown, seeds blackish.

*Distribution* — *Malesia*: W Central Papua New Guinea (West Sepik and Western Prov.).

*Habitat & Ecology* — Mountain forest; forest on ridges, on latosol, fagaceous moss forest, *Nothofagus* forest on swampy site; also on limestone or on well-drained old volcanic soil; 1500–2100 m altitude; fl. & fr. throughout the year.

Fig. 91. *Myristica verruculosa* W.J. de Wilde. a. Leafy twig with male inflorescences; b. leaf; c. male bud, opened, note the irregularly warted lower inside, (sub)persistent bracteole drawn separately; d. male inflorescence with one flower blooming; e. female bud, opened, showing pistil; f. twig with infructescence [a–d: *Polak 1283*; e, f: *Polak 697*]. — Scale bar for a, d, f = 2 cm; for b = 4 cm; for c, e = 1.65 mm.



**146. *Myristica verruculosa* W.J. de Wilde**

*Myristica verruculosa* W.J. de Wilde, *Blumea* 43 (1998) 177, f. 4. — Type: *Polak MP 1283*, Irian Jaya, Bird's Head.

Tree 15 m. *Twigs* 4–5 mm diameter, subterete with faint lines from petiole to petiole, light brown, partially hollow with incidental ant-holes, without swellings, early glabrescent, hairs minute, bright brown, less than 0.1 mm; older twigs striate with scattered lenticels. *Leaves* chartaceous, (elliptic-)oblong, 20–32 by 8–13 cm, base broadly rounded or shallowly cordate, apex acute(-acuminate); upper surface olivaceous, lower surface with persistent indumentum, hairs dense, pale, 0.1 mm or less; not papillose; dots absent; midrib slightly raised above, lateral nerves 20–23 per side, at 60–80° to the midrib, flat or sunken above, lines of interarching and venation indistinct; petiole 20–40 by 5 mm; leaf bud slender, 15–20 mm, hairs dense, brown, stellate, 0.1 mm or less. *Inflorescences* between the leaves or below, of the *Knema*-type: a simple or forked brachyblast, to 10 mm long, with stout peduncle to 5 mm, glabrescent; in male: with clusters of 10 (–20) flowers, buds of various sizes; bracts minute, caducous; in female: with sessile clusters, 5–10-flowered; flowers with yellow brown mealy hairs 0.1(–0.2) mm. *Male flowers*: stout, pedicel 10–11 by 1.5 mm, bracteole ovate-broad-triangular or rhomboid, acute, 4–4.5 mm, (sub)persistent; buds oblong, (10–)12 by 4–5 mm, apex ± blunt to acute, base somewhat tapered, cleft 1/3, lobes ± fleshy, 4 mm long, 0.5(–0.8) mm thick, perianth inside for the lower 1/3 finely irregularly warty. Androecium (8–)10 mm long; androphore slender, 5–6 by 0.8 mm, in lower half with pale hairs less than 0.1 mm; synandrium oblong, subacute, 4–5 by 1.5–2 mm, thecae c. 17, sterile apex glabrous, ± acute, 0.2–0.3 mm. *Female flowers*: pedicel 2(–2.5) mm long, bracteole ovate, ± hooded, 2.5 mm long, (sub)persistent; buds ovoid(-oblong), narrowed in the apical part, 8 by 4–5 mm, lobes 1.5 mm; ovary ovoid, tapering, (including 1.5 mm long stigma lobes) 5 by 3 mm, hairs appressed 0.1(–0.2) mm. *Fruits* in sessile clusters of 1–3, (ovoid-)oblong, 3.5–5 by 2.5 cm, apex acute, base broadly rounded, hairs rusty, 0.5 mm; pericarp 5 mm thick; seeds ellipsoid-oblong, 2.5–3 cm; fruiting pedicel 1–3 mm. — **Fig. 91.**

Field-notes — Exudate clear. Leaves pale brown below. Flowers yellow brown, 1 cm long.

Distribution — *Malesia*: Papua Barat (Bird's Head: E of Sorong, and Bombarai Peninsula).

Habitat & Ecology — Limestone area; in degraded forest on clay soil; 450 m altitude.

Note — Related and similar to *M. bialata*, *M. fissiflora*, *M. hollrungii*, *M. ingrata*, and *M. subcordata*, and especially close to *M. bialata*, a species of the Bismarck Archipelago; *M. verruculosa* is distinguishable by the fine warty structure within the perianth. A warty inner perianth, however, is shared with *M. fissiflora*, but that species differs in its deeper cleft male perianth. *Myristica ingrata* usually has ant-holes in the twigs, a glabrescent lower leaf surface, and much smaller flowers (except var. *velata*); *M. hollrungii* grows in swampy areas, and equally has smaller flowers and (sub)glabrous leaves; *M. subcordata*, with similar persistent leaf indumentum, has smaller and more narrow male perianths, with a caducous bracteole; *M. bialata* has similarly stout male flowers, but differs in the lower number (10 or 12) of thecae (16 or 18 in *M. verruculosa*), shorter perianth lobes, the (almost) absence of a warty inner surface, and it has a glabrescent lower leaf surface (densely short-felty in the present species).

**147. Myristica villosa Warb.**

*Myristica villosa* Warb., Mon. Myrist. (1897) 419, t. 14; J. Sinclair, Gard. Bull. Sing. 16 (1958) 356, in obs.; 23 (1968) 311, f. 41; W.J. de Wilde, Blumea 42 (1995) 188; Tree Fl. Sabah & Sarawak 3 (2000) 471. — Lectotype: *Beccari 1526*, Sarawak.

*Myristica fatua* auct. non Houtt.: Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 46 (quoad spec. born. de Vriese).

*Myristica borneensis* Gand., Bull. Soc. Bot. France 66 (1919) 225, in clavi (non Warb., 1897). — Type: *Korthals s.n.*, Borneo.

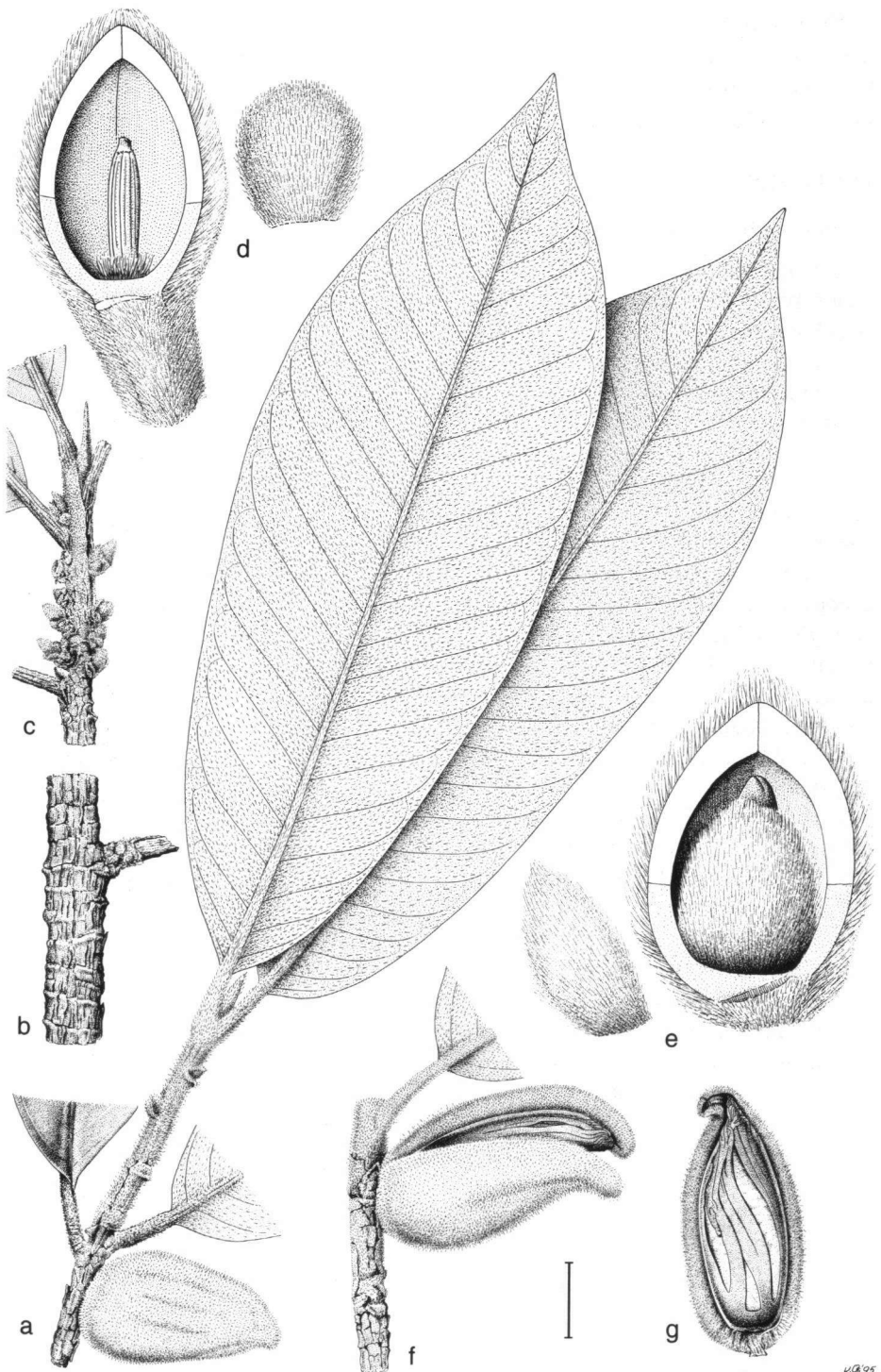
Tree (5–)10–40 m. *Twigs* 5–10 mm diameter, glabrescent, hairs villose, (1–)2–3 mm long; older twigs brown or blackish, coarsely longitudinally cracking and flaking; lenticels absent. *Leaves* chartaceous or thinly coriaceous, (elliptic-)oblong, (15–)20–40 by 6–13 cm, base acute or narrowly rounded, apex acute(-acuminate); upper surface olivaceous or brown, lower surface late glabrescent or hairs persistent, dense, grey or cinnamon, scale-like (dendroid), 0.1–0.2 mm, mixed with widely spaced unbranched uniseriate emergent hairs 1–3 mm; not obviously papillose; dots absent; midrib ± raised above, lateral nerves 20–25 per side, at 45–60° to the midrib, sunken, lines of interarching and venation distinct; petiole (12–)20–25 by 3.5–5 mm, late glabrescent; leaf bud 7–12 by 4–6 mm, hairs conspicuous, (1–)2–3 mm. *Inflorescences* between the leaves or below, of the *Knema*-type: a sessile scar-covered brachyblast, pubescent; bracts ovoid or rounded, 3–4 mm, caducous; in male: simple or 2–4-furcate, 5–13 by 5–10 mm, terminally with 1–3 subsessile flowers, buds subequal in size; in female: similar, shorter, with 1 or 2 flowers ± hidden in coarse indumentum; flowers coriaceous, with villose hairs 1–2 mm long. *Male flowers*: pedicel rather thick, 3–4(–5) mm long, bracteole broadly rounded, 3–4 mm, late caducous; buds ovoid(-ellipsoid), 6–8 by 4–5(–6) mm, apex narrowly rounded, cleft c. 2/3, lobes 1 mm thick. Androecium slender, 4–5 mm long; androphore (0.5–)1 by 0.4–0.5 mm, at base with a collar of pale hairs 1 mm; synandrium 3.5–4.5 by 0.6 mm, thecae c. 12, sterile apex ± blunt (0.2–)0.3–0.5 mm long. *Female flowers*: pedicel 1 mm long, bracteole broadly rounded, 4–5 mm, ± caducous; buds ovoid, 8(–10) by (5–)6–8 mm, cleft c. 2/3; ovary (broadly) ovoid, 5–6 by 4 mm, hairs 1–1.5 mm; stigma 1(–1.5) mm. *Fruits* 1 or 2 per infructescence, subsessile, broadly (ovoid-)ellipsoid, apex rounded or narrowed with somewhat uncinat apex, 4–6(–8) by 2.5–4(–4.5) cm, hairs dense, pale brown or rust-coloured, somewhat hispid, 2–3(–4) mm; pericarp 3–6(–8) mm thick; seeds broad-ellipsoid, 3–5 cm, aril coarsely lacinate, the laciniae finely divided at the apex; fruiting pedicel up to 5 mm long. — **Fig. 61c, 92.**

*Field-notes* — Usually without buttresses, or with stilt-roots at base. Bark blackish, hard, rough, flaking or longitudinally furrowed (as in *Knema hookeriana* and related species), strips (1.5–)2–3 mm wide and long, 1 mm thick, sometimes smooth (finely scaly); underbark reddish brown; outer bark pinkish, laminated, soft, 5–10 mm thick; sapwood cream or pale brown, with odour of coconut; sap red. Leaves glossy above, silvery (brown), in old leaves glaucous below. Flowers yellow-brown, inside pale yellow, fragrant. Fruits yellow- or apricot-brown pubescent.

*Distribution* — *Malesia*: throughout Borneo.

*Habitat & Ecology* — Primary dry land (mixed dipterocarp) forest, sometimes marsh forest; also in kerangas; on flatland, hillsides, and ridges; mostly on sand or loam soils, sandstone derived soil, also on heavy yellow clay (Setap Shale); 20–1200 m altitude; fl. Feb., June, Aug.–Sept., fr. May–Sept.





Note — A homogeneous species, distinguishable by the subpersistent conspicuous indumentum of lower leaf surface, midrib (also above), twig apex, and flowers, by the flaking dark brown or blackish bark of older twigs, by the sessile *fatua*-type of inflorescences, and by the  $\pm$  asymmetrical coarsely hairy fruits.

