BLUMEA 31 (1986) 451–486

REVISION OF THE GENUS GYMNACRANTHERA (MYRISTICACEAE)

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CONTENTS

SUMMARY

In *Gymnacranthera*, a small genus of Southeast Asian Myristicaceae, at present 7 species have been accepted, one (*G. forbesii*) with 2 and another (*G. farquhariana*) with 4 varieties. One species, *G. canarica*, occurs in S. India, the remainder of the species is distributed in the area from S. Thailand east to E. New Guinea and the Bismarck Archipelago; the genus is absent from Java and the Lesser Sunda Islands. Species distinction is difficult because the androecium, which provides good characters in most other Southeast Asian Myristicaceae, is particularly uniform in *Gymnacranthera*. Two new species, *G. ocellata* from Borneo and *G. maliliensis* from Celebes, have been described. Some of the varieties are new combinations. The Indian *G. canarica* is distinct by globose fruits and by the anthers of which the large free apical portions are ± spreading, rather than erect or incurved. The Malesian *G. bancana* differs from the other Malesian species by its stout habit, conspicuous tomentum, and large flowers (male perianth 4–6 mm long) with relatively small androecium. The name of one common species, by Sinclair named *G. eugeniifolia* (with 2 varieties), is presently changed into *G. farquhariana*, an old name proposed by Hooker f. & Thomson. The distinction of *Gymnacranthera* among the other Southeast Asian genera of the Myristicaceae is discussed, the androecium newly described and pictured, and an ample genus description and full taxonomic treatment of all species is presented. An index of all names pertaining to *Gymnacranthera* is given at the end.

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INTRODUCTION

When the genus *Gymnacranthera* was conceived by Warburg (in 1897, based on a section of *Myristica* proposed by A. de Candolle) he distinguished 11 species. Sinclair, when revising the genus for Malaya (in Gard. Bull. Sing. 16, 1958, 434–450) and as a whole (op. cit. 17, 1958, 96–120), recognized 6 species and 4 varieties. In the present revision there are 7 species and 6 varieties accepted, among which 2 species newly described. In Warburg's time only a limited amount of specimens was available, and, according to his key to the species (l.c., 354–356) the species distinction was based on a mixture of mainly vegetative characters (leaves, tomentum) with in addition external characters of the male flowers, and fruits. At present the available collections have tremendously augmented, comprising several hundreds of specimens. Still, I agree with the complaints by Sinclair, who stressed the fact of the remarkable uniformity of the male* flowers (and still more so the female flowers) in most species, and that one has largely to rely on vegetative characters (like thickness of the leaves, number of nerves, and whether or not these are raised, level, etc.) and often the rather subtle characteristics of the fruits. Therefore, unlike in the treatment by Sinclair and in the recent revisions by De Wilde of *Knema* (Blumea 25, 1979; 27, 1981) and *Horsfieldia* (Gard. Bull. Sing. 37^2, 1984), I have framed only one general key to the species, for which, however – in an ideal situation – male flowering as well as fruiting specimens are needed.

Obviously most species are closely allied, but in my present study I have come to conclusions which are partly similar and partly quite different from the work of Sinclair. Especially the recognition of two new species – in my opinion among the best segregated within the genus – and the inevitable reinstatement of the name *'farquhariana'* for one of the commonest species should be mentioned here. Summarizing, as compared to Sinclair's results, the present study differs in the following points: 1) *G. bancana* var. *borneensis* has been sunk under *G. bancana*. – 2) *G. paniculata* var. *paniculata* and var. *zippeliana* have been transferred as varieties to *G. farquhariana*. – 3) *G. forbesii* var. *forbesii* occurs also in Borneo. – 4) *G. contracta* is regarded as a species confined to northern Borneo. – 5) *G. farquhariana* var. *zippeliana* appeared to be distributed also in West Malesia. – 6) *G. eugeniifolia* is reduced to *G. farquhariana* var. *eugeniifolia*, and presently contains specimens from West Malesia including Borneo. – 7) Two new species have been described: *G. ocellata* from Borneo based on specimens formerly placed under *G. contracta*, and *G. maliliensis* from Celebes based on specimens formerly included in *G. paniculata* var. *zippeliana*.

As regards vernacular names, these are given as found on the herbarium labels, but some of these (see Sinclair, l.c., p. 96), like the Malay names 'pendarah', 'chendarah', 'penarah', 'darahan', 'chendarahan', 'pendarahan', and 'penarahan' (referring to the blood-like red colour of the sap exuding from the cut stem) are equally applicable to members of the other genera of the Myristicaceae.

* Only *G. canarica* and *G. bancana* show some significant differences in male flowers as compared to the other species of *Gymnacranthera*.

As regards future collecting I may draw attention to 1) the apparent absence of any recent collections of *G. canarica*, a large tree now very rare or even extinct in S. India, and 2) the as yet not satisfactorily understood variation in specimens from the Philippines here all brought together under the name *G. farquhariana* var. *paniculata*.

THE CHARACTERS IN GYMNACRANTHERA

Diagnostic genus characters. Already Warburg (Mon. Myrist., 1897) when describing the genus, later Sinclair (Gard. Bull. Sing. 16, 1958, 250–252, 435), and recently De Wilde (Blumea 30, 1984, 175–179) when proposing his new genus *Endocomia*, have given the distinctive characters of *Gymnacranthera*, but for convenience they have been summarized here. The main genus characters are in the construction of the androecium and the appearance of the aril of the seed, but also vegetatively there are typical features. There are 5 genera of Southeast Asian Myristicaceae, viz. *Myristica, Knema, Horsfieldia, Endocomia*, and *Gymnacranthera*. Briefly, the following diagnostic picture of *Gymnacranthera* can be given, with marked differences in the other genera indicated between brackets. *Gymnacranthera:* Hairs of leaf bud, etc. mostly appressed (± erect in *Knema, Horsfieldia*). Bark of twigs smooth or finely fissured, with lenticels (bark often striate in *Knema*; without lenticels in *Myristica* p.p. and *Endocomia*). Leaves usually whitish beneath, with alveolar material; reticulation by tertiary venation indistinct, usually not visible above (alveolar material absent in *Myristica* p.p., *Endocomia*, most *Horsfieldias*; reticulation very distinct in most *Knemas*). Dioecious (monoecious in *Endocomia*, rarely monoecious in *Myristica*). Inflorescences paniculate (condensed, as wart-like brachyblasts in *Knema, Myristica* p.p.). Bracteole absent (present in *Knema, Myristica*). Male perianth ellipsoid (often globose or depressed-globose in *Knema, Horsfieldia*), perianth pubescent inside and outside (glabrous inside in most species of *Knema, Myristica*, and *Horsfieldia*), male perianth valves 3 or 4, in anthesis erect or little spreading (much spreading or recurved in anthesis in *Knema, Endocomia*), androecium cylindrical-ellipsoid, subsessile, with the anthers largely sessile with free apices (see further under generative characters; androecium different in other Asian genera, especially in *Knema*. Ovary short-pubescent; stigma sessile, 2-lobed and each lobe shallowly lobulate (ovary either glabrous or hairy in *Horsfieldia, Myristica*; glabrous in *Endocomia*; stigma more-lobulate in *Knema, Horsfieldia iryaghedhi*). Seed not variegated (variegated in *Endocomia*), aril completely covering the seed but deeply laciniate (like in *Myristica* and *Endocomia* p.p.; aril little or not laciniate at the top in *Endocomia* p.p., *Knema, Horsfieldia*). Also the anatomy is diagnostic, as reported in a separate chapter below.

Species characters. – As remarked before, the species delimitation in *Gymnacranthera* is difficult because good characters based on differences in the shape and architecture of the androecium are lacking for most species. Only in *G. canarica* the androecium is somewhat different, and in *G. bancana* it is small in comparison to the perianth. Therefore, in key and description characters taken from the vegetative parts are more important here as compared to the other genera. A brief survey and discussion of the main characters follows below.

Vegetative characters

1. Indumentum. – In all species the leaf bud, twig apex, lower leaf surface, inflorescence, flowers and fruits are pubescent, but usually the hairs are inconspicuous; only *G. bancana* and *G. maliliensis* make a rather pubescent impression. Most of the tomentum in all species is more or less like that in *Myristica* (see Koster & Baas, Blumea 27, 1981, 115–173, and the chapter on anatomy below) and in dry specimens the hairs generally give an appressed and predominantly 'glassy' appearance; they usually are short and rather spaced, either persistent or shed early or later. The tomentum of all parts of a plant is in general the same, but in the two species named above the hairs are rather erect, not appressed and visible especially on twig apices and inflorescences.

a) *Tomentum of leaf bud and twig apex.* – Initially this is always present, but usually early shed. In *G. bancana* and *G. maliliensis* it consists of relatively large, ± erect, 'woolly' hairs, in the remainder of the species the hairs are appressed, and early shed; in *G. ocellata* the hairs are generally more persistent.

b) *Tomentum of the lower leaf surface.* – This, as well, is initially always present; the upper leaf surface is glabrous. The hairs are ± erect and woolly in *G. bancana*, and generally quite persistent and visible with the naked eye. In the other species the hairs are predominantly appressed, in *G. maliliensis* and ± in *G. ocellata* subpersistent and just visible with the naked eye, in *G. canarica, G. farquhariana, G. forbesii* and *G. contracta* the hairs are minute, early shed, and visible only with a lens.

c) *Tomentum of flowers.* – All flowers are pubescent by (pale) rusty appressed hairs, i.e. the pedicels, and the perianth outside as well as inside. These hairs are very short, scale-like, only 0.1–0.2 mm long (up to 0.3 mm in *G. bancana*). The tomentum of the flowers is persistent in all species, but may wear off in herbarium collections.

d) *Tomentum of inflorescences.* – This is more woolly, not of appressed hairs, in all species, but mostly it is thin, not densely set. The length of the hairs varies from short, c. 0.2 mm in *G. farquhariana* and *G. canarica*, c. 0.2–0.4 mm in *G. forbesii* or c. 0.5 mm in *G. contracta, G. ocellata, G. maliliensis*, to long, 1–2 mm, in *G. bancana*. The height of the (woolly) layer of the tomentum is used as a character to separate the species.

e) *Tomentum of the fruits.* – This consists of a thin, rather woolly layer, and is present on all young fruits. Old, mature fruits are glabrescent or but very scarcely pubescent, but fruits of *G. bancana, G. ocellata* and *G. maliliensis* more or less retain their tomentum.

2. Twigs. – Characters of the twigs are regarded as of great importance for species delimitation. The stoutness of the twigs, i.e. the diameter just below the apex, and at about 10 cm lower down is, though overlapping for the species, fairly characteristic. Furthermore there are good additional characters from the shape of a section of the twigs (terete, triangular, or ± flattened), the colour of the bark, and especially the density of the lenticels in the apical twig portion. In *G. ocellata*, for instance, the ultimate twig portion is ± flattened, densely set with conspicuous lenticels, and at

the base provided with many scars of the cataphylls which belonged to the previous vegetative bud.

The bark of the twigs in all species is smooth or (very) finely fissured, never coarsely fissured or striate, and never flaking.

3. Leaves. – Regarding the leaves, the following features are of taxonomic importance:

a) *Size and shape of the blade.* – These overlap for most species, but averages give good additional characters, and they are used in the key. The blade base is in most species short-attenuate to (broadly) rounded; in *G. farquhariana* and *G. maliliensis* it is often rather long-attenuate.

b) *Nervation.* – The number of lateral nerves varies among the species; there are 7–23 pairs. This, and the mode of interarching, as used by Sinclair, has proved to be of little taxonomic importance. The appearance of the nerves on the lower leaf surface may be characteristic: they are not or hardly raised (*G. farquhariana* var. *eugeniifolia*), distinct but not prominent, not stout (e.g. *G. contracta*), or very prominent (e.g. *G. bancana, G. forbesii* var. *crassinervis*); on the upper leaf surface the nerves are flattish, never raised. The tertiary venation usually is indistinct on both surfaces.

c) *The drying colour of the leaves.* – This is variable, and not used to distinguish species. It ranges for the upper leaf surface from light olivaceous to dark brown or chocolate, dull or shiny. In *Knema* or *Horsfieldia* the drying colour of the leaves has sometimes been used in species delimitation.

d) *Texture.* – Some species have exclusively chartaceous or coriaceous leaves, e.g. *G. bancana*; in other species it is variable, ranging from subherbaceous to chartaceous. It is used as an additional character in key and descriptions.

Generative characters

1. Inflorescences. – All species have paniculate inflorescences; they differ somewhat in size. The flowers are solitary (in females only) or in few-flowered clusters. In general, the female inflorescences are shorter than the males. In *G. contracta* the female inflorescence is particularly short and contracted. There are significant specific differences in the tomentum of the inflorescences, as discussed before in the chapter 'vegetative characters' (1d).

2. Flowers. – The flower colour is uniform in *Gymnacranthera*; young perianths are green or brownish yellow, turning bright yellow in anthesis. The pollen is whitish.

a) *Staminate flowers.* – Unlike in *Knema, Horsfieldia, Endocomia* and *Myristica*, the male flowers are almost uniform for most species. The size and shape of the mature male perianth are overlapping in such a degree that these do not offer workable differences. The androecium is typical for the genus, but is rather uniform for most species. Only in *G. canarica* it differs from the other species. The androecium consists of a rather short to very short stipe (androphore) carrying the synandrium. The androphore can be considerably variable in length, even within one specimen. The synandrium is ± truncately ellipsoid, and consists of a narrow to rather broad central column to which the anthers are narrowly attached with their backsides,

leaving the apices free. In *Gymnacranthera* these attachments are narrow and relatively long radially, extremely so in *G. canarica*. Schematic drawings of longitudinal and transverse sections, elucidating the structure of the androecium, are presented in figure 1. The free apices vary somewhat in length and are erect or slightly incurving, sometimes (in *G. forbesii*) the whole anthers or the free apices are ± contorted. In *G. canarica* the free apices are relatively longest, and slightly curved outward in anthesis; the anther-bearing septa to the central column are relatively long, and the anthers widely and deeply separated (see fig. 1). The number of anthers varies from five to thirteen and is of little diagnostic value.

Not very conspicuous but probably characteristic for and occurring in all species is the outer tissue of the connectivum which protrudes as a short appendix of c. 0.5 mm. This minute protrusion is not present in immature anthers and possibly it shows up with the ripening of the anther when the tissue of the said appendix tears away from the rest of the anther.

b) *Pistillate flowers.* – These offer little diagnostic characters among the species. As compared to male flowers, the perianth lobes are deeper and in anthesis more spreading or even reflexed. The perianth valves of female flowers of *G. canarica*, however, are hardly spreading in anthesis. Size nor any other character of the pistil shows much variation. The stigma is sessile, always 2-lobed, the ovary ± broadly ovoid, minutely pubescent.

3. Fruit and seed. – These offer some useful characters. The average size of the fruit is often a reasonably reliable additional species character. Also the fruit shape is often important; it is ellipsoid-oblong in most species, the fruit base is ± truncate in *G. ocellata; G. canarica* has globose fruits; subglobose fruits occur in certain varieties and forms of *G. farquhariana*. Sometimes the length of the fruit stalk seems diagnostic. The dry pericarp is relatively thick in *G. bancana* (c. 3 mm) and exceptionally thick (3–5 mm) in *G. maliliensis*. The indumentum of the fruits is discussed before under 'vegetative characters' (1e). The seed is ellipsoid or ellipsoid-oblong in all species, except in *G. canarica* where it is perfectly globose.

Anatomy

A recent study of the leaf anatomy of Asian Myristicaceae by Koster & Baas Blumea 27, 1981, 115–173) showed that anatomically *Gymnacranthera* is distinct, on the genus level, by 1) hairs with cells with two arms of different length, 2) subsidiary cells of stomata dome-shaped, 3) midrib adaxially approximately flat to shallowly concave, 4) adaxial vascular bundle in the midrib absent, 5) major veins with (very) small sclerenchyma caps, and 6) filiform, rarely branched sclereids present in the mesophyll. The authors present a synoptical key to the genera on differential leaf anatomical characters (l.c.: 159, table V).

On the species level the genus is fairly homogeneous; only *G. bancana* takes a more or less isolated position, mostly by epidermal features (l.c.: 130, table I; 151). A synoptical key to the species (as delimited by Sinclair), based on anatomical characters, is presented by Koster & Baas (l.c.: 162).

Table 1.

Species studied	Specimens studied	Thickness of cuticle		Number of basal parts of hairs/0.1 mm^2 in the areolae
		adaxial	abaxial	
G. bancana	Sinclair SF 40045	14	8	30
	Haji Bujang S 11044	18	10	50
G. ocellata	Zehnder 9437	10	8	15
	Haviland 1650	8	8	15
	Kostermans 7241	10	8	15
	Galau 14970	11	11	15
G. farquhariana				
var. *farquhariana*	King's Coll. 6622	9	5	5
var. *eugeniifolia*	SAN 17514	11	7	5
	Anderson 9420	7	6	5
	FRI 3908	8	5	5
	Rahmat si Boeea 8035	8	6	5
var. *zippeliana*	Jacobs 5363	5	6	15
	Kostermans 13696	5	2	15
	Jacobs 5326	5	5	10
	Rahmat si Toroes 3944	8	4	10
	van Rossem 63	6	2	15
	bb 23779	7	5	15
var. *paniculata*	Miranda FB 18969	5	2	15
G. forbesii				
var. *forbesii*	FRI 5749	5	2	20
	King's Coll. 6591	6	2	20
	Jacobs 5259	5	5	20
	Rosli 3393	5	2	15
G. contracta	Sinclair & Kadim SF 10231	4	2	15
	Whitmore 8415	5	3	12
G. maliliensis	van Balgooy 3960	11	4	24
	bb 1880	12	4	24
G. canarica	Beddome 1/68	7	2	4

The hairs of Myristicaceae are uniseriate, and each cell is provided with one arm in *Horsfieldia, Endocomia* and *Knema*, with two arms in *Myristica* and *Gymnacranthera*; in the latter genus the arms are unequal of length, in *Myristica* the arms are ± equal. In the latter two genera the hairs are thin-walled, and, when dried, give a typical 'glassy' and 'appressed' appearance, as mentioned earlier under the vegetative characters.

Many Myristicaceae have a typical layer of alveolar cutinaceous material overlying the cuticle on the abaxial (lower) leaf surface; this is also present in *Gymnacranthera*. Such alveolar material is otherwise only known in the family Winteraceae. The alveolar material in Myristicaceae, in addition to several other markedly xeromorphic leaf anatomical features of this family, may have had some adaptive significance in the possibly more xeric ancestors of the recent Myristicaceae with a predominantly mesic

ecology, as pointed out by Koster & Baas (l.c., 1981; and in Linn. Soc. Symp. Series 10, Suppl., 1982, 131–138).

Koster & Baas (l.c., 1981: 130, table I) present a table of some leaf anatomical characters of all species as delimited by Sinclair, but in the view of the present author the investigated specimens belong to only four of the presently accepted seven species. In the present revision 1) two species are newly described, 2) some specimens by Sinclair treated under *G. contracta* and named as such by Koster & Baas in their table I, are regarded by me as belonging to various other taxa (including one of the new species, *G. ocellata*), because I retained *G. contracta* only in a much restricted sense, and finally 3) material of the Indian *G. canarica* had not been seen by Koster & Baas. Therefore the table by Koster & Baas is newly arranged and extended with data on the following species: *G. contracta* (s.s.), *G. maliliensis* (a newly described species endemic of Central Celebes), *G. ocellata* (formerly in *G. contracta*) and *G. canarica*. In this new table (table 1) the data on the highly variable thickness of the lamina and presence or absence of sclerified parenchyma cells in the ground tissue of midrib and leaf margin, which offer no distinguishing characters, are omitted. The thickness of the cuticle has some diagnostic significance, especially for *G. bancana*. The number of basal parts of hairs is rather constant for the species, 30–50 in *G. bancana*. 15 in *G. ocellata*, 5 in two varieties of *G. farquhariana*, 10–15 in the two other varieties or this species, 15–20 in *G. forbesii*, 12–15 in *G. contracta*, 24 in *G. maliliensis*, and the lowest number, 4, in *G. canarica*.

GYMNACRANTHERA

Gymnacranthera (A. DC.) Warb., Ber. Pharm. Ges. 2 (1892) 227; Ber. Deutsch. Bot. Ges. 13 (1895) 82; Mon. Myrist. (1897) 131, tab. II; Gamble, Mat. Fl. Mal. Pen. 5 (1912) 222; Ridley, Fl. Mal. Pen. 3 (1924) 61; Sinclair, Gard. Bull. Sing. 16 (1958) 434; 17 (1958) 96. – *Myristica* sect. *Gymnacranthera* A. DC., Ann. Sc. Nat. 4, 4 (1855) 31; Prod. 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.

Trees or shrubs, 3–50 m, dioecious. Twigs terete or bluntly angular, rarely lined from petiole to petiole in young twigs, usually early glabrescent from appressed hairs (tomentum woolly in *G. maliliensis*), bark smooth, when older finely cracked, never striate, always lenticellate but sometimes inconspicuously so. *Leaves* distichous, petiole distinct, blades up to 40 cm long, thickly membranous or usually chartaceous or coriaceous, tough, rarely brittle when dry, on lower surface glabrescent or with persistent tomentum usually of rather remote, appressed, inconspicuous hairs (tomentum ± persistent, conspicuous, woolly in *G. bancana*); nerves above ± flat or slightly raised, beneath flat to very prominent, tertiary venation forming a coarse network, usually ± indistinct at both surfaces; lower surface not glaucous but often whitish, with alveolar material, without larger dots by non-traumatic cork warts. *Inflorescences* axillary, in between or behind the leaves, rarely on the older wood, paniculate, in male usually several times branched, in female more condensed, or simple, fewer-flowered than in male, glabrescent or pubescent to various degree, at

base of common peduncle with few minute cataphylls; bracts small, (broadly) triangular, caducous. *Flowers* pedicelled, pubescent to various degree, ± solitary (in female only) or in loose clusters of a few flowers, all flowers in one inflorescence usually in about the same stage of development; pedicels at base not articulated; bracteoles absent. *Perianths* membranous to thinly leathery, (2-), 3- or 4-valved, (thinly) appressed-pubescent outside and inside, outside yellow in anthesis, inside brown-yellow to golden, never red; valves splitting the perianth to various depths, in female always deeper than in male, the lobes or valves in male erect or slightly spreading, in female strongly spreading or ± reflexed (except in *G. canarica*). *Male perianth* elliptic or elliptic-oblong; androecium markedly uniform in all species, about as long as the perianth-tube (shorter in *G. bancana*); synandrium ± cylindrical-ellipsoid, sessile or on a short rather narrow stipe (androphore), the anthers 5–12, connate with their backsides into a narrow to rather broad central column, without excavation at the top, the anthers mutually separated by a deep cleft, the apices of the anthers free, these latter ± erect or somewhat curved inward, in *G. canarica* ± distinctly curved outward in anthesis; thecae often septate in juvenile state, opening extrorsely, the connective slightly protruding at apex (see fig. 2). *Female perianth* smaller and usually wider than in male, ovoid or pyriform, pedicel shorter than in male; ovary globose to broadly ovoid, short-pubescent, stigma small, sessile, obliquely 2-lobed and these usually minutely 3–6-lobulate. *Infructescences* similar to female inflorescences or slightly larger; fruits globose (*G. canarica*) or usually subglobose to ellipsoid, pericarp hard-fleshy, drying brownish, short-pubescent or glabrescent, the perianth not persistent under the fruit; seed ellipsoid (globose in *G. canarica*), aril completely covering the seed, deeply laciniate to near the base (as in *Myristica*); albumen ruminate, containing a fixed oil but no starch; cotyledons divaricate, connate at the base (fide Warburg, Sinclair).

Field notes. Trees of primary forest, often maintaining in secondary growth; sometimes in marshy forest but stiltroots usually absent. The bark is usually recorded as reddish brown to grey-brown, smooth or finely fissured, sometimes minutely flaky. The flowers are bright yellow, sometimes sweet smelling or with a spicy odour when crushed, characters shared with most *Horsfieldia*s.

Distribution. Like the other four genera of Southeast Asian Myristicaceae, the genus *Gymnacranthera* has a wide distribution, ranging from S. India through Malesia eastwards to New Guinea, including the Bismarck Archipelago. However, it possibly has the smallest area, because it is absent from continental Southeast Asia (except for S. India, southern Peninsular Thailand and Malaya) and from the whole of Java, the Lesser Sunda Islands, Tanimbar Islands, NE. Australia and the Solomon Islands (fig. 1). In the distribution map also the areas of the species are drawn, and from these it can be seen that Borneo has the greatest species density. The widely conceived *G. farquhariana* (with 4 varieties) has the largest extension, almost covering the whole area of the genus, except that of the Indian *G. canarica*. This latter species is much resembling in habit to the former, but differs in some marked characters of the androecium (see the chapter on generative characters above) and the fruit. *Gymnacranthera bancana* has an area approximating the Riau-pocket pattern of distribu-

tion as discussed by Corner, Gard. Bull. Sing. Suppl. 1 (1978) 87–90, f. 17. *Gymnacranthera* has never been found on Palawan, Philippines, not even during the extensive collecting of the Palawan Botanical Expedition 1981, but still I think it might be present there.

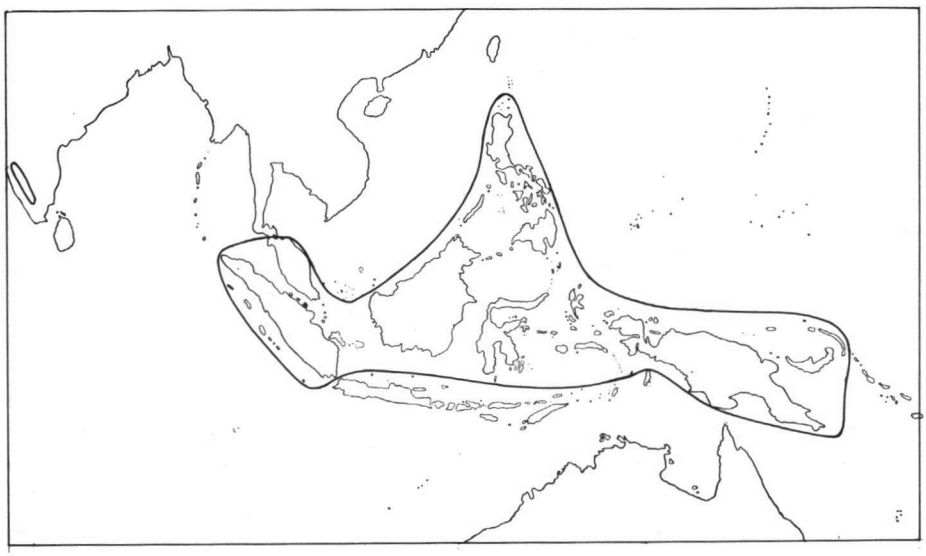


Fig. 1. Distribution of the genus *Gymnacranthera* (A. DC.) Warb. – It should be noted that no specimens have yet been collected in Palawan and some other southern Philippine islands.

KEY TO THE SPECIES

1a. Androecium c. 2 mm long, with the anthers rather separated and spaced, the free apical portions erect or rather spreading, c. 1 mm long, occupying c. 1/3–1/2 of the androecium. Valves of female perianth only slightly spreading. Fruit globose, c. 2.5 cm diam., seed globose. *S. India* **1. G. canarica**

b. Androecium of various size, the anthers mutually rather appressed, the free apical portions shorter, erect or usually curved inward, occupying not more than 1/4 of the androecium. Valves of female perianth spreading or recurved in anthesis. Fruit ellipsoid or globose, of various size, seed ellipsoid to nearly (never perfectly) globose 2

2a. Male perianths large, 4–6 mm long; androecium much smaller than the perianth, shorter than the perianth-tube. Tomentum of young twigs and inflorescences composed of woolly hairs c. 1(–2) mm high; lower leaf surface with woolly hairs c. 0.5 mm high. Leaves stout, 18–42 cm long, petiole 3–5 mm thick. Fruits 2.5–3.5 cm long, pubescent by hairs 0.3–0.5 mm. *Malaya, Sumatra, Borneo* . . . . . **2. G. bancana**

2b. Male perianths generally smaller, 2–5 mm long; androecium relatively longer, about as long as the perianth tube. Tomentum of young twigs and inflorescences less conspicuous, glabrescent or composed of hairs up to 0.5 mm high; lower leaf surface glabrescent or with appressed, not woolly hairs less than 0.5 mm high. Leaves of various sizes, petiole generally more slender, 1–3 mm diam. Fruits generally smaller, pubescent or glabrescent 3

3a. Young twigs conspicuously pubescent by woolly, i.e. not appressed hairs up to 0.5 mm high. Leaves densely pubescent beneath. Fruits large, 2.3–3 by 2–2.2 cm, conspicuously pubescent, pericarp 3–5 mm thick. *Central Celebes* **3. G. maliliensis**

b. Young twigs glabrescent or variously pubescent by appressed, not woolly hairs less than 0.2 mm high. Leaves beneath glabrescent or variously pubescent by more remotely set hairs. Fruits generally smaller, glabrescent or pubescent, pericarp up to c. 2 mm thick 4

4a. Young twigs, including the apical portion, conspicuously densely set with distinct lenticels. Undersurface of leaves with distinct, usually brown hairs. Midnerve flat above. Lateral nerves making an angle of c. 45° in the middle of the leaf. Fruits short-pubescent, c. 2 cm long, ellipsoid-ovate, with truncate base. *Borneo* ..... **4. G. ocellata**

b. Twigs towards the apex without or with but a few lenticels. Lower leaf surface glabrescent or with scattered, inconspicuous, usually greyish or pale brown hairs. Fruits globose to ellipsoid-oblong, glabrescent or pubescent, base not truncate, of various size 5

5a. Twigs usually slender, at apex 1–2 mm, about 10 cm lower down 2–3.5 mm diam. Leaves smaller, 5–17 by 1.5–5.5(–6) cm; midnerve flat or sunken above. *West & East Malesia* (in East Malesia not rarely twigs thicker and leaves larger) **7. G. farquhariana**

b. Twigs stout, at apex (2–)2.5–4 mm, about 10 cm lower down (3–)3.5–5.5 mm diam. Leaves large, 14–33 by (5.5–)6–13 cm 6

6a. Lateral nerves on lower leaf surface distinct though but little prominent, making an angle of 60–70° with the midnerve in the middle of the leaf. Leaves drying flat, not undulate; midnerve usually sunken. Anthers 6(–8), straight. *Borneo* **5. G. contracta**

b. Lateral nerves on lower leaf surface very distinct and prominent, making an angle of (35–)40–50(–55)° with the midrib in the middle of the leaf. Leaves generally drying irregularly undulate, not flat; midrib usually sunken. Anthers 6–10, sometimes twisted. *S. Thailand, West Malesia* ..... **6. G. forbesii**

1. Gymnacranthera canarica (King) Warb. – **Fig. 2a, b, 4.**

Myristica canarica King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 307, t. 138. – *G. canarica* (King) Warb., Mon. Myrist. (1897) 368, t. 20, 1–5. – Types: *Beddome 6723 & s.n. 1/68, 12/79 (6724)* (lecto K), S. India.

Myristica farquhariana auct. non Hook. f. & Th., p.p. (see the notes): Hook. f. & Th., Fl. Ind.

(1855) 161; A.DC., Prod. 14, 1 (1856) 200; Miq., Fl. Ind. Bat. 1, 2 (1859) 63; Bedd., Fl. Sylv. (1869) t. 270; Hook.f., Fl. Brit. India 5 (1886) 108; Sinclair, Gard. Bull. Sing. 17 (1958) 96, 113.

Tree up to 50 m. Twigs slender, subterete, at apex 1.5–2 mm diam., lower down c. 3.5(–6) mm diam., when young thinly greyish to rusty pubescent by hairs 0.1–0.2 mm, early glabrescent, bark smooth or finely striate, grey-brown, lenticels present. *Leaves* chartaceous, above olivaceous to brown, sometimes shiny; lower surface thinly pubescent by appressed minute hairs, early glabrescent, grey-brown; blade elliptic-oblong to oblong-lanceolate, widest at about the middle or ± parallel-sided, 16–25 by 5–8 cm, top acute or acute-acuminate, base short-attenuate to rounded, margin not revolute; midrib above slightly sunken, narrow, c. 1 mm wide; nerves 12–16 pairs, flat above, distinct but not prominent beneath; tertiary venation forming a coarse network indistinct at both surfaces; petiole 9–15 by 2–2.5 mm, glabrescent; leaf bud slender, minutely pubescent. *Inflorescences* axillary to the lower leaves, broadly paniculate, in male 8–14 cm long, up to 14 cm wide, many-flowered, (thinly) rusty tomentose by hairs c. 0.2 mm long, in female up to c. 1.5 by 1 cm, fewer-flowered (6–10); bracts not seen. *Flowers* ± thinly rusty pubescent inside and outside by hairs 0.1–0.2 mm long. *Male flower pedicel* 1–2 mm long; mature perianth in bud ellipsoid-oblong, c. 3.5 by 1.5–2 mm, valves 3 or 4, triangular, splitting the bud to 1/3–1/2, in anthesis erect or but slightly spreading, perianth tube 1.5–2 mm long; androecium ± truncately ellipsoid-oblong, 1.7–2.2 mm long (about as long as the perianth tube), c. 1.5 mm wide, subsessile or stiped for 0.2–0.5 mm; anthers (6 or) 7 or 8(–11), narrowly attached into a slender central column for about the lower half, the anthers rather spaced by the deep incisions between the flat connectives, the upper halves of the anthers (c. 1 mm) free, suberect and ± spreading in anthesis (fig. 2a, b). *Female flower pedicel* c. 1.5 mm long; perianth in bud narrowly obovoid-oblong, 3–3.5 by 1.5 mm, valves 3 or 4, splitting the bud in anthesis to 1/3–3/4, suberect, not spreading or recurved, tube short-urceolate, 1–2 mm long; ovary subglobose, c. 1.5 mm diam., densely short-pubescent, stigma sessile, semi-lunate, 2-lobed. *Fruits* 2–5 per infructescence, globose, 2.5–3 cm diam., early glabrescent; pericarp c. 1.5 mm thick; seed globose, 2–2.3 cm diam.; fruit stalk thickish, c. 3 mm long.

Distribution. S. India, Kerala and Madras States: S. Canara plains, S. Canara and Coorg Ghats, Tambercherry Ghat (Wynad), Tinnevelly (fide Beddome, 1869).

INDIA. Beddome 6723, 6724, s.n. (1/68, 12/79); Bourdillon s.n., 93; Hohenacker 541.

Ecology. Recorded by Beddome (l.c.) as a medium-sized tree, locally very abundant in dense moist forest, up to c. 600 m. Fl. Dec.–Feb., fr. June–Nov.

Uses. Nothing about the use of the wood was known to Beddome. According to Warburg (l.c.) the seeds were probably used as incense in candles, and also produced the Mangalore fatt. The seeds seem to have been mistaken for true nutmegs several times.

Vernacular names. Pindee, pindi.

Notes. 1. Field notes. Recorded as a handsome medium-sized tree (although on

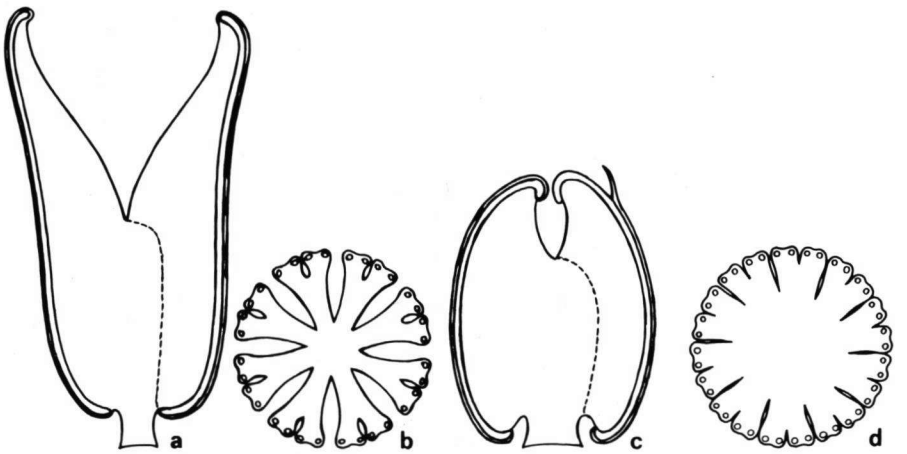


Fig. 2. Schematic longitudinal and transverse sections through the androecium of *Gymnacranthera*. – a, b. *G. canarica* (King) Warb.; note deeply incised androecium with widely spaced anthers (from *Beddome 1/68*). – c, d. *G. maliliensis* R. Schouten; note minute appendix of connectivum; the broken lines in the longitudinal sections indicate the depth of the incisions between the anthers (from *van Balgooy 3960*). All about × 25.

the field labels also annotated as 'immense tree' and 'tree, 150 ft.'), trunk erect, branches regularly verticillate at quite right angles, young parts rufo-pubescent.

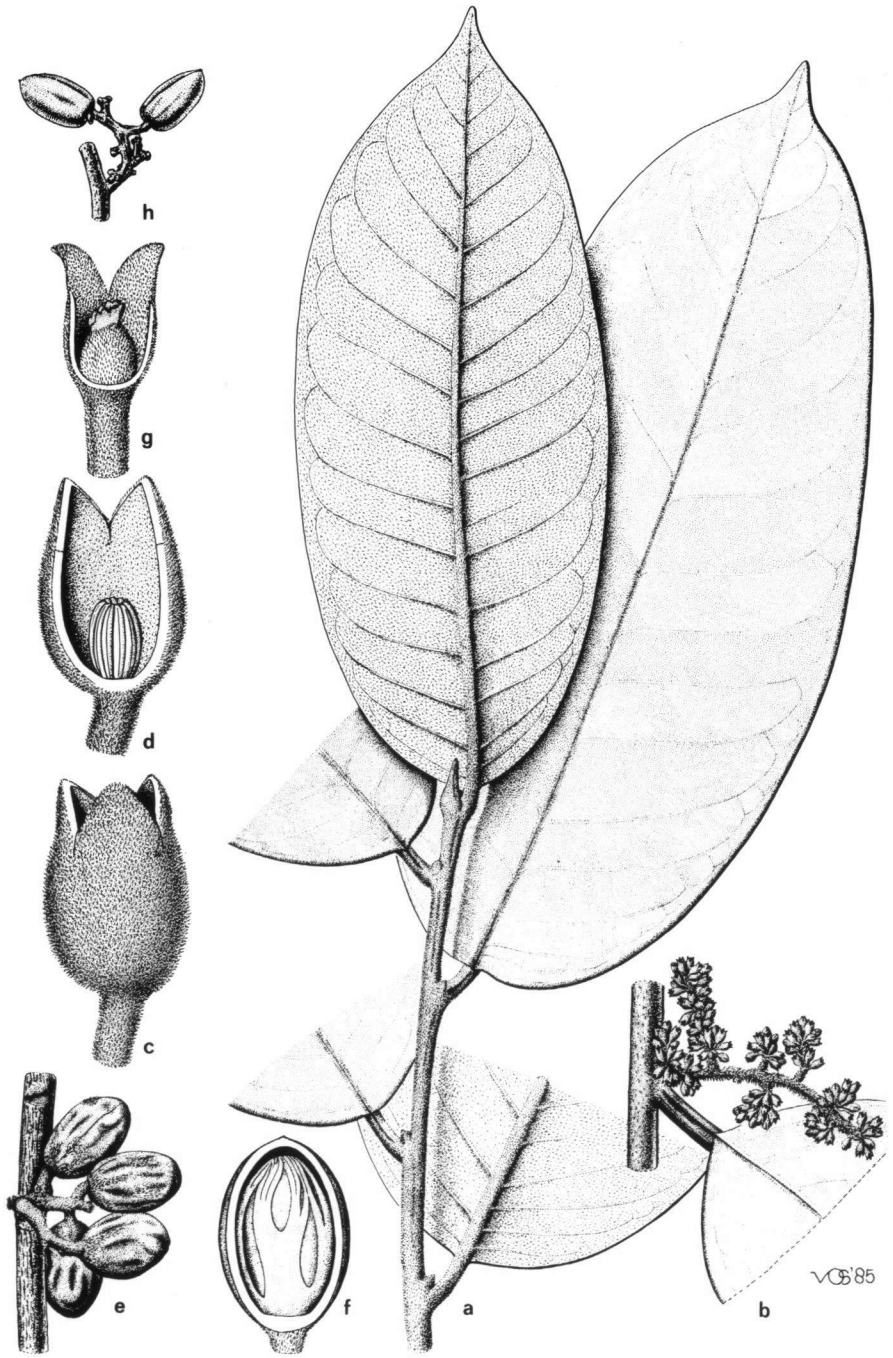
2. *Gymnacranthera canarica* is in the vegetative parts (leaves) very like Malesian species such as *G. contracta* and *G. farquhariana*. Taxonomically, however, it is quite distinct by its different androecium composed of anthers free for about the upper half, and rather spreading in anthesis, and by globose fruits with globose seeds. The aril is similarly divided as those in *Myristica* and the other species of *Gymnacranthera*.

3. Apparently the last herbarium collection of *G. canarica* was made in 1894 and presently the species may be very rare or even extinct since it is a rather big tree not easily overlooked.

4. I do not agree with De Candolle (1856) and Sinclair (1958) that *Myristica farquhariana* can be typified by Hohenacker 541. Instead, I follow King (1891) and Warburg (1897) and maintain that inevitably *Myristica farquhariana* should be lectotypified by the Malayan specimen Wallich 6798, as cited between brackets after the name by Hooker f. & Thomson (l.c.) in the original publication. See further under *G. farquhariana*.

2. Gymnacranthera bancana (Miq.) Sinclair – Fig. 3a–f, 4.

Myristica bancana Miq., Fl. Ind. Bat. Suppl. 1 (1861) 383; Warb., Mon. Myrist. (1897) 518. – *G. bancana* (Miq.) Sinclair, Gard. Bull. Sing. 16 (1958) 436, f. 53, pl. XIIIA; 17 (1958) 99. – Type: *Teijsmann 3279* (U, n.v.), Bangka.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Myristica murtonii Hook. f., Fl. Brit. India 5 (1886) 105; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 297, pl. 124 ter. – *G. murtonii* (Hook. f.) Warb., Mon. Myrist. (1897) 357, t. 20, f. 1–3; Gamble, Mat. Fl. Mal. Pen. 5 (1912) 223; Ridley, Fl. Mal. Pen. 3 (1924) 61. – Type: *Murton 13* (K), Singapore.

Myristica ferruginea Wall. ex King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 298, pl. 125. – Types: *Wallich Cat. 6803* (lecto BM; G, K, LE n.v.), *Ridley 1835* (BM; CAL, MEL, SING, n.v.), *3364* (CAL n.v.; K, SING n.v.), *4815* (CAL, MEL, SING, n.v.), Singapore.

Myristica amplifolia Warb., Mon. Myrist. (1897) 517. – Type: *Anon. no 16* 'Medang Simpai' (L), Palembang.

G. murtonii (Hook. f.) Warb. var. *borneensis* Warb., Mon. Myrist. (1897) 359. – *Myristica murtonii* Hook. f. var. *borneensis* (Warb.) Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 88, nom. alt. – *G. bancana* (Miq.) Sinclair var. *borneensis* (Warb.) Sinclair, Gard. Bull. Sing. 16 (1958) 439; 17 (1958) 100. – Types: *Beccari 1211* (A, C, FI, G & Boiss., n.v.; K; M, P, S, n.v.), *3977* (FI, G, n.v.; K), Kuching.

Tree 15–40 m. Twigs stout, subterete to faintly angular, at apex 3–6 mm diam., lower down 4.5–8 mm diam., when young rusty brown woolly-tomentose by hairs 0.5–1 mm high, lower down glabrescent, greyish, bark smooth or finely cracked, densely set with lenticels. *Leaves* coriaceous, above olivaceous, often shiny; lower surface densely rusty woolly-tomentose by hairs c. 0.5 mm high, when old glabrescent, grey-brown; blade elliptic to lanceolate, widest at or below the middle, 18–42 by 7.5–19 cm, top acute or up to 1.5 cm acute-acuminate, base short-attenuate to broadly rounded or subcordate, margin often revolute; midrib above flat, narrow or broad, 1–2 mm wide; nerves (13–)15–23 pairs, flat or slightly raised above, distinct and very prominent beneath; tertiary venation forming a coarse network ± indistinct at both surfaces; petiole stout, late-glabrescent, 10–20 by 3–5 mm; leaf bud c. 10–20 by 4–6 mm, densely dark brown or rusty tomentose by hairs 0.5–1 mm. *Inflorescences* paniculate, in male 6–10 cm long, up to c. 6 cm wide, many-flowered, rusty tomentose by hairs 1–2 mm long, in female 2–5 cm long, fewer flowered; bracts triangular, 2–4 mm long, pubescent, caducous. *Flowers* rusty pubescent inside and outside by hairs 0.2–0.3 mm long. *Male flower pedicel* 1–3 mm long; mature perianth bud ellipsoid-oblong, 4–6 by 2–3 mm, valves 3 (or 4), (long) triangular, splitting the bud to c. 1/4 to nearly 1/2-way, in anthesis erect or slightly spreading, perianth tube c. 2.5–3.5 mm long; androecium ± truncately ellipsoid, (sub)sessile, shorter than the perianth tube, 1.5–2 mm long, 0.8–1.2 mm wide; anthers (7–)9 or 10, subsessile with free apices ± erect, c. 0.25 mm long. *Female flower pedicel* (known from slightly immature flowers) c. 1 mm long; perianth in bud ovoid, 4–6 mm long, coriaceous; valves 3; ovary subglobose, densely pubescent, stigma sessile, 2-lobed. *Fruits* 2–8 per infructescence, ellipsoid to ellipsoid(-oblong), 2.2–3.5 by 1.5–2.2 cm, rusty tomentose by hairs 0.3(–0.5) mm high; pericarp c. 3 mm thick; stalk 3–5 mm long.

Fig. 3. *Gymnacranthera bancana* (Miq.) Sinclair. a. Habit of leafy twig, × ½; b. male inflorescence, × ½; c. male flower, × 6; d. ditto, opened, showing proportionally small androecium, × 6; e. fruits, × 1½; f. fruit, opened, showing thin pericarp and deeply laciniate aril of seed, × 1. – *G. ocellata* R. Schouten. g. Female flower, opened, showing pubescent ovary with obliquely 2-lipped sessile stigma, each lip shallowly lobulate, × 6; h. fruits, note truncate bases, × 1½ (a. *Sinclair SF 39502*, b–d. *Sinclair SF 40045*, e, f. *Sinclair & Kadim 10436*; g. *Endert 4835*, h. *Ilias Paie S 39255*).

Distribution. Malaya (Johore), Singapore, Sumatra (Aceh, Indragiri, Jambi, Palembang), Bangka, Borneo (Sarawak, Brunei).

MALAYA. Sine loc.: KEP 70190. – Johore: FRI 185, 2134, 2768, 6871, 17111, 23457; SF 29945, 32193, 33597.

SINGAPORE. Murton 13; Ridley s.n., 1835, 3364, 3890; SF 39502, 40045; Wallich 6803.

SUMATRA. S. Aceh: de Wilde & de Wilde-Duyfjes 20591, 20635. – Indragiri: bb 27590, 28624. – Jambi: bb 13659; Roos & Franken 1943. – Palembang: Anon. 16; bb E 580, E 581; Dumas 1575; Grashoff 645.

BANGKA. bb 11822; Kostermans 105A; Kostermans & Anta 694.

BORNEO. Sarawak: Beccari 1211, 3977; S 11044, 13411, 32452; Sinclair & Kadim 10176. – Brunei: BRUN 5029; Sinclair & Kadim 10436.

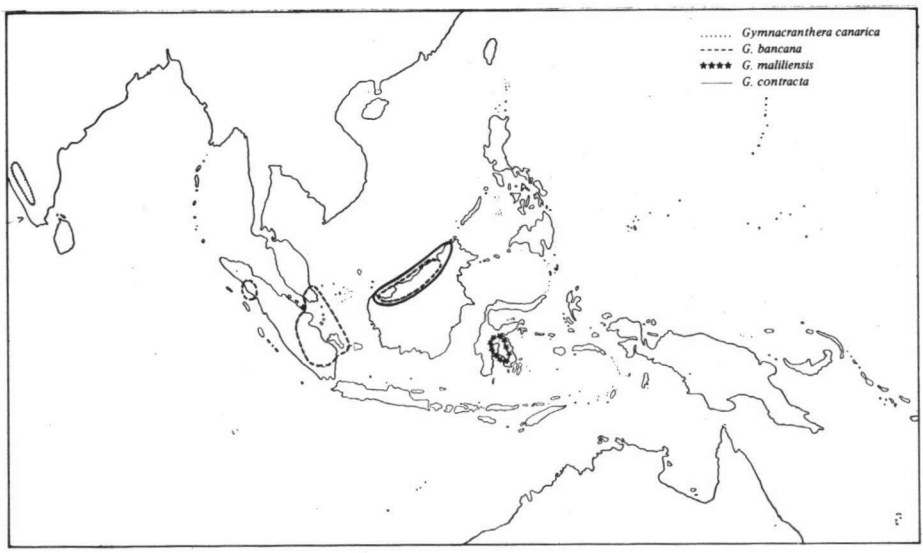

Fig. 4. Distribution of four species of *Gymnacranthera*.

Ecology. Primary and secondary dryland forest, also in swamp forest, hillsides and ridges; found on granite rock, sand and sandy loam soil; up to 250 m altitude. Fl. Sept., Oct., fr. throughout the year.

Vernacular names. Sumatra: kayu asap, medang simpai, perang, salak oetan; Malaya: penarahan; Bangka: balo (Malay).

Notes. 1. Field notes. 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. Recorded as a handsome tree, especially when in flower; flowers golden yellow with a brownish tinge, with a spicy odour when crushed.

2. This is a well-defined species within the genus, distinct by its stout habit and conspicuous tomentum on twig apex and lower leaf surface. Apart from this it is

taxonomically distinct from the other species by the androecium which is shorter than the perianth tube; in the remainder of the species the androecium equals the length of the perianth tube. By the distinct tomentum the present species may be confused with *G. maliliensis*, but the latter lacks the woolly hairs on the lower leaf surface.

3. Sinclair (l.c.) distinguished the Bornean specimens as a separate variety, var. *borneensis*, on account of acute leaf bases and somewhat larger flowers, but specimens with a rounded leaf base have been collected in Borneo, and the flower size in Bornean material appears to be similar to that of Malayan and Sumatran material.

3. Gymnacranthera maliliensis R. Schouten, *spec. nov.* – Fig. 2c, d, 4, 5.

Tomentum ramulorum et inflorescentiarum lanato-pubescens, pilis usque ad 0.5 mm longis. Folia subtus dense pubescentia. Ramuli dense lenticellati. Perianthium ♂ 3.5–4 mm longum; antherae 8–10. Fructus pubescentes, ellipsoideis, 2.3–3 × 2–2.2 cm; pericarpium in sicco 3–5 mm crassum. – Typus: *van Balgooy 3960* (L; iso BO, K), eastern Central Celebes, 2°15′–3° S, 121°45′ E, 11 July 1979, male flowers.

Tree 6–20 m. Twigs terete to slightly angular, fairly slender, at apex 1.5–2.5 mm diam., lower down 3–4 mm diam., when young rusty pubescent by woolly, not appressed, hairs up to c. 0.5 mm high, twigs lower down glabrescent, greyish to brown with the bark smooth or finely longitudinally cracked, densely set with lenticels. *Leaves* chartaceous to coriaceous, drying above olivaceous to brown, often shiny; lower surface densely pubescent by appressed hairs c. 0.2–0.3 mm long, when old glabrescent, brown to purplish grey; blade oblong to (oblong-)lanceolate, widest at about the middle, 10–28 by 3–7 cm, top acute or up to 2 cm acute-acuminate, base attenuate, margin not or but slightly revolute; midrib above flat or slightly sunken, narrow (c. 1 mm wide); nerves 8–17 pairs, flat above, distinct but not prominently raised beneath; tertiary venation forming a coarse network ± indistinct at both surfaces; petiole stoutish, glabrescent, 7–14 by 1.5–2(–2.5) mm; leaf bud slender, c. 10 by 2 mm, densely appressed-pubescent. *Inflorescences* (broadly) paniculate, in male 4.5–7 cm long, up to 6 cm wide, many-flowered, rusty tomentose by hairs c. 0.5 mm long, in female (only known from infructescences) little or much branched, rather few to many flowered, 3–5 cm long; bracts broadly triangular, c. 2.5–3 by 2.5 mm, pubescent, caducous. *Flowers* rusty pubescent inside and outside by hairs 0.1–0.2 mm long. *Male flower pedicel* 2.5–4 mm long; mature perianth in bud ellipsoid-oblong, c. 3.5–4 by 2 mm; valves 3 or 4, triangular to long-triangular, splitting the bud to 1/4–1/2, in anthesis ± erect or somewhat spreading; perianth tube c. 2–2.7 mm long; androecium ± truncately ellipsoid, c. 1.8–2.3 by 1.7 mm (nearly as long as the perianth tube), stipe c. 0.2 mm; anthers 8–10, subsessile, the free apices c. 0.5 mm long, erect or slightly curved inward. *Female flowers* not seen. *Fruits* seen up to 25 in immature infructescences, 3–6 when mature, ellipsoid, 2.3–3 by 2–2.2 cm, with persistent rusty tomentum of hairs c. 0.2 mm; pericarp 3–5 mm thick; stalk stout, 4–8 mm long.

Distribution. E. Central Celebes, east of Malili.


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CELEBES. Central: van Balgooy 3884, 3960; bb 1880, Cel. II 303, 316, 352, 402, Cel. V 255; Jacobs 1749.

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

Vernacular names. Morolarië, naoe-naoe-boeloe, taloenga, taloenga poeté.

Notes. 1. Field notes. Tree to 20 m, d.b.h. to 25 cm, with red sap. Flowers dark yellow, unripe fruits brown.

2. Apparently endemic to Central Celebes and obviously bound to ultrabasic soils. Distinguished from the only other in Celebes occurring species, *G. farquhariana* var. *zippeliana* by the more conspicuous tomentum of woolly hairs on the young twigs and the large fruits with thick pericarp.

3. Specimens of the present new species were by Sinclair included in his *G. paniculata* var. *zippeliana*.

4. Gymnacranthera ocellata R. Schouten, *spec. nov.* – Fig. 3g, h, 6.

Tomentum ramulorum et inflorescentiarum pilis appressis 0.2–0.3 mm longis compositum. Folia subtus sparse pubescentia. Ramuli robusti, dense lenticellis magnitudine variabilibus obsiti. Perianthium ♂ 3–4(–5) mm longum; antherae 8–10. Fructus breviter pubescentes, ovoidei-ellipsoidei, basi truncati, 1.8–2.2 × 1.1–1.3 cm; pericarpium in sicco c. 1 mm crassum. – Typus: *Saikeh SAN 72177* (L; iso K; KEP, SAR, SING, n.v.), Sabah, Beaufort Hill, 6 June 1972, male flowers.

Tree 10–25 m. Twigs terete or usually somewhat angular or ± compressed, stout, at apex 2–3.5(–5) mm diam., lower down 3.5–5.5(–6.5) mm diam., when young pubescent by appressed hairs c. 0.2 mm high, twigs when older glabrescent, the bark brown or usually grey, smooth or finely cracked, densely set with conspicuous lenticels of mixed sizes, including in the apical portion of the twig; at base of each season-shoot a distinct group of scars of cataphylls or bud scales (see notes), more conspicuous so than in other species. *Leaves* chartaceous to thinly coriaceous, drying above olivaceous to brown, often shiny; lower surface with rather coarse, distinct but not very densely set appressed rusty brown hairs, when old glabrescent, grey-brown; blade ovate-elliptic to oblong-lanceolate, widest at or below the middle, 10–25 by 4–9.5 cm, top acute, base short-attenuate to broadly rounded, margin not revolute; midrib above flat, narrow, c. 1 mm wide; nerves 11–18 pairs, flat to slightly raised above, distinct but not prominent beneath, making an angle with the midrib of c. 45° in the middle of the leaf; tertiary venation forming a coarse network rather indistinct at both surfaces; petiole stoutish, early glabrescent, 9–18 by 2–2.5 mm; leaf

Fig. 5. *Gymnacranthera maliliensis* R. Schouten. a. Habit of leafy twig with immature fruits, × ½; b. portion of twig with male inflorescence, × ½, c. male flower, × 6; d. ditto, opened, showing androecium, × 6; e. infructescence, × ½; f. fruit, opened, showing thick pericarp and deeply laciniate aril of seed, × 1 (a. *van Balgooy 3884*, b–d. *van Balgooy 3960*, e, f. *bb Cel./V 255*).

bud stoutish, composed of the unexpanded leaf often in addition with several cataphylls, c. 10 by 3 mm, densely appressed-pubescent. *Inflorescences* (broadly) paniculate, in male 3–8.5 cm long, up to 7 cm wide, many-flowered, rusty tomentose by hairs 0.3–0.5 mm long; in female up to 2 cm long, up to 1.5 cm wide, few-flowered; bracts broadly triangular, c. 2.5 by 3 mm, pubescent, caducous. *Flowers* rusty pubescent inside and outside by hairs 0.1(–0.2) mm long. *Male flower pedicel* 1.5–3.5 mm long; mature perianth in bud ellipsoid-oblong, 3–4(–5) by 2–3(–3.5) mm, valves 3 or 4, (long-)triangular, splitting the bud to 1/3–1/2, in anthesis erect or somewhat recurved, perianth tube 2–2.5 mm long; androecium ± truncately ellipsoid, subsessile or up to c. 0.2 mm stiped, 1.5–2.3 by 0.7–1 mm, about as long as the perianth tube; anthers 7–10, subsessile, the free apices 0.4–0.5 mm long, ± erect. *Female flower pedicel* 1.5–2.5 mm long; mature perianth in bud narrowly ovoid, 2.7–3 by 2 mm, valves (2 or) 3, long-triangular, splitting the bud to c. 1/2–3/4, in anthesis strongly spreading or ± recurved; perianth tube 0.5–1.3 mm long; ovary subglobose, 1.2–1.5 mm diam., densely minutely pubescent, stigma sessile, shallowly 2-lobed. *Fruits* 4–10 per infructescence, ovoid-ellipsoid with truncate base, 1.8–2.2 by 1.1–1.3 cm, short pubescent by hairs 0.1–0.2 mm long; pericarp 0.7–1.3 mm thick; stalk 3–7 mm long.

Distribution. Borneo: Sarawak, Brunei, Sabah, SE., E. & NE. Kalimantan (including also Pulau Nunukan).

BORNEO. Sarawak: Haviland 1650, 1760; S 14970, 25173, 28766, 35472, 35601, 35659, 36824, 39255; Zehnder 9457. – Brunei: BRUN 250. – Sabah: SAN 21166, 67965, 72177, 92957. – E. & NE. Kalimantan (incl. Nunukan I.): bb 26195, 29349; Kostermans 4288, 7730, 9154; Meijer 2395. – S. & SE. Kalimantan: bb 16792, 16838, 16868; Endert 4835; Kostermans 6086, 7241.

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

Vernacular names. Darah, daran, kumpang (Iban), perupak (Kelabit).

Notes. 1. Field notes. Bole smooth, 10–17 m; no buttresses. Bark smooth or fissured or regularly cracked, sometimes 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. Flower buds green-brown, yellow in anthesis, anthers (pollen) whitish yellow. Fruits green turning orange or orange-brown.

2. Specimens belonging to this species were by Sinclair included in *G. contracta*, which is here accepted in a much more restricted sense. The present species differs by the characters given in the key, but furthermore may be recognized by the conspicuous and numerous scars of cataphylls or bud scales present at the base of each seasonal shoot. Apparently *G. ocellata* has a marked seasonal growth, with the resting terminal bud of a more complicated structure. Observations in the field should confirm this. The epithet refers to the ocellus-like pale lenticels on the twigs.

3. The specimens bb 16838 and 16868 from SE. Kalimantan have relatively small leaves but certainly belong to the present species.

5. Gymnacranthera contracta Warb. – Fig. 4.

G. contracta Warb., Mon. Myrist. (1897) 360, t. 20, f. 1–4 (excl. *Motley 1284 = G. forbesii*); Sinclair, Gard. Bull. Sing. 16 (1958) 439, f. 54, p.p.; 17 (1958) 100, p.p. – *Myristica contracta* (Warb.) Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 88. – Types: *Beccari 321* (♂, ♀; K lecto; BO, C, FI, G, M, NY, P, S, n.v.), *419* (K; FI, G, n.v.), *2999* (K; FI, G, P, n.v.).

Tree 5–26 m. Twigs stoutish, when young subterete to angular or ± ridged, at apex 3–4(–5) mm diam., lower down 3.5–5.5 mm diam., early glabrescent from very minute tomentum, bark chocolate to greyish brown, smooth with few small lenticels when young, finely longitudinally cracked with lenticels when older. *Leaves* chartaceous to subcoriaceous, drying above brownish, often shiny; lower surface with scattered appressed hairs, glabrescent, greyish to violaceous; blade elliptic-oblong to lanceolate, widest at or below the middle or ± parallel-sided, (16–)20–29 by 6–9.5 cm, top acute or up to 2 cm acute-acuminate, base short-attenuate to broadly rounded, margin not revolute; midrib above slightly sunken (grooved), narrow, c. 1 mm wide; nerves (11–)13–18 pairs, above flat, beneath slender, distinct but not much prominent, making an angle of 60–70° with the midrib in the middle of the leaf; tertiary venation forming a coarse network indistinct at both surfaces; petiole rather stout, early glabrescent, 10–20(–25) by 2–2.5 mm; leaf bud slender or broad, c. 4–8 by 2–3 mm, sometimes with additional cataphylls (scales), densely minutely appressed-pubescent. *Inflorescences* in male (broadly) paniculate, 3.5–4.5 cm long, up to 4 cm wide, many-flowered, rusty tomentose by hairs 0.3–0.5 mm long, in female contracted, c. 1.5–2 by 1 cm, fewer but more densely flowered; bracts broadly triangular, c. 2.5 by 3 mm, pubescent, caducous. *Flowers* rusty pubescent inside and outside, hairs 0.1–0.2 mm long. *Male flower pedicel* 2–2.5 mm long; mature perianth in bud ellipsoid-oblong, 2.5–2.8 by 1.5–2 mm; valves 3 or 4, triangular, splitting the bud to 1/3 to nearly 2/3, the valves in anthesis erect or but slightly spreading; perianth tube 1–1.8 mm long; androecium ± truncately ellipsoid-oblong, c. 1.7 mm long, 0.6–0.7 mm wide (i.e. about as long as the perianth tube), subsessile or up to 0.2 mm stiped; anthers 6(–8), subsessile, the free apices c. 0.25 mm long, ± erect. *Female flower pedicel* 1–2 mm long; mature perianth in bud narrowly obovoid, c. 3–3.5 by 2 mm; valves 3 or 4, long-triangular, splitting the bud to c. 2/3–3/4, in anthesis strongly curved outward or reflexed; perianth tube 0.7–1 mm long; ovary subglobose, densely minutely pubescent, c. 1.2 mm diam., stigma sessile, minutely 2-lobed. *Fruits* c. 7 per infructescence, ellipsoid, 2–2.2 by 1–1.4 cm, minutely pubescent (hairs c. 0.1 mm) or early glabrescent; pericarp 1.2–1.4 mm thick; fruit stalk 3–7 mm long.

Distribution. Borneo: Sarawak, Brunei, Sabah.

BORNEO. Sarawak: Anderson 4324; Beccari 321, 419, 2999; Bojeng 9351; Haviland & Hose 3308; Rosli 3395; S 15677, 16993, 24636; Sinclair & Kadim 10221, 10231; Whitmore 8415; Yakup 9326. – Brunei: BRUN 5512. – Sabah: SAN 16368, 77732.

Ecology. Primary lowland forest, up to 250 m altitude. Fl. July–Sept., fr. Oct.–Dec.

Vernacular name. Kumpang (Iban).

Notes. 1. Field notes. Bark of bole recorded as reddish brown, nearly smooth, very fine scaly; inside hard, pale reddish brown. Flowers yellow. Fruit dark red.

2. This species was originally described by Warburg as confined to Borneo (Sarawak); the cited Motley specimen from Banjermasin is referred to *G. forbesii*. Sinclair had a much wider conception of *G. contracta*, including also specimens presently referred to a new species, *G. ocellata*, as well as specimens now placed in *G. farquhariana* var. *zippeliana*. Sinclair mentions *G. contracta* besides from Borneo also from Malaya (Alvins 854/897, not seen) and Singapore (Sinclair 39581, sterile), but these collections almost certainly belong to *G. farquhariana* var. *zippeliana*; the records from Billiton (Belitung) surely belong to the latter.

3. *Gymnacranthera contracta* apparently is named with reference to the rather condensed female inflorescence as in Beccari 321 and Haviland & Hose 3308 (depicted by Sinclair, 1958: 440, f. 54) but the limited material makes it uncertain whether this is a true characteristic. Although *G. contracta* obviously is a small and 'difficult' species, I prefer to maintain it in its original restricted sense, recognized by its smooth, usually ± angular, purplish twigs, by the leaves usually drying flat, not undulating, with the midrib slender and sunken, the lateral nerves usually flat (not raised), making a relatively wide angle of 60–70° with the midrib (see also note 4).

4. Deviating specimens. Anderson 4324 has comparatively very narrow leaves; Beccari 2999 has the leaves also narrow, and rather small; S 16993 and BRUN 5512 deviate by coriaceous leaves drying rather undulated, not flat; S 15677 somewhat resembles *G. forbesii* var. *forbesii* with rather prominent nerves.

6. Gymnacranthera forbesii (King) Warb. – Fig. 6.

Myristica forbesii King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 306, t. 137. – *G. forbesii* (King) Warb., Mon. Myrist. (1897) 363, t. 20, f. 1–2; Gamble, Mat. Fl. Mal. Pen. 5 (1912) 224; Ridley, Fl. Mal. Pen. 3 (1924) 61; Sinclair, Gard. Bull. Sing. 16 (1958) 441, f. 55, pl. XIII B; 17 (1958) 101. – Types: *Forbes 2976* (female fl.) (BM; K lecto; L), Sumatra, Benkulu; *Maingay 1293* (CAL, n.v.; K), Malaya, Penang; *Maingay 1295* (K), Malacca; *Ridley 6157* (SING, n.v.), *6270* (K; SING, n.v.), Singapore.

Tree, 5–35 m. Twigs stout, subterete to angular or ridged in the young parts, at apex (2–)2.4–4 mm diam., lower down 3.5–5.5 mm diam., early glabrescent, rarely with little pubescence of hairs 0.1 mm or less on young twigs, bark at first chocolate with few lenticels, later on brown or grey, finely cracked, with many lenticels. *Leaves* chartaceous to coriaceous, drying often coarsely undulating (not flat), above olivaceous to dark brown, sometimes shiny; lower surface glabrescent from scattered appressed minute hairs, grey(-purple) to brownish; blade elliptic to oblong-lanceolate, widest at or below the middle, 14–33 by (5.5–)6–13 cm, top acute or up to 1 cm acute-acuminate, base (short-)attenuate to broadly rounded, margin not revolute; midrib above somewhat sunken (grooved) above, narrow (c. 1.5 mm wide); nerves 10–18 pairs, flat above; yellowish, distinct and prominent or very prominent beneath, making an angle of (35–)40–50(–55)° with the midrib in the middle of the

leaf; tertiary venation forming a coarse network, sometimes distinct at the lower surface; petiole stout, early glabrescent, 8–20 by 1.5–3 mm; leaf bud rather broad or slender, 5–10 by 1.5–4 mm, densely minutely pubescent by greyish hairs c. 0.1 mm. *Inflorescences* paniculate, in male 4–12 cm long, up to 8 cm wide, many-flowered, (grey-)rusty tomentose by ± woolly hairs 0.2–0.4 mm long; in female 1–4 cm long, 1–3 cm wide, generally fewer-flowered; bracts triangular, c. 3 by 3.5 mm, pubescent, caducous. *Flowers* grey-rusty pubescent inside and outside by hairs 0.1–0.2 mm long. *Male flower pedicel* 2–3 mm long; mature perianth in bud ellipsoid-oblong, 2.5–4 by 1.5–2 mm, valves 3 (or 4), (long-)triangular, splitting the bud to c. 1/3 to nearly half-way, in anthesis erect or but slightly spreading, perianth tube 1.5–2.3 mm long; androecium ± truncately ellipsoid-oblong, subsessile or up to c. 0.2 mm stiped, c. 1.5–2.3 by 1 mm, i.e. about as long as the perianth tube; anthers 6–10, subsessile, often somewhat twisted, with free apices 0.3–0.5 mm long, ± erect. *Female flower pedicel* c. 2 mm long; mature perianth in bud ovoid or pyriform, 2–2.5 by 1.7–2 mm, valves (2 or) 3 (or 4), long-triangular, splitting the bud to c. 3/4, in anthesis the valves strongly spreading or recurved; perianth tube short-urceolate, 0.5–0.7 mm long; ovary subglobose, 1–1.3 mm diam., densely minutely pubescent; stigma sessile, minutely 2-lobed. *Fruits* c. 4–25 per infructescence (see also under the varieties), ellipsoid-oblong, 1.8–2.4 by 1–1.4 cm, (early) glabrescent or short-pubescent (hairs c. 0.1 mm); pericarp c. 1 mm thick; stalk 4–10 mm long.

Distribution. S. Thailand, Malaya, Singapore, Sumatra, Borneo; somewhat arbitrarily two varieties can be distinguished, one confined to Borneo.

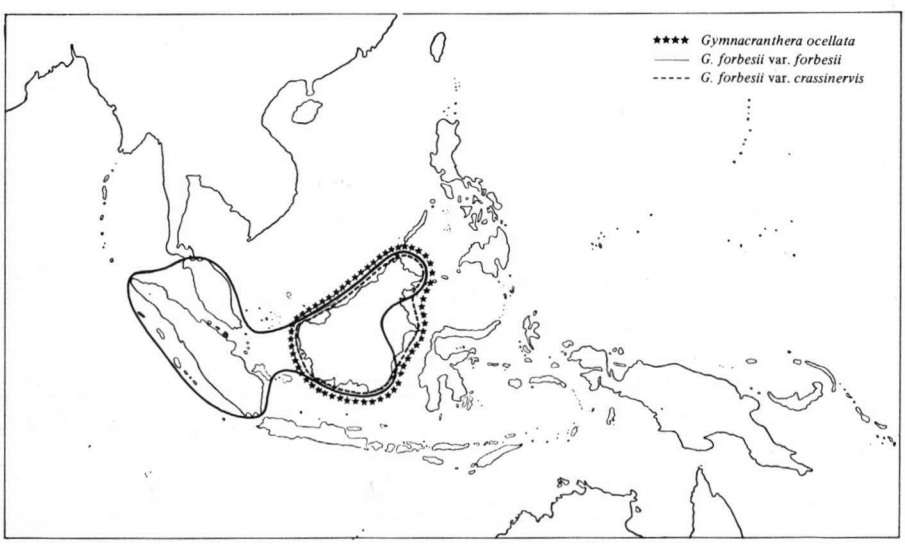

Fig. 6. Distribution of three taxa of *Gymnacranthera*.

KEY TO THE VARIETIES

1a. Leaves chartaceous to coriaceous; nerves on lower surface moderately prominent, 0.3–0.5 mm wide. Infructescences usually not much branched at base, few-fruited. *Malaya, Sumatra, Borneo* ..... **a.** var. **forbesii**

b. Leaves (very) coriaceous; nerves on lower surface more prominent and slightly thicker on the average, 0.5–0.7 mm wide. Infructescences conspicuously branched from the base, many-fruited. *Borneo* ..... **b.** var. **crassinervis**

a. var. **forbesii**

G. forbesii (King) Warb. var. *forbesii*; Sinclair, Gard. Bull. Sing. 17 (1958) 101, f. 1A, C, p.p. (see the notes).

Twigs stout, at the apex (2–)2.5–3 mm diam., lower down 3.5–4 mm diam. Leaves chartaceous or rarely 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 but little branched at base, rather few-fruited, each bearing 4–10 fruits.

Distribution. S. Thailand (Pattani), Malaya, Singapore, Sumatra, Borneo.

THAILAND. South, Pattani: Lakshnakara 600, 601.

MALAYA. FRI 5749. – Wellesley: Ridley 9464. – Perak: FRI 6071; KEP 77285, 80605; King's Coll. 3783, 6591, 6784, 6973, 7419, 7645, 7732, 8159, 8722, 8756; Wray 1429. – Kelantan: FRI 4228; KEP 104275, 104848. – Trengganu: FRI 10630, 25015. – Pahang: Awang Lela 2683; FRI 14328, 14416, 14670, 22157; Hamid 10864; Soepadmo 777. – Selangor: Ahmad 4581, 4874; Arnott 14801; KEP 80814, 98272, 99252; Millard 1333; Ridley s.n. – Negeri Sembilan: FRI 16119; KEP 109413; Ridley 1843. – Malacca: Goodenough 1317; Maingay 1295, 2428. – Johore: FRI 7986, 8681, 17147, 25314; KEP 64086, 77873; SF 28712, 28970, 36866, 36961. – Penang: Fox 12741; Maingay 1293; Ridley 12741.

SINGAPORE. Ridley s.n., 6270.

SUMATRA. S. Aceh: de Wilde & de Wilde-Duyfjes 20542, 20544, 20550, 20648. – East Coast: Bartlett 7052. – Indragiri: bb 28501. – Bengkulu: Forbes 2061, 2976, 3061. – Palembang: bb 32217, T. 512; Endert 62 E 1 P 619, 62 E 1 P 620, 86 E 1 P 606. – Simeuluë: Achmad 1258, 1316, 1376, 1442, 1452, 1554.

BORNEO. Sarawak: Jacobs 5203, 5259; Rosli 3393; S 3526, 3531, 15801, 29063. – Sabah: SAN 22087, 59283, 65485, 66186. – SE. Kalimantan: Motley 1284.

Ecology. Primary and secondary forest; hill sides and riverbanks, alluvial forest; on sandy and lime-sand stone derived soils; up to 600 m altitude. Fl. Feb.–April and Aug.–Sept., fr. May–July(–Aug.) and Dec.–Jan.

Vernacular names. Malaya: medang kuning, penarahan (Temnan); Simeuluë: balak, oeding, sebel foeloeng (Edaran); Borneo: darah-darah, kumpang, lahu (Kayan).

Notes. 1. Field notes. Bole usually straight, not buttressed, bark soft, grey to brown, smooth or finely fissured, sometimes thinly flaky, inner bark pink to red-brown, laminated, sometimes fibrous; slash wood white to pale yellow; crown irregular, dense; flowers brown-green in bud, bright yellow in anthesis; pollen whitish; fruits brown-green turning orange.

2. With Sinclair the var. *forbesii* consists of a mixture of what I presently regard as var. *forbesii* and specimens now referred to *G. farquhariana* var. *zippeliana* and the present new species *G. ocellata*; *G. farquhariana* var. *zippeliana* differs by generally narrower leaves, lateral nerves less prominent beneath and usually more slender, not stoutish twigs; *G. ocellata* can be distinguished by more conspicuous lenticels on the twigs, usually distinct scars of bud scales at the base of the season shoots, and a more conspicuous tomentum on the lower leaf surface (see also note 3). A possibly good herbarium character is that the leaves of *G. forbesii* usually dry coarsely undulating, not flat as in other species.

3. Deviating specimens. FRI 22157 and Wray 1429 (Malaya) and bb 32217 and Endert 86 E 1 P 606 resemble *G. farquhariana* var. *zippeliana* by rather slender twigs or small leaves with relatively weak nerves. Motley 1284 (Borneo; identified as var. *crassinervis* by Sinclair) somewhat resembles *G. contracta*, but in my opinion belongs to *G. forbesii* var. *forbesii*. Rosley 3393 and S 29063 (from Borneo) are intermediate between var. *forbesii* and var. *crassinervis*, especially in the stoutness of the lateral nerves beneath (c. 0.5 mm wide) but the texture of the leaves is rather chartaceous as in good var. *forbesii*.

b. var. crassinervis (Warb.) Sinclair

G. crassinervis Warb., Mon. Myrist. (1897) 362, t. 20, f. 1–3. – *Myristica crassinervis* (Warb.) Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 88. – *G. forbesii* var. *crassinervis* (Warb.) Sinclair, Gard. Bull. Sing. 17 (1958) 102, f. 1B. – Types: *Beccari 1119* (fr.; K lecto; iso FI, G, LE, P, n.v.), Sarawak; *Fraser 241* (male fl.; K; iso CAL, n.v.), Sabah.

Twigs stout, at the apex (2.5–)3–4 mm diam., lower down 3.5–5.5 mm diam. 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, many-fruited, each bearing 8–25 fruits.

Distribution. Borneo (Sarawak, Sabah, Central & S., E. & NE. Kalimantan, according to Sinclair also W. Kalimantan, but no specimens seen).

BORNEO. Sarawak: Beccari 1119; Fuchs 21215, 21231; Richards 2289; S 21787, 21909, 22472, 22810, 23904, 23969, 24801, 25987, 26241, 32201, 37790, 37879, 38076, 41524; Sinclair & Kadim 10225. – Sabah: Fraser 241; SAN 16689, 59283, 73081, 73833, 80966, 83458; Sinclair & Kadim 9248. – Central & S. Kalimantan: Mogea 4331, 4357. – E. & NE. Kalimantan: bb 13918, 17806, 17837, 18356, 18463.

Ecology. Primary and secondary dryland as well as wet forest, alluvial forest; on sandy, sandy-clay and loamy soils; up to 1250 m altitude. Fl. mainly April and Aug.–Oct., fr. April and Aug.–Dec.

Vernacular names. Kumpang, kumpang semah (Iban), raja koejoe.

Notes. 1. Field notes. Bole recorded as without buttresses; bark grey to brown, smooth or sometimes slightly flaky, slash wood white-orange-brown. Flowers bright yellow. Fruit brown green, orange-red when ripe.

2. *Gymnacranthera forbesii* var. *crassinervis* usually is easily recognized and distinguished from var. *forbesii* and all other species of *Gymnacranthera* by its stout habit (twigs and leaves) and usually strong orange-yellowish lateral nerves very distinctly raised on the lower leaf surface. *Gymnacranthera bancana* also is a stout species, but leaves and young twigs always carry a conspicuous rusty tomentum, whereas *G. forbesii* var. *crassinervis* is almost glabrous.

3. The distinction of var. *crassinervis* from var. *forbesii* is not always quite clear; SAN 83458, approaching var. *forbesii*, is regarded as a meagre specimen of var. *crassinervis*.

7. Gymnacranthera farquhariana (Hook.f. & Th.) Warb. – Fig. 7.

Myristica farquhariana Wall. ex Hook.f. & Th., Fl. Ind. (1855) 161, p.p. – *G. farquhariana* (Hook.f. & Th.) Warb., Mon. Myrist. (1897) 365, t. 20. – For other references and typification see under var. *farquhariana*.

For further synonyms see under the varieties.

Tree 3–30(–45) m. Twigs usually slender, subterete to faintly angular, ± ridged or lined when young, at apex 1–2 mm diam., lower down 2–3.5 mm diam., rarely slightly thicker, early glabrescent from minute tomentum, rarely some tomentum (hairs c. 0.1 mm) present on young twigs, bark at first chocolate to grey, later on grey-brown, smooth, lenticellate. *Leaves* thinly chartaceous to coriaceous, above drying olivaceous to brown or chocolate, sometimes shiny; lower surface glabrescent from thin pubescence of appressed hairs c. 0.1 mm, pale greenish brown to grey-purplish; blade elliptic to lanceolate, widest usually at or above the middle, 5–17 by 1.5–5.5(–6) cm, in East Malesia up to 27 by 8.5 cm, top acute or up to 2 cm acute-acuminate, base ± attenuate, margin conspicuously revolute or not; midrib above flat or sunken (grooved), narrow, to c. 1 mm wide; nerves 7–11(–15) pairs, flat or slightly raised or slightly sunken above, flat or raised beneath and distinct and contrasting in colour with the lower leaf surface or not; tertiary venation forming a coarse network, generally indistinct; petiole slender, 6–15(–18) by 1–2.5 mm, early glabrescent; leaf bud slender, c. 5–10 by 1–2 mm, densely appressed pubescent by greyish hairs c. 0.1 mm. *Inflorescences* paniculate, in male 2.5–12 cm long, up to 8 cm wide, many-flowered, rusty tomentose by hairs c. 0.2 mm long; female inflorescences up to 4 by 2 cm, fewer flowered than in male; bracts broadly triangular, c. 1 by 2 mm, pubescent, caducous. *Flowers* rusty pubescent by hairs c. 0.1 mm long inside and outside. *Male flower pedicel* 1.5–4 mm long; mature perianth in bud ellipsoid to ellipsoid-oblong, 2.5–4 by 2–3 mm, valves 3 or 4, triangular or long-triangular, splitting the bud to c. 1/3–2/3, in anthesis the valves erect or slightly spreading, perianth tube 1–2.3 mm long; androecium ± truncately ellipsoid-oblong, c. 1–2.5 by 0.8–1 mm, i.e. about as long as the perianth tube, subsessile or up to 0.3 mm stiped; anthers (6 or) 7–11(–13), subsessile, with free apices up to 0.5 mm long, ± erect or somewhat incurved. *Female flower pedicel* 1.5–3 mm long; perianth in bud ovoid or obpyriform, 2–3 by 1.5–2 mm, valves 3 or 4, long-triangular, in anthesis splitting

the bud to c. 1/2–3/4, the valves strongly spreading or recurved; perianth tube short-urceolate, 0.7–1.5 mm long; ovary subglobose, densely minutely pubescent, c. 1 mm diam., stigma minute, subsessile, 2-lobed. *Fruits* up to 10 per infructescence, subglobose to ellipsoid-oblong, 1.8–2.8 by 1.1–1.9 cm, glabrescent (glabrous) or inconspicuously pubescent by hairs c. 0.1 mm; pericarp c. 1 mm thick; fruit stalk 4–15 mm long.

Distribution. A widespread particularly complex species ranging from Malaya through Malesia to the Bismarck Archipelago. The diversity is accommodated in four rather arbitrarily segregated varieties.

KEY TO THE VARIETIES

1a. Leaves oblong-lanceolate, small, 5–13.5 by 1.5–4.5 cm; nerves beneath not or hardly raised, i.e. usually they cannot be felt with the finger. Fruits short-ellipsoid to globose. *Malaya, Sumatra, Borneo* . . . . . **b. var. eugeniifolia**

b. Leaves small or large, 6–27 by 2–8.5 cm; nerves beneath usually clearly visible and contrasting, usually distinctly raised and to be felt with the finger. Fruits various 2

2a. Leaves coriaceous, elliptic to elliptic-oblong, 6–15(–17) by 3–5.5(–6) cm, usually with conspicuous revolute edge. Fruits short-ellipsoid to globose. *Malaya, Borneo, Sumatra* (see notes) . . . . . **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 short-ellipsoid to globose, stipe 8–15 mm long. *Philippines* **c. var. paniculata**

b. Fruits ellipsoid to oblong, rarely subglobose (*Moluccas*, see notes), stipes 4–8 mm. *West Malesia* (nerves beneath usually pale yellowish), *East Malesia* (nerves usually reddish brown and contrasting), rare in the *Philippines* **d. var. zippeliana**

a. var. farquhariana

Myristica farquhariana Wall. ex Hook. f. & Th., Fl. Ind. (1855) 161, p.p.; A. DC., Prod. 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. – *G. farquhariana* (Hook. f. & Th.) Warb., Mon. Myrist. (1897) 365, t. 20, p.p. – Syntypes: *Griffith s.n.*, Malaya; *Wallich Cat. 6795* (BM; K lecto; K-W, n.v.), Singapore; *Hohenacker 541* (BM, K), India, Canara; *Cuming 901* (BM, K. L; C, G, M, MEL, NY, UPS, n.v.), Philippines, Luzon. See also the notes.

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*). – *G. farquhariana* var. *griffithii* (Hook. f.) Warb., Mon. Myrist. (1897) 368; Gamble, Mat. Fl. Mal. Pen. 5 (1912) 226, p.p.; Ridley, Fl. Mal. Pen. 3 (1924) 62. – *G. eugeniifolia* var. *griffithii* (Hook. f.) Sinclair, Gard. Bull. Sing. 16 (1958) 447, f. 57; 17 (1958) 113. – Syntypes: *Griffith 4356* (K lecto; A, CAL, P, n.v.), Malaya, Malacca; *Maingay 1306* (BM, K, L), Singapore.

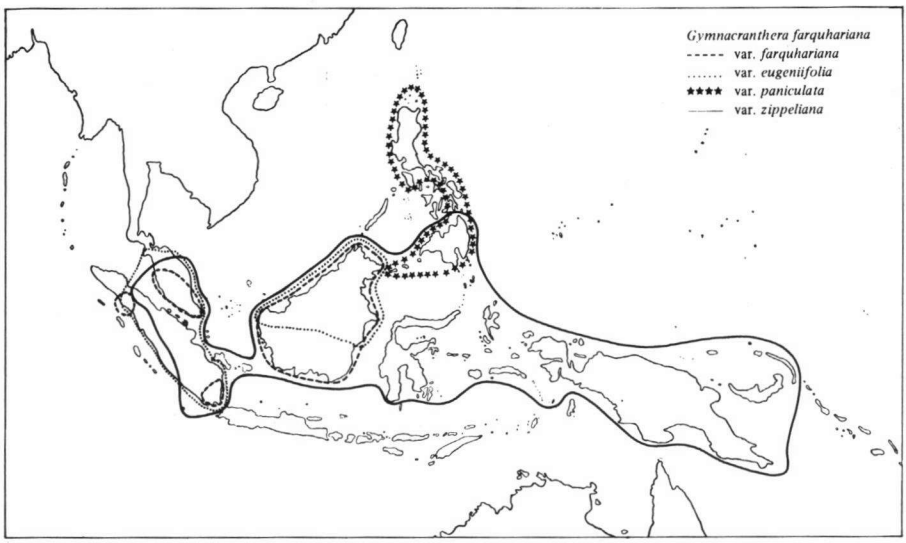

Fig. 7. Distribution of *Gymnacranthera farquhariana* and its four varieties.

Myristica farquhariana var. *major* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 306, pl. 136, f. 4. – *G. farquhariana* var. *major* (King) Gamble, Mat. Fl. Mal. Pen. 5 (1912) 226; Ridley, Fl. Mal. Pen. 3 (1924) 62. – Syntypes: *King 6548* (K, L; CAL, DD, E, FI, n.v.), *King 6622* (BM, K, L; CAL, DD, G, SING, n.v.), *King 6736* (CAL, MEL, UPS, n.v.), *King 7928* (K, L; CAL, FI, G, n.v.), *Wray 2399* (K; CAL, SING, n.v.), *Wray 2695* (K; CAL, FI, SING, n.v.), all Malaya, Perak; *Griffith 4355* (K lecto; A, CAL, FI, LE, M, n.v.), Malacca.

Tree 3–30 m. Leaves coriaceous; blade elliptic to elliptic-oblong, widest at or above the middle, 6–15(–17) by 3–5.5(–6) cm, usually with conspicuously revolute edge; nerves 7–11 pairs, on the lower leaf surface distinct and contrasting in colour 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; stalk 6–15 mm long.

Distribution. Peninsular Thailand, Malaya, Singapore, S. Sumatra (Lampung), Borneo.

THAILAND. Bangkhon Tong, Tak Bai: Niyomdham 813.

MALAYA. Sine loc.: FRI 2127. – Perak: FRI 5682; KEP 98517; King's Coll. 5801, 6548, 6620, 6622, 6652, 7732, 7928; Wray 2399, 2695. – Pahang: FRI 17903. – Selangor: KEP 71574, 97799; Omar 8504; SF 34093. – Malacca: Griffith s.n., 4355, 4356. – Johore: FRI 2149, 2152, 2192; Hardial 524; Kadim & Noor 406; KEP 100003; Ridley 3365, 13263; SF 29499, 32157.

SINGAPORE. Ridley 1834, 3961; SF 37718, 40716; Wallich 6795.

SUMATRA. S. Aceh: De Wilde & de Wilde-Duyfjes 20458, 20542, 20544, 20550. – Lampung: Muchtar 51A (see notes).

BORNEO. Sarawak: Beccari 2246; S 14916, 16799, 24605, 29312, 32973, 39581, 40161, 42111; Sinclair & Kadim 10185; Yakup 8905; Zehnder 9567, 9584. – Brunei: BRUN 697, 837; S 1002; Sinclair & Kadim 10420. – Sabah: SAN 17434, 17453, 17559, 35170, 35196, 50082, 50601, 51011, 52613, 58424, 63195, 78132, 80059, 83234. – S. & SE. Kalimantan: Kostermans 8010. – E. Kalimantan: Nunukan I., Kostermans 9301.

Ecology. Primary and secondary forest; mostly in peat swamp forest but occasionally found on hillsides; 0–1000 m altitude. Fl. mainly April–July, fr. Sept.–March.

Vernacular names. Malaya: penarahan; Sarawak: kumpang (Iban).

Notes. 1. Field notes. Crown dense or spreading; bole smooth, in peat swamp sometimes recorded as with buttresses or with a few stilt roots; bark dark brown, brittle; slash wood whitish; flowers yellow; fruit yellow to orange, very spicy.

2. Nomenclature and typification. As also explained under *G. canarica*, contrary to Sinclair I insist that the oldest name in the present species, *Myristica farquhariana*, should be typified by the Wallich Catalogue specimen no. 6795. The name was validly published by Hooker f. & Thomson in Flora Indica, July 1855, p. 162, where they enumerate specimens belonging to it, viz. a Griffith collection from Malaya, Wallich 6795 from Singapore, Hohenacker 541 from India, and Cuming 901 from the Philippines, but the name '*farquhariana*'* was taken from Wallich's List no. 6795 and 'Wallich' was quoted (erroneously as no. 6798) by Hooker & Thomson behind the name and ahead of the species description. In this description the anthers are described as 'incurved', and at the end, when discussing affinities with other groups within *Myristica*, they state: 'The anthers are, however, distinctly involute, and lobed at apex.' In the Indian species (in our present treatment *G. canarica*), represented by Hohenacker 541, the free apices of the anthers are erect or rather outward-curved, and hence the name *farquhariana* never can be applied to that species. This view was earlier adopted by King (1891), followed by Warburg (1897), who accepted the new name '*canarica*' for the Indian species.

Shortly after the publication by Hooker f. & Thomson of the name *farquhariana* A. de Candolle was aware of the heterogeneity of the elements quoted by Hooker & Thomson, and in the Annales des Sciences Naturelles Bot. 4, 4 (1855) p. 31 and the Prodromus (1856) he divided the specimens over two species, viz. 1) *Myristica paniculata* (here: *G. farquhariana* var. *paniculata*) for Cuming 901 from the Philippines, and 2) (in my opinion erroneously) *Myristica farquhariana* for the Indian specimen Hohenacker 541, but quoting here Wallich 6795 (from Singapore) as well. The Griffith-specimen is not mentioned by De Candolle, but possibly this would have fallen within his species *Myristica eugeniifolia* (presently: *G. farquhariana* var. *eugeniifolia*), published at the same time in Ann. Sc. Nat. (1855) p. 29. De Candolle's names do not antedate '*farquhariana*' because they are later, as can be proved by the fact that under *Myristica paniculata* A. DC. the name *Myristica farquhariana* Hook. f. & Th., in part, already is quoted.

* Named after Wallich's friend William Farquhar, first resident of Singapore (1819).

3. Synonyms. *Myristica griffithii* and *M. farquhariana* var. *major* are taxonomic synonyms according to their lectotype specimens.

4. The four varieties here recognized under *G. farquhariana* are instated to deal with the annoying variation within this complex species. The varieties are very close to each other, and this means that several specimens are not easily placed within a variety. Some marked examples of such intermediates (other cases are enumerated in the notes to the other varieties) are the following:

– FRI 2192, 17903 and KEP 98517 (Malaya) rather deviate by relatively large fruits measuring c. 2.8 by 1.8 cm.
– Muchtar 51A (from S. Sumatra) differs by rather chartaceous, not coriaceous, leaves and hence approaches var. *eugeniifolia* which has a wide distribution in Sumatra.
– SAN 52613, 83234 (Sabah) resemble var. *zippeliana* by their large leaves, reaching up to 19 cm long.

b. var. **eugeniifolia** (A. DC.) R. Schouten, *comb. nov.*

Myristica eugeniifolia A. DC., Ann. Sc. Nat. 4, 4 (1855) 29; Prod. 14, 1 (1856) 190; Miq., Fl. Ind. Bat. 1, 2 (1858) 58; Hook. f., Fl. Brit. India 5 (1886) 113. – *G. eugeniifolia* (A. DC.) Sinclair, Gard. Bull. Sing. 16 (1958) 444, p.p. – *G. eugeniifolia* var. *eugeniifolia* Sinclair, Gard. Bull. Sing. 16 (1958) 444, f. 56, pl. XIV, p.p.; 17 (1958) 112, p.p. – Type: *Gaudichaud 116* (FI, G, P, n.v.), Malaya, Penang.

Myristica farquhariana auct. non Hook. f. & Th., p.p.: Hook. f., Fl. Brit. India 5 (1886) 108; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 305. – *G. farquhariana* auct. non (Hook. f. & Th.) Warb., p.p.: Warb., Mon. Myrist. (1897) 365; Gamble, Mat. Fl. Mal. Pen. 5 (1912) 225; Ridley, Fl. Mal. Pen. 3 (1924) 62.

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

G. apiculata Warb., Mon. Myrist. (1897) 359, t. 20, f. 1–2. – *Myristica apiculata* (Warb.) Boerl., Handb. Fl. Ned. Ind. 3, 1 (1900) 88. – Type: *Beccari 2246* (K; FI, G, LE, S, n.v.), Borneo, Sarawak.

Tree 3–30 m. Leaves chartaceous to coriaceous; blade oblong-lanceolate, widest at or below the middle, small, 5–13.5 by 1.5–4.5 cm, the margins little or conspicuously revolute or not; nerves 6–10 pairs, on lower leaf surface not or hardly raised, usually not contrasting in colour, usually 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; stalk 4–13 mm long.

Distribution. Malaya, Singapore, whole of Sumatra, Borneo.

MALAYA. Sine loc.: Maingay 1302, 1303, 1303B. – Kedah: Darus 7682; FRI 0391, 25070. – Kelantan: FRI 4350, 4446. – Perak: FRI 1773, 6100, 13122, 17370; KEP 72518; King's Coll. 4640, 5408, 6141, 6631; Wray 2084. – Trengganu: FRI 3908, 3925, 11862, 13539, 25154. – Pahang: FRI 4786, 14546. – Selangor: Curtis 3768; KEP 79106. – Malacca: Maingay 1290. – Johore: Corner 29955; FRI 17540; KEP 2127; Ngadiman 36909; Ridley 11029. – Langkawi I.: FRI 15007. – Penang I.: Curtis s.n., 487, 804; Ridley s.n.

SINGAPORE. Cantley s.n.; SF 34628; Ridley 2102, 3366, 11646; Sinclair 8905.

SUMATRA. Tapanuli: bb 19305. – West Coast: bb 3995. – East Coast: Krukoff 4052;

Rahmat si Bocea 8035; Soepadmo 230. – Indragiri: bb 28598. – Jambi: Franken & Roos 1998. – Palembang: Grashoff 1131.

BORNEO. Sarawak: Anderson 9420; S 24289, 38330; Sinclair & Kadim 10229. – Brunei: BRUN 568. – Sabah: SAN 17514, 22396, 44629, 44740, 66029, 73834. – E. & NE. Kalimantan: bb 16048.

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

Vernacular names. Malaya: darah-darah, penarahan; Sumatra: kayu gajah, mandarahan; Borneo: kumpang (Sarawak).

Notes. 1. Field notes. Crown small, narrow, dense or not; bole smooth, no buttresses; bark brown or brown-grey, finely fissured, with small scales; wood white to pale brown; flowers bright yellow, fruits green turning golden yellow to orange, recorded as very spicy.

2. The distribution of var. *eugeniifolia* largely coincides with that of var. *farquhariana*. Specimens from Borneo presently referred to var. *eugeniifolia* were formerly sometimes erroneously determined as *G. contracta*, a species now accepted in a much more restricted sense.

3. Specimens intermediate with var. *zippeliana* (a variety ranging from Sumatra to New Guinea) are SAN 22396, 44629 and 73834, from Sabah, because of their rather ellipsoid fruits; the specimen Sinclair & Kadim 10229 from Sarawak deviates by large leaves (c. 15 cm long) but its nerves are not conspicuously raised beneath.

c. var. **paniculata** (A. DC.) R. Schouten, *comb. nov.*

Myristica paniculata A. DC., Ann. Sci. Nat. Bot. 4, 4 (1855) 31; Prod. 14, 1 (1856) 200; Miq., Fl. Ind. Bat. 1, 2 (1858) 63; F.-Vill., Nov. App. (1880) 177; Vidal, Phan. Cuming. Philip. (1885) 139; Rev. Pl. Vasc. Filip. (1886) 221. – *G. paniculata* (A. DC.) Warb., Mon. Myrist. (1897) 370, t. 20; Merr. Philip. J. Sc. 1 (1906) Suppl. 55; Enum. Philip. Fl. Pl. 2 (1923) 181; Elmer, Leafl. Philip. Bot. 3 (1911) 1059; Sinclair, Gard. Bull. Sing. 17 (1958) 104. – *G. paniculata* var. *paniculata*; Sinclair, Gard. Bull. Sing. 17 (1958) 104, f. 2. – Type: *Cuming 901* (BM, K, L; C, G holo, LE, M, MEL, NY, UPS, n.v.), Philippines, Luzon.

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

G. laxa Elmer, Leafl. Philip. Bot. 8 (1915) 2772. – Type: *Elmer 13715* (BM, K, L; A, E, G, LE, NSW, NY, n.v.), Philippines, Mindanao.

G. acuminata Merr., Philip. J. Sc. 12 (1917) Bot. 265; Enum. Philip. Fl. Pl. 2 (1923) 181. – Type: *Cenabre & Cortes FB 21074* (K), Philippines, Samar.

G. macrobotrys Merr., Philip. J. Sc. 13 (1918) Bot. 284; Enum. Philip. Fl. Pl. 2 (1923) 181. – Type: *Ramos BS 1171* (BM, K, L; BRSL, G, M, n.v.), Philippines, Leyte.

Tree 8–14 m. Leaves chartaceous; blade oblong-lanceolate to lanceolate, widest at or above the middle, rarely below, 9–21 by 3–6 cm, margin not revolute; nerves (8–)9–11 pairs, on lower leaf surface distinct, sometimes darker of colour, but only 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; stalk 8–15 mm long.

Distribution. Philippines.

PHILIPPINES. Sine loc.: Cuming s.n.; Vidal 3552, 3556. – Mindoro: Edaño 3584; McGregor 231; Merritt FB 3663; Ramos BS 41102. – Babuyan: Velasca FB 26647 – Luzon: Amarillas FB 24664; Barnes FB 174; Bernardo FB 13105; Borden FB 669; Cenabre & Porte FB 28547; Cuming 901; Darling FB 14843, BS 14875; Edaño BS 78564; Elmer 15769, 17606, 17962, 18381; Gutierrez 78298; Loher 6706, BS 14942; Merrill 1029; Ramos 1544, BS 14552, 33100; Ramos & Edaño BS 45422; Sinclair & Edaño 9458, 9586; Vidal 508; Williams 566. – Sibuyan: Elmer 12068, 12138A. – Samar: FB 21074; Sulit 14603. – Leyte: Ramos BS 1171. – Panay: Ramos & Edaño BS 30766, 31450. – Basilan: Miranda BS 18969; Reillo BS 15460. – Mindanao: Elmer 13715; Frake BS 38256; Miranda FB 20529; Reillo BS 16444; Wenzel 2672, 2858. – Sulu I.: Ramos & Edaño BS 44284.

Ecology. Forest on ridges as well as along rivers and lakes; up to 1400 m altitude. Fl. mainly April–June, Aug.–Oct., fr. Jan.–July.

Notes. 1. Field notes. Bark smooth, brittle, pale grey-brown, c. 1 cm thick. Ripe fruit orange; seed banded brown and black, with but little spicy taste.

2. This variety is restricted to the Philippines. It is very close to var. *zippeliana* from which it only differs in the fruits; in var. *zippeliana* the fruits are usually ellipsoid-oblong (not subglobose) and with a shorter stalk.

According to Sinclair (l.c.) the leaves in var. *zippeliana* would be generally larger and broader on the average, but I found this not a reliable difference.

The specimen Sinclair & Kadim 9266, sterile, from Sabah, was tentatively included by Sinclair (l.c.) in var. *paniculata*, but is here referred to var. *zippeliana*, which is widely distributed in Borneo.

3. Noteworthy specimens. Comparatively large fruits (2.2–2.3 cm long) are found in Edaño 3584, Elmer 12068, Ramos & Edaño BS 45422, Sinclair & Edaño 9586; Edaño 3584, furthermore, has a marked ridge on the suture, but otherwise belongs to var. *paniculata*. FB 21074 (the type of *G. acuminata*) and Sulit 14603, from Samar I., have rather small leaves with shiny upper surface, but in other respects cannot be distinguished from the remainder of the Philippine material.

d. var. zippeliana (Miq.) R. Schouten, *comb. nov.*

Myristica zippeliana Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 50; Scheffer, Ann. Jard. Bot. Btzg 1 (1876) 45. – *G. zippeliana* (Miq.) Warb., Mon. Myrist. (1897) 373. – *G. paniculata* var. *zippeliana* (Miq.) Sinclair, Gard. Bull. Sing. 17 (1958) 108, f. 3. – Type: *Zippelius s.n.* (L; CAL, n.v.), New Guinea, Vogelkop.

G. suluensis Warb., Mon. Myrist. (1897) 373; Elmer, Leafl. Philip. Bot. 3 (1911) 1058; Merr., Enum. Philip. Fl. Pl. 2 (1923) 181. – Syntypes: *Vidal 3546, 3561* (K), Sulu I., Basilan.

Tree 3–30(–45) m. Leaves thickly membranous to chartaceous, sometimes subcoriaceous; blade oblong-lanceolate to 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; nerves either pale yellowish and little contrasting in colour (West Malesia) or reddish or purplish brown, contrasting with the rest of the lower leaf surface (generally in East Malesia); petiole 7–15 by 1–2.5 mm. Fruits (1 or) 2–10 per infructescence, ellipsoid to oblong, rarely subglobose, (1.5–)1.8–2.5 by 1.1–1.5 cm; stalk 4–8 mm long.

Distribution. Malaya, Singapore, Sumatra (incl. also Bangka and Belitung), Borneo, Philippines (only known from Sulu I. and Mindanao), Celebes, Moluccas, New Guinea (incl. also Bismarck Archipelago).

MALAYA. Sine loc.: FRI 18394. – Perak: FRI 5749. – Trengganu: FRI 25041. – Pahang: FRI 8159, 14305. – Selangor: KEP 60617. – Malacca: FRI 6690. – Johore: FRI 7881, 7965, 8015, 8027, 8844; Gcob 5920; KEP 77737, 105004, 110397, 110450; SF 36918. – Penang I.: Haniff & Nur 3020.

SINGAPORE. Hardial 331; SF 37936, 39581.

SUMATRA. East Coast: Bartlett 7299; Rahmat si Toroes 3886, 3944. – Indragiri: bb 25783, 27559, 27644; Soepadmo 55. – Jambi: Franken & Roos 1848. – Palembang: bb 62 E 1 P 595, 604, 610, 619, 620. – Enggano: Lütjeharms 4365. – Bangka: bb 33966, 34070, 34228; Kostermans & Anta 813. – Belitung: Anonymous 30; van Rossum 63.

BORNEO. Sarawak: Jacobs 5028, 5326, 5363; S 15103, 19085, 22101, 22143, 22193, 25447, 26103, 29598, 32798, 35472, 35595, 36719, 36812, 37229, 38110, 40431, 43413, 43598. – Sabah: NBFD 4023; SAN 15155, 16266, 20232, 22351, 25265, 53877, 63217, 65485, 66050, 73384; Sinclair & Kadim 9266. – E. & NE. Kalimantan: bb 14971, 16146, 19027, 19088, 19456, 28356, 29364, 32494, 34310, 34363; Kostermans 5955, 13696; Meijer 2475. – S. & SE. Kalimantan: Kostermans 7963.

PHILIPPINES. Mindanao: BS 34462; Elmer 10941. – Sulu Archipelago: Vidal 3546, 3561.

CELEBES. North Peninsula: bb 19416, 29466; Koorders 18147B; de Vogel 2523, 6682. – Central: Cel. IV-191. – SE. Peninsula: Prawiro Atmodjo & Maskuri 1295, 1373. – Muna I.: bb 5870. – Buton I.: bb 6645.

MOLUCCAS. Talaud: Lam 2919, 2942, 3329. – Bacan: de Vogel 3789, 3795, 3955. – Obi: bb 23778, 23779. – Buru: bb 22815, 25191; Nooteboom 5148. – Ceram: Kuswata & Soepadmo 74, 194. – Ambon: Kuswata & Soepadmo, 276, 295; Robinson 239. – Kai Is.: Jaheri 714.

NEW GUINEA. Sine loc.: BW 11335; NGF 8232; Pulle 1472; Hartley 10507. — Irian Jaya: Sine loc.: Schlechter 16338, 17186; Versteeg 1472. – Vogelkop: bb 22273, 33490; BW 1106, 2370, 2486, 4383, 5634, 6084, 7379, 7456, 11784, 12804, 13278, 15646, 15666; Kostermans 2975; Zippelius s.n. – Geelvink Bay: Aët & Jojan 798; bb 30254, 30378, 30396, 30420, 30427, 30430, 30459, 30490, 30493, 30528, 30532, 30536, 30591, 30657, 30770, 30805, 30819; BW 1051, 9711, 10556, 10690, 11143. – Fak-fak: bb 22311, 32694; BW 5144, 9930, 12993. – Jayapura: Assem 18; bb 25748; BW 3796, 4316, 5477, 8079; Kostermans & Soegeng 324; van Royen & Sleumer 6220. – Digul: van Royen 4731. — Papua New Guinea: Northeast: sine loc.: Ledermann 9659, 10456. – West Sepik: LAE 52932; NGF 41999, 42576, 42652, 48177. – East Sepik: Pullen 1729. – Madang: Hoogland 4896; NGF 49225; Saunders 208, 229, 236, 247, 255, 260, 265, 293, 297, 308, 338, 352, 361, 378, 394, 405, 451, 477, 480, 497, 504, 507, 512, 521. – Morobe: Brass 29288; Clemens 2189; Jacobs 9589, 9675, 9681; NGF 3205, 7251, 9625, 9683, 9786, 10516, 10665, 11130, 11936, 12035, 13428, 14308, 16479, 16732, 17204, 18883, 19087, 19173, 19218, 19228, 19400, 20764, 22249, 33858, 43999, 47005; Hartley 9944, 10501. – Western Highlands: NGF 38819. – Western Papua: Brass (s. loc.) 941, 7897; Forbes 236, 329, 350, 374, 375, 646, 709; Jacobs 9063; LAE 60402, 73914; NGF 18304, 18369, 48473; Pullen 7347, 7497. – Gulf: Craven & Schodde 767; NGF 8166; Schodde 4228, 4396, 4436. – Central: Carr 12064, 16172, 16467; Darbyshire 1013; LAE 51599; NGF 19636, 19669; Saunders 1102. – Northern: Hoogland 4618; NGF 20785, 22343. – Milne Bay: LAE 70900; NGF 16939, 28998. – Papuan I.: Brass 28202, 28297.

BISMARCK ARCHIPELAGO. New Britain: Floyd 3449, 7009; LAE 51182, 51189, 52181, 58552, 66647, 66688, 74235; NGF 7036, 7929, 10010, 10920, 12321, 15570, 21742, 21778, 21779, 21875, 21925, 22460, 24261, 25512, 27217, 27390, 32323, 32598, 36769, 40560, 41448; Womersley 3409. – New Ireland: NGF 46074, 40482.

Ecology. Variable; found in primary and secondary forest, mostly on hillsides and ridges, in New Guinea most frequently recorded from hill foots and on river-

banks, also close to the coast; found on sandstone, clay, and loam, and granite rock; 0–900 m, in Borneo all records from 400–1200 m alt. Locally abundant, frequently mentioned as part of regenerating forest. Fl. mainly Jan.–June, Aug.–Oct. (Borneo mainly July–Nov.); fr. Jan.–June, Aug.–Sept. (Borneo March– May, Oct.–Nov.).

Uses. In New Guinea (Vogelkop) the bark, together with lime is used to prepare the skins of birds.

Vernacular names. Malaya: penarahan; Sumatra: kaju banitang rodang, salak goiong aloes; Borneo: binarg (Murut), kumpang, sengayen (Iban), darah-darah, mandarahan (Malay); Celebes: kankoerano (Ondoké), hondala; Moluccas: lahu; New Guinea: arfait (Mabrat), apapi (Samber), ara (Ormoe), bendoet, bepoes, oera (Hattam), betelehoi (Manikiong), bali (Je), bisip, sarenki, susuik (Dumpu), bulus, palai (Jal), ehmeh (Mekeo), etsipa (Onjob), fon (Mooi), gamukua, sigiria, yangau (Faita), hagil (Madang), hoerapja (Koemfoor), hokolkol, saksak (Amele), janggan (Thehid), kaulien (Bembi), kondeh (Rawa), kwarra (Mawan), kini, mobo (Bilia), mar (Kebar), mansiendor (Biak), ngguma (Maprik), nogobomor (Kaigorin), pajora (Borowai), posiposi, soeboer (Wandammen), wase (Samotong); New Britain: ahwumu, goma (Maprik), kokomo (Pidgin), maue, rabele (Garumaia).

Notes. 1. 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, when young greenish, odourless or faintly sweetish; androecium brownish, pollen whitish; seed dark brown.

2. *Gymnacranthera farquhariana* var. *zippeliana* is the most widespread taxon of *Gymnacranthera*, ranging from Malaya to East New Guinea, including also the Bismarck Archipelago. It is sometimes recorded as locally abundant and mentioned as part of the regenerating forest.

3. Variability. Var. *zippeliana* is particularly variable in leaf size; especially in Celebes, the Moluccas, and New Guinea frequently specimens with large leaves (up to 27 cm long) may be found.

Also the fruit is variable in shape and size. Conspicuously deviating fruits are found in de Vogel 3789, 3795, 3955, from Bacan I.; these have small, almost globose fruits c. 1.2 cm diam., whereas the trees are recorded as 40–45 m high (other specimens have never been recorded as reaching more than 33 m). In all other characters these specimens seem similar to normal var. *zippeliana*, but more material may show them to represent a separate taxon.

The fruits of the following specimens from New Guinea are ± ellipsoid, rather oblong, and are intermediate of shape with those of var. *paniculata*, but kept under var. *zippeliana* because of their short fruit stalks: Brass 28297, bb 14971, BW 9930, 10690, LAE 70900, 73914, Kostermans & Soegeng 324, NGF 19669.

Particularly brittle leaves when dry, a character not often met with in other *Gymnacranthera* species are found in the specimens bb 34228 (Bangka), 34310 (E. Kalimantan), Koorders 18147b (N. Celebes), Lam 2942, 3329 (Talaud I.), van Rossum 63 (male flowers, fruits; Belitung). In *Horsfieldia* and *Myristica*, partly, the leaves are often very brittle in the herbarium, in *Knema* not.

A part of the collections from New Britain, viz. Floyd 3449, 7009, NGF 7036, 7929, 10010, 10920, 21925, Womersley 3409, have the leaves drying dull above, pale, often purplish whitish, and the nerves distinctly sunken above, but intermediate forms resembling the remainder of var. *zippeliana* exist. The collection Womersley 3409 contains a male and a female specimen.

Kuswata & Soepadmo 74, from Ceram, looks somewhat intermediate to *G. forbesii* because of its stoutish, prominent nerves beneath.

S 26103 from Sarawak is aberrant by its very stout twigs and coriaceous leaves.

4. Specimens of the present very variable and widespread taxon had been placed by Sinclair in *G. forbesii*, *G. contracta*, and *G. eugeniifolia* var. *griffithii*.

EXCLUDED SPECIES

Gymnacranthera cryptocarioides Elmer = **Knema stellata** Merr. subsp. **cryptocaryoides** (Elmer) de Wilde.
Gymnacranthera ibutii Holthuis = **Endocomia macrocoma** (Miq.) de Wilde.
Gymnacranthera lanceolata Merr. = **Myristica agusanensis** Elmer (fide Sinclair).
Gymnacranthera negrosensis Elmer = **Myristica cumingii** Warb. (fide Sinclair).
Gymnacranthera stenophylla Warb. = **Knema stenophylla** (Warb.) Sinclair.
Gymnacranthera sulphurascens Elmer = **Myristica elliptica** Hook. f. & Th. var. **simiarum** (A. DC.) Sinclair (fide Sinclair).
Gymnacranthera urdanatensis Elmer = **Myristica cumingii** Warb. (fide Sinclair).

ACKNOWLEDGEMENTS

The preparation of the present revision formed part of the study for my Masters degree in Biology and was executed at the Rijksherbarium under supervision of Dr. W. J. J. O. de Wilde, to whom I am indebted for continuous interest and help. Through funds provided by the Rijksherbarium it was possible to visit the extensive collections in the herbaria at BM (London) and K (Kew), and I thank the directors of these institutions for providing facilities and sending selected specimens on loan to Leiden. Dr. R. C. Bakhuizen van den Brink kindly translated the diagnoses of the new species into Latin. I also wish to acknowledge the help of Dr. W. A. van Heel (L) for preparing microscopical slides of the androecium of some species and Dr. P. Baas' assistance with the section on vegetative anatomy. To Mr. J. H. van Os I am grateful for preparing the drawings.

INDEX

Numbers refer to species numbers as accepted in this treatment. New names and combinations are in **bold type**. Synonyms have '=' before the number of the species to which they belong.