BLUMEA 25 (1979) 321–478

NEW ACCOUNT OF THE GENUS KNEMA (MYRISTICACEAE)

W. J. J. O. DE WILDE

Rijksherbarium, Leiden, The Netherlands

CONTENTS

SUMMARY

A tentative subdivision of *Knema* into 12 series, containing 83 species. The series and species are mainly defined by the shape of the mature male flower bud (perianth) and the androecium, with in addition various vegetative characters primarily concerning the tomentum of the apical part of the twigs, of the lower leaf surface, and of the flowers. This subdivision into series is partly fairly differing from the division into groups poposed by Sinclair in Gard. Bull. Sing. 16 (1958) and 18 (1961), which was mainly based on characters of the female flowers, mainly style and stigma; these latter characters are presently regarded as of less taxonomic significance.

A survey of the characters regarded as important in *Knema* is given. The genus occurs in mainland SE. Asia and Malesia, from India to western New Guinea; not in Ceylon. Of the 83 species, 63 occur in Malesia, and 30 in mainland SE. Asia excluding Malaya and Singapore; 20 species are restricted to that latter area, and most of the remaining 10 species are of Malesian origin, just penetrating into the moist evergreen forest in Peninsular Thailand. Most species occur in Borneo, 39, of which 22 are endemic.

A general key to all species of *Knema*, inside and outside Malesia, based mainly on male flower- and on vegetative characters, is presented. For female flowering and fruiting material five separate regional keys, one for mainland SE. Asia (excl. Malaya and Singapore), and four keys covering the Malesian area, also using in addition vegetative characters, is presented. As compared to Sinclair's monograph (1961), in which 37 species, 14 varieties, and 1 form were accepted, several species have presently been taken out of synonymy and re-installed, necessitating the redescription of many species. Many of the newly proposed species appeared to be not yet or insufficiently collected at the time of Sinclair's treatment.

Description and discussion of the 12 newly proposed series. Enumeration and treatment of all species accepted. Several species have been subdivided into subspecies, varieties, or forms. Besides the 12 new series, 25 new species, 8 new subspecies, 3 new varieties, and 3 new forms are described, and in addition there are several proposals of a new status of already existing taxa. For all new names and combinations, see the index. All extra-Malesian taxa are fully treated, providing for synonymy, typification, description, notes, and enumeration of examined specimens; of the Malesian species usually merely the synonymy, types, some notes, and examined specimens are presented, as full descriptions of these species will appear in Flora Malesiana. An index of all scientific names pertaining to *Knema* is given at the end.

INTRODUCTION

Besides *Myristica*, *Horsfieldia*, and *Gymnacranthera*, the genus *Knema* is one of the four Asian genera of *Myristicaceae*. It is distributed from S. and NE. India through SE. Asia to S. China and Indo-China, and throughout Malesia, east to W. New Guinea (Vogelkop Peninsula). Its greatest species density is in Borneo, and there are smaller centres of species development in the Malay Peninsula and Indo-China.

While working up the revisions of the genus *Knema* by the late J. Sinclair for the treatment of the family *Myristicaceae* in the Flora Malesiana, it soon became clear that again a personal reconsideration of the whole genus was necessary. Sinclair's work on *Knema* was published in two papers, one dealing with the family *Myristicaceae* for Malaya, published in Gard. Bull. Sing. 16 (1958) 254–332, and an additional publication dealing with the whole genus, in and outside Malaysia, in Gard. Bull. Sing. 18 (1961) 102–327; this latter also being a precursor for his then anticipated treatment in the Flora Malesiana. Both works contain very much information on the genus; they offer a taxonomic subdivision, a survey of the criteria for the delimitation of the species, several keys, and descriptions and drawings of species, including field characters. Useful general chapters on morphology can be found especially in the publication of 1958. These works greatly enriched our knowledge of the genus since Warburg's monograph of the *Myristicaceae* (1897). This latter was, at least for *Knema*, unsatisfactory, as it obviously was based on too few specimens. King's account for former British India, in Ann. Roy. Bot. Gard. Calcutta 3 (1891) 284–331, where the genus still is treated as sections of *Myristica*, appeared to be very useful for the interpretation of several species from that area.

Since 1961 the amount of unidentified material of *Knema* from Malesia in the Leiden herbarium had considerably augmented. One of the difficulties encountered with the determination of this material with Sinclair's keys, as well as with the incorporation of the rather numerous newly discovered facts into Sinclair's scientific framework, was that Sinclair's system was primarily founded on the structure of the style and stigma, present only in the pistillate flowering specimens of the dioecious genus. Moreover, it appeared that the main criterion for his classification, namely whether the stigma is few- or many-lobed, proved to be in many cases variable and too much overlapping, also in specimens studied or identified by Sinclair himself.

This led me to investigate the flowers of both sexes still more intensively than Sinclair did. It was found that in the staminate flowers several fairly distinct types could be distinguished, based on the general shape and architecture of the perianth and the androecium, characters that were underestimated by Sinclair. In addition, several other new findings proved to be of taxonomic importance, such as the presence or absence of small non-traumatic cork warts on the lower leaf surface, and a more accurate description of the composition and appearance of the tomentum of the flowers, the twig apices, and the lower leaf surface, as well as of characters already introduced by Warburg, e.g. the size of the perianth expressed in the diameter of the mature male flower buds.

With the introduction of these characters it appeared that several of the difficult, i.e. rather obscure or very variable taxa as defined by Sinclair, could be better understood by accepting many more species. These had partly to be newly described

or taken out of synonymy, whereas in several cases I came to the conclusion that taxa accepted by Sinclair in an infraspecific rank could better be treated as distinct species. In some cases, the material at my disposal for the recognition of a new species was in Sinclair's time not yet, or merely very incompletely, collected.

All species names accepted by Sinclair are retained in the present study, though these had, as a matter of course, sometimes to be fundamentally redefined. Thus, the number of species in *Knema* has increased from 37 (with 14 varieties and 1 form) as accepted by Sinclair (1961), to as much as 83 in the present survey. Warburg, in 1897, recognized some 39 species and 18 varieties in *Knema*.

In my present account I have, for most species, presented a short commentary as to the differences with Sinclair's opinion, and for the new- and re-installed species explained why these were not recognized by him.

Only the extra-malesian taxa are fully described in the present paper, as the Malesian species will be completely dealt with in the Flora Malesiana treatment.

ACKNOWLEDGEMENTS

My gratitude is herewith expressed to the directors and keepers of the herbaria of the British Museum of Natural History (London), the Royal Botanic Gardens, Kew, and of the Natural History Museums at Paris and Utrecht for enabling me to work in their collections and sending me selected specimens on loan. The herbaria at Singapore, Bogor, Aårhus, and Copenhagen are acknowledged for sending me on loan much of the unnamed specimens there. The herbarium of the Arnold Arboretum, Harvard University, generously provided the loan of a type specimen.

The visit to the Paris herbarium was made possible by a grant from the Netherlands Organization for Pure Scientific Research (Z.W.O.), the Netherlands.

Dr. R. C. Bakhuizen van den Brink and Dr. H. O. Sleumer generously provided for most of the translation of the diagnoses of the new taxa into Latin.

The drawings of 18 species were prepared by Miss Ruth van Crevel and Mr. J. van Os of the Rijksherbarium.

THE CHARACTERS IN KNEMA

Much information on the characters to be used in the delimitation and classification in *Myristicaceae* in general, incl. *Knema*, is presented by Sinclair, especially in his publication of 1958 dealing with the representatives of the family in Malaya. However, as some valuable additional characters have been found, and as it appeared that certain features should be estimated somewhat differently as compared to Sinclair's practice, I have enumerated below those characters which are considered by me as useful and which have served in the delimitation of the species accepted in the present account.

Some of these characters should be judged as being important enough to warrant a subdivision of the genus into series; as a whole, these coincide with the larger divisions made in the general key to the male specimens. Also, I feel that these characters may have some evolutionary significance, and that most species in a series generally will have mutually a closer alliance. With the present knowledge, however, the proposed series are probably not yet finally delimited as to harbour all species properly. In this respect it should be kept in mind that *Knema* is a genus of trees occurring mainly in the ecologically relatively uniform conditions of the under- and middle storey of the everwet rain forest, and that its species, which have typically reticulate relationships, are notoriously difficult to distinguish.

VEGETATIVE CHARACTERS

1. Indumentum of (a) **flowers,** (b) **twig apex, and** (c) **lower leaf surface.**

(a) Tomentum of flowers. Initially all flowers are tomentose in various ways. In most species the tomentum is persistent, and the composition and appearance are usually very typical for the species or for a group of species. Early glabrescent flowers have *K. lamellaria* and *K. psilantha* (partly), belonging to the group with flaking twig bark, and further *K. galeata*, *K. mammillata*, and *K. membranifolia; K. curtisii*, e.g., is somewhat variably glabrescent.

In a large group of species centering around *K. glauca*, the flowers have a very short tomentum, composed of hairs only *c.* 0.1(−0.2) mm long, without or occasionally with some scattered emergent hairs up to 0.3 mm long. In some other species, e.g. *K. ashtonii* and *K. latifolia*, the tomentum is composed of extremely minute hairs, less than 0.1 mm long, so that the flowers look as if they are glabrous when superficially examined.

In most of the remaining species the tomentum of the flowers is distinct and persistent, and of various appearance. In several species it is quite long and fur-like, e.g. in *K. hookeriana*, *K. percoriacea*, and others. In the present paper, the length of the hairs is often regarded as a diagnostic character, and in several instances it is used in the keys.

(b) Tomentum of the twigs. This is initially always present in the apical portion, but it is early or later on always shed. In some cases it is very minute and early shed, e.g. in most species of the group around *K. glauca;* in other species it is composed of moderately to very long hairs, and often very conspicuous, e.g. in *K. hookeriana*, *K. percoriacea*, and many others. The nature of the tomentum is several times used as an additional character for distinguishing species.

(c) Tomentum of the lower leaf surface. The leaves, too, are initially always tomentose in various degree, but the hairs may be very early shed. In most species it is at least early shed from the upper leaf surface, while on the lower surface it may be persistent or the lower surface is late-glabrescent. Usually the tomentum of the young leafblades, or rather of the conduplicate leaf bud, is initially somewhat similar to that on the twig apex and the petioles.

The composition and appearance of the tomentum, as well as the size and the type of the hairs on the lower surface of the adult leaf, are presently regarded as very characteristic for the species, and are often used by me as diagnostic characters in the keys.

All hairs are essentially uniseriate sympodially branched. They may appear as stellate scales, stellate sessile hairs, or stellate-dendroid or dendroid hairs. A remarkable and very distinct type of persistent tomentum on the lower leaf surface is one composed of rather coarse and stiff, rather densely set, evenly spaced, dendroid, i.e. stalked, hairs of about the same length; this occurs typically in e.g. *K. laurina* var. *laurina*, *K. tonkinensis*, *K. elegans*, and *K. pachycarpa*, species which because of certain differences in the male flowers seem not closely related at all.

In several species, e.g. *K. cinerea* and *K. squamulosa*, the tomentum on the lower leaf surface is present and persisting, but consists of scattered very minute scales of less than 0.1 mm diameter only, by which it looks as if the leaves are glabrous.

In the series *Sericeae*, comprising the species *K. elmeri* (a species which stands a little apart as it is obviously also closely related to *K. latericia*, the latter being a species with a rather uncertain position), as well as *K. ashtonii*, *K. sericea*, and *K.*

retusa, the tomentum on the lower leaf surface is very dense and short, and composed of flattish, stellate-scaly, woolly, closely interwoven hairs, making the tomentum silky to the touch, but at first sight the leaves seem glabrous beneath. Similar tomentums are found in the genus *Myristica* rather frequently.

The colour of the tomentum may be characteristic to various degree.

A study on various aspects of the anatomy of the leaves, including the tomentum, of Asian *Myristicaceae* was recently performed by Mr. J. Koster at the Rijksherbarium. Special attention was paid to *Knema*. His results, with reference to the present subdivision into series and species, will be published in a forthcoming separate paper.

2. Twigs. Several characters of the twigs are of great diagnostic value, additional to the tomentum mentioned above. Firstly, the stoutness of the twigs, i.e. the diameter, in the apical portion. Though this is often overlapping, the average thickness of the twigs is quite typical for most species. Furthermore, the texture of the surface of the dry twigs at apex, as well as that of the bark of the older twigs is typical for species or for groups of species: the twigs at apex may either be smooth, or finely or coarsely striate, or sometimes coarsely ridged or angular. In *K. oblongifolia*, *K. rubens*, and *K. luteola* the twigs are rather distinctly flattened at the apex.

In the following species the bark of the twigs in the apical portion is longitudinally cracking and lower down usually distinctly flaking: *K. pierrei*, *K. elmeri*, and the group consisting of the closely related species *K. hookeriana*, *K. furfuracea*, *K. lampongensis*, *K. lamellaria*, *K. pallens*, *K. psilantha*, *K. percoriacea*, *K. lunduensis*, and *K. latericia; K. membranifolia* has incidentally a flaking bark, whereas in some species the older bark may occasionally be somewhat flaking, e.g. *K. galeata*.

The colour of the dry twigs may be typical for the species, e. g. yellowish in *K. curtisii*, *K. linguiformis*, and *K. membranifolia*, or usually blackish and flaking in *K. furfuracea*, and others.

3. Leaves. The (a) size and shape of the blade, (b) shape of the blade base, (c) number and appearance of the nerves and reticulation by the tertiary venation, (d) drying colour, (e) texture, and (f) other special features e.g. special structures of the leaf surface, are to a certain extend characteristic, and in several instances diagnostic.

(a) Size and shape of the leaf blades overlap for most species, but the average may be characteristic. Most of the species with stout twigs also have the largest leaves, e.g. *K. hookeriana*, *K. lamellaria*, *K. pallens*, and others, with leaves of up to 65 cm long and 24 cm wide. Usually small-leaved are species like *K. curtisii* and *K. stenophylla* for instance.

(b) Blade base. Several species have almost obligatory a cordate blade base, e.g. *K. pulchra*, or the stout-leaved species *K. furfuraceae*, *K. pallens*, etc., while in e.g. *K. rufa* the blade base always is acute-attenuate.

(c) The number of lateral nerves and characteristics of the veins may be diagnostic. *K. pectinata* can often vegetatively be recognized by the usually many lateral nerves, 25–50 pairs.

In several cases it is important for the determination to ascertain whether the midrib and lateral nerves are sunken, flattish, or raised above; on the lower leaf surface midrib and side nerves are always raised.

Distinct, very finely reticulate tertiary venation, raised on the upper leaf surface, with areoles less than 0.5 mm diam., is prevalent in *K. lenta*, *K. bengalensis*, *K. luteola*, and some other species.

(d) The drying colour of the upper surface of the leaves is for most species usually in between olivaceous and dark brown. In some species, however, the leaves usually dry a conspicuous olivaceous, e.g. *K. curtisii;* most specimens of *K. globularia* have leaves drying above dark brown to blackish, with a typical blackish metallic lustre; the leaves of *K. latifolia* often dry dark brown or blackish, with some purple-red tinge.

The upper surface of the leaves may further be dull or glossy, often partly depending on the species, but in this character there is apparently also much correllation with the age of the leaves and the habitat.

(e) Texture. Several species can be recognized by the texture of the leaves: very coriaceous leaves have the generally mountainous species *K. kinabaluensis*, *K. rigidifolia*, *K. squamulosa*, and *K. kunstleri* subsp. *alpina*, and the lowland species, partly from 'karengas'-forest, *K. percoriacea*, *K. galeata*, and *K. kunstleri* subsp. *coriacea*.

(f) Special structures on the leaf surface are sometimes diagnostic. Several species, e.g. *K. conferta* (partly) and *K. oblongata*, have a glossy or dull upper leaf surface beset with scattered, typical, small, 'crater'-like hairs-scars, well visible with a lens × 30 only.

In *K. oblongifolia* the upper leaf surface usually has a typically pitted structure, seen under magnification reminiscent of the surface of a citrus fruit.

Many species have a distinct papillation on the lower leaf surface, but this seems to be rather variable within most of them.

One group of species (series *Punctatae*), comprising the variable *K. kunstleri*, as well as the otherwise rather remote *K. conferta*, *K. pedicellata*, and *K. pubiflora* possess very characteristic minute blackish dots on the lower leaf surface, especially on and in the vicinity of the reticulations, due to non-traumatic cork warts.

GENERATIVE CHARACTERS

4. Inflorescences. These consist in *Knema* of a short, woody brachyblast up to *c.* 17 mm long, of slow unlimited growth, and covered with the scars of fallen pedicels and bracts. It is simple or 2- or 3-furcate, usually appearing as one or more lumpy warts, but sometimes it has a typically furcate habit, e.g. the slender 2- or 3-furcate inflorescences of *K. tridactyla*. They are never distinctly ramified or even paniculate as in a large part of *Myristica* or in all members of *Horsfieldia* and *Gymnacranthera*. In *Knema*, the flowers themselves are arranged in terminal, umbel-like, contracted racemes. For the infrageneric taxonomy of *Knema* it is important to know whether the inflorescence are sessile or peduncled; peduncles occur of up to *c.* 10 mm long. The taxonomic significance of this character is only restricted, as there are many species in which apparently sessile as well as peduncled inflorescences occur. In some species, however, at least a part of the inflorescences on the twigs of a herbarium specimen seem to show the tendency to be pedunculate. Typically peduncled inflorescences have e.g. *K. tridactyla*, *K. globularia*, and *K. kunstleri* subsp. *kunstleri*. Many other species have always sessile inflorescences.

5. Indumentum of the flowers. This is various, and in most cases it is very characteristic for the species. For a discussion of this see above, under point 1.

The flowers are inside generally glabrous, but in a few taxa, e.g. in *K. hirtella* var. *hirtella* and occasionally in some other species the staminal column is at base very finely pubescent. Only in *K. pubiflora* the inner side of the perianth is entirely densely finely pubescent.

6. Flower colour. The colour of the inner side of the perianth seems to provide a constant character, especially useful in the group of closely related species around *K. glauca*. It is used several times in the key. A disadvantage is that this character is not always observed and annotated in the field, and in dry specimens it cannot be ascertained. The colour of the perianth inside varies from red to pink, or it is greenish, creamy, or (greenish-)yellow. A list of flower colours is given by Sinclair, 1958, p. 226, but as the species in the present treatment do not always agree with Sinclair's it is not sure whether this list holds true for my present species.

The flower coulour, if known, is given in the species descriptions.

7. Staminate flowers. These provide some of the most valuable characters for the infrageneric classification of *Knema*, for the groups or series as well as on the species level. Mention should be made of (a) the general shape of the flowers, as seen in the mature (perianth) buds; (b) the androecium, especially the shape and size of the staminal column in relation to the size of the staminal disk, and the number and the mode of attachment of the anthers; (c) the size of the flowers, and (d) the length of the pedicel and the position of the bracteole.

As this was observed in the field by myself in *K. losirensis* and *K. laurina*, I can agree with Sinclair's observations made on certain other species that the flowers remain closed for several weeks before opening, even when they look full-grown as if they might open every day.

(a) In the shape of the mature male flower bud, several types can be distinguished, though in a number of species it is, unfortunately, as yet not always clear to which group it precisely belongs; obviously this is partly due to the state and stage of the herbarium material studied.

The differences in general shape of the buds, in connection with the general shape and architecture of the androecium (see below, under b.), are used in the main forks in the general key to the species, and are also among the main characters by which the series are defined.

The flower buds vary in shape from ellipsoid or longly-obovoid (or ovoid) to depressed globose; in the latter case the buds may be somewhat saccate at the base or not; in cross section they are circular to trigonous, or rarely even sharply angled, as e.g. in *K. galeata*, a species with peculiarly mitriform male flower buds.

In anthesis the perianth lobes or valves spread more or less horizontally, splitting the bud to various depths, typical for the species or group of species. According to the general shape and architecture of the male flowers and the depth to which the perianth is cleft in anthesis, three main groups can be recognized, viz.

I. Mature male flower buds generally ellipsoid to obovoid or longly-ovoid (in general appearance resembling female flowers), in anthesis split by the perianth valves to about halfway. About halfway the bud there is usually a rather faint contraction which demarcates the lower entire portion of the perianth. This shape is correlated with a relatively long staminal column, and the almost vertical or

oblique, not horizontal, position of the anthers; see also under (b) androecium. This group comprises species 1 – 11, and agrees with series *Laurinae*.
II. Buds generally obovoid or pear-shaped, tapering or at least somewhat narrowed in the lower half, in anthesis split by the perianth valves to *c.* 2/3 – 3/4. This condition is prevalent in species 25 – 35.
III. In species 12 – 24 and 36 – 83 the shape of the mature male flower buds is various, but in general (sub)globose or very broadly obovoid, or derived from these forms, with the base rounded, truncate, or saccate, not or but faintly and shortly attenuate. In anthesis the bud is cleft by the perianth lobes usually to about 3/4 or more, in many cases nearly to the base of the perianth.

The consistency of the perianth valves is sometimes typical; *K. pectinata* and *K. woodii* have very thick-valved male flowers.
(b) The androecium consists of the staminal column and the staminal disc, to which the anthers are radially attached. The way in which the anthers are attached to the column is the most important character for the distinction of the four Malesian genera. As to *Knema*, the relative length of the column, compared to the diameter of the staminal disc incl. anthers, appeared to be correlated to a large degree with the general shape of the flower buds, explained above under (a).

As judged from the more or less stiped anthers in some other genera of *Myristicaceae* and in some species of *Knema*, phylogenetically the column can be regarded as originated by the fusion of the staminal filaments.

In some species the staminal disc is characteristically convex, or even provided with a distinct mamilla, e.g. in *K. plumulosa*, *K. intermedia*, *K. uliginosa*, *K. mamillata*, and *K. pedicellata*.

Also the number as well as the position of the anthers, i.e. whether they are situated almost vertically, or obliquely, or horizontally, and whether they are entirely sessile, or half sessile, just stiped, or distinctly stiped is of taxonomic importance, at least when accounted for some range of overlapping. These latter characters were used by Sinclair (1961, p. 115) as some of the main criteria for distinguishing groups in the skeleton key.

The fewest anthers has *K. latifolia*, only 3 (or 4); among those with many anthers can be mentioned *K. woodii* (18 – 23), *K. pulchra* (12 – 24), *K. pallens* (23), and *K. hookeriana* (15 – 25); *K. curtisii* has up to 25 small, closely appressed anthers.

As regards the terms used to describe the position of the anthers the following explanation should be given: with (completely) sessile is meant that the anthers (or thecae) are fused with the staminal column over their whole length; when half-sessile the anthers are fused with the staminal column for about half their length; when subsessile or just stiped the anthers are attached to the staminal column (or staminal disc) only with their bases; in stiped anthers there is a short but distinct filamental part in between the staminal disc and the anther.
(c) The size of the flowers, measured as the diameter of the mature male flower bud. Though there is often a considerable variation in the flower size within a species, it still appeared that flower size is of great use in the distinction of the species, much more than was assumed by Sinclair. The size of the flower buds was used for *Knema* as an important character by Warburg in his monograph.

Apparently, the largest flowers has *K. galeata*, the mature male flower buds being up to *c.* 15 mm diam.; the smallest flowers possibly has *K. tridactyla*, *c.* 1.5 mm diam.
(d) Pedicel and bracteole. The length of the mature pedicel is frequently regarded as of highly diagnostic value. The position of the bracteole on the

pedicel is often very variable, but the average or usual position is sometimes a good character. It may also be useful to know whether the bracteole is persistent or caducous, especially in the difficult *K. glauca*-group.

8. Pistillate flower characters are (a) the size of the mature flower bud (perianth bud), (b) the thickness and appearance of the tomentum, (c) the length of the pedicel and the position of the bracteole, and, most important, (d) the characters found in the pistil, especially the style and stigma.

(a) S i z e . Usually, the female flowers are of different shape and size as compared to the male flowers; they are more elongated, i.e. ellipsoid(-oblong) to longly ovoid, and often slightly contracted at about the middle, at the level of the apex of the ovary, to which depth the perianth is usually cleft in anthesis; the style and stigma, concealed in the upper portion of the perianth bud, are exposed in anthesis.

In some cases the female flower buds are considerably larger than the male ones, e.g. in *K. oblongata*, *K. psilantha*, and *K. latericia*.

(b) The thickness and appearance of the t o m e n t u m of the flowers is of similar importance as in the male specimens; see above, under point 1a.

(c) T h e p e d i c e l s in the female flowers are usually much shorter than in male ones, and hence the precise position of the bracteole is less easy and less accurate to ascertain. The pedicels of the female flowers in e.g. *K. pallens* and *K. lamellaria* are 10 – 20 mm long, or in *K. stenophylla* up to 12 mm long, which is very long for female pedicels in *Knema;* in *K. sessiflora* the female pedicels are almost absent.

(d) Apart from the size of the p i s t i l (which is, of course, correlated with the size of the flower), the characters of the style and the stigma, namely whether a style is present or not, and whether the stigma is few- or many-lobed, is generally very distinctive for a species or a group of species. These characters served in Sinclair's subdivision of *Knema* as a main criterion, primarily used in his skeleton key to the groups. Also in the opinion of the present author these characters are of great importance, even though it was found that there is much overlapping in the number of stigma lobes for many species, and hence, that the distinction between 'few-lobed' (i.e. 2 – 6-lobed), and 'many-lobed' is obscure in many cases. Also to ascertain whether a style is present or not is often difficult, as the style rarely exceeds 2 mm in length, whereas in many species the style is only about 0.5 mm long.

The stigma is essentially 2-lobed, and each lobe may be divided again into 2 – many lobelets or serrations. In certain species with or without a style, and with usually a few-lobed stigma, the lobes of the latter are generally rather upwards directed, e.g. in *K. malayana*, *K. cinerea*, and *K. glauca* (partly), and also in most species of the group around *K. laurina* (species 1 – 11; series *Laurinae*). In several other species, especially those with a stouter general habit, the stigma is conspicuous, usually sessile, flattish, and composed of many often horizontally spreading lobes, e.g. in *K. latericia* (stigma *c.* 6 – 12-lobulate), *K. hookeriana* (*c.* 20-lobulate), *K. furfuracea* (*c.* 10 – 20-lobulate), etc.

In a few cases the appearance of the tomentum of the ovary is distinctive, e.g. in *K. lenta* where it is composed of rufous-yellow hairs of up to 2 mm long, especially at the base of the ovary, the hairs becoming longer and shaggy in the fruit.

9. Fruits. These are characteristic in various ways: by their shape, size, by the nature of the tomentum, the thickness of the pericarp, and the length of the fruit stalk, though the latter character is often fairly variable.

The fruits in *K. hookeriana* are rather large, and, like the twigs and young leaves, covered with a very thick fur composed of hairs 5 – 13 mm long. In *K. lenta* and *K. rufa*, the tomentum of the fruit is composed of rufous-yellow or rufous, shaggy, relatively long hairs. Early or late glabrescent fruits have *K. latifolia*, *K. membranifolia*, *K. galeata*, *K. curtisii*, and *K. linguiformis*. In some species of the group of *K. glauca* (series *Glaucae p.p.*) the fruits are seemingly glabrescent because the tomentum consists of very minute hairs, and sometimes these fruits may later on become truly glabrous as well.

The general shape of fruits in *Knema* varies from globose to ellipsoid-oblong, according to the species. In *K. angustifolia* (syn. *Myristica gibbosa*) the fruit is rather small, ± ellipsoid, with at the base at one side a typical gibbosity. In *K. latifolia* and some other species the fruits are often somewhat ridged along the suture.

THE SERIES IN KNEMA

Considerations and comparison with Sinclair's subdivision into groups

As pointed out in the preceding list of important characters in *Knema*, also used in the general key to the species, the following characters seem sufficiently reliable for the distinction of series:

(1) The general shape of the mature male flower bud;

(2) The shape and size of the androecium, and the mode of attachment and position of the anthers;

(3) The presence or absence of a style, and whether the stigma is few- or many-lobed, in female flowers (the characters of female flowers are regarded as additional, considered as of less value);

(4) The nature of the tomentum on the lower leaf surface and on the flowers, in combination with the characters listed under 1 and 2, and the presence or absence of non traumatic cork warts; and

(5) The nature of the bark of the twigs, in combination with 1 and 2.

Although the series are presumably only partly natural, it is also clear, as seen from the heterogeneity of the characters used for their distinction, that their respective taxonomic weight is not the same. Therefore, it is expected that they are primarily of some practical use, because most specimens can readily be classified in one of the series on the characters listed above.

Similar to the series in *Myristica* as defined by Sinclair in Gard. Bull. Sing. 23 (1968) p. 45 seq., the series presently proposed in *Knema* are also to be regarded as natural groupings containing species which are presumably close to each other. The species from such a series are less likely to be confused with species from other series.

For various reasons, however, of several species it is not yet quite clear to what series they belong. These dubious cases are discussed in the observations to each series, where also a comparison is made with the groups in *Knema* accepted by Sinclair, covering the whole genus, published in Gard. Bull. Sing. 18 (1961) p. 115.

Sinclair (1961, p. 115, and in the general key to the species p. 121) accepted 2 divisions, one of which he divided into 2 subdivisions, together comprising 7

groups. Some of these groups were again divided into 2 subgroups. The whole subdivision was based essentially on the following characters: stigma many-lobed versus few-lobed; bracteole median versus situated close to the base of the flower; style present versus absent; anthers sessile versus stalked; anthers few versus many; and in his group 1a a further division into subgroups based on the nature of the bark, either tending to crack or not.

When compared with the presently poposed subdivision into series, it will be seen that some of Sinclair's groups largely coincide with the present series, whereas several discrepancies can be explained on various grounds, including still incomplete material at his time, and disagreement in the observation of the characters concerned. The 83 species accepted in the present treatment are distributed over 12 series defined as follows:

I. series LAURINAE – *Male flower* buds usually longer than broad, ellipsoid-oblong to (ob)ovoid or obconical; in anthesis cleft to *c.* $\frac{1}{2}$-way to 2/3. *Staminal column* usually longer than the diameter of the staminal disc incl. anthers. *Anthers* 6 – 18, generally suberect or oblique. *Staminal disc* flat to slightly convex. *Female flower:* style distinct, i.e. 1 – 2 mm long; stigma 2 – 10-lobulate. Flowers with persistent tomentum, composed of hairs 0.1 – 1.5 mm long. *Tomentum* on lower leaf surface various, persistent, not very dense and not silky to the touch, or leaves glabrescent. *Twigs* usually not robust, at apex 1 – 8 mm diam. *Bark* of older twigs flaking or not.

Here belong species 1 – 11, namely: – 1. *K. linifolia*, 2. *K. pierrei*, 3. *K. oblongifolia*, 4. *K. conica*, 5. *K. andamanica*, 6. *K. mixta*, 7. *K. angustifolia*, 8. *K. petelotii*, 9. *K. pseudolaurina*, 10. *K. laurina*, and 11. *K. tonkinensis*.

Distribution: Mainly continental SE. Asia, incl. the Malay Peninsula, with *K. andamanica* also on Andaman- and Nicobar I. and in N. Sumatra, *K. pseudolaurina* also in Sumatra, and *K. laurina* extending to Sumatra, Java, and Borneo.

Observations: 1. *K. linifolia*, from NE. India and Burma, possibly occupies a rather isolated position in the series because of its comparatively very large flowers. It also differs in its leaf anatomy, as found by Mr. J. Koster and to be published in a later article. *K. pierrei* somewhat deviates by its flaking bark similar to that found in the species of series III. *Lamellariae*.

2. Series *Laurinae* largely coincides with Sinclair's group 3a, and group 4 (*K. linifolia*). *K. globularia* and *K. attenuata* from group 3a with Sinclair, are removed to other series because of the essentially different shape of the male flowers. In *K. globularia* the stigma can be either few- or many-lobed, not solely few-lobed as stated for his group 3a.

II. series SERICEAE – *Male flower* buds about as long as broad, subglobose to broadly obovoid; in anthesis cleft to *c.* 4/5. *Staminal column* shorter than the diameter of the disc incl. anthers. *Anthers* 10 – 24, oblique to horizontal. *Staminal disc* strongly convex to flat. *Female flower:* style absent or rather short, up to 1 mm long; stigma 4 – 6(– 8)-lobulate. Flowers with persistent tomentum. *Tomentum* of lower leaf surface very dense and short, silky to the touch, persistent, or in *K. ashtonii* var. *ashtonii* leaves usually glabrescent. *Twigs* moderately robust, at apex 2 – 6 mm diam. *Bark* of older twigs flaking or not.

Here belong species 12–15, namely: – 12. *K. elmeri*, 13. *K. sericea*, 14. *K. retusa*, and 15. *K. ashtonii*.

Distribution: Malaya and northern part of Borneo.

Observations: 1. This series is mainly characterized by the shape of the male flowers in combination with the dense and silky tomentum on the lower leaf surface; the latter character, however, is lacking in *K. ashtonii* var. *ashtonii*. Possibly, this series is only partly natural.

2. *K. elmeri* is rather isolated from the other three species in this series because of its flaking bark and the strongly convex or mammillate staminal disc, both characters by which it seems closely related to 24. *K. latericia* as well. *K. sericea*, in which the disc is slightly convex, possibly occupies a position somewhat intermediate between *K. elmeri* and *K. ashtonii*. In the type-variety of *K. ashtonii* the leaves are almost glabrous beneath.

3. Except for *K. elmeri* the series *Sericeae* agrees with Sinclair's group 3b. (with stigma few-lobed, style present, etc.). *K. elmeri* was listed by Sinclair in a different group because the stigma was assumed to have 8, i.e. many, lobelets. By studying more material, however, it has appeared that the stigma is 4–6(–8)-lobulate.

III. series LAMELLARIAE – *Male flower* buds about as long as broad, subglobose to broadly obovoid, or ellipsoid; in anthesis cleft to 2/3–4/5. *Staminal column* shorter than the diameter of the disc incl. anthers. *Anthers* 6 or 7, or 10–25, slightly oblique to horizontal. *Staminal disc* flat. *Female flowers:* style absent or up to 2 mm long; stigma 10–25 (–many)-lobulate. Flowers with persistent tomentum, sometimes late-glabrescent. *Tomentum* on lower leaf surface conspicuous, early glabrescent. *Twigs* generally robust, at apex 3–12 mm diam. *Bark* of older twigs longitudinally cracking, and flaking.

Here belong species 16–23, namely: – 16. *K. hookeriana*, 17. *K. furfuracea*, 18. *K. lampongensis*, 19. *K. lamellaria*, 20. *K. pallens*, 21. *K. psilantha*, 22. *K. percoriacea*, and 23. *K. lunduensis;* possibly, 24. *K. latericia* belongs here also.

Distribution: S. Peninsular Thailand, Malay Peninsula, Sumatra, and Borneo.

Observations: 1. This series is most typically represented by the species 16–20. It is mainly characterized by the general shape of the male flowers, the stout habit, and the flaking bark of the twigs. In all species the stigma is many-lobulate. *K. psilantha* deviates by its ellipsoid male flower buds and by the few, only 6 or 7, very distinctly stalked anthers. *K. lunduensis* shows a very close relationship with 24. *K. latericia*, especially with its subsp. *ridleyi*. *K. latericia* is a complex species (presently divided into three subspecies) tentatively included in the present series. The subsp. *latericia*, without flaking bark, is restricted to Palawan I., and may fit better in X. series *Glomeratae*, where the dubious position of the species is briefly discussed.

2. Series *Lamellariae* largely corresponds with Sinclair's group 1a (with stigma many-lobed, the bracteole median, and the bark tending to crack), except for 12. *K. elmeri* and 39. *K. galeata*, and possibly 24. *K. latericea;* each of these species is certainly related to the present series *Lamellariae* in some respects, but they are presently placed in three different series.

Sinclair regarded *K. lunduensis* as a variety of *K. latericia*.

IV. series OBOVOIDEAE – *Male flower* buds about as long as broad, obovoid or pear-shaped, more or less narrowed in the lower half; in anthesis cleft by the perianth-valves to *c.* halfway to 3/4(–4/5). *Staminal column* about as long as to shorter than the diameter of the staminal disc incl. anthers. *Anthers* 7–25, oblique to horizontal. *Staminal disc* flat. *Female flowers*: style absent or up to 1.5 mm long; stigma 4–14-lobulate. Flowers with persistent tomentum. *Tomentum* on lower leaf surface persistent (though often inconspicuous), or early deciduous. *Twigs* usually slender to moderately stout, at apex 1–10 mm diam. *Bark* of older twigs not flaking.

Here belong species 25–35, namely: – 25. *K. rigidifolia*, 26. *K. pulchra*, 27. *K. piriformis*, 28. *K. oblongata*, 29. *K. mandaharan*, 30. *K. tenuinervia*, 31. *K. poilanei*, 32. *K. rufa*, 33. *K. globulatericia*, 34. *K. globularia*, and 35. *K. bengalensis*.

Distribution: Continental SE. Asia, incl. the Malay Peninsula, Sumatra, Borneo.

Observations: 1. A rather heterogeneous series, coherent mainly because of the generally obovoid shape of the mature male flower buds and the shape of the androecium.

2. The species presently brought together in series *Obovoideae* belonged in Sinclair's classification to various groups, viz. his group 2 (*K. mandaharan*, *K. rufa*), group 3a (*K. globularia* and *K. oblongata*, the latter with Sinclair being a synonym of *K. laurina*), group 7a (*K. rigidifolia*), and group 7b (*K. pulchra*, which is with Sinclair the var. *cordata* of *K. cinerea*). As can be seen from the descriptions in the present study or those to be published in Flora Malesiana, several of these species do not fit in Sinclair's groups, however.

3. *K. globularia* (with *K. corticosa* Lour., the type of the genus *Knema*, as a synonym) is a variable species with a rather wide geografic range; it seems to have close affinities with X series *Glomeratae* and XI. series *Glaucae* as well.

V. series LATIFOLIAE – *Male flower* buds about as broad as to broader than long, (depressed) globose; in anthesis cleft by the perianth valves to *c.* 4/5. *Staminal column* shorter than the diameter of the staminal disc incl. anthers. *Anthers* 3 (or 4), horizontal. *Staminal disc* flattish. *Female flowers:* style short, 0.5–0.8 mm long; stigma (4–)6–10-lobulate. Flowers (sub)glabrescent. Lower *leaf* surface early glabrescent. *Twigs* rather slender, at apex (1–)2–3 mm diam. *Bark* of older twigs sometimes cracking, not flaking.

Here belongs one species: – 36. *K. latifolia*.

Distribution: Sumatra (Palembang), Borneo.

Observations: 1. *K. latifolia* stands isolated to form a series of its own mainly because of its subglobose male flower bud with peculiar 3-angular androecium with only 3(or 4) anthers. With Sinclair it forms his monotypic group 6, which is characterized by a few-lobed stigma and the absence of a style. Both these latter characters are rather arbitrary, however.

VI. series CURTISIANAE – *Male flower* buds broadly obovoid to subglobose, about as broad as long; in anthesis cleft by the perianth valves to *c.* 4/5. *Staminal column* shorter than the diameter of the staminal disc incl. anthers. *Anthers* 9–25(–30),

suberect or oblique, completely sessile, ± tightly appressed and touching each other. *Staminal disc* flat. *Female flowers:* style 0–0.5 mm long; stigma 6–21-lobulate. Flowers with persistent tomentum or partially glabrescent. *Leaves* at lower surface glabrescent. *Twigs* slender, at apex (0.5–)1–2 mm diam. *Bark* of older twigs neither cracking, nor flaking.

Two species: – 37. *K. linguiformis* and 38. *K. curtisii.*

Distribution: Malay Peninsula, Sumatra, Borneo.

Observations: 1. This series is mainly characterized by the globose mature male flower buds and the androecium with usually tightly set, laterally touching, completely sessile anthers. The fruits are early glabrescent, as in the related series V. *Latifoliae*, VII. *Galeatae*, and VIII. *Membranifoliae.*

2. With Sinclair, the present series *Curtisianae* forms, together with *K. membranifolia*, his group 5; *K. linguiformis* was by Sinclair included in *K. curtisii* as a variety. Sinclair's group 5 is characterized by the absence of a style and the few-lobed stigma, but in most specimens seen the stigma appeared to be rather many-lobulate.

VII. series GALEATAE – *Male flower* buds about as broad as or broader than long, mitriform, with sharp angles; in anthesis cleft by the perianth valves to nearly at the base. *Staminal column* shorter than the diameter of the disc incl. anthers. *Anthers* 14–23, ± oblique to horizontal. *Staminal disc* flattish or ± convex. *Female flowers:* style absent; stigma 8–16-lobulate. Flowers glabrescent. Lower *leaf* surface early glabrescent. *Twigs* usually rather stout, at apex 4–10 mm diam. *Bark* of older twigs often cracking and sometimes flaking.

Monotypic with species 39. *K. galeata.*

Distribution: northern part of Borneo.

Observations: 1. *K. galeata* links up in several respects with the species of series III. *Lamellariae*, especially because of the many-lobed stigma, the robust general habit, and the sometimes flaking bark, but it is separated because of its peculiar, mitriform, glabrescent flowers. Also the fruits are early glabrescent.

2. By Sinclair the species was placed in his group 1a (with the stigma many-lobed, and the bark tending to crack), i.e. together with the species now largely placed in series III. *Lamellariae.*

VIII. series MEMBRANIFOLIAE – *Male flower* buds about as broad as or broader than long, depressed globose; in anthesis cleft by the perianth-valves to *c.* 4/5. *Staminal column* shorter than the diameter of the staminal disc incl. anthers. *Anthers* 19 or 20 (–23?), horizontal. *Staminal disc* flattish to convex, not mamillate. *Female flowers:* style absent; stigma (5–)10–12-lobulate. Flowers glabrescent. Lower *leaf* surface early glabrescent. *Twigs* rather slender, at apex 1.5–3 mm diam. *Bark* of older twigs usually tending to crack and flake.

Monotypical, with species 40. *K. membranifolia.*

Distribution: Borneo.

Observations: 1. *K. membranifolia* occupies some central or intermediate position in between the foregoing series V, VI, and VII, because of the glabrescent

flowers and fruits, and especially with VI. series *Curtisianae* also because of the similar yellowish twigs. There is also a possible connection with III. series *Lamellariae* because of the flaking bark. Furthermore, there is a distinct connection with the next series *Mamillatae*, especially with 41. *K. mamillata* (a species with glabrescent flowers as well), but that species has a very distinctly mamillate staminal disc, characteristic for that series.

2. The present species seems erroneously placed by Sinclair, together with *K. curtisii*, in his group 5, a group defined by having a few-lobed stigma and sessile anthers. Possibly, the anthers are (sub)sessile only in young flowers, but become just stiped when older.

IX. series MAMILLATAE – *Male flower* buds about as broad as or broader than long, generally globose or depressed globose; in anthesis cleft by the perianth valves to over 3/4. *Staminal column* shorter than the diameter of the staminal disc incl. anthers. *Anthers* 9–20, horizontal, subsessile to just stiped. *Staminal disc* mamillate. *Female flowers:* style absent; stigma (4–)6–14-lobulate. Flowers usually with persistent tomentum, or glabrescent. Lower *leaf* surface glabrescent. *Twigs* slender to moderately stout, 1.5–5 mm diam. *Bark* of older twigs usually not cracking or flaking.

Here belong species 41–45, namely: – 41. *K. mamillata*, 42. *K. plumulosa*, 43. *K. intermedia*, 44. *K. uliginosa*, and 45. *K. korthalsii*.

Distribution: Malay Peninsula, Sumatra, Java, Borneo, southern Philippines (Palawan, Sulu I., Mindanao).

Observations: 1. A rather homogeneous series, mainly united by the low- or long-mamillate staminal disc. As pointed out under the foregoing series VIII, the species 41. *K. mamillata*, with glabrescent flowers, shows characters intermediate with that series. On the other hand, 45. *K. korthalsii*, in which sometimes the staminal disc is rather flattish, has much in common with 54. *K. glomerata* from the next series.

2. A mamillate or convex staminal disc is present in some species of other series, e.g. in 12. *K. elmeri*, and 24. *K. latericia*, partly, and 83. *K. pedicellata*.

3. Series *Mamillatae* largely coincides with Sinclair's group 2 (except for *K. mandaharan* and *K. rufa*), which was defined by a many-lobed stigma, the bracteole situated at the base of the flower, and sessile anthers. In all species, however, the bracteole is usually situated ± median and the anthers are stiped or nearly so. *K. mandaharan* and *K. rufa* are now placed in the series IV. *Obovoideae*, because these species have essentially differently shaped male flower buds.

X. series GLOMERATAE – *Male flower* buds generally about as broad as long, more or less globose; in anthesis cleft by the perianth valves to over 3/4. *Staminal column* shorter than the diameter of the staminal disc incl. anthers. *Anthers* 5–23, oblique to horizontal, half-sessile to stiped. *Staminal disc* flat or convex, rarely low-mamillate. *Female flowers:* style absent or up to 2.5(–3) mm long; stigma (1–)4–16-lobulate. Flowers with persistent tomentum. Lower *leaf* surface glabrescent or with persistent tomentum. *Twigs* slender to moderately stout, at apex 1.5–6 mm diam. *Bark* of older twigs not flaking.

Here belong species 24, and 46 – 59, namely: – 46. *K. woodii*, 47. *K. pectinata*, 48. *K. scortechinii*, 49. *K. elegans*, 50. *K. pachycarpa*, 51. *K. tridactyla*, 52. *K. stenocarpa*, 53. *K. alvarezii*, 54. *K. glomerata*, 55. *K. tomentella*, 56. *K. attenuata*, 57. *K. austrosiamensis*, 58. *K. saxatilis*, and 59. *K. erratica*, and tentatively also 24. *K. latericia*.

Distribution: Continental SE. Asia, from India through to E. Malesia (Philippines, Moluccas, W. New Guinea).

Observations: 1. A heterogeneous series in which several clusters of mutually more related species can be distinguished, for instance: the species 46. *K. woodii*, 47. *K. pectinata*, and 48. *K. scortechinii* (all with thick-valved male flowers, with a minute tomentum); or the group of 49. *K. elegans* and 50. *K. pachycarpa* (both with the tomentum on the lower leaf surface composed of conspicuous, all equally long stalked, dendroid hairs); or 52. *K. stenocarpa*, 53. *K. alvarezii*, 54. *K. glomerata*, and 55. *K. tomentella;* or the group of 57. *K. austrosiamensis*, 58. *K. saxatilis*, 59. *K. erratica*, and possibly 56. *K. attenuata* (all four species with the inflorescences usually peduncled, and styles 1.5 – 3 mm long).

K. glomerata resembles at times much *K. korthalsii*, a species presently included in the foregoing series *Mamillatae*.

K. tridactyla has very minute flowers and occupies a rather isolated position, though stouter sterile specimens sometimes are reminiscent of sterile 28. *K. oblongata* from IV. series *Obovoideae*.

K. scortechinii has a conspicuous tomentum on the lower leaf surface, which is rather late glabrescent; it has a variable style, 0.5 – 1.5 mm long, and a variable stigma, (3 –)10 – 16-lobulate. The tomentum of the flowers is composed of minute hairs, *c.* 0.2 mm long or less, by which it may be confused with species from series XI. *Glaucae* and XII. *Punctatae;* most frequently it was confused with 82. *K. conferta*. For differences see the general key and the species descriptions.

K. latericia (species 24) is difficult to place in a series. It is a complex species, divided into three subspecies; subsp. *latericia* seems to fit best in the present series; the subsp. *ridleyi* usually has the bark of the twigs cracking and flaking and the staminal disc often convex or somewhat mamillate, and obviously links up with the stout 23. *K. lunduensis* which is presently placed in III. series *Lamellariae*; the subsp. *albifolia*, also with the bark of the twigs cracking and flaking, deviates by its generally more elongated male flower buds which are rather ellipsoid or obovate, not globose, and thus is somewhat reminiscent of IV. series *Obovoideae*.

2. With Sinclair, the species presently brought together in series *Glomeratae* were placed in various groups: 46. *K. woodii*, 47. *K. pectinata*, and 54. *K. glomerata* (with 52. *K. stenocarpa* as a synonym) were in his group 1b, together with *K. korthalsii*, a species presently placed in the foregoing series; the species 48. *K. scortechinii* and 59. *K. erratica* were placed in group 7b; 49. *K. elegans* and 51. *K. tridactyla* (both species erroneously regarded by Sinclair as synonyms of *K. laurina*) and 56. *K. attenuata* were in his group 3a; and 55. *K. tomentella* and 53. *K. alvarezii* (with Sinclair a synonym of *K. tomentella*) in his group 7a. All these groups of Sinclair, however, are very heterogeneous as well; for instance *K. scortechinii* was placed in group 7b, defined by a few-lobed stigma, the absence of a style, and by many stalked anthers. In true *K. scortechinii*, however, the style was presently observed as being 0.5 – 1.5 mm long and the stigma up to *c.* 16-lobulate.

XI. series GLAUCAE – *Male flower* buds about as broad as long, generally globose; in anthesis cleft by the perianth-valves to *c.* 3/4 or more. *Staminal column* shorter than the diameter of the staminal disc incl. anthers. *Anthers* 6–18, horizontal, half-sessile to stiped. *Staminal disc* ± flat. *Female flowers:* style usually absent or short, 0–0.5(–1), rarely 1–1.5 mm long (in *K. lenta*, see also the observations), stigma usually few-lobulate, 2–8-, or sometimes up to 20-lobulate. Flowers with short tomentum generally persistent. Lower *leaf* surface not blackish spotted, with persistent tomentum, or glabrescent, often the hairs very inconspicuous. *Twigs* usually slender, at apex 0.5–4 mm diam. *Bark* of older twigs not cracking or flaking.

Here belong species 60–62, doubtful, and 63–76, namely: –60. *K. lenta*, 61. *K. squamulosa*, 62. *K. sessiflora*, 63. *K. rubens*, 64. *K. kinabaluensis*, 65. *K. luteola*, 66. *K. glauca*, 67. *K. sumatrana*, 68. *K. kostermansiana*, 69. *K. patentinervia*, 70. *K. malayana*, 71. *K. cinerea*, 72. *K. stenophylla*, 73. *K. hirtella*, 74. *K. communis*, 75. *K. glaucescens*, and 76. *K. losirensis*.

Distribution: SE. Asia (Burma, Thailand, Indo-China: species 60–62) and Malesia: Peninsular Thailand, Malay Peninsula, Sumatra, Java, Borneo, Celebes, Moluccas, S. Philippines (Mindanao).

Observations: 1. The first three species listed possibly do not belong to the present series, as their resemblance to the remainder of the species may be superficial, mainly due to the general shape of the male flowers (in *K. lenta*) and the short tomentum of the flowers. *K. lenta* rather deviates by a distinct style of 1–1.5 mm long, by the many-lobulate stigma, and by the flowers which are sometimes tending to become glabrescent; 60. *K. lenta* and 61. *K. squamulosa* (male flowers not known), both from continental SE. Asia, are apparently intimately related; 62. *K. sessiflora* (Indo-China) possibly is also related to 34. *K. globularia*, a species which is presently listed under IV. series *Obovoideae*.

K. stenophylla (species 72) is a very variable entity in which the number of stigma lobelets may be 5–20; also in 73. *K. hirtella* and 75. *K. glaucescens* the number of stigma lobelets is high, 12–16 and 10–15 respectively; in the remaining species it varies from 2–8; *K. hirtella* var. *stylosa* deviates by the rather long style of *c.* 1 mm and the rather obovoid male flower buds.

2. All species of the present series *Glaucae*, so far as known at that time, were classified by Sinclair under his groups 7a and 7b, both characterized by the stigma being few-lobed, the style absent, and the anthers stalked. However, several other species listed there are presently transferred to other series, e.g. *K. tomentella*, *K. erratica*, and *K. scortechinii* to the preceding series X. *Glomeratae*, and *K. muscosa*, *K. conferta*, and *K. kunstleri* to the next series XII. *Punctatae*.

K. lenta was erroneously regarded by Sinclair as a synonym of *K. cinerea* var. *andamanica*. the latter taxon being presently recognized as a separate species in I. series *Laurinae* because of the different shape of the male flowers.

XII. series PUNCTATAE – *Male flower* buds about as broad as long, (depressed) globose, sometimes sagged at base; in anthesis cleft by the perianth valves to *c.* 3/4 or more. *Staminal column* shorter than the diameter of the staminal disc incl. anthers. *Anthers* 7–18, horizontal, subsessile to stiped. *Staminal disc* flat, or convex, or low-mamillate. *Female flowers:* style absent or short, up to 1 mm long; stigma

3–25(–many)-lobulate. Flowers with persistent tomentum. Lower *leaf* surface with scattered, minute, blackish cork warts; with persistent tomentum or glabrescent. *Twigs* rather slender, at apex 1–6 mm diam. *Bark* of older twigs usually not tending to crack or flake.

Here belong species 77–83, namely: – 77. *K. celebica*, 78. *K. muscosa*, 79. *K. pubiflora*, 80. *K. kunstleri*, 81. *K. stellata*, 82. *K. conferta*, and 83. *K. pedicellata*.

Distribution: Malay Peninsula, Sumatra, Borneo, Celebes, Philippines.

Observations: 1. This series is close to the preceding one, and apparently rather heterogeneous as well, as can be seen in the conspicuous differences in the general habit and other characters of the species. The species are united by the typical reddish-brown to blackish dots on the lower (and upper) leaf surface, especially on and near the veins, caused by minute non-traumatic cork warts. The dots are readily visible with a lens.

2. *K. celebica* (species 77) and 78. *K. muscosa* have the lower leaf surfaces glabrescent; in the remaining species the tomentum is rather persistent. Both species have small mature male flower buds, 2–3 mm diam., and seem to be related with *K. tomentella* of X. series *Glomeratae*.

K. pedicellata (species 83) deviates by the low-mamillate staminal disc and by the 5–25(or more)-lobulate stigma; in the remaining species the stigma is not more than 10-lobulate.

3. The species of the present series *Punctatae*, as far as known at that time, were with Sinclair all in his groups 7a and 7b, both groups being rather heterogeneous as pointed out already in the observations under the preceding series *Glaucae*. The species 81. *K. stellata* was treated by Sinclair as a synonym of *K. tomentella*, which was listed under his group 7a.