#### 148. *Myristica vinkeana* W.J. de Wilde

*Myristica vinkeana* W.J. de Wilde, *Blumea* 40 (1995) 339. — Type: *Eyma* 4283, Irian Jaya.

Tree 17 m tall. *Twigs* 1.5–2(–2.5) mm diameter, glabrescent, hairs 0.1 mm; older twigs (coarsely) striate, not flaking; lenticels small, inconspicuous. *Leaves* thinly coriaceous, elliptic-oblong, 8–15 by 2–4.5 cm, base (short-)attenuate, apex acute or (long-)acuminate; upper surface dark (blackish) brown, lower surface grey-brown, glabrescent, hairs inconspicuous, widely spaced, grey or cinnamon brown, scale-like, 0.1 mm or less; not papillose; dots absent; midrib flat or in a groove (and slightly raised) above, lateral nerves 16–18 per side, at 60–80° to the midrib, flat or sunken, lines of interarching and venation faint or distinct and contrasting below; petiole (6–)10–15 by 1.5 mm; leaf bud 10 by 1 mm, hairs grey-brown, 0.1 mm. *Inflorescences* between the lower leaves, with dense hairs 0.1 mm; of the *Knema*-type: a sessile scar-covered brachyblast, less than 1 mm long; in male: with clusters of 1–3(–5) flowers, buds of various sizes; bracts caducous; in female (from infructescences): 1(–3)-flowered; flowers with hairs 0.1 mm. *Male flowers* (*Eyma* 4283): pedicel slender, 3 mm long, bracteole comparatively large, broadly ovate, 2–2.5 mm long, apex acute, (sub)persistent; buds ovoid(–ellipsoid) to oblong, 5(–5.5) by 2–2.5 mm, apex  $\pm$  blunt, cleft c. 1/3, lobes 1.5–1.7 mm long, 0.2–0.3 mm thick. Androecium slender, 4(–4.5) mm long; androphore 2 by 0.5 mm, longitudinally  $\pm$  ribbed, almost entirely pubescent, hairs pale brown, 0.2–0.3 mm; synandrium 2 by 0.8–0.9 mm, thecae c. 12, the sterile apex irregularly  $\pm$  blunt, 0.3 mm long. *Female flowers* not seen. *Fruits* (immature) sessile, solitary, just below the leaves,  $\pm$  (ovoid-) ellipsoid, 3 by 1.5 cm, apex somewhat acute, base shortly narrowed; hairs dense, grey-brown, scale-like, 0.1 mm; pericarp 3 mm thick; seeds not seen; fruiting pedicel 10 by 2.5 mm, lenticellate, bracteole scar about median.

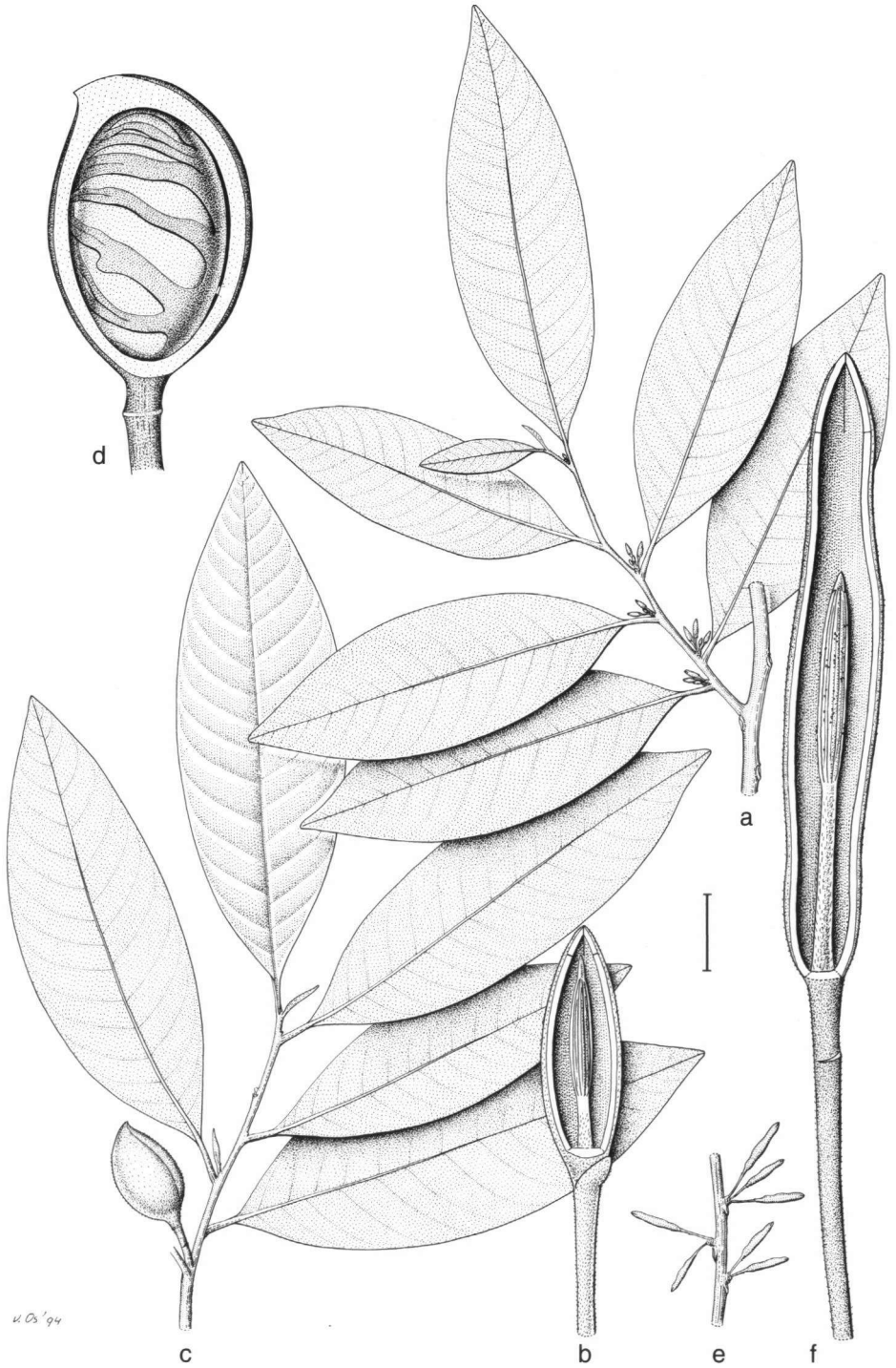
Field-notes — Rather common. Inner bark red. Fruits (immature) light brown.

Distribution — *Malesia*: Papua Barat (Wissel Lake region).

Habitat & Ecology — Mountain forest on stony sandy-clayey soil; 1600–1800 m altitude; fl. Jan.; fr. May.

Note — Close to *M. crassipes*, which differs in its larger male flowers with (sub)caducous bracteole, and less hairy androphore.

Fig. 92. *Myristica villosa* Warb. a. Leafy twig with fruit; b. older twig showing blackish bark, conspicuously cracking; c. apex of leafy twig with few-flowered male inflorescences arranged distichously; d. opened male bud showing androecium beside the detached caducous bracteole; e. opened female bud showing pistil beside the detached caducous bracteole; f. twig with infructescence with a single ripe fruit; g. ditto, opened, showing arillate seed [a: *S* 39444; b, f, g: *Mogea & de Wilde* 3502; c: *Anderson & Hou* 488; d: *Paijmans* 33; e: *S* 29211]. — Scale bar for a–c, f, g = 2 cm; for d, e = 2 mm.



149. *Myristica warburgii* K. Schum.

*Myristica warburgii* K. Schum. in K. Schum. & Lauterb., Nachtr. Fl. Schutzgeb. Südsee (1905) 267; W.J. de Wilde, Blumea 40 (1995) 341, f. 9. — Type: *Biró 21*, Papua New Guinea, Sattelberg.

Tree 3–20(–25) m. Twigs usually markedly (2- or 3-) angular, 1–2.5(–3) mm diameter, early glabrescent, hairs 0.1(–0.2) mm or less; older twigs with inconspicuous lenticels. Leaves membranous or thinly coriaceous, elliptic(–oblong) or oblong-lanceolate, base attenuate, apex acute(–acuminate), 6–16 by (1.5–)2.5–5.5 cm; upper surface olivaceous or (bright) brown, lower surface slightly paler, early glabrescent, hairs weak, scattered, 0.1 mm or less; not papillose; dots absent (minute dots sometimes present in young leaves, see note 1 under subsp. *warburgii*); midrib raised above, lateral nerves 10–20 per side, at (45–)60–70(–80)° to the midrib, flat or sunken and inconspicuous above, little raised below, lines of interarching and venation distinct or faint; petiole 7–15 by 1–2 mm; leaf bud 7–10 by 1.5–2 mm, hairs (0.2–)0.3–0.4 mm. Inflorescences between the leaves or below, of the *Knema*-type: a sessile or to 1(–2) mm pedunculate simple or forked scar-covered brachyblast to 4 mm long, late glabrescent (hairs 0.3 mm), in male: subumbel of 3–6 flowers, buds of various sizes; bracts minute; in female: with 1–4 flowers, almost equal in size; flowers often partially glabrescent or subglabrous, hairs 0.1 mm or less. Male flowers: pedicel slender, 5–10 by 0.5–1 mm, bracteole ± ovate, 1–1.5 mm, (persistent or) caducous, apical or to 2.5 mm below apex; buds oblong-lanceolate, ± fusiform (with base attenuate) or tubiform, the upper 1/3 narrowed, acute, ± angled, 8–14 by 1.5–3 mm, cleft c. 1/8, lobes 1–2 mm long, 0.2–0.3 mm thick. Androecium slender, 5.5–9 mm long; androphore (2–)2.5–4.5 by 0.5–0.7 mm, hairs weak, glossy, 0.2–0.3 mm long; synandrium 3.5–5 by 0.7–0.8(–1) mm, thecae 12–16, sterile apex ± acute or blunt, 0.1–0.5 mm long, or absent. Female flowers: pedicel 9–15 by 0.8–1.5 mm, bracteole scar 3–6 mm below apex; buds ovoid-oblong, narrowed in the upper part, 7.5–9 by 3.5–4 mm, lobes 1 mm; ovary ovoid-oblong, 6 by 2–3 mm, hairs 0.2–0.3 mm. Fruits solitary or 2 or 3 together, long-stiped, often axillary to leaves, broadly ellipsoid, sometimes fusiform, (1.5–)2–4 by 1.5–2.5 cm, apex rounded or narrowed, often somewhat acute with up to 2 mm long beak, base tapered or ± rounded and contracted into 2–5(–7) mm long pseudostalk, hairs dense, mealy, brown, 0.1–0.2 mm or less; pericarp 1.5–3 mm thick; seeds ellipsoid, (1.5–)2 cm, attached (up to c. 5 mm) above the base of the fruit rendering seeds and aril lobes generally in a transverse, not erect, position (see note 2 under subsp. *warburgii*); fruiting pedicel slender, 10–20(–25) by 1.5–3 mm, sometimes with few lenticels, bracteole scar at about 1/4 to halfway from apex. — Fig. 93.

Distribution — *Malesia*: Central and East New Guinea; there are 3 subspecies.

Note — Most specimens of the present species were included by Sinclair (1968) in *M. longipes*. However, *M. warburgii* is more closely related to *M. flosculosa* and *M. laevifolia*, as also appears from the keys. *Myristica laevifolia* differs in its more coriaceous

Fig. 93. *Myristica warburgii* K. Schum. subsp. *warburgii*. a. Male flowering twig; b. immature male bud, opened (perianth considerably longer at anthesis); c. leafy twig with one-fruited infructescence; d. opened fruit, showing seed with obliquely or transversely situated aril lobes. — *M. warburgii* subsp. *siphonantha* W.J. de Wilde. e. Part of twig with male inflorescences; f. opened male bud; note scar of caducous bracteole [a, b: *BW 2815* (*Schram*); c, d: *Kostermans & Soegeng 336*; e, f: *Sands 1048*]. — Scale bar for a, c, e = 2 cm; for b, f = 1.65 mm; for d = 6.5 mm.

leaves, smaller hairs on the leaf bud, smaller male flowers, more elongate, glabrescent fruits, and occurs generally at higher altitudes, 1000–1800 m. *Myristica flosculosa* differs in e.g. leaf bud with hairs 0.1 mm or less and smaller male flowers.

#### KEY TO THE SUBSPECIES

- 1a. Nerves and venation on lower leaf surface usually faint, not much contrasting in colour ..... 2  
 b. Nerves and venation on lower leaf surface distinct, much contrasting in colour. Fruits 2–3 cm long. — E Papua New Guinea, at c. 1000 m ..... **b. subsp. *hybrida***  
 2a. Male buds fusiform or long-urceolate, (8–)9–10.5 by 2.5–3 mm; androecium 5.5–7.5 mm long, sterile apex 0.2 mm or less, or absent. Fruits 3–4 cm long. — E Papua New Guinea, at 350–1300 m ..... **a. subsp. *warburgii***  
 b. Male buds narrowly ± tubiform, (10–)13–14 by 1.5–2 mm, narrowed in the upper and basal 1/3; androecium 8–9 mm long, sterile apex 0.5 mm long. Fruits 2.5–3 cm long. — Northern New Guinea, at 15–400 m ..... **c. subsp. *siphonantha***

#### **a. subsp. *warburgii***

Nerves and venation on lower leaf surface faint, not much contrasting in colour. *Male flowers*: buds fusiform-urceolate, (8–)9–10.5 by 2.5–3 mm; androecium 5.5–7.5 mm long, sterile apex to 0.2 mm long. *Female flowers*: pedicel 10–15 by 1 mm, bracteole scar about median; buds 7.5–9 by 4 mm; ovary 6 by 2.5(–3) mm. *Fruits* ellipsoid-fusiform, 3–4 cm long, hairs 0.1–0.2 mm, pericarp 2–3 mm thick; fruiting pedicel 10–20 (–25) by 1.5–3 mm. — Fig. 93a–d.

Field-notes — Medium-sized or small tree. Bark smooth or fissured and flaky, dark brown; inner bark red-brown; exudate little, (yellow) reddish; wood straw, sometimes rust-red on exposure, with ± thick reddish exudate; heartwood dark pink. Leaves dull or glossy dark green above, dull mid-green below. Flowers cream(-green) or (pale) yellow; male flowers pendent, female flowers cone-shaped, 10 mm long. Fruits golden brown or orange-brown. Fruiting in the upper crown, flowering in the lower crown.

Distribution — *Malesia*: E Papua New Guinea (Morobe, Central, and Milne Bay Prov., incl. Fergusson I.).

Habitat & Ecology — Hill and lower montane forest, *Castanopsis* (oak) forest; on steep slopes; 350–1300 m altitude; fl. June, July, Dec.; fr. throughout the year.

Notes — 1. Immature or just mature leaves may have a fine dark punctation below (lens!); however, these tiny dots are markedly smaller than, but probably essentially similar to those found in species with a dotted lower leaf surface.

2. The seed is positioned somewhat obliquely within the pericarp, that is, attached not basally but higher up; hence the slips of the aril are largely orientated transversely rather than lengthwise. This has been seen also in the fully mature fruits of a specimen of *M. scripta* (Jacobs 9059) and probably it occurs in other species as well.

#### **b. subsp. *hybrida* W.J. de Wilde**

*Myristica warburgii* K. Schum. subsp. *hybrida* W.J. de Wilde, Blumea 40 (1995) 341. — Type: Jacobs 9396, Papua New Guinea.

Nerves and venation on lower leaf surface contrasting in colour. *Male flowers* not known. *Female flowers* (Jacobs 9396): pedicel 9–10 by 1–1.5 mm, bracteole scar (3–) 3.5–4 mm below the apex; buds 9 by 3.5 mm; ovary 6 by 2 mm. *Fruits* (broadly) ellipsoid, (1.5–)2–3 cm long, apex 2 mm beaked, base with 2 mm long pseudostalk, hairs mealy, light rust-coloured, 0.1 mm; pericarp 1.5–2 mm thick; fruiting pedicel slender, 11–15 by 1.5–2.5 mm.

Field-notes — Leaves pale green below. Flowers white. Fruits (dull) orange-brown.

Distribution — *Malesia*: Papua New Guinea (Eastern Highlands Prov., possibly also Sepik Prov.).

Habitat & Ecology — Mixed primary montane forest; mostly on ridges; well-drained volcanic soil; c. 1000 m altitude; fl. & fr. Sept., Oct.

Note — Subsp. *hybrida* belongs with some doubt to *M. warburgii*, whereas it also may be related to *M. gracilipes*. Male flowers of subsp. *hybrida* are unknown, and the seed of the type specimen is not yet fully developed. The subspecies differs mainly in the distinct, contrasting nervation on the lower leaf surface.

### c. subsp. *siphonantha* W.J. de Wilde

*Myristica warburgii* K. Schum. subsp. *siphonantha* W.J. de Wilde, Blumea 40 (1995) 341, f. 9e, f. — Type: *Sands 1048*, Papua New Guinea.

Nerves and venation on lower leaf surface faint. *Male flowers*: pedicel 10 mm, bracteole minute, 1 mm, caducous, scar 1–3 mm below the apex; buds ± tubiform, (10–)13–14 by 1.5–2 mm, narrowed in the apical and basal 1/3; androecium 8–9 mm long, sterile apex 0.5 mm long. *Female flowers* not known. *Fruits* ellipsoid(-fusiform), 2.5–3 cm long, hairs 0.1–0.2 mm; pericarp 2–3 mm thick; fruiting pedicel 10–20 by 2 mm, bracteole scar 1–3 mm below apex. — Fig. 93e, f.

Field-notes — Tree to 10 m tall. Bark crisp, rough, rusty, smooth or fissured, or peeling off 1–2 mm thick; living bark 8 mm, dark brown, sap red, or orange; underbark crimson, spongy; inner bark exuding red sap darkening on exposure; wood smooth, pale (pinkish) straw, darkening on exposure. Leaves pale below. Flowers apricot cream, or creamy green with brown or yellow indumentum. Fruits (pale) brown, seeds dark brown.

Distribution — *Malesia*: northern New Guinea (Papua Barat: in the area of Jayapura; Papua New Guinea: W Sepik Prov.).

Habitat & Ecology — Locally rather common in sloping terrain, steep slopes; understory treelet on sandy clay or heavy clay-loam, also on limestone hills; 15–390 m altitude; fl. & fr. Mar., Aug.

Note — This subspecies may resemble *M. lancifolia* (with a similar faint venation), but differs in smaller fruits, with the seeds not transversely positioned, and the leaves papillose below. The male flowers of subsp. *siphonantha* resemble those of *M. cornuti-flora*, a species with a stalked inflorescence and dotted lower leaf surface.

## 150. *Myristica wenzelii* Merr.

*Myristica wenzelii* Merr., Philipp. J. Sci., Bot. 10 (1915) 270; Enum. Philipp. Flow. Pl. 2 (1923) 180; W.J. de Wilde, Blumea 42 (1997) 188. — *Myristica fatua* Houtt. var. *wenzelii* (Merr.) J. Sinclair, Gard. Bull. Sing. 23 (1968) 309, f. 40. — Type: *Wenzel 1152*, Philippines, Leyte.

Tree 10–15 m. *Twigs* 4–7 mm diameter, early glabrescent, hairs 0.1 mm; older twigs pale grey-brown, longitudinally coarsely and irregularly warty-striate; remotely lenticellate or not. *Leaves* ± membranous or chartaceous, oblong-ob lanceolate, ± gradually narrowed to the narrowly rounded or cuneate base, apex acute, (20–)25–40 by 7–12 cm; upper surface dark olivaceous or blackish brown, lower surface grey-brown, indumentum felty, cobweb-like, hairs scale-like, 0.1 mm or less (lens!); not papillose; dots absent; midrib little raised above, 4–5 mm wide towards the base, lateral nerves 30–35 per side, at 45–60° to the margin lines of interarching ± distinct, venation faint or invisible at both surfaces; petiole 17–20(–30) by 4–5 mm; leaf bud ± conical, 15 by (4–)6–8 mm, hairs 0.1 mm. *Inflorescences* between the leaves, of the *Knema*-type: in male a sessile woody brachyblast 5(–10) mm long, ± glabrous, few-flowered; female not seen; flowers minutely pubescent. *Male flowers* (immature, *Wenzel 1152*): pedicel 1–2 mm long, bracteole caducous; buds ovoid, 3 mm long, not angled. Androecium 2.5 mm long; androphore with dense appressed hairs in the lower part. *Female flowers* (from young fruit, *FB 23019*): ovary densely pubescent. Infructescence subsessile, knob-like, up to 1.5 cm long, ± below the leaves. *Fruits* solitary, ellipsoid, base and apex rounded, (5–)6–6.5 by 3–4.5 cm, hairs conspicuous, dense, bright rusty, 1–1.5 mm; pericarp 10 mm thick; seeds ellipsoid, 4 cm; fruiting pedicel 3 mm long.

Distribution — *Malesia*: S Philippines (Samar, Leyte, Mindanao).

Habitat & Ecology — Forests at low altitudes; fl. Oct.; fr. Oct.–Mar.

Notes — 1. Flowers and fruits approach those of *M. fatua*, but *M. wenzelii* is distinguishable by its stout habit, thick twigs with pale bark, large leaves with broad midrib, with 30–35 pairs of lateral nerves. The lower leaf surface has a persistent felt-like indumentum, resembling that of *M. fatua* s. s., but it is paler and shorter, with hairs only 0.1 mm long. Mature male flowering specimens are not known.

2. *Myristica wenzelii* may be confused with *M. philippensis*; both species have a stout habit; the latter with a pedunculate paniculate inflorescence, and the leaves glabrescent below.

### 151. *Myristica womersleyi* J. Sinclair

*Myristica womersleyi* J. Sinclair, Gard. Bull. Sing. 23 (1968) 249, f. 24; Foreman, Handb. Fl. Papua New Guinea 1 (1978) 215, f. 84, 93; W. J. de Wilde, Blumea 40 (1995) 343. — Type: *NGF 11374* (*Womersley*), Papua New Guinea.

Tree 20–27 m. *Twigs* subterete or bluntly angled, 3–5 mm diameter, late glabrescent, hairs (0.5–)1 mm; older twigs somewhat longitudinally cracking, not flaking, (finely and) inconspicuously lenticellate. *Leaves* coriaceous, ovate-oblong or oblong(-lanceolate), 12–21 by (3–)4–9 cm, base short-attenuate or rounded, apex acute(-acuminate); upper surface brown, lower surface grey- (or reddish) brown by dense (sub)persistent indumentum, hairs interwoven, scale-like, 0.1–0.2 mm, mixed with scattered variously sized emergent hairs, longly branched from the base, to 1(–2) mm; not papillose; dots absent; midrib slender, ± raised above (sometimes in a groove), lateral nerves 23–27 per side, at 50–80° to the midrib, flat or sunken above, lines of interarching ± distinct, venation somewhat scalariform, ± sunken above, rendering the surface slightly bullate; petiole 8–15 by 3–4 mm, leaf bud 20 by 4–5 mm, hairs 1 mm long. *Inflorescences* (from infructescences) between the leaves or below, of the *Knema*-type: sessile, wart-like

brachyblasts, 1- or few-flowered. *Male* and *female flowers* not known. *Fruits* sessile, single, below the leaves, globose, 6–9 cm diameter, hairs dense,  $\pm$  rough, dark brown, 0.5–1 mm; pericarp 6 mm thick; seeds subglobose, 5.5 by 5 cm, aril with narrow segments; fruiting pedicel 3–5 by 5 mm. — **Fig. 62a, b.**

**Field-notes** — Tree with deep narrow crown, without buttresses. Bark grey, rather hard and brittle; underbark red; inner bark dark straw-brown; wood pale straw; sap runs clear and slowly, turning red-brown. Young foliage rusty tomentose below, old leaves glaucous below, nerves deeply impressed. Fruits apparently not dehiscent, seeds brown, intensely aromatic.

**Distribution** — *Malesia*: Papua New Guinea (a local endemic of Eastern Highlands Prov.: Mt Michael, and Mt Piora).

**Habitat & Ecology** — Forest of slopes and ridges; on steep slope in *Cunoniaceae* and *Nothofagus* dominated forest; 2000–2330 m altitude; fr. May, Sept., Oct.

**Notes** — 1. Resembles *M. fusca* and *M. sphaerosperma* in general habit and inflorescences, taxonomically closest related to the latter. *Myristica fusca* is distinguishable by the papillose lower leaf surface; *M. sphaerosperma* differs e.g. in the irregularly papillose lower leaf surface and a longer fruiting pedicel (7–15 mm). *Myristica womersleyi* also resembles *M. chrysophylla* with similar leaves, but that species has different fruits, 2–4.5 cm long, with 2–5 mm long yellow brown hairs.

2. According to Foreman (l.c.) this species is, although restricted in its distribution, locally quite common. In the Mt Piora area the seeds of *M. womersleyi* are used as a bait in kapul (possum) traps. The seeds also are a possible source of spice and oil, as already noted by Sinclair, l.c.

## 152. *Myristica wyatt-smithii* Airy Shaw

*Myristica wyatt-smithii* Airy Shaw, Kew Bull. No. 2 (1948) 251; W.J. de Wilde, Blumea 42 (1997) 188. — Type: *KEP 52149*, Peninsular Malaysia.

Tree 12–25 cm. *Twigs* sometimes yellowish, 2–3(–3.5) mm diameter, glabrous or early glabrescent, hairs 0.1 mm or less; older twigs smooth with irregular cracks,  $\pm$  flaking; lenticels absent or few and faint. *Leaves* membranous or chartaceous, elliptic-oblong or oblong-(ob)lanceolate, (15–)20–35 by (5–)6–12 cm, base cuneate, rarely  $\pm$  rounded, apex acute-acuminate; upper surface dull, greyish-olivaceous or brown, lower surface dull, paler, glabrous; not obviously papillose; dots absent; midrib above flat or slightly raised to the apex, lateral nerves 15–20 per side, at 45–80° to the midrib, sunken, indistinct above and below (faint intersecondary nerves often present), lines of interarching and venation indistinct; petiole 15–30 by 2–4 mm; leaf bud 10–15(–20) by 2–3 mm, hairs 0.1 mm. *Inflorescences* between the leaves or (*KEP 52149, 63176; FRI 20025*) axillary to fallen reduced leaves along up to 5 cm long lateral short-shoots with apical leaf bud; paniculate, pedunculate, glabrescent, hairs 0.1 mm or less; in male: 2–4.5 cm long, peduncle 15–20 mm, lateral branches 4–6 mm long, central axis 10–20 mm long, with 1 or 2 spaced subumbels, the latter with 4–8 flowers, buds of variable sizes; bracts caducous, 1–3 mm long; in female: peduncle 2–15 mm, not or hardly branched, 1–3 (–5)-flowered; flowers with hairs 0.1 mm or less. *Male flowers*: pedicel 4–8 mm, bracteole rounded, 2–3 by 4 mm, with minutely ciliate margin, (sub)persistent, apical or up to 1 mm adnate to the perianth; buds ovoid, 5 by 3.5–4 mm, cleft 1/3–nearly 1/2, lobes



(0.3–)0.4 mm thick. Androecium 3–3.5 mm; androphore 1.5 by 0.6–0.7 mm, with hairs less than 0.1 mm towards the base; synandrium 2(–2.3) by 0.6–0.7 mm, thecae 14–16, sterile apex  $\pm$  blunt, 0.2–0.3 mm. *Female flowers*: pedicel 3–4 mm, bracteole 1.5 by 4 mm; buds ovoid, 4.5 by 3 mm, cleft c. 1/3, lobes hard-fleshy, 0.5 mm thick; ovary ovoid, 3 by 2 mm, hairs scattered, less than 0.1 mm. *Fruits* 1 or 2 per infructescence, ellipsoid (–oblong), 5.5–8.5 by 3.5–4.5 cm, early or late glabrescent, hairs scurfy, pale brown, 0.1(–0.2) mm or less (remnants of indumentum persistent in hidden places close to the fruit stalk); pericarp (5–)10–15 mm thick, blackish brown; seeds ellipsoid, 4–5 cm; fruiting pedicel stoutish, 4–10 mm long.

*Field-notes* — Erect tree of tall forest, no buttresses nor stilt-roots. Bark blackish brown or greyish black, scaly or flaky (flakes flat, adherent, rather widely spaced or gritty). Leaves glossy green, lighter below, quite glabrous. Flowers yellow. Fruits apricot(–brown) or orange-red; finely scurfy.

*Distribution* — *Malesia*: Peninsular Malesia (possibly Sumatra, Borneo, see notes 3 and 4).

*Habitat & Ecology* — Hillsides and ridges with tall forest; also on crests, conglomeratic ridge; 0–600 m altitude; fl. Apr., May; fr. throughout the year.

*Notes* — 1. This species may be confused with *M. iners* and *M. malaccensis*. *Myristica wyatt-smithii* is distinguishable by its large, dull-drying leaves; the male flowers are larger than those of *M. malaccensis*, smaller than those of *M. iners*. The latter species furthermore differs in its smaller leaves and details of habit, twigs, leaves, flowers (incl. androecium), and fruits. In *M. malaccensis* the lines of interarching of the nerves on the lower leaf surface are more distinct.

2. Mature fruits of *FRI 12553* have a rather persistent indumentum of more densely set longer hairs, 0.1–0.2 mm.

3. Some fruiting specimens from Borneo (*S 16416, 42356; SAN 16808*), probably close to *M. extensa* from which they differ mainly by glabrous (early glabrescent) fruits, key out besides *M. wyatt-smithii*. Possibly these specimens represent a separate, as yet undescribed species.

4. Some sterile collections from outside Peninsular Malaysia (Enggano I., off Sumatra, and Sepilok, Sabah) may belong to *M. wyatt-smithii*, and are discussed by De Wilde, l.c.

#### DOUBTFUL AND EXCLUDED NAMES

There are a number of names in *Myristica* which do not belong to the family (but alternatively to, e.g., *Annonaceae*, *Lauraceae*, *Myrsinaceae*), or to other myristicaceous genera, including those from Africa and South America, remembering that in the foregoing century all *Myristicaceae* were described in the sole genus *Myristica*, chiefly by A. De Candolle (in his *Prodromus*), until King published his revision of the family for British India [Ann. Roy. Bot. Gard. Calcutta 3 (1891)]. Only since Warburg (1897) the modern genera were defined clearly.

Excluded and doubtful names were enumerated and discussed by Sinclair [Gard. Bull. Sing. 3 (1968) 480–488], and for New Guinea also by De Wilde [Blumea 40 (1995) 237–344]. Below follow some obscure names of true Malesian *Myristicas* (all New Guinean), doubtful in synonymy and to be excluded:

- Myristica avis paradisiacae* Warb. — Papua New Guinea; based on seeds only.
- Myristica costata* Warb. — Papua New Guinea; type lost, a doubtful species.
- Myristica finschii* Warb. — Papua New Guinea; a mixtum compositum now destroyed, of loose fruits of *M. inutilis* subsp. *papuana* and a leafy twig of *M. argentea*.
- Myristica macrocarya* Warb. — Papua New Guinea, based on seeds only.
- Myristica pseudo-argentea* Warb. — Papua New Guinea; seeds (or fruits?) only.
- Myristica resinosa* Warb. — NW Papua Barat; type destroyed, a doubtful species.

### PARAMYRISTICA

*Paramyristica* W.J. de Wilde, Blumea 39 (1994) 341–350, f. 1, 2. — Type species: *Paramyristica sepicana* (Foreman) W.J. de Wilde, based on *Myristica sepicana* Foreman.

Trees, dioecious. *Twigs* lenticellate, flaky, crowded scars of cataphylls at base of innovations usually present. *Leaves* brittle when dry, lower surface pale, papillose, dots absent; reticulation faint. *Inflorescences* (synflorescences) below the leaves, a compound panicle-like short-shoot 1–5 cm long, ending in a vegetative bud; partial inflorescences pedunculate, with flowers in subumbels of 5–10 in male, fewer in female; basal cataphylls absent; bracts caducous. *Flowers* long pedicellate, bracteole absent. *Male flowers*: perianth ± urceolate, leathery, inside glabrous except at base of androphore, creamy (?); buds ovoid, 5–7 mm long, cleft for 1/3 to nearly halfway, lobes 3, not reflexed in anthesis; androecium 4(–4.2) mm long, androphore slender, 1.5–2 mm long, glabrous, except for a dense collar of fine hairs at base, synandrium of c. 20 completely fused linear anthers, subglobose, 2–2.4 mm diameter, the central column deeply and broadly excavated nearly to the base. *Female flowers* not known. *Infructescences* 2–5 cm long, with 2–6 fruits. *Fruits* ovoid-ellipsoid, 4–5.5 cm long, woolly tomentose; pericarp ± thick, ± woody; aril lacinate to the base; seeds ellipsoid-oblong, 3 cm long, not variegated; cotyledons not known. — **Fig. 94.**

Distribution — *Malesia*: Papua New Guinea; one species. — Map 6 (see p. 5).

Notes — 1. Because the compound inflorescence is a short-shoot, with a vegetative terminal bud, the inflorescence can be named a synflorescence.

2. The deeply hollowed-out subglobose synandrium, in which the anthers curve in at the apex, is reminiscent of many species of *Horsfieldia*.

#### *Paramyristica sepicana* (Foreman) W.J. de Wilde

*Paramyristica sepicana* (Foreman) W.J. de Wilde, Blumea 39 (1994) 348, f. 1, 2. — *Myristica sepicana* Foreman, Contr. Herb. Austral. no. 9 (1974) 40, f. 2; Handb. Fl. Papua New Guinea 1 (1978) 209. — Type: *NGF 19516* (Sayers), Papua New Guinea.

Tree 5–25 m. *Twigs* (sub)terete, 3–6(–7) mm diameter, with minute ± appressed pale or bright rusty hairs 0.2–0.5 mm long, glabrescent, bark greyish, coarsely striate, when older ashy or blackish, conspicuously cracked and flaky, with ± concolorous lenticels; crowded scars of bud scales at base of innovations. *Leaves* chartaceous, elliptic-oblong or oblong-oblancheolate, 21–45 by (5–)8–17 cm, base rather gradually cuneate, apex

broadly acute with acute(-acuminate) or  $\pm$  blunt tip; upper surface (greenish) olivaceous, lower surface glabrous, grey(-brown) with the yellowish nerves contrasting; strongly papillose; dots absent; midrib in large leaves to 5 mm wide, flat or slightly raised above;

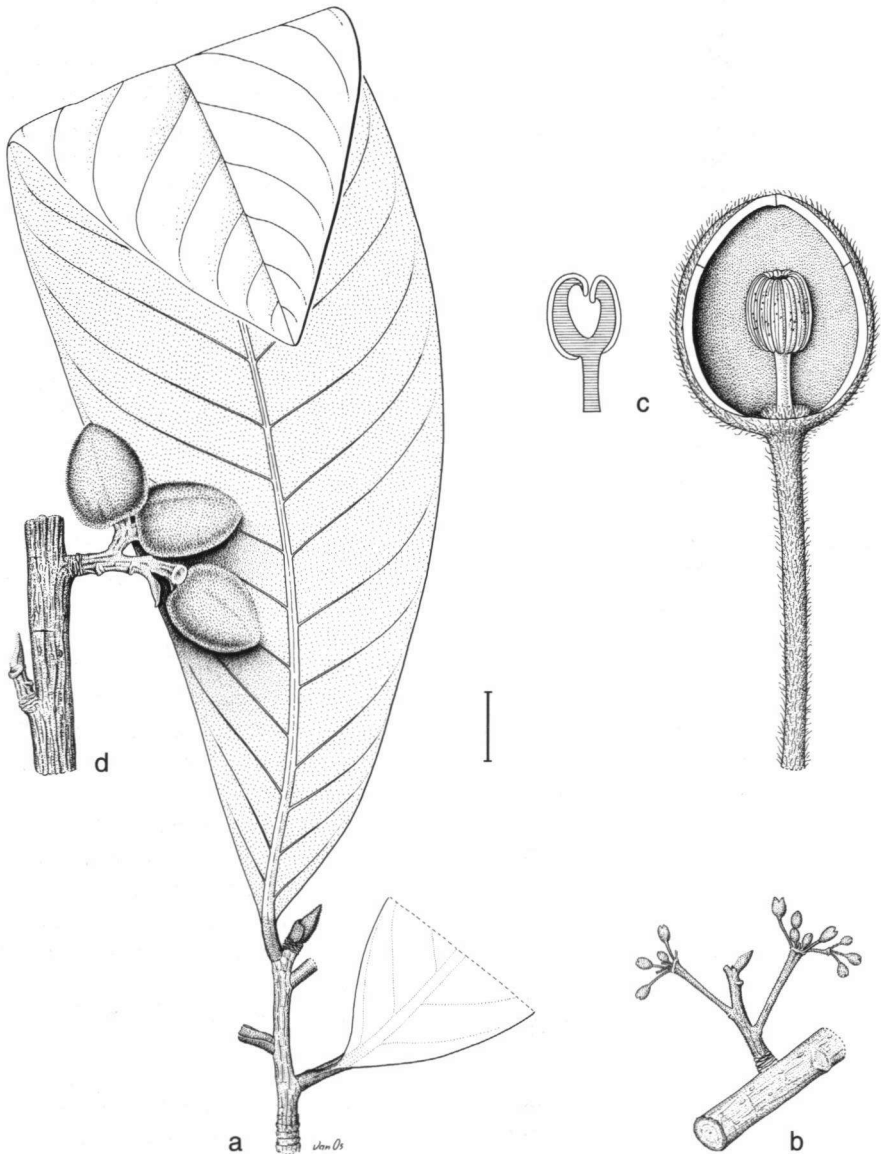


Fig. 94. *Paramyristica sepicana* (Foreman) W.J. de Wilde. a. Leafy twig apex; note sterile apical bud with scale and scale scars, and congested scars of scales lower down at transition with previous innovation; b. male synflorescence; note apical bud; c. male bud, opened, and schematic longitudinal section of androecium showing hollowed-out central column; d. infructescence on older wood of twig, fruits somewhat immature [a: LAE 52983 (and NGF 48265); b, c: NGF 19516; d: LAE 73769]. — Scale bar for a, b, d = 2 cm; for c = 2 mm.

nerves 15–22 per side, at 45–60(–70)° to the midrib, slender, flat above, much raised below, lines of interarching indistinct, venation faint on both surfaces; petiole (6–)10–20 by 4–6 mm, brown or blackish, contrasting with light brown midrib and grey twigs; apical leaf bud (sub)acute, 10–15 by 4–6 mm, with appressed dull brown hairs 0.5 mm, at base with few or several bud scales, mostly with the apical part broken off. *Inflorescences* apically or below the leaves, compound; synflorescences consisting of short-shoots (1–)2–4 cm long, always ending in a sterile vegetative bud 0.5(–1) cm long, and with scars of cataphylls at base, the partial inflorescences 3–5, distichous, in the axils of fallen cataphylls, with shaggy bright rusty hairs 0.5(–1) mm, peduncle flattened; flowers with shaggy yellow-brown hairs 0.5(–1) mm long, bracts irregularly broadly rounded, ± convex, 5–10 mm diameter, early shed, leaving distinct scars. *Male synflorescences* 3–6 cm long; partial inflorescences with peduncle 1–3 cm long, rachis up to 15 mm, with 1–3 subumbels of 5–10 flowers, buds in equal stages of development. *Female synflorescences* (from infructescences) possibly always on the older wood, 1–4 cm long, with partial inflorescences 1 cm long, each few-flowered; female flowers not seen. *Male flowers*: pedicel slender, (5–)8–10 by 0.8(–1) mm, bracteole absent; buds ovoid, (5–)6–7 by (4–)5 mm, not angular, apex rounded, base broadly rounded, inside glabrous, cleft c. 1/3 to nearly halfway, into 3 (or 4) lobes, 2.5–3 mm long, at sutures 0.2–0.3 mm thick; androecium 4–4.2 mm long, androphore slender, 1.5(–2) by (0.3–)0.4 mm, finely striate, glabrous, except for a basal collar of dense curly brown hairs 0.3–0.4 mm long, synandrium subglobose or broadly ellipsoid, truncate or depressed at both ends, 2–2.4 by 2 mm, at apex deeply hollowed out nearly to the base; anthers probably c. 20 (i.e., c. 40 linear thecae), contiguous, partially curving into the apical hollow, sterile apex absent. *Infructescences* 2–6-fruited, on the older wood below the leaves, 2–4(–5) cm long, bark of branches fissured and flaking. *Fruits* ovoid-ellipsoid, (4–)5–5.5 by 2.5(–3) cm, base rounded or truncate, apex narrowed, subacute, or somewhat uncinately, hairs woolly, rusty, 1–1.5 mm long; pericarp rather woody, 5–7 mm thick, seeds ellipsoid-oblong, 3 by 1.5 cm, with impressions of the aril lobes; fruiting pedicel 3–6 by 3–5 mm, without bracteole scar, pubescent. — **Fig. 94.**

**Field-notes** — Bole to 8 m, branches horizontal or slightly pendulous. Bark brown or black, finely longitudinally fissured, smooth, or peeling in large sheets; inner bark light (reddish) brown, with red sap; wood soft, straw, or pale reddish brown. Leaves glossy and light green above, whitish, or almost glaucous below. Inflorescence covered with brown indumentum; inflorescences and infructescences ramiflorous; flowers cream. Fruits with dark brown or reddish brown indumentum, aril red.

**Distribution** — *Malesia*: Papua New Guinea (a restricted area in West and East Sepik Prov.).

**Habitat & Ecology** — Lowland forest on ridges, on flats near creeks, and swamp forest dominated by *Calamus* species; 30–300 m altitude; fl. Mar.; fr. throughout the year.

**Note** — *Paramyristica sepicana* much resembles some species of *Myristica* from New Guinea. Because of its papillose leaf undersurface it would key out in the genus *Myristica* beside *M. ornata*. However, it does not at all resemble the latter in habit or in fruit. The present species seems rather more related to *M. markgraviana*, *M. carrii*, and *M. hooglandii*, all with a similar androecium and, indeed, in habit approaching the latter two species. For differences between *Myristica* and *Paramyristica*, see De Wilde (l.c.: 344–347).

## LEGENDS OF THE COLOUR PHOTOGRAPHS

Photographs 1–9 (between pages 8 and 9):

1. *Gymnacranthera bancana* (Miq.) J. Sinclair  
*De Wilde & Duyffes 20635* — Sumatra
2. *Gymnacranthera farquhariana* (Hook. f. & Thomson) Warb. var. *farquhariana*  
*De Wilde & Duyffes 20542* — Sumatra
3. *Gymnacranthera forbesii* (King) Warb. var. *forbesii*  
*De Wilde & Duyffes 20648* — Sumatra
4. *Myristica fatua* Houtt. subsp. *fatua*  
*De Wilde & Duyffes 21921* — Hortus Bogoriensis (origin Ambon)
5. *Knema glauca* (Blume) Petermann var. *glauca*  
*De Wilde & Duyffes 21923* — Hortus Bogoriensis (origin Ambon)
6. *Knema kinabaluensis* J. Sinclair  
*SAN 141918 (De Wilde & Duyffes)* — Sabah
7. *Knema sumatrana* (Blume) W.J. de Wilde  
*De Wilde & Duyffes 19860* — Sumatra
8. *Horsfieldia wallichii* (Hook. f. & Thomson) Warb. — Bark slash  
*De Wilde & Duyffes 20151* — Sumatra
9. *Myristica iners* Blume — Stilt-roots  
*Geesink & Santisuk 5353* — Peninsular Thailand

Photographs nos. 1–8 by W.J.J.O. de Wilde; no. 9 by R. Geesink

## INDEX TO SCIENTIFIC PLANT NAMES

Numbers refer to page numbers. Infrageneric epithets have been entered directly under the generic name to which they belong, preceded by the indication of their rank (sect., subsect., etc.). Intraspecific epithets have been entered under the specific name to which they belong, preceded by the indication of their rank (subsp., var., forma, etc.).

Some frequently occurring author names are abbreviated here, viz.: JS (= J. Sinclair), Hk.f. & Th. (= Hook. f. & Thomson), and WJdW (= W. J. de Wilde).

Synonyms have been printed in *italics*. Page numbers in **bold type** denote main treatment; page numbers with an asterisk refer to a drawing.

- Cnema glomerata* 135  
*Comacum* Adans. 359  
*Embelia ridleyi* King & Gamble 30  
*Endocomia* WJdW 3 (map), 28, 29  
   *canarioides* (King) WJdW 30, 36\*  
   *macrocoma* (Miq.) WJdW 30, 31  
     subsp. *longipes* WJdW 32, 33, 34\*  
     subsp. *macrocoma* 32, 34\*, 36\*  
     subsp. *prainii* (King) WJdW 32, 35, 36\*  
   *rufirachis* (JS) WJdW 30, 34\*, 36\*, 38  
   *virella* WJdW 30, 39  
*Gymnacranthera* (A. DC.)  
   *Warb.* 3 (map), 28, 40  
   *acuminata* Merr. 47  
   *apiculata* Warb. 46  
   *bancana* (Miq.) JS 40, 41, 42\*  
     var. *borneensis* (Warb.) JS 41  
   *contracta* Warb. 41, 43  
   *crassinervis* Warb. 50  
   *cryptocaryoides* Elmer 344  
   *eugeniifolia* (A. DC.) JS 46  
     var. *eugeniif* 46  
     var. *griffithii* (Hk.f.) JS 45  
   *farquhariana* (Hk.f. & Th.) Warb. 41, 44, 45  
     var. *eugeniifolia* (A. DC.) Schouten 45, 46  
     var. *farquhariana* 45  
     var. *griffithii* (Hk.f.) Warb. 45  
     var. *griffithii* auct. 165  
   (*Gymnacranthera farquhariana*)  
     var. *major* (King) Gamble 46  
     var. *paniculata* (A. DC.) Schouten 45, 47  
     var. *zippeliana* (Miq.) Schouten 45, 47  
   *farquhariana* auct. 46  
   *forbesii* (King) Warb. 41, 48  
     var. *crassinervis* (Warb.) JS 49, 50  
     var. *forbesii* 49  
   *ibutii* Holthuis 33  
   *lanceolata* Merr. 405  
   *laxa* Elmer 47  
   *macrobotrys* Merr. 47  
   *maliliensis* Schouten 41, 50, 51\*, 52\*  
   *murtonii* (Hk.f.) Warb. 41  
     var. *borneensis* Warb. 41  
   *negrosensis* Elmer 446  
   *ocellata* Schouten 41, 42\*, 51  
   *paniculata* (A. DC.) Warb. 47  
     var. *paniculata* 47  
     var. *zippeliana* (Miq.) JS 47  
   *stenophylla* Warb. 346, 347  
   *sulphurascens* Elmer 569  
   *urdanetensis* Elmer 446  
   *zippeliana* (Miq.) Warb. 47  
*Horsfieldia* Willd. 4 (map), 28, 29, 54  
   sect. *Bivalves* JS 56  
   sect. *Orphanthera* Warb. 55  
   sect. *Irya* (Hk.f. & Th.) Warb. 56  
     subsect. *Euirya* Warb. 57  
     subsect. *Eyirya* Warb. 56  
     subsect. *Trivalves* Warb. 57  
   sect. *Orphanthera* Warb. 57  
   (*Horsfieldia*)  
     sect. *Pyrrhosa* (Bl.) Warb. 57  
       subsect. *Bivalves* Warb. 56  
       subsect. *Eupyrhosa* Warb. 57  
       subsect. *Papillosae* Warb. 29  
   sect. *Trivalves* JS  
     subsect. *Orphanthera* (Warb.) JS 55  
     subsect. *Trivalves* 57  
   *acuminata* Merr. 132  
   *affinis* WJdW 177  
   *amklaal* Kaneh. 132  
   *ampla* Markgr. 64, 84  
   *ampliformis* WJdW 64, 84, 85, 86\*  
   *amplomontana* WJdW 71, 79, 87  
   *amygdalina* auct. 93  
   *androphora* WJdW 71, 79, 88\*, 89  
   *angularis* WJdW 64, 69, 82, 89  
   *ardisiifolia* (A. DC.) Warb. 64, 81, 90, 92\*  
   *aruana* (Blume) WJdW 64, 81, 82, 91  
   *aruensis* Warb. 199  
   *atjehensis* WJdW 67, 76, 93  
   *australiana* auct. 187  
   *bartlettii* Merr. 147  
   *basifissa* WJdW 65, 82, 94  
   *batjanica* Warb. 190  
   *bivalvis* (Hk.f.) Merr. 161  
   *borneensis* WJdW 71, 78, 95  
   *brachiata* (King) Warb. 69, 74, 76, 77, 96  
     var. *brachiata* 96  
     var. *laticostata* JS 143  
     var. *sumatrana* (Miq.) JS 170

## (Horsfieldia)

- bracteosa* Henderson 203  
var. *bracteosa* 202  
var. *microcarya* JS 161  
*canarifomis* (Blume) Merr.  
190  
*canarioides* (King) Warb. 30  
*carnosa* Warb. 69, 78, 98\*, 99  
*clavata* WJdW 65, 83, 100,  
109\*  
*confertiflora* Merr. 105  
*congestiflora* A.C. Sm. 132  
*coriacea* WJdW 72, 80, 101  
*corrugata* Foreman 65, 84,  
102\*, 103  
*coryandra* WJdW 65, 83, 104  
*costulata* (Miq.) Warb. 71, 80,  
105  
*crassifolia* (Hk. f. & Th.)  
Warb. 62, 72, 74, 76,  
106\*, 107  
*crassithyrsa* 105  
*crux-melitensis* Markgr. 65,  
83, 108, 109\*  
*decalvata* WJdW 65, 81, 110  
*discolor* WJdW 69, 78, 111  
*disticha* WJdW 70, 79, 112  
*elongata* WJdW 69, 73, 112,  
113\*  
*endertii* WJdW 71, 79, 114  
*erubescens* JS 187  
*flocculosa* (King) Warb. 68,  
73, 115  
*fragillima* Airy Shaw 67, 71,  
77, 79, 116, 117\*  
*fulva* (King) Warb. 67, 73,  
75, 119  
var. *paludicola* (King)  
Warb. 107  
*gigantifolia* Elmer 90  
*glabra* (Blume) Warb. 66, 72,  
76, 119, 121  
var. *glabra* 120, 121  
var. *javanica* WJdW 120,  
121  
var. *oviflora* WJdW 120,  
122  
*glabrescens* Warb. 126  
*globularia* (Blume) Warb.  
161  
var. *minahassae* Warb. 161  
*globularia* auct. 200

## (Horsfieldia)

- gracilis* WJdW 68, 77, 122,  
163\*  
*grandis* (Hk. f.) Warb. 68, 73,  
75, 77, 123  
*hellwigii* (Warb.) Warb. 66,  
84, 125  
var. *brachycarpa* WJdW  
126  
var. *hellwigii* 124\*, 126,  
173  
var. *lignosa* WJdW 126, 127  
var. *novobritannica* JS 140  
var. *pulverulenta* (Warb.) JS  
173  
*hirtiflora* WJdW 67, 69, 76,  
127, 128\*  
*inflexa* WJdW 63, 82, 129,  
130\*  
*iriana* WJdW 64, 82, 131  
*irya* (Gaertn.) Warb. 62, 72,  
74, 76, 80, 81, 132, 133\*  
*iryagedhi* (Gaertn.) Warb.  
62, 72, 74, 135, 136\*  
*kerangasicola* JS 178  
*labillardieri* Warb. 132  
*laevigata* (Blume) Warb. 66,  
80, 84, 137  
var. *laevigata* 138\*, 139, 140  
var. *novobritannica* (JS)  
WJdW 138\*, 139, 140  
*lancifolia* WJdW 65, 80, 141,  
142\*  
*laticostata* (JS) WJdW 70, 79,  
143  
*lauterbachii* Warb. 200  
*lemanniana* (A.DC.) Warb.  
132  
*lemanniana* auct. 169  
*leptantha* WJdW 66, 84, 144  
*leptocarpa* Warb. 33  
*leptosperma* 33  
*macilenta* WJdW 70, 74, 76,  
79, 145  
*macrobotrys* Merr. 151  
*macrocoma* (Miq.) Warb. 31  
var. *canarioides* (King) JS  
30  
var. *macrocoma* 32  
var. *rufirachis* JS 38  
*macrothyrsa* (Miq.) Warb. 72,  
76, 146

## (Horsfieldia)

- majuscula* (King) Warb. 72,  
73, 76, 147  
*megacarpa* Merr. 105  
*merrillii* Warb. 35  
*minahassae* (Warb.) Koord.  
161  
*minahassae* auct. 105  
*moluccana* WJdW 63, 83,  
148  
var. *moluccana* 81, 148, 149  
var. *petiolaris* WJdW 148,  
149  
var. *pubescens* WJdW 148,  
149  
var. *robusta* WJdW 148, 150  
*montana* Airy Shaw 71, 79,  
150  
*motleyi* Warb. 68, 77, 151  
*nervosa* WJdW 70, 79, 152  
*nesophila* (Miq.) Warb. 140  
*nesophila* auct. 200  
*novae-lauenburgiae* Warb.  
141  
*novo-guineensis* Warb. 91,  
131, 166  
var. *moseleyana* Warb. 216  
*nunu* Kaneh. 132  
*oblongata* Merr. 35  
*obscura* WJdW 72, 78, 153  
*obscurinervia* Merr. 63, 81,  
154  
*obtusa* WJdW 70, 79, 155  
*odorata* Willd. 135  
*olens* WJdW 69, 82, 155  
*oligocarpa* Warb. 68, 78, 156  
*olivaeformis* Warb. 33  
*pachycarpa* A.C. Sm. 65, 84,  
102\*, 157  
*pachyrachis* WJdW 69, 79,  
158  
*pachythyrsa* Warb. 105  
*pallidicaula* WJdW 67, 69, 77,  
78, 159  
var. *macrocarya* WJdW  
160, 161  
var. *microcarya* (JS) WJdW  
160, 161  
var. *pallidicaula* 160  
*papillosa* Warb. 35  
*parviflora* (Roxb.) JS 63, 72,  
81, 161

## (Horsfieldia)

- parviflora* auct. 190  
*paucinervis* Warb. 68, 77, **162**, 163\*  
*penangiana* JS 63, 72, 74, 76, **78, 164**  
 subsp. *obtusifolia* WJdW **165**  
 subsp. *penangiana* 74, **165**  
*perangusta* WJdW 67, 73, **166**  
*pilifera* Markgr. 66, 83, 138\*, **166**  
*polyantha* Warb. 140  
*polyantha* auct. 94  
*polyspherula* (Hk. f. em. King) JS 70, 74, 76, 80, **167**, 169, 208  
 var. *oligocarpa* (Warb.) JS 156  
 var. *maxima* WJdW 168, **169**  
 var. *polyspherula* 80, 168, **169**  
 var. *sumatrana* (Miq.) WJdW 168, **170**  
*praetermissa* JS 157  
*prainii* (King) Warb. 35  
*psilantha* WJdW 66, 83, **171**  
*pulcherrima* WJdW 68, 74, **75, 172**  
*pulverulenta* Warb. 66, 84, **172**  
*punctata* WJdW 71, 72, 74, **174**  
*punctatifolia* JS 72, 74, 76, 78, **175**  
*racemosa* (King) Warb. 30  
*ralunensis* Warb. 66, 84, **176**  
*ralunensis* auct. 141  
*ramosii* Merr. 154  
*ramuensis* Warb. 200  
*reticulata* Warb. 68, 77, 163\*, **177**  
*ridleyana* (King) Warb. 70, 73, **79, 178**  
*rostrata* Markgr. 201  
*roxburghii* Warb. 190  
*rufo-lanata* Airy Shaw 68, 77, **179**  
*sabulosa* JS 66, 77, **180, 181\***  
*samarensis* WJdW 64, 81, **182**  
*schlechteri* Warb. 65, 82, **182**, 183\*

## (Horsfieldia)

- sepikensis* Markgr. 71, 82, **184, 185\***  
*sessilifolia* WJdW 67, 77, **186**  
*sinclairii* WJdW 66, 83, **187**  
*smithii* Warb. 63, 81, **188**  
*solomonensis* A.C. Sm. 216  
*sp.* Merr. 161  
*sparsa* WJdW 67, 73, 75, **189**  
*spicata* (Roxb.) JS 63, 81, **190**, 191\*  
 var. *sepikensis* (Markgr.) JS 184  
*splendida* WJdW 68, 77, **192**, 194\*  
*squamulosa* WJdW 65, 83, 109\*, **193**  
*squamulosa* auct. 104  
*sterilis* WJdW 63, 77, **196**  
*subalpina* JS 72, **197**  
 subsp. *kinabaluensis* WJdW 78, 197, **198**  
 subsp. *subalpina* 73, 197, **198**  
*subglobosa* (Miq.) Warb. 132  
 var. *brachiata* (King) JS 96  
*subglobosa* auct. 170  
*subtilis* (Miq.) Warb. 65, 82, **198**  
 var. *aucta* WJdW 199, **200**  
 var. *calcarea* WJdW 199, **200**  
 var. *rostrata* (Markgr.) JS 199, **201**  
 var. *schlechteri* (Warb.) JS 182  
 var. *subtilis* 81, 82, 183\*, **199**  
*sucosa* (King) Warb. **201**, 202  
 subsp. *bifissa* WJdW 63, 77, 202, **203**  
 subsp. *sucosa* 67, 69, 73, **75, 202**  
*sucosa* auct. 189  
*superba* (Hk. f. & Th.) Warb. 67, 73, 75, **203**  
*sylvestris* (Houtt.) Warb. 64, 80, 82, **204**, 206\*  
 var. *villosa* Warb. 204  
*talauensis* WJdW 64, 81, **207**  
*tenuifolia* (JS) WJdW 70, 79, **208, 209\***

## (Horsfieldia)

- tomentosa* Warb. 68, 73, 75, **210**  
*triandra* WJdW 67, 75, **211**, 212\*  
*trifida* A.C. Sm. 35  
*tristis* WJdW 67, 75, 78, **213**  
*tuberculata* (K. Sch.) Warb. 65, 83, **215**, 216  
 var. *crassivalva* WJdW 215, **216**  
 var. *tuberculata* 214\*, 215, **216**  
*urceolata* WJdW 65, 83, **217**  
*valida* (Miq.) Warb. 71, 75, **79, 218**  
*villamilii* Merr. 105  
*vulcanica* Merr. 105  
*wallichii* (Hk. f. & Th.) Warb. 68, 69, 74, 76, 77, 78, **219**  
*warburgiana* Elmer 90  
*xanthina* Airy Shaw 72, 78, **220**  
 subsp. *macrophylla* WJdW 220, **221**  
 subsp. *xanthina* 220, **221**  
**Knema** Lour. 4 (map), 27, 29, **222**  
*acuminata* Merr. 267  
*alvarezii* Merr. 229, 242, **243**  
*andamanica* (Warb.) WJdW 224, **244**  
 subsp. *nicobarica* (Warb.) WJdW 235, 237, **244**  
*ashtonii* JS **245**  
 var. *ashtonii* 228, 240, **245**  
 var. *cinnamomea* 224, 238, 245, 246\*, **247**  
*bicolor* Rafin. 266  
*cantlyi* (Hk. f.) Warb. 294  
*celebica* WJdW 232, 243, **247, 248\***  
*cenabrei* Merr. & Quis. 274  
*cinerea* (Poir.) Warb. 243, **249**  
 var. *alpina* JS 279  
 var. *andamanica* (Warb.) JS 244  
 var. *cordata* (JS) JS 332  
 var. *patentinervia* JS  
 forma *longipedicellata* JS 347  
 forma *patentinervia* JS 319



## (Knema cinerea)

- var. *rubens* (JS) JS 337  
 var. *sumatrana* (Blume) JS 350  
 var. *sumatrana* auct. 262, 264  
 communis JS 232, 235, **250**  
 conferta (King) Warb. 233, 236, 239, **251**  
 var. *borneensis* Warb. 289  
 var. *scortechinii* (King) Warb. 340  
*coriacea* Warb. 279  
*corticosa* Lour. 266  
*curtisii* (King) Warb. 227, 233, 239, 252, 253\*, **254**  
 var. *amoena* JS 222\*, 254, **255**  
 var. *arenosa* JS 254, **255**  
 var. *curtisii* 236, 253\*, **254**  
 var. *linguiformis* JS 295  
 var. *paludosa* JS 253\*, 254, **256**  
*elmeri* Merr. 222\*, 224, 237, **256**  
*elongata* Warb. 289  
*emmae* WJdW 227, 240, **257**  
*furfuracea* (Hk.f. & Th.) Warb. 225, 233, 236, **258**  
*furfurascens* Gand. 295  
*galeata* JS 227, 238, 239, **259**, 260\*  
*geminata* (Miq.) Warb. 264  
*gitingensis* Elmer 267  
*glauca* (Blume) Petermann 231, 235, 237, 241, 242, 261, **262**  
 var. *andamanica* Warb. 244  
 var. *bancana* Warb. 351  
 var. *glauca* **262**  
 var. *nicobarica* Warb. 244  
 var. *riparia* WJdW 262, **263**  
 var. *sumatrana* (Blume) Warb. 350  
*glauca* auct. 267  
*glaucescens* Jack 232, 235, 237, 241, **264**  
 var. *cordata* JS 332  
 var. *glaucescens* forma *rubens* JS 337  
 var. *glaucescens* auct. 262  
 var. *patentinervia* JS 319

## (Knema)

- glaucescens* auct. 350  
*globularia* (Lam.) Warb. 227, 229, 230, 234, 236, **265**  
*glomerata* (Blanco) Merr. 229, 240, 242, **267**  
*heterophylla* (Fern.-Vill.) Warb. 267  
 var. *pubescens* Warb. 267  
*hirtella* WJdW 232, 242, **268**  
 var. *hirtella* **269**  
 var. *pilocarpa* WJdW **269**  
 var. *stylosa* WJdW 348  
*hookeriana* (Hk.f. & Th.) Warb. 225, 233, 236, **270**  
*insularis* Merr. 274  
*intermedia* (Blume) Warb. 228, 234, 236, 240, **271**  
 var. *dubia* Warb. 333  
*kinabaluensis* JS 230, 241, **272**  
*korthalsii* Warb. 228, 240, 242, 273, **274**  
 subsp. *korthalsii* 273, **274**  
 subsp. *rimosa* WJdW 226, 273, **274**  
*kostermansiana* WJdW 230, 241, **275**  
*krusemaniana* WJdW 233, 239, **276**  
*kunstleri* (King) Warb. 233, 238, 277, **278**  
 subsp. *alpina* (JS) WJdW 278, **279**  
 subsp. *coriacea* (Warb.) WJdW 278, **279**  
 subsp. *kunstleri* 233, **278**  
 subsp. *leptophylla* WJdW 278, 280\*, **281**  
 subsp. *macrophylla* WJdW 236, 278, **281**  
 subsp. *parvifolia* (Merr.) WJdW 243, 278, **282**  
 subsp. *pseudostellata* WJdW 278, **282**  
 var. *surigaoensis* JS 344  
*lamellaria* WJdW 225, 233, **283**  
*lampongensis* WJdW 225, 236, 238, **283**

## (Knema)

- latericia* Elmer 226, 233, 238, **284**  
 subsp. *albifolia* (JS) WJdW 285, **287**, 288\*  
 subsp. *latericia* 230, 242, **285**  
 var. *latericia* 286\*, **287**  
 var. *subtilis* WJdW 242, 286\*, **287**  
 subsp. *ridleyi* (Gand.) WJdW 236, 285, **289**  
 forma *nana* WJdW 288\*, **290**  
 forma *olivacea* WJdW **290**  
 forma *ridleyi* **290**  
 var. *albifolia* JS 287  
 var. *latericia* 285  
 var. *latericia* auct. 289  
 var. *lunduensis* JS 301  
*latifolia* Warb. 222\*, 227, 236, 240, **291**, 292\*  
*laurina* (Blume) Warb. 223, 234, 236, 239, **293**, 294  
 var. *heteropilis* WJdW 224, 294, **295**  
 var. *laurina* **294**  
 var. *malayana* Warb. 329  
 var. *minahassae* Warb. 345  
*linguiformis* (JS) WJdW 227, 239, **295**, 296\*  
*linguiformis* auct. 357  
*longepilosa* (WJdW) WJdW 225, 238, **297**, 298\*  
*losirensis* WJdW 232, 237, **299**, 300\*  
*lunduensis* (JS) WJdW 226, 238, **301**  
*luteola* WJdW 230, 241, **301**  
*malayana* Warb. 231, 235, **302**  
*mamillata* WJdW 228, 239, **303**, 304\*  
*mandaharan* (Miq.) Warb. 226, 234, 236, **305**  
*matanensis* WJdW 230, 242, **306**, 307\*  
*membranifolia* H. J. P. Winkler 222\*, 226, 228, 238, 239, 308\*, **309**  
*meridionalis* JS 289

## (Knema)

- mindanaensis* auct. 274  
*minima* WJdW 229, 240,  
 288\*, **310**  
*missionis* (King) Warb. 266  
*mogeana* WJdW 232, 242,  
**310, 312\***  
*muscosa* JS 232, 238, **311**  
*nitida* Merr. 291  
*oblongata* Merr. 226, 240,  
**313**  
 subsp. *oblongata* **314, 315\***  
 subsp. *parviflora* WJdW  
**314, 316**  
 subsp. *pedunculata* WJdW  
**314, 316**  
*oblongifolia* (King) Warb.  
 223, 234, **316**  
 var. *monticola* (King) Warb.  
 316  
*obovoidea* Merr. 314  
*palembanica* (Miq.) Warb.  
 262  
*palless* WJdW 225, 238, **317,**  
**318\***  
*parvifolia* Merr. 282  
*patentinervia* (JS) WJdW  
 231, 235, 237, **319**  
*pectinata* Warb. 229, 240, **320**  
 subsp. *pectinata* **321**  
 subsp. *vestita* WJdW **321**  
*pedicellata* WJdW 233, 239,  
**322\*, 323**  
*peltata* (Roxb.) Warb. 249  
*percoriacea* JS 225, 238, **324**  
 forma *fusca* WJdW **325**  
 forma *longepilosa* WJdW  
 297  
 forma *percoriacea* **325**  
 forma *sarawakensis* WJdW  
**325**  
*piriformis* WJdW 226, 241,  
**326**  
*plumulosa* JS 228, 234, **327**  
*pseudolaurina* WJdW 224,  
 234, 236, **328\*, 329**  
*psilantha* WJdW 225, 238,  
**329**  
*pubiflora* WJdW 232, 239,  
**330, 331\***  
*pulchra* (Miq.) Warb. 226,  
 234, 241, **332**

## (Knema)

- retusa* (King) Warb. 224, 233,  
**333**  
*riangensis* WJdW 232, 241,  
**334**  
*ridsdaleana* WJdW 227, 242,  
**335**  
*rigidifolia* JS 235, **336**  
 subsp. *camerona* WJdW  
 226, 336, **337**  
 subsp. *rigidifolia* 231, **336**  
*rubens* (JS) WJdW 230, 234,  
 237, **337**  
*rufa* Warb. 227, 240, **338\*, 339**  
*scortechinii* (King) JS 229,  
 232, 235, 237, **340**  
*sericea* WJdW 224, 238, **340**  
*sphaerula* (Hk. f. & Th.) Airy  
 Shaw 266  
*steenii* WJdW 226, 243,  
**341, 342\***  
*stellata* Merr. 233, 243, **343**  
 subsp. *cryptocaryoides*  
 (Elmer) WJdW **344**  
 subsp. *minahassae* (Warb.)  
 WJdW 344, **345**  
 subsp. *stellata* **344**  
*stenocarpa* Warb. 229, 242,  
**345**  
*stenophylla* (Warb.) JS 231,  
 235, 237, **346, 347**  
 subsp. *longipedicellata* (JS)  
 WJdW 241, **347**  
 subsp. *stenophylla* **347**  
*stylosa* (WJdW) WJdW 241,  
**348**  
*subhirtella* WJdW 226, 232,  
 242, **349**  
*sumatrana* (Blume) WJdW  
 231, 235, 237, **350**  
*tomentella* (Miq.) Warb. 230,  
 242, **351**  
*tridactyla* Airy Shaw 229,  
 240, **352**  
 subsp. *pachydactyla* WJdW  
**353**  
 subsp. *salicifolia* WJdW  
**353, 355**  
 subsp. *sublaevis* WJdW  
 231, 240, **288\*, 353, 355**  
 subsp. *tridactyla* **353, 353,**  
**354\***

## (Knema)

- uliginosa* JS 228, 240, **355**  
*umbellata* Warb. 291  
*vidalii* Warb. 267  
*viridis* WJdW 227, 239, **356\*,**  
**357**  
*winkleri* Merr. 291  
*woodii* JS 222\*, 229, 240,  
**358**  
*wrayi* (King) Warb. 350  
*Litsea rumphii* (Blume) Fern.-  
 Vill. 555, 556  
**Myristica** Gronov. 5 (map), 27,  
 28, **359**  
 sect. *Caloneura* A. DC. 57  
 sect. *Eumyristica* Hk. f. & Th.  
 55, 57  
 subsect. *Horsfieldia*  
 (A. DC.) King 55  
 sect. *Gymnacranthera* A. DC.  
 40  
 sect. *Horsfieldia* A. DC. 55  
 sect. *Irya* Hk. f. & Th. 56  
 sect. *Irya* auct. 55, 57  
 sect. *Knema* Blume 222  
 sect. *Myristica* Blume 359  
 sect. *Pyrhrosa* Blume 54–57  
*affinis* Warb. 463  
*agusanensis* Elmer 362, 364,  
 375, **398, 405**  
 subsp. *agusanensis* 400,  
**405**  
 subsp. *squamulosa* WJdW  
 400, **405**  
*alba* WJdW 366, 377, 379,  
**403\*, 406**  
*albertisii* Warb. 485  
*amboinensis* Gand. 470  
*amplifolia* Warb. 41  
*anceps* Warb. 588  
*andamanica* Hook. f. 367  
*apiculata* (Warb.) Boerl. 46  
*archboldiana* A. C. Sm. 384,  
 390, **407**  
*ardisiiifolia* A. DC. 90  
*arfakensis* WJdW 381, 382,  
**407**  
*argentea* Warb. 384, 390,  
**408**  
*aromatica* Lam. 470  
*aruana* Blume 91  
*aruensis* (Warb.) Boerl. 199

## (Myristica)

- atrescens* WJdW 385, 390, 409  
*atrocorticata* WJdW 388, 394, 410  
*avis paradisiacae* Warb. 619  
*bancana* Miq. 41  
*basilanica* WJdW 367, 375, 411  
*batjanica* (Warb.) Boerl. 190  
*bäuerlenii* Warb. 484  
*beccarii* Warb. 368, 372, 413  
*bialata* Warb. 382, 398, 414  
 var. *bialata* 412\*, 415\*, 416  
 var. *brevipila* WJdW 412\*, 416, 417  
*bifurcata* (JS) WJdW 365, 376, 389, 417  
 subsp. *bifurcata* 367, 377, 379, 384, 403\*, 418  
 subsp. *sulaica* WJdW 367, 377, 379, 418, 419  
*bivalvis* Hk. f. 161  
*borneensis* Warb. 362, 371, 419, 420\*  
*borneensis* Gand. 609  
*brachiata* King 96  
*brachypoda* WJdW 386, 391, 402\*, 422  
*bracteata* A. DC. 543  
*bracteata* auct. 523  
*brassii* A. C. Sm. 380, 422  
*brevistipes* WJdW 386, 392, 402\*, 423  
*buchneriana* Warb. 388, 394, 397, 398, 424  
*byssacea* WJdW 388, 392, 425  
*caesia* Span. 249  
*cagayanensis* Merr. 367, 375, 426, 427\*  
*calocarpa* Miq. 459  
*canariformis* Blume 190  
*canarioides* King 30  
*cantleyi* Hk. f. 294  
*cantleyi* auct. 333  
*carnosa* (Warb.) Boerl. 99  
*carrii* JS 395, 428  
*celebica* Gand. 463  
*celebica* Miq. 569

## (Myristica)

- ceylanica* A. DC.  
 var. *cagayanensis* (Merr.) JS 426  
 var. *ceylanica* auct. 447  
*chalmersii* Warb. 482  
*chrysophylla* JS 386, 389, 394, 396, 429  
 subsp. *chrysophylla* 401\*, 430  
 subsp. *entrecasteauxensis* (JS) WJdW 398, 430, 431  
 var. *entrecasteauxensi* 431  
*cimicifera* R. Br. 499  
 var. *acutifolia* Warb. 499  
 var. *insipida* (R. Br.) Warb. 499  
*cinerea* Poir. 249  
*cinnamomea* King 364, 369, 370, 374, 431  
*clemensii* A. C. Sm. 384, 389, 433  
*coacta* WJdW 389, 392, 434  
*colinridsdalei* WJdW 365, 374, 434  
*collettiana* King 170  
*commersonii* Blume 541  
*concinna* JS 386, 391, 435  
*conferta* King 251  
 var. *borneensis* (Warb.) Boerl. 289  
*conspersa* WJdW 381, 436  
*contracta* (Warb.) Boerl. 43  
*cookii* Warb. 484  
*coriacea* (Warb.) Boerl. 279  
*cornutiflora* JS 381, 382, 437  
 subsp. *cornutiflora* 399\*, 438  
 subsp. *elegans* WJdW 438, 439  
*corticata* WJdW 363, 372, 439  
*corticiosa* (Lour.) Hk. f. & Th. 265, 271  
 var. *amplifolia* Miq. 351  
 var. *ceramensis* Miq. 351  
 var. *lanceolata* Miq. 262  
 var. *sumatrana* (Blume) Miq. 350  
 var. *tomentella* Miq. 351  
*corticosa* auct. 262, 267, 302  
*costata* Warb. 578, 619

## (Myristica)

- costulata* Miq. 105  
*crassa* King 365, 368, 371, 440, 441\*  
*crassifolia* Hk. f. & Th. 107  
*crassinervis* (Warb.) Boerl. 50  
*crassipes* Warb. 383, 387, 391, 393, 442, 444  
 subsp. *altmontana* WJdW 444, 445  
 subsp. *crassipes* 401\*, 444, 548\*  
 subsp. *marronia* WJdW 444, 445  
*cucullata* Markgr. 380, 445  
*cucullata* auct. 454  
*cumingii* Warb. 364, 367, 375, 446  
 var. *floribunda* Airy Shaw 494  
*curtisii* King 252, 254  
*cylindrocarpa* JS 385, 390, 448  
*dasycarpa* WJdW 382, 449, 450\*  
*depressa* WJdW 364, 369, 370, 451  
*devogelii* WJdW 366, 373, 452  
*discolor* Merr. 568  
*diversifolia* Miq. 512  
*duplopunctata* WJdW 380, 452  
 subsp. *duplopunctata* 453  
 subsp. *versteeghii* WJdW 453, 454  
*edulis* F. Muell. 204  
*elliptica* Hk. f. & Th. 361, 369, 370, 454, 455\*  
 var. *celebica* (Miq.) JS 569  
 var. *elliptica* 459  
 var. *simiarum* (A. DC.) JS 565, 568  
*elliptilimba* Merr. 569  
*ensifolia* JS 384, 389, 457  
*eugeniifolia* A. DC. 46  
*eurycarpa* Warb. 485  
*extensa* WJdW 362, 371, 457  
*fallax* Warb. 363, 371, 459  
*faroensis* Hemsl. 561  
*farquhariana* Hk. f. & Th. 44, 45, 46

## (Myristica)

- farquhariana* auct. 46, 47  
*fasciculata* WJdW 383, **460**  
*fatua* auct. 463, 609  
*fatua* Houtt. 366, 368, 397, **460**  
 subsp. *affinis* (Warb.)  
 WJdW 373, 462, **463**  
 subsp. *fatua* 372, 374, 376, 377, 378, 401\*, 403\*, 461, **462**  
 var. *affinis* (Warb.) JS 463  
 var. *fatua* 462  
 var. *ingens* Foreman 495  
 var. *macrocarpa* Miq. 462  
 var. *morindiifolia* (Blume) JS 584  
 var. *morobensis* JS 434  
 var. *morotaiensis* JS 529  
 var. *papuana* Markgr. 503  
 var. *quercicarpa* JS 550  
 var. *sangowoensis* JS 557  
 var. *spanogheana* (Miq.) JS 556  
 var. *subcordata* (Blume) Miq. 583  
 var. *wenzelii* (Merr.) JS 615  
*ferruginea* King 41  
*filipes* WJdW 386, 393, **463**  
*finschii* Warb. 408, 503, 619  
*firmipes* JS 388, 392, **464**  
*fissiflora* WJdW 382, **465**  
 subsp. *fissiflora* **466**  
 subsp. *kostermansii* WJdW 466, **467**  
*fissurata* WJdW 365, 376, 378, 403\*, **467**  
*flavovirens* WJdW 381, 382, **468**  
*flocculosa* King 115  
*flosculosa* JS 387, 393, 402\*, **469**, 548\*  
*flosculosa* auct. 425  
*forbesii* King 49  
*fragrans* Houtt. 365, 376, 379, 399\*, 403\*, **470**, 471\*  
*fragrans* auct. 569  
*frugifera* WJdW 362, 374, **472**  
*fugax* WJdW 385, 391, **473**  
 subsp. *fugax* **474**  
 subsp. *septentrionalis* WJdW 474, **475**

## (Myristica)

- fulva* King 119  
*furfuracea* Hk. f. & Th. 258  
*furfuracea* auct. 333  
*fusca* Markgr. 396, **475**  
*fusifformis* WJdW 385, 391, **476**  
 subsp. *fusifformis* 402\*, 476, **477**  
 subsp. *pseudostipitata* WJdW 401\*, 402\*, 476, **477**  
*garciniifolia* Warb. 395, **477**, 478\*  
*geminata* Miq. 264  
*geminata* auct. 347  
*gigantea* King 363, 369, 370, 371, 372, **479**  
*glabra* Blume 119, 121  
 var. *grandifolia* Miq. 121  
 var. *sumatrana* Miq. 170  
*glabra* De Vriese 271  
*glauca* Blume 261, 262  
 var. *bancana* (Warb.) Boerl. 351  
 var. *sumatrana* (Blume) Miq. 350  
*glauca* auct. 271, 556  
*glaucescens* (Jack) Hk. f. & Th. 264  
*glaucescens* auct. 266, 267, 302, 327  
*globosa* Warb. 388, 394, **480**  
 subsp. *chalmersii* (Warb.) WJdW **482**  
 subsp. *globosa* **482**  
*globosa* auct. 514, 596  
*globularia* Blume 161  
 var. *subglobosa* (Miq.) Miq. 132  
*globularia* Lam. 265  
*globularia* auct. 169  
*glomerata* Miq. 135  
*glomerata* Thunb. 135  
*glomerata* auct. 426  
*gracilipes* JS 387, 393, **483**  
*grandiflora* Wall. 543  
*grandis* Hk. f. 123  
*griffithii* Hk. f. 45  
*griffithii* auct. 46  
*guatteriifolia* A. DC. 364, 369, 372, 374, **483**

## (Myristica)

- hackenbergii* Diels 517  
*hellwigii* Warb. 125, 126  
*heritierifolia* Lecomte 494  
*heterophylla* Fern.-Vill. 267  
*heterophylla* K. Sch. 485, 578  
*heterophylla* auct. 426  
*hollrungii* Warb. 398, 399\*, **485**, 486\*  
*hooglandii* JS 395, 486\*, **487**  
*hookeriana* Hk. f. & Th. 270  
*horsfieldii* Blume 135  
*horsfieldia* auct. 107, 219  
*hyposticta* Miq. 591  
*impressa* Warb. 367, 373, **488**, 489\*  
*impressinervia* JS 365, 373, 489\*, **490**  
*inaequalis* WJdW 396, **491**, 492\*  
*incredibilis* WJdW 396, **493**  
*iners* Blume 363, 369, 371, 372, 375, 400\*, **493**  
*iners* auct. 267  
*ingens* (Foreman) WJdW 397, **495**  
*ingrata* WJdW 383, **496**  
 subsp. *ingrata* 412\*, **497**  
 subsp. *velata* WJdW **497**  
*inopinata* JS 396, **498**  
*insipida* R. Br. 367, 377, 380, 386, 391, 403\*, **499**, 500\*  
*integra* Wall. 170  
*intermedia* Blume 271  
 var. *minor* Miq. 262  
*inundata* WJdW 388, 389, 394, **502**  
*inutilis* A. Gray 368, 389, 392, 397, **502**  
 subsp. *papuana* (Markgr.) WJdW 377, 378, 397, **503**  
 var. *foremaniana* WJdW **504**  
 var. *papuana* **504**  
*iryga* Gaertn. 132  
 var. *crassifolia* Hk. f. 107  
 var. *longifolia* King 132  
 var. *wallichii* King 132  
*iryghedhi* Gaertn. 135  
*iteophylla* Miq. 271  
*javanica* Blume 132

## (Myristica)

- kalkmanii WJdW 398, **505**  
 kjellbergii WJdW 367, 373, **505**  
 koordersii Warb. 367, 373, **506**  
*koordersii* auct. 488  
*korthalsii* (Warb.) Boerl. 273, 274  
*kunstleri* King 277, 278  
*labillardieri* (Warb.) Boerl. 132  
*laevifolia* WJdW 385, 386, 391, 394, 401\*, 402\*, **507**  
*laevigata* Blume 137  
*laevis* WJdW 362, 375, **508**  
 subsp. *badia* WJdW **509**  
 subsp. *laevis* **509**  
*lakilaki* Murata & Nitta 587  
*lanceolata* Wall. 266  
*lancifolia* Poir. 366, 377, 379, 391, **510, 511**  
 subsp. *kutubuensis* WJdW 510, **511**  
 subsp. *lancifolia* 386, 403\*, 510, **511**  
 subsp. *montana* (Roxb.) WJdW 403\*, 510, **512**  
 var. *bifurcata* JS 417  
 var. *clemensii* (A.C. Sm.) JS 433  
 var. *montana* JS 512  
*lancifolia* Merr. 405  
*lasiocarpa* WJdW 389, **512**  
*laurella* Gand. 471  
*laurifolia* auct. 426  
*laurina* Blume 293, 294  
 var. *amboinensis* (Warb.) Boerl. 294  
 var. *bancana* (Warb.) Boerl. 294  
 var. *borneensis* Miq. 294  
 var. *longifolia* Miq. 294  
*laurina* auct. 267  
*laxiflora* Merr. 405  
*lemanniana* Wall. 132  
*lepidota* Blume **513, 514**  
 subsp. *lepidota* 368, 377, 378, 388, 392, 403\*, **514**  
 subsp. *montanoides* (Warb.) WJdW 366, 377, 379, 388, 393, 403\*, **514**

## (Myristica)

- leptophylla* WJdW 381, **515**  
*littoralis* Miq. 484  
*longepetiolata* WJdW 366, 374, **515**  
*longifolia* auct. 258  
*longipes* Warb. 385, 390, 402\*, **516**  
*lowiana* King 363, 370, 372, **517**  
*lowiana* auct. 440  
*luzonica* Blanco 543  
*macgregorii* Warb. 499  
*macrocarpa* Blume 543  
*macrocarpa* Wall. 459  
*macrocarpa* Warb. 619  
*macrocoma* Miq. 31  
*macrophylla* Miq. 578  
*macrophylla* Roxb. 462  
*macrothyrsa* Miq. 146  
*madagascariensis* auct. 543  
*maingayi* Hk. f. 363, 370, **518**  
*majuscula* King 147  
*malaccensis* Hk. f. 362, 369, 371, **520, 521**  
 subsp. *malaccensis* 520, **521**  
 subsp. *papillosa* WJdW 520, **521**  
*malayana* (Warb.) Boerl. 302  
*mandaharan* Miq. 305  
*markgraviana* A.C. Sm. 395, **521, 522\***  
*mas* (non Rumph.) Labill. 561  
*mascula* De Vriese 462  
*maxima* Warb. 362, 364, 369, 370, 371, 400\*, 401\*, **523**  
*mediovibex* WJdW 389, **525**  
 var. *kosteriana* WJdW 384, 390, 525, **526**  
 var. *mediovibex* 384, **525**  
*mediterranea* WJdW 386, 392, **526**  
*merrillii* Warb. 569  
*microcarpa* Zipp. 514  
*millepunctata* WJdW 380, **527, 528\***  
*mindanaensis* Warb. 367, 375, 377, 379, 403\*, **529**  
*mindanaensis* auct. 274  
*mindorensis* Merr. 447  
*missionis* King 266

## (Myristica)

- montana* Roxb. 512  
 var. *papuana* (Scheff.) Warb. 515  
*montanoides* Warb. 514  
*morindifolia* Blume 584  
*moschata* Thunb. 470  
*motleyi* (Warb.) Boerl. 151  
*motleyi* Warb. 479  
*muelleri* Warb. 482  
*multinervia* A.C. Sm. 584  
*murtonii* Hk. f. 41  
 var. *borneensis* (Warb.) Boerl. 41  
*myrmecophila* Becc. 578  
*nana* WJdW 387, 393, **530**  
*neglecta* Warb. 380, **531**  
*nesophila* Miq. 33, 140  
*nesophila* auct. 134  
*nitida* Merr. 447  
*nivea* Merr. 367, 375, 377, 379, **532**  
*notha* auct. 135  
*oblongifolia* King 316  
 var. *monticola* King 316  
*odorata* de Vriese 135  
*officinalis* L. f. 470  
*oligocarpa* (Warb.) Boerl. 156  
*olivacea* WJdW 385, 390, **532**  
*olivaeformis* (Warb.) Boerl. 149  
*ornata* WJdW 395, **533**  
*ovicarpa* WJdW 386, 391, **534**  
*pachycarpidia* WJdW 383, **535**  
*pachyphylla* A.C. Sm. 381, 382, **536**  
*pachythyrsa* (Warb.) Boerl. 105  
*palawanensis* Merr. 484  
*palembanica* Miq. 262  
*paludicola* King 107  
*pandurifolia* H. J. P. Winkler 521  
*paniculata* A. DC. 47  
*papillatifolia* WJdW 385, 391, **537**  
*papillosa* (Warb.) Boerl. 35  
*papuana* Scheff. 511

## (Myristica)

- papyracea* JS 361, 371, **537**, 538\*  
*parviflora* Roxb. 161  
*paucinervis* (Warb.) Boerl. 162  
*pectinata* (Warb.) Boerl. 320  
*pedicellata* JS 388, 392, **539**  
*peltata* Roxb. 249  
*pendulina* Hk. f. 204  
*perlaevis* WJdW 361, 376, 378, **540**  
*philippensis* Lam. 363, 374, **541**  
*philippensis* auct. 426, 521  
*philippinensis* Gand. 471  
*pilosella* WJdW 384, 389, **542**  
*pilosigemma* WJdW 367, 375, **543**  
*pinnaeformis* Zipp. 204  
*plumeriifolia* Elmer 462  
*polyantha* WJdW 387, 394, **544**  
*polyantha* (Warb.) Boerl. 140  
*polyspherula* Hk. f. 167, 169  
*pseudo-argentea* Warb. 619  
*psilocarpa* WJdW 395, **544**  
*pubicarpa* WJdW 365, 376, 378, 404\*, **545**, 546\*  
*pulchra* Miq. 332  
*pulverulenta* (Warb.) Boerl. 172  
*pumila* WJdW 387, 393, 401\*, 548\*, **549**  
*pygmaea* WJdW 384, 389, **550**  
*quercicarpa* (JS) WJdW 396, 401\*, **550**  
*racemosa* King 30  
*radja* Miq. 585  
*resinosa* Warb. 619  
*reticulata* (Warb.) Boerl. 177  
*retusa* King 333  
*ridleyana* King 178  
*ridleyi* Gand. 289  
*riedelii* Warb. 484  
*robusta* WJdW 365, 376, 378, 404\*, **551**  
*rosselensis* JS 385, 390, **552**  
 subsp. *minutiflora* WJdW **553**  
 subsp. *rosselensis* **553**

## (Myristica)

- roxburgii* (Warb.) Boerl. 190  
*rubiginosa* King 123  
*rubrinervis* WJdW 362, 364, 374, 375, **554**  
 var. *duplex* WJdW 554, **555**  
 var. *rubrinervis* 554, **555**  
*rufa* (Warb.) Boerl. 339  
*rumphii* (Blume) Kosterm. 367, 372, **555**, 556  
 var. *florentis* WJdW 556, **557**  
 var. *rumphii* **556**  
*salicifolia* Willd. 204  
*sangowoensis* (JS) WJdW 366, 376, 378, 404\*, **557**  
*sarcantha* WJdW 383, 558\*, **559**  
*schefferi* Warb. 587  
*schlechterii* WJdW 386, 393, **560**  
*schleinitzii* Engl. 385, 390, 395, **561**, 562\*  
*schumanniana* Warb. 484  
*scortechinii* King 340  
*scripta* WJdW 377, 378, 381, 382, **563**  
 var. *incrassata* WJdW **564**  
 var. *scripta* **564**  
*sepicana* Foreman 619  
*sericea* Warb. 503  
*simiarum* A. DC. 364, 374, **565**, 568  
 subsp. *calcarea* WJdW 372, 567\*, **569**  
 subsp. *celebica* (Miq.) WJdW 373, 374, 376, 378, 404\*, 566\*, 567\*, **569**  
 subsp. *simiarum* 374, 566\*, 567, **568**  
*simulans* WJdW 397, **570**  
*sinclairii* WJdW 84, 389, **570**, 571\*  
*smithii* (Warb.) Boerl. 188  
*smythiesii* JS 368, 372, **572**  
*sogeriensis* WJdW 387, 391, 393, 402\*, **573**  
*sorsogonensis* Merr. 405  
*sp.* Hk. f. 254  
*spadicea* Blume 462  
*spanogheana* Miq. 556

## (Myristica)

- spanogheana* auct. 561  
*speciosa* Warb. 585, 587  
*sphaerosperma* A. C. Sm. 397, **574**  
*sphaerula* Hk. f. & Th. 266  
*spherocarpa* Wall. 132  
*spicata* Roxb. 190  
*spuria* Blume 446  
*stenocarpa* (Warb.) Boerl. 345  
*stenophylla* (Warb.) Boerl. 347  
*suavis* King 440  
*subalulata* Miq. 365, 376, 378, 382, 575, 578  
 var. *hagensis* WJdW 383, 577, **579**  
 var. *leptantha* WJdW 577, **580**  
 var. *paucifruca* WJdW 577, **580**  
 var. *pedunculata* WJdW 412\*, 577, **581**  
 var. *subalulata* 399\*, 401\*, 404\*, 412\*, 576\*, 577, **578**  
*subalulata* auct. 467  
*subcordata* Blume 392, 397, **581**, 583  
 var. *gigacarpa* WJdW 583  
 var. *morindiiifolia* (Blume) WJdW 583, **584**  
 var. *rimosa* WJdW 583, **585**  
 var. *subcordata* **583**  
*subglobosa* Miq. 107, 132  
*sublanceolata* Miq. 494  
*subtilis* Miq. 198, 199  
*succedanea* Blume 375, 376, 379, 404\*, 546\*, **585**, 586\*  
 var. *brevifolia* Scheff. & Teijsm. 587  
*sucosa* King 201, 202  
*sulcata* Warb. 387, 393, 398, **588**  
*sulphurascens* Elmer 569  
*sumatrana* Blume 350  
*sumbawana* Warb. 366, 368, 372, **589**  
*superba* Hk. f. & Th. 203  
*syncarpa* Miq. 459

## (Myristica)

- sylvestris* Houtt. 204  
*sylvestris* auct. 543  
*tamrauensis* WJdW 380, **590**  
*teijsmannii* Miq. 362, 368, **591**  
*tenuivenia* JS 388, 392, **592**  
 subsp. *lignosa* WJdW 592, **593**  
 subsp. *tenuivenia* **592**  
*tingens* Blume 161  
*tomentella* (Miq.) Boerl. 351  
*tomentosa* Hk. f. & Th. 210  
*tomentosa* Thunb. 462  
*tomentosa* auct. 294  
*trianthera* WJdW 384, 389, **593**  
*tristis* Warb. 367, 377, 379, 388, 394, **594**, 596  
 subsp. *ingambitense* WJdW **596**  
 subsp. *louisiadensis* WJdW **596**  
 subsp. *moluccana* WJdW 595, **597**  
 subsp. *sessilifruca* WJdW 595, **597**  
 subsp. *tristis* 401\*, 404\*, 595, **596**  
*tuberculata* K. Sch. 215, 216  
*tubiflora* Blume 386, 393, **597**, **598\***

## (Myristica)

- ultrabasica* WJdW 366, 373, **600**  
*umbellata* Elmer 362, 375, 400\*, **600**  
*umbellata* (Warb.) Boerl. 291  
*umbrosa* JS 395, **601**  
*uncinata* JS 395, **602**  
*undulatifolia* JS 397, **604**  
*valida* Miq. 218  
*velutina* Markgr. 383, **605**  
 subsp. *breviflora* WJdW 605, **606**  
 subsp. *velutina* 605, **606**  
*verruculosa* WJdW 398, 607\*, **608**  
*verrucosula* Merr. 569  
*villosa* Warb. 365, 371, 401\*, **609**, **610\***  
*vinkeana* WJdW 387, 394, **611**  
*vordermanii* Warb. 494  
*vrieseana* Miq. 132  
*wallacea* Warb. 503  
 var. *keyensis* Warb. 583  
*wallichii* Hk. f. & Th. 219  
*warburgii* K. Schum. 387, 393, **613**  
 subsp. *hybrida* WJdW 387, 393, **614**  
 subsp. *siphonantha* WJdW 612\*, 614, **615**

## (Myristica warburgii)

- subsp. *warburgii* 612\*, **614**  
*wenzelii* Merr. 366, 374, **615**  
*womersleyi* JS 396, 401\*, **616**  
*wrayi* King 350  
*wyatt-smithii* Airy Shaw 362, 369, **617**  
*zippeliana* Miq. 47  
**Myristiceae** R.Br. 1–621  
**Myristiceae** 1  
*Pala radja* Teijsm. 585  
*Palala* Rumph.  
*aruana* Rumph. 91  
*globularia* Rumph. 161  
*quinta* 161  
*sexta* Rumph. 351  
**Paramyristica** WJdW 5 (map), 28, **619**  
*sepicana* (Foreman) WJdW **619**, **620\***  
*Pyrrhosa* Endl. 54  
*glabra* (Blume) Hassk. 121  
*globularia* (Blume) Hassk. 161  
*horsfieldii* (Blume) Hassk. 135  
*Sterculia decandra* Blanco 267  
*glomerata* Blanco 267  
*Tetranthera rumphii* Blume 555, 556