KEYS TO THE SERIES AND SPECIES

As a consequence of the dioecism of *Knema*, specimens, if not sterile, will usually be either provided with staminate flowers, or with pistillate flowers and/or fruits, and separate keys for male and for female flowering and fruiting material have therefore been framed.

Since the female flowers provide comparitively few characters, as, moreover, those of several taxa are still not or insufficiently known, and as also the fruits are often considerably variable and their characters difficult to define, at least as found in the dried state in herbarium specimens, it appeared to be impossible to offer a general key to female flowering and fruiting specimens for the whole area of the genus. Therefore, besides the general key (1), for these specimens regional keys mainly based on vegetative characters have been constructed for the following areas: (2) Mainland SE. Asia (incl. Andaman- and Nicobar I., excl. Malaya and Singapore): 30 species of which 10, mainly from Peninsular Thailand, occur also outside the area in the region covered by the Flora Malesiana; (3) Malaya and Singapore: 27 species; (4) Sumatra and Java: 21 species; (5) Borneo (incl. Anambas- and Natuna I.): 39 species; (6) the Philippines, Celebes, Moluccas, New Guinea (Vogelkop Penins.), Lesser Sunda I.: 11 species. Determinations with these keys should always be checked against the species descriptions.

For male flowering specimens a general key (1) to all 83 species is provided. In this key primarily the characters are used with which the series are defined as well.

(1) GENERAL KEY TO THE SPECIES AND SERIES, BASED MAINLY ON MALE FLOWERING SPECIMENS

1a. Male flower buds usually longer than broad (in general resembling female flowers): obconical, pear-shaped, ovoid or obovoid, or ellipsoid-oblong; the base rounded to attenuate; buds in anthesis split by the perianth valves to *c.* halfway to 2/3. Staminal column about as long as to usually longer than the diameter of the staminal disc incl. anthers. (These characters are sometimes less obvious in 5. *K. andamanica* and 6. *K. mixta*). Anthers 6 – 18, generally suberect. Series LAURINAE . . . . . 2.

b. Male flower buds usually about as broad as long, or broader than long: globose, pear-shaped, obovoid, or rarely ellipsoid; at base rounded, truncate, saccate, or attenuate; buds in anthesis split by the perianth valves sometimes to about 2/3 but usually to much deeper. Staminal column usually shorter than the diameter of the staminal disc incl. anthers. Anthers 3 – 25, suberect to horizontal. (In 30. *K. tenuinervia*, 27. *K. piriformis*, and 26. *K. pulchra* the male flower buds are ± pear-shaped and in anthesis split by the perianth lobes to *c.* halfway to 2/3, and in these species the staminal column is relatively long) 13.

2a. Male flower buds 7 – 9 mm long; pedicels 8 – 15 mm long. Anthers 12 – 18 **1. K. linifolia**

b. Male flower buds 3 – 6 mm long; pedicels 1 – 10 mm long. Anthers 6 – 12. 3.

3a. Lower leaf surface either early glabrescent, or with persistent tomentum composed either of sessile and (usually for the smaller part) stalked hairs, or all hairs sessile. Tomentum of flowers composed of hairs 0.05 – 0.3 mm (or in 10. *K. laurina* 0.5 – 1.5 mm) long. Anthers half-sessile to stiped, suberect to almost horizontal. Pedicels (0.5 –)1 – 10 mm long . . . . . 4.

b. Lower leaf surface with conspicuous persistent tomentum consisting of coarse stellate-dendroid hairs all or predominantly equally long stalked, ± evenly spaced. . . . . 12.

4a. Twigs stout, at apex 5 – 6 mm diam., lower down with the bark tending to crack or flake or not. Leaves 18 – 50 cm long. Male flower buds *c.* 6 mm long; pedicels 6 – 7 mm long. Anthers 11 – 13. . . . . **2. K. pierrei**

b. Twigs rather slender, at apex 1 – 5 mm diam., lower down the bark not or but faintly tending to crack, never flaking. Leaves up to 40 cm long. Male flower buds 3 – 6 mm long; pedicels 1 – 10 mm long. Anthers 6 – 12 . . . 5.

5a. Twigs in apical portion ± flattened. Pedicels 1 – 3 mm long. Leaves above rather faintly reticulate, usually very finely pitted (only visible with a lens × 30). Fruit apex acute or beaked. . . . . **3. K. oblongifolia**

b. Twigs in apical portion terete. Pedicels 0.5 – 10 mm. Leaves above with a fine and distinct reticulation or not, not very finely pitted. Fruit apex blunt to subacute . . . . . 6.

6a. Male inflorescences all or partly (1 –)2 – 7 mm peduncled; in 5. *K. andamanica* and 6. *K. mixta* sometimes all sessile. Twigs at apex 1 – 3(– 4) mm diam., striate or not, usually very shortly tomentose, early or late glabrescent. Leaves beneath finely and usually inconspicuously tomentose by mainly sessile stellate hairs, early to rather late glabrescent . . . . . 7.

b. Male inflorescences sessile or rarely up to *c.* 1 mm peduncled. Twigs at apex (2–)3–5 mm diam., usually finely or coarsely striate, rarely only faintly so; usually distinctly short-tomentose, rarely only scurfy and early glabrescent. Leaves beneath usually with conspicuous (sub)persistent tomentum, rarely rather early glabrescent . . . . . 11.

7a. Pedicels 2–3 mm long. Flower buds narrowly obconical, *c.* 3.5–4 by 2–2.5 mm. Anthers 7 or 8, stiped. Leaves coriaceous. *Thailand* . . **4. K. conica**

b. Pedicels 3–10 mm long. Flower buds ellipsoid to obovoid, (2–)2.5–5.5 by 1.5–4.5 mm. Anthers 6–12, either half-sessile, or subsessile, or stiped. Leaves membranous to thinly coriaceous . . . . . 8.

8a. Bracteole situated usually apically or subapically on the pedicel, usually not more than 2 mm below the perianth. Anthers 6–12, just sessile to stiped. Fruits at base rounded, not gibbous. . . . . 9.

b. Bracteole usually ± halfway the pedicel. Anthers 8–10, half-sessile, not stiped. Fruits at base rounded or gibbous . . . . . 10.

9a. Twigs at apex finely or not striate, when young very shortly tomentose by hairs *c.* 0.1 mm or less. *Andaman I., Nicobar I., N. Sumatra, Penins. Thailand, Penang I.*. . . . . **5. K. andamanica**

b. Twigs at apex coarsely striate, tomentose by hairs 0.1–0.3 mm long. *Annam* **6. K. mixta**

10a. Twigs at apex 1–2 mm diam., with tomentum of hairs *c.* 0.1 mm long. Leaves 5–20 by 1.5–4 cm. Fruits at base at one side gibbous. *NE. India, N. Burma.* **7. K. angustifolia**

b. Twigs at apex 1.5–2.5 mm diam., with tomentum of hairs 0.2–0.3 mm long. Leaves 12–35 by 2.5–10 cm. Fruits rounded at base. *Tonkin, Annam, Laos (?), Yunnan* . . . . . **8. K. petelotii**

11a. Hairs of tomentum on twig apex 0.05–0.5 mm long; those on lower leaf surface mainly sessile, stellate; those on flowers *c.* 0.2 mm long. Twigs towards apex usually distinctly coarsely or finely striate. Pedicels 4.5–8.5 mm long **9. K. pseudolaurina**

b. Hairs on twig apex 0.5–1 mm long; those on lower leaf surface predominantly stellate-dendroid of various sizes, mixed with sessile stellate hairs; those on flowers 1–1.5 mm long. Twigs towards apex coarsely striate or not. Pedicels 0.5–2.5 mm long.. . . . . **10. K. laurina** var. **heteropilis**

12a. Pedicels 2–5 mm long. Hairs on flowers 0.5–1.5 mm long. Anthers nearly completely sessile, erect or suberect. Inflorescences sessile . **10. K. laurina**

b. Pedicels 6–9 mm long. Hairs on flowers 0.3–0.4 mm long. Anthers half-sessile, suberect. Inflorescences peduncled for 1–6 mm **11. K. tonkinensis**

13a. Leaves beneath with persistent very short and dense tomentum silky to the touch, composed of densely interwoven stellate-scaly hairs only well visible with a lens × 30. Series SERICEAE . . . . . 14.

b. Leaves beneath glabrescent, or with persistent tomentum of much longer hairs, or of much less densely set, or of ± scattered hairs which do mutually touch only loosely or not at all; hairs not intricately interwoven, not silky to the touch. . . . . 17.

14a. Twigs stout, at apex 4–6 mm diam. Leaves large, 25–60 cm long. Bark of twigs smooth or longitudinally striate or ridged, neither coarsely longitudinally cracking, nor flaking . . . . . 15.

b. Twigs more slender, at apex 2–4 mm diam. Leaves smaller, 12–32 cm long. Bark of twigs at apex coarsely longitudinally striate or ridged, cracking, lower down flaking. Tomentum on lower leaf surface whitish to grey, or pale brown. Staminal disc convex to mamillate. Anthers 10–14. . . . **12. K. elmeri**

15a. Flower buds globose, at base rounded; densely tomentulose by stellate scales *c.* 0.1 mm long. Staminal disc convex to mamillate. Anthers 11–15. Tomentum on lower leaf surface pale cinnamon. . . . . **13. K. sericea**

b. Flower buds broadly obovate, at base ± shortly attenuate. Staminal disc flat 16.

16a. Leaf apex obtuse to retuse, base rounded to cordate. Tomentum on lower leaf surface greyish. Flower buds shortly tomentose. Anthers *c.* 15. **14. K. retusa**

b. Leaf apex acuminate, base attenuate to obtuse or rounded, or rarely subcordate. Tomentum on lower leaf surface cinnamon, rarely greyish. Flower buds seemingly glabrous because of the presence of very minute scales less than 0.1 mm long only. Anthers 22–24 . **15. K. ashtonii** var. **cinnamomea**

17a. Bark of twigs either smooth, or striate, or ridged, not flaking: i.e. bark of twigs towards apex at most coarsely striate or occasionally cracking, never coarsely longitudinally ridged and not or only occasionally cracking; bark of older wood (sometimes) faintly or finely flaking (e.g. 29. *K. mandaharan*, 39. *K. galeata*, 40. *K. membranifolia*, 45. *K. korthalsii*, 44. *K. uliginosa (?)*, 83. *K. pedicellata*) . . . . . 27.

b. Bark of twigs towards apex usually coarsely longitudinally striate, or sharply ridged, or grooved, usually soon longitudinally cracking and lower down usually finely or coarsely flaking. (This latter character usually visible in between the insertions of the older leaves and lower down, at least from there where the inflorescences are situated; thus, in e.g. 29. *K. mandaharan*, 39. *K. galeata*, 45. *K. korthalsii*, and 56. *K. attenuata* the bark of older twigs is sometimes finely flaking, but at apex it is not coarsely striate, and these species are entered in the alternative lead.) . . . . . 18.

18a. Twigs rather slender, at apex (1–)1.5–4(–6) mm diam., usually striate or coarsely ridged or angular, and cracking or not; bark lower down usually only rather thinly flaking or not. Leaves 8–30(–40) cm long, usually membranous to chartaceous. Flower buds depressed globose or depressed short-obovoid. Staminal disc flat or usually ± convex or low-mamillate. . . . . 26.

b. Twigs stout, at apex (3–)4–12 mm diam.; the bark lower down distinctly cracking and flaking. Leaves (12–)15–60 cm long, thinly chartaceous to coriaceous. Flower buds either large, 4–10 mm wide, of various shape, or only 3–3.5 mm wide and then ellipsoid. Staminal disc ± concave or flat, not convex or mamillate. Pedicels up to 20 mm long. Series LAMELLARIAE 19.

19a. Leaf blades, and sooner or later also the petioles and the twigs, glabrescent from a very conspicuous lanose tomentum consisting of hairs 3–8 mm long; hairs on flowers 1–3 mm long . . . . . **16. K. hookeriana**

b. Leaf blades, petioles, and twigs glabrescent from a conspicuous tomentum consisting of hairs 0.2–2.5 mm long; hairs on flowers up to 1 mm long. 20.

20a. Leaf base usually cordate or subcordate, rarely rounded; the basal nerves ± crowded. Twigs, also in the apical portion, usually early coarsely cracking and flaking. Pedicels 3–20 mm long . . . . . 21.

b. Leaf base attenuate to obtuse, or (broadly) rounded, or occasionally cordate; basal nerves usually not or but faintly crowded. Twigs in the apical portion

longitudinally striate or ridged and usually cracking, lower down coarsely or rather finely flaking. Pedicels 2–4.5 mm long . . . . . 24.

21a. Male flower buds rather small, 4–5 mm wide, usually glabrescent or the tomentum easily rubbed off. Male pedicels 3–15 mm long. Anthers 10–14. Disc at the bottom of the flower absent or inconspicuous. Bark of twigs usually dark brown or blackish brown; the tomentum at apex composed of hairs *c.* 1 mm long. [Female flower pedicels 1.5–2 mm long; fruits 25–35 mm long, sessile or but shortly stalked, the tomentum composed of hairs up to 2 mm long]. *Penins. Thailand, Malay Penins* . . . . . **17. K. furfuracea**

b. Male flower buds (5–)6–10 mm wide, either glabrescent or with persistent tomentum. Male pedicels 7–20 mm long. Anthers 14–23. Disc at the bottom of the flower present. Bark of twigs pale brown to blackish brown; the tomentum at apex composed of hairs 0.2–2.5 mm long. [Female flower pedicels and fruit stalks 8–20 mm long; fruits larger, with a tomentum composed of hairs up to 5 mm long.] . . . . . 22.

22a. Male flower buds (5–)6–6.5 mm wide, with persistent tomentum. Male pedicels 7–9 mm long. Anthers 13 or 14. Disc at the bottom of the flower consisting of separate pads or ridges, or rather the perianth at base thickened and very coarsely transversely ridged. Bark of twigs dark brown to blackish brown; the tomentum at apex consisting of hairs 1–2.5 mm long. [Female flowers not known; fruits (immature) with tomentum consisting of hairs *c.* 2–3 mm long, fruit stalks 8–10 mm long.]. *C. and S. Sumatra, Anambas I.* **18. K. lampongensis**

b. Male flower buds 6.5–10 mm wide, either glabrescent or with persistent tomentum. Male pedicels 12–20 mm long. Anthers (15–)17–23. Disc at the bottom of the flower ± conspicuous, entire or interrupted. Bark of twigs pale brown to dark brown or blackish brown; the tomentum at apex consisting of hairs up to 2 mm long. [Female flowers and fruits stiped for 14–20 mm; tomentum of fruits consisting of hairs 1–5 mm long.] 23

23a. Male flowers largely glabrescent. Disc at the bottom of the flower coarsely striate or ridged. Bark of twigs brown to blackish; the tomentum at apex composed of hairs 1–2 mm long. [Fruits velvety-felty tomentose by hairs 3–5 mm long.] *Malay Penins.* **19. K. lamellaria**

b. Male flowers with persistent tomentum. Disc at the bottom of the flower rather conspicuous, ± entire or striate. Bark of twigs pale brown or greyish brown; the tomentum at apex consisting of hairs 0.2–1 mm long. [Tomentum of fruits consisting of hairs 1–1.5 mm long.] *Borneo.* . . . **20. K. pallens**

24a. Male flower buds depressed globose or ± obovoid, with persistent tomentum. Anthers 10–18. . . . . 25.

b. Male flower buds ± ellipsoid, glabrescent in the upper portion. Anthers 6 or 7 **21. K. psilantha**

25a. Male flower buds ± obovoid, at base tapering, (3.5–)4–5.5 by (3.5–)4–5.5 mm; anthers usually curved upwards. Leaves usually coriaceous, drying above usually olivaceous. (A very variable species; the flaking of bark of twigs indistinct in part of the material). . . . . **22. K. percoriacea**

b. Male flower buds depressed globose, 3–3.5 by 4–5 mm; anthers horizontal. Leaves chartaceous to coriaceous, drying above usually dark brown. **23. K. lunduensis**

26a. Male flower buds 5–8 mm diam., early glabrescent; pedicels 6–9 mm long.

Twigs at apex early glabrescent, often yellowish. . **40. K. membranifolia**

b. Male flower buds 3–4.5 mm diam., with persistent tomentum; pedicels 3–6 mm long. Twigs at apex rather late-glabrescent. Series GLOMERATAE *p.p.* **24. K. latericia**

27a. Male flower buds broadly ovoid to broadly obovoid, at base either rounded, or truncate, or saccate, or only shortly attenuate or shortly tapering. Perianth lobes in anthesis splitting the bud to over 2/3, in several cases nearly to the base of the perianth. Anthers generally horizontal, sometimes suberect; staminal column tapering or cylindrical. (Male flowers not known in 15. *K. ashtonii* var. *ashtonii*) . . . . . 38.

b. Male flower buds obovoid or pear-shaped, in the lower half usually distinctly attenuate or tapering or at least ± narrowed. Perianth lobes in anthesis splitting the bud usually only to *c.* halfway to 3/4. Anthers generally half-erect or suberect; staminal column usually tapering. (These latter characters are not always obvious and should be rechecked if the final identification is unsatisfactory: e.g. 38. *K. curtisii* and 37. *K. linguiformis* have the male flower buds at base sometimes tapering, though split in anthesis over 3/4, and these species are entered in the alternative lead. Male flowers not known in 31. *K. poilanei.*) Series OBOVOIDEAE . . . . . 28.

28a. Tomentum of flowers consisting of stellate or stellate-dendroid hairs more than 0.2 mm long . . . . . 31.

b. Tomentum of flowers short-scurfy, either consisting of stellate or stellate-scaly flattish hairs less than 0.2 mm long, or of stellate-dendroid hairs of *c.* 0.2 mm long (25. *K. rigidifolia*) . . . . . 29.

29a. Leaves coriaceous. [Fruit possibly globose, subsessile.] **25. K. rigidifolia** subsp. **camerona**

b. Leaves chartaceous to thinly coriaceous. [Fruits subglobose or ovoid, to ellipsoid-oblong, stalked.] . . . . . 30.

30a. Twigs usually stout, at apex 3–6(–8) mm diam. Leaf base cordate to broadly rounded. Male flower buds (3–)4–5.5 mm long; pedicels 4–8 mm long.; anthers 12–25 . . . . . **26. K. pulchra**

b. Twigs rather slender, at apex 1–3 mm diam. Leaf base rounded to attenuate. Male flower buds 4–5 mm long; pedicels 2–5 mm long; anthers 11 or 12. (Compare also 73. *K. hirtella* var. *stylosa.)* . . . . . **27. K. piriformis**

31a. Leaves beneath with persistent tomentum consisting of rather coarse and stiff sessile-stellate and stalked stellate-dendroid hairs; old leaves partially glabrescent . . . . . **28. K. oblongata**

b. Leaves beneath either glabrescent, or with tomentum easily rubbed off, or tomentum very inconspicuous, consisting of minute scattered hairs . 32.

32a. Twigs stout, at apex (3–)4–8(–10) mm diam. Leaves chartaceous to coriaceous, 15–55 cm long, the base attenuate, or rounded, or cordate. Male pedicels 1–6 mm long . . . . . 33.

b. Twigs slender, at apex 1–3 mm diam. Leaves membranous to thinly coriaceous, 6–30 cm long, the base attenuate to rounded. Male pedicels 3–15 mm long . . . . . 35.

33a. Leaves coriaceous, above usually glossy. Lateral nerves above usually raised and distinct. Male pedicels (2–)3–6 mm long; the bracteole small, caducous. *Malay Penins., Sumatra.* . . . . . **29. K. mandaharan**

b. Leaves chartaceous to thinly coriaceous, usually rather dull above. Lateral

nerves above thin, flattish, not raised, rather inconspicuous. Male pedicels 1–4 mm long; the bracteole large, 3–5 mm long, rather late caducous. *E. Nepal, NE. India to Vietnam* . . . . . 34.

34a. Leaves above drying olivaceous. [Female flower buds 5–6 mm long]. *E. Nepal to Thailand and SW. Laos.* . . . . . **30. K. tenuinervia**

b. Leaves above drying dark brown to blackish. [Male flowers not known; female flower buds 8–10 mm long] *Annam.* . . . . . **31. K. poilanei**

35a. Leaves ± lanceolate, *c.* 15–30 by 1.5–4(–5.5) cm. Male flower buds 6–7 mm long; pedicels 10–15 mm long. *Borneo.* . . . . . **32. K. rufa**

b. Leaves oblong to lanceolate, 6–30 by 1.5–8 cm. Male flower buds 3–5.5(–6) mm long; pedicels 3–13 mm long. *Continental SE. Asia incl. the Malay Peninsula* . . . . . 36.

36a. Male inflorescences sessile. Staminal column 1.5–2 mm long. Male flower buds 4–5 mm diam.; pedicels 4–6 mm long. Twigs at apex faintly bluntly 2–3-angled, not striate. Reticulation on upper leaf surface coarse or fine, not very prominent. . . . . **33. K. globulatericia**

b. Male inflorescences usually all or partly up to 5 mm peduncled . . 37.

37a. Staminal column only 0.5–1 mm long because of fusion of basal part with the perianth. Male flower buds 3–5 mm diam.; pedicels 3–11 mm long. Twigs at apex terete, usually striate. Leaves drying often with a blackish metallic lustre; reticulation on upper surface not very prominent . . . **34. K. globularia**

b. Staminal column 2–2.2 mm long. Male flower buds *c.* 5.5 mm diam.; pedicels 9–13 mm long. Twigs at apex subterete, not striate. Leaves drying brown; reticulation on upper surface prominent and distinct. . **35. K. bengalensis**

38a. Anthers 3 (or 4). Series LATIFOLIAE . . . . . **36. K. latifolia**

b. Anthers (5 or) 6–25 . . . . . 39.

39a. Anthers (5 or) 6–23(–25), mutually free, i.e. not or at least not completely and tightly touching each other; anthers either half-sessile, or just sessile, or stiped . . . . . 41.

b. Anthers 9–25, these completely sessile and tightly set, completely touching, the thecae appearing as if representing twice as many, i.e. 18–50 sessile anthers. Twigs usually slender and often yellowish (resembling those in 40. *K. membranifolia;* see also the note on deviating specimens under 46. *K. woodii*). Series CURTISIANAE . . . . . 40.

40a. Leaves chartaceous to thinly coriaceous, drying greenish; the reticulation distinct at both surfaces; base cuneate to rounded, top (sub)acute to obtuse, rarely subacuminate. Male flower buds subtrigonous with rounded angles **37. K. linguiformis**

b. Leaves membranous to chartaceous, the base usually cuneate to attenuate; when leaves membranous these drying greenish, with the reticulation distinct or not, and with the top acute to acuminate; when leaves chartaceous these drying brown, with the reticulation very fine or faint, and the top acute, or obtuse, or rounded. Male flower buds trigonous or subtrigonous with rounded or sharp angles. . . . . **38. K. curtisii**

41a. Flower buds generally with persistent tomentum; sometimes buds seemingly glabrous because of the presence of very minute appressed scales only (lens, × 30). Lower leaf surface glabrescent or not . . . . . 44.

b. Flower buds early glabrescent. Lower leaf surface early glabrescent . 42.

42a. Male flower buds mitriform, with sharp angles, (8–)9–15 mm diam. Twigs at

apex 4–10 mm diam., grey-brown. Leaves rigidly coriaceous. Series GALEATAE. . . . . **39. K. galeata**

b. Male flower buds globose or depressed-globose, in transverse section circular or obtusely trigonous, 2.5–7(–8) mm diam. Twigs at apex 1.5–3 mm diam., often ± yellowish. Leaves chartaceous to thinly coriaceous . . . . 43.

43a. Inflorescences mainly on the older branches, lower than the leaves. Male flower buds 5–7(–8) mm diam., glabrescent from a short tomentum consisting of hairs *c.* 0.2 mm long. Staminal disc flat to convex, not with a mamilla. Anthers 19–23. Series MEMBRANIFOLIAE. . . . . **40 K. membranifolia**

b. Inflorescences mainly in the axils of leaves in the apical portion of the twigs. Male flower buds 2.5–4.5 mm diam., glabrescent from a woolly tomentum consisting of dendroid hairs *c.* 0.5–0.7 mm long. Staminal disc provided with a very conspicuous mamilla. Anthers 9–12. Series MAMILLATAE *p.p.* **41. K. mamillata**

44a. Leaves on lower surface with scattered small cork warts appearing as dark brown dots, especially situated on the finer nerves (lens, × 30). Series PUNCTATAE . . . . . 87.

b. Leaves on lower surface without dark brown cork warts appearing as brown dots, or sometimes only incidentally a few minute dots especially when leaves beneath glabrescent . . . . . 45.

45a. Flower buds of various consistency and size. Staminal disc either concave, or flat or flattish, or but slightly convex (sometimes low-mamillate in 54. *K. glomerata*, 52. *K. stenocarpa*, 63. *K. rubens*, and 24. *K. latericia*) . . 49.

b. Flower buds rather robust, 4–7 mm diam. Staminal disc usually distinctly convex or provided with a mamilla; in dry specimens the mamilla sometimes shrivelled and hence indistinct. Staminal disc sometimes flattish in 45. *K. korthalsii* from the *Philippines*. Series MAMILLATAE *p.p.* . . . . . 46.

46a. Leaves rigidly coriaceous. Tomentum of twig apex and younger petioles composed of hairs 2–4 mm long; that of flowers of hairs 1–2 mm long. A ring-shaped disc present at base of perianth around the staminal column. **42. K. plumulosa**

b. Leaves chartaceous to coriaceous. Tomentum of twig apex and younger petioles composed of hairs up to 1 mm long; that of flowers of hairs up to 0.5 mm long. Perianth at base around the staminal column somewhat thickened or not, without a distinct ring-shaped disc. . . . . 47.

47a. Leaves coriaceous. Mamilla longer than broad. . . . . **43. K. intermedia**

b. Leaves chartaceous. Mamilla about as long as broad, or shorter . . 48.

48a. Lateral nerves 8–15 pairs, at upper leaf surface much raised. Twigs usually rather slender, at apex 1.5–3 mm diam., (sub)terete, smooth or finely striate. Bracteole in male flower at or near the apex of the pedicel. Anthers 10–13. **44. K. uliginosa**

b. Lateral nerves 14–40 pairs, at upper leaf surface not or but slightly raised. Twigs rather stout, at apex 3–5 mm diam., rather coarsely ridged from the bases of the petioles, or 2- or 3-angled. Bracteole in male flower situated about halfway the pedicel. Anthers 10–20. (Compare also 54. *K. glomerata*). **45. K. korthalsii**

49a. Flower buds usually small or medium-sized, rarely large, 1.5–7 mm diam. Valves of perianth not very coarse, at sutures *c.* 0.3–1 mm thick. Tomentum of flowers various, composed of hairs 0.1–1 mm long. Anthers (5–)6–17.

(Compare also 47. *K. pectinata* from the second lead.) . . . . . 53.

b. Flower buds generally more robust, (3.5 –)4 – 8 mm diam. Valves of perianth at sutures (0.7 –)1 – 2 mm thick. Tomentum of flowers thin, finely farinose or scurfy, composed of minute scales or stellate hairs less than 0.1 – 0.2 mm long. Anthers 11 – 24. (In 47. *K. pectinata* male flower buds 3.5 – 7 mm diam., with 11 – 15 anthers; in 48. *K. scortechinii* male flower buds 3.5 – 5 mm diam., with 11 – 16 anthers.) . . . . . 50.

50a. Tomentum on twig apex seemingly absent, though actually consisting of minute appressed scales, chocolate, dark brown, or cinnamon. Twigs at apex 4 – 6 mm diam., usually angular or coarsely striate. Leaves chartaceous to thinly coriaceous; lateral nerves 20 – 35 pairs. (Male flowers not known) Series SERICEAE *p.p.* . . . . . **15. K. ashtonii** var. **ashtonii**

b. Tomentum on twig apex usually very early shed, mealy, consisting of pale brown to yellowish brown, minute, stellate-scaly and/or stellate-dendroid hairs; tomentum not consisting of appressed scales only. Series GLOMERATAE *p.p.*. . . . . 51.

51a. Anthers 18 – 23, completely sessile. Twigs at apex ± angular, dark brown or blackish, 2.5 – 4 mm diam. Leaves chartaceous to thinly coriaceous; lateral nerves 20 – 30 pairs . . . . . **46. K. woodii**

b. Anthers 11 – 16, half-sessile to stiped. Twigs at apex usually terete, finely or coarsely striate, greyish-brown, rarely blackish. Leaves thinly to rigidly coriaceous . . . . . 52.

52a. Leaves up to 47 cm long; lateral nerves 25 – 50 pairs, reticulation by tertiary venation rather coarse or fine. Flower buds (3.5 –)4 – 7 mm diam.; anthers 11 – 15, halfsessile to nearly stiped. Perianth inside pinkish. Twigs at apex 3 – 6 mm diam.. . . . . **47. K. pectinata**

b. Leaves up to 30 cm long; lateral nerves 18 – 30 pairs, tertiary venation finely reticulate. Flower buds 3.5 – 5 mm diam.; anthers 11 – 16, usually shortly stiped. Perianth inside greenish to yellowish. Twigs at apex 2 – 4 mm diam. **48. K. scortechinii**

53a. Tomentum of flowers and twig apices usually inconspicuous, scurfy or felty by minute, mainly flattish, stellate-scaly hairs, or in e.g. 25. *K. rigidifolia* and 63. *K. rubens* with stellate-dendroid hairs only 0.1 – 0.2 mm long; without or with but a few emergent stellate-dendroid hairs of up to *c.* 0.3 mm long. Series GLAUCAE (excl. 25. *K. rigidifolia*, 51. *K. tridactyla*). . . . . 66.

b. Tomentum of flowers and twig apices either conspicuous, or at least of a farinose or fine or coarse woolly appearance by stellate or stellate-dendroid hairs usually more than (0.1 –)0.2 mm long; tomentum sometimes short in 54. *K. glomerata* from the *Philippines*. Series GLOMERATAE *p.p.* . . . . . 54.

54a. Adult leaves on lower surface either completely glabrescent, or with tomentum persistent, or partially glabrescent, with hairs of various sizes, i.e. sessile as well as stalked dendroid hairs, or all hairs (sub)sessile. Inflorescences sessile or peduncled. Flower buds of various sizes, up to 5.5 mm diam. . . . 56.

b. Adult leaves on lower surface with dense tomentum, persistent or late-glabrescent, composed of conspicuous dendroid hairs all distinctly about equally long stalked; old leaves partially or wholly glabrescent. Inflorescences usually all or partly peduncled. Flower buds *c.* 5 mm diam.. . . . 55.

55a. Flower buds (3.5 –)4 – 5 mm diam.; anthers 9 – 12. Fruits 20 – 25 mm long, the pericarp *c.* 1.5 mm thick. . . . . **49. K. elegans**

b. Flower buds 6–7 mm diam.; anthers 15–17. Fruits 30–36 mm long, the pericarp 2.5–5 mm thick. . . . . **50. K. pachycarpa**

56a. Adult leaves on lower surface either completely glabrescent, or with tomentum only partially persistent near midrib and nerves especially towards the base of the blade, the hairs usually soft and inconspicuous; or tomentum persistent, usually either composed of minute scattered soft-stellate or woolly hairs, or rarely, if twigs 3–5 mm diam., composed of mixed coarser hairs. Inflorescences sessile or peduncled. Twigs at apex 1–5 mm diam. Flowers various 59.

b. Adult leaves on lower surface late-glabrescent or with dense persistent tomentum; tomentum composed of sessile and/or stalked hairs. Inflorescences usually all or partly peduncled. Twigs at apex 1–2 mm diam. Flower buds 1.5–3 mm diam.; anthers (5–) 6–9 . . . . . 57.

57a. Leaves oblong-lanceolate to lanceolate; upper surface with many hair scars (lens, × 30). Flower buds 1.5–2 mm diam. *Borneo*. . . **51. K. tridactyla**

b. Leaves ovate to oblong; upper surface without distinct hair scars. Flower buds 2–3 mm diam.. . . . . 58.

58a. Flower buds 2–2.5 mm diam. Twigs at apex 1–1.5 mm diam., not or hardly striate. *Philippines: Sulu I., Mindanao* . . . . . **52. K. stenocarpa**

b. Flower buds *c.* 3 mm diam. Twigs at apex 2–2.5 mm diam., coarsely striate or angled. *Philippines: Luzon*. . . . . **53. K. alvarezii**

59a. Twigs towards apex 1.5–2.5(–3) mm diam., (when tomentum removed) smooth, the striations either fine and only visible with a lens, or absent; twigs lower down striate or not, but not striate right up to the apex (very young twig-apices sometimes drying striate). Flower buds 3–5 mm diam. Anthers 9–13(–15). Staminal disc either flattish, or convex, or low-mamillate. Inflorescences sessile. (Compare also 45. *K. korthalsii* and 55. *K. tomentalla.)* **54. K. glomerata**

b. Twigs towards apex slender to moderately stout, usually either finely but distinctly, or coarsely striate or ridged, lower down as well as right up to the apex; if striations faint, then twigs at apex rather thick, 2–3 mm (not 1–2.5 mm) diam. (Twigs at apex in specimens of 55. *K. tomentella* from *Celebes* and *Ceram* often only hardly striate) . . . . . 60.

60a. Male inflorescences usually all or partly up to 5 mm peduncled. Pedicels 3–11 mm long. Flower buds 3–5.5 mm diam. Anthers (7–)8–13(–16). *Continental SE. Asia, incl. the Malay Peninsula* . . . . . 62.

b. Inflorescences all sessile. *E. Malesia*. . . . . 61.

61a. Pedicels 2–5 mm long. Flower buds 2.5–3 mm diam.; anthers 6–9(–11). Tomentum on lower surface of immature leaves consisting of woolly-stellate hairs, usually subpersistent on and near the base of the midnerf. *Celebes, Moluccas, New Guinea* . . . . . **55. K. tomentella**

b. Pedicels 3–6 mm long. Flower buds 3–4.5 mm diam.; anthers 9–12. Leaves on lower surface completely early glabrescent. *Palawan.* **24. K. latericia** subsp. **latericia**

62a. Leaves generally small, 6–18(–24) by 1.5–4(–6) cm, at upper surface often drying with a blackish metallic lustre. Twigs rather slender, at apex 1–2(–2.5) mm diam., usually, as are the petioles, coarsely striate and at first finely woolly tomentose. Tomentum of lower surface of younger leaves consisting of rather sparse, minute, mainly sessile, stellate hairs, leaves later on

glabrescent. Bracteoles usually (sub)apically on the pedicel. [Fruits 12–20(–25) mm long.] *E. Bengal (rare), Burma, Indo-China, Thailand, Malay Penins.* . . . . . **34. K. globularia**

b. Leaves usually medium-sized to rather large, 10–25(–32) by 2–8(–11) cm, not or rarely drying with a blackish metallic lustre. Twigs at apex (1.5–)2–4(–5) mm diam., finely or coarsely striate. [Fruits generally larger, 15–35 mm long] . . . . . 63.

63a. Twigs at apex finely striate, usually rather woolly tomentulose when young, early glabrescent. Tomentum on lower leaf surface consisting of rather sparse, fine, pale, sessile-stellate hairs, completely glabrescent or the hairs subpersistent at and near the base of the midrib. *Peninsular India* **56. K. attenuata**

b. Twigs at apex coarsely striate, rather shortly tomentose. Tomentum on lower surface of young leaves consisting of sessile stellate and stalked stellate-dendroid hairs, lower leaf surface early to late glabrescent . . . . . 64.

64a. Flower buds 5–5.5 mm diam. Bracteole apically or subapically on the pedicel. Anthers 12–15. Twigs at apex 3–4(–5) mm diam. *Southern Thailand.* **57. K. austrosiamensis**

b. Flower buds 3.5–5 mm diam. Bracteole situated about halfway on the pedicel. Anthers 9–13. Twigs at apex 1.5–4 mm diam. . . . . 65.

65a. Fruits 26–33 mm long, the tomentum composed of hairs *c.* 0.5 mm long or less; fruit stalks 1–4 mm long. *Vietnam (Annam)* . . . **58. K. saxatilis**

b. Fruits *c.* 15–20 mm long, the tomentum composed of hairs *c.* 1–1.5 mm long; fruit stalks 5–10 mm long. *NE. India, Yunnan, Vietnam* . **59. K. erratica**

66a. Reticulation by the tertiary venation on upper leaf surface distinct or not, coarse or fine. Inflorescences sessile or peduncled. Leaves drying without or with a blackish metallic lustre. [Ovary with hairs less than 1 mm long; fruits either with tomentum composed of hairs less than 1–2 mm long, or completely glabrescent.] *Continental SE. Asia and Malesia.* 68.

b. Reticulation by the tertiary venation on upper leaf surface very fine and usually distinct; the areoles less than 0.5 mm diam. Inflorescences usually peduncled for 0.5–3 mm. Leaves drying without a blackish metallic lustre. *Continental SE. Asia, excl. the Malay Peninsula; not in Malesia* . . 67.

67a. Leaves chartaceous to thinly coriaceous, the lower surface usually early glabrescent from mainly sessile stellate and fewer short stellate-dendroid hairs 0.2–0.3 mm long. [Ovary conspicuously long-pubescent by hairs 0.5–1 mm long. Fruits 17–27 mm long, shaggy long-pubescent by hairs 1–2 mm long, sometimes glabrescent except at the very base.] . . . . . **60. K. lenta**

b. Leaves rigidly coriaceous, the lower surface rather densely set with persistent, very minute, dark brown scales less than 0.1 mm long. [Fruits 35–40 mm long, glabrescent from tomentum consisting of hairs *c.* 0.5 mm long or less.] (Male and female flowers not known.) . . . . . **61. K. squamulosa**

68a. Leaves at upper surface drying usually without a blackish metallic lustre. Specimens from *Malesia, incl. the Malay Peninsula (Malaya and Peninsular Thailand)* . . . . . 70.

b. Leaves at upper surface drying usually with a blackish metallic lustre. Specimens from *continental SE. Asia, excl. the Malay Peninsula* . . . . 69.

69a. Tomentum of flowers in *Indo-China* very short, with hairs *c.* 0.1 mm long, or, outside *Indo-China*, with hairs usually longer, more than 0.2 mm long. Male

flower pedicels 3 – 11 mm long. [Female flower pedicels 1.5 – 4 mm long.] **34. K. globularia**

b. Tomentum of flowers minute by very short scaly hairs 0.1 mm long or less. Male flower pedicels 2 – 2.5 mm long. [Female flower pedicels 0.5 – 1.5 mm long] . . . . . **62. K. sessiflora**

70a. Leaves membranous to chartaceous, at lower surface early glabrescent except for the basal part of the midrib which usually ramains covered by greyish scales or minute stellate hairs. Twigs at apex usually somewhat flattened or sometimes blunt-triangular, at first with farinose tomentum consisting of orange-red or orange-yellowish stellate-dendroid hairs *c.* 0.2 mm long. **63. K. rubens**

b. Leaves either membranous, or chartaceous, or coriaceous, at lower surface either completely glabrescent, or with various (sub)persistent tomentum (lens, × 30). Twigs at apex terete or subterete, or (in 65. *K. luteola*) ± flattened, (early) glabrescent from a very fine tomentum of hairs *c.* 0.1 mm long or less 71.

71a. Lower leaf surface either with (sub)persistent, though usually inconspicuous, tomentum consisting of minute stellate hairs or scales *c.* 0.1 mm long or less (lens, × 30), or lower leaf surface (late) glabrescent from a rather conspicuous tomentum composed of rather densely set stellate and/or stellate-dendroid hairs *c.* 0.2 mm long. [Fruits with (sub) persistent tomentum.] . . . 77.

b. Lower leaf surface rather early glabrescent from a tomentum composed of scattered to dense, usually weak and inconspicuous, stellate(-dendroid) to scale-like, minute hairs. Reticulation on upper leaf surface usually distinct 72.

72a. Leaves coriaceous, drying brown above; the reticulation on the upper surface usually very distinct and prominent. Twigs drying usually blackish. Bracteoles caducous. [Fruits with persistent very short tomentum.] **64. K. kinabaluensis**

b. Leaves membranous to thinly coriaceous, drying above greenish to brown, or blackish. Twigs drying grey to brown. [Fruits early glabrescent, usually leaving a finely warty surface, or in 65. *K. Luteola* minutely scaly.] . 73.

73a. Twigs at apex somewhat flattened. Reticulation on upper leaf surface very fine; areoles less than 0.5 mm diam. Bracteoles caducous. Perianth inside yellowish. . . . . **65. K. luteola**

b. Twigs at apex terete. Reticulation on upper leaf surface coarser; areoles *c.* 0.5 mm diam. or more. Bracteoles persistent or caducous. Perianth inside reddish, or in *Java*, *Bali*, and *Borneo* reddish or yellowish . . . . . 74.

74a. Lateral nerves above usually flattish to sunken; tertiary venation in older leaves usually faint. Bracteoles caducous or very much reduced. Staminal column glabrous or puberulous . . . . . 76.

b. Lateral nerves usually raised above; tertiary venation distinct. Bracteoles usually persistent. Staminal column glabrous. . . . . 75.

75a. Leaves 6 – 20(– 25) cm long. Flower buds 2.5 – 3.5 mm diam. Anthers 8 – 10, or in *E. Java* and *Bali* frequently, and in *Borneo* sometimes, 11 – 15. [Fruits 18 – 30(– 40?) mm long.] . . . . . **66. K. glauca**

b. Leaves generally larger, 12 – 30 cm long. Flower buds 3 – 4 mm diam. Anthers 12 – 18. [Fruits 30 – 40 mm long.] . . . . . **67. K. sumatrana**

76a. Bracteole apically on the pedicel. Staminal column glabrous. Leaves 5.5 – 12

cm wide, at base shallowly cordate to rounded, or subattenuate. Anthers 8–10. . . . . **68. K. kostermansiana**

b. Bracteole subapically on the pedicel. Staminal column at base minutely puberulous (always?). Leaves 2.5–8.5 cm wide, at base broadly rounded to attenuate. Anthers 11 or 12 . . . . . **73. K. hirtella** var. **stylosa**

77a. Sub- and just mature leaves on lower surface with conspicuous tomentum composed of rather densely set (though not intricately felt-like interwoven as in the group of 12. *K. elmeri*) stellate and stellate-dendroid hairs of *c.* 0.2 mm long; hairs of mixed sizes, not almost uniformly sessile stellate, and/or scale-like; mature leaves in many cases on lower surface glabrescent. Reticulation on upper leaf surface distinct and usually very fine; areoles *c.* 0.5 mm diam. or less. Bracteoles caducous or rudimentary. . . . . 84.

b. Tomentum on lower leaf surface composed either of inconspicuous, minute (though not particularly weak), scattered, almost uniform stellate hairs or scales of *c.* 0.2 mm long or less, or of much more densely set minute scales only. Reticulation on upper leaf surface distinct or not . . . . . 78.

78a. Leaves very coriaceous; reticulation on upper surface distinct, prominent. Bracteoles caducous. Flower buds usually pear-shaped, at base tapering or not: recheck also fork 27. [Fruits globose, 30–35 mm diam.; stalk 1–3 mm long.] . . . . . **25. K. rigidifolia** subsp. **rigidifolia**

b. Leaves membranous to chartaceous; reticulation on upper surface distinct or not, not so very prominent. [Fruits usually ellipsoid or obovoid, smaller, up to 25(–40) mm long; fruit stalk up to 15(–20) mm long.] . . . . . 79.

79a. Flower buds rather small, 2–3.5 mm diam.; pedicels 2–7 mm long, or in Bornean specimens up to 10 mm long. Anthers 5–9, or in specimens from Sumatra up to 11, and Borneo up to 15. Bracteoles persistent or caducous. *Mainly Borneo* . . . . . 82.

b. Flower buds generally larger, 3–5 mm diam.; pedicels 6–15 mm long. Anthers 9–15. Bracteoles caducous. *Not in Borneo* . . . . . 80.

80a. Flower buds at base truncate or ± saccate. Lateral nerves and reticulation at upper leaf surface flattish or sunken, indistinct. Perianth inside yellowish (always?). . . . . **69. K. patentinervia**

b. Flower buds at base rounded to subtruncate, or shortly attenuate. Lateral nerves and reticulation at upper leaf surface usually raised and distinct. Perianth inside creamy or yellowish (always?) . . . . . 81.

81a. Twigs at apex usually rather slender, 0.5–2 mm diam., not striate. Anthers opening almost laterally. [Fruits narrowed at base, rather woolly by hairs 0.2–0.4 mm long.] . . . . . **70. K. malayana**

b. Twigs at apex 1.5–3.5 mm diam., striate. Anthers opening rather downwards directed. [Fruits rounded at base, scurfy-tomentulose by hairs 0.1–0.2 mm long.] . . . . . **71. K. cinerea**

82a. Reticulation by tertiary venetion at upper leaf surface very fine, distinct; areoles less than 0.5 mm diam. Flower buds *c.* 2 mm diam.; pedicels 2–3 mm long. Anthers 5 or 6. Perianth inside reddish (?).
51. K. tridactyla subsp. **sublaevis**

b. Reticulation by the tertiary venation at upper leaf surface distinct or indistinct, rather coarse; diam. of the areoles *c.* 0.5 mm or more. Flower buds 2–3.5(–4?) mm diam.; pedicels 3–10 mm long. Anthers 6–13(–15). Perianth inside creamy or yellowish (always?) . . . . . 83.

83a. Anthers 6–11. Twigs at apex 0.5–2(–3) mm diam. Leaves 5–20 cm long; lateral nerves at upper surface flattish to raised. [Fruits 12–25(–30) mm long.] . . . . . **72. K. stenophylla**

b. Anthers 10–13(–15). Twigs stouter, at apex 2–3.5 mm diam. Leaves generally larger, 10–23 cm long; lateral nerves at upper surface sunken or flattish. [Fruits 20–40 mm long.] . . . . . **73. K. hirtella**

84a. Twigs rather stout, at apex (1.5–)2–4 mm diam. Flower buds rather large, 3.5–5 mm diam.; perianth inside greenish to yellowish . . . . . 86.

b. Twigs usually more slender, at apex 1–2(–3) mm diam. Flower buds smaller, 2.5–3.5 mm diam. . . . . 85.

85a. Pedicels 2–5 mm long. Leaves oblong-lanceolate to lanceolate, broadest usually at the middle; base cuneate. Perianth inside reddish (?) **74. K. communis**

b. Pedicels 5–11 mm long. Leaves oblong to lanceolate, broadest at or usually below the middle; base rounded to cuneate. Perianth inside greenish-creamy to yellowish. . . . . **75. K. glaucescens**

86a. Leaves chartaceous, the lower surface with rather loose greyish tomentum. Pedicels 3–10 mm long. . . . . **76. K. losirensis**

b. Leaves (sub)coriaceous, the lower surface with dense, usually yellowish to rusty tomentum. Pedicels 7–16 mm long . . . . . **48. K. scortechinii**

87a. Leaves at lower surface with tomentum persistent or late shed and then often leaving distinct hair-scars (lens, × 30); the tomentum sometimes consisting of remote minute stellate scales only. Twigs at or towards the apex coarsely or finely, though usually distinctly, striate (striations sometimes not distinct in 80. *K. kunstleri* subsp. *coriacea* and subsp. *alpina*) . . . . . 89.

b. Leaves at lower surface early glabrescent. Twigs at apex (when tomentum removed) not striate . . . . . 88.

88a. Twigs rather stout, at apex 1.5–4 mm diam. Leaves coriaceous, 10–20 cm long. Bracteole on male pedicel apically. Anthers long-stiped **77. K. celebica**

b. Twigs slender, at apex 1–1.5 mm diam. Leaves chartaceous, smaller, 5.5–15 cm long. Bracteole on male pedicel attached about halfway. Anthers just stiped.. . . . . **78. K. muscosa**

89a. Leaves rather large, 10–35 cm long; tomentum on lower surface coarse and stiff, consisting of sessile and stalked hairs. Flower buds (3.5–)4–5 mm diam. 92.

b. Leaves generally smaller, 5–20(–27) cm long; tomentum on lower surface conspicuous or inconspicuous, consisting of mainly (sessile) stellate hairs or scales. Flower buds 2–3(–4) mm diam. . . . . 90.

90a. Perianth inside pubescent. Staminal disc convex. . . . **79. K. pubiflora**

b. Perianth inside glabrous. Staminal disc flat or rarely shallowly convex 91.

91a. Tomentum of lower leaf surface consisting of sessile stellate hairs and/or scales. Tomentum of flowers consisting of very short hairs, 0.1–0.2 mm long or less. . . . . **80. K. kunstleri**

b. Tomentum of lower leaf surface consisting of sessile stellate hairs mixed with stellate-dendroid hairs, though these latter sometimes early shed and leaving minute hair scars. Tomentum of flowers usually more conspicuous and woolly, consisting of hairs 0.2–0.3 mm long, mixed with emergent dendroid

hairs . . . . . **81. K. stellata**

92a. Twigs at apex 2–5 mm diam. Pedicels 7–15 mm long. Flowers usually 3-valved, without disc at base. Staminal disc subtriangular, flat or slightly convex. Anthers 10–17. [Fruits ellipsoid to subglobose; stalk 5–10 mm long.]. . . . . **82. K. conferta**

b. Twigs at apex 4–6 mm diam. Pedicels 20–30 mm long. Flowers usually 4- or 5-valved, at base with a conspicuous disc. Staminal disc circular, distinctly mamillate. Anters 14–18. [Fruits globose or depressed globose; stalk 18–30 mm long.] . . . . . **83. K. pedicellata**

(2–6) REGIONAL KEYS TO THE SPECIES FOR FEMALE FLOWERING AND FRUITING SPECIMENS (based mainly on vegetative characters and distribution)

(2) Mainland SE. Asia, incl. Andaman- and Nicobar I., excl. Malaya and Singapore.*)

1a. Bark of twigs longitudinally cracking, when older flaking; sometimes not so in 2. *K. pierrei* and 24. *K. latericia* . . . . . 2.

b. Bark of twigs neither cracking nor flaking; bark sometimes slightly flaking in the older wood in 1. *K. linifolia* . . . . . 5.

2a. Twigs rather slender, in apical portion 2–4 mm diam. Leaves 8–30 cm long. Fruits 15–25(–30) mm long.. . . . . ***24. K. latericia** subsp. **ridleyi**

b. Twigs stout, in apical portion 4–10 mm diam. Leaves (10–)20–60 cm long. Fruits 22 mm long or more. . . . . 3.

3a. Tomentum of flowers consisting of hairs *c.* 0.2–0.5 mm long. [Male perianth in bud pear-shaped.] *Cochin-China.* . . . . . **2. K. pierrei**

b. Tomentum of flowers consisting of hairs 0.5–3 mm long. [Male perianth in bud subglobose.] *Peninsular Thailand.* . . . . . 4.

4a. Tomentum of twigs at apex consisting of hairs (3–)5–8 mm long, on flowers 1–3 mm long. Bark of twigs greyish-brown or brown. Fruits 45–80 mm long, with tomentum of hairs 5–13 mm long; stalk 5–10(–20?) mm long. ***16. K. hookeriana**

b. Tomentum of twigs at apex consisting of hairs 1–1.5 mm long, on flowers 0.5–1 mm long. Bark of twigs usually dark brown or with a blackish tinge. Fruits 25–35 mm long, with the tomentum of hairs up to 2 mm long; stalk 2–5 mm long . . . . . ***17. K. furfuracea**

5a. Tomentum of twigs at apex, and of flowers, consisting of hairs *c.* 0.2 mm long or more; sometimes hairs all or partly shorter than 0.2 mm in 9. *K. pseudolaurina*, 6. *K. mixta*, and 34. *K. globularia* . . . . . 6.

b. Tomentum of twigs at apex, and usually of flowers, very short, consisting of minute hairs *c.* 0.1 mm long. (34. *K. globularia* also included in this lead) 22.

*) Species marked with an asterisk occur in this area only in Peninsular Thailand or the Andaman- and Nicobar I. and are distributed in Malaya as well.

6a. Lower leaf surface with persistent tomentum consisting of almost equally long stalked dendroid hairs . . . . . 7.
b. Lower leaf surface glabrescent, sometimes with remnants of tomentum on and near midrib and nerves, or lower surface late glabrescent, or tomentum persistent and then composed of hairs of various sizes, either all hairs sessile or hairs sessile-stellate and stellate-dendroid . . . . . 10.
7a. Tomentum of twigs at apex consisting of hairs 0.5–2 mm long . . 8.
b. Tomentum of twigs at apex consisting of hairs 0.2–0.5 mm long . . 9.
8a. Fruits ovoid to ellipsoid-oblong, 15–25 mm long; pericarp 1.5–2 mm thick at suture. Female perianth in bud 4–6 mm long. *Peninsular Thailand* ***10. K. laurina**
b. Fruits larger, broadly ellipsoid to subglobose, 30–36 mm long; pericarp 2.5–5 mm thick at suture. Female flowers not known, possibly larger. *Annam* **50. K. pachycarpa**
9a. Twigs at apex 2–3 mm diam. Fruits 25–35 mm long, with tomentum consisting of hairs 1–2 mm long. [Male perianth ± obovoid, *c.* 5–5.5 × 3–3.5 mm.]. . . . . **11. K. tonkinensis**
b. Twigs at apex 2–4 mm diam. Fruits *c.* 20–25 mm long, with tomentum of hairs *c.* 1 mm long. [Male perianth subglobose, 4–5 mm diam.] **49. K. elegans**
10a. Twigs at apex 1.5–4(–5) mm diam., with woolly tomentum by soft hairs *c.* 0.3 mm long, early or late glabrescent; the bark smooth or finely striate. Fruits rather woolly tomentose, later on (partly) glabrescent. *Peninsular India.* **56. K. attenuata**
b. Twigs various. Fruits usually with persistent tomentum; often glabrescent in 34. *K. globularia.* Plants from *continental SE. Asia, excl. Peninsular India* 11.
11a. Twigs stout, in apical portion 3 mm diam. or more, not striate, or twigs (3–)4–8 mm diam. and variously striate in 1. *K. linifolia* from *NE. India, Bangladesh, N. Burma* . . . . . 12.
b. Twigs either slender, towards apex up to *c.* 3 mm diam. with the bark striate or not, or twigs stouter, up to 5 mm diam. and then coarsely striate . . 14.
12a. Midrib and nerves stout, raised and distinct above. . . . **1. K. linifolia**
b. Midrib and nerves rather slender, flat or only slightly raised above . 13.
13a. Leaves drying olivaceous to brown above. Female perianth in bud 5–6 mm long. *NE. India to Thailand and Laos.* . . . . . **30. K. tenuinervia**
b. Leaves drying blackish above. Female perianth in bud *c.* 8–10 mm long. *Annam* . . . . . **31. K. poilanei**
14a. Twigs slender, at apex 1–2(–2.5) mm diam., usually striate. Leaves 6–18(–24) cm long, drying above usually with a blackish metallic lustre; on lower surface early or late glabrescent from tomentum of minute stellate hairs *c.* 0.1 mm long. Female perianth 4–5 mm long. Fruits 12–25 mm long, often glabrescent . . . . . ***34. K. globularia**
b. Twigs slender to rather stout, 1.5–5 mm diam., striate or not. Leaves generally larger, 5–40 cm long, drying above olivaceous to brown, without blackish metallic lustre; on lower surface glabrescent or not from tomentum of hairs *c.* 0.2 mm long or more. Female perianth usually larger. Fruits usually larger, with persistent tomentum . . . . . 15.
15a. Twigs in apical portion smooth or finely striate . . . . . 16.

b. Twigs in apical portion coarsely striate. Female perianth 5–8 mm long. 17.
16a. Female perianth *c.* 4.5 mm long. Reticulation on upper leaf surface not very distinct . . . . . **33. K. globulatericia**
b. Female flowers not known. Leaves on upper surface with very fine and distinct reticulation . . . . . **35. K. bengalensis**
17a. Twigs rather stout, at apex (2–)3–5 mm diam. *Southern Thailand* . 18.
b. Twigs more slender, at apex 1.5–3 (in 59. *K. erratica* 1.5–4) mm diam. Four species, difficult to segregate without male flower characters. *NE. India, Yunnan, to Vietnam; not in southern Thailand.* 19.
18a. Tomentum on flowers consisting of hairs 0.3–0.5 mm long. [Male perianth in bud subglobose, 5–5.5 mm diam.; anthers 12–15.] *SW., SE., and Peninsular Thailand.* . . . . . **57. K. austrosiamensis**
b. Tomentum of flowers consisting of hairs 0.05–0.5 (on an average *c.* 0.2) mm long. [Male perianth in bud obovoid (-oblong), 4–6 × 2.5–4.5 mm.; anthers 8–11.] *Southern Peninsular Thailand* ***9. K. pseudolaurina**
19a. [Male perianth in bud obovoid or pear-shaped, in anthesis split by the lobes to *c.* halfway] . . . . . 20.
b. [Male perianth in bud broadly obovoid or subglobose, in anthesis split by the lobes to over 2/3] . . . . . 21.
20a. [Bracteole in male flowers subapically on the pedicel; anthers stiped.] Leaves coriaceous. *Annam* . . . . . **6. K. mixta**
b. [Bracteole in male flowers about halfway on the pedicel; anthers largely sessile.] Leaves membranous to chartaceous. *Yunnan, Vietnam (Tonkin, Annam), possibly Laos.* . . . . . **8. K. petelotii**
21a. Tomentum of twigs at apex consisting of hairs *c.* 0.3 mm long. Leaves coriaceous. Female flowers not known. Fruits 26–33 mm long, the hairs *c.* 0.5 mm long or less; stalk 1–4 mm long . . . . . **58. K. saxatilis**
b. Tomentum of twigs at apex consisting of hairs *c.* 0.5 mm long. Leaves thinly coriaceous. Female flower pedicels 3–5 mm long. Fruits *c.* 15–20 mm long, with tomentum consisting of hairs *c.* 1–1.5 mm long; stalk 5–10 mm long. **59. K. erratica**
22a. Leaves chartaceous. Female flowers (and generally fruits) subsessile, the pedicel 0.5–1.5 mm long. *Annam.* . . . . . **62. K. sessiflora**
b. Leaves of various consistency. Female pedicels usually more than 1.5 mm long 23.
23a. Leaves membranous to chartaceous; the tertiary venation on upper surface distinct, forming a lax to fine network with areoles *c.* 0.5 mm diam. or more 24.
b. Leaves chartaceous to rigidly coriaceous; the tertiary venation forming a distinct and very fine network with the areoles *c.* 0.5 mm diam. or less 28.
24a. Leaves on upper surface drying usually with a blackish metallic lustre ***34. K. globularia**
b. Leaves on upper surface olivaceous to brown, without blackish metallic lustre 25.
25a. Fruits at one side saccate at base; the tomentum composed of hairs *c.* 0.1 mm long. *NE. India, N. Burma.* **7. K. angustifolia**
b. Fruits at base attenuate to broadly rounded, not saccate. *Peninsular Thailand* 26.

26a. Lower leaf surface with persistent tomentum of minute stellate hairs, or sometimes late-glabrescent. Fruits with persistent tomentum consisting of hairs 0.2–0.4 mm long. . . . . ***70. K. malayana**
b. Lower leaf surface early glabrescent from tomentum composed of weak, greyish, minute, stellate hairs. Fruits usually glabrescent from tomentum of hairs *c.* 0.1 mm long . . . . . 27.
27a. Twigs at apex (1–)1.5–3.5 mm diam. Leaves 6–20(–25) cm long. Fruits 18–30(–40?) mm long . . . . . ***66. K. glauca**
b. Twigs generally stouter, at apex 2–3 mm diam. Leaves 12–30 cm long. Fruits 30–40 mm long . . . . . ***67. K. sumatrana**
28a. Leaves rigidly coriaceous, on lower surface with persistent tomentum consisting of minute scaly hairs less than 0.1 mm long. *Annam* **61. K. squamulosa**
b. Leaves chartaceous to coriaceous, on lower surface early or late glabrescent from stellate and stellate-dendroid hairs, partly to *c.* 0.2 mm long or more 29.
29a. Twigs fairly stout, in apical portion 3–4 mm diam. Leaves coriaceous. [Male perianth in bud obconical.] *SE. Thailand: Chantabun Prov.* . **4. K. conica**
b. Twigs usually more slender, in apical portion 1.5–3 mm diam. Leaves chartaceous to thinly coriaceous. [Male perianth in bud broader, either obovoid-ellipsoid or subglobose.]. . . . . 30.
30a. Fruits with tomentum consisting of hairs up to 1 mm long. [Male perianth obovoid-ellipsoid.] *Peninsular Thailand, Nicobar and Andaman I.* ***5. K. andamanica**
b. Fruits with shaggy tomentum, persistent or remaining only at the base of the fruit, composed of hairs 1–2 mm long. [Male perianth subglobose.] *Bangladesh to S. Vietnam, also in Thailand S. to Krabi* . . . . **60. K. lenta**

(3) Malaya, Singapore

1a. Lower leaf surface seemingly glabrous, though actually provided with a (sub)persistent dense tomentum consisting of flattish tightly interwoven hairs, silky to the touch. . . . . **14. K. retusa**
b. Lower leaf surface either glabrous (glabrescent), or with tomentum not silky to the touch. . . . . 2.
2a. Bark of twigs longitudinally cracking, when older flaking . . . . 3.
b. Bark of twigs neither cracking nor flaking. . . . . 6.
3a. Twigs stout, in apical portion 4–12 mm diam. Female perianth 6–10 mm long. Fruits 25–75(–80) mm long . . . . . 4.
b. Twigs less stout, in apical portion 2–4 mm diam. Female perianth 5–8 mm long. Fruits 15–25(–30) mm long. . . . . **24. K. latericia**
4a. Tomentum of twigs at apex consisting of hairs (3–)5–8 mm long, of flowers 1–3 mm long, of fruits 5–13 mm long. . . . . **16. K. hookeriana**
b. Hairs shorter . . . . . 5.
5a. Female pedicels 1.5–2 mm long; fruits 25–35 mm long, stalk 2–5 mm long **17. K. furfuracea**
b. Female flowers not known; fruits 40–45 mm long, stalk 18–25 mm long **19. K. lamellaria**
6a. Lower leaf surface with minute reddish-brown to blackish spots, predo-

minantly on the smaller veins, caused by minute non-traumatic cork warts 7.

b. Lower leaf surface without or incidentally with merely a few minute blackish spots . . . . . 8.

7a. Lower leaf surface with minute, scattered, stellate or stellate-scaly hairs *c.* 0.1 mm long . . . . . **80a. K. kunstleri** subsp. **kunstleri**

b. Lower leaf surface with stellate and stellate-dendroid hairs (0.2–)0.3–1.0 mm long.. . . . . **82. K. conferta**

8a. Leaves usually small, 3.5–15(–20) cm long, membranous to chartaceous, drying greenish or brown. Twigs slender, early glabrescent, at apex (0.5–)1–2 mm diam., often yellowish. Fruits often glabrescent, 20–50 mm long. [Anthers 9–25(–30), the thecae closely appressed.] . **38. K. curtisii**

b. Leaves small to large, membranous to coriaceous, greenish or brown. Twigs slender to stout, usually drying brown to blackish. Fruits various [Anthers not tightly appressed.] . . . . . 9.

9a. Tomentum on twigs at apex, and usually of flowers, consisting of hairs (0.1–)0.2 mm long or more; hairs often comparatively short in 34. *K. globularia* and 9. *K. pseudolaurina*, both species with the twigs distinctly striate at apex . . . . . 10.

b. Tomentum of twigs at apex, and usually of flowers, consisting of hairs 0.1–0.2 mm long or less; hairs comparatively long in 63. *K. rubens*, a species with the twigs ± flattened in the apical portion, and fruits with a ± acute top 16.

10a. Female perianth *c.* 8 mm long, inside with a conspicuous disc at base; perianth persistent in fruit. . . . . **42. K. plumulosa**

b. Female perianth 4–10 mm long, without disc at base; perianth not persistent in fruit . . . . . 11.

11a. Twigs slender, in apical portion striate, 1–2(–2.5) mm diam. Leaves 6–18(–24) cm long, drying above usually with a blackish metallic lustre; lower surface rather late glabrescent from tomentum of mainly stellate hairs *c.* 0.1 mm long. . . . . **34. K. globularia**

b. Twigs striate or not, at apex 1.5–6(–10) mm diam. Leaves 9–40(–55) cm long, above without blackish metallic lustre; on lower surface glabrescent or with persistent tomentum of hairs *c.* 0.2 mm long or more . . . . 12.

12a. Twigs in apical portion somewhat flattened or bluntly 2-or 3-angular. Leaves on upper surface (on magnification) pitted like the surface of the peel of an orange. Fruits usually beaked at apex. . . . . **3. K. oblongifolia**

b. Twigs in apical portion ± terete. Leaves not pitted. Fruits not beaked. 13.

13a. Leaves on lower surface early glabrescent . . . . . 14.

b. Leaves on lower surface with persistent tomentum . . . . . 15.

14a. Twigs stout, at apex (4–)5–8(–10) mm diam. Leaves 15–55 cm long. Female perianth 8–10 mm long. Fruits *c.* 30–60 mm long, with tomentum of hairs (0.5–)1–2 mm long.. . . . . **29. K. mandaharan**

b. Twigs at apex 1.5–4(–5) mm diam. Leaves 9–35 cm long. Female perianth *c.* 5(–6) mm long. Fruits 25–40 mm long, rather glabrescent from tomentum of hairs 0.3–0.5 mm long.. . . . . **43. K. intermedia**

15a. Female perianth 7–8 mm long, with tomentum consisting of hairs 0.05–0.3 mm long. Fruits (25–)30–40(–50) mm long. Hairs on lower leaf surface of mixed lengths . . . . . **9. K. pseudolaurina**

b. Female perianth 4 – 6 mm long, the tomentum of hairs 0.5 – 1(– 2) mm long. Fruits 15 – 25 mm long. Hairs on lower leaf surface all ± equally long stalked (except in var. *heteropilis*) . . . . . **10. K. laurina**

16a. Twigs at apex somewhat flattened, the tomentum consisting of hairs 0.1 – 0.2 mm long. Leaves beneath early glabrescent except for the basal part of the midrib. . . . . **63. K. rubens**

b. Twigs in apical portion terete, the tomentum consisting of hairs *c.* 0.1 – 0.2 mm long or less. Leaves beneath either glabrescent or with persistent tomentum . . . . . 17.

17a. Leaf base rounded to cordate. Lower leaf surface either glabrescent, or with inconspicuous tomentum by weak hairs 0.1 – 0.2 mm long. Fruits ellipsoid, (30 –)40 – 60 mm long; stalk (2 –)5 – 12 mm long . . . . **26. K. pulchra**

b. Leaf base rounded to attenuate, or rarely (sub)cordate in 25. *K. rigidifolia* (with coriaceous leaves) and 48. *K. scortechinii* (a species with coriaceous leaves and on the lower leaf surface a subpersistent rather conspicuous tomentum). Lower leaf surface glabrescent or with various tomentum. Fruits up to *c.* 40 mm long; stalk various . . . . . 18.

18a. Lower leaf surface glabrescent from tomentum composed of weak, greyish, stellate hairs 0.1 mm long or less. . . . . 19.

b. Lower leaf surface with (sub)persistent tomentum (lens, × 30), or late glabrescent; sometimes largely glabrescent though usually with some tomentum (composed of hairs 0.1 – 0.4 mm long) remaining on and near midrib and nerves; leaves usually entirely glabrescent, with distinct hair scars, in 25. *K. rigidifolia* (with globose fruits). . . . . 20.

19a. Leaves 6 – 20(– 25) × 2 – 5.5(– 11) cm. Fruits 18 – 30(– 40?) mm long. **66. K. glauca**

b. Leaves 12 – 30 × 4.5 – 12 cm. Fruits 30 – 40 mm long . **67. K. sumatrana**

20a. Leaves coriaceous. Fruits subglobose, 30 – 40 mm diam.; stalk 1 – 3 mm long **25. K. rigidifolia**

b. Leaves membranous to chartaceous, or ± coriaceous in 48. *K. scortechinii* and 69. *K. patentinervia*. Fruits usually ellipsoid, of various sizes; stalk (3 –)4 – 20 mm, in 5. *K. andamanica* 0.5 – 7 mm long. . . . . 21.

21a. Lower leaf surface usually largely glabrescent, the tomentum composed of minute stellate and stellate-dendroid hairs 0.1 – 0.4 mm long, persistent on and near midrib and nerves. Style slender, stigma lobes erect; together *c.* 1.5(– 2) mm long. [Male perianth ellipsoid or pear-shaped. Anthers 6 or 7] **5b. K. andamanica** subsp. **nicobarica**

b. Lower leaf surface usually with (sub)persistent tomentum, conspicuous or inconspicuous. Style usually shorter, or absent, stigma lobes usually more spreading. [Male perianth subglobose. Anthers 6 – 18; 6 – 11 in 72. *K. stenophylla*, 7 – 9 in 74. *K. communis*.] . . . . . 22.

22a. Sub- and just mature leaves on lower surface with conspicuous tomentum composed of rather densely set stellate and stellate-dendroid hairs *c.* 0.2 mm long; hairs not stellate-scaly *c.* 0.1 mm long or less; older leaves often glabrescent beneath. Reticulation on upper leaf surface distinct, usually very fine, with areoles *c.* 0.5 mm diam. or less . . . . . 23.

b. Tomentum on lower leaf surface composed either of more scattered stellate hairs *c.* 0.2 mm long or less, or composed of remotely or densely set stellate scales *c.* 0.1 mm long or less. Reticulation on upper leaf surface distinct or

indistinct; areoles usually *c.* 0.5 mm diam. or more. . . . . 25.
23a. Twigs usually rather slender, at apex 1 – 2 mm diam., smooth, not wrinkled. Fruits 15 – 22 mm long. . . . . 24.
b. Twigs generally stouter, at apex (1.5 –)2 – 4 mm diam., surface often wrinkled. Fruits 20 – 25 mm long . . . . . **48. K. scortechinii**
24a. Fruits 15 – 18 mm long. Female perianth *c.* 4 mm long; inside reddish (?). Leaves oblong-lanceolate to lanceolate, broadest usually at the middle; base cuneate . . . . . **74. K. communis**
b. Fruits 18 – 22 mm long. Female perianth 4 – 5.5 mm long; inside greenish-creamy to yellowish. Leaves oblong to lanceolate, broadest at or usually below the middle; base rounded to cuneate . . . . . **75. K. glaucescens**
25a. Leaves thinly coriaceous, usually glossy above. Lateral nerves rather patent; nerves and reticulation on upper surface flattish or sunken, indistinct. Perianth inside yellowish (always?) . . . . . **69. K. patentinervia**
b. Leaves membranous to chartaceous, usually dull above. Lateral nerves not so patent; nerves and reticulation distinct or not above . . . . . 26.
26a. Lateral nerves and reticulation on upper leaf surface sunken, or flattish, or raised, distinct or indistinct. Perianth inside creamy or yellowish (always?). Fruits at base rounded or sometimes attenuate; the tomentum consisting of stellate scales *c.* 0.1 mm long or less. . . . . **72. K. stenophylla**
b. Lateral nerves and reticulation on upper leaf surface raised and distinct. Perianth inside creamy. Fruits often narrowed at base; the tomentum consisting of hairs 0.2 – 0.4 mm long. . . . . **70. K. malayana**

(4) Sumatra, Java

1a. Bark of twigs longitudinally cracking, when older usually flaking . . 2.
b. Bark of twigs not cracking or flaking . . . . . 4.
2a. Twigs stout, in apical portion 5 – 10 mm diam. Female perianth in bud 8 – 10 mm long. . . . . 3.
b. Twigs more slender, in apical portion 2 – 4 mm diam., with tomentum consisting of hairs 0.5 – 2 mm long. Female perianth in bud 5 – 8 mm long. Fruits 15 – 25(– 30) mm long, with tomentum of hairs 1 – 2 mm long. *Not known from Sumatra and Java, but recorded for Bangka I.*
24b. K. latericia subsp. **ridleyi**
3a. Tomentum of twigs at apex consisting of hairs (3 –)5 – 8 mm long, of flowers 1 – 3 mm long. Fruits 45 – 80 mm long, with tomentum of hairs 5 – 13 mm long. . . . . **16. K. hookeriana**
b. Tomentum of twigs at apex consisting of hairs 1 – 2.5 mm long, of flowers 0.7 – 1.2 mm long. Fruits *c.* 25 mm long, with tomentum of hairs 0.6 – 1 mm long . . . . . **18. K. lampongensis**
4a. Leaves on lower surface provided with scattered, minute, reddish-brown to blackish spots caused by non-traumatic cork warts, especially on the veinlets 5.
b. Leaves beneath without minute blackish spots . . . . . 6.
5a. Lower leaf surface with persistent tomentum composed of minute, scattered, stellate or stellate-scaly hairs *c.* 0.1 mm long
80b. K. kunstleri subsp. **macrophylla**

b. Lower leaf surface with persistent tomentum composed of stellate and stellate-dendroid hairs (0.2–)0.3–1.0 mm long . . . . . **82. K. conferta**

6a. Twigs slender, in apical portion (0.5–)1–2 mm diam., usually early glabrescent, yellowish. Leaves drying usually olivaceous, on lower surface early glabrescent. Fruits 20–50 mm long, often glabrescent, often ± beaked at apex . . . . . **38a. K. curtisii** var. **curtisii**

b. Twigs slender to stout, in apical portion drying brown to blackish. Leaves drying olivaceous to dark brown above, on lower surface with various persistent tomentum, or lower surface glabrescent . . . . . 7.

7a. Tomentum of twigs at apex and of flowers consisting of hairs generally (0.1–)0.2 mm long or more (hairs often comparatively short in 34. *K. globularia* and 9. *K. pseudolaurina*, both with the twigs striate at apex). 8.

b. Tomentum of twigs at apex and usually of flowers composed of hairs 0.1–0.2 mm long or less (hairs comparatively long in 63. *K. rubens*, a species with twigs ± flattened in the apical portion and fruits usually with acute top) . . 12.

8a. Twigs slender, in apical portion striate, 1–2(–2.5) mm diam. Leaves 6–18(–24) cm long, drying above usually with a blackish metallic lustre; lower surface rather late glabrescent from tomentum of mainly stellate hairs *c.* 0.1 mm long. . . . . **34. K. globularia**

b. Twigs striate or not, at apex 1.5–6(–10) mm diam. Leaves 9–40(–55) cm long, above without blackish metallic lustre; on lower surface glabrescent or with persistent tomentum consisting of hairs *c.* 0.2 mm long or more 9.

9a. Lower leaf surface early glabrescent. . . . . 10.

b. Lower leaf surface with persistent tomentum. . . . . 11.

10a. Twigs stout, at apex (4–)5–8(–10) mm diam. Leaves 15–55 cm long. Female perianth 8–10 mm long. Fruits *c.* 30–60 mm long, with tomentum of hairs (0.5–)1–2 mm long.. . . . . **29. K. mandaharan**

b. Twigs at apex 1.5–4(–5) mm diam. Leaves 9–35 cm long. Female perianth *c.* 5(–6) mm long. Fruits 25–40 mm long, rather glabrescent from tomentum of hairs 0.3–0.5 mm long. . . . . **43. K. intermedia**

11a. Female perianth 7–8 mm long, with tomentum consisting of hairs 0.05–0.3 mm long. Fruits (25–)30–40(–50) mm long. Hairs on lower leaf surface of various sizes. . . . . **9. K. pseudolaurina**

b. Female perianth 4–6 mm long, the tomentum of hairs 0.5–1(–2) mm long. Fruits 15–25 mm long. Hairs on lower leaf surface all ± equally long stalked (except in var. *heteropilis*). . . . . **10. K. laurina**

12a. Leaves (20–)30–50 × (6–)10–17 cm, the base rounded or usually cordate. Fruits (30–)40–60 mm long.. . . . . **26. K. pulchra**

b. Leaf size various, the base rounded to attenuate. Fruits up to 40 mm long 13.

13a. Leaves elliptic-oblong to obovate-oblong, (7–)10–30 × (2.5–)4.5–12.5 cm, above drying usually brown to blackish, often ± shining. Fruits 20–35 mm long, often ridged, at base somewhat saccate. [Anthers 3 or 4.] **36. K. latifolia**

b. Leaves of various shape and size. Fruits various, not saccate at base. [Anthers 6 or more.] . . . . . 14.

14a. Twigs in apical portion somewhat flattened, the tomentum consisting of hairs 0.1–0.2 mm long. Leaves beneath early glabrescent except for the basal part of the midrib. . . . . **63. K. rubens**

b. Twigs terete, the tomentum at apex consisting of hairs *c.* 0.1 mm long or less. Leaves beneath glabrescent or with persistent tomentum . . . . . 15.

15a. Style slender, stigma erect, 3–8-lobed, together *c.* 1.5(–2) mm long. [Male perianth in bud ± ellipsoid or pear shaped; anthers only 6 or 7.] *Sumatra: Atjeh*. . . . . **5b. K. andamanica** subsp. **nicobarica**

b. Style 0–0.5 mm long; stigma broader, *c.* 6–12-lobulate . . . . . 16.

16a. Leaves on lower surface early glabrescent from tomentum of weak stellate hairs *c.* 0.1 mm long. Fruits rather glabrescent . . . . . 17.

b. Leaves on lower surface with persistent tomentum or rather late glabrescent from stellate hairs 0.05–0.2 mm long mixed with (sometimes caducous) dendroid hairs up to 0.5 mm long. Fruits with persistent tomentum . 18.

17a. Leaves 12–30 × 4.5–12 cm. Fruits 30–40 mm long. . . **67. K. sumatrana**

b. Leaves 6–20(–25) × 2–5.5(–11) cm. Fruits 18–30(–40?) mm long **66. K. glauca**

18a. Tomentum of lower leaf surface consisting of minute stellate scales 0.2 mm long or less. Lateral nerves and tertiary venation on upper leaf surface distinct or not . . . . . 19.

b. Tomentum on lower leaf surface consisting of stellate hairs 0.05–0.2 mm long, mixed with (sometimes caducous; lens, × 30) stouter hairs up to 0.5 mm long. Lateral nerves and tertiary venation on upper leaf surface distinct. 20.

19a. Leaves thinly coriaceous, usually glossy above. Lateral nerves 12–24 pairs, rather patent, on upper surface not raised and indistinct; reticulation indistinct. [Male perianth in bud 3.5–5 mm diam.; anthers 11–17.] **69. K. patentinervia**

b. Leaves membranous to chartaceous, not glossy. Lateral nerves 10–21 pairs, not so patent, on upper surface flat or little raised, usually indistinct; reticulation distinct or indistinct. [Male perianth in bud (1.5–)2–3(–4?) mm diam.; anthers 6–11.] . . . . . **72. K. stenophylla**

20a. Twigs at apex 1–2 mm diam. Leaves 6–20 cm long; lateral nerves 13–20 pairs. Fruits 18–22 mm long. *C. and S. Sumatra* . . **75. K. glaucescens**

b. Twigs at apex 1.5–2.5 mm diam. Leaves 13–26 cm long; nerves 20–25 pairs. Fruits 20–27 mm long. *Northern Sumatra: Atjeh, E. Coast* **76. K. losirensis**

(5) Borneo

1a. Lower leaf surface seemingly glabrous, though actually provided with a persistent dense tomentum consisting of flattish tightly interwoven hairs, silky to the touch . . . . . 2.

b. Lower leaf surface either glabrous (glabrescent), or with various tomentum not silky to the touch . . . . . 4.

2a. Bark of twigs longitudinally cracking and flaking. . . . . **12. K. elmeri**

b. Bark of twigs neither cracking nor flaking. . . . . 3.

3a. Leaf apex ± rounded. Tomentum of flowers consisting of hairs *c.* 0.1 mm long. Fruits subglobose to broadly ovoid, *c.* 45–50 mm long **13. K. sericea**

b. Leaf apex acute-acuminate. Tomentum of flowers very inconspicuous, composed of stellate scales *c.* 0.1 mm long or less. Fruits obovoid-oblong to oblong, 50–80 mm long. . . . . **15b. K. ashtonii** var. **cinnamomea**

4a. Bark of twigs longitudinally cracking, when older flaking . . . . 5.
b. Bark of twigs neither cracking nor flaking. . . . . 12.
5a. Flowers wholly or largely glabrescent . . . . . 6.
b. Flowers with persistent tomentum (though sometimes easily rubbed off in 22. *K. percoriacea*) . . . . . 8.
6a. Fruits with persistent tomentum of hairs *c.* 1 mm long. . **21. K. psilantha**
b. Fruits glabrescent . . . . . 7.
7a. Female perianth in bud ± mitriform, 7–9 mm long. Twigs at apex 4–10 mm diam., brown . . . . . **39. K. galeata**
b. Female perianth in bud not sharp-angled, *c.* 4 mm long. Twigs at apex 1.5–3 mm diam., often yellowish.. . . . . **40. K. membranifolia**
8a. Twigs rather slender, at apex (1–)2–4 mm diam. Female flowers either sessile or with pedicel up to *c.* 1.5 mm long. . . . . **24. K. latericia**
b. Twigs stout, at apex 3–12 mm diam. Female pedicels 2–20 mm long (0–2 mm in 23. *K. lunduensis*) . . . . . 9.
9a. Female perianth *c.* 6–9 mm long. Stalk of fruits 0–3 mm long . . 10.
b. Female perianth *c.* 9–11 mm long. Stalk of fruits 10–30 mm long . 11.
10a. Leaves chartaceous to thinly coriaceous, drying brown above; leaf base obtuse to subcordate . . . . . **23. K. lunduensis**
b. Leaves usually coriaceous, drying greenish to brown above; leaf base attenuate to rounded . . . . . **22. K. percoriacea**
11a. Tomentum of twigs at apex consisting of hairs 1–2.5 mm long; of flowers 0.7–1.2 mm long. Fruits *c.* 25 mm long. *Anambas I.* . **18. K. lampongensis**
b. Tomentum of twigs at apex of hairs 0.2–1 mm long; of flowers 0.1–0.8 mm long. Fruits 35–55 mm long. . . . . **20. K. pallens**
12a. Lower leaf surface with minute reddish-brown to blackish spots, caused by non-traumatic cork warts, predominantly on the smaller veins . . . 13.
b. Lower leaf surface without spots . . . . . 17.
13a. Twigs slender, in apical portion 1–1.5 mm diam. Leaves glabrescent beneath. Fruits obovoid-oblong, 17–18 mm long . . . . . **78. K. muscosa**
b. Twigs stouter, at apex 1.5–6 mm diam. Lower leaf surface with persistent or subpersistent tomentum. Fruits of various shape, 15–40 mm long . 14.
14a. Tomentum on lower leaf surface consisting of scattered, minute, stellate hairs *c.* 0.1 mm long . . . . . **80. K. kunstleri**
b. Tomentum on lower leaf surface consisting of stellate and stellate-dendroid hairs *c.* 0.2–1.2 mm long . . . . . 15.
15a. Leaves usually rather small, 4–15 cm long, drying brown above. Perianth inside hairy. Fruits subglobose to short-ellipsoid, 15–22 mm long **79. K. pubiflora**
b. Leaves usually larger, 10–36 cm long, drying above olivaceous or brown. Perianth inside glabrous. . . . . 16.
16a. Female pedicels 5–8(–10) mm long. Perianth lobes usually 3. No disc at base of perianth. Fruits subglobose to usually ellipsoid or obovoid, (15–)20–40 mm long; stalk 5–10 mm long. . . . . **82. K. conferta**
b. Female pedicels 10–12 mm long. Perianth lobes 4 or 5. Perianth inside with disc at base. Fruits subglobose, usually somewhat broader than long, *c.* 20–30 × 25–28 mm; stalk 18–30 mm long.. . . . **83. K. pedicellata**
17a. Fruits glabrescent. Flowers wholly or partially glabrescent, or tomentum easily rubbed off, except in 37. *K. linguiformis* (with flowers with persistent

tomentum of hairs *c.* 0.2–0.3 mm long) and sometimes in 38. *K. curtisii* (with flowers with persistent tomentum and twigs slender, usually yellowish or pale brown) . . . . . 18.

b. Fruits either with persistent tomentum, or glabrescent. Flowers with persistent tomentum, though sometimes inconspicuous because of very minute scale-like hairs. If fruits glabrescent, then the tomentum of the flowers persistent and consisting of hairs only *c.* 0.1 mm long and the bark of twigs dark brown to blackish, not yellowish . . . . . 22.

18a. Twigs in apical portion 4–10 mm diam. Female perianth 8–9 mm long, ± mitriform, sharp-angled. . . . . **39. K. galeata**

b. Twigs at apex 1–3 mm diam. Female perianth not mitriform, 4–6 mm long 19.

19a. Twigs at apex glabrescent from a tomentum consisting of hairs *c.* 1 mm long 20.

b. Twigs at apex glabrescent from a tomentum of hairs *c.* 0.1–0.5 mm long 21.

20a. Flowers glabrescent from a tomentum consisting of hairs *c.* 0.6–1 mm long. Fruits not seen . . . . . **41. K. mamillata**

b. Flowers glabrescent from a tomentum of hairs *c.* 0.1 mm long. Stalk of fruits 1–5 mm long . . . . . **40. K. membranifolia**

21a. Tomentum of twigs at apex consisting of hairs *c.* 0.2–0.5 mm long. Fruit stalks 5–8 mm long . . . . . **37. K. linguiformis**

b. Tomentum of twigs at apex consisting of hairs *c.* 0.1 mm long or less. Fruit stalks 8–16 mm long . . . . . **38. K. curtisii**

22a. Tomentum of twigs at apex consisting of hairs *c.* 0.2 mm long or more 23.

b. Tomentum of twigs at apex consisting of hairs *c.* 0.1 mm long or less. 30.

23a. Lower leaf surface with persistent tomentum . . . . . 24.

b. Lower leaf surface glabrescent, sometimes with some tomentum persisting on midrib and nerves in 54. *K. glomerata* . . . . . 26.

24a. Tomentum on lower leaf surface consisting of ± uniformly stalked dendroid hairs. Fruits 15–30 mm long, with tomentum of hairs 1–3 mm long; stalk 0–1(–5) mm long . . . . . **10. K. laurina**

b. Tomentum on lower leaf surface consisting of hairs of various sizes, sessile-stellate and stellate-dendroid. . . . . 25.

25a. Female perianth 6–7.5 mm long. Fruits 20–38 mm long, with tomentum of hairs 1–1.5 mm long; stalk 3–10 mm long. (Female flowers and fruits not known in subsp. *parviflora*.) . . . . . **28. K. oblongata**

b. Female perianth *c.* 2–2.5 mm long. Fruits 14–20 mm long, with tomentum consisting of hairs 0.2–0.5 mm long; stalk 2–3 mm long. **51a. K. tridactyla** subsp. **tridactyla**

26a. Leaves above drying greenish brown to blackish. Fruits with tomentum of hairs *c.* 3 mm long. . . . . **32. K. rufa**

b. Leaves above drying olivaceous to brown. Tomentum of fruits consisting of hairs *c.* 0.1–0.5 mm long . . . . . 27.

27a. Leaves generally coriaceous; midrib and nerves much raised above, reticulation raised and distinct above . . . . . 28.

b. Leaves generally chartaceous; midrib and nerves flat or little raised above, reticulation little raised and less distinct above . . . . . 29.

28a. Bracteole ± halfway on the pedicel. [Staminal disc long-mamillate.] **43. K. intermedia**

b. Bracteole (sub)apically on the pedicel. [Staminal disc convex or low-mamillate.] . . . . . **44. K. uliginosa**

29a. Twigs stoutish, in apical portion 3 – 5 mm diam. Fruits 15 – 35 mm long, with tomentum consisting of hairs *c.* 0.5 mm long; stalk 2 – 6 mm long. **45. K. korthalsii**

b. Twigs more slender, at apex 1.5 – 2.5(– 3) mm diam. Fruits 15 – 25(– 30) mm long, with tomentum of hairs 0.1 – 0.2 mm long; stalk 4 – 6(– 10) mm long **54. K. glomerata**

30a. Fruits generally largely glabrescent, somewhat flattened, often ridged, and at base somewhat saccate. Leaves elliptic-oblong to obovate-oblong; above drying dark brownish to blackish, on lower surface often tinged reddish brown or purplish. [Anthers 3 or 4.] . . . . . **36. K. latifolia**

b. Fruits either with persistent tomentum, or glabrescent and then not saccate at base. Leaves of various shape; above drying olivaceous to brown, on lower surface greyish. [Anthers 5 – 25.] . . . . . 31.

31a. Female perianth 2 – 2.5 mm long. Fruits 14 – 20 mm long; stalk 2 – 3 mm long. [Anthers 5 or 6] . . . . . **51b. K. tridactyla** subsp. **sublaevis**

b. Female perianth 3.5 – 7 mm long. Fruits of various sizes; stalk usually more than 3 mm long. [Anthers 6 or more.] . . . . . 32.

32a. Twigs at apex 4 – 6 mm diam. Fruits large, 60 – 75 (– 80) × 30(– 35) mm; stalk 10 – 15(– 20) mm long. Leaves chartaceous to thinly coriaceous; tertiary venation on upper surface forming a distinct, very fine, ± trabeculate network, the areoles *c.* 0.5 mm diam. or less. (Compare also 65. *K. luteola*) **15a. K. ashtonii** var. **ashtonii**

b. Twigs at apex 1 – 6(– 8) mm diam. Fruits up to *c.* 50 mm long, the stalk usually less than 12 mm long, or up to 20 mm in 72. *K. stenophylla* (fruit 12 – 25 mm long) and 65. *K. luteola;* fruit 30 – 60 mm long, with stalk (2 –)5 – 12 mm long in 26. *K. pulchra.* Reticulation on upper leaf surface various . . . 33.

33a. Valves of perianth 1 – 2 mm thick at sutures. (Female flowers not seen in 47. *K. pectinata.)* . . . . . 34.

b. Valves of perianth up to *c.* 1 mm thick at sutures . . . . . 35.

34a. Twigs at apex usually blackish brown and ± angled by ridges from the bases of the petioles. Leaves thinly coriaceous; lateral nerves 20 – 30 pairs **46. K. woodii**

b. Twigs at apex medium brown or greyish brown, not angled. Leaves coriaceous or rigidly coriaceous; lateral nerves 25 – 50 pairs. . . . **47. K. pectinata**

35a. Leaf base usually broadly rounded to (sub)cordate. Leaves elliptic to oblong-lanceolate, 12 – 50 cm long, 5.5 – 17 cm wide. Twigs stoutish. . . . 36.

b. Leaf base attenuate to rounded (rarely subcordate in 66. *K. glauca*). Leaves usually elliptic-oblong to lanceolate, up to 25 cm long, 1 – 8.5 cm (or in 66. *K. glauca* rarely up to 11 cm) wide. Twigs usually more slender, at apex (0.5 –)1 – 3.5 mm diam.. . . . . 37.

36a. Twigs at apex 3 – 6(– 8) mm diam. Leaves (20 –)30 – 50 × (6 –)10 – 17 cm; nerves flat or little raised above. Fruits (30 –)40 – 60 mm long, often glabrescent. [Male perianth in bud pear-shaped.] . . . . . **26. K. pulchra**

b. Twigs at apex 2 – 4 mm diam. Leaves 12 – 30 × 5.5 – 12 cm; nerves sunken to flattish above. Fruits *c.* 27 × 17 mm, with persistent minute tomentum. [Male

perianth in bud globose.] . . . . . **68. K. kostermansiana**

37a. Leaves coriaceous to rigidly coriaceous, the tertiary venation on the upper surface forming a raised and very distinct network. *Mt. Kinabalu and vicinity, Sabah; at 1000–2300 m alt.* . . . . . **64. K. kinabaluensis**

b. Leaves membranous to thinly coriaceous; tertiary venation on upper surface distinct or not. *Altitude 0–1000(–1200) m, or 27. K. piriformis at (400?–)1000–2000 m. (also on Mt. Kinabalu).* . . . . . 38.

38a. Twigs in apical portion somewhat flattened, pale brown. Tertiary venation on upper leaf surface forming a distinct very fine network, the areoles less than *c.* 0.5 mm diam. . . . . **65. K. luteola**

b. Twigs not flattened, towards apex terete or somewhat angular, drying brown to blackish. Tertiary venation on upper leaf surface generally coarser, distinct or indistinct . . . . . 39.

39a. Fruits usually glabrescent. Bracteole in (female) flowers usually persistent. Lower leaf surface early glabrescent from minute pubescence of weak greyish hairs. . . . . **66. K. glauca**

b. Fruits with persistent tomentum. Bracteole subpersistent or caducous. Lower leaf surface with persistent tomentum of usually minute stellate-scaly hairs, or sometimes glabrescent in 27. *K. piriformis* and 73. *K. hirtella* . . . 40.

40a. [Male perianth in bud obovoid or pear-shaped, much tapering in the lower half.] *A (sub)montane species at (400?–)1000–2000 m alt* **27. K. piriformis**

b. [Male perianth globose or broadly obovoid.] *Mainly in lowland forest, 0–1000(–1200) m alt* . . . . . 41.

41a. Twigs at apex 2–3.5 mm diam. Leaves 10–23 cm long; lateral nerves at upper surface sunken or flattish. Fruits 20–40 mm long; stalk 4–10 mm long. **73. K. hirtella**

b. Twigs generally more slender; fruits generally smaller . . . . . 42.

42a. Twigs at apex 0.5–2(–3) mm diam. Leaves 5–20 cm long; lateral nerves at upper surface flattish to raised. Fruits 12–25(–30) mm long; stalk 5–15(–20) mm long. . . . . **72. K. stenophylla**

b. Twigs at apex 1–2(–3) mm diam. Leaves 6–20(–23) cm long; lateral nerves usually raised above. Fruits 18–22 mm long; stalk in Bornean specimens 3–5 mm long.. . . . . **75. K. glaucescens**

(6) Philippines, Celebes, Moluccas, New Guinea (Vogelkop Penins.), Lesser Sunda I.

1a. Leaves on lower surface without minute spots (lens, × 30). . . . . 2.

b. Leaves on lower surface with scattered, minute, reddish-brown to blackish spots, caused by non-traumatic cork warts. . . . . 9.

2a. Tomentum on twig apex and, if present, on lower leaf surface composed of hairs *c.* 0.2 mm long or more . . . . . 3.

b. Tomentum on twig apex and lower leaf surface composed of hairs *c.* 0.1 mm long or less.. . . . . 8.

3a. Twigs at apex 3–5 mm diam. Tomentum of fruits composed of hairs *c.* 0.5 mm long. *S. Philippines (incl. Palawan)* . . . . . **45. K. korthalsii**

b. Twigs in apical portion usually *c.* 3 mm diam. or less . . . . . 4.

4a. Twigs in apical portion 1 – 2 mm diam. Female flower perianth *c.* 4 mm long. Fruits *c.* 13 – 15 mm long, the tomentum composed of hairs *c.* 0.1 mm long. *S. Philippines: Sulu I., Mindanao* . . . . . **52. K. stenocarpa**

b. Twigs in apical portion (1.5 –)2 – 3(– 4) mm diam. Female flower perianth 4.5 – 6 mm long. Fruits (10 –)15 – 25(– 30) mm long . . . . . 5.

5a. Twigs in apical portion very finely striate or smooth, terete. Fruits with tomentum of hairs 0.1 – 0.2 mm long. *Philippines (not yet found in Palawan)* **54. K. glomerata**

b. Twigs in apical portion usually striate or angled. Tomentum of fruits composed of hairs *c.* 0.5 – 1 mm long. . . . . 6.

6a. Leaves on lower surface partly glabrescent or with subpersistent tomentum. Fruits with tomentum of rather soft hairs *c.* 0.5 mm long . . . . 7.

b. Leaves on lower surface entirely early glabrescent. Tomentum of fruits composed of rather rigid hairs *c.* 1 mm long. *Philippines: Palawan* **24a. K. latericia** subsp. **latericia**

7a. Lower leaf surface late glabrescent or with subpersistent tomentum. *Philippines: Luzon.* **53. K. alvarezii**

b. Lower leaf surface largely glabrescent. *Celebes, Moluccas, New Guinea (Vogelkop Penins.)* **55. K. tomentella**

8a. Lower leaf surface early glabrescent from weak stellate hairs. Perianth inside reddish (always?). Fruits 18 – 30(– 40) mm long, usually early glabrescent. *Bali I.* (See also *K. glomerata*) . . . . . **66. K. glauca**

b. Lower leaf surface with persistent tomentum of minute scales. Perianth inside greenish-creamy (?). Fruits 12 – 18 mm long, with persistent minute tomentum. *Lesser Sunda I. (except Bali), Celebes, Moluccas, S. Philippines: Mindanao* . . . . . **71. K. cinerea**

9a. Leaves on lower surface early glabrescent. *Central Celebes.* **77. K. celebica**

b. Leaves on lower surface either with persistent tomentum, or late glabrescent 10.

10a. Tomentum on lower leaf surface consisting of minute stellate hairs *c.* 0.1 mm long. *Philippines* **80c. K. kunstleri** subsp. **parvifolia**

b. Tomentum on lower leaf surface consisting of sessile stellate and stellate-dendroid hairs *c.* 0.2 – 0.7 mm long. *Philippines, N. Celebes*. **81. K. stellata**

ENUMERATION AND DESCRIPTIONS OF SPECIES

I. series LAURINAE de Wilde, *ser. nov.*

Alabastra ♂ longiora quam lata, ellipsoidea ad obovoidea; in anthesi fissa ad dimidium vel usque ad 2/3 attingentia. Columna staminalis longiora quam disci staminalis diameter (antheris inclusis). Antherae 6 – 18. Discus staminalis planus vel parum convexus. Flores tomento vario persistente induti. Folia subtus tomento vario obtecta vel glabrescentia; tomento haud crebro, atque haud sericeoso ad tactum. Ramuli 1 – 8 mm diam.; cortice lamellari vel non.

T y p u s : *Knema laurina* (Bl.) Warb.

Species 1 – 11.

1. Knema linifolia (Roxb.) Warb. – Fig. 1.

Myristica linifolia Roxb., Fl. Ind. 3 (1832) 847. – *K. linifolia* Warb., Mon. Myrist. (1897) 558, t. 24 fig. 1–3; Sinclair, Gard. Bull. Sing. 18 (1961) 256, fig. 17. – Type: Chittagong, *Roxburgh 252* (BM).
Myristica longifolia Wall. *ex* Bl., Rumphia 1 (1835) 188; Hook. *f.* & Th., Fl. Ind. 1 (1855) 156, *p.p.*, excl. Malesian spec. which are *K. furfuracea;* A. DC., Prod. 14 (1856) 204, *p.p.;* Miq., Fl. Ind. Bat. 1, 2 (1858) 69, *p.p.;* Kurz, For. Fl. Br. Burma (1877) 283; Gamble, Man. Ind. Timbers (1881) 314; Hook. *f.*, Fl. Brit. Ind. 5 (1886) 110, excl. var. *erratica*; Clarke, J. Linn. Soc. 25 (1889) 62; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 324, pl. 164, 166. – Type: Assam, Sylhet, *Wallich Cat. 6801* (K-W; iso BM, L, P; A, BR, CAL, CGE, DD, E, G, G-Prod. & Boiss., LE, PDA, W, *n.v.*).
Myristica clarkeana King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 325, pl. 165. – *K. linifolia* var. *clarkeana* Warb., Mon. Myrist. (1897) 561. – Syntypes: Chittagong, *King's Collector 97* (CAL, K, *n.v.*), *412* (CAL, *n.v.;* iso in L; DD, PDA, *n.v.*), *496* (CAL, K, *n.v.*), *605* (CAL, *n.v.;* iso in BM, K, L); *Peel 90* (CAL, *n.v.*).

Tree 10–20 m. *Twigs* stout, towards apex (3–)4–8 mm diam., terete, somewhat woolly pubescent by dense rusty brown to pale brown or greyish hairs *c.* 0.5–1 mm long, lower down the *bark* grey to brown, ± striate, not or only in the older wood slightly cracking, not flaking. *Leaves* coriaceous; above greenish brown, ± shiny; lower surface finely papillate, glabrescent from a dense furfuraceous tomentum easily rubbed off and composed of hairs *c.* 0.5 mm long, sometimes with remnants of pubescence near insertion of petiole; *blade* (elliptic-oblong or) oblong-lanceolate to lanceolate, widest below to above the middle, sometimes ± parallel-sided, or gradually narrowed towards the base, 15–45(–75) × 5–13(–16) cm, top (sub)acute or faintly up to 3 cm acuminate, base attenuate to shallowly cordate; *midrib* stout, raised on both surfaces; nerves (20–)25–30 pairs, raised above; tertiary venation forming a coarse or fine network raised and well visible above; *petiole* 10–25 × 3–6 mm, glabrescent. *Inflorescences* sessile or sometimes peduncled for 2–3 mm, simple or up to 4-furcate, up to 10 mm long, 2–10-flowered in male, 1–5-flowered in female; flowers with rusty tomentum of hairs 0.2–0.7(–1.0) mm long. *Male flower* pedicels 8–15 mm, the bracteole ± caducous, below to above the middle, in immature flowers sometimes subapically; *perianth* in bud (depressed) obovoid or pyriform, 7–9(–10) × 6–7 mm, inside yellowish; valves 3, at sutures 1–2 mm, splitting the bud to *c.* halfway to 2/3.; *staminal disc* flat to deeply concave, circular, incl. anthers 2.5–3 mm diam.; column 3–3.5 mm long, striate; *anthers* 12–18, half-sessile, suberect or oblique, 0.7–1.2 mm, not touching each other. *Female flowers* (mainly after Warburg, *l.c.*, and Sinclair, *l.c.*): pedicels 1–6 mm long; *perianth* in bud ellipsoid-ovoid, *c.* 6 × 4 mm; valves at sutures *c.* 1.5 mm thick, splitting the bud to *c.* halfway; pistil 4–4.5 mm long; ovary ovoid, *c.* 3 mm long; style *c.* 1.5 mm long; *stigma* flattish, shortly 2(–4)-lobulate. *Fruits* 1–3 per infructescence, (subglobose to) broadly ellipsoid or ovoid, 25–35 × 20–30 mm, rusty tomentose by hairs *c.* 0.2–0.5 mm long; pericarp 2–3 mm thick at suture; stalk 1–6 mm long.

Distribution: NE. India (Sikkim, Assam), Bangladesh (Chittagong), Burma.

INDIA. Assam: *Clarke 40679E, 42324A; Griffith 4345; Masters 1400; Wallich 6801.*
BANGLADESH. Chittagong: *King's Collector 412, 605; Roxburgh 252.*
BURMA: *Parkinson 392.*

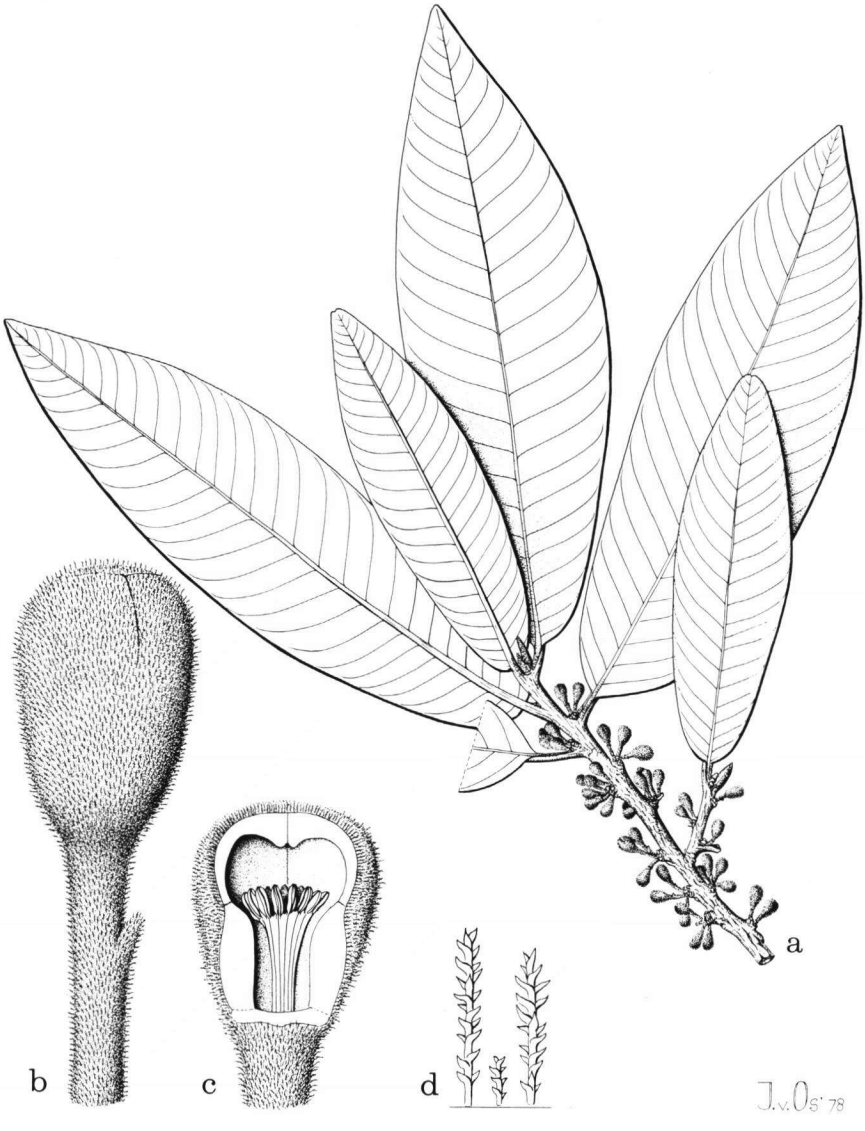


Fig. 1. *Knema linifolia* (Roxb.) Warb. – a. habit of male flowering twig, $\times \frac{1}{4}$; b. mature male flower bud, $\times 3\frac{1}{2}$; c. opened mature male perianth in bud, showing the androecium, $\times 3\frac{1}{2}$; d. sample of hairs from perianth (half-schematic), $\times 60$. – All from *Parkinson 392*.

E c o l o g y : Lower montane forest; 200 – 1000 m alt. Flowers in Nov., Jan., and Feb.

N o t e s : 1. Fieldnotes. Bark rough, greyish brown with horizontal wrinkles and light vertical fissures.

The colour of the perianth inside is yellow, as noted on the label of the type-specimen *Roxburgh 252*, in BM.; Sinclair, *l.c.*, mentions red in his description of the species.

2. Resembling species. Sterile forms with narrow leaves may be confused with *K. erratica* from the same area; this species has smaller male flowers with a different general shape.

2. Knema pierrei Warb.

K. pierrei Warb., Mon. Myrist. (1897) 585; Lecomte, Not. Syst. 1, 4 (1909) 101; Fl. Gén. I.-C 5, 2 (1914) 105. – *Myristica dongnaiensis* Pierre, *nom. nud. in sched.* – T y p e : Cochinchina, *Pierre 1627* (P; iso BM, K, L; BRI, CAL, E, G, G-Boiss, SING, *n.v.*)

Tree 10 – 15 m. *Twigs* stout, towards apex 5 – 6 mm diam., subterete to coarsely angled by ridges from the bases of the petioles, glabrescent, tomentum dense, rusty to dull brown, composed of hairs *c.* 0.5 – 0.7 mm long, not striate; *bark* towards apex partially somewhat cracking or not, lower down cracking or flaking or not. *Leaves* (thinly) coriaceous; above brown to greenish brown, dull or shiny; lower surface finely papillate, glabrescent, tomentum rather woolly, composed of stellate-dendroid hairs *c.* 0.5 mm long, often leaving scattered hair scars; *blade* oblong-lanceolate to lanceolate, broadest usually at the middle, often tapering towards base and apex, 18 – 50 × 5 – 12 cm, base rounded to slightly cordate, top bluntish to acute-acuminate; *midrib* stout, flat to slightly raised above; nerves 25 – 40 pairs, slightly raised above; tertiary venation forming a fine network, slightly raised and distinct above; *petiole* stout, 10 – 20 × 4 – 5 mm, glabrescent. *Inflorescences* sessile, simple or 2- or 3-furcate, up to 10 mm long, 5 – 15-flowered in male and female; flowers densely dull brown or greyish- or yellowish brown tomentose by hairs 0.2 – 0.5 mm long. *Male flower* pedicels 6 – 7 mm long, the bracteole rather late caducous, situated about halfway; *perianth* in bud obovoid, *c.* 6 × 4.5 – 5 mm, inside reddish(?); valves 3, at sutures *c.* 0.5 mm thick, splitting the bud to slightly over halfway; *staminal disc* flat, ± triangular, incl. anthers 2 – 2.2 mm diam.; column slender, 2 – 2.5 mm long; *anthers* 11 – 13, half-sessile, oblique to subhorizontal, *c.* 0.5 mm, not tightly touching each other. *Female flower* pedicels 1 – 1.5 mm long, the bracteole caducous, situated ± median; *perianth* in bud ellipsoid to ovoid, 5 – 6.5 × 4 – 5 mm; valves at sutures 0.5 – 0.7 mm thick, splitting the bud to *c.* halfway; pistil 3.5 – 5.5 mm long; ovary ovoid, *c.* 3.5 – 4 by 3 mm; style 1 – 1.5 mm long; *stigma* 2-lobed and each lobe again 2- or 3-lobulate. *Fruits* in clusters of 5 – 12 per infructescence, broadly ellipsoid, 22 – 26 × 18 – 20 mm, densely rusty-brown tomentose by hairs 1.5 – 2 mm long; pericarp *c.* 2 mm thick at suture; stalk 1 – 2 mm long.

D i s t r i b u t i o n : S. Vietnam (Cochinchina).

VIETNAM. S o u t h V i e t n a m, Cochinchina: *A. Chevalier 36744, 36762; Pierre 1627; Poilane 6335, 6663.*

Ecology: Lower montane forest, on rocky clayey soil; 300–600 m alt. Flowers in Feb., March; fruits in May.

Notes: 1. Fieldnotes. Ripe fruits are recorded as yellow.

2. Resembling species. The bark of the older twigs is sometimes cracking and flaking by which such specimens recall *K. furfuracea*. All specimens of the present species were referred by Sinclair (1961, p. 209–211) to *K. furfuracea*, a species essentially differing by the shape and structure of the male flowers.

3. Taxonomy. *K. pierrei* apparently is much related to *K. linifolia* from NE. India and Burma; it also comes close to *K. tenuinervia*, a species with differently shaped male flowers (though with a relatively long staminal column), and with the bracteole apically, not median.

3. Knema oblongifolia (King) Warb.

Myristica oblongifolia King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 313, *p.p.*, pl. 148 fig. 1–7, 10, 11. – *K. oblongifolia* Warb., Mon. Myrist. (1897) 586, t. 24 fig. 1 & 2; Sinclair, Gard. Bull. Sing. 16 (1958) 321, *p.p.*, fig. 17A & B; 18 (1961) 266. – Syntypes: Malaya, Perak, *King's Coll. 835* (CAL, FI, K, *n.v.*), *5434* (CAL, E, SING, *n.v.*), *5983* (CAL, *n.v.*; iso in K, L, P; E, FI, MEL, SING, UPS, *n.v.*).

Myristica oblongifolia var. *monticola* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 314, pl. 148 fig. 8 & 9. – *K. oblongifolia* var. *monticola* Warb., Mon Myrist. (1897) 587; Sinclair, Gard. Bull. Sing. 16 (1958) 323, fig. 17 C–G; 18 (1961) 266. – Syntypes: Malaya, Perak, *King's Coll. 3582* (CAL, *n.v.*; iso in K, P; FI, *n.v.*), *3810* (CAL, *n.v.*; iso in BM, P; DD, *n.v.*), *6330* (BM; CAL, DD, K, MEL, *n.v.*), *8322* (CAL, K, SING, *n.v.*), *10953* (CAL, *n.v.*; iso in L; DD, FI, G, *n.v.*); *Scortechini s.n.* (CAL, *n.v.*; iso in K, L, P; FI, G, *n.v.*); *Wray 993* (CAL, SING, *n.v.*), *1077* (CAL, SING, *n.v.*), *1087* (CAL, *n.v.*; iso in K, L; DD, *n.v.*).

Myristica cantleyi Hook. *f.* forma *glabrior* Ridley, *nom. nud.* (See Sinclair, *o.c.*, 1961, p. 266).

Distribution: Malaya

MALAYA. Perak: *King's Coll. 3582, 3810, 5983, 10953; Shah & Sidek MS. 1067; Wray 1087.* – Kelantan: *Soepadmo & Mahmud 1197.* – Trengganu: *Whitmore FRI 12765.* – Pahang: *Chew Wee-Lek 885; FRI 2155, 3326, 3550, 5889, 12840, 17243; Purseglove P. 4246, 4275, 4276; Shah & Noor MS. 900; Stone 8323.* – Selangor: *FRI 0111, 2672; Kep. FN 98219, 98224.*

Ecology: Lowland- and montane forest, 0–1700 m alt. Flowers Feb. – March; fruits in March, July, Sept., and Dec.

Notes: 1. Some specimens with pedicels of the male flowers longer than 4 mm, included by Sinclair in the present species, have been removed to *K. pseudolaurina*.

2. The var. *monticola* King, maintained by Warburg and by Sinclair, is presently sunk into the type variety as only vague differences in leaf texture remained after comparison.

3. Specimens from lower altitudes often have on the upper leaf surface a rather typical pitted structure which under magnification reminds of the pitted structure of the rind of an orange.

4. This is one of the few species, besides *K. rubens* and *K. luteola* (both in series *Glaucae*), in which the younger twigs are usually somewhat flattened in the apical portion.

5. Specimens from the montane forest are often provided with conspicuous axillary vegetative buds.

4. Knema conica de Wilde, *sp. nov.*

Folia coriacea, nervis tertiariis in pagina superiore tenerrimis atque conspicuis, subtus fere glabrescentia, stellato-pilosa, pilis sparsis minutis. Inflorescentiae ♂ pedunculo 1 – 2 mm longo. Flores ♂ pedicello 2 – 3 mm longo, apice bracteolato; perianthium in alabastro anguste obconicum, circa 3.5 – 4 × 2 – 2.5 mm. Antherae 7 vel 8, stipitatae. Discus staminalis (antheris inclusis) 1 – 1.2 mm diam.; columna staminalis circa 2.5 mm longa.

T y p e : Thailand, SE., Chantabun, Kao Pra Baht, 23 November 1930, male fl., *M. C. Lakshnakara 508* (K; iso in BM, L, P).

Tree *c.* 5 – 10 m. *Twigs* rather stout, terete, towards apex 3 – 4 mm diam., faintly striate or not, with dense, very short, yellowish brown, scurfy tomentum by hairs *c.* 0.1 mm long; *bark* lower down not tending to crack or flake. *Leaves* coriaceous; above drying greenish brown; lower surface almost glabrescent with sparingly set, very minute, sessile, stellate hairs 0.1 – 0.2 mm long, densely minutely whitish blotched (only visible with a lens × 30), not papillate; *blade* oblong to lanceolate, broadest at about the middle, 24 – 35 × 4 – 10.5 cm, base (sub)attenuate, top subacute to acute-acuminate; *midrib* above rather slender, flat; nerves 22 – 30 pairs, flat and faint above; tertiary venation forming a very fine network, raised above; *petiole* early glabrescent, 15 – 20 × 2 – 4 mm. *Inflorescences* peduncled for 1 – 2 mm in male, irregularly knotty to forked, *c.* 4 mm diam., 10 – 25-flowered in male; flowers with dense yellowish brown tomentum composed of hairs 0.2(– 0.3) mm long. *Male flower* pedicels 2 – 3 mm long, the bracteole caducous, strictly apical; *perianth* in bud obovoid-obconical, slender, *c.* 3.5 – 4 × 2 – 2.5(– 3) mm, inside reddish (?); valves 3, at sutures 0.3 – 0.5 mm thick, splitting the bud to *c.* halfway; *staminal disc* incl. anthers circular, ± flat, 1 – 1.2 mm diam.; *anthers* 7 or 8, just stiped, oblique, *c.* 0.5 mm long, not touching each other; column somewhat tapering to the base, slender, *c.* 2.5 mm long. *Female flowers* and *fruits* not seen.

D i s t r i b u t i o n : SE. Thailand, Chantabun; only known from the type.

E c o l o g y : Small tree in evergreen forest; *c.* 200 m. Flowers in November.

N o t e s : 1. Characterized by the narrowly conical short-pedicellate male flowers; the fine and very distinct reticulation on the upper leaf surface is reminiscent of that of *K. andamanica* and *K. lenta*.

2. The type specimen on which the present species is based was included by Sinclair in *K. cinerea* var. *andamanica*, a heterogeneous taxon, which is, in a restricted sense, presently regarded as a species of its own, *K. andamanica*.

5. Knema andamanica (Warb.) de Wilde, *stat. nov.*

K. glauca Bl. var. *andamanica* Warb., Mon. Myrist. (1897) 596. – S y n t y p e s : Andaman I.: *King's Coll. s.n.* (several collections, ♂ fl., fr., B, †; iso in G, K lecto!, L); Narcondam, *Prain s.n.*, March 1891 (BM, K, L; BO, CAL, G, *n.v.*); *Kurz s.n.* (K, P; CAL, G-Prod., M, *n.v.*); *Hamilton s.n.* (BM). – For further synonyms and literature see under the subspecies.

Tree 6 – 16 m. *Twigs* rather slender, apical portion 1.5 – 3 mm diam., terete, smooth or finely striate when young, densely grey brown or yellowish brown scurfy tomentulose by scaly-stellate hairs *c.* 0.1 mm long or less, early glabrescent; lower down *bark* finely striate, not tending to crack or flake. *Leaves* chartaceous; above drying greenish brown; lower surface faintly finely papillate, in younger leaves ± densely tomentose by fine, sessile, stellate hairs *c.* 0.1 – 0.4 mm (in subsp. *anda-*

manica mixed with longer dendroid hairs or not), rather late deciduous or subpersistent, the coarser hairs often early shed and leaving minute scars; *blade* oblong to lanceolate, broadest below or usually at or above the middle, 8 – 30 × 2 – 8.5 cm, base attenuate to rounded, top acute, or subobtuse, or faintly up to 2.5 cm acuminate; *midrib* above rather slender, flat or slightly raised; nerves 12 – 24 pairs, rather thin and faint, flat or slightly raised above; tertiary venation forming a fine or very fine network, areoles 0.5 mm diam. or less, distinct above; *petioles* rather slender, 8 – 20 × 1.5 – 3 mm, early glabrescent. *Inflorescences* sessile or up to 5 mm peduncled, simple or knotty or forked, 2 – 8 mm diam., 3 – 15(– 30)-flowered in male, 2 – 6-flowered in female; flowers minutely dull yellowish brown or grey brown scurfy-tomentose by hairs 0.1 (or less) – 0.2(– 0.3) mm long. *Male flower* pedicels 3 – 10 mm long, the bracteole subpersistent or caducous, apical or subapical, usually not more than 2 mm below the perianth; *perianth* in bud obovoid, (2 –)2.5 – 6 × (1.5 –)2 – 4.5 mm, inside pink or reddish; valves 3, at sutures 0.5 – 0.7 mm thick, splitting the bud to *c.* halfway to 2/3; *staminal disc* flattish to convex, circular, incl. anthers 0.8 – 2.5(– 3) mm diam.; *anthers* either 6 or 7, or 9 – 12, half-sessile or short-stiped, ± horizontal to suberect, 0.3 – 0.6 mm, not or not tightly touching each other; staminal column rather slender, tapering to the base or not, 1 – 3 mm long, rarely (*Phusomsaeng 45*) minutely pubescent at base. *Female flowers* (only known in subsp. *nicobarica*): pedicel *c.* 6 mm long, the bracteole subapical; perianth in bud ovoid-oblong, *c.* 6 × 2.5 mm; valves 3, at sutures *c.* 0.4 mm, splitting the bud to *c.* halfway; pistil *c.* 3.5 mm long; ovary ovoid, *c.* 2 × 1.5 mm; style incl. stigma slender, *c.* 1.5 mm long; *stigma* ± deeply 2-lobed and each lobe shallowly 2 – 4-lobulate at the top. *Fruits* 1 or 2 per infructescence, ellipsoid, at top rounded or faintly pointed, base rounded, not sagged, not ridged along the line of suture, 18 – 20 × 12 – 16 mm, rusty or rufous brown tomentose by hairs 0.2 – 1 mm long; pericarp *c.* 1.5 mm thick at suture; stalk 0.5 – 7 mm long.

Distribution: Andaman and Nicobar I., Peninsular Thailand, N. Malaya, N. Sumatra; see further under the subspecies.

Ecology: Rain forest; 100 – 1200 m alt. Flowers Aug., Nov., Dec., Feb.; fruits in Feb., March, May, and Aug.

Notes: 1. Related to *K. angustifolia* and *K. pseudolaurina;* for differences see also the key. *K. angustifolia* has the fruits at one side at the base with a gibbosity. *K. pseudolaurina* has the twigs generally stouter, more distinctly striate, and with a thicker, much more conspicuous tomentum; also the lower leaf surface is usually much more pubescent; its fruits are considerably larger. The leaves of *K. andamanica* have usually a fine and distinct reticulation on the upper surface, reminiscent of that in *K. piriformis* or *K. lenta*; the latter species, generally with more broadly obovoid or subglobose male flowers, is tentatively placed in series *Glaucae*. Certain broad-flowered specimens of the subspecies *andamanica* and *peninsularis* may approach to *K. lenta* very closely.

2. Three taxa, presently regarded as subspecies, can be recognized, each with largely its own distributional area.

KEY TO THE SUBSPECIES

1a. Male flower buds (2 –)2.5 – 4.5 × 1.7 – 3 mm; anthers 6 or 7, half-sessile. Fruit stalk *c.* 7 mm long . . . . . **b. subsp. nicobarica**

b. Male flower buds somewhat larger, 4.5–6 × 3–4.5 mm; anthers 9–12. 2.
2a. Anthers 10–12, just stiped. Fruit stalk 0.5–4 mm long.
a. subsp. **andamanica**
b. Anthers 9–11, half-sessile. Fruits not known.. . . **c.** subsp. **peninsularis**

a. subsp. **andamanica**

K. glauca Bl. var. *andamanica* Warb., Mon Myrist. (1897) 596. – *K. cinerea* (Poir.) Warb. var. *andamanica* Sincl., Gard. Bull Sing. 18 (1961) 174, fig. 4, *p.p.* – Lectotype: Andaman I., *King's Coll. s.n.*, ♂ fls. (BM, iso in K, L).

Myristica glaucescens auct. non Jack: Hook. *f.*, Fl. Brit. Ind. 5 (1886) 111, *p.p., quoad sp. andamanica tantum;* Parkinson, For. Fl. Andaman I. (1923) 223.

Myristica glauca auct. non Bl.: King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 320, pl. 157, *p.p., quoad sp. andamanica tantum;* Prain, J. As. Soc. Beng. 62, 2 (1893) 74.

Distribution: Andaman I., Nicobar I. (Katchall I., Great Nicobar).

ANDAMAN I.: *Balakrishnan 634; Hamilton s.n.; King s.n.; King's Coll. s.n.* (♂ fls., fr.; 1890, 1894, 1895); *Kurz s.n.;* Narcondam, *Prain s.n.; Nooteboom 6307, 6337, 6396;* South Andaman, *Balakrishnan & Bhargawa 3474, Nair 3645;* Little Andaman, *Bhargawa 3262, 3379.*
NICOBAR I.: Katchall I., *Chakraborty 2524;* Great Nicobar, *Balakrishnan 2971.*

Notes: 1. *Balakrishnan 2971* is somewhat doubtful because its male flower buds are immature; their shape is rather obovoid and the staminal column relatively short. The specimen resembles *K. glauca*, but in that species the tomentum on the lower leaf surface is different and early shed.

2. *K. cinerea* var. *andamanica* (Warb.) Sinclair is in Sinclairs circumscription a very heterogeneous entity, including in its synonymy the names of some taxa which are kept separate in the present treatment, viz. *K. angustifolia* (Roxb.) Warb. (with its synonym *Myristica gibbosa* Hook. *f.* & Th.) and *K. lenta* Warb.; the first species is distinct by its differently shaped fruits, the second species differs e.g. in the generally more globose male flowers and the long-hairy fruits. Also *K. glauca* var. *nicobaria* Warb. was placed by Sinclair in the synonymy of *K. cinerea* var. *andamanica*, but this variety is presently recognized as a distinct subspecies under *K. andamanica*.

b. subsp. **nicobarica** (Warb.) de Wilde, *comb. et stat. nov.*

K. glauca Bl. var. *nicobarica* Warb., Mon. Myrist. (1897) 596 – Syntypes: Nicobar I., *King's Coll. 536* (B, *n.v.;* iso in BM; L, lecto ; LE, *n.v.*); *Kurz s.n.* (BM; W, *n.v.*).

Distribution: Nicobar I., Penang, northern Sumatra (Atjeh).

NICOBAR I.: *Chakraborty 2028, 2157; King's Coll. 536; Kurz s.n.*
SUMATRA. Atjeh: *de Wilde & de Wilde-Duyfjes 14752.*
MALAYA. Penang: *King's Coll. 1372.*

Notes: *Chakraborty 2157* is the only specimen of the species investigated with female flowers; the perianth inside was recorded as reddish.

The collection *de Wilde & de Wilde-Duyfjes 14752* is the only specimen from Sumatra; it was collected in montane rain forest at *c.* 1200 m alt. in Atjeh, G. Leuser Nature Reserves. The other collections apparently are of much lower altitude.

c. subsp. **peninsularis** de Wilde, *subsp. nov.*

Folia chartacea, nervis tertiariis in pagina superiore tenerrimis atque conspicuis, subtus subglabrescentia ob pilos minutos varios. Inflorescentiae ♂ sessiles vel pedunculo ad 5 mm longo. Flores ♂ pedicello

4–8.5 mm longo apice bracteolato; perianthium in alabastro obovoideum, 4.5–6 × 3–4.5 mm. Antherae 9–11, subsessiles. Discus staminalis (antheris inclusis) 1.5–1.7 mm diam.; columna staminalis 1.5–2.5 mm longa.

T y p e : Peninsular Thailand, Trang, *S. Phusomsaeng 45* (L; iso in AAU, C, P).

Leaves chartaceous; tertiary venation on upper surface very fine and distinct; lower leaf surface subglabrescent from minute hairs of mixed sizes. Male *inflorescences* sessile or up to 5 mm peduncled. *Male flower* pedicels 4–8.5 mm long, the bracteole apical; perianth in bud obovoid, 4.5–6 × 3–4.5 mm. *Anthers* 9–11, half-sessile. *Staminal disc* incl. anthers 1.5–1.7 mm diam.; staminal column 1.5–2.5 mm long.

D i s t r i b u t i o n : Peninsular Thailand and islands off Peninsular Thailand.

THAILAND. P e n i n s u l a r : *Geesink & Santisuk 5499; Kerr 11663; Kloss 6936; Phusomsaeng 45.*

N o t e : Possibly as an exception, the staminal column in *Phusomsaeng 45* is minutely pubescent at the base; in most Knemas the flowers are completely glabrous inside.

6. Knema mixta de Wilde, *sp. nov.*

Folia coriacea, nervis tertiariis in pagina superiore tenerrimis atque conspicuis, subtus fere glabrescentia ob tomentum e pilis sessilibus stellatis et stallato-dendroideis compositum. Inflorescentiae ♂ pedunculo 1–2 mm longo. Flores ♂ pedicello 4–5 mm longo subapice bracteolato; perianthium in alabastro obovoideum, 4.5–5 × 4–4.5 mm. Antherae 8, brevissime stipitatae. Discus staminalis (antheris inclusis) 1.5–2 mm diam.; columna staminalis 1.5–1.8 mm longa.

T y p e : Annam, vicinity of Quang Tri, 4 July 1924, *Poilane 11140* (P, 2 sheets).

Tree 15–20 m. *Twigs* subterete, towards apex 2–2.5 mm diam., coarsely striate, pale rusty tomentose by hairs 0.1–0.3 mm long, *bark* lower down striate, not tending to crack or flake. *Leaves* coriaceous; above drying olivaceous; lower surface faintly papillate, rather early glabrescent from tomentum composed of sessile stellate and stellate-dendroid hairs, the latter leaving minute hair scars, tomentum ± remaining on midrib and nerves; *blade* oblong to lanceolate, broadest at or ± below the middle, 10–17 × 2.5–5.5 cm, base cuneate, top acute, faintly up to 2 cm acuminate; *midrib* above slightly raised; nerves 15–20 pairs, flat above; tertiary venation forming a very fine network, distinct above, the areoles less than 0.5 mm diam.; *petioles* glabrescent, 8–10 × 1.5–2.5 mm. *Inflorescences* in male peduncled for 1–2 mm, simple, *c.* 2 mm diam., 3–10-flowered; flowers with (grey-)rusty tomentum by hairs 0.1–0.2 mm long. *Male flower* pedicels 4–5 mm long, the bracteole minute, caducous, (sub)apical; *perianth* in bud obovoid, 4.5–5 × 4–4.5 mm, inside reddish (?); valves 3, at sutures *c.* 0.8 mm thick, splitting the bud to (halfway to) 2/3; *staminal disc* incl. anthers circular, flat or slightly concave, 1.5–2 mm diam.; *anthers* 8, just stiped, half-erect, 0.6–0.8 mm long, hardly touching each other; column ± tapering to the base, 1.5–1.8 mm long. *Female flowers* and *fruits* not known.

D i s t r i b u t i o n : Vietnam, Annam; known only from the type.

E c o l o g y : Montane forest; *c.* 700 m alt. Flowers in July.

N o t e s : 1. In habit this species resembles much *K. saxatilis* from about the same area, but the latter species differs by its broad-obovoid male flower buds, in anthesis cleft to *c.* 3/4 or more, and by the bracteoles situated about halfway on the pedicel; also, in *K. saxatilis* the reticulation on the upper leaf surface is indistinct, and on closer examination quite different from that in *K. mixta*. In *K. mixta* the reticulation formed by the tertiary venation on the upper leaf surface is very fine, prominent, and distinct, similar to that in *K. lenta* (series XI. *Glaucae*), a species widespread in Indo-China.

K. mixta resembles in its male flowers very much *K. andamanica* (a variable species from the Andaman I. to Peninsular Thailand), which differs by various minor characters, incl. the mode of striation of the twigs.

Finally, *K. mixta* seems also closely related to a taxon represented by a few collections from Annam and Laos (*Poilane* in *Chevelier 1007*, *Thorel 3153*) which are presently tentatively included in *K. erratica;* these specimens are in fruit, while male flowers, needed for the systematic assessment, are lacking. Also *K. petelotii* is closely related.

2. The specimen (2 sheets) on which the present species is based was in the Paris herbarium identified in 1959 by Sinclair as *K. glaucescens* var. *andamanica* (Warb.) Sincl. or *K. globularia;* it is not mentioned in his publication of 1961.

7. **Knema angustifolia** (Roxb.) Warb.

Myristica angustifolia Roxb., Fl. Ind. 3 (1832) 847, *et* Icones Roxb., Kew, *ined.*, no. 2572. – *K. angustifolia* Warb., Mon. Myrist. (1897) 561, *p.p.*, only for the type. – L e c t o t y p e : East Bengal, *Roxburgh s.n.* (BM, upper right hand specimen with male flowers).

Myristica gibbosa Hook.*f.* & Th., Fl. Ind. (1855) 158; A. DC., Prod. 14 (1856) 205; Hook.*f.*, Fl. Brit. Ind. 5 (1886) 112; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 321, *p.p.*, pl. 159, *p.p.*, only for the fruit; Kanjilal & Das, Fl. Assam 4 (1940) 46. – T y p e : Assam, Khasia Hills, fr., *J. D. Hooker & Thomson 1082* (BM; K).

K. cinerea var. *andamanica auct. non* (Warb.) Sincl.: Sinncl., Gard. Bull. Sing. 18 (1961) 174, *p.p.*

Tree 10–20 m. *Twigs* slender, terete, in apical portion 1–2 mm diam., finely striate or not, with minute, grey brown or pale brown, scurfy tomentum of hairs *c.* 0.1 mm long, lower down glabrescent, rather blackish, smooth, the *bark* not tending to crack or flake. *Leaves* chartaceous; above drying greenish; lower surface of young leaves with tomentum of rather remote, minute, stellate hairs mixed with small, stalked, dendroid hairs, the latter soon falling and leaving minute scars, older leaves beneath glabrescent, not or but faintly finely papillate; *blade* oblong-lanceolate to lanceolate, broadest usually at or ± below the middle, 5–20 × 1.5–4 cm, base attenuate to rounded, top acute, faintly up to 2.5 cm acuminate; *midrib* above rather slender, flat or slightly raised; nerves 12–25 pairs, flat and thin above; tertiary venation forming a fine network ± trabeculate between the nerves, distinct above; *petioles* early glabrescent, 10–20 × 1–2 mm. *Inflorescences* in male (2–)3–7 mm peduncled, in female (sub)sessile, simple or 2- or 3-furcate, up to 6 mm long, 5–15-flowered in male, 2–6-flowered in female; flowers with greyish-brown scurfy tomentum by hairs 0.1–0.2 mm long. *Male flower* pedicels 6–8 mm, the bracteole persistent or caducous, ± median; *perianth* in bud obovoid to obovoid-oblong,

slightly contracted at the middle, 5 – 5.5 × 4 – 4.5 mm, inside reddish (?); valves 3, at sutures *c.* 0.5 mm thick, splitting the bud to *c.* halfway or slightly more; *staminal disc* incl. anthers (sub)circular, flat or slightly concave, 1.5 – 2 mm diam.; *anthers* 8 – 12, half-sessile to almost stiped, half erect, 0.6 – 0.8 mm long, not touching each other; column terete, 2 – 2.5 mm long. *Female flowers* not seen. *Fruits* 1 or 2 per infructescence, ovoid-ellipsoid, top obtuse to subacute, base broadly rounded to subtruncate, ± gibbose (sagged) at one side (always?), ± ridged along the suture, 25 – 35 × 17 – 20 mm, with yellow-brown or rusty tomentum of hairs *c.* 0.1 mm long; pericarp *c.* 1.5 – 2 mm thick at suture; stalk 5 – 9 mm long (with the scar of the bracteole at or much below halfway).

Distribution: NE. India (Assam, Khasia, E. Bengal), Northern Burma.

INDIA. Assam: *Kingdon Ward 7913.* – Khasia: *Clarke 43779B; Griffith 692; Hook. f. & Thomson 1082.* – E. Bengal: *Griffith 4348; Hb. Wight 2487* (L, P), *2516* (P).
BURMA. Northern: *Kingdon Ward 22083.*

Ecology: Montane forest on steep faces, in gullies, etc.; 500 – 1200 m alt. Flowers in June, fruits in March and June.

Notes: 1. Typification. *Roxburgh s.n.* in BM is a mixture of two species, consisting of three elements. I have chosen the upper right hand specimen, with male flowers, as the lectotype of *K. angustifolia.* The other two elements, a sterile branch and a branch with one fruit, can be referred to *K. lenta* (see also the notes under that species). The present lectotype agrees completely with Roxburgh's drawing of a male specimen (with male flower in detail) in Icones Roxb., Kew, ined., no 2572.

2. Possibly, the number of anthers is 8 – 11; Hook. *f.* & Thomson recorded 12 for *Griffith 692,* but I counted in that specimen only 10. The type as figured by Roxburgh has 11 anthers.

3. The present species was included by Sinclair (1961, p. 174) in *K. cinerea* var. *andamanica* (Warb.) Sinclair, with him a large heterogeneous taxon also including *K. lenta.* In the present revision, the latter is regarded as a species of its own, and the same holds true for the var. *andamanica* in a more restricted sense. *K. andamanica* differs by a set of rather small characters, incl. the sessile or nearly sessile male inflorescences, the relatively somewhat broader male flowers with the bracteole apical or subapical on the pedicel, the lower leaf surface with a denser tomentum usually with coarser hairs and somewhat later shed, and the fruits which are more coarsely hairy and not gibbous at the base.

8. **Knema petelotii** Merr.

K. petelotii Merr., J. Arn. Arb. 23 (1942) 164. – Type: Tonkin, Sontoy Prov., Mt. Bavi, ♂ fls., *Pételot 6608* (A).

Tree 5 – 10(– 20?) m. *Twigs* fairly slender, terete, in apical portion 1.5 – 3 mm diam., rather coarsely striate (as are the petioles), with fine rusty or yellowish brown tomentum of hairs 0.2 – 0.3 mm long, lower down striate, the *bark* not tending to crack or flake. *Leaves* membranous to chartaceous; above drying greenish to

brown, on lower surface distinctly finely papillate, rather early glabrescent from a tomentum of mainly sessile stellate hairs and fewer stellate-dendroid hairs, the larger leaving distinct scars (lens, × 30); *blade* elliptic-oblong to oblong-lanceolate, broadest at or above the middle, 12–30 × 3–9,5 cm, base subobtuse to attenuate, top acute or up to 2 cm acuminate; *midrib* above slender, ± flat or sunk; nerves 15–25 pairs, slender, flat to sunk above; tertiary venation forming a fine network, distinct, usually raised above; *petioles* striate, rather late glabrescent, 8–15 × 1.5–3 mm. *Inflorescences* peduncled for 2–8 mm, simple, 2–4 mm long, 2–6(–10?)-flowered in male, few-flowered in female; flowers with dense dull brown tomentum of dendroid hairs 0.2–0.3 mm long. *Male flower* pedicels 6–10 mm long, the bracteole caducous, situated at about halfway; *perianth* in bud obovoid, slightly constricted below the lobes, *c.* 5 × 3.5–4 mm, inside reddish (?); valves 3 or 4, at sutures 0.4–0.6 mm thick, splitting the bud to *c.* halfway; *staminal disc* incl. anthers circular, flat, 1.7–2.0 mm diam.; *anthers* 8–10, half- to almost entirely sessile, suberect, 0.6–0.8 mm long, not or hardly touching each other; column slightly tapering to the base, (2.0–)2.2–3 mm long. *Female flower* pedicels 3–7 mm long, the bracteole ± median; *perianth* in bud longly ovoid, *c.* 5 × 2.5–3 mm; valves 3, at sutures *c.* 0.5 mm thick, splitting the bud to *c.* halfway; pistil *c.* 4 mm long; ovary ovoid, *c.* 2 × 1.5 mm; style *c.* 2 mm long; *stigma* 2-lobed and each lobe again faintly 2-lobulate or not. *Fruits* 1–4 per infructescence, ellipsoid, 26–40 × 18–30 mm, top rounded to subattenuate, densely rusty tomentose by hairs up to 0.6 mm long; pericarp thin, *c.* 1–1.5 mm at suture; stalk 3–7 mm long.

Distribution: Yunnan, Vietnam (Tonkin, Annam), possibly Laos.

CHINA. Yunnan: Ping-pien (Hsien dist.), *H. T. Tsai 61533, 61638.*
VIETNAM. Northern, Tonkin: *Balansa 4175, 4199; Pételot 6608; Poilane P. M. 88.* – Annam: *Poilane 27815, 29817; Vidal 791A.*
LAOS. Prov. Vientiane: *Vidal 5980* (sterile).

Ecology: Montane forest; 800–1200 m alt. Flowers Sept.–Oct., fruits April.

Vernacular name: *sa luat* (Laos).

Notes: 1. Fieldnotes. Shrub or small tree 5–8 m high. The fruits were described as a little fleshy, yellowish.

2. Related species. *K. petelotii* is closely related to *K. tonkinensis*, which differs essentially by its persistent tomentum on the lower leaf surface, composed of distinct, all ± equally long stalked, stellate-dendroid hairs, but with the male flowers almost identical. In *K. tonkinensis* the anthers are apparently somewhat larger, *c.* 1 mm long, and the tomentum of the flowers (as of the whole plant) is more conspicuous, the hairs being 0.3–0.4 mm long.

A fine fruiting specimen of the present species, *Balansa 4199*, is one of the two syntypes of *K. conferta* var. *tonkinensis* described by Warburg, the basionym of the present *K. tonkinensis*. However, as pointed out under that species, these two syntypes belong to different taxa.

A third specimen of *K. petelotii*, *Balansa 4175* (seen in K, P), with male flowers, is together with the two syntypes of *K. conferta* var. *tonkinensis* annotated in Warburg's handwriting as '*K. conferta* var. *Balansae* Warb.', but the specimen

Balansa 4175 was not enumerated with the final publication of Warburg's var. *tonkinensis*.

3. Deviating specimen. *Poilane P. M. 88* (in P), from Tonkin, is a sterile specimen possibly belonging to the present species. The specimen is relatively stout as compared to fertile specimens of *K. petelotii*. The twig is at apex somewhat flattened, 2.5 – 3.5 mm diam., the leaves large, *c.* 20 – 45 × 6.5 – 12 cm, with 25 – 30 lateral nerves. The leaf blades are rather early glabrescent beneath. Likely, it represents a sapling shoot collected as a voucher, as the plant was annotated as a medicine for teeth disease. The specimen deviates from *K. petelotii* rather essentially in that the twig and the petioles are not or hardly striate, and by the thickish, somewhat pulvinate petioles.

4. *K. petelotii* was by Sinclair erroneously placed in the synonymy of *K. globularia*, from which it is quite different.

9. **Knema pseudolaurina** de Wilde, *nom. et stat. nov.* – **Fig. 2.**

K. laurina (Bl) Warb. var. *malayana* Warb., Mon. Myrist. (1897) 607, *p.p.*, only for the lectosyntype (see the notes) – *Myristica laurina* Bl. var. *malayana* Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 92 – Lectotype: Malay Peninsula, Penang I., *Curtis* (in Warburg *o.c.* as *King's Collector*) *1044*, ♂ fl. (BM).

Distribution: Peninsular Thailand and Malaya, possibly Sumatra (E. Coast, 1 collection).

THAILAND. S. Peninsular, Narathiwat, Waeng: *Sangkhachand, Phusomsaeng, and Nimanong s.n.*
SUMATRA. E. Coast, Asahan: *Rahmat si Boeea 9539.*
MALAYA *s.l.: Maingay (2961) 1294.* – Kedah: *FRI 0384, 0394, 6889, 11504(3); SFN 35070.* – Perak: *FRI 0607, 0878; Kep. FN 99816; King's Coll. 4307, 8645.* – Kelantan: *FRI 4016, 4044; Kep. FN 68031* (or *68301*); *SFN 29519; Soepadmo & Mahmud 1169.* – Trengganu: *FRI 8314, 8475; SFN 33839.* – Pahang: *FRI 3400, 3435, 3488, 3582, 4918, 6301, 14335, 14397, 17867; Kadim & Noor KN. 548; Kep. FN 104391, 108988; Ridley 2264; Sha (& Noor) MS. 1292, 1297, 1403, 1601, 1756, 1891.* – Selangor: *Chin 1187; Kep. FN 76147, 80224, 85219, 94508, 94645, 99286, 99355, 99370, 108705.* – Negri Sembilan: *FRI 11313, 17067.* – Johore: *FRI 7832, 13797; Noor & Samsuri MN. 69; SFN 36927.* – Penang: *Curtis 1044, 1161, 2770.*

Notes: 1. Typification: Warburg, *l.c.*, distinguished within *K. laurina* five varieties, one of which, ß *malayana*, comprised all the material from the Malay Peninsula. This variety was characterized by longer, though narrower, leaves and by larger fruits 30 × 20 mm. The material cited (p. 609) consists of the following collections:

Perak: *Scortechini 831* (♂ fl., not ♀!); *King's Coll. 5092* (♀ fl., fr.), *7452* (fr.), *7686* (fr.). Penang: *Curtis 1044* (♂ fl.), *1161* (fr.) (not *King's Coll. 1044, 1191*). Singapore: *Cantley s.n.* (fr., not seen); *Ridley 2044* (♂ fl.).

These collections appeared to be very heterogeneous and to belong to the following three taxa:

1. *K. laurina* var. *heteropilis* de Wilde: *Scortechini 831; King's Coll. 5092.*
2. *K. laurina* (Bl.) Warb. var. *laurina: King's Coll. 7452, 7686; Ridley 2044.*
3. *K. pseudolaurina* de Wilde: *Curtis 1044, 1161.*

I have chosen the collections *Curtis 1044* (in BM), and *1161* (in BM, K, and P) as lectosyntypes, as they are conspecific and agree with the present species which is differentiated from both varieties in *K. laurina* by the large fruits, as mentioned in Warburg's description of his var. ß *malayana*. The specimen *Curtis 1044* in BM is chosen as the lectotype.

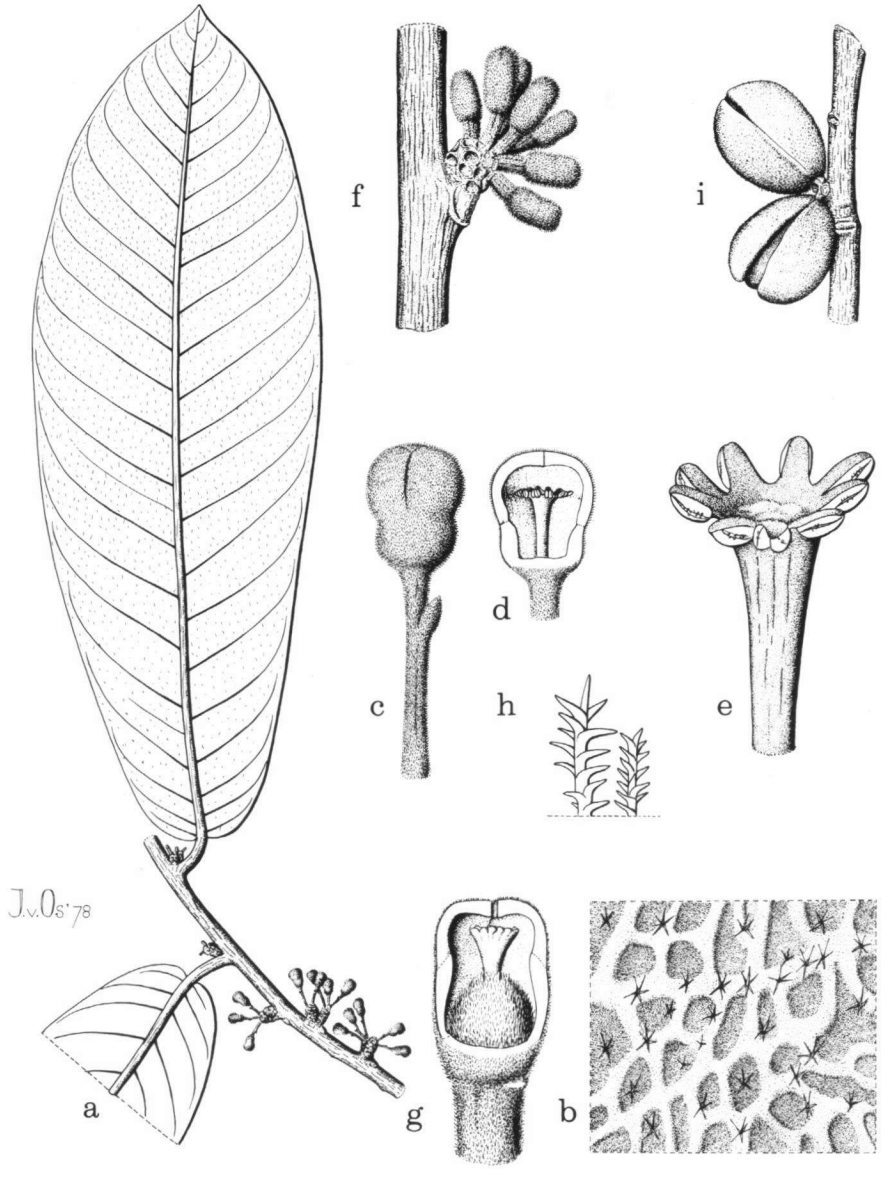


Fig. 2. *Knema pseudolaurina* de Wilde – a. habit of male flowering branchlet, × ½; b. detail of lower leaf surface showing areoles of venation and stellate hairs of mixed sizes, × 30; c. mature male flower bud, × 3½; d. opened mature male perianth in bud showing the androecium, × 3½; e. androecium, × 15; f. female inflorescence, × 1½; g. opened mature female perianth in bud showing the pistil, × 3½; h. sample of hairs from female perianth (half-schematic), × 60; i. infructescence, × ½. – a, c–e. from *Kep. FN 99355*; b. from *Soepadmo & Mahmud 1169*; f–h. from *FRI 7832*; i. from *FRI 4044*.

As specific epithet I could not retain the name *malayana* because of *K. malayana* Warb., a different species presently in XI. series *Glaucae*.

2. Sinclair evidently had a much too wide conception of *K. laurina*, which included several names presently regarded as belonging to distinct species (see under *K. laurina*). The present species was overlooked altogether.

3. The only known collection from Sumatra is somewhat doubtful as it concerns a specimen with only half-grown fruits; it deviates from the specimens from the Malay Peninsula by the tomentum on the lower leaf surface, which is composed of rather sparse stellate hairs, rather early caducous.

10. Knema laurina (Bl.) Warb.

For synonyms and types see under the varieties.

Distribution: Peninsular Thailand, Malaya, Sumatra, Java, and Borneo.

This species is well-characterized by the essentially obovoid-ellipsoid, rather small, long-hairy male flower buds, the androecium with 6–9 sessile, (sub)erect anthers, and the short male pedicels with the bract apical or almost so. The female flowers are in bud essentially ovoid-ellipsoid, the style is slender with a few-lobed stigma. The fruits are comparatively small, 15–25 mm long, and usually (sub)sessile. Furthermore, very characteristic for the type-variety is the persistent tomentum on the lower leaf surface composed of mainly stalked stellate-dendroid hairs of almost the same size, mixed with only a small percentage of smaller almost sessile hairs. In the var. *heteropilis* the tomentum on the lower leaf surface is rather mixed, with a majority of sessile or but shortly stalked stellate-dendroid hairs resembling (though being still much stouter than) that of *K. pseudolaurina*.

Within var. *laurina* there is a considerable individual variation in the shape of the stalked hairs: the hairs may be comparatively slender with short side branches, or with long branches mainly in the apical portion giving the hair a broadly crowned appearance; apparently, hairs of all imaginable intermediate forms occur in individual specimens.

KEY TO THE VARIETIES

1a. Tomentum on lower leaf surface composed of hairs all or predominantly stalked stellate-dendroid, all of almost equal size and shape. Fruits 15–25(–30) mm long. . . . . **a.** var. **laurina**

b. Tomentum on lower leaf surface composed of hairs of various size and shape, *i.e.* of sessile stellate, stellate-dendroid, and stalked (stellate-)dendroid hairs. Fruits 15–20 mm long. . . . . **b.** var. **heteropilis**

a. var. **laurina**

Myristica laurina Bl., Rumphia 1 (1835) 189, t. 61; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 319, pl. 156 – *Myristica tomentosa auct. non* Thunberg: Blume, Bijdr. 2 (1825) 577. – – *K. laurina* Warb., Mon. Myrist. (1897) 606, tab. 24 fig. 1–3 (excl. var. *malayana, p.p.;* incl. vars. *borneensis, bancana,* and *amboinensis);* Sinclair, Gard, Bull. Sing. 16 (1958) 329, fig. 19, *p.p.;* 18 (1961) 248, *p.p.* – Type: Java, *Blume s.n.* (L. several sheets, fl., fr.).

Myristica laurina Bl. var. *longifolia* Miq., Fl. Ind. Bat. 1, 2 (1858) 71, *et* Suppl. (1861) 385. – Syntypes: Sumatra, P. Pisang, *Teijsmann s.n.* (K, LE, *n.v.*), *484* (BO, *n.v.*; U).

Myristica laurina Bl. var. *borneensis* Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 51. – Type: Borneo, Sakumbang, *Korthals s.n.* (L, U).

Myristica cantleyi Hook. *f.*, Fl. Br. Ind. 5 (1886) 110, not in the sense of King and later authors. – *K. cantleyi* Warb., Mon. Myrist. (1897) 554, *p.p.*, for the type only. – Type: Singapore, *Cantley 195* (K, *n.v.*).

K. laurina Warb. var. *amboinensis* Warb., Mon. Myrist. (1897) 607. – *Myristica laurina* Bl. var. *amboinensis* Boerlage, Handl. Fl. Ned. Ind. 3, 1 (1900) 92. – Type: *culta Hort. Bot. Bogor*, said to be introduced from Ambon, *Beccari s.n.* (FI, *n.v.*).

K. laurina Warb. var. *bancana* Warb., Mon. Myrist. (1897) 607. – *Myristica laurina* Bl. var. *bancana* Boerlage, Handl. Fl. Ned. Ind. 3, 1 (1900) 92. – Type: not indicated.

Distribution: as the species.

THAILAND. Peninsular: *Kerr 13990, 15156, 16818; Phusomsaeng 401.*

MALAYA. Kedah: *Chew Wee-Lek 143* – Perak: *FRI 0792, 2431; King's Collector 7452, 7686* – Trengganu: *Cockburn FRI 8468* – Pahang: *Burkill 2121; Chew Wee-Lek 901; FRI 0076, 0899, 3756, 19875, 20002; Kadim & Mahmud 98; Kep. FN. 99147, 104404, 108964, 108978* – Selangor: *Kep. FN. 99459; Ridley s.n.* – Malacca: *Derry 485; Maingay 1294; Ridley s.n. (1800).* – Johore: *SFN 32334, 32379; Shah & Kadim 428* – Langkawi I.: *FRI 6595, 6826.* – Negri Sembilan: *FRI 17348.*

SINGAPORE. *Ridley 2044; SFN 36146, 36951, 39475, 39491.*

SUMATRA. Atjeh: *de Wilde & de Wilde-Duyfjes 12374, 14429, 15521, 15708, 15717, 15734, 16453, 16494* – Tapanoeli: *Rahmat si Toroes 4413, 5027* – W. Coast: *Maradjo 279; Teijsmann s.n.* – East Coast: *Forbes 2683; Kostermans 22012; Lörzing 5538, 12615* – Palembang: *Forbes 1306, 1409; Grashoff 1148; Teijsmann H.B. 3718* – Lampong: *Jacobs 8425* – Siberoet I.: *Boden-Kloss SFN 13092; Iboet 178* – Bangka: *Kostermans 5; Kostermans & Anta 1181.*

JAVA. Mainly W. and Central Java: 56 collections, not cited because the species is unmistakable in Java.

BORNEO. Sarawak: *Beccari 1546; Haviland 634; S. 13338, 19215, 23203, 25299, 26944, 31125, 34314, 34405, 34487* – Sabah: *SAN. A. 4400, 16012, 16815, 17085, 19824, 30873, 30959, 33685, 36026, 38717, 41273, 48443 NT. 224, 50946, 51071, 52611, 66790, 78195, 79845, 80933.* – W. Kalimantan: P. Lemoekoetan, *Hallier 323;* P. Karimata, *Mondi 205* – S. & SE. Kalimantan: *Korthals s.n.; de Vogel 915.* – E. & NE. Kalimantan: *Endert 2281, 2436; Kostermans 4831, 7367, 8948, 9667, 21083; Paymans 52* – Anambas I.: *van Steenis 1349.*

Notes: 1. Synonyms. *K. laurina* var. *malayana* Warb. is excluded by its lectotype, as explained under the species *K. pseudolaurina.*

Myristica cantleyi Hook. *f.* is placed in the synonymy with some doubt, as I have not seen the type in Kew; possibly it belongs under the var. *heteropilis.*

K. laurina var. *amboinensis* Warb. belongs to the type-variety. Its type, collected in the botanic gardens at Bogor, said to be originating from Ambon, cannot have been introduced from that island, as explained by Sinclair, *l.c.*

2. The species was accepted by Sinclair (1958, 1961), in my opinion erroneously, in a much wider sense; it included in its synonymy *K. conferta* var. *tonkinensis* Warb., *K. elegans* Warb., *K. glauca* var. *nicobarica* Warb., *K. oblongata* Merr. (syn. *K. obovoidea* Merr.), and *K. tridactyla* Airy Shaw, all these taxa presently being reinstalled. Besides, *K. laurina* in Sinclair's conception included the newly segregated species *K. pseudolaurina.*

3. Specimens of *K. laurina* may be confused with *K. conferta*, a species with a coarse tomentum on the lower leaf surface as well, but in that species the hairs are essentially mixed of size and mainly sessile; furthermore, it has quite differently shaped male flowers, different fruits, etc., and very characteristic minute blackish dots on the lower leaf surface, caused by non-traumatic cork warts.

4. *Phusomsaeng 401*, from Peninsular Thailand, has as an exception very fine stellate hairs at the base of the staminal column.

b. var. **heteropilis** de Wilde *nom. et stat. nov.*

Myristica furfurascens Gandoger, Bull. Soc. Bot. France 66 (1919) 226, *in clavi.* – Type: Java, *Junghuhn*, date 1855 (LY, *n.v.*; iso in L?).

Distribution: Malaya, Sumatra (Simaloer I.), W. Java.

MALAYA. Kedah: *Whitmore FRI 0401.* – Perak: *FRI 0885, 17369; King's Coll. 5092; Scortechini 831.* – Selangor: *Kep. FN 98714.* – Negri Sembilan: *FRI 14644, 17299; Holttum 9867.* – Pahang: *FRI 2976* – Johore: *FRI 17641.*

SUMATRA. Simaloer I.: *Achmad 63, 1195, 1808.*

JAVA. W. Java: *Junghuhn s.n. (56), (57), 716; Koorders 37501 β; de Vriese 47.*

Notes: 1. The specimens *Scortechini 831* and *King's Coll. 5092* are cited by Warburg, p. 609, under his var. *malayana*, presently lectotypified in such a way that it becomes a synonym of *K. pseudolaurina* (see there).

2. The var. *heteropilis* is a rather heterogeneous entity; all specimens recall very much the type variety, but differ in the nature of the tomentum on the lower leaf surface. This is composed of hairs of various sizes, comprising stalked hairs as well as a considerable amount of non-stalked hairs.

3. Specimens from the Malay Peninsula and W. Java have somewhat narrower leaves as compared to those from Simaloer I. and as generally in the type-variety. Probably they have always rather small fruits measuring only *c.* 15 mm in length.

4. The specimens from Simaloer I., *Achmad 63*, *1195*, and *1808*, are rather stout, with large broad leaves and thick twigs at apex *c.* 4 mm diam. Their fruits measure *c.* 20 × 12 mm. Typical var. *laurina* is known from the more southern Siberoet I. by the collection *Iboet 178.*

5. A deviating specimen of uncertain identity. The collection *Lütjeharms 4421* (A, BO, K, L, P, SING, US) from Enggano I. resembles superficially very much *K. laurina.* Its tomentum on the lower leaf surface is still less well-developed as compared to that in var. *heteropilis*, and consists largely of small, sessile, stellate hairs or even stellate scales; also the male flowers are deviating. Possibly the specimen is of hybrid origin, and seems to include certain characters of species in XI. series *Glaucae*, namely *K. glaucescens* and *K. losirensis*, especially as regards the androecium. The rather immature male flower buds measure *c.* 3 × 2.5 mm and are cleft by the valves to *c.* 3/4 – 4/5. The tomentum of the flowers is composed of hairs 0.3 – 0.5 mm long. There are 8 anthers, *c.* 0.6 mm long, half-sessile, suberect. The staminal disc incl. anthers measures *c.* 1.5 mm diam. and is flattish. The staminal column is *c.* 1 mm long. Possibly, this collection represents a new taxon, but more material is required to ascertain this.

11. Knema tonkinensis (Warb.) de Wilde, *stat. nov.*

K. conferta Warb. var. *tonkinensis* Warb., Mon. Myrist. (1897) 581 (excl. syntype specimen *Balansa 4199* which is *K. petelotii*) – Lectotype: Tonkin, Mt. Bavi, 20 July 1886, ♂ fl., *Balansa 4176* (K, P).

Tree *c.* 8 m. *Twigs* terete, in apical portion 2 – 3 mm diam., coarsely striate, glabrescent from yellowish brown tomentum composed of stellate(-dendroid) hairs 0.2 – 0.3 mm long; *bark* lower down striate, not tending to crack or flake. *Leaves* chartaceous to thinly coriaceous, above drying dark brown, the tomentum rather persisting on the midrib, on lower surface finely papillate, without minute dark reddish brown cork warts, with (sub)persistent tomentum of mainly evenly spaced

dendroid hairs of almost equal size; *blade* oblong to lanceolate, broadest at about the middle, 12 – 23 × 3 – 5.5 cm, base broadly rounded to attenuate, top long-acute or faintly acuminate; *midrib* above slender, not or but faintly raised; nerves 18 – 25 pairs, slender and sunk above; tertiary venation forming a fine network (rather) distinct above; *petioles* late glabrescent, 7 – 12 × 2 – 3 mm. *Inflorescences* peduncled for 1 – 6 mm, simple, 2 – 4 mm long, 2 – 10-flowered in male; flowers with dense yellowish-rusty tomentum of dendroid hairs 0.3 – 0.4 mm long. *Male flower* pedicels 6 – 9 mm, the bracteole subpersistent, situated at about the middle; *perianth* in bud obovoid, *c.* 5 – 5.5 × 3 – 3.5 mm, inside reddish (?); valves 3 or 4, at sutures *c.* 0.5 mm thick, splitting the bud to *c.* halfway – 2/3; *staminal disc* incl. anthers circular, flat to concave, 2 – 2.3 mm diam.; *anthers* 9, half-sessile, suberect, *c.* 1.0 mm long, not touching each other; column somewhat tapering to the base, 2 – 2.5 mm long. *Female flowers* not seen. *Fruits (Poilane 26396)* 1 – 3 per infructescence, ellipsoid, top and base obtuse, 25 – 35 × 16 – 22 mm, densely rusty tomentose by hairs 1 – 2 mm long; pericarp 1.5 – 2 mm thick at suture; stalk 3 – 6 mm long.

Distribution: Upper Laos, N. Vietnam (Tonkin).

VIETNAM. Tonkin: *Balansa 4176*.
LAOS. Haute Laos, Prov. Haute Mekong: *Poilane 26396*.

Ecology: Montane forest; *c.* 800 – 900 m alt. Flowers and fruits June – July.

Notes: 1. Apparently closely related to *K. petelotii*, which differs mainly in the tomentum on the lower leaf surface; also the pericarp of the fruits is thinner and with a shorter tomentum, composed of hairs *c.* 1 mm long or less.

2. Resembling species are *K. elegans*, *K. pachycarpa*, and *K. laurina*, with approximately the same type of tomentum on the lower leaf surface; *K. elegans* and *K. pachycarpa* are distinct by the quite differently shaped male flower buds, *K. laurina* resembles in the fruit but differs by various characters, e.g. by shorter male flower pedicels and the almost non-striate twigs.

3. Lectotypification. The syntype of *K. conferta* var. *tonkinensis* Warb. consists of two collections, viz. *Balansa 4176* (K, P), with male flowers, and *Balansa 4199* (B, G, *n.v.*; K, L, P), in fruit; both collected on Mt. Bavi, Tonkin. These specimens belong to different, though closely related species because of the essentially different nature of the tomentum on the lower leaf surface. Warburg, *l.c.*, remarked with the original description that the new variety probably represents a separate species because of the male flowers which are rather constricted below the perianth lobes. This latter character is regarded as of high taxonomic value in the present treatment of *Knema*.

For *K. tonkinensis* I have chosen the male flowering collection *Balansa 4176* (K, P) as lectotype; the second collection, *Balansa 4199* (in fruit) belongs to *K. petelotii*.

4. *K. conferta* var. *tonkinensis* was placed by Sinclair (1961, p. 249) under *K. laurina*, a resembling species, as briefly discussed above.

II. series SERICEAE de Wilde, *ser. nov.*

Alabastra ♂ circa aequilonga ac lata, subglobosa ad late obovoidea; in anthesi fissa circa ad 4/5. Columna staminalis brevior quam disci diameter (antheris inclusis). Antherae 10 – 24. Discus staminalis planus ad valde convexus. Flores

tomento persistente induti. Folia subtus tomento persistente obtecta, tomento creberrimo atque sericeoso ad tactum, breviter stellato-pilosa, pilis dense commictis. Ramuli 2–6 mm diam.; cortice lamellari vel non.

T y p u s : *Knema sericea* de Wilde.

Species 12–15.

12. **Knema elmeri** Merr.

K. elmeri Merr., Univ. Calif. Publ. Bot. 15 (1929) 75; Sinclair, Gard. Bull. Sing. 18 (1961) 202, fig. 8 – T y p e : Sabah, Tawao, fr., Oct. 1922, *Elmer 21527* (UC, *n.v.*; iso BM, C, K, L, P, U; A, BO, BR, G, M, NY, PNH, SING, *n.v.*).

D i s t r i b u t i o n . Borneo: Sarawak, Brunei, Sabah, E. Borneo (P. Nunukan)

SARAWAK: *Anderson 4046; Bakar 4360; S. 13792, 18294, 23344, 23469, 33325, 36575, 37182.*
BRUNEI: *Ashton BRUN 865.*
SABAH: *Agama 419 (Hb. Bur. Sc. Manila); B. N. B. For. Dept. 4587; Elmer 21042, 21527; SAN A 4139, 16643, 22223, 24506, 29483, 31596, 71007, 71039; Sinclair 9299, 9311.*
NE. BORNEO: P. Nunukan, *Meijer 2327.*

N o t e s : 1. Sinclair (*l.c.*) placed this species in the alliance of *K. hookeriana*, *K. furfuracea*, and *K. latericia*, on account of the cracking and scaling bark, but also (p. 205) because of the sessile anthers, the numerous stigma lobes, and the bracteole median on the pedicel; it was regarded as nearest to *K. latericia*.

In my opinion it is less close to *K. hookeriana* and *furfuraceae* because of various characters, which include a different general habit, the convex staminal disc, the half-sessile to stalked (not sessile) anthers, and the only 4–6(–8?) (not numerous) stigma lobes. I agree that *K. elmeri* comes close to *K. latericia*, especially in the general habit.

2. *K. elmeri* is very well characterized by its often silvery whitish dense tomentum on the lower leaf surface, silky to the touch, in addition to the globose male flower buds, the strongly convex staminal disc, and the cracking and flaking bark of the twigs. The present circumscription of the species is the same as that by Sinclair, *l.c.*

13. **Knema sericea** de Wilde, *sp. nov.*

K. ashtonii auct. non Sinclair: Sinclair, Gard. Bull. Sing. 18 (1961) 162, *pro Jaheri 611*, fig. 1 A, C–E, and I.

Ramulorum cortex non lamellaris. Folia membranacea ad chartacea, nervis tertiariis in pagina superiore tenuibus atque conspicuis, subtus tomento persistente denso canescenti-brunneo ad pallide cinnamomeo, sericeoso ad tactum. Inflorescentiae ♂ pedunculo 5–7 mm longo. Flores ♂ pedicello 12–18 mm longo subapice bracteolato; perianthium in alabastro sublobosum, ca. 6 mm. diam. Antherae 11–15, stipitatae. Discus staminalis (antheris inclusis) ca. 3 mm diam., convexus ad mamillatus; columna staminalis ca. 0.5 mm longa.

T y p e : NE. Borneo, Sungei Moegne, Exp. Nieuwenhuis 1896–97, ♂ fl., *Jaheri 611* (SING; iso BO, *n.v.*).

Bark of twigs not flaking. *Leaves* membranous to chartaceous; tertiary venation on upper surface fine and distinct, lower leaf surface with dense, grey-brown to pale cinnamon, persistent tomentum, silky to the touch. Male *inflorescences* peduncled for 5–7 mm. *Male flower* pedicels 12–18 mm, the bracteole subapical; perianth in

bud subglobose, *c.* 6 mm diam. *Anthers* 11 – 15, stiped. *Staminal disc* incl. anthers *c.* 3 mm diam., convex to mamillate; staminal column *c.* 0.5 mm long.

Distribution: Sarawak and NE. Kalimantan.

BORNEO. Sarawak: 1st. Div., *James Manit S. 32675.* – NE. Kalimantan: Sungei Moegne: *Jaheri 611.*

Ecology. At foot of limestone mountain; altitude not known. Fruits in January.

Notes: 1. Related to *K. retusa*, *K. ashtonii* var. *cinnamomea*, and *K. elmeri*, with which it has the dense silky tomentum on the lower leaf surface in common. It seems most closely related to *K. elmeri*, which is less stout of habit and with the bark of the twigs flaking. Especially the morphology of the flowers is very similar, both having a typically convex, mamillate staminal disc; the flowers are smaller in *K. elmeri*.

K. retusa is obviously closely related in other respects, i.e. by the stout obtuse leaves, the broad, subglobose to ovoid, ± apiculate fruits, and the stalked inflorescences.

2. This species was overlooked by Sinclair and erroneously included in, and depicted under, *K. ashtonii*.

14. Knema retusa (King) Warb.

Myristica retusa King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 330, pl. 171. – *K. retusa* Warb., Mon. Myrist. (1897) 612, t. 25; Sinclair, Gard. Bull. Sing. 16 (1958) 318; 18 (1961) 272, fig. 22. – Type: Malaya, Perak, May 1885, ♂ fl., *King's Coll. (King) 7690* (CAL, *n.v.*; iso K, L, P; BO, G, *n.v.*).

Distribution: Malaya, endemic in Perak.

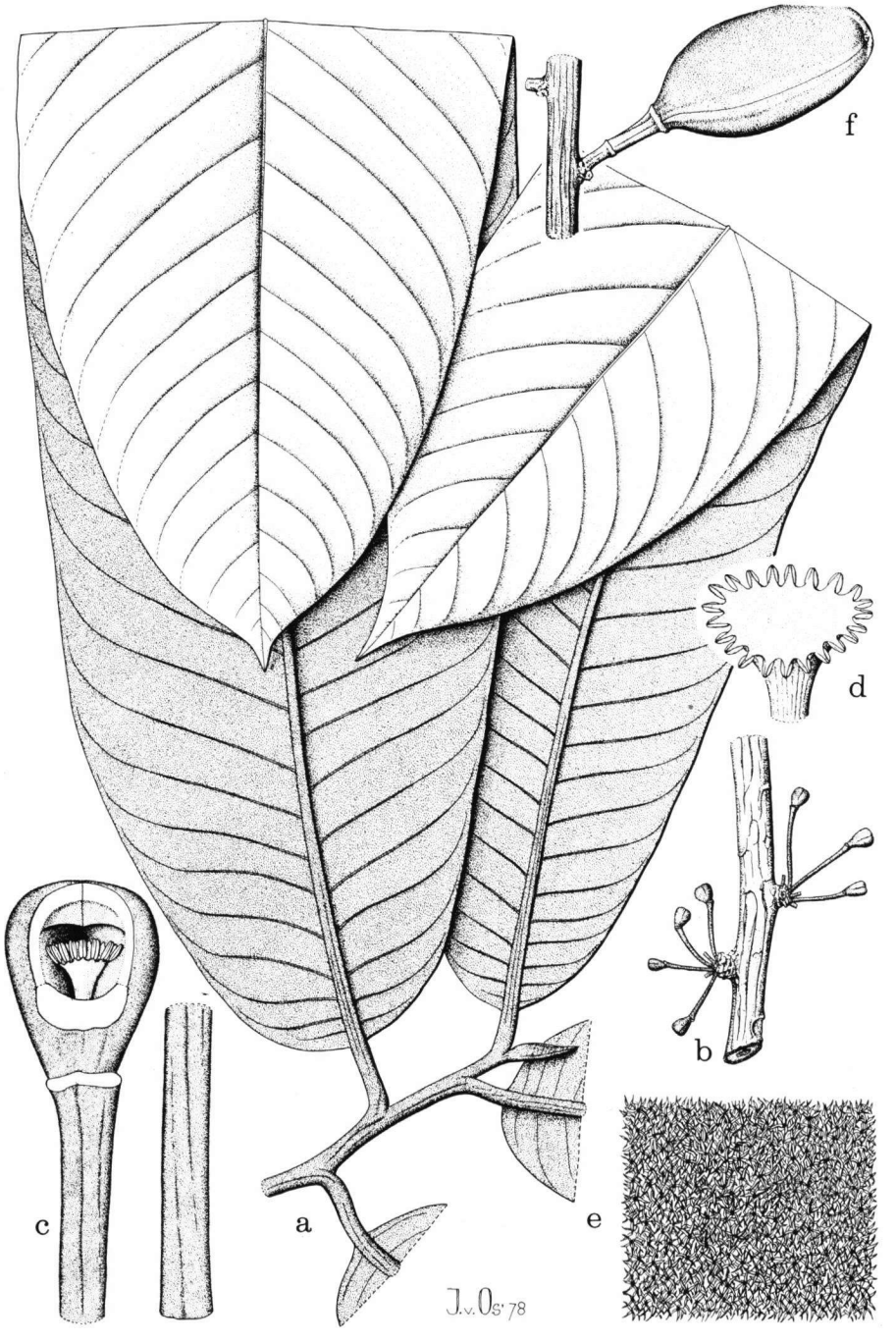
MALAYA. Perak: *King 7690; Sinclair 9885, 9907, 9908.*

Note: Sinclair listed this species in the group with the stigma few-lobed, along with *K. ashtonii* and *K. oblongifolia*; on the label of *Sinclair 9908* (♀), as well as in the description (Sinclair, 1961, p. 272) and in the figure the stigma is described and shown as 4-lobed. In the female flower analysed I found the stigma 4 – 6-lobulate. *K. oblongifolia* (series I. *Laurinae*) cannot be related, as was suggested by Sinclair, because it has quite differently shaped male flower buds.

15. Knema ashtonii Sinclair

K. ashtonii Sinclair, Gard. Bull. Sing. 18 (1961) 162, fig. 1, *p.p.*, excl. specim. *Jaheri 611*, fig. 1 A, C – E, I, excl. descr. male flowers. – Type: Sebah, Temburong Dist., 22 March 1957, ♀ fl., fr., *Smythies, Wood, Ashton SAN 17386* (K; iso L; A, BO, BRI, BRUN, KEP, SAN, SING, *n.v.*).

Fig. 3. *Knema ashtonii* Sinclair var. *cinnamomea* de Wilde – a. habit of twig apex with leaves, × ½; b. part of older twig with male inflorescences, flowers submature, × ½; c. opened mature male flower bud showing the androecium, scar of caducous bracteole apically on the pedicel, × 3½; d. androecium, × 7; e. detail of lower leaf surface showing dense tomentum, × 150; f. infructescence, bracteole scar about halfway on the fruit stalk, × ½. – a – d. from *S. 23449* (type); e, f. from *Kostermans 10415.*


f
d
b
c
a
e
J.v.Os.78

Distribution: Borneo (Sarawak, Brunei, Sabah, E. Kalimantan).

Ecology: Primary forest, often by streams; 0–600 m alt. Flowers March, April; fruits throughout the year.

Notes: 1. Two rather easily distinguished varieties are recognized, mainly based on the tomentum on the lower leaf surface. Male flowers are only known from var. *cinnamomea*. Of both varieties fine fruiting collections are available.

2. According to Mr. J. Koster, Anatomy Department, Rijksherbarium, the anatomy of the hairs of these two varieties is quite different. He will report on these differences in a forthcoming separate publication.

3. Sinclair (*l.c.*) did not recognize the present varieties, and also included *Jaheri 611*, the only male specimen known to him; this specimen is presently described as a new species, *K. sericea*. Since then the specimen *S. 23449* has been collected, with good male flowers that appeared to be quite different from those of *Jaheri 611*.

4. Sinclair (p. 165) also included *Ridley 8504* (CAL, SING, *n.v.*) from Selangor, Malaya. I have not seen the specimen, which may belong to a different species as it would be the only known specimen from the Malay Peninsula.

KEY TO THE VARIETIES

1a. Lower leaf surface glabrous or sparingly scaly by minute, weak, whitish, sessile, stellate-scaly hairs. Fruit stalk 10–15(–20) mm long, the bracteole scar usually situated above the middle . . . . . **a.** var. **ashtonii**

b. Lower leaf surface densely brownish-grey to cinnamomeous pubescent, silky to the touch. Fruit stalk 20–30 mm long, the bracteole scar usually situated at about the middle . . . . . **b.** var. **cinnamomea**

a. var. **ashtonii** .

Distribution. Borneo: Sarawak (most collections from 4th Div.), Brunei, Sabah.

BORNEO. Sarawak: *Anderson 4457, 4628; Bakar 3008; Chew Wee-lek CWL 1045; S. 22841, 23298* – Brunei: *Ashton BRUN 5202.* – Sabah: *SAN A. 4582, 17386.*

Note: Certain smaller-leaved specimens, if sterile or with young fruits, may recall stout specimens of *K. woodii* or *K. luteola*.

b. var. **cinnamomea** de Wilde, *var. nov.* – **Fig. 3.**

Folia subtus tomento persistente sericeoso ad tactum, composito e pilis dense commictis stellato-squamatis sessilibus, canescenti-brunneis vel vulgo cinnamomeis. Inflorescentiae ♂ sessiles. Flores ♂ pedicello 20–25 mm longo, bracteolato bracteola apice apposita, caduca; tomentum e squamulis minutis minus quam 0.1 mm longis compositum. Perianthium ♂ in alabastro late obovoideum, circa 8 × 6 mm. Antherae 22–24, subsessiles ad brevissime stipitatae. Discus staminalis (antheris inclusis) ca. 3.5 mm diam.; columna 1.5–2 mm longa. Fructus pedicellus 20–30 mm longus.

Type: Borneo, Sarawak, 4th Div., ♂ fls., 10 April 1965, (*Haji Suib*) *S. 23449* (L; iso K, SING); a good fruiting specimen is: *S. 13795* (K, L; A, KEP, SAN, SING, *n.v.*).

Leaves on lower surface with persistent tomentum silky to the touch, consisting of densely interwoven, sessile, stellate-scale hairs, brownish grey or usually cinnamon-

brown. Male *inflorescences* sessile. *Male flower* pedicels 20–25 mm long, the bracteole caducous, apical; tomentum consisting of minute scales less than 0.1 mm long. Male *perianth* in bud broadly obovoid, *c.* 8 × 6 mm. *Anthers* 22–24, subsessile to just stiped. *Staminal disc* incl. anthers *c.* 3.5 mm diam.; column 1.5–2 mm long. Stalk of *fruit* 20–30 mm long.

Distribution. Borneo: Sarawak, Central East Kalimantan.

BORNEO. Sarawak: *(Sinclair) S. 10271, 10275, 13795, 18931, 19204, 23449, 23916, 24276, 27163.* – Central E. Kalimantan: W. Kutei, *Endert 4775;* C. Kutei: *Kostermans 10415.*

Note: This new variety was found distinct among the material of *K. ashtonii* as conceived by Sinclair; see also the notes under the species. The perianth inside is yellowish.

III. series **LAMELLARIAE** de Wilde, *ser. nov.*

Alabastra ♂ circa aequilonga ac lata, subglobosa ad late obovoidea vel ellipsoidea; in anthesi fissa ad 2/3–4/5 attingentia. Columna staminalis brevior quam disci diameter (antheris inclusis). Antherae 6 vel 7, vel 10–25. Discus staminalis planus. Flores tomento persistente, vel tarde glabrescentes. Folia subtus tomento conspicuo induta, praecoce glabrescentia. Ramuli 3–12 mm diam.; cortice longitudinaliter rimoso, atque lamellari.

Typus: *Knema hookeriana* (Wall. *ex* Hook. *f.* & Th.) Warb.

Species 16–24.

16. Knema hookeriana (Wall. *ex* Hook. *f.* & Th.) Warb.

Myristica hookeriana Wall. *ex* Hook. *f.* & Th., Fl. Ind. 1 (1855) 156; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 325, pl. 163. – *K. hookeriana* Warb., Mon. Myrist. (1897) 551, tab. 24, fig. 1–4; Sinclair, Gard. Bull. Sing. 16 (1958) 272, fig. 1, pl. IA; 18 (1961) 226. – Type: Malaya, Penang, *Wallich Cat. 6802 A* (K; iso BM; A, CAL, DD, E, G, M, *n.v.*)

Distribution: Peninsular Thailand, Malaya, Sumatra.

THAILAND. Southern Peninsular: *Larsen & Larsen 32926; Smitinand 10994 (BKF. 46724).*
MALAYA. Perak: *Ng FRI 5793; KEP 69416, 76260; King's Coll. 5754, 6007, 6656.* – Kelantan: *FRI 4023, 4205, 7059, 7232, 7471.* – Trengganu: *FRI 17938.* – Pahang: *FRI 3155, 8587; KEP 100101, 104403, 108969; Kadim & Mahmud 95.* – Negri Sembilan: *Everett FRI 14219; FRI 14649.* – Malacca: *de Montigny s.n.* – Johore: *Cockburn FRI 7650; Shah & Kadim MS. 430.* – Panang: *de la Croix (5455); Curtis 2479; Whitmore FRI 0264; Mainga y 1279; Wallich Cat. 6802.* – P. Tioman: *Kadim & Noor KN. 526.*
SINGAPORE: *Anderson 10; Ridley 4813; Sinclair 8907.*
SUMATRA. East Coast: Asahan, *Krukoff 4289;* Sibolangit: *Lörzing 5258, 12207, 16703.* – Palembang: *Lambach 1335.*

Note: A very characteristic species, standing out by the flaking bark of the twigs, the large leaves, and the long, dense, wolly tomentum on twigs, petioles, flowers, and fruits. The present circumscription of the species is the same as that by Sinclair and earlier authors.

17. Knema furfuracea (Hook. *f.* & Th.) Warb.

Myristica furfuracea Hook. *f.* & Th., Fl. Ind. 1 (1855) 159; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 318,

p.p., pl. 155 (incl. var. *major*). – *K. furfuracea* Warb., Mon. Myrist. (1897) 581, t. 24, fig. 1–2; Sinclair, Gard. Bull. Sing. 16 (1958) 275, fig. 2, pl. IB; 18 (1961) 209, *p.p.* – Type: Penang, collect. *Porter* or *Wallich* in *Hb. Hookerianum* (K; iso A, *n.v.*), not *Wallich Cat 6810.*
Myristica longifolia auct. non. Bl.: Hook. *f.* & Th., Fl. Ind. 1 (1855) 156, *p.p.*

Distribution: Southern Peninsular Thailand, Malaya, Singapore.

THAILAND. Southern Peninsular, Trang: *Phusomsaeng 121.*
MALAYA. *s. loc.: Hb. Griffith 4346, Ridley 101* – Kedah: *FRI 0410, 4702, 11536; Ridley 15510.* – Prov. Wellesley: *Curtis 1161.* – Perak: *FRI 0561, 3032, 3115; KEP 98651, 99831, 104601, 104623, 104667; King's Coll. 5600, 6025, 6059.* – Kelantan: *FRI 4025, 4051, 4107, 4161, 4448, 5327, 7170; Sha & Kadim MS. 536.* – Trengganu: *Whitmore FRI 3902.* – Pahang: *Kadim & Mahmud 22; Ridley 2261; Shah & Noor MS. 1973; FRI 14739, 17854.* – Selangor: *Whitmore FRI 0350, 15953.* – Negri Sembilan: *FRI 021533.* – Malacca: *Goodenough 2001; Maingay 1287.* – Johore: *FRI 5498, 7952; Kep FRI. 14108; Shah & Kadim 391; Samsuri & Shukor SA. 514.* – Langkawi I: *FRI 6825, 11206, 15023.* – P. Penang: *Anon. 1823; Haniff 131; Ridley 2769; Kiah SFN 35330.* –
SINGAPORE: *Sinclair SFN 39488; Samsuri Ahmad SA 1216, 1218.*

Note: 1. The present circumscription of *K. furfuracea* is much narrower than and quite different from that accepted by Sinclair, as I have taken out of synonymy and accepted as a different species *K. pierrei* Warb., which includes all specimens cited from Indo China; furthermore, I have excluded the specimens cited from Thailand north of southern Peninsular Thailand, and presently described under *K. tenuinervia;* the specimens cited for Sumatra are described as *K. lampongensis*, and those from Borneo as *K. pallens*. Some recently collected Malayan specimens, also resembling *K. furfuracea*, have presently been segregated as *K. lamellaria*. The specimen *Everett Kep. FRI 14108*, from SE. Johore, somewhat deviates from the present species by its larger male flowers, *c.* 5.5 mm diam.

2. The type specimen is in *Herb. Hookerianum*, in K, a collection possibly by *Porter* or *Wallich*. The specimen *Wallich Cat. 6810*, cited in the synonymy in the original description as *K. glaucescens Wall. Cat. 6810, non* Jack, is actually *K. plumulosa* Sinclair.

King, *l.c.*, mentions the sub-accrescent perianth at the base of the fruit; this is possibly wholly or partly based on *Wall. 6810*, belonging to *K. plumulosa*.

18. Knema lampongensis de Wilde, *sp. nov.*

Ramuli in parte apicali 5–10 mm diam., tomento e pilis 1–2.5 mm longis composito, deorsum cortice conspicue lamellari. Folia chartacea ad coriacea, subtus glabra. Inflorescentiae ♂ sessiles. Flores ♂ pedicello 7–9 mm longo, bracteolato, bracteola ad vel infra medium apposita; perianthium in alabastro subgloboso-obovoideum, 5–6 × 5–6.5 mm. Antherae 13 vel 14, subsessiles vel brevissime stipitatae. Discus staminalis planus, 2–2.5 mm diam. (antheris inclusis); columna staminalis 1–1.5 mm longa.

Type: Sumatra, Lampong, G. Rati Berenong, 9 Nov. 1921, ♂ fl., *Iboet 159* (L).

Tree 10–15 m. *Twigs* in apical portion 5–10 mm diam., the tomentum composed of hairs 1–2.5 mm long, lower down with the *bark* distinctly flaking. *Leaves* chartaceous to coriaceous, glabrous beneath. *Male inflorescences* sessile. *Male flower* pedicels 7–9 mm long, with the bracteole at or below the middle; *perianth* in bud subglobose-obovoid., 5–6 × 5–6.5 mm. *Anthers* 13 or 14, subsessile or just stiped. *Staminal disc* flat, incl. anthers 2–2.5 mm diam.; staminal column 1–1.5 mm long. *Female flowers* not seen. *Fruits* obovoid to subglobose, *c.* 25 × 20 mm,

with dense brown tomentum of hairs 0.6 – 1 mm long; stalk *c.* 10 mm long; stigma remnants many-lobulate, sessile.

Distribution: Malesia: Sumatra, Riouw I., Anambas I.

SUMATRA. E. Coast (or Palembang?): Batoe Pantjeh, *Forbes 2694.* – Lampong: G. Rati Berenon, *Iboet 159.* – Riouw: *Teijsmann s.n.* – Palembang: *Teijsmann 3745.*
BORNEO. Anambas I.: *Henderson SF. 20372.*

Notes: 1. This species is closely related to *K. furfuracea*, *K. lamellaria*, and *K. pallens;* its distributional area is more or less in between as well; for differential characters see the key to the species.

2. The specimen *Teysmann s.n.*, from Riouw, is somewhat doubtful; it is almost sterile, and may represent *K. furfuracea* as well.

3. The specimens belonging to the present new species were included in *K. furfuracea* by Sinclair.

19. Knema lamellaria de Wilde, *sp. nov.*

Ramuli in parte apicali 7 – 12 mm diam., tomento e pilis 1 – 2 mm longis composito, subtus cortice conspicue lamellari. Folia chartacea ad coriacea, subtus glabra. Inflorescentiae ♂ sessiles. Flores ♂ pedicello 16 – 21 mm longo, bracteolato, bracteola circa medium apposita; perianthia in alabastro subgloboso-obovoidea, ca. 7 × 8 mm. Antherae ca. 20, subsessiles ad brevissime stipitatae. Discus staminalis (antheris inclusis) planus, ca. 3.5 mm diam.; columna staminalis ca. 1.5 mm longa. Tomentum fructus obtegens e pilis 3 – 5 mm longis caducis compositum.

Type: Malaya, C. Pahang, Keran Game Res., 14 March 1967, ♂ fl., *Whitmore FRI 3482* (L).

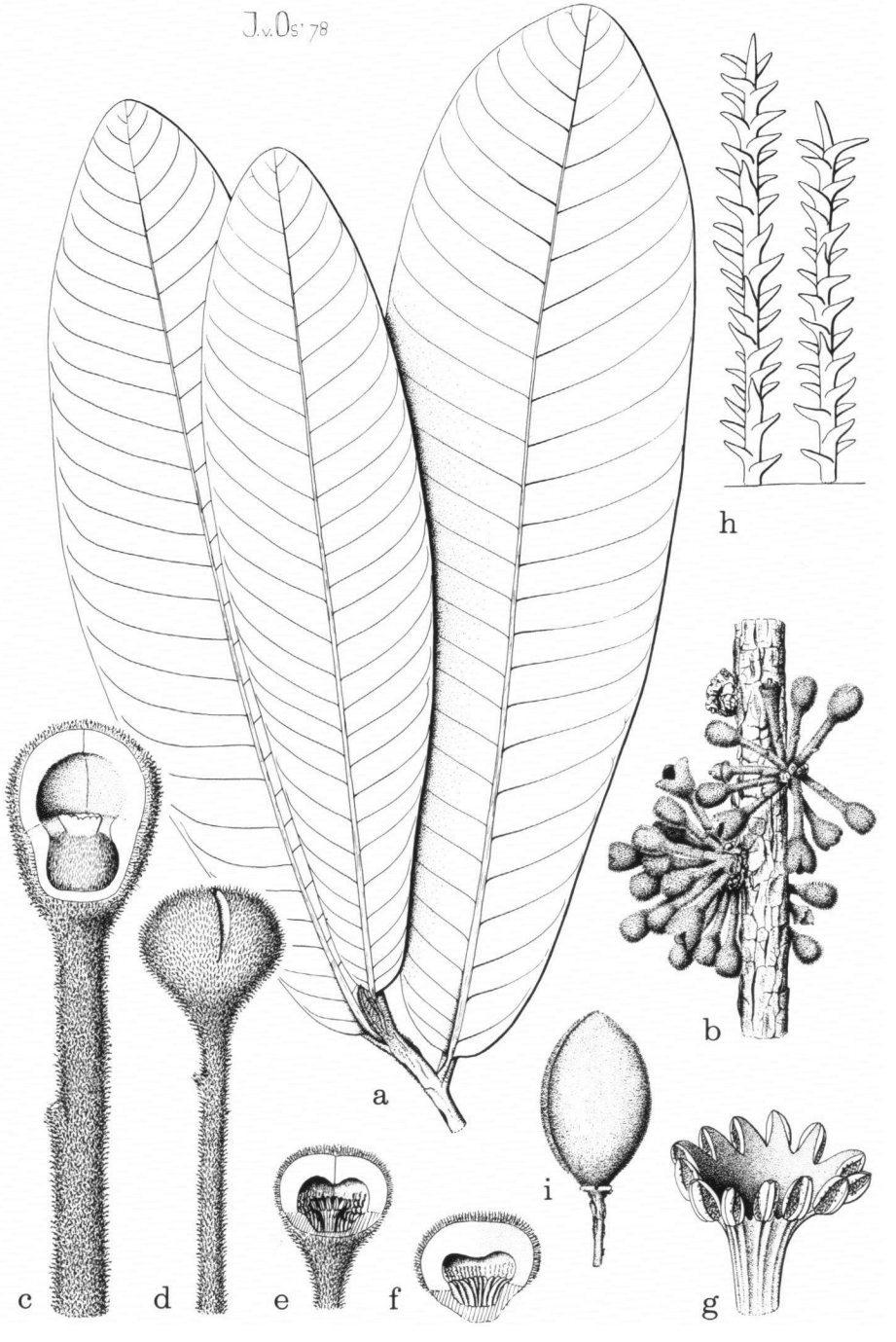
Tree 10 – 20 m. *Twigs* in apical portion 7 – 12 mm diam., the tomentum composed of hairs 1 – 2 mm long, lower down with the *bark* distinctly flaking. *Leaves* chartaceous to coriaceous, glabrous (i.e. early glabrescent) beneath. *Male inflorescences* sessile. *Male flower* pedicels 16 – 21 mm long, the bracteole situated at about halfway; *perianth* in bud subglobose-obovoid, *c.* 7 × 8 mm. Anthers *c.* 20, subsessile to just stiped. *Staminal disc* flat, incl. anthers *c.* 3.5 mm diam.; staminal column *c.* 1.5 mm long. *Female flowers* not seen. *Fruits* ellipsoid-obovoid to oblong, 40 – 45 × 20 – 26 mm, with the tomentum composed of hairs 3 – 5 mm long, caducous or rather easily rubbed off; stalk 18 – 25 mm long.

Distribution: Malaya.

MALAYA. Trengganu: *Cockburn FRI 10574.* – Pahang: *FRI 3482, 17188.*

Notes: 1. This belongs in the close alliance with *K. lampongensis* from Sumatra and *K. pallens* from Borneo, as well as with *K. furfuracea* which differs by much smaller male flowers, shortly stalked fruit, etc.; for other differentiating characters see the key to the species. Also rather closely related seem *K. lunduensis* and its smaller relative *K. latericia*.

2. Specimens of the present new species had not yet been collected when Sinclair wrote his revisions of *Knema;* the three known collections are from 1967, 1968, and 1970.


J.v.Os' 78
a
b
c
d
e
f
g
h
i

20. **Knema pallens** de Wilde, *sp. nov.* – **Fig. 4.**

Ramuli ad apices 5–12 mm diam. tomentoque pilis 0.2–1 mm longis, deorsum cortice distincte lamelloso obtecti. Folia chartacea usque coriacea, subtus glabrescentia. Inflorescentiae ♂ sessiles. Flores ♂: pedicelli 12–20 mm longi, bracteola medio vel supra inserta; perianthium in alabastro subglobosum usque late obovoideum, 6–10 mm longum, 6.5–10 mm latum. Antherae 15–23, subsessiles. Discus staminalis (sub)planus, antheris inclusis 2.5–4.5 mm diam.; columna staminalis 1.0–1.5 mm longa. Fructus persistenter pilis 1.0–1.5 mm longis tomentosus.

T y p e : Borneo, Sabah, Keningau Dist., 25 May 1971, ♂ fl., *Saikeh Lantoh SAN 73312* (L).

Tree 8–30 m. *Twigs* in apical portion 5–12 mm diam., the tomentum composed of hairs 0.2–1 mm long, lower down with the *bark* distinctly flaking. *Leaves* chartaceous to coriaceous, glabrous beneath. Male *inflorescences* sessile. *Male flower* pedicels 12–20 mm long, the bracteole situated at or above halfway; *perianth* in bud subglobose to broadly obovoid, 6–10 × 6.5–10 mm. *Anthers* 15–23, just sessile. Staminal disc flattish, incl. anthers 2.5–4.5 mm diam.; staminal column 1–1.5 mm long. *Female flower* pedicels 10–20 mm long; perianth in bud *c.* 11 × 8–9 mm. Stigma 10–14-lobulate. *Fruits* ellipsoid, 35–55 by 25–35 mm, with the tomentum composed of hairs 1–1.5 mm long, persistent; stalk (10–)14–30 mm long.

D i s t r i b u t i o n : Borneo.

BORNEO. S a r a w a k : *Purseglove P. 5047; S. 13687, 14498, 32964, 37794.* – S a b a h : *SAN. 15430, 17111, 17402, 17504, 19193, 20148, 20858, 26830, 26888, 27501, 29851, 33555, 34708 (NT. 231), 49148, 63602 (NT. 231), 72162, 72251, 73312.* – E. K a l i m a n t a n : Nunukan, *Kostermans 10713;* Tarakan, *Meijer 2533;* Telok Kaba, N. of Samarinda, *Soegeng 98.*

N o t e s : 1. This species is one of a group of four closely allied species, to which belong furthermore *K. furfuracea*, *K. lamellaria*, and *K. lampongensis*. I is most closely related to *K. lamellaria* from Malaya, which differs by serveral smaller characters as given in the key and by the fruits, which have a ± deciduous tomentum composed of hairs 3–5 mm long.

2. Specimens of the present new species were by Sinclair (1961, p. 210) included in *K. furfuracea*.

21. **Knema psilantha** de Wilde, *sp. nov.*

Ramuli apicibus 3–5 mm diam. tomentoque pilis 0.5–1 mm longis, deorsum cortice distincte lamelloso obtecti. Folia tenuiter coriacea, subtus cito glabrescentia. Inflorescentiae ♂ sessiles; flores

Fig. 4. *Knema pallens* de Wilde – a. habit of twig apex with leaves, × ¼; b. portion of older branch with female inflorescences, × ½; c. opened mature female flower bud showing the pistil, pedicel with bracteole scar about halfway, × 2½; d. mature male flower bud, × 2½; e. opened mature male perianth in bud showing the androecium (somewhat shrunken by desiccation), × 2½; f. ditto, androecium removed, showing furrowed inner basal part of perianth, × 2½; g. androecium, × 10; h. sample of hairs from male perianth, × 60; i. fruit, with remnants of tomentum on the stalk, × ½. – a–c. from *SAN 73312*; d–h. from *SAN 29851*; i. from *S. 32964*.

tomento fere generaliter caduco induti. Flores♂: pedicelli 2 – 3 mm longi, bracteola circa medio vel usque ad apicem inserta; perianthium in alabastro plus minus obovoideo-ellipsoideum, ca. 4.5 – 5 mm longum, 3 – 3.5 mm latum. Antherae 6 vel 7, distincte stipitatae. Discus staminalis plus minus planus, antheris inclusis ca. 1.5 mm diam.; columna staminalis 1 – 1.2 mm longa.

Type: Borneo, Sarawak, Kapit Dist., 18 Aug. 1961, ♂ fl., *Anderson S. 14373* (L; iso K).

Tree 5 – 10 m. *Twigs* in apical portion 3 – 5 mm diam., the tomentum composed of hairs 0.5 – 1 mm long, lower down with the *bark* distinctly flaking. *Leaves* thinly coriaceous, glabrous (i.e. early glabrescent) beneath. Male *inflorescences* sessile; flowers with largely deciduous tomentum. *Male flower* pedicels 2 – 3 mm long, the bracteole situated about halfway or towards the top; *perianth* in bud ± obovoid-ellipsoid, *c.* 4.5 – 5 × 3 – 3.5 mm. *Anthers* 6 or 7, distinctly stiped. *Staminal disc* flattish, incl. anthers *c.* 1.5 mm diam.; staminal column 1 – 1.2 mm long. *Female flower* pedicels 1 – 2 mm long; perianth in bud 8 – 9 × 5 – 5.5 mm. *Stigma* sessile, 10 – 12-lobulate. *Fruits* ellipsoid, 25 – 30 × 20 mm, with the tomentum composed of hairs *c.* 1 mm long, persistent; stalk *c.* 2 mm long.

Distribution: Borneo (Sarawak, Sabah).

BORNEO. Sarawak: Kapit, 3rd. Div., *S. 14373, 29064.* – Sabah: Beaufort Dist., *SAN. 22209.*

Notes: 1. Much resembling, though apparently not closely related to, *K. latericia* and *K. furfuracea; K. latericia* differs by the more depressed-globose mature male flower buds, not glabrescent, with a quite different androecium, and also by the more slender twigs that are usually much less conspicuously flaking; *K. furfuracea* has longer male flower pedicels and the androecium quite differently shaped, but the flowers are often largely glabrescent as well.

The present species is strikingly characterized by the ellipsoid male flowers, with the androecium with only 6 or 7 conspicuously long-stiped anthers.

2. The specimens on which this new species is based were not yet collected when Sinclair published his revision.

22. Knema percoriacea Sinclair

K. percoriacea Sinclair, Gard. Bull. Sing. 18 (1961) 268, fig. 21 – Type: Borneo, East Kalimantan, Loa Djanan, west of Samarinda, ♂ fl., 6 Sept. 1954, *Kostermans 9945* (K; iso L; BO; SING, *n.v.*).

Distribution: Borneo (Sarawak, Brunei, Sabah, NE., E., and SE. Kalimantan).

Notes: 1. The many collections made in the last decades contributed considerably to our knowledge of the variability of this now complex species. Four main groups, presently treated as forms, can be distinguished, as below.

2. The anthers are usually shortly stalked (sessile in forma *longepilosa*) and usually curved upward; the staminal column is rather short and stout, and tapering to the base. The species is much related to *K. lunduensis*, where further information on the differences can be found.

3. *K. percoriacea* seems also closely related to *K. latericia* and *K. furfuracea*, and if sterile certain specimens may be difficult to discriminate. Sinclair, *o.c.* p. 271,

argues that the number of anthers is a good criterion for separation: 14–17 in *K. percoriacea*, 9–12 in *K. latericia*, and 10–13 in *K. furfuracea*. In the present study, the number was found to be more variable, viz. 10–18 (10–12 in the type specimen). Sinclair also mentions that the tomentum of the flowers does not tend to get rubbed off as in *K. furfuraceae*, but the present author found in some specimens the tomentum of the flowers partly deciduous as well. The male pedicels are 3–4 mm long, shorter than in both related species.

As a whole, the circumscription of *K. percoriacea* is presently the same as that conceived by Sinclair.

KEY TO THE FORMS

1a. Twigs at apex 3–4 mm diam., with tomentum composed of rusty-red hairs *c.* 0.5 mm long. Anthers 10–12. Leaves coriaceous. *E. Kalimantan, Sarawak.* **a.** forma **percoriacea**

b. Twigs at apex 4–6 mm diam., with the tomentum either composed of pale brown hairs *c.* 0.5 mm long, or hairs chocolate-coloured or dark brown, *c.* 1–2(–3) mm long. Anthers 11–18. Leaves chartaceous to coriaceous. 2.

2a. Leaves rather chartaceous. Tomentum on twig apex pale brown or yellowish brown by hairs 0.3–1 mm long (sometimes early shed). Anthers 11–14. *Sarawak, Brunei, Sabah, Nunukan I.* . . . . . **b.** forma **sarawakensis**

b. Leaves coriaceous. Tomentum on twig apex chocolate to dark brown by hairs 1–2 mm long. Anthers 15–18. . . . . 3.

3a. Tomentum of flowers composed of hairs *c.* 1 mm long. Anthers 15. Leaves coriaceous, the reticulation on the lower surface indistinct. *Brunei* **c.** forma **fusca**

b. Tomentum of flowers of hairs 2.5–3 mm long. Anthers 18. Leaves thinly coriaceous, the reticulation on the lower surface very distinct. *Sarawak, 4th Division.* . . . . . **d.** forma **longepilosa**

a. forma **percoriacea**

Twigs in apical portion relatively slender, generally 3–4 mm diam., rather smooth, not or little striate, with dense rusty-red tomentum of hairs *c.* 0.5 mm long, lower down with the *bark* rather inconspicuously flaking. *Leaves* relatively small, coriaceous; reticulation distinct on both surfaces. *Anthers* 10–12. Tomentum of *flowers* composed of hairs 0.5(–1) mm long.

Distribution. Borneo: Sarawak, E. and SE. Kalimantan, in karengas forest.

BORNEO. Sarawak: *S. 37645.* – E. Kalimantan: *Kostermans 6731, 9880, 9945.* – SE. Kalimantan: *Achmad bb. 34455, 34467, 34469; Kostermans 4060, 4164, 4535; Sauveur 17, 122; Winkler 2110.*

b. forma **sarawakensis** de Wilde, *forma nov.*

Ramuli apicibus 4–6 mm diam., tomento e pilis ca. 0.5 mm longis obtecti. Folia plerumque chartacea. Antherae 11–14.

Type: Borneo, Sarawak, Kapit, 3rd Div., ♂ fl., 18 Oct. 1965, *E. Wright S. 23889* (L; iso BO, K, SING; A, KEP, MEL, SAN, *n.v.*).

Twigs in apical portion 4–6 mm diam., coarsely striate, with (pale) brown or yellowish brown tomentum composed of hairs 0.3–1 mm long (sometimes early shed), the *bark* lower down ± distinctly and coarsely flaking. *Leaves* generally relatively large, chartaceous to coriaceous; reticulation distinct on both surfaces. *Anthers* 11–14. Tomentum of *flowers* composed of hairs (0.5–)1 mm long.

Distribution. Borneo: Sarawak, Brunei, Sabah, and NE. Kalimantan (Nunukan I.).

BORNEO. Sarawak: *Anderson 4309; Anderson & Keng K 8; Chew Wee-lek CWL. 411; Hou Ding 460; Anderson & Keng S. 4306; Nielsen 295; Sinclair & Kadim 10244; S. 13384, 13426, 19887, 23645, 23733, 23889, 24082, 24233, 24834, 27971, 29314, 34717, 35008, 36548, 36635, 36663, 37565, 38527.* – Brunei: *Ashton BRUN 5270.* – Sabah: *SAN 16749, 17080, 25859, 28094, 31182, 35096, 72251.* – NE. Kalimantan: Nunukan I., *bb. 26185.*

Note: In this form the tomentum of the flowers is often partly deciduous or rather easily rubbed off, as in *K. furfuracea.*

c. forma **fusca** de Wilde, *forma nov.*

Ramuli apicibus ca. 6 mm diam., tomento saturate brunneo e pilis ca. 1.5 mm longis composito obtecti. Florum tomentum saturate brunneum, pilis ca. 1 mm longis formatum. Folia coriacea. Antherae 15.

Type: Borneo, Brunei, 24 Jan. 1959, ♂ fl., *Ashton BRUN 5164* (L; iso BO, K).

Twigs in apical portion *c.* 6 mm diam., early flaking, with dark brown tomentum of hairs *c.* 1.5 mm long. Tomentum of flowers composed of dark brown hairs *c.* 1 mm long. *Leaves* coriaceous, the reticulation on both surfaces indistinct. *Anthers* 15, subsessile.

Distribution. Borneo: Brunei, known only from the type.
Note: In habit, not in the flowers, this resembles *K. plumulosa* from Malaya.

d. forma **longepilosa** de Wilde, *forma nov.*

Ramuli apicibus 3–5 mm diam., tomento ferrugineo e pilis 1.5–2 mm longis obtecti. Florum tomentum pilis ferrugineis 2.5–3 mm longis formatum. Folia tenuiter coriacea. Antherae 18.

Type: Borneo, Sarawak, Maudi, 4th Division, ♂ fl., 7 April 1965, *Sibat ak Luang S. 22985* (L; iso K; A, SAN, SING, *n.v.*).

Twigs in apical portion 3–5 mm diam., finely striate, with dense rusty tomentum composed of hairs 1.5–2 mm long, the *bark* lower down flaking. *Leaves* thinly coriaceous, distinctly reticulate on both surfaces. Tomentum of *flowers* composed of hairs 2.5–3 mm long. *Anthers* 18, sessile.

Distribution. Borneo: Sarawak, 4th Division, known only from the type.
Note: The specimen on which this new form is based strongly resembles *K. plumulosa* from Malaya in habit, but in that species the male flower is quite different by a mamillate staminal disc, and by a disc at the base of the perianth, around the column.

23. **Knema lunduensis** (Sinclair) de Wilde, *stat. nov.*

K. latericia Elmer var. *lunduensis* Sinclair, Gard. Bull. Sing. 18 (1961) 244, fig. 15 A, D, & E. – Type: Borneo, Sarawak, 1st. Division, G. Gading, Lundu, 17 Aug. 1960, fr., Sinclair & Kadim in *Sinclair 10381* (K; iso L; A, E, SAR, SING, *n.v.*).

Distribution: Borneo (Sarawak, Sabah).

BORNEO. Sarawak: *Anderson 4552; Chew Wee-lek CWL. 411, 592; Purseglove P 4549, 4674, 5367; Sinclair 10375, 10381; S. 15378, 15406, 15674, 16321, 17552, 18478, 18620, 19177, 21931, 34359, 34236, 36565, 37486.* – Sabah: *SAN 16709, 22209, 53259, 72162.*

Notes: 1. Closely related to *K. latericia*, and to a lesser extend to *K. furfuracea* and *K. percoriacea;* it is more or less intermediate between the two species mentioned first. On the whole the present species is stouter than *K. latericia*, though coarse forms of *K. latericia* may be difficult to distinguish. *K. furfuracea* differs markedly by its cordate leaf bases, though in *K. lunduensis* the base is occasionally subcordate in the larger leaves. The fruit is generally larger than that of *K. latericia*, with longer hairs of (1–)1.5–2 mm. *K. percoriacea* has a quite different general habit, and usually has more coriaceous leaves.

2. The present species was accepted as a variety of *K. latericia* by Sinclair.

24. **Knema latericia** Elmer

K. latericia Elmer, Leafl. Philip. Bot. 5 (1913) 1815; Sinclair, Gard. Bull. Sing. 16 (1958) 278, fig. 3, & pl. IIA; 18 (1961) 238, fig. 15 B, C, G., excl. var. *lunduensis*. – Type: Philippines, Palawan, March 1911, ♀ fl., fr., *Elmer 12757* (iso in BM, K, L, P; A, BO, BRSL, CAL, E, G, LE, NSW, NY, U, US, *n.v.*). For other synonyms see under the subspecies.

Distribution: Peninsular Thailand, Malaya, Singapore, Sumatra, Borneo, Philippines; not in Indo-China.

Notes: As compared to the circumscription of this species by Sinclair (1961), I have accepted the var. *lunduensis* as a separate species. Even after this segregation *K. latericia* remains a complex entity in which 3 subspecies are recognized; of these the subsp. *ridleyi* is very variable again, incl. small- and large-fruited forms, and coarse forms difficult to separate from smaller-leaved *K. lunduensis*.

The type-subspecies differs by having the bark of the twigs ± non-flaking, a character regarded as rather important in the present treatment, and at least as of great practical use in the taxonomy of *Knema*. As this character varies within the species, however, *K. latericia* appears two times in the general key to the species. Possibly, the species is heterogeneous, and it might have been better classified in X. series *Glomeratae*.

KEY TO THE SUBSPECIES

1a. Bark of older twigs not or hardly longitudinally cracking, not flaking. Twigs at apex coarsely rusty pubescent, striate or ridged, and ± angled by ridges from the bases of the petioles. *Palawan I.* . . . . . **a.** subsp. **latericia**

b. Bark of older twigs usually longitudinally cracking, later on (finely) flaking. Twig apices variably hairy, striate or not, usually not angled. . . . 2.

2a. Tomentum of twigs at apex and of flowers dark brown or rusty. Male flower buds ± depressed globose, often somewhat broader than long. Staminal disc

usually convex or low-mamillate. Leaves rather large, 4 – 10 cm broad, above drying dark brown to green brown, beneath pale brown to grey-glacous. Fruits variable in size, with bright brown to rusty-reddish tomentum. *Malay Penins. (incl. Peninsular Thailand), Sumatra (Bangka), Borneo.* . **b.** subsp. **ridleyi**

b. Tomentum of twigs at apex and of flowers pale brown or yellowish brown. Male flower buds obovoid. Staminal disc flat or slightly convex. Leaves smaller, *c.* 11 – 22 × 2 – 5 cm, above drying pale brown or pale greenish-brown, beneath usually whitish. Fruits rather small, with pale brown or yellowish-brown tomentum. *Borneo.* . . . . . **c.** subsp. **albifolia**

a. subsp. **latericia**

[*K. badia* Merr., *nom. nud. in sched.* – Type: Palawan, fr., May 1914, *Agama For. Bur. 21612* (US, *n.v.*; iso K, P).]

K. latericia Elmer var. *latericia;* Sinclair, Gard. Bull. Sing. 18 (1961) 240, *p.p.*, for the type only.

Distribution: Palawan.

PHILIPPINES. Palawan: *Elmer 12757; Agama For. Bur. 21612; PNH 12456, 14233, 23062, 80821.*

Note: Resembles in the leaves *K. tomentella* from the Moluccas, whereas the appearance of the twig apices is reminiscent of that of *K. korthalsii* from Palawan and Borneo.

b. subsp. **ridleyi** (Gandoger) de Wilde, *stat. nov.*

[*K. elongata* Warb., *nom nud. in sched.* – Type: Borneo, ♂ fl., fr., *Korthals (10)* (L).]

K. conferta (King) Warb. var. *borneensis* Warb., Mon. Myrist. (1897) 580, *p.p.* – *Myristica conferta* King var. *borneensis* Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 1. – Lectotype: Borneo, Sarawak, fr., *Beccari 2003* (FI, *n.v.*; iso K, P).

Myristica ridleyi Gandoger, Bull. Soc. Bot. Fr. 66 (1919) 226, in clavi – Type: Singapore, *Ridley s.n.*, date 1898 (LY, *n.v.*).

K. meridionalis Sinclair, Gard. Bull. Sing. 13, 2 (1951) 297, fig. 1 – Type: Singapore, ♀ fl., 17 Apr. 1950, *Sinclair SFN 38561* (SING, *n.v.*; iso K, *n.v.*).

K. latericia Elmer var. *latericia auct.*: Sincl., Gard. Bull. Sing 18 (1961) 240, fig. 15 B, F, G, *p.p.*, excl. type.

Distribution: Peninsular Thailand (deviating), Malaya, Singapore, Sumatra (Bangka), Borneo.

THAILAND. W. Peninsular, Kapor, *Kerr 16686* (a deviating specimen).

MALAYA. – Trengganu: *Cockburn FRI 8267; Suppiah FRI 14833.* – Johore: *Burkill HMB. 1842; FRI 7857, 8672, 16450; Hassan & Kadim H. 45; Kadim & Noor KN. 192; Shah & Kadim 357; Maxwell 78 – 252.*

SINGAPORE. *Burkill 1251; Langlassé 306; Ridley 12541; SFN 34957, 38915; Noor SRMN. 19; Samsuri 1227.*

SUMATRA. Bangka: *H.B. 3484* (BO, *n.v.*); *Kostermans & Anta 691* (BO, *n.v.*).

BORNEO. Sarawak: *Anderson 4551, 4552; Beccari 2003; Purseglove P. 4680; S. 12681, 34729, 35638.* – S. & SE. Kalimantan: *s. loc., Korthals (10);* Sampit, *Kostermans 7964;* P. Laoet, *Verhoef 78;* Jaro Dam, *Kuswata 939.* – E. Kalimantan: *Endert 3178, 3342; Kostermans 5233, 5449, 7396, 13721.* – Sabah: *N. B. For. Dept. 1737, 1796, 4503, 4913, 7250, 9394, 9395; Chew & Corner RSNB. 7085; Clemens 28325, 50433; Elmer 20809; Fabia A 4003; SAN A 1996, A 2917, A 3957, 15293, 15382, 16515, 16918, 17322, 21147, 21370, 21704, 21762, 24488, 27486, 28792, 29423, 31695, 33703, 34007, 34172, 34683, 34892, 35008, 35275, 35336, 36360, 36447, 37506 NT. 655, 36903, 38120, 48852, 51106, 53425, 71951, 72291, 73224, 73308, 73664, 74436, 76751, 78675, 79662, 79739, 79820, 80778, 80893; SFN 26772; Villamil 241.*

Note: This subspecies is variable in many aspects; two sorts of deviating specimens are noteworthy, viz.:

(1) *Kerr 16686*, with male flowers, from Kapor, W. Peninsular Thailand, deviates by the absence of cracks in the bark of the twigs, by the short pedicels, only *c.* 2–3 mm long, and by the flat staminal disc with only 8 or 9 (or 10) anthers. It is the only specimen of *K. latericia* from Thailand seen by me. The specimen *FRI 14833*, from nearby Trengganu, Malaya, is almost similar but has 12 anthers.

(2) *S. 32311* is a very slender specimen, with small, narrow, membranous leaves 8–13 × 1–2.5 cm; the twigs at apex 1.5–2 mm diam. The rather immature fruits are small, only *c.* 10 mm long, and have, as judged from the flower remnants, developed from small female flowers. The older bark in this specimen is not or only hardly flaking. It was collected from a ridge in lowland Dipterocarp forest in Sarawak.

c. subsp. **albifolia** (Sinclair) de Wilde, *stat. nov.*

K. latericia Elmer var. *albifolia* Sinclair, Gard. Bull. Sing. 18 (1961) 243, fig. 15 C. – Type: Sabah, Sepilok F. R., 27 June 1957, st., *Sinclair 9296* (K; iso BM, L, P; A, B, E, M, PNH, SAN, SING, *n.v.*).

Distribution: Borneo.

BORNEO. Sarawak: *Anderson (& Keng) K 10, K 93; Jacobs 5355, 5356, 5393; S. 22833, 23964, 29077, 32311, 34710.* – S. & SE. Kalimantan: *Kuswata 763, 768; Sauveur H–11, 112; de Vogel 843; Wiriadinata 840.* – E. & NE. Kalimantan: *Endert 2434, 5113; Kostermans 5690;* P. Nunukan, *Paymans 83.* – Sabah: *Agama 556; Elmer 20895, 21040, 21409; SAN A 1883, A 3433, A 4665, 15394, 30624, 36561, 38982, 70894, 71038, 71951, 73308, 73664, 74436; Sinclair c.s. 9296.*

Note: *K. latericia* subsp. *albifolia* was recognized as a variety by Sinclair, l.c., mainly on its narrower leaves and paler lower leaf surface, nerves, flowers, and fruits.

Possibly, the taxon merits the status of species, as it seems usually to differ from the other subspecies also in the general shape of the male flower buds, which is usually obovoid rather than depressed globose, and by the staminal disc, which is flat or but slightly convex, not convex or low-mamillate as usual in subsp. *ridleyi*. Several specimens, however, seem to be ± intermediate with subsp. *ridleyi*, in habit as well as in flower shape.

IV. series OBOVOIDEAE de Wilde, *ser. nov.*

Alabastra ♂ longitudine et diametro subaequales, forma obovoidea vel pyriformi, in parte media inferiore plus minus angustata, valvis anthesi circiter usque ad dimidium vel ad 3/4(–4/5) partem liberis. Columna staminalis quam disci diam. (antheris inclusis) aequilonga vel brevior. Antherae 7–25. Discus staminalis planus. Flores tomento persistente induti. Folia subtus tomento conspicuo vel inconspicuo, persistenti vel cito caduco obtecta. Ramuli apicibus 1–10 mm diam., in partibus vetustioribus cortice haud lamelloso instructi.

Typus: *Knema oblongata* Merr.

Species 25–35.

Note: This series includes also 34. *K. globularia* (Lamk.) Warb., with *K. corticosa* Lour., the type of the genus, as a synonym. The generic name is not adopted for the present series because the serial position of *K. globularia* is uncertain, as alluded to in chapter 3 and shortly discussed in the notes under the species.

25. Knema rigidifolia Sinclair

K. rigidifolia Sinclair, Gard. Bull. Sing. 16 (1958) 284, fig. 5 (excl. B–D); 18 (1961) 274 – Type: Malaya, Pahang, Fraser's Hill, fr., 16 Aug. 1937, *Corner SFN 33226* (SING, *n.v.*; iso K, L; E, *n.v.*).

Distribution. Endemic in Malaya: Pahang and Selangor; in the mountains.

Notes: 1. Two subspecies are recognized, mainly on the shape and architecture of the male flowers, which are rather fundamentally different. As judged from the limited material there are also some differences in general habit and leaf shape between the subspecies. The male flowers of subsp. *rigidifolia* come close to those of e.g. *K. kinabaluensis* from Sabah, a species also with coriaceous leaves, presently in XI. series *Glaucae*. The subspec. *camerona* has male flowers approaching in shape those of e.g. *K. mandaharan*, i.e. with the mature buds obovoid and tapering in the lower half, and cleft by the valves to *c.* 3/4.

There is also a difference in area, both regions being known to have a somewhat different floristic composition.

2. The figure given by Sinclair with the original description, *l.c.*, fig. 5, is partly wrong: the figures of the male flowers B–D cannot have been drawn after *Purseglove P. 4213*, as these figures clearly represent *K. oblongifolia* and are possibly based upon *Purseglove P. 4275*.

3. Because of the rather essential differences between the two subspecies, which are tentatively kept in the one species *K. rigidifolia*, this species appears two times, and rather wide apart, in the general key to the species based on male specimens.

KEY TO THE SUBSPECIES

1a. Twigs at apex stout, 3–5 mm diam. Leaves rigidly coriaceous, at base rounded to cordate. Male flowers robust; pedicel *c.* 2 mm diam., valves *c.* 1–1.5 mm thick at sutures, splitting the bud to *c.* 2/3 to 3/4; anthers 14–16 **b.** subsp. **camerona**

b. Twigs at apex more slender, 2–4 mm diam. Leaves coriaceous, at base rounded to attenuate. Male flowers less robust; pedicel *c.* 1 mm diam., valves *c.* 0.5 mm thick at sutures, splitting the bud to *c.* 4/5; anthers 8 . **a.** subsp. **rigidifolia**

a. subsp. **rigidifolia**

Distribution: Malaya, Pahang (Pahang/Selangor border: Fraser's Hill, Pine Tree Hill, Ginting Highlands) and Selangor (G. Bunga Bua).

MALAYA. Pahang/Selangor, Fraser's Hill and Pine Tree Hill: *FRI 0237, 2754, 19171; Imp. For. Inst. Herb. (Henderson) 23328; Burkill, Shah, & Noor HMB. 2349; Kep. 94828, 99626; Purseglove P. 4213; Corner SFN 33226;* Ginting Highlands, *Kochummen FRI 16472.* – Selangor, G. Bunga Bua: *Whitmore FRI 0305.*

b. subsp. **camerona** de Wilde, *subsp. nov.*

Ramuli apicibus 3–5 mm diam. Folia rigide coriacea, basi rotundata usque cordata. Flores ♂ robusti; pedicelli 1.5–2 mm diam., valvae ad suturas 1–1.5 mm crassae; alabastra in anthesi per ca. 2/3 usque ad 3/4 partem fissa; antherae 14–16, semisessiles, suberectae. Discus staminalis antheris inclusis 2–2.2 mm diam.; columna staminalis 1–1.2 mm longa.

T y p e : Malaya, Pahang, Cameron Highlands, *c.* 5000 ft., ♂ fl., 10 April 1930, *Henderson SFN s.n.* (K).

Twigs at apex 3 – 5 mm diam., coarsely striate. *Leaves* rigidly coriaceous, at base rounded to shallowly cordate. *Male flowers* robust; pedicels *c.* 5 mm long, 1.5 – 2 mm diam., *perianth* in bud *c.* 4 × 4 – 4.5 mm; valves *c.* 1 – 1.5 mm thick at sutures, splitting the bud to *c.* 2/3 to 3/4. *Staminal disc* incl. anthers 2 – 2.2 mm diam.; *anthers* 14 – 16, half-sessile, suberect; staminal column stout, 1 – 1.2 mm long. *Female flowers* not known. *Fruits* globose, nearly sessile, 38 – 41 mm diam.

D i s t r i b u t i o n : Malaya, Pahang; apparently endemic in the Cameron Highlands.

MALAYA. P a h a n g , Cameron Highlands (Perak – Pahang border): *Ng FRI 5958; Kochummen FRI 16610.*

E c o l o g y : Montane forest; 1500 – 1800 m alt. Flowers and fruits March, April.

26. Knema pulchra (Miq.) Warb.

Myristica pulchra Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 51. – *K. pulchra* Warb., Mon. Myrist. (1897) 600, t. 24 fig. 1 & 2. – S y n t y p e s : Borneo, G. Sakumbang, *Korthals s.n.* (L); G. Prarawin, *Korthals s.n.* (L); River Tewe, *Korthals s.n.* (U; iso CAL *n.v.*).

K. glaucescens Jack var. *cordata* Sincl., Gard. Bull. Sing. 16 (1958) 310, f. 13 D. – *K. cinerea* (Poir.) Warb. var. *cordata* Sinclair, Gard. Bull. Sing. 18 (1961) 181 – T y p e : Malaya, Trengganu, *Sinclair & Kiah SFN 39959* (SING, *n.v.*; iso BM, K, L, P; A, BO, E, KEP, *n.v.*)

D i s t r i b u t i o n : Sumatra (doubtful), Malaya, Borneo.

SUMATRA. P a d a n g : *Beccari 532* (doubtful). – P a l e m b a n g : *Grashoff 1019* (doubtful).
MALAYA. T r e n g g a n u : *Sinclair & Kiah SFN 39959, 40845.* – J o h o r e : *Corner SFN 29015, 29436, 29477.*
BORNEO. S a r a w a k : *Jacobs 5030, 5100; S. 10339, 12511, 12637, 16328, 19226, 21111, 23253, 28953, 33863, 34502.* – W. K a l i m a n t a n : *Hallier 2994, 3013.* – S . & S E . K a l i m a n t a n : *Kuswata 762, 806, 937; de Vogel 848.* – E. K a l i m a n t a n (Kutei): *Endert 2721, 3046; Kostermans 5103, 5209, 5355, 5568, 9762; Soegeng 753.* – N E . K a l i m a n t a n : *Amdjah 696.* – B r u n e i : *(Sow) Kep. 80168.* – S a b a h : *B.N.B. For. Dept. 3022; SAN 22768, 41159.*

N o t e s : 1. Sinclair apparently did not notice the quite differently shaped male flowers as compared to those of *K. cinerea*. Furthermore, in *K. pulchra* the anthers are largely sessile, whereas they are stiped in *K. cinerea*, *K. glauca*, and related species.

2. This is close to the more slender *K. piriformis* (from Borneo); it also seems quite closely related to *K. oblongata* from Borneo, a species which differs by the conspicuous rusty tomentum on twigs, lower leaf surfaces, and flowers and fruits. In habit, not in the flowers, it recalls *K. kostermansiana* (from Borneo).

3. Sinclair mentions in the description of var. *cordata* 13 anthers; I found 12 – 14 in Malaya, and even 14 – 25 in Borneo.

4. The two specimens seen from Sumatra are both somewhat doubtful. They have female flowers and fruits; the fruits are small for the species, and the specimens also deviate somewhat in general habit and in the leaves; possibly they belong to *K. glauca* or *K. sumatrana*.

5. *Jacobs 5030*, with female flowers, has one somewhat enlarged flower containing two normally developed ovaries.

27. Knema piriformis de Wilde, *sp. nov.*

Ramuli apicibus 1.5–3 mm diam., tomento e pilis 0.1(–0.2) mm longis formato, deorsum cortice haud lamelloso obtecti. Folia tenuiter coriacea, subtus citius usque tardius glabrescentia, tomento e pilis minutis ca. 0.1 mm longis formato. Inflorescentiae ♂ sessiles; flores tomento persistente e pilis 0.1–0.2 mm longis induti. Flores ♂: pedicelli 2–5 mm longi, bracteola medio vel supra inserta, perianthio in alabastro obovoideo, 4–5 mm longo, 3–4 mm diam. Antherae 11 vel 12, substipitatae. Discus staminalis planus, antheris inclusis 1.5–2 mm diam.; columna staminalis 1.5–2.2 mm longa.

T y p e : Borneo, Sabah, Ranau Dist., Aug. 1961, ♂ fl., *Meijer SAN 34619* (L; iso K).

Tree 6–12 m. *Twigs* in apical portion 1.5–3 mm diam., with minute tomentum composed of hairs 0.1(–0.2) mm long, lower down the *bark* not tending to crack nor to flake. *Leaves* thinly coriaceous, beneath early to late glabrescent from tomentum of hairs mainly *c.* 0.1 mm long. Male *inflorescences* sessile; flowers with persistent tomentum of hairs 0.1–0.2 mm long. *Male flower* pedicels 2–5 mm long, the bracteole caducous, at or above halfway; *perianth* in bud obovoid, tapering in the lower half, 4–5 × 3–4 mm. *Anthers* 11 or 12, just stiped. *Staminal disc* flat, incl. anthers 1.5–2 mm diam.; staminal column 1.5–2.2 mm long. *Female flowers* not seen. *Fruits* ovoid to ellipsoid, 24–26 × 15–17 mm, with tomentum composed of hairs *c.* 0.1 mm long; stalk *c.* 6 mm long.

D i s t r i b u t i o n : Borneo (Sarawak, Sabah; especially on Mt. Kinabalu and vicinity).

BORNEO. S a r a w a k : *Geh & Samsuri GS. 701* – Sabah: *Clemens 30505, 30888, 32027, 32202, 32852; SAN 34619, 70740.*

E c o l o g y : Montane forest, hill sides, ridges; (400?–)1000–2000 m alt. Flowers Apr. – July, fruits in Jan.

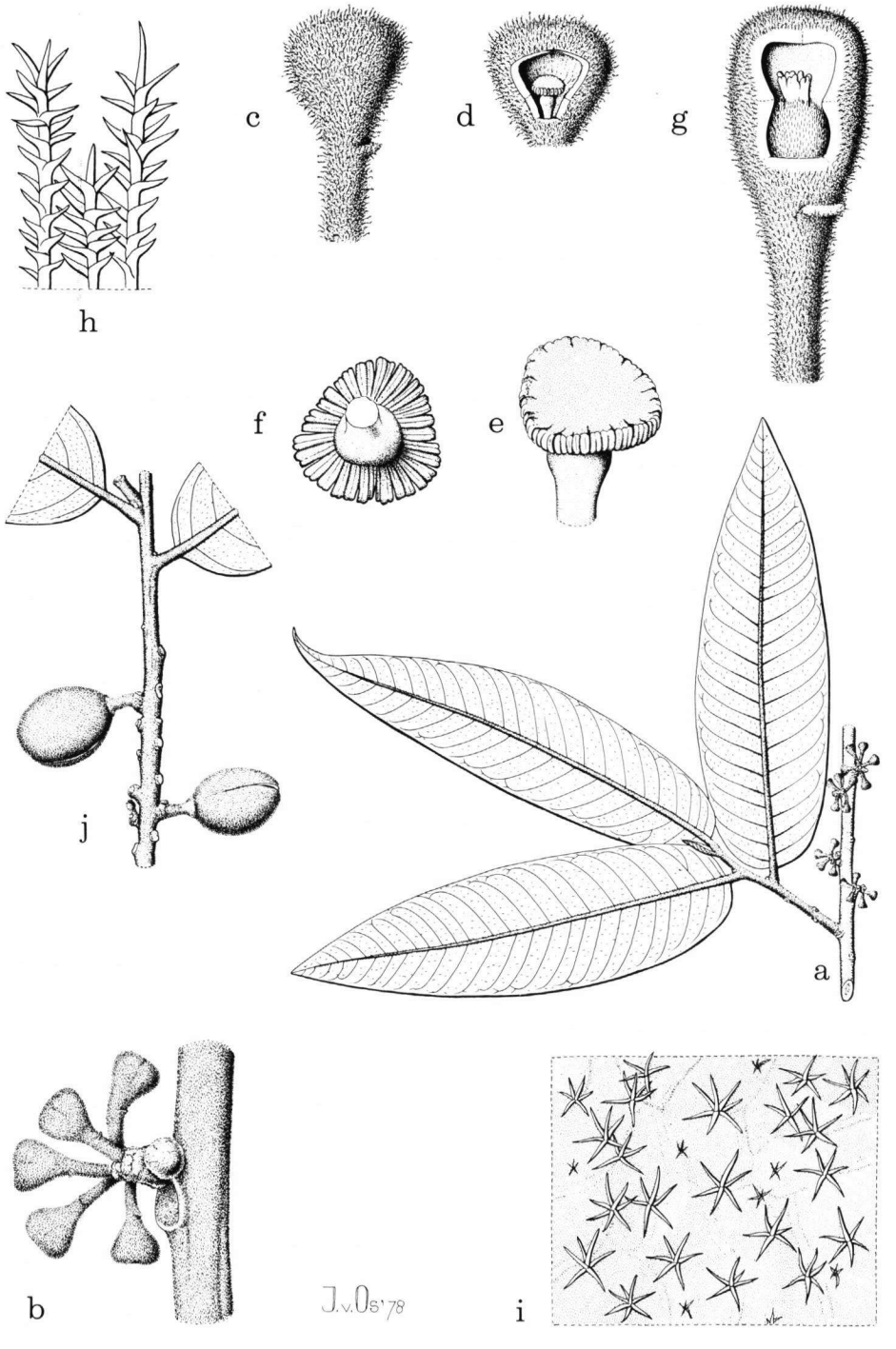
N o t e s : 1. As judged from the shape and architecture of the male flowers this species seems closest related to *K. pulchra*, and to a lesser extend to *K. oblongata*. If sterile it may be confused with *K. hirtella*, the latter having the mature male bud subglobose or only shortly pyriform.

2. Specimens had been determined by Sinclair as *K. cinerea* var. *sumatrana* (presently *K. glauca*) and as *K. korthalsii*, both differing essentially in the globose male flowers, cleft by the perianth valves to *c.* 4/5 or more.

28. Knema oblongata Merr.

K. oblongata Merr., J. As. Soc. Str. Br. 85 (1922) 190 – T y p e : Sabah, Sandakan, ♀ fl., fr., Sept. – Dec 1920, *Ramos 1663* (PNH, *n.v.*; iso BM, K, L; A, BO, BRI, UC, US, *n.v.*).

Fig. 5. *Knema oblongata* Merr. subsp. *oblongata* – a. habit of branchlet with male inflorescences, × ¼; b. male inflorescence, × 1½; c. mature male flower bud, × 3½; d. opened mature male perianth in bud showing the androecium, × 3½; e. androecium, halflateral view, × 15; f. ditto, seen from below, × 15; g. opened mature female flower bud showing the pistil, × 3½; h. sample of hairs from male flower, × 60; i. detail of lower leaf surface with stellate-dendroid hairs of mixed sizes, × 30; j. twig with infructescences, each with a single mature fruit, × ½. – a, b. from *SAN 30740*; c–f, h, i. from *SAN 30369*; g. from *Sinclair 9291*; j. from *SAN 32857*.


h
c
d
g
f
e
j
a
b
J.v.Os '78
i

K. obovoidea Merr., Univ. Calif. Publ. Bot. 15 (1929) 75 – Type: Sabah, Tawau, Elphinstone Prov., ♂ fl., Oct. 1922 – March 1923, *Elmer 21017* (iso in BM, C, K, L, P; A, BO, BR, G, M, NY, PNH, SING, U, UC, *n.v.*).

Distribution: Borneo (Sarawak, rare; Sabah; E. Kalimantan).

Note: This rather complex species, in which 3 subspecies are recognized, was almost entirely included in *K. laurina* by Sinclair, 1961, p. 248. It is distinguished from *K. laurina* by the shape and architecture of the male flowers, the different tomentum on the lower leaf surface (not uniformly of stalked dendroid hairs), by the crater-like hair scars on the upper leaf surface, and, evident after some experience, by the different general appearance or habit. Some specimens were identified by Sinclair as *K. conferta*.

KEY TO THE SUBSPECIES

1a. Tomentum of twigs at apex composed of hairs *c.* 0.2(–0.3) mm long. Lateral nerves *c.* 10 pairs. Mature male flower buds *c.* 2.5 mm diam., with tomentum of hairs 0.1(–0.2) mm long. Anthers 8, shortly stiped. Inflorescences sessile; male flower pedicels *c.* 2 mm long. . . . . **c.** subsp. **parviflora**

b. Tomentum of twigs at apex composed of hairs 0.3–0.6 mm long. Lateral nerves 18–26 pairs. Mature male flower buds 3.5–5 mm diam., with tomentum composed of hairs 0.4–1.0(–2.0) mm long . . . . . 2.

2a. Leaves rather narrow, oblong to lanceolate, 2–5.5 cm wide, at base attenuate to obtuse. Inflorescences peduncled for 1–4 mm. Male flower buds *c.* 4 mm diam.; pedicels 2–3 mm long. Anthers 7–9, almost entirely sessile **b.** subsp. **pedunculata**

b. Leaves usually broader, elliptic to oblong-lanceolate, 4–14 cm wide, at base usually broadly rounded to shallowly cordate, rarely subattenuate. Inflorescences sessile or up to 1 mm peduncled. Male flower buds 3.5–5 mm diam.; pedicels 2–8 mm long. Anthers 13–21, half-sessile to just stiped **a.** subsp. **oblongata**

a. subsp. **oblongata** – **Fig. 5.**

K. obovoidea Merr., Univ. Calif. Publ. Bot. 15 (1929) 75.

Distribution: as the species.

BORNEO. Sarawak: Semengoh F. R., Kuching, *S. 25489;* Baram Dist., *Moulton 6722; S. 34822* – Sabah: *B.N.B. For. Dept. 3816, 4145; Cuadra Al. 110, A 2407; Elmer 21017; Ramos 1433, 1663, 1757; SAN 1726, A 4247, A 4787, 17387, 24985, 27744, 30369, 30740, 31383, 32185, 32419, 32564, 32654, 32692, 32829, 32857, 35005, 35359, 36531, 36578, 36997, 44232 NT. 204, 46614 NT. 18, 62112 NT. 69, 62387, 65422, 72068, 74272, 76652, 79681, 81306, 83037, 83558, 83661, 85028; Sinclair 9282, 9291.* – NE. Kalimantan, Nunukan I.: *Abidin bb. 34630; Kostermans 8903, 9059; Meijer 2081, 2094, 2161, 2184; Paymans 61.* – E. Kalimantan: W. Kutai, *Endert 4932.*

Notes: 1. Variable, especially in the size of mature male flower buds, ranging from 3.5–5 mm in diameter, and the number of anthers, 13–21. Examples of

extremes are *SAN 31383* with the male perianth in bud *c.* 4 × 3.5 mm, with 13 subsessile anthers, the staminal disc incl. anthers measuring *c.* 1.3 mm diam.; and *SAN 62387* in which the bud is *c.* 5 × 5 mm, with 20 or 21 anthers, just stiped, the staminal disc incl. anthers *c.* 3 mm diam.

The female flower pedicels vary considerably in length, apparently without correlation to any other systematically useful character: thus, in *SAN 1726* the female pedicel is 2.5 mm long, in *Ramos 1663*, the type of *K. oblongata*, it is *c.* 10 mm long.

Also, the shape of the leaves is variable. Usually the leaf bases are broadly rounded or shallowly cordate, but in e.g. *SAN 31076* (with 16 anthers), or in *SAN 62387* (with 20 or 21 anthers), the leaf base is subattenuate or only narrowly obtuse.

2. Two deviating specimens are noteworthy: *Kep. FN. 80161* from Brunei shows exceedingly broad male flowers, 4.5 – 5 mm diam.., cleft by the valves to *c.* 3/4; there are 14 – 16 just stiped, rather horizontally placed anthers. In other characters, e.g. the general habit, the tomentum, and the shape of the androecium, the specimen agrees with normal subsp. *oblongata*. *Kostermans 13126*, from W. Kutai, E. Kalimantan, mainly deviates by the shape of its leaves: they are partly lanceolate, parallel-sided, the base in all leaves attenuate, not broadly rounded. Its tomentum and its fruits agree with normal subsp. *oblongata*.

b. subsp. **pedunculata** de Wilde, *subsp. nov.*

Ramuli ad apices tomentoque pilis 0.3 – 0.6 mm longis obtecti. Folia oblonga usque lanceolata, 2 – 5.5 cm lata, basi attenuata usque obtusa; nervis lateralibus utroque ca. 20. Alabastra ♂ ca. 4 mm diam. tomento e pilis 0.4 – 2 mm longis obtecti; pedicelli 2 – 3 mm longi; antherae 7 – 9. Inflorescentiae ♂ pedunculo 1 – 4 mm longo.

T y p e : Borneo, Sabah, Sapanggar I., Jesselton Dist., ♂ fl., 27 Sept. 1966, *Aban Gibot SAN 49195* (L; iso K).

Twigs fairly slender, at apex 2 – 3.5 mm diam., the tomentum composed of hairs *c.* 0.5 mm long. *Leaves* rather narrow, oblong to lanceolate, 11 – 32 × 2 – 5.5 cm, at base attenuate to obtuse; lateral nerves *c.* 20 pairs. *Inflorescences* 1 – 4 mm peduncled. *Male flower* pedicels 2 – 3 mm long; *perianth* buds obovoid, 3 – 4 × 3 – 4.2 mm; valves 3, variable in thickness, 0.3 – 1.5 mm thick at sutures, splitting the bud to *c.* halfway or slightly more; *anthers* 7 – 9, just sessile. Tomentum of flowers composed of hairs 0.4 – 2 mm long. *Fruits* (immature) *c.* 20 × 10 mm, top acute; stalk *c.* 6 mm long.

BORNEO. S a b a h : Papar Dist., *SAN 32265;* Jesselton Dist., *SAN 49195;* Tenom Dist., *SAN 63248.*

E c o l o g y : Primary forest on ridges and hill sides; on yellow or brown soil; 0 – 600 m alt. Flowers Sept.

N o t e s : 1. This subspecies strikingly resembles some stouter specimens of *K. tridactyla*, and obviously it is closely related to that species, which differs by considerably smaller, differently shaped male flowers. The leaves are almost similar, apparently only differing in a less dull upper surface, a less pronounced reticulation, and the somewhat finer tomentum on the lower surface in the present species.

2. The specimen *SAN 63248* from Crocker Range has relatively small male flowers containing 7 anthers. It deviates by its relatively broad leaves, the long tomentum on the flowers composed of hairs up to 2 mm long, and the rather soft

and rather early shed hairs on the lower leaf surface. In habit this specimen shows much resemblance with certain specimens of *K. piriformis*, a species which differs by much thinner tomentum on the lower leaf surface, twig apices, and flowers. By its tomentum on flowers and lower leaf surface the specimen also comes close to *K. laurina* var. *heteropilis*.

c. subsp. **parviflora** de Wilde, *subsp. nov.*

Ramuli ad apices tomentoque pilis ca. 0.2(–0.3) mm longis obtecti. Folia oblonga, 8–17 cm longa, 3–6.5 cm lata, basi rotundata; nervis lateralibus utroque ca. 10. Alabastra ♂ ca. 2.5 mm diam. tomento e pilis ca. 0.1 mm longis obtecti; pedicelli ca. 2 mm longi; antherae 8. Inflorescentiae ♂ sessiles.

Type: Borneo, Sabah, Lahad Datu Dist., ♂ fl., 18 May 1963, *Agam Ambullah SAN 31488* (L; iso BO, K).

Twigs fairly slender, at apex 2–3 mm diam., the tomentum composed of hairs 0.1–0.3 mm long. *Leaves* 8–17 × 3–6.5 cm, at base rounded; lateral nerves *c.* 10 pairs. *Inflorescences* sessile. *Male flower* pedicels *c.* 2 mm long, the bracteole apical; *perianth* buds broadly obovoid, *c.* 2.5 mm diam.; valves 3, at sutures *c.* 0.5 mm thick, splitting the bud to *c.* 2/3; *anthers* 8, just stiped, 0.3–0.4 mm long. Tomentum of flowers composed of hairs *c.* 0.1 mm long. *Fruits* not seen.

Distribution: Sabah; only known from the type.
Ecology: Primary forest on hill side; *c.* 150 m alt. Flowers in May.

Note: This may represent a separate species; as, however, only one specimen is available, it is treated as a subspecies of *K. oblongata*, to which it certainly is closely related. It also has close affinities with *K. tridactyla* because of the small flowers with only 8 anthers, but in general appearance our present plant is quite different from that species.

29. Knema mandaharan (Miq.) Warb.

Myristica mandaharan Miq., Fl. Ind. Bat. Suppl. 1 (1861) 384; Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 48. – *K. mandaharan* Warb., Mon. Myrist. (1897) 553, t. 24; Sinclair, Gard. Bull. Sing. 16 (1958) 319, fig. 16; 18 (1961) 261 – Type: Sumatra, W. Coast, Prov. Priaman, *Diepenhorst in Teijsmann 3091* (U; iso BO, *n.v.*).

Distribution: Sumatra (Atjeh, Tapanoeli, W. Coast, E. Coast) and Malaya.

SUMATRA: *bb. 6214, 6823, 15562, 22410; Diepenhorst in Teijsmann 3091; Korthals (65); Krukoff 4082; Lörzing 4585, 14700; Meijer 4075; Monley & Kardin 176; van Steenis 10092; de Vriese (66); de Wilde & de Wilde-Duyfjes 12998, 13392, 13769, 15602, 15603, 15828, 16427.*
MALAYA: *Cockburn FRI 7975; KEP 24870, 76058; King's Collector 6515; Sinclair 10162; Selvaraj FRI 11198.*

Notes: 1. A polymorphic species. Variation abounds in the distinctness of the reticulation on the upper leaf surface and in the size of the fruits and the thickness of the pericarp.

In the material from North and Central Sumatra possibly two forms can be distinguished. These forms are, in view of the limited material at hand and because

of the rather obscuring material from the remaining parts of Sumatra and that from Malaya, not formally recognized at present.

The one form comprises stout plants with thick twigs and usually large leaves with faint reticulation above; the fruits are large, 4–6 cm long, with the pericarp 4–8 mm thick, and with a rather short-haired tomentum (*bb. 155621, 22410; van Steenis 10092; Meijer 4075; de Wilde & de Wilde-Duyfjes 12998, 15602, 15603; Lörzing 4585, 14700*). The other form in North Sumatra (*bb. 6214, 6823; de Wilde de Wilde-Duyfjes 13392, 13769, 15825, 16427*) has usually smaller leaves with very distinct reticulation above, the deciduous tomentum on the immature leaves looser and more farinose; the fruits are smaller, *c.* 3–4 cm long, with longer, more lanose tomentum, especially at the base of the fruits, and with the pericarp only 2–3 mm thick at suture. In other material from Sumatra, and in the specimens from Malaya, these differences are not so apparent, and specimens of various habit from these areas may have leaves with a distinct reticulation on the upper surface.

2. Most male flowers have 4 perianth lobes; in most other Knemas it is usually 3, with occasionally a 4-lobed flower. The aril in *de Wilde & de Wilde-Duyfjes 13769* is up to nearly halfway incised, which is rather unusual in *Knema*.

30. **Knema tenuinervia** de Wilde, *sp. nov.*

Ramuli in parte apicali 3–10 mm diam., tomento e pilis 0.2–1 mm longis composito; cortice basin versus non lamellari. Folia chartacea ad coriacea, subtus praecociter glabrescentia. Inflorescentiae ♂ sessiles. Flores ♂ pedicellis 1–6 mm longis, bracteola (sub)apicali, 2–5 mm longa; perianthio in alabastro subgloboso ad late obovoideo, 4.5–6 × 4–6 mm. Antherae 7–16, fere omnio sessiles. Discus staminalis applanatus, antheris inclusis 2–3 mm diam.; columna staminalis 1.5–2 mm longa.

Type: E. Nepal, Soktim, 26°48′ N, 87°55′ E., ♀ fl., 18 April 1971, *J. D. A. Stainton 6782* (BM).

Tree 6–25 m. *Twigs* stout, in apical portion 3–10 mm diam., subterete to obtusely angled or somewhat flattened by ridges from the petiole bases, not striate, grey-brown, rather early glabrescent from dull brown to rusty tomentum of hairs 0.2–1 mm long, lower down the *bark* finely striate, not tending to crack or flake. *Leaves* chartaceous to coriaceous; above olivaceous to brown, dull or shiny; on lower surface greyish, finely papillate, at both surfaces early glabrescent from soft stellate-dendroid hairs; leaf bud with tomentum of bristly dendroid hairs 0.2–2.0 mm long; *blade* oblong to lanceolate, broadest usually at or slightly above the middle, usually somewhat narrowed towards the base, (15–)20–50 × (3.5–)4–18 cm, base subattenuate to rounded or cordate, top acute or up to 2 cm acute-acuminate; *midrib* stout, flattish or slightly raised above; nerves 25–50 pairs, slender and faint, flattish, not raised above; tertiary venation forming a rather fine, sometimes ± trabeculate network, distinct above; *petiole* usually stout, pulvinate in apical portion or not, rather late glabrescent, (5–)8–25 × (2–)3–7 mm. *Inflorescences* sessile, simple or 2- or 3-furcate, up to 15 mm long, 5–20-flowered in male, 2–8(–15)-flowered in female; flowers with dense bright to dull brown or rusty tomentum composed of hairs 0.3–0.8 mm long. *Male flower* pedicels 1–6 mm long, the bracteole rather large, 2–4(–5) mm, early to rather late caducous, apically or subapically on the pedicel; perianth in bud subglobose to broadly ellipsoid or broadly obovoid, sometimes furrowed, 4.5–6 × 4–6 mm, inside reddish or pink; valves 3, at sutures 0.7–1.5 mm thick, splitting the bud to (*c.*

halfway –)2/3 to 3/4(–4/5); *staminal disc* incl. anthers subcircular to subtriangular, flat or somewhat concave, 2–3 mm diam.; *anthers* (7–)9–16, sessile to half-sessile, suberect to oblique, 0.7–1 mm, not touching each other; column stout, striate, ± tapering to the base, 1.5–2 mm long. *Female flower* pedicels 0.5–1 mm long, the bracteole late-caducous, apical; perianth in bud broadly ellipsoid to obovoid, sometimes coarsely grooved, 5–6 × 4–5 mm; valves 3 or 4, at sutures 0.7–1 mm thick, splitting the bud to *c.* 2/3 to 3/4; pistil *c.* 4 mm long; ovary globose or depressed globose, 2.5–3 × 3–4 mm; style 0–0.5(–1) mm long; *stigma* flattish, 2-lobed and each lobe again 6–9-lobulate. *Fruits* 1–3 per infructescence, subglobose to broadly ellipsoid, (25–)30–40 × (20–)25–30 mm, with dense dark rusty tomentum of coarse bristly hairs 1.5–3 mm long; pericarp at suture 2–3 mm thick; stalk 1–2 mm long.

Distribution: NE. India (Sikkim) and E. Nepal to Thailand and Laos.

Ecology: Hill evergreen forest, semi-moist forest, hill Dipterocarp forest, deciduous forest; hill sides, gullies, etc.; 100–1500 m alt. Flowers Jan. – June, fruits March – June.

Vernacular names: *Kat-toot* (Maru, N. Burma); *Sa luât* (Laos).

Notes. 1. Fieldnotes. Fresh leaves glaucous beneath. Flowers inside pink or reddish, anthers yellow. Fruit brown, or ochre, or ochrish-light brown; mace (aril) bright red; seed yellow. Bark producing profusely clear red sap.

2. Resembling species are *K. linifolia* and *K. furfuracea; K. linifolia* differs vegetatively by the much stronger and above prominent lateral nerves; in *K. furfuracea* the bark of the older twigs is always distinctly flaking.

K. tunuinervia is a polymorphic species in which rather arbitrarily 3 subspecies can be recognized.

KEY TO THE SUBSPECIES

1a. Twigs at apex (4–)5–10 mm diam., usually coarsely blunt-angled. Leaf base cordate; petiole relatively stout, 5–12 mm long, pulvinate at apex. Leaves (20–)25–50 cm long. Leaf bud with tomentum of bristly hairs 0.5–2 mm long. Anthers 12–14. *N., C., and E. Thailand, and Laos* . . . **c.** subsp. **setosa**

b. Twigs at apex 3–5(–6) mm diam., not or only faintly angled. Leaf base either attenuate, or rounded, or cordate; petiole more slender, 10–25 mm long, not or but faintly pulvinate at apex. . . . . 2.

2a. Twigs at apex 4–6 mm diam. Leaves 18–45 cm long. Leaf bud with tomentum of hairs 0.4–1 mm long. Anthers (7–)9–16. *E. Nepal, NE. India, Bangladesh; N., C., and W. Burma* . . . . . **a.** subsp. **tenuinervia**

b. Twigs at apex 3–4 mm diam. Leaves 12–24 cm long. Leaf bud with tomentum of hairs 0.2–0.5 mm long. *SW. Thailand (Prov. Kanchanaburi)* (Male flowers not known) . . . . . **b.** subsp. **kanburiensis**

a. subsp. **tenuinervia**

Twigs in apical portion 4–6(–10) mm diam., not or only faintly angled, pubescent by hairs *c.* 0.4–1 mm long. *Leaves* chartaceous to thinly coriaceous, (15–)18–45 × 5–17 cm, base (sub)attenuate to rounded, or (sub)cordate; *petiole* 10–25 mm long, at apex not or only slightly pulvinate; leaf bud with tomentum composed of hairs 0.4–1 mm long. *Male flower* pedicels 2.5–6 mm long, the

bracteole early to late caducous, 2–5 mm long; perianth in bud 4–5(–6) × 4–6 mm; anthers (7–)9–16. *Female perianth* in bud *c.* 6 × 5 mm. *Fruits c.* 30 × 25 mm.

Distribution: E. Nepal, NE. India, Bangladesh; N., C., and W. Burma.

NEPAL. East Nepal: *Stainton 6483, 6782, 6867.*
NE. INDIA (Khasia, Sikkim): *Gamble 483 D; Haines 443; Lister 382.*
BANGLADESH. Chittagong: *Gamble 7941; Griffith 4345; Lister 74.*
BURMA. N. Burma: *Keenan c.s. 3275;* Pegu: *Kurz 2433.*

Ecology: Lower montane forest; gullies; 100–1500 m alt.

Notes: 1. The type subspecies seems to be rather heterogeneous. It includes specimens that are in aspect rather different from e.g. the type, and recall the subspecies *setosa*. Possibly, these specimens represent a separate taxon, but the scant material prevents a decision.

2. Specimens of this subspecies were by Sinclair, 1961, p. 257–259, included in *K. linifolia* from the same area, but that species is distinct by larger and differently shaped male flowers and by the lateral nerves on the upper leaf surface being emergent and much more distinct.

b. subsp. **kanburiensis** de Wilde, *subsp. nov.*

Ramuli in parte apicali 3–4 mm diam., exangulati vel tantum parum angulati. Gemmae tomentosae, tomento e pilis 0.2–0.5 mm longo composito. Folia 12–24 cm longa, basi rotundata ad truncata, petiolo 7–14 mm longo, apice non vel tantum parum pulvinato.

Type: SW. Thailand, Kanchanaburi Prov., fr., 27 March 1968, *van Beusekom & Phengklai 133* (L; iso AAU).

Twigs in apical portion 3–4 mm diam., not or faintly angled or faintly flattened, pubescent by densely set hairs of *c.* 0.2 mm long. *Leaves* chartaceous, 12–24 × 4–7.5 cm, at base rounded or truncate; *petiole* 7–14 mm long, at apex not or only slightly pulvinate; leaf bud with tomentum composed of hairs 0.2–0.5 mm long. *Male flowers* not seen. *Female perianth* in bud *c.* 5–5.5 × 4–4.5 mm. *Fruits* 25–32 × 20–25 mm.

Distribution: SW. Thailand (Kanchanaburi Prov.).

THAILAND. South-Western, Kanchanburi Prov.: *van Beusekom & Phengklai 133; Larsen & Larsen 33846; Nimanong 10.*

Ecology: Mixed deciduous forest; *c.* 500–800 m alt.

Note: This subspecies comes closest to subsp. *tenuinervia;* it is distinguished from subsp. *tenuinervia* and especially *setosa* by the smaller dimensions of mainly the twigs and leaves.

c. subsp. **setosa** de Wilde, *subsp. nov.*

Ramuli in parte apicali (4–)5–10 mm diam., obtuso-angulati ob petiolorum bases. Gemmae tomentosae, tomento e pilis grossis 0.2–2 mm longis composito, praesertim ad costam setosae. Folia 18–50 cm longa, basi cordata, petiolo 5–12 mm longo, distincte pulvinato ad zonam transitionis cum lamina.

Type: N. Thailand, Mae Kray, 17°45′ N., 100°15′ E., ♂ fl., 9 Jan. 1972, *van Beusekom & Geesink c.s. 4747* (L; iso C, K.).

Twigs stout, in apical portion (4–)5–10 mm diam., usually coarsely blunt-angled by ridges from the bases of the petioles downwards; pubescent by hairs *c.* 0.5(–1) mm long. *Leaves* thinly to rather thickly coriaceous, 18–50 × 4–18 cm, base cordate; *petiole* short and stout, (5–)8–12 mm long, distinctly pulvinate at the transition to the blade; leaf buds with tomentum composed of coarse hairs 0.2–2 mm long, particularly setose on the midrib. *Male flower* pedicels 1–4 mm long, the bracteole rather late caducous, 2–3 mm long; *perianth* in bud *c.* 5–6 × 4.5–6 mm; *anthers* 12–14. *Female flowers* not seen. *Fruits c.* 30–35 × 25–30 mm.

Distribution: N., C., and E. Thailand; SW. Laos.

THAILAND: *van Beusekom & Phengklai 3045, van Beusekom & Geesink c.s. 4747; Geesink, Phanichapol & Santisuk 5639; Hennipman 3630; A. F. G. Kerr 2518, 5621, 20150; Kostermans 18; Winit 1577.* LAOS: Prov. Thakhek, *J. E. Vidal 1243.*

Ecology: Hill evergreen forest; in Laos collected on damp limestone debris; 400–1000 m alt.

Notes: 1. Possibly as an exception, in the specimen *van Beusekom c.s. 4747* (the type) the base of the staminal column is finely hairy.

2. Specimens of subsp. *setosa* were included by Sinclair (1961, p. 209) in *K. furfuracea*, a species which differs by various characters, most strikingly by the flaking bark of the older twigs.

31. Knema poilanei de Wilde, *sp. nov.*

Ramuli in parte apicali 4–5 mm diam., leviter angulati, cortice inferne non lamellari. Folia chartacea, 30–47 cm longa, 4–8 cm lata, supra in sicco nigrescenti-brunnea, subtus praecociter glabrescentia. Flores ♂ ignoti. Inflorescentiae ♀ sessiles, 5–15-flores. Flores ♀ pedicellis ca. 0.5 mm longis, perianthio in alabastro ca. 8–10 mm longo, 6–7 mm lato.

Type: Vietnam, Annam, Prov. Quang Nam, ♀ fl., 22 March 1939, *Poilane 29527* (P; iso K; SING, *n.v.*).

Tree *c.* 10 m. *Twigs* in apical portion 4–5 mm diam., faintly angled by ridges from the bases of the petioles, not striate, glabrescent from light-rusty tomentum of hairs 0.5–1 mm long, lower down *bark* finely striate, not tending to crack or flake. *Leaves* chartaceous; above blackish brown, on lower surface early glabrescent, grey, finely papillate and with scattered hair scars (lens, × 30); *blade* oblong-lanceolate to lanceolate, parallel-sided or broadest somewhat above the middle, 30–47 × 4–8 cm, base rounded to shortly attenuate, top long-acute with obtuse tip; *midrib* flat or slightly raised above; nerves 30–33 pairs, slender, flat or but slightly raised above; tertiary venation fine, forming a rather coarse network, distinct above; *petiole* rather stout, slightly pulvinate, rather late glabrescent, 16–20 × 3–5 mm. *Inflorescences* (female) sessile, bifid, 10–15 mm diam., 5–15-flowered; flowers with dense tomentum of coarse hairs *c.* 0.5 mm long. *Male flowers* not seen. *Female flower* pedicels *c.* 0.5 mm long, the bracteole caducous; *perianth* in bud ovoid to ellipsoid, *c.* 8–10 × 6–7 mm, inside reddish (?); valves 3, at sutures *c.* 0.5 mm thick, splitting the bud to *c.* halfway; pistil 5–6 mm long; ovary subglobose to broadly ovoid, *c.* 5–5.5 × 5 mm; style 0–0.5 mm long; *stigma* faintly 2-lobed and each lobe again shallowly 6–10-lobulate. *Fruits* not seen.

Distribution: Vietnam (Annam, Prov. Quang Nam); known only from the type.

Ecology: Montane forest at 600 m alt. Flowers in March.

Vernacular name: *chro'ta* (Moï).

Notes: 1. This is apparently a close relative of *K. tenuinervia*, but its exact place in the key is doubtful by the missing of the male flowers. The specimen differs from *K. tenuinervia* in the general appearance of the leaves and twigs, and by the blackish colour of the dried leaves, as well as by the much larger female flowers (5–6 mm long in *K. tenuinervia*); also, its locality is far outside the area accepted for that species.

2. With Sinclair (1961, p. 259) the specimen on which the present new species is based was included in *K. linifolia.*

32. **Knema rufa** Warb. – **Fig. 6.**

K. rufa Warb., Mon Myrist. (1897) 556, t. 24 fig. 1–3; Sinclair, Gard. Bull. Sing. 18 (1961) 274, 288, fig. 23 – *Myristica rufa* Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 90. – Type: Borneo, Sarawak, 1865–1868, ♂ fl., *Beccari 1798* (FI, *n.v.*; iso K, P; G, *n.v.*).

Distribution: Borneo (Sarawak, Brunei).

BORNEO. Sarawak: *Beccari 1798; S. 13146, 13963, 16452, 31848; Sinclair & Kadim SING 10191* – Brunei: *Sinclair & Kadim SING 10451.*

Notes: 1. The fruits are characteristically shaggy hairy.

2. The flowers were recorded as red inside in *S. 13146*, the immature male flowers of *SING 10451* were recorded as cream inside. The female flowers are still unknown.

3. This species is presently accepted in the same sense as by Sinclair, *l.c.*

33. **Knema globulatericia** de Wilde, *sp. nov.*

Ramuli in parte apicali 1.5–3 mm diam., tomento e pilis ca. 0.3–0.5 mm longis composito, inferne cortice non lamellari. Folia tenuiter coriacea, subtus praecociter glabrescentia. Inflorescentiae ♂ sessiles, floribus tomento persistente e pilis 0.2–0.5 mm longis composito. Flores ♂ pedicellis 4–6 mm longis, bracteola supra medium vel ad apicem posita, perianthio in alabastro late obovoideo, ca. 4–5 mm longo, 4–5 mm lato. Antherae 9–14, subsessiles ad breviter stipitatae. Discus staminalis planus, antheris inclusis 1.5–2.5 mm diam.; columna staminalis 1.5–2 mm longa.

Type: SE. Thailand, Kao Sabab, E. of Makam, ♂ fl., 18 Jan. 1958, *Larsen & Hansen 519* (C; iso K).

Tree 5–12 m. *Twigs* slender, in apical portion subterete or faintly 2–3-angular, finely striate, 1.5–3 mm diam., early glabrescent from brown tomentum composed of hairs *c.* 0.3–0.5 mm long, *bark* lower down not tending to crack or flake. *Leaves* membranous to thinly coriaceous; above greenish-brown to dark brown; on lower surface early glabrescent from grey-brown woolly tomentum, greyish to pale brown, minutely papillate (lens, × 30); *blade* oblong to lanceolate, broadest usually at or somewhat above the middle, 13–30 × 2.5–8 cm, top acute-acuminate, base attenuate to ± rounded; *midrib* raised above, sometimes flattish in the basal part; nerves 15–25 pairs, thin and faint, flat or but slightly raised above; tertiary venation forming a rather coarse network, not very distinct above; *petiole* 8–16

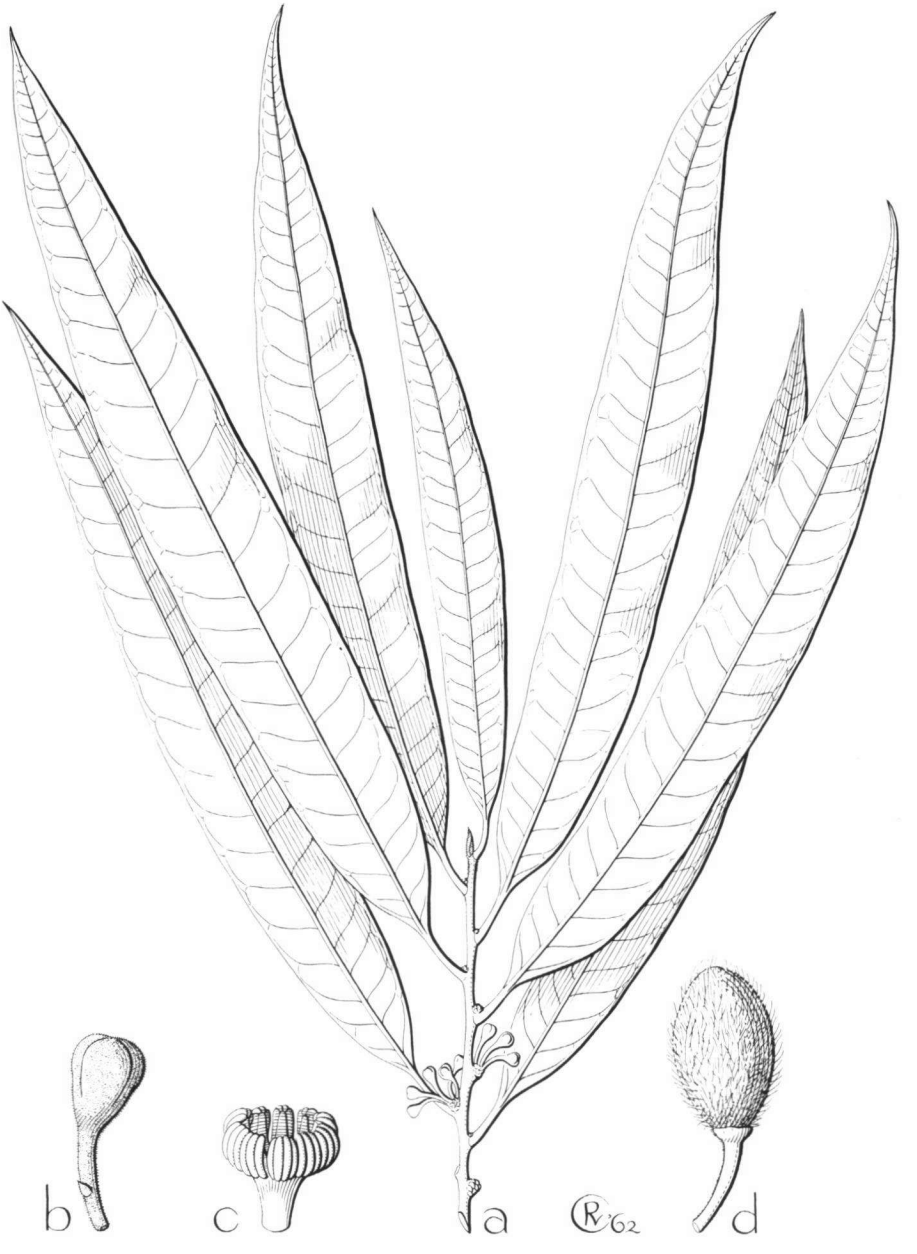


Fig. 6. *Knema rufa* Warb. – a. habit of twig with male inflorescences, × ½; b. immature male flower bud with the pedicel not yet fully developed, × 2½; c. immature androecium, × 6; d. fruit, the bracteole not discernable, apparently minute, attached at base of the stalk, × 1. – a. from *S. 13146*; b, c. from *Sinclair 10451*; d. from *Sinclair 10191*.

× 1.5 – 3 mm. *Inflorescences* sessile, simple or knobby, up to 5 mm long, 5 – 25-flowered in male, 3 – 10 (?)-flowered in female; flowers with pale brown to rusty tomentum composed of hairs 0.2 – 0.5 mm long. *Male flower* pedicels 4 – 6 mm long, the bracteole caducous, above the middle or usually apical; *perianth* in bud depressed obovoid-globose, at base attenuate or tapering, *c.* 4 – 5 × 4 – 5 mm, inside pinkish, sometimes finely warty; valves 3, at sutures 0.3 – 0.6 mm thick, splitting the bud to *c.* halfway or up to 3/4; *staminal disc* incl. anthers circular or faintly trigonous, 1.5 – 2.5 mm diam., flat; *anthers* 9 – 14, oblique to sub-erect, *c.* 0.5 – 0.7 mm, subsessile or just stiped, not touching each other; staminal column slightly tapering to the base, 1.5 – 2 mm long. *Female flower* pedicels 1.5 – 4.5 mm long, the bracteole apical or subapical; perianth in bud ovoid to ellipsoid, 4 – 5 × 2.5 – 3.5 mm; valves 3, splitting the bud to *c.* halfway; pistil 3 – 4 mm long; ovary subglobose, 1.5 – 2 mm diam.; style 0.7 – 1 mm long; *stigma* 2-lobed and each lobe again (3 –)4 – 7-lobulate. *Fruits* not seen.

Distribution: SE. and SW. Thailand (not in Peninsular).

THAILAND. Kanchanaburi, *Kerr 10423;* Dan Chumpon Krat, *Kerr 17671;* Chantaburi (Chantabun), *Lakshnakara 509; Maxwell 73 – 12;* E. of Makam, *Larsen & Hansen 503, 519.*

Ecology. Evergreen forest; 0 – 900 m alt. Flowers in Nov. – Febr.

Notes: 1. Closely related to and apparently more or less intermediate between *K. globularia* and *K. latericia*; the latter differing mainly by the more depressed-globose male flower buds, the usually convex or mamillate staminal disc, and the usually longitudinally cracking and flaking bark of the older twigs. *K. globularia* differs in its general habit, by the twigs that are more coarsely and distinctly striate, by the somewhat larger male and female flowers, and by the shape and architecture of the male flowers with the staminal column usually much shorter, only *c.* 0.5 mm long, this latter because of coalescence of the lower part with the base of the perianth; in *K. globulatericia* the staminal column is entirely free, *c.* 1.5 – 2 mm long, and the inflorescences are always sessile.

2. Specimens of the present new species were by Sinclair included in *K. globularia.*

34. Knema globularia (Lamk.) Warb.

Myristica globularia Lamk., Mém. Ac. Paris (1788) 162. – *K. globularia* Warb., Mon. Myrist. (1897) 601; Sinclair, Gard. Bull. Sing. 16 (1958) 325, fig. 18; 18 (1961) 214. – Type: Malaya (?), *Sonnerat in Herb. Lamarck* (P; iso C; G, *n.v.*).

K. corticosa Lour., Fl. Cochinch. ed. 1 (1790) 605; ed. 2 (Willd.) (1793) 742; Warb., Mon. Myrist. (1897) 593, t. 25 fig. 1 – 4; Lecomte, Not. Syst. 1, 4 (1909) 101; Fl. Gén. I.-C. 5 (1914) 105, fig. 10, 14; Merr., Trans. Amer. Phil. Soc. 24, 2 (1935) 163. – *K. bicolor* Raf., Sylva Tellur. (1838) 137. – *Myristica corticosa* Hook.*f.* & Th., Fl. Ind. 1 (1855) 158, *p.p.*, only for the type; DC., Prod. 14, 1 (1856) 205, *p.p.;* Kurz, For. Fl. Br. Burma 2 (1877) 284, *p.p.* – Type: Cochinchina, *Loureiro s.n.* (BM).

K. corticosa Lour. var. *tonkinensis* Warb., Mon. Myrist. (1897) 593. – Syntypes: Tonkin, 29 Dec 1885, ♂ fl., *Balansa 1012* (B, †; iso P, K; BR, G, *n.v.*), *4198*, July 1887, fr. (B, †; iso K, L, P).

Myristica sphaerula Hook.*f.*, Fl. Brit. Ind. 5 (1890) 859. – *K. sphaerula* Airy Shaw, Kew Bull. (1939) 545. – Type: Malaya, *Cantley 31* (K; iso SING, *n.v.*).

Myristica missionis Wall. *ex* King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 321, pl. 158 – *K. missionis* Warb., Mon Myrist. (1897) 602, t. 24. fig. 1 – 3; Gamble, Mat. Fl. Mal. Pen. 5, 23 (1912) 247; Ridley, Fl. Mal. Pen. 3 (1924) 71; Corner, Wayside Trees Mal. 1 (1940) 477, fig. 159, 161 – Type: *Wallich Cat. 6788* (K; CAL, *n.v.*).

Myristica glaucescens auct. non (Jack): Hook.*f.* & Th., Fl. Ind. 1 (1855), 157 *p.p.;* Hook.*f.*, Fl. Brit. Ind. 5 (1886) 111, *p.p.*

[*Myristica lanceolata* Wall., Cat. *6794.*]
[*K. wangii* H. H. Hu, J. Roy. Hort. Soc. 63, 8 (1938) 387, *nom. nud.*]
[*Myristica chereevensis* Pierre, *nom. nud. in sched.*]

Distribution: NE. India (Assam, 1 somewhat doubtful collection), China (Yunnan), Burma (5 collections seen), Indo-China (N., Central, and S. Vietnam, Laos, Cambodia, Thailand), Sumatra (Atjeh, Riouw; fide Sinclair), Malaya, Singapore.

INDIA. Assam, Khasi Hills: *Kanjilal 2772* (a somewhat doubtful specimen from *c.* 800 m alt., inflor. ± sessile and the twigs only little striate).
CHINA. Yunnan: *C. W. Wang 80634* (*c.* 850 m alt.).
BURMA: *Beddome 6728; Dickason 6813.*
LAOS: *J. E. Vidal 1756, 2250.*
CAMBODIA: *Béjaud 344, 665; Chevalier 36857; Harmand 1114; Martin 1315; Müller 367; Pierre 5431; Poilane 16297, 17567, 22854.*
VIETNAM. *s. loc.: Loureiro Fl. Cochinchin. 605; Máu 15; Müller 1002; Prades 5.* – Tonkin: *Balansa 1012, 4196, 4198, 4199; Bon 307, 1435, 1540, 1643, 3182, 3363, 4142, 4210, 4332, 5102, 6106; Butreau 43; Fleury (Hb. Chevalier) 30.114; Pételot 1546, 5375, 5683, 5825; Poilane 25188; W. T. Tsang 27429, 27516.* – Annam: *Fleury (Hb. Chevalier) 30.145, 38.000; Chevalier 37.053, 37.054, 38.283, 38.438, 38.566; Clemens 3864, 4377; Pételot 5720; Poilane 486, 1007, 1581, 1741, 6600, 8079, 8401, 10198, 10486, 20004, 29.919.* – Cochinchina: *(Fleury in) Chevalier 30.009, 39.179, 39.348; Harmand 602; Hayata 376; Hiëp 429; Müller 898; Phung van Dien 119, 135; Pierre 260* (several localities); *Thorel 1154.* – Poulo Condor: *Harmand 771, 937; de Perry in Hb. Pierre 260.*
THAILAND: *Van Beusekom c.s. 4398; Bunchuai 1327 (BKF 36228); Collins 583, 817, 1775, 1941; Franck 0473; Furtado 473; Md. Haniff 376; Hansen & Smitinand 11819, 12239, 12308, 12338 (BKF 40719); A. F. G. Kerr 440, 669, 5842, 6863, 8168* (a deviating specimen, see notes), *8193, 8311, 9430, 9553, 11169, 11650, 12524, 12699, 12786 (BKF 12786), 13852, 14080, 14735, 15127, 16016, 16599, 18556, 18906; Lakshnakara 440; Maxwell 71–766, 72–130, 72–147, 72–596, 73–593, 73–780; Phusomsaeng & al. 111; Put 638, 669, 834, 1262, 2751; Smidt 516, 831, 880; Sørensen, Larsen, & Hansen 507.*
SUMATRA: no specimens seen.
MALAYA. *s. loc.: Griffith (Herb. East Ind. Comp.) 4344; Hb. Pierre 5465; Ridley 14958, 14959.* – Kedah (incl. Lankawi I.): *FRI 0441, 0442, 0443, 6743, 6834; Kep. FN 57016, 67862, 71198; Ridley 15497; Robinson 6383.* – Kelantan: *Kep. FN 94972.* – Trengganu: *Soepadmo & Mahmud 9131.* – Pahang: *Curtis in Hb. Gandoger 76612; FRI 3715; Kadim & Noor KN. 661; Kep FN 97942, 97943; Lambak 4169; Ridley 1541, 2262, 2263.* – Malacca: *Griffith 4344; Helfer in Hb. Griffith 4344.* – Johore: *FRI 5068, 5149; Kep FN 77828; SFN 9358, 40612; Stone 11926.* – Penang I.: *Curtis s.n.* – Langkawi I.: *van Balgooy 2302.*
SINGAPORE: *Sidek bin Kiah S. 101; SFN 39240; Wall. Cat. 6794.*

Notes: 1. Variation. Specimens from the Asian continent, e.g. from Thailand, partly deviate by slightly larger male flower buds, *c.* 3.5–5 mm diam., as compared to those from Malaya. The specimen *Kerr 8168*, from E. Thailand, has comparatively large mature male flower buds, *c.* 5 mm diam., with a conspicuous tomentum of hairs 0.5–0.7 mm long, and it has 16 anthers, in contrast to the usual 8–13 anthers. Possibly this specimen represents a separate taxon.

Specimens from Indo-China usually have the twig apices not or but little striate, and the tomentum of the flowers often very short; specimens from Tonkin often have somewhat larger fruits, *c.* 25 × 20 mm, as compared to those of the rest of the material. Here belongs the type specimen of *K. corticosa* Lour.

A few other specimens, from Annam, e.g. *Fleury in Herb. Chevalier 37053, Chevalier 30145, Clemens 3864, 4377*, in fruit, resemble much *K. sessiflora*, a related species from the same area. These specimens seem only to be somewhat stouter in habit as compared to *K. sessiflora*, but the fruit stalks are possibly longer, 2–4 mm long; they have similarly very short tomentum on the twig apices. More material of

both species from this area is required. The fruits of true *K. sessiflora* are not yet known.

2. *K. globularia* seems also related to *K. attenuata* from India (see there); through *K. globulatericia* it is connected with *K. latericia*, as is briefly discussed under the former name.

3. The specimen from Khasi Hills, Assam, *Kanjilal 2772*, collected at *c.* 800 m alt., is somewhat doubtful: it has sessile male inflorescences, and the twigs are not or only little striate in the apical portion. It is the only collection from India seen by me. The specimen *Wang 80634* from Yunnan is good *K. globularia*, collected at *c.* 850 m alt. All other collections are from lower altitudes. In Peninsular Thailand and Malaya the species is common at or near rocky seashores.

4. The species, as presently accepted, is largely the same as with Sinclair.

35. **Knema bengalensis** de Wilde, *sp. nov.*

Ramuli in parte apicali 2–2.5 mm diam., cortice non lamellari nec rimosi. Folia tenuiter coriacea, subtus praecociter glabrescentia; supra venatio reticulata, reticulatione tenui, distincta, areolis 0.5 mm diam. vel minus. Inflorescentiae ♂ pedunculo 3–5 mm longo. Flores ♂ pedicellis 9–13 mm longis, bracteola tarde caduca, ad medium posita, perianthio in alabastro late obovoideo, 5–6 mm longo, 5–5.5 mm lato. Antherae 13 vel 14, semi-sessiles, semi-erectae. Discus staminalis planus ad parum concavus, antheris inclusis orbicularis, 3–3.5 mm diam. Columna staminalis valida, attenuata, 2–2.2 mm longa.

Type: Bangladesh, Chittagong Dist., Dulahazara, 31 Dec. 1957, ♂ fl, *M. S Khan 311* (K).

Tree; *twigs* subterete, in apical portion 2–2.5 mm diam., finely striate or not, glabrescent from tomentum composed of stellate-dendroid hairs 0.3–0.5 mm long, *bark* lower down finely striate, not tending to crack or flake. *Leaves* thinly coriaceous; above drying olivaceous; on lower surface greyish, not papillate, early glabrescent from tomentum of soft stellate-dendroid hairs; *blade* oblong-lanceolate to lanceolate, widest at or slightly above the middle, 15–30 × 2.5–5.5 cm, top up to 2 cm acute-acuminate, base obtuse or rounded to subattenuate; *midrib* rather slender, raised above; lateral nerves 20–28 pairs, slender and but little raised above; tertiary venation forming a fine network, areoles *c.* 0.5 mm diam. or less, distinct above; *petiole* 15–18 × 2 mm. *Inflorescences* peduncled for 3–5 mm, 2-furcate, 3–6 mm long, 10–20-flowered in male; flowers with tomentum composed of dendroid hairs 0.2–0.3 mm long. *Male flower* pedicels 9–13 mm long, the bracteole *c.* 1.5–2 mm long, late-caducous or subpersistent, situated at or below half-way; *perianth* in bud broadly (depressed) obovoid, 5–6 × 5–5.5 mm, inside reddish (?); valves 3, at sutures *c.* 1 mm thick, splitting the bud to *c.* 2/3; *staminal disc* flat to slightly concave, incl. anthers circular, 3–3.5 mm diam.; *anthers* 13 or 14, half-sessile, *c.* 0.6 mm long, half-erect, not touching each other; staminal column stout, tapering to the base, 2–2.2 mm long. *Female flowers* and *fruits* not seen.

Distribution: Bangladesh, Chittagong Dist., Dulahazara (*c.* 21° 39′ N, 92° 04′ E); known only from the type.

Ecology: Apparently collected below 200 m alt. Flowers Dec.

Notes: 1. Fieldnotes. Recorded as a tree; blood red resin oozes from the stem by injury. Sepals rusty pubescent.

2. This new species is apparently a close relative of *K. linifolia* as well as of *K. erratica* and *K. attenuata*. *K. linifolia* differs by a much stouter habit, much larger male flowers, and a coarser reticulation of the leaves; *K. erratica*, also from about the same area, has striate twigs and a different leaf reticulation, its flowers are very similar but usually deeper cleft by the valves; *K. attenuata* from southern India has the male flower buds more globose and deeper cleft, and the tomentum more woolly; moreover, it has a different leaf reticulation.

The reticulation of the leaves of the present species recalls that of *K. lenta*, a species differing in various aspects, especially in the shape and structure of the male flowers.

3. Only known from the type specimen, which was apparently not seen by Sinclair.

V. series LATIFOLIAE de Wilde, *ser. nov.*

Alabastra ♂ fere pariter lata quam longa vel latiora, depresso-globosa, in anthesi usque ad circa 4/5 fissa. Columna staminalis brevior quam diameter disci staminalis (antheris inclusis). Antherae 3 (vel 4), horizontales. Discus staminalis subplanus. Flores (sub)glabrescentes. Folia subtus praecociter glabrescentia. Ramuli in parte apicali (1–)2–3 mm diam., cortice vetustiore non lamellari.

Monotypic: species 36. *K. latifolia* Warb.

36. Knema latifolia Warb. – Fig. 7.

K. latifolia Warb., Mon. Myrist. (1897) 610, pl. 25 fig. 1 & 2; Sinclair, Gard. Bull. Sing. 18 (1961) 244, fig. 16. – Syntypes: Sumatra, Palembang, fr., *Forbes 2997* (B, †; K, L; FI, *n.v.*); fr., *3188* (B, †; BM, L; FI, *n.v.*); Borneo, Sarawak, Mt. Mattang, fr., *Beccari 1991 b.* (FI, *n.v.*; iso K, *n.v.*).

K. umbellata Warb., Mon. Myrist. (1897) 609. – *Myristica umbellata* Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 92 – Type: Borneo, Sarawak, Mt. Mattang, ♀ fl., *Beccari 1824* (FI, *n.v.*; iso K).

K. nitida Merr., J. As. Soc. Str. Br. 85 (1922) 190 – Type: Sabah, Sandakan Dist., 1920, ♂ fl., *Ramos 1530* (PNH, *n.v.*; iso BM, K; A, BRI, UC, *n.v.*).

K. winkleri Merr., J. As. Soc. Str. Br. 85 (1922) 189 – Type: Borneo, Hayoep, 11 June 1908, ♂ fl., *Winkler 2390* (PNH, *n.v.*; iso BM, K, L, P; G, SING, *n.v.*).

Distribution: Sumatra (Palembang), Borneo.

SUMATRA. Palembang: *Forbes 2997, 3188.*

BORNEO. W. Kalimantan: *Main (exp. Polak) 2067* – SE. Kalimantan: *Sauveur 24; Winkler 2390* – Central E. Kalimantan: *Endert 2713, 3158, 4846, 4889; Kostermans 4301, 4436, 5778, 10148, 12816; Soegeng 1, 708; Wiriadinata 594* – NE. Kalimantan (Nunukan I.): *Kostermans 8636, 9120, 9121.* – Sarawak: *Beccari 1824; Rosli 3378; S. 3009, 5390, 14962, 14821, 15642, 15675, 21568, 24642, 24942, 25373, 26107, 27148, 32367, 36262, 37683, 38464; Sinclair (SING) 10297.* – Brunei: *BRUN 157.* – Sabah: *B. N. B. For. Dept. 1858, 10169, 10219, 10377; Ramos 1530, 1664, 1729; SAN 1997, 17682, 17749, 21727, 22516, 26159, 26867, 27261, 30171, 31000, 31189, 31371, 31991, 35181, 39044, 39734 NT 830, 42926, 43363 NT 1118, 47282, 51920, 53451, 55736, 64725, 66985, 67995, 72123, 72274, 73619 (73819), 74350, 78648, 80954, 82121, 82401, 82573, 82930, 83856; Kloss SFN. 19186; Wood A 4792.*

Notes: 1. A well-defined species, with characteristic male flowers containing only 3 anthers; *Winkler 2390* (the type of *K. winkleri*) has some 4-merous flowers with a 4-angular disc and 4 anthers. The fruits of *K. latifolia* are usually ± flattened, and ridged, and somewhat saccate at the base; the leaves are early glabrescent, with

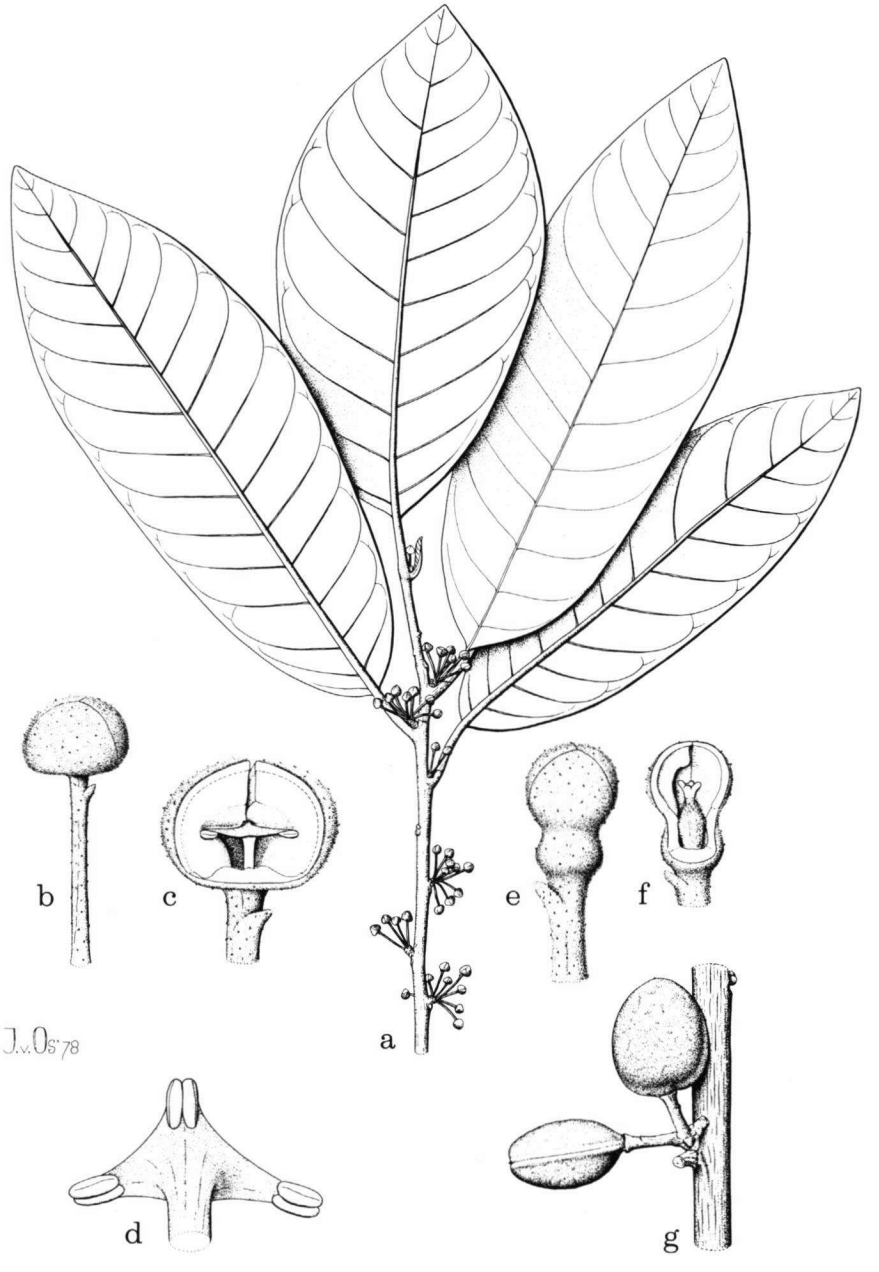


Fig. 7. *Knema latifolia* Warb. – a. habit of twig with male inflorescences, × ½; b. mature male flower bud, × 3½; c. opened mature male perianth in bud showing the androecium, × 7; d. androecium, seen from ± below, × 15; e. mature female flower bud, × 3½; f. opened mature female perianth in bud showing the pistil, × 3½; g. infructescence, × ½. – a–d. from *SAN 51920*; e, f. from *S. 15642*; g. from *SAN 82573*.

a very distinct rather coarse reticulation, and often drying some purplish or pinkish-red beneath.

2. *K. latifolia* is presently accepted in the same sense as by Sinclair, *l.c.*; Sinclair supposed its alliance with *K. curtisii*.

3. The only known specimens from Sumatra are Forbes's syntype.

VI. series CURTISIANAE de Wilde, *ser. nov.*

Alabastra ♂ late obovoidea usque globosa, circa aequilonga ac lata; in anthesi fissa circa ad 4/5 attingentia. Columna staminalis breviora quam disci staminalis diameter (antheris inclusis). Antherae 9–25(–30), suberectae ad obliquae, omnio sessiles, vulgo arcte adpressae. Discus staminalis planus. Flores tomento persistente induti vel pro parte glabrescentes. Folia subtus cito glabrescentia. Ramuli tenues, ad apices (0.5–)1–2 mm diam., in partibus vetustioribus cortice haud lamellari.

Typus: *Knema curtisii* (King) Warb.

Species 37–38.

37. **Knema linguiformis** (Sinclair) de Wilde, *stat. nov.* – **Fig. 8.**

K. curtisii (King) Warb. var. *linguiformis* Sinclair, Gard. Bull. Sing. 18 (1961) 200, fig. 6 B. – Type: Sabah, Sepilok For. Res., Sandakan Dist., ♂ fl., 27 June 1957, *Sinclair (Kadim & Kapis) 9294* (K; iso BM, L; A, B, E, M, SAN, SING, *n.v.*).

Distribution: Borneo.

BORNEO. S. Kalimantan: *Kostermans 7942* – E. Kalimantan: *Endert 3559* – Sarawak: *Anderson 4585; S. 26195, 26978, 27799, 28126, 32290* – Sabah: *B. N. B. For. Dept. 3990, 7275, 10466; Chew, Corner, & Stainton RSNB 227, RSNB 247; Clemens 50432; SAN 16322, 27106 (NT 224), 43063, 62526, 76658, 77466, 81118 (NT 111), 82567; Sinclair c.s. 9294.*

Note: 1. This species was recognized by Sinclair, *l.c.*, as a variety of *K. curtisii*, to which it is obviously closely related. It is easily distinguished from *K. curtisii* by its general habit, especially the shape and texture of the leaves, oblong to lanceolate and thinly coriaceous, as against usually elliptic or ovate and membranous in *K. curtisii*. Furthermore, the twig apices and flowers are more pubescent and the fruit stalks shorter.

2. *K. linguiformis* is fairly variable, especially in flower size: e.g. in *S. 26195* the mature male flower buds measure 2.5–3 mm diam., in *S. 28126* they are *c.* 6 mm through. The stigma is many-lobed; in *SAN 43063* it as much as 21-lobulate.

38. **Knema curtisii** (King) Warb.

Myristica curtisii King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 326, pl. 167. – *K. curtisii* Warb., Mon. Myrist. (1897) 567, t. 25 fig. 1 & 2; Gamble, Mat. Fl. Mal. Penins. 5, 23 (1912) 240; Ridley, Fl. Mal. Penins. 3 (1924) 69; Sinclair, Gard. Bull. Sing. 16 (1958) 281, fig. 4; 18 (1961) 196, fig. 6, 7 (excl. var. *linguiformis*) – Syntypes: Malaya, Penang, *Curtis 1024* (CAL, *n.v.*; iso BM, K); Perak, *Curtis 1320* (K; iso SING, *n.v.*); *Scortechini 292* (CAL, *n.v.*; iso K, L; FI, G, SING, *n.v.*); *Wray 2112* (CAL, *n.v.*; iso K, SING); Malacca, *Maingay (Kew Distr. 1301)* (CAL, *n.v.*; K, L).
Myristica sp. Hook. *f.*, Fl. Brit. Ind. 5 (1886) 113 (*Maingay 1301*).

Distribution: Sumatra, Malaya, Borneo.

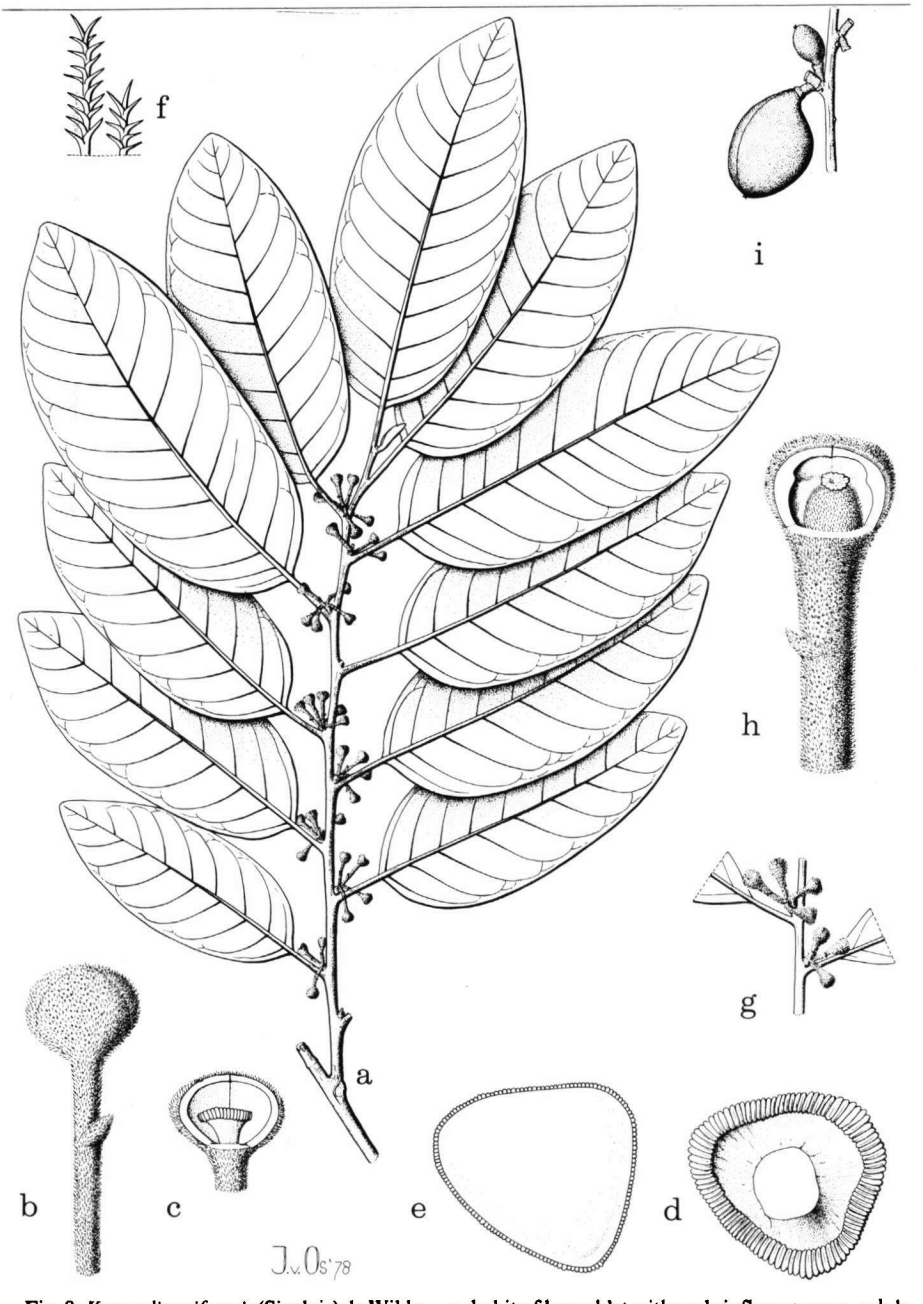


Fig. 8. *Knema linguiformis* (Sinclair) de Wilde – a. habit of branchlet with male inflorescences, × ½; b. mature male flower bud, × 3½; c. opened mature male perianth in bud showing androecium, × 3½; d. androecium, seen from beneath, × 15; e. androecium (staminal disc), seen from above (thecae of anthers half-schematic), × 15; f. sample of hairs from male perianth, × 60; g. portion of twig with female inflorescences, × ½; h. opened mature female flower bud showing the pistil, × 3½; i. infructescence with submature and immature fruit, × ½. – a–f. from *S. 26978*; g, h. from *S. 32290*; i. from *SAN 81118*.

This is a complex species in which Sinclair, 1961, recognized 5 varieties. One of these, var. *linguiformis*, is presently treated as a separate species. The remaining four varieties are maintained in the present treatment. Each of these varieties is considerably variable of its own. The varieties have marked differences in general habit, and have largely different areas of distribution and habitat as well.

K. curtisii is, together with its close relative *K. linguiformis*, easily recognized by the androecium. This was described by previous authors as with 30–45 anthers; in fact there are only 9–25(–30) anthers of which the thecae, which are completely sessile and closely set and touching each other, appear as representing twice as many anthers as there actually are.

Further notes are presented under the varieties.

KEY TO THE VARIETIES

1a. Leaves membranous, *c.* 5–15(–20) cm long, drying greenish; leaf apex usually acute or acuminate; nerves and tertiary venation distinct at both sides. Male flower buds tending to become partially glabrescent; with blunt or sharp angles. Lowland forest. *Sumatra*, *Malaya* (anthers 17–25), *Borneo* (anthers 9–15) **a.** var. **curtisii**

b. Leaves membranous or chartaceous, usually smaller, *c.* 3.5–10 cm long, drying some greenish brown or dark brown; leaf apex acute, or acuminate, or obtuse or rounded; nerves and tertiary venation (rather) indistinct. Flowers tomentose or partially glabrescent. Anthers 18–25(–30) . . . . . 2.

2a. Male flower buds with tomentum of minute, mainly sessile, stellate hairs, tending to be partly shed or easily rubbed off; angles sharp. Leaves drying dark brown above; the top obtuse to rounded, or subacuminate with obtuse tip 3.

b. Male flower buds with persistent tomentum of sessile-stellate and dendroid hairs; angles rounded. Leaves drying above some greenish brown; the top acute to acuminate. *Ridges in forest, often on sandy soils. Borneo.* **d.** var. **arenosa**

3a. Leaves membranous or chartaceous, elliptic to oblong. *Lowland forest, usually in marshy forest. Sumatra, Malaya, Borneo* . . . . . **b.** var. **paludosa**

b. Leaves chartaceous, lanceolate, with nearly parallel sides. *Ridges in lowland forest. Borneo (Brunei)* . . . . . **c.** var. **amoena**

a. var. **curtisii** – **Fig. 9a.**

K. curtisii (King) Warb. var. *curtisii*; Sinclair, Gard. Bull. Sing. 18 (1961) 196, fig. 6 C.

Distribution: Sumatra, Malaya, Borneo.

SUMATRA. E. Coast (N. Sumatra): *Lörzing 4623, 12617, 17233; Nasution 81A.* – Palembang: *Forbes 3193.* – Simaloer I.: *Achmad 93, 790, 1152, 1492, 1803.*

MALAYA. – s. loc.: *SFN 35975, FRI 109436.* – Perak: *FRI 0845; Ridley 14601; Scortechini 292, 292b.* – Kelantan: *Kep. FN 94513.* – Trengganu: *FRI 2517; Kep. FN 76076.* – Pahang: *FRI 3164, 11589, 12833, 13648, 14395, 15856, 23382; Kep. FN 104425; Shah & Noor MS. 1809, 1979; Samsuri & Shukor SA. 430.* – Selangor: *Gadak in Hillard 1582; Kep. FN 79047, 95090, 115662, 115689; SING 10723.* – Negri Sembilan: *FRI 11317, 17324; ISI 1854.* – Malacca: *Derry 1172; Goodenough 1854; Maingay 1301, 1306.* – Johore: *FRI 8798, 12326.* – P. Penang: *Curtis 1024; Ridley 9374.* – P. Tioman: *Henderson SING 21675.*

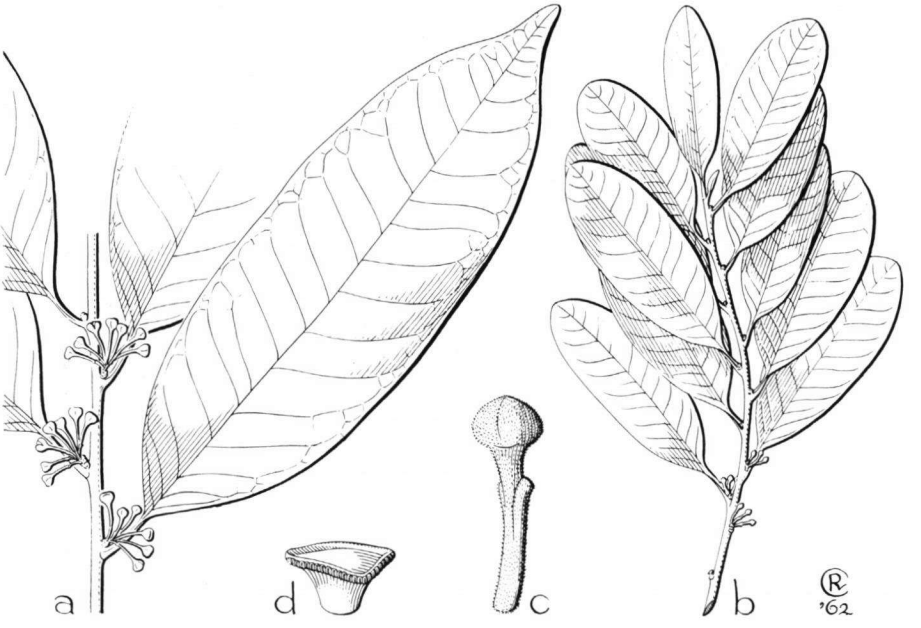


Fig. 9. *Knema curtisii* (King) Warb. – a. var. *curtisii*: habit of portion of branchlet with male inflorescences, × 2/3; – b–d: var. *paludosa* Sinclair: b. habit of twig with male inflorescences, × 2/3; c. (sub)mature male flower bud, × 4; d. androecium, × 16. – a. from *Achmad 93*; b–d. from *Corner SFN 26155*.

BORNEO. W. Kalimantan: *Hallier 3358; Hans Winkler 45.* – E. Kalimantan: *Endert 2586, 3018; Meijer 2521, 2590a; Wiriadinata 817.* – Sarawak: *Jacobs 5101, 5223; S. 13972, 19934, 22941, 23065, 23652, 27601, 29997, 31502, 36222; SFN 35739.* – Brunei: *BRUN 5587.* – Sabah: *Amdjah 144; SAN 30343, 40240, 66871, 77434.*

Notes: 1. The flowers are very variable in shape and size. In Malaya the male flower buds are usually sharp-angled, but apparently also specimens with blunt-angled male flowers occur there. In Borneo and Sumatra only blunt-angled male flower buds have been found. In the specimens from the Malay Peninsula always flowers with 18–25 anthers were found; in Borneo the male flower buds are generally smaller and contain only 9–15 anthers; in Sumatra 17 or 18.

In Sumatra and Borneo the anthers have apparently a somewhat more vertical position and seem to be attached more laterally on the rim of the staminal disc; in Malaya the anthers seem to be more hidden under de rim of the staminal disc.

2. *K. curtisii*, and particularly the var. *curtisii*, is closely related to *K. membranifolia*, a species also with usually yellowish twigs, but the latter differs a.o. by more distinctly angular twigs and the flowers are produced on the older wood, below the leaves. In *K. curtisii* the inflorescences are found in between the leaves.

Sterile material, or specimens of which the androecium is not examined, may be confused with K. *globularia*.

3. Deviating specimen. *Amdjah 144*, collected in northern Borneo, G. Moera-Tagal, deviates in several respects. By Sinclair the specimen was identified as *K. membranifolia*. It has rather large mature male flower buds, *c.* 4 mm diam.,

apparently with persistent tomentum; the staminal disc with 14 or 15 anthers is circular, not (sub)trigonous; the habit of the plant is rather stout, with relatively large leaves.

b. var. **paludosa** Sinclair – **Fig. 9b–d.**

K. curtisii (King) Warb. var. *paludosa* Sinclair, Gard. Bull. Sing. 18 (1961) 201, fig. 6A, E. – Type Singapore, Jurong, fr., *Corner SFN 26155* (K; iso BO, CAL, SING, *n.v.*).

Distribution: Sumatra (*fide* Sinclair; no specimens seen), Malaya, Singapore, Borneo (Sarawak).

MALAYA. Perak: *Ng FRI 5623.* – Johore: *Kadim & Noor KN. 231, 287, 383.*
SINGAPORE: *Corner SFN 26155; Kiah SFN 37148.*
BORNEO. Sarawak, Lundu Dist.: *Clemens 22291.*

Notes. Apparently predominantly a fresh water swamp forest taxon. Trees usually provided with a few stilt roots. Furthermore it is characterized by the leaves, which are smaller than in the type-variety, usually elliptic-oblong to obovate, with obtuse top, and drying brown, with the nerves and reticulations faint.

c. var. **amoena** Sinclair

K. curtisii (King) Warb. var. *amoena* Sinclair, Gard. Bull. Sing. 18 (1961) 198, fig. 7. – Type: Borneo, W. Brunei, Andulau For. Res., ♂ fl., 26 Aug. 1960, *Sinclair (& Kadim) 10442* (K; iso in BM, BO, L; A, B, E, M, NY, SAR, SING, *n.v.*).

Distribution: Borneo (Brunei), only known from the type, collected on a ridge in lowland forest.

d. var. **arenosa** Sinclair

K. curtisii (King) Warb. var. *arenosa* Sinclair, Gard. Bull. Sing. 18 (1961) 198, fig. 6 D. – Type: Borneo, NE. Kalimantan, Nunukan I., 31 Oct. 1953, ♂ fl., *Kostermans 8653* (K; iso BM, L, P; BO, SING, *n.v.*).
[*Myristica lanceolata* Korthals, *nom. nud. in sched., non* Wall. – based on *Korthals (99)* (L).]

Distribution: Borneo.

BORNEO. S. & SE. Kalimantan: *bb. 14646, 18174; Korthals (99).* – E. Kalimantan: *Kostermans 4927, 9764, 10194.* – NE. Kalimantan, Nunukan I.: *Abidin 21; Kostermans 8653.* – Sarawak: Kuching Dist., *Haji Bujang S. 12818, 37957; SFN 10183;* Kapit Dist., *Ilias bin Paie S 28405.* – Sabah: *SAN 82302, 83565.*

Note: This variety is characterized by small chartaceous leaves with the nerves and reticulations not or only scarcely visible.

Fig. 10. *Knema galeata* Sinclair – a. habit of twig with leaves, $\times \frac{1}{2}$; b. old male inflorescence with immature flowers, on the older wood, $\times \frac{1}{2}$; c. older branch with male inflorescence with (sub)mature flowers, $\times \frac{1}{2}$; d. mature male flower bud, $\times \frac{3}{4}$; e. androecium, $\times 4$; f. (sub)mature female flower bud, $\times \frac{3}{4}$; g. pistil, $\times 1\frac{1}{2}$; h. top of ovary with sessile lobed stigma, lateral view, $\times 4$; i. young fruit, $\times \frac{3}{4}$; j. top of young fruit with sessile lobed stigma, $\times 2\frac{1}{4}$; k. mature fruit, showing seed, $\times \frac{3}{4}$. – a, b. from *Kostermans 7062*; c. from *S. 1177*; d, e. from *S. 4855*; f–h. from *Ladi anak Bikas s.n. (27/2–1961)*; i, j. from *Ladi anak Bikas s.n. (6/1–1961)*; k. from *Ladi anak Bikas s.n. (23/3–1961)*.


a
b
c
d
e
f
g
h
i
j
k
® 1962

VII. series GALEATAE de Wilde, *ser. nov.*

Alabastra ♂ circa aequilonga ac lata vel latiora quam longa, mitriformia, acute angulata, in anthesi fere ad basin fissa. Columna staminalis breviora quam disci staminalis diameter (antheris inclusis). Antherae 14–23, horizontales ad leviter obliquae, subsessiles. Discus staminalis planus vel plus minus convexus. Flores glabrescentes. Folia subtus cito glabrescentia. Ramuli crassi, in parte apicali 4–10 mm diam., in partibus vetustioribus cortice interdum indistincte lamellari.

Monotypicus: *Knema galeata* Sinclair

39. Knema galeata Sinclair – **Fig. 10.**

K. galeata Sinclair, Gard. Bull. Sing. 18 (1961) 211, fig. 10. – Type; Borneo, Brunei, Berakas F. R., *Anderson (Md. Hasan) S. 4855* (SAR, *n.v.*; iso BRUN, KEP, SING, *n.v.*).

Distribution: Borneo (Sarawak, Brunei, Sabah, E. & NE. Kalimantan).

BORNEO. Sarawak: *S. 12935, 13341, 13651, 13711, 15055, 16508, 16757, 23429, 24062, 25699, 27612, 36496, 37014, 38329, 38419; Sinclair & Kadim 10189, 10301; Yakup S. 8914.* – Brunei: *BRUN 636, 945; Brunig S. 1177; Sinclair 10546, 10547; van Niel 4607.* – Sabah: *B.N.B. For. Dept. 10281.* – (Central) E. Kalimantan: *Endert 4924; Kostermans 4094, 7062.*

Notes: 1. The specimen *Anderson S. 12935*, in L, with predominantly male flowers, has one female flower with a normal pistil, the shape of the perianth similar to the male flowers.

2. The circumscription of this characteristic species is similar to that by Sinclair. He discussed the superficial resemblance with *K. mandaharan* and *K. furfuracea*, both species with quite differently shaped male flowers. According to Sinclair (p. 214) there are 18–20 anthers, but by examining more recently collected material, the number appeared to be more variable, 14–23.

VIII. series MEMBRANIFOLIAE de Wilde, *ser. nov.*

Alabastra ♂ circa aequilonga ac lata vel latiora quam longa, depresso-globosa, in anthesi fissa usque ad circa 4/5 attingentia. Columna staminalis breviora quam disci diam. (antheris inclusis). Antherae 19 vel 20(–23?), horizontales, subsessiles ad stipitatae. Discus staminalis planus usque convexus. Flores glabrescentes. Folia subtus cito glabrescentia. Ramuli modice tenues, in parte apicali 1.5–3 mm diam., in partibus vetustioribus cortice plerumque fissurato atque lamellari.

Monotypicus: *Knema membranifolia* Hubert Winkler.

40. Knema membranifolia Hubert Winkler – **Fig. 11.**

K. membranifolia Hubert Winkler, Engl. Bot. Jahrb. 49 (1913) 368; Sinclair, Gard. Bull. Sing. 18 (1961) 262, fig. 18. – Syntypes: SE. Borneo, Hayoep, ♂ fl., 15 June 1908, *Hubert Winkler 2460* (B, †; iso BM, K, L, P; BO, BRSL, G, PNH, SING, *n.v.*); 21 June 1908, *Hubert Winkler 2546* (B, †; iso BM, K, L; BO, BRSL, G, SING, *n.v.*).

Distribution: Borneo.

BORNEO. Sarawak: *Chew Wee-lek CWL 680; S. 13640, 17553* (a deviating specimen, see notes), *19225, 23277, 34249, 35003; SFN 36113.* – Sabah: *SAN 17049, 17127, 40471.* – E. Kaliman-

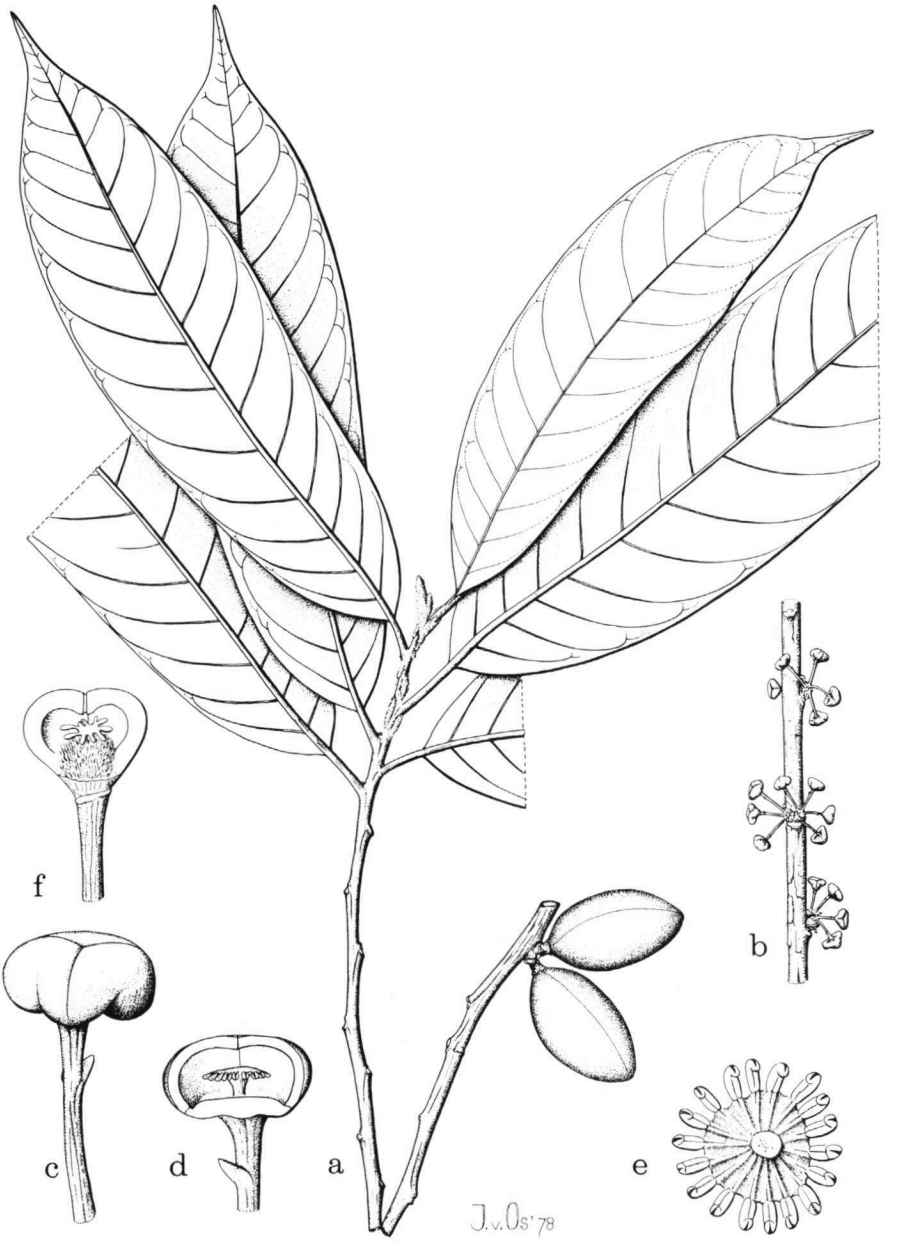


Fig. 11. *Knema membranifolia* Hubert Winkler – a. habit of twig with leaves and infructescence, × ½; b. portion of older branchlet with male inflorescences in the axils of fallen leaves, × ½; c. mature male flower bud, note glabrescent perianth, × 3½; d. opened mature male perianth in bud showing androecium laterally, × 3½; e. androecium, seen from below (anthers somewhat curved downwards), × 7; f. opened (sub)mature female flower bud, × 5. – a. from *S. 19225*; b–e. from *S. 23277*; f. from *Kostermans 9536* (reconstructed from immature flower and stigma persistent on fruit).

tan: *bb. 24649; Kostermans 4382, 4854, 4869, 9536.* – SE. Kalimantan, Hayoep: *Hubert Winkler 2460, 2546.*

Notes: 1. This species resembles typical *K. curtisii* in the yellowish twigs, which are, however, more terete and not flaking in that species; furthermore its androecium is quite different.

K. membranifolia has its closest alliance rather with *K. korthalsii*; this latter species has the bark of the older twigs not flaking, the leaves generally larger (longer), with more veins, the flowers with a persistent tomentum and with 12–20 smaller anthers, and the fruits smaller, 15–30 mm long.

2. Deviating specimen. *Haji Bujang S. 17553*, from Serian Dist., Sarawak, Ist. Div., deviates from all other specimens by (1) the short tomentum on the twig apex, composed of hairs only 0.1(–0.2) mm long; (2) the leaves, which are chiefly broadly rounded, not attenuate, at the base; and (3) its fruits, which are stalked for 16 mm. The only specimen with similar leaf bases is *Chew Wee-lek CWL 680* from the same area (Kuching Dist.), but this has short fruit stalks as is normal in *K. membranifolia*. The specimen *S. 17553* recalls in certain aspects also a part of the more slenderly built specimens of *K. percoriacea*. Possibly it is of hybrid origin, or it may represent a new taxon besides or under *K. membranifolia*. More material, preferably with male flowers, is required for a definite decision.

3. *K. membranifolia* is presently accepted in the same circumscription as by Sinclair.

IX. series MAMILLATAE de Wilde, *ser. nov.*

Alabastra ♂ longitudine et diametro subaequales vel latiora quam longa, forma (depresso-)globosa, in anthesi fissa ad ultra 3/4. Columna staminalis breviora quam disci staminalis diameter (antheris inclusis). Antherae 9–20, horizontales, subsessiles usque brevissime stipitatae. Discus staminalis mamillatus. Flores glabrescentes vel persistenter tomentosi. Folia subtus glabrescentia. Ramuli tenues usque modice crassi, ad apices 1.5–5 mm diam., in partibus vetustioribus cortice plerumque non fissurato nec lamellari.

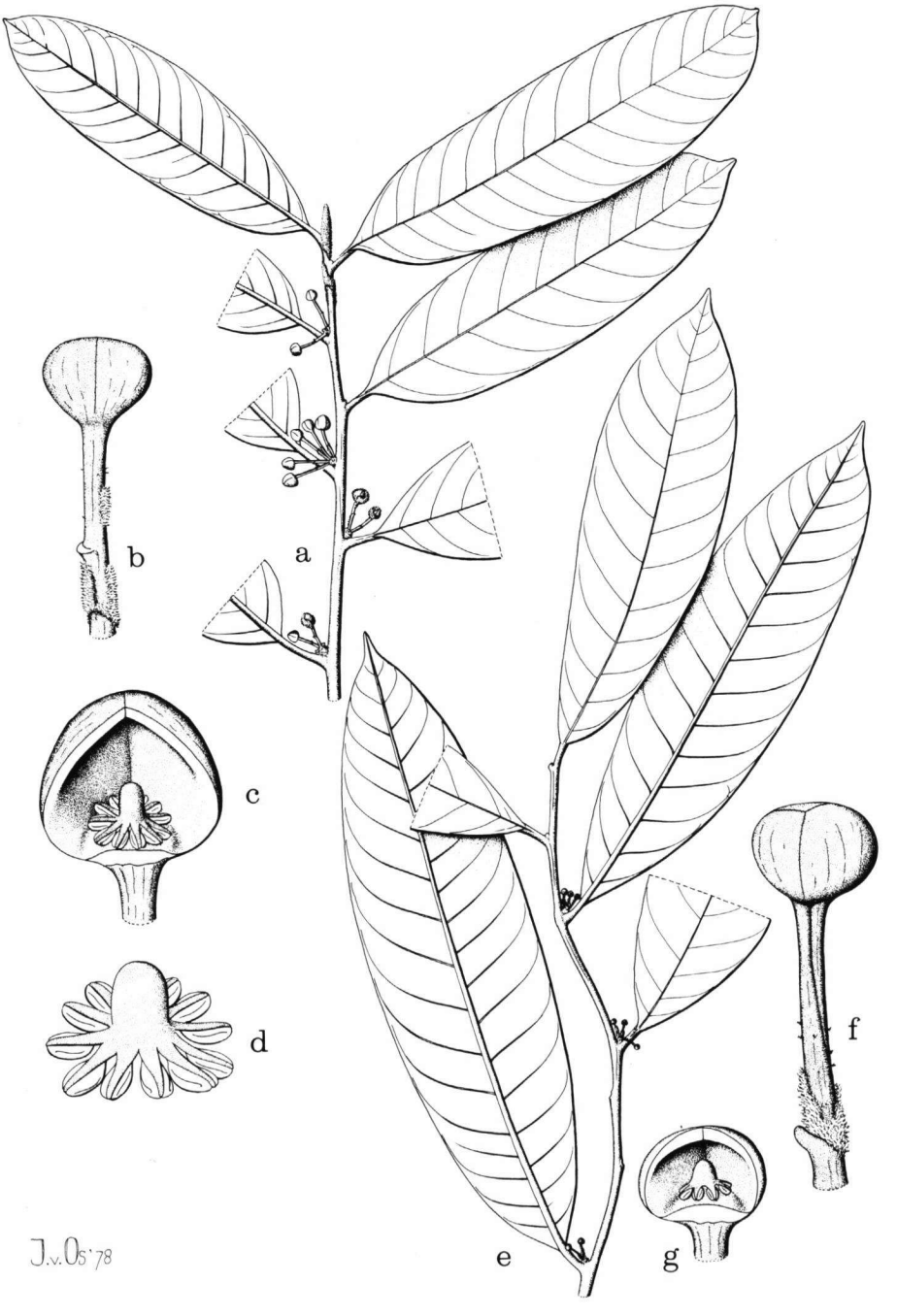
Typus: *Knema mamillata* de Wilde

Species 41–45

41. **Knema mamillata** de Wilde, *sp. nov.* – **Fig. 12.**

Ramuli ad apices 1.5–2.5 mm diam., praecoce glabrescenti e tomento pilis circa 1 mm longis formantes, deorsum cortice haud lamellari obtecti. Folia chartacea usque tenuiter coriacea, subtus cito glabrescentia e tomento pilis 0.5–1 mm longis formantes. Inflorescentiae ♂ sessiles; flores cito glabrescentes e tomento pilis 0.6–1 mm longis formantes. Flores ♂: pedicelli 5–10 mm longi, bracteola medio

Fig. 12. *Knema mamillata* de Wilde – a. twig with male inflorescences, × ½; b. mature male flower bud (note glabrescence, and scar of bracteole about halfway the pedicel), × 3½; c. opened mature male perianth in bud showing the androecium, × 7; d. androecium, seen almost laterally (note strongly mamillate staminal disc), × 14; e. habit of twig with male inflorescences (note much smaller size of mature flower buds as compared to a.), × ½; f. mature male flower bud (note glabrescence, and bracteole towards the base of the pedicel), × 7; g. opened mature male perianth in bud showing mamillate androecium, × 7. – a–d. from *Anderson (1975)7* (type); e–g. from *Buwalda 7658.*


a
b
c
d
e
f
g
J.v.O. '78

vel infra medium inserta; perianthio in alabastro globoso, 2–3.5 mm longo, 2.5–4.5 mm diam. Antherae 9–12, brevissime stipitatae. Discus staminalis per 0.5–1 mm longo mamillatus, 1.5–2 mm diam. (antheris inclusis); columna staminalis 0.5–1 mm longa.

Type: Borneo, S. Kalimantan, Sg. Sekumpir, Kumai, ♂ fl., 14 March 1975, *Anderson (1975) 7* (BO).

Tree 5–10 m. *Twigs* in apical portion 1.5–2.5 mm diam., early glabrescent from woolly tomentum of hairs *c.* 1 mm long, lower down the *bark* not tending to crack or flake. *Leaves* chartaceous to thinly coriaceous, beneath early glabrescent from tomentum of hairs *c.* 0.5–1 mm long. Male *inflorescences* sessile; flowers early glabrescent from tomentum composed of hairs 0.6–1 mm long. *Male flower* pedicels 5–10 mm long, the bracteole caducous or persistent, situated at or below halfway; *perianth* in bud globose, 2–3.5 × 2.5–4.5 mm. *Anthers* 9–12, just stiped. *Staminal disc* with mamilla 0.5–1 mm long, incl. anthers 1.5–2 mm diam.; staminal column 0.5–1 mm long. *Female flowers* and *fruits* not seen.

Distribution: Borneo (S. Kalimantan).

BORNEO. S. Kalimantan: Kumai, *Anderson (1975) 7*; Sampit, *Buwalda 7658*; Banjermasin, *van Heutsz 823* (U).

Ecology: Found in *Agathis* forest on sand ridge in peat forest, and riparian along peaty river; 0–50 m alt. Flowers in Febr., March, and August.

Notes: 1. This species resembles in certain aspects *K. membranifolia*, and furthermore is apparently closely related to *K. intermedia* and *K. uliginosa*, especially to the latter. *K. uliginosa* differs essentially by the flowers with persistent much shorter tomentum, and by the staminal disc which is convex or only low-mamillate; in the present species the mamilla on the staminal disc is remarkably conspicuous, up to 1 mm long, nearly as long as the staminal column.

2. Known only from 3 collections. The flowers in *Buwalda 7658*, in L, are possibly not mature, *c.* 2.5 mm diam., but apparently will remain smaller than those of the type, *Anderson (1975) 7*, in BO, which are 4–4.5 mm diam. or those of *van Heutsz 823* (in U), which are 3.5 mm diam. All 3 collections are from the peaty forest area of southern Borneo. The flowers of *van Heutsz 823* are partly 4-merous.

3. The specimen *Buwalda 7658* was included by Sinclair in *K. uliginosa*.

42. **Knema plumulosa** Sinclair

K. plumulosa Sinclair, Gard. Bull. Sing. 16 (1958) 312, fig. 14; 18 (1961) 272 – Type: Malaya, Trengganu, swampy forest, ♂ fl., 13 Nov. 1954, *Sinclair & Kiah SFN 40455* (SING, *n.v.*; iso BM, K, L, P; B, BK, BO, Delhi Univ., E, PNH, SAN, *n.v.*).

Myristica glaucescens auct. non K. glaucescens Jack: Wall. Cat. 6810, *nom. nud.* – *K. intermedia* (Bl.) Warb. var. *dubia* Warb., Mon. Myrist. (1897) 567 – Type: Malaya, Penang, *Wallich Cat. 6810* (K; iso BM; A, E, G, *n.v.*).

Myristica furfuracea auct. non Hook. *f.* & Thomson: DC., Prod. 14 (1856) 206.

Myristica cantleyi auct. non Hook. *f.*: King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 327, pl. 168, *p.p.*, excl. the Cantley specimens, which are *K. laurina.* – *K. cantleyi auct. non* (Hook. *f.*) Warb.: Warb., Mon. Myrist. (1897) 554, tab. 24 fig. 1 & 2; Gamble, Mat. Fl. Mal. Penins. 5, 23 (1912) 238; Ridley, Fl. Mal. Penins. 3 (1924) 68.

Distribution: Malaya.

MALAYA. Comp. 34, G. Arang, *Kochummen FRI 2763.* – P e r a k: *FRI 2236; Kep. FN 104611, 104665; King's Coll. 5317, 6569, 6867, 7290; Wray 2700.* – T r e n g g a n u: *Sinclair & Kiah SFN 40455.* – S e l a n g o r: *Burkill & Kiah HMB. 1067; Carrick 1510; Hardial & Sidek 434, 449; Motan Kep. FN 70412.* – J o h o r e: *Chew Wee-lek CWL 1185; Corner SFN 29367, 29944, 30972; Hardial Singh HS. 1059.* – P. P e n a n g: *Wallich Cat. 6810.*

N o t e s: 1. Related to *K. intermedia*, a species also with a distinct mamillate staminal disc. *K. intermedia* differs by the tomentum, which is shorter and never lanose, by the thinner twigs and smaller leaves, and by the smaller flowers with more slender pedicels; furthermore, the perianth is not persistent in fruit and there is no annular disc at the bottom of the flower. According to Sinclair both species have stilt roots if growing in wet soil.

The woolly tomentum of the young twigs and the glabrous coriaceous leaves resemble much those of *K. percoriacea* from Borneo, a species which differs by the flat, not mamillate staminal disc, by the absence of an annular disc at the bottom of the perianth, and by the perianth being not persistent in fruit.

K. plumulosa, in both sexes, is distinguished from all other Knemas by the annular disc at the bottom of the perianth and by the perianth, which is persistent in fruit.

2. *K. plumulosa* is accepted in the present account in the same sense as when conceived by Sinclair.

43. **Knema intermedia** (Bl.) Warb.

Myristica intermedia Bl., Rumph. 1 (1835) 187; Hook. *f.* & Thomson, Fl. Ind. 1 (1855) 158; DC., Prod. 14, 1 (1856) 206; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 317, pl. 154 – *K. intermedia* Warb., Mon. Myrist. (1897) 564, pl. 25 fig. 1 & 2; Sinclair, Gard. Bull. Sing. 16 (1958) 315, fig. 15, pl. II B; 18 (1961) 227 – T y p e: Java, Salak, Tjampea, & mountains of W. Java, st., ♂ fl., *Blume s.n.* (L; iso K).

Myristica glauca auct. non Bl.: Zollinger Msc., Moritzi, System. Verzeichniss Java (1845) 38, based on: Java, *Zollinger 1163* (BM, P; FI, G, LE, MEL, *n.v.*).

Myristica glabra de Vriese, Pl. Ind. Bat. Orient (Pl. Reinw.) (1857) 85. – T y p e: W. Java, ♂ fl., *Reinwardt s.n.* (L; iso MEL, *n.v.*).

Myristica iteophylla Miq., Fl. Ind. Bat. 1, 2 (1858) 59. – T y p e: Sumatra, W. coast, Pajakumbu, *Teijsmann 478* (U; BO, *n.v.*).

Myristica corticosa var. *decipiens* Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 51. – T y p e: Borneo, S. & SE. Kalimantan, ♂ fl., *Korthals s.n.* (L; iso U; CAL, MEL, *n.v.*).

D i s t r i b u t i o n: Malaya, Singapore, Sumatra, W. Java, Borneo.

MALAYA. P e r a k: *Ng FRI 1280, 5849, 17371; King's Coll. 5419, 6146; Scortechini 631, 803; Shah & Kadim 279, 280, 313, 343; Wray 3010.* – P a h a n g: *Whitmore FRI 0934; Kadim & Noor KN. 528, 533, 582; KEP 104401; Stone 6566* – S e l a n g o r: *Burkill & Shah HMB. 1046; FRI 0024, 0112, 1969, 2653; KEP 8768, 71576, 79009, 79110, 93453, 98864, 115688; Gadoh in Millard 1689; Mohd. Nur SFN 34043, 34046, 34125.* – M a l a c c a: *Griffith 4359; Maingway 1281, 1288; Sinclair SFN 40591.* – J o h o r e: *FRI 7622, 7679, 13550, 19970; Kadim & Noor K. 385; Corner SFN 21333, 29252.*

SINGAPORE: *Lanclassé 130; Lobb 315; Ridley 1820, 2039, HM 2107, 4818, 4826 (4820); Sinclair SFN 39564, 39571; Warburg 4853.*

SUMATRA. E. C o a s t (incl. N. Sumatra): *Bartlett 7329; Lörzing 14263; Ramat si Toroes 4008.* – W. C o a s t: Padang, *Beccari 901; Teijsmann 478.* – P a l e m b a n g: *Forbes 2573; Lambach 1348; van Steenis 3765.* – B a n g k a: *Kostermans & Anta 184; Cult. hort. Bog., Warburg 1743.*

JAVA. W. J a v a: *Bakhuizen van den Brink 5064, 6141, 6381; Dransfield 998, 2488; Forbes 542a, 2573; Koorders 5238B, 5239B, 5240B–1076a, 5242B, 5248B, 5262B, 11793B, 12294B–1117a, 30470B; Unesco (Kostermans) 112, 132; Kostermans 23924, 23931; Kühl & van Hasselt s.n. (46); Nengah Wirawan 97; Rastini (200) (Hort. Bog. IV. H. 82); Reinwardt s.n. (1870 Myristica glabra); Utja/Wasijat Ja. 6886; Zollinger 1163.*

BORNEO. S. K a l i m a n t a n: Sampit, *Buwalda 7820* – S E. K a l i m a n t a n: *Korthals s.n.* –

Sarawak: *Anderson 7931, 9039, 9055; Anderson S. 12948; S. 32481.* – Sabah: Sandakan Dist., *SAN 71155* (a somewhat deviating specimen, see notes). – Natuna I.: *van Steenis 1335.*

Notes: 1. A species rather variable in general habit. Related to *K. plumulosa*; for differences see under that species. A good character for *K. intermedia* is the conspicuous long-mamillate staminal disc. The present circumscription of *K. intermedia* is largely the same as that of Sinclair and previous authors.

2. Deviating specimen. *SAN 71155*, the only collection seen by me from Sabah, is somewhat deviating by its stout habit with rather thick twigs and large leaves, and by the relatively short fruit stalks of only 2–4 mm. long. *FRI 17371*, from Malaya, has small narrow leaves of 7–12 × 1.3–2 cm.

3. Sinclair, 1958, p. 318, mentions that the flower buds, observed on the tree in the Singapore Arboretum, remained closed for six weeks before opening, and that they had probably been in the unopened stage for a considerable time prior to having been noticed. When in Sumatra I noticed the same phenomenon in *K. losirensis*, in which the apparently full grown flower buds of male and female specimens remained closed for *c.* six weeks.

44. **Knema uliginosa** Sinclair

K. uliginosa Sinclair, Gard. Bull. Sing. 18 (1961) 281, fig. 25. – Type: Borneo, W. Kalimantan, P Nibung Silimban, Kapuas, 1949, ♂ fl., *Main (exp. Polak) 2098* (K; iso L; A, SING, *n.v.*).

Distribution: Borneo (Sarawak, W. Kalimantan).

BORNEO. Sarawak: 2nd. Div., Lubok Antu, *Brooke 10696.* – W. Kalimantan: Sungei Kenapai, *Hallier 2102; Main 2098.*

Note. A species close to *K. intermedia*, the latter with a more pronounced mamillate staminal disc, more distinctly reticulate leaves, and the fruit with an easily rubbed off scurf, and to *K. plumulosa* which differs by a more conspicuous pubescence on twigs and leaves. *K. uliginosa* has also some resemblance to *K. latericia*, which differs by the usually cracking and flaking bark of the older twigs, and to *K. korthalsii.*

45. **Knema korthalsii** Warb.

K. korthalsii Warb., Mon. Myrist. (1897) 557; Sinclair, Gard. Bull. Sing. 18 (1961) 232, fig. 13 – *Myristica corticosa* (Lour.) Hook. *f.* & Th. var. *borneensis* Miq., *nom. nud. in sched.* – *Myristica korthalsii* Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 90 – Type: Borneo, S. & SE. Kalimantan, *Korthals s.n.* (U; iso L; CAL, S, *n.v.*).

Myristica mindanaensis auct. non Warb.: Merr., Philip. Bur. For. Bull. 1 (1903) 21; Philip. J. Sc. 3, Bot. (1908) 76. – *K. mindanaensis auct. non* (Warb.) Merr.: Merr., Enum. Philip. Fl. Pl. 2 (1923) 184, *p.p.*, excl. type.

K. insularis Merr., Philip. J. Sc. 30 (1926) 394. – Type: Philippines, Sulu I., Tawitawi, ♂ fl., *Ramos & Edaño BS. 44288* (NY, *n.v.*; iso BM, K, P; A, B, BO, SING, UC, *n.v.*).

K. cenabrei Merr. & Quisumbing, Philip. J. Sc. 37 (1928) 144, pl. 3. – Type: Philippines, Palawan, 7 Aug. 1925, ♂ fl., *Cenabre For. Bur. 29973* (NY, *n.v.*; iso K).

Myristica cinerea auct. non Poir.: A. Gray, Bot. Wilkes U.S. Explor. Exped. (1854) 35 (not seen, *fide* Sinclair, l.c.).

Distribution: Borneo, Southern Philippines

BORNEO. Sarawak: *Anderson S. 14712; Sibat ak Luang S. 21772, 37206.* – Sabah: *Amdjah 440; B.N.B. For. Dept. 1438, 10342; Gibbs 2803; SAN 19211, 19436, 31121, 33422, 36423, 37129, 42126,*

80095. – W. K a l i m a n t a n: *Hallier 2766.* – S. &. S. E. K a l i m a n t a n: *Buwalda 7937; Kuswata 993; Motley 1146; Sauveur 917* (somewhat deviating, see notes); *de Vogel 974; Winkler 2753.* – E. K a l i m a n t a n: *Kostermans 5755, 13126, 13355, 21310.*

PHILIPPINES. P a l a w a n I.: *Agama For. Bur. 21605; Cenabre For. Bur. 29973; Celestino & Ramos PNH 23002; Gutierrez & Espiritu PNH 80821.* – S a m a r I.: *Sulit PNH 14417.* – S u l u I.: *Ramos & Edaño BS. 44288.* – B a s i l a n I.: *Reillo BS. 15472; For. Bur. 18.942.* – M i n d a n a o I.: *Miranda For. Bur. 11880; Ramos & Edaño BS. 36633, 37366*; Zamboanga Dist., *Ramos & Edaño BS. 37443.*

N o t e s: 1. This species is placed in the series of species with a mamilla on the staminal disc or with the disc distinctly convex; on the other hand, *K. korthalsii* is closely related to a group of species to which belong *K. glomerata*, *K. pectinata*, and *K. woodii*. It seems most closely related to *K. glomerata*, a species which differs by a flat or only inconpicuously mamillate staminal disc, by more slender twigs, the leaves with less numerous lateral nerves, 12–20 pairs, and by the male flowers with fewer anthers, 9–13, average 11, as against (10–)11–20, average 18, for *K. korthalsii*. *K. glomerata* and *K. korthalsii* overlap in area in Mindanao, the Sulu I., and Samar Island. *K. pectinata* has much more lateral nerves, and *K. woodii* is best distinguished by the more numerous sessile anthers.

2. *Ramos & Edaño BS. 44288*, from Sulu I., the type of *K. insularis* Merr., is rather intermediate to *K. glomerata* and might belong to that species.

3. The specimen *Sauveur 917* has the bark of the twigs somewhat flaky, and only 10–13 anthers; in general the specimen seems somewhat intermediate to *K. uliginosa*.

4. *K. korthalsii* is accepted in the present treatment in the same sense as was done by Sinclair.

X. series GLOMERATAE de Wilde, *ser. nov.*

Alabastra ♂ plerumque circa aequilonga quam lata, plus minus globosa, in anthesi fissa plus quam 3/4 attingentia. Columna staminalis breviora quam disci staminalis diameter (antheris inclusis). Antherae 5–23, obliquae ad horizontales, semi-sessiles usque stipitatae. Discus staminalis planus usque convexus, vel raro brevi-mamillatus. Flores tomento persistente induti. Folia subtus glabrescentia vel tomento persistente obtecta. Ramuli tenues usque modice crassi, in parte apicali 1.5–6 mm diam., in partibus vetustioribus cortice haud lamellari.

T y p u s: *Knema glomerata* (Blanco) Merr.

Species 46–59, and possibly 24. *K. latericia.*

46. Knema woodii Sinclair

K. woodii Sinclair, Gard. Bull. Sing. 18 (1961) 283, fig. 26. – T y p e: Sabah, Sepilok For. Res., Cpt. 15, Sandakan Dist., ♂ fl., 27 June 1957, *Sinclair & Kadim c.s. 9298* (SING, *n.v.*; iso BM, K, L; A, B, E, M, SAN, *n.v.*).

D i s t r i b u t i o n: Borneo (Sarawak, Sabah, E. & NE. Kalimantan).

BORNEO. S a r a w a k: *Jacobs 5235, 5400; S. 21729, 21766; S. 37882, 38068*, deviating specimens, see notes. – S a b a h: *Puasa & Enggoh B.N.B. For. Dept. 10.685; SAN. A 3962, 15388, 34188; Sinclair c.s. 9298.* – E. & N E. K a l i m a n t a n: *bb. OB. 1144, 16562, 18927, 29574; Kostermans 10635, 13694.*

N o t e s: 1. This species belongs in a group of related species together with *K. pectinata*, *K. glomerata*, and also *K. korthalsii* from series *Mamillatae*; it is distin-

guished from these mainly by the numerous, 18 – 23, sessile anthers. It is close to *K. pectinata*, which has also a thick-valved perianth with very minute tomentum, but that species differs by more pairs of lateral nerves, and by the leaves with obtusish to acute, not acuminate, top. From *K. korthalsii* it is distinguished mainly by the flat-topped staminal disc, the usually almost glabrous twig-apices, and fewer flowers per inflorescence.

2. *K. woodii* resembles in the sterile state *K. luteola*. In *K. woodii*, however, the minute tomentum on the twig apex consists of pale yellow stellate-dendroid hairs, whereas in *K. luteola* it is of rather dark brown stellate scales.

3. The specimens *S 37882* (♂ flowers) and *38068* (in fruit), from Sarawak, 4th Div., deviate from the other material by a number of characters, and possibly they represent a new species. The twigs in these deviating specimens are more yellowish, the tomentum at the very apex is somewhat longer, *c.* 0.3 mm, the leaves are more coriaceous, drying olivaceous, and with a coarser and more distinct reticulation, and rather with prominent, not flattish, nerves above. The mature male perianth in bud is *c.* 4.5 – 5 × 6(– 6.5) mm, thick valved, with the minute tomentum rusty brown rather than yellowish brown. There are *c.* 25 – 30 anthers (*c.* 60 thecae) which are tightly set and touching each other (not free as in typical specimens). This latter character is strongly reminiscent of the species in series *Curtisianae*, which seem in other characters not so closely related.

The glabrescent thick-valved fruits of our deviating specimen are striking, and only because of the absence of fruits of the typical form for comparison, I have tentatively included the present deviating specimens in *K. woodii*.

4. Except for the deviating specimens, *K. woodii* is presently accepted in the same sense as when originally described by Sinclair.

47. **Knema pectinata** Warb.

K. pectinata Warb., Mon. Myrist. (1897) 556, tab. 24; Sinclair, Gard. Bull. Sing. 18 (1961) 266, fig. 20 – *Myristica pectinata* Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 90. – T y p e: Borneo, Sarawak, Kuching Dist., ♂ fl., *Beccari 1607* (B, *n.v.*; iso K, P; FI, G, M, S, *n.v.*).

D i s t r i b u t i o n: Borneo (Sarawak, also close to the Indonesian border, Sabah).

BORNEO. S a r a w a k: *Anderson 4234; Beccari 1607; Jacobs 5112; Sinclair & Kadim 10340; S. 22102, 26349* (a deviating specimen), *26431* (a deviating specimen); *Anderson & Ilias bin Paie S. 28534.* – S a b a h: *Chew, Corner, & Stainton RSNB 130; Wood SAN 16286.*

N o t e s: 1. A lower montane species, at (400 –)500 – 1500 m altitude, presently accepted in the same circumscription as by Sinclair.

2. Resembling and related species. Apparently closely related on the one hand to *K. korthalsii* and *K. glomerata* (both distinguished by the usually convex staminal disc), on the other to *K. woodii* and *K. scortechinii* because of the thick-fleshy perianth valves; *K. woodii* differs by less coriaceous leaves with fewer lateral nerves, and in the androecium with as much as 18 – 23 sessile anthers; *K. scortechinii* differs by usually distinctly stiped anthers and by different fruits, as well as by its general habit.

3. Variation and deviating specimens. Although the present species is based on a rather limited amount of collections, there is still a considerable variation, notably in the size of the mature male flower buds and the numer of stamens. In *Jacobs 5112*

and *Beccari 1607* the perianth in bud is 5–7 mm across, and there are 14 or 15 anthers, whereas the specimens *Chew, Corner, and Stainton 130* and *Anderson 4234* have the perianth buds only 3.5–4 mm diam., with 15 and 11 stamens respectively.

The specimens *Ilias Paie S. 26349* and *S. 26431*, from Sarawak 4th Division, deviate from the rest of the material by the rigidly coriaceous leaves and the tomentum on the lower leaf surface, which is persistent and especially in *S. 26349* relatively thick and conspicuous; in most other specimens the tomentum on the lower leaf surface is composed of rather weak and scattered hairs, and largely early shed. Both specimens further deviate by apparently rather ellipsoid-globose fruits, not or but faintly ridged at the suture.

At first sight, the small-flowered specimens and the specimens with very coriaceous leaves may be confused with *K. kinabaluensis*.

48. **Knema scortechinii** (King) Sinclair

Myristica scortechinii King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 317, pl. 153, excl. female flowers. – *K. conferta* var. *scortechinii* Warb., Mon. Myrist. (1897) 580; Gamble, Mat. Fl. Mal. Penins. 5, 23 (1912) 244; Ridley, Fl. Mal. Penins. 3 (1924) 70. – *K. scortechinii* Sinclair, Gard. Bull. Sing. 16 (1958) 288, fig. 7; 18 (1961) 276. – S y n t y p e s: Malaya, Perak: *Scortechini 178a* (CAL, *n.v.*; iso K, L; SING, *n.v.*); *Wray 285* (CAL, *n.v.*), *1422* (CAL, SING, *n.v.*); *King's Coll. 5939* (CAL, *n.v.*; iso K; DD, E, MEL, SING, UPS, *n.v.*), *6043* (CAL, *n.v.*; iso BM; Fl, G, *n.v.*), *5617* (CAL, *n.v.*; iso BM, K, L, lectotype; E, Fl, G, *n.v.*), *6694* (CAL, *n.v.*; iso K, L; DD, UPS, *n.v.*), *10635* (CAL, *n.v.*; iso K, P; Fl, *n.v.*), *7926* (CAL, Fl, G, *n.v.*).

D i s t r i b u t i o n: Malaya (Kedah, Perak, Kelantan, Trengganu, Pahang, Selangor, Negri Sembilan, Malacca, Johore), possibly not in Sumatra as stated by Sinclair, 1961.

MALAYA. *Kep. FN 94752* – K e d a h: *FRI 6891; SFN 35176* – P e r a k: *FRI 1765, 14504; King's Coll. 5617, 5939, 6043, 6694, 10635; Scortechini 178a.* – K e l a n t a n: *FRI 4328, 4370.* – T r e n g g a n u: *FRI 10524 (5); SFN 40984* – P a h a n g: *FRI 3609, 3688, 3801, 8556, 20011; Kep. FN 97801, 108976.* – S e l a n g o r: *FRI 2284, 108880; Kep. FN 94453.* – N e g r i S e m b i l a n: *Md. Shah 81, 126; FRI 021530.* – M a l a c c a: *Maingay 1288.*

N o t e: 1. This species was treated as a variety of *K. conferta* by Warburg. Sinclair again kept it separate as a species on the grounds of a number of smaller characters. Recent study revealed that *K. conferta* belongs in a quite different group, now series *Punctatae*, comprising species with minute blackish dots on the lower leaf surface, caused by nontraumatic cork warts. Besides other characters, the tomentum on the lower leaf surface is different, and the twigs are striate in the apical portion, smooth or rather wrinkled in *K. scortechinii*, etc. The species is possibly confined to Malaya, though I have not seen the specimen *b.b. 10335*, in BO, recorded by Sinclair for Sumatra's East Coast.

2. Sinclair, 1961, p. 120, described the stigma as 2-lobed and each lobe again bifid; from several recently collected specimens it appeared to be many-lobulate.

49. **Knema elegans** Warb.

K. elegans Warb., Mon. Myrist. (1897) 615; Lecomte, Not. Syst. 1, 4 (1909) 101; Fl. Gén. I.-C. 5 (1914) 106 – *Myristica elegans* Pierre, *nom. nud. in sched.* – T y p e: Cambodia, Prov. Samrong Tong, fr., April 1870, *Pierre 5432* (P; iso K; BO, CAL, LE, *n.v.*).

K. siamensis Warb., Fedde Rep. 16 (1919) 254 – T y p e: Thailand, Ko-shan I. (Koh Chang), riverbank at Klong Son, ♂ fl., 1899–1900, *J. Schmidt 690* (C).

Tree 5–20 m. *Twigs* stoutish, in apical portion coarsely striate, 2–4 mm diam., rather late glabrescent from dense yellowish to rusty tomentum composed of hairs 0.2–0.5 mm long, lower down with the *bark* striate, not tending to crack or flake. *Leaves* thinly coriaceous; above olivaceous; on lower surface greyish, distinctly minutely papillate, with persistent tomentum composed of regularly spaced almost equally long dendroid hairs 0.4–0.8(–1.0) mm long; *blade* oblong to lanceolate, broadest below to above the middle, (10–)12–40 × 3.5–12 cm, base attenuate to broadly rounded, top subobtuse to up to 2.5 cm acute-acuminate; *midrib* flat or slightly raised above; nerves 17–30 pairs, flattish to sunken above; tertiary venation forming a fine network well-visible above; *petiole* late-glabrescent, coarsely striate, 8–18 × 2–4 mm. *Inflorescences* up to 5 mm peduncled, simple or bifurcate, 4–15 mm long, 3–10-flowered in male, 1–5-flowered in female; flowers with pale brown to rusty tomentum by hairs 0.2–0.5 mm long. *Male flower* pedicels 6–9 mm long, the bracteole caducous, at about halfway; *perianth* in bud subglobose, 4–5 mm diam., inside reddish (?); valves 3, at sutures 0.5–1 mm thick, splitting the bud to *c.* 2/3–4/5; *staminal disc* flat, incl. anthers circular, 2–3 mm diam.; *anthers* 9–12, half-sessile to almost stiped, 0.5–0.7 mm, oblique, not or hardly touching each other; column somewhat tapering to the base, 1.5–1.8 mm long, glabrous or rarely with a few minute hairs at base. *Female flower* pedicels 2–4 mm long, the bracteole median; perianth in bud ovoid, 5–7 × 4–5 mm; valves 3, at sutures 1–1.5 mm thick, splitting the bud to *c.* halfway; pistil *c.* 4 mm long; ovary subglobose, *c.* 3 mm diam.; style incl. erect *stigmas c.* 1.5 mm long, the latter *c.* 0.5 mm long, 2-lobed and each lobe again shallowly 3–4-lobulate. *Fruits* 1–3 per infructescence, broadly ovoid-ellipsoid, *c.* 20–25 × 15–18 mm, top obtuse; the tomentum rusty, hairs *c.* 1 mm long; pericarp *c.* 1.5 mm thick at suture; stalk 2–9 mm long.

Distribution: Thailand (not in southern Peninsular), Cambodia, Vietnam (Annam: 2 collections).

THAILAND: *van Beusekom & Charoenpol 1787, 1935; van Beusekom & Santisuk 3215; van Beusekom & Geesink 3317; Collins 857, 1939; Hardial 598; A.F.G. Kerr 2120, 9383, 9849, 16321, 16818; Larsen c.s. 3105; Marcan 1386; Maxwell 74–51, 74–1071; Phengkhlai 450; Santisuk 180; Schmidt 690; Smitinand 7528.*

CAMBODIA: *Pierre 5432; Müller 442* (a sterile, somewhat doubtful specimen with the tomentum on the lower leaf surface very soft and dense).

VIETNAM. Annam: *Poilane 23677, 29454* (fr. immature).

Ecology: Evergreen forest; 0–1100 m alt. Flowers and fruits Aug.–Jan.

Notes: 1. Resembles *K. erratica*, *K. laurina*, and particularly *K. pachycarpa*; *K. erratica* has the lower leaf surfaces rather early glabrescent from mainly sessile stellate hairs, *K. laurina* has the tomentum almost similar, but quite different male flowers, *K. pachycarpa* is generally stouter in habit and has much larger fruits with a very thick pericarp.

2. With Sinclair (1961), the name *K. elegans* is in the synonymy of *K. laurina*; the name *K. siamensis*, presently a synonym of *K. elegans*, was placed in the synonymy of *K. erratica*.

50. **Knema pachycarpa** de Wilde, *sp. nov.*

Ramuli ad apices 3–6 mm diam., tomento e pilis 0.5–1 mm longis formato, deorsum cortice haud lamellari obtecti. Folia tenuiter coriacea, subtus tomento persistente e pilis stipitato-dendroideis composito obtecta. Inflorescentiae ♂ pedunculo 1–6 mm longo. Flores ♂: pedicelli 8–11 mm longi, bracteola circa media inserta, perianthio in alabastro late-obovoideo usque subgloboso, circa 5–6 mm longo, 6–7 mm diam. Antherae 15–17, fere omnio sessiles, semi-erectae. Discus staminalis planus, antheris inclusis circa 3 mm diam., columna staminalis circa 2 mm longa. Pericarpium ad sutura 2.5–5 mm crassum, tomento e pilis 0.5–1.5 mm longis formato.

T y p e: Vietnam, Annam, Bach Ma, Prov. Binh Tri Thiêy (Thua Thiêy), 23 Jan 1944, ♂ fl., *J. E. Vidal 790A* (P).

Tree 10–20 m. *Twigs* at apex subterete, coarsely striate, 3–6 mm diam., glabrescent from dense yellowish brown to rusty tomentum of coarse hairs 0.5–1 mm long, lower down striate, the *bark* not tending to crack or flake. *Leaves* thinly coriaceous; above dark brown; on lower surface greyish, finely papillate, with persistent tomentum of about equally sized dendroid hairs 0.7–1.0 mm long, not easily rubbed off; *blade* oblong to oblong-lanceolate, ± parallel-sided or broadest about the middle, 14–36 × 4–11 cm., base broadly rounded to subcuneate, top acute or up to 2 cm acute-acuminate; *midrib* flat to slightly raised above; nerves 20–30 pairs, flat above; tertiary venation forming a fine network distinct above; *petiole* late-glabrescent, 6–17 × 2.5–6 mm, sometimes faintly pulvinate. *Inflorescences* peduncled for 1–6 mm, simple or indistinctly forked, 4–6 mm diam., *c.* 5–10-flowered in male; flowers with tomentum of hairs 0.5–1 mm long. *Male flower* pedicels 8–11 mm long, the bracteole caducous, at or ± above the middle; *perianth* in bud depressed broadly obovoid to subglobose, *c.* 5–6 × 6–7 mm, inside reddish (?); valves 3, at sutures 0.6–1.0 mm thick, splitting the bud to *c.* 2/3–3/4; *staminal disc* flat, incl. anthers faintly trigonous, *c.* 3 mm diam.; *anthers* 15–17, half erect, *c.* 1.0 mm, almost entirely sessile, not or but faintly touching each other; column tapering to the base, *c.* 2 mm long. *Female flowers* not seen. *Fruits* 1–2 per infructescence, broadly ellipsoid to subglobose, 30–36 × 25–30 mm, with rusty tomentum of hairs 0.5–1.5 mm long; pericarp 2.5–5 mm thick at suture; stalk 2–6 mm long.

D i s t r i b u t i o n: Vietnam (Annam, apparently endemic in the vicinity of Da Nang).

VIETNAM. A n n a m, Tourane (Da Nang) and vicinity: *Clemens 3467; Poilane 18219; Vidal 790A.*

E c o l o g y: Mountainous evergreen forest, *c.* 1000 m alt. Flowers in Jan., fruits May–July, and Sept.

N o t e s: 1. Close to *K. elegans*, which generally has a less stout habit and smaller male flower buds of 3.5–5 mm diam. with fewer (9–12) anthers, and smaller fruits with the dry pericarp only 1–2 mm thick.

2. Specimens belonging to the present species were determined by Sinclair as *K. laurina*, a species which resembles the present one by its almost similar tomentum on the lower leaf surface, but which essentially differs in many characters of flowers and fruits, as well as in general appearance.

51. **Knema tridactyla** Airy Shaw

K. tridactyla Airy Shaw, Kew Bull. 10 (1940) 543 – T y p e: Borneo, Sarawak, 4th Division, Mt. Dulit, 12 Aug. 1932, ♂ fl., *Richards 1220* (K).

Characterized by the small globose male flower buds. By Sinclair included in *K. laurina*; on the type collection is a label written in Sinclair's hand, 'I think this is only *K. laurina* (Bl.) Warb. with young flowers'.

Two subspecies are distinguished as follows:

KEY TO THE SUBSPECIES

1a. Tomentum of twig apices, flowers, and fruits consisting of dendroid hairs *c.* 0.5 mm long . . . . . **a.** subsp. **tridactyla**
b. Tomentum of twig apices, flowers, and fruits consisting of stellate scales *c.* 0.1 mm long . . . . . **b.** subsp. **sublaevis**

a. subsp. **tridactyla** – **Fig. 13.**

D i s t r i b u t i o n: Borneo (Sarawak, 4th Division; W. Sabah).

BORNEO. S a r a w a k , 4 th Division: *Richards 1220; S. 19337, 21378, 26128, 27758, 29136, 34674.* – S a b a h, Kota Belud Dist., *SAN A. 4237*; Keningau Dist., *SAN 78095.*

N o t e s: 1. The leaves have conspicuous scattered crateriform hair scars on the upper surface (lens, × 30), similar to e.g. in *K. oblongata*, especially in its subsp. *pedunculata*, to which it much resembles vegetatively.

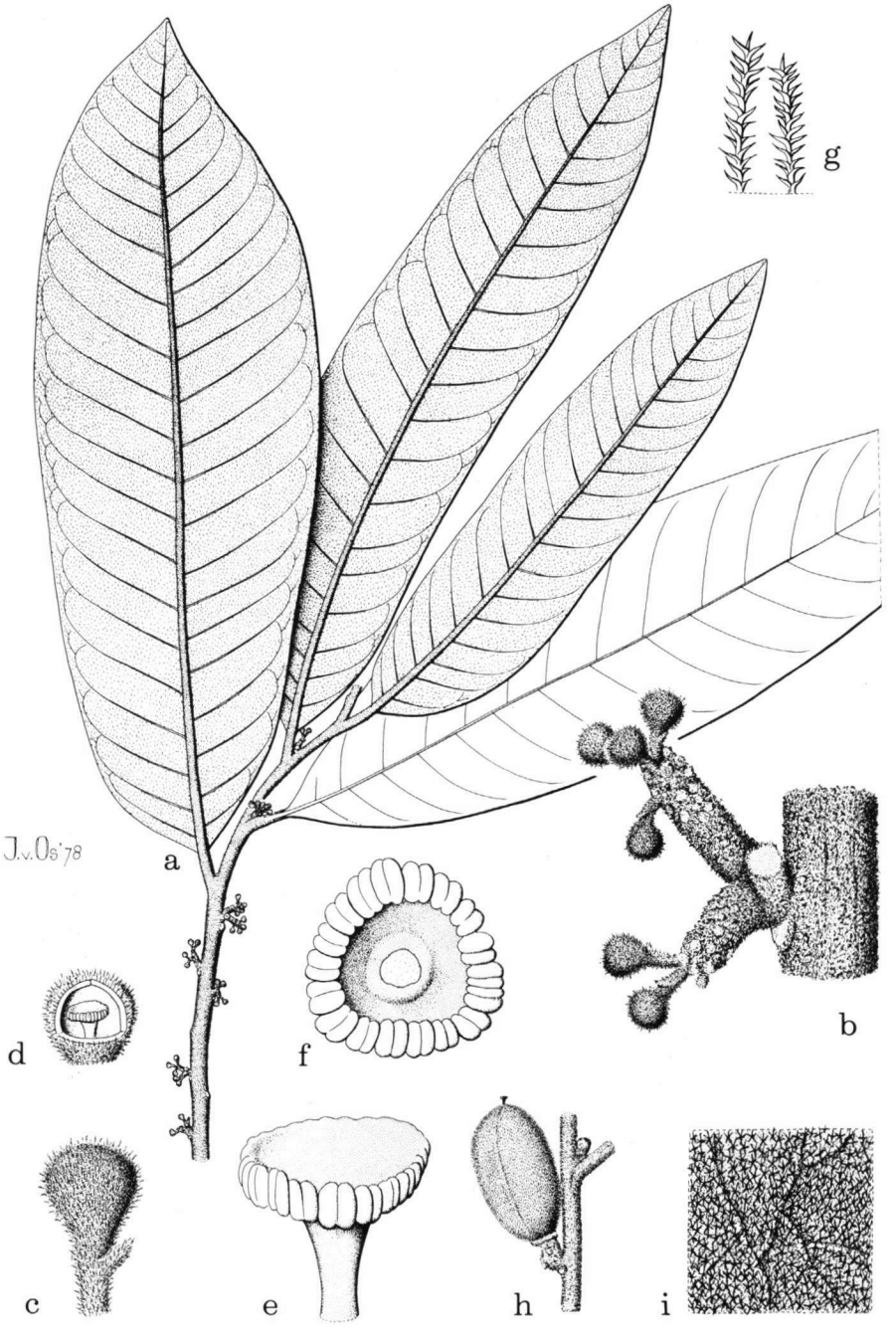
2. The species is named after the characteristically 2- or 3-fid male inflorescences in the type specimen, with the ramifications up to 17 mm long. In other specimens the inflorescences are not or only little branched and much shorter.

3. The subsp. *tridactyla* reminds in the tomentum on the the lower leaf surface somewhat of *K. scortechinii* and *K. conferta*. The midrib is very prominent above, and on the lower surface often covered with characteristic, appressed, scale-like hairs.

b. subsp. **sublaevis** de Wilde, *subsp. nov.*

Ramuli ad apices 1.5 – 2 mm diam., tomentosis e pilis cinereis minutis squamiformibus circa 0.1 mm longis compositi, cito glabrescentes, deorsum cortice haud lamellari. Folia chartacea, 10 – 18 cm longa, subtus citius glabrescentia ab tomentum e pilis minutis squamiformis compositum. Inflorescentiae ♂ pedunculo usque ad 3 mm longo. Flores ♂: pedicelli circa 2 mm longi, bracteola ad media vel supra inserta, perianthio in alabastro globosa, 1.5 – 2 mm diam. Antherae 5 vel 6. Discus staminalis planus, antheris inclusis circa 1 mm diam., columna staminalis circa 0.5 – 0.8 mm longa.

Fig. 13. *Knema tridactyla* Airy Shaw subsp. *tridactyla* – a. branchlet with male inflorescences, × ½; b. piece of branchlet with male inflorescence, × 3½; c. mature male flower bud, × 7; d. opened mature male perianth showing androecium, × 7; e. androecium, ± lateral view, × 30; f. ditto, seen from beneath, × 30; g. sample of hairs from male perianth (half-schematic), × 60; h. piece of branchlet with infructescence (note fruit with persistent style), × 1; i. detail of lower leaf surface showing rather dense persistent tomentum of small stellate hairs, × 30. – a – g. from *Othman Haron S. 21378*; h, i. from *Ingah Kudi S. 27758.*


J.v.Os '78
a
b
c
d
e
f
g
h
i

T y p e: Borneo, Sarawak, 1st Division, Lundu Dist., 11 April 1961, ♂ fl., *Ilias Paie S. 13590* (L; iso BO, K).

Twigs at apex seemingly glabrous because of very short tomentum composed of scale-like hairs only *c.* 0.1 mm. long. *Leaves* beneath with sparsely set minute stellate-scaly hairs, mixed with scattered somewhat coarser scales, rather early glabrescent. *Tomentum* of *flowers* and *fruits* thin, composed of scales *c.* 0.1 mm long. *Anthers* 5 or 6.

D i s t r i b u t i o n: Borneo (Sarawak, 1st Division).

BORNEO. S a r a w a k, 1st Division: *Chew Wee-lek CWL 1354; S. 13029, 13590.*

E c o l o g y: Primary lowland Dipterocarp forest.

52. **Knema stenocarpa** Warb.

K. stenocarpa Warb., Mon. Myrist. (1897) 577, *p.p.*, only for the fruiting specimens; Elmer, Leafl. Phil. Bot. 3 (1911) 1064; Merr., Enum. Phil. Fl. Pl. 2 (1923) 184. – *Myristica stenocarpa* Boerl., Handl. Fl. Ned. Ind. 2, 1 (1900) 91. – S y n t y p e s: Philippines, S. Mindanao, 1888, *Warburg 13303* (♀ fl.; fr. lectotype) (B, *n.v.*; iso C, L, P; FI, M, W, *n.v.*), *13303a* (♂ fl.) (B, *n.v.*; iso C, L, P; W, *n.v.*).

D i s t r i b u t i o n: Philippines (Sulu I., Mindanao).

PHILIPPINES. S u l u I., Tawi-tawi: *Ramos & Edaño BS. 44119.* – M i n d a n a o (mainly Zamboanga Prov.): *BS. 36682, 36854; Elmer 10960, 10990, 11935; Frake PNH 38112, 38259; Warburg 13303.*

N o t e s: 1. The present species was by Sinclair, 1961, included in the related *K. glomerata*, from which it differs by an overall smaller habit: more slender twigs, smaller leaves with fewer nerves, smaller male and female flowers, and different fruits, viz. ellipsoid, *c.* 15 mm long, as opposed to subglobose, *c.* 15 – 25 mm long in *K. glomerata*.

2. The syntypes, *Warburg 13303* (female flowers, fruits) and *13303a* (male flowers), are heterogeneous. I have only seen the female and male flowering specimens. The male (*Warburg 13303a*) apparently does not belong to the present species, as the male flower buds are too large, and have 9 – 14 anthers; it belongs to *K. glomerata*. The female specimens rather deviate by their stouter habit. The small-fruited specimen, as described by Warburg, not seen by me, is chosen as the lectotype. Good illustrating specimens of the present species are *BS 36854*, female fl., fr., in BM, K, L., and *BS 36682*, male fl., in K.

3. Variation. A few specimens tend to be more or less intermediate to *K. glomerata*, e.g. the female flowering specimens of *Warburg 13303* (syntype), and *Elmer 10960* (male fl.) and *10990* (female flowers). In these specimens the twigs are slightly stouter, and the leaves larger, as compared to the remaining specimens; in *Elmer 10990* the female pedicels are relatively long, *c.* 2 mm. The specimen *Elmer 10960* has relatively large male flower buds, *c.* 2.5 mm diam., with 8 just-sessile anthers and the staminal disc provided with a small mamilla; in the remaining male specimens the disc is flat and there are 6 – 9 distinctly stiped anthers.

4. The leaves are rather densely fine-woolly, grey, stellate-hairy on the lower surface, and later glabrescent as compared to *K. glomerata*.

53. Knema alvarezii Merr.

K. alvarezii Merr., Philip. J. Sc. Bot. 13 (1918) 288; Enum. Philip. Flow. Pl. 2 (1923) 183. – S y n t y p e s: Philippines, Luzon, Nueva Ecija Province, Mt. Macasandal, ♂ fl., Feb. 1911, *Alvarez For. Bur. 22395*, lectotype (PNH, *n.v.*; iso BM, L, P; BO, *n.v.*); fr. (immature), Feb. 1911, *Alvarez For. Bur. 22397* (PNH, *n.v.*; iso BM, K; US, *n.v.*).

D i s t r i b u t i o n: Philippines, Luzon, Prov. Nueva Ecija; known only from the two syntype specimens.

N o t e s. Possibly, the closest relative is *K. tomentella* from East Malesia, in which species the present one was included by Sinclair, 1961. That species differs mainly by the much earlier glabrescent lower leaf surface and the somewhat smaller male flowers with 8–11 anthers (6 or 7 in *K. alvarezii*) and with the bracteole apically on the pedicel.

54. Knema glomerata (Blanco) Merr.

Sterculia glomerata Blanco, Fl. Filip. (1837) 764; ed. 2 (1845) 525; ed 3, 3 (1879) 164; F.-Vill., Noviss. Append. (1880) 27; Merr., Govt. Lab. Publ. (Philip.) 27 (1905) 24, 73. – *K. glomerata* Merr., J. Str. Br. Roy. As. Soc. 76 (1917) 81; Sp. Blanc. (1918) 151; En. Philip. Fl. Pl. 2 (1923) 183; Sinclair, Gard. Bull. Sing. 18 (1961) 219, fig. 11, map 9, *p.p.*, excl. syn. *K. stenocarpa* Warb. – T y p e: Philippines, no specimen known; neotype, interpreted by Merrill from Blancos description and vernacular names '*hindurugu*' and '*tambalao*', Luzon, Bataan Prov., *Merrill, Species Blancoanae 504* (PNH, *n.v.*; iso BM, K, L, P).

Sterculia decandra Blanco, Fl. Filip. (1837) 766; ed. 2 (1845) 526; ed. 3, 3 (1879) 166. – T y p e: Philippines, no specimen indicated.

Myristica heterophylla F.-Vill., Noviss. Append. (1880) 178; Vidal, Rev. Pl. Vasc. Filip. (1886) 220. – *K. heterophylla* Warb., Mon. Myrist. (1897) 573, t. 25 fig. 1 & 2; Merr., Philipp. J. Sc. 1, Bot., Suppl. (1906) 55; 3, Bot. (1908) 407. – T y p e: Philippines, Luzon, (date?), ♂ fl., *Comission de la Flora Forestal de Filipinas, Vidal 507* (L).

K. heterophylla var. *pubescens* Warb., Mon. Myrist. (1897) 576. – *Myristica laurina auct. non* Bl.: Vidal, Rev. Pl. Vasc. Filip. (1886) 221. – T y p e: Philippines, Luzon, Prov. Tarlac, (date?), ♂ fl., *Comission de la Flora Forestal de Filipinas, Vidal 509* (K, L).

K. vidalii Warb., Mon. Myrist. (1897) 615; Merr., Enum. Philip. Fl. Pl. 2 (1923) 184. – *Myristica iners auct. non* Bl.: Vidal, Rev. Pl. Vasc. Filip. (1886) 221. – T y p e: Philippines, Marinduque I., (date?), fr., *Comission de la Flora Forestal de Filipinas, Vidal 1679* (L).

K. gitingensis Elm., Leafl. Philip. Bot. 3 (1911) 1065. – T y p e: Philippines, Sibuyan I., Capiz Prov., Mt. Giting-giting, ♂ fl., *Elmer 12200* (PNH, *n.v.*; iso BM, K, L; A. BO, BRSL, CAL, E, G, NSW, NY, US, *n.v.*).

K. acuminata Merr., Philip. J. Sc. 17 (1920) 256. – T y p e: Philippines, Luzon I., Prov. Isabela, *Klemme 11266* (PNH?, *n.v.*; specimen not found by Sinclair in many herbaria; see Sinclair, o.c., p. 225).

Myristica corticosa auct. non (Lour) Hook. *f.* & Th.: F.-Vill., Noviss. App. (1880) 178; DC., Prod. 14 (1856) 205, *p.p.*, for the Philipp. specimens; Vidal, Phan. Cuming. Philip. (1885) 139; Rev. Pl. Vasc. Filip. (1886) 220.

Myristica glaucescens auct. non (Jack) Hook. *f.* & Th.: Ceron, Cat. Pl. Herb. Manila (1892) 141, *p.p.*

K. glauca auct. non (Bl.) Warb.: Merr., En. Philip. Fl. Pl. 2 (1923) 183, *p.p.*

D i s t r i b u t i o n: Philippines, Borneo (Sarawak, 4th Div., 1 collection).

PHILIPPINES. *Kamphövener 2804* (Galathea Exp.). – M i n d o r o I. (for provinces and districts see Sinclair, l.c.): *BS 40865, 40924, 41105; PNH 3241, 17628, 37576.* – L u z o n I.: *Adduru 243; BS 2638, 8266, 22574, 22575, 22974, 28026, 33094, 33095; Cuming 844, 1042, 1309; Elmer 6156, 8957, 16220, 16229, 16616, 17565; For. Bur. 11932, 15396, 17317, 21444, 27159, 27765; Llanos s.n.* (type material?); *Merrill, Sp. Blanc. 504; PNH 22880, 33399, 35487; Sinclair 9454, 9553; Vidal 507, 509; Warburg 11589 (13589), 11590, 13301, 13644a, 13664; Whitford 366.* – M a r i n d u q u e I.: *Comission de la Flora Forestal de Filipinas, Vidal 1679.* – S i b u y a n I.: *Elmer 12200; BS 30948.* – B i l i r a n I.: *BS 18576* – N e g r o s I.: *For. Bur. 13569.* – P i n a y I.: *BS 45971.* – S a m a r I.: *BS 17590.* – L e y t e I.:

Wenzel 743, 1134. – Basilan I.: *For. Bur. 6110.* – Mindanao I *BS 36879, 49330; Elmer 14040; For. Bur. 20745, 23328, 30364; PNH 13563, 13735, 42048, 42173, 42280, 42336; Warburg 13303, p.p., 13303a; Wenzel 2789.*

Borneo. Sarawak: 4th Division, Sg. Ulu Bakong, Miri Dist., *Sibat ak Luang S. 24419* (see notes).

Notes: 1. This is the most common species of *Knema* in the Philippines. It is close to *K. korthalsii*, which differs by more pairs, 20–35, of lateral nerves, somewhat larger flowers with in the males 13–20, average 18, anthers (9–13, average 11, in the present species), and a more pronounced mamilla on the staminal disc. Also the relationship with *K. tomentella* is very close (for differences see the key), but this latter species possibly does not occur in the Philippines. *K. glomerata* is presently accepted almost in the same sense as by Sinclair; only *K. stenocarpa* is removed from its synonymy and reinstalled as a distinct species.

2. The specimen *S. 24419* from Sarawak is highly improbable as regards the locality, far away from the main area of the species. The specimen is in male flowers, which I have analysed, and according to my present knowledge belongs to *K. glomerata.*

3. Variation. There is a rather great variation in the degree of development of the deciduous tomentum on flowers, twig apices, and petioles: there is a more woolly form, with the hairs relatively long, up to 1 mm, and somewhat longer persisting; in this form also the tomentum on the lower leaf surface is slightly denser and somewhat longer remaining. On the other hand there are specimens with considerably shorter, thinner, and less dense tomentum, but I have the impression that many intermediate forms occur.

55. Knema tomentella (Miq.) Warb.

Myristica corticosa (Lour.) Hook.*f.* & Th. var. *tomentella* Miq., Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 207. – *K. tomentella* Warb., Mon. Myrist. (1897) 588, t. 25 fig. 1 & 2; Sinclair, Gard. Bull. Sing. 18 (1961) 277, fig. 24, map 18, *p.p.*, excl. syn. *K. laurina* var. *minahassae*, *K. stellata*, *K. alvarezii.* – *Myristica tomentella* Boerl., Handl. Fl. Ned. Ind. 3,1 (1900) 91. – Type: Moluccas, Ambon, *de Fretes in Teijsmann* (U).

[*Palala sexta* Rumph., Herb. Amb. 2 (1750) 28].

Myristica corticosa var. *amplifolia* Miq., Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 202. – Type: Celebes, Manado, *Riedel in Beccari 7772* (Fl, *n.v.*).

Myristica corticosa var. *ceramensis* Miq., Ann. Mus. Bot. Lugd.-Bat. 2 (1865) 51. – Type: Ceram, female fl., fr., *Teijsmann & de Vriese (12) (13)*, (several sheets) (U; iso K, L; CAL, *n.v.*).

K. glauca (Bl.) Warb. var. *bancana* Warb., Mon. Myrist. (1897) 597. – *Myristica glauca* Bl. var. *bancana* Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 92. – Type: Cult. Hort. Bogor., *Beccari s.n.* (Fl, *n.v.*) (origin must be Moluccas, not Bangka).

Distribution: East Malesia: Celebes (N, SW., & SE. Peninsula), Moluccas (Morotai, Halmaheira, Batjan, Obi, Buru, Ceram, Ambon), New Guinea (Vogelkop Penins.).

Celebes. Cult. Hort. Bogor., *Warburg 1742; Rachmat (exp. van Vuuren) 160.* – North: Menado: *bb. 17178.* – South Penins.: *Warburg 16719.* – SW. Peninsula: Pangkadjene, *Teijsmann 11735* (a deviating specimen, see notes).

Moluccas: *Alston 16910; Anang (exp. de Haan) 542; bb. 23801; de Fretes in Teijsmann 5745* (Ambon); *Kostermans 646; Robinson 236, 237, 238; Rastini (88)* (Cult. Hort. Bogor., Ambon), *SFN 10029* (Cult. Hort. Bog., Ambon); *de Vogel 3838, 4036, 4070, 4074, 4158, 4197, 4306, 4361, 4406, 4500.* – Ceram: *Kuswata & Soepadmo 75; Rutten 2103; de Vriese & Teijsmann (12), (13); Teijsmann 5019.*

New Guinea. Vogelkop Penins.: N. of Ransiki, *Kostermans 4745.*

N o t e s: 1. The circumscription of *K. tomentella* by Sinclair is somewhat different from the present one, as the names *K. laurina* var. *minahassae*, *K. stellata*, and *K. alvarezii* are taken out of the synonymy and reinstalled as separate taxa.

2. This is the only *Knema* occurring in New Guinea. Specimens formerly recorded for the Philippines (Luzon, Samar) appeared to belong to *K. glomerata*, which has a finer reticulation on the upper leaf surface, the bracteole median on the pedicel, etc.

3. Variation and deviating specimens. In most specimens from the Moluccas the twigs are distinctly striate in the apical portion. In a part of the specimens from Ceram and Celebes, however, the twigs are only faintly striate towards the apex.

The specimen *Teijsmann 11735*, from SW. Peninsula, Celebes, deviates by its narrow lanceolate leaves with coriaceous texture and with the reticulation above very fine and distinct, by which it is reminiscent of *K. celebica*; for differences see the discussion under that species.

The specimen *Rachmat (exp. van Vuuren) 160*, from Celebes, has 11, not the usual 6–9, anthers, and the twigs at apex are more slender and only little striate. Possibly it belongs to *K. tomentella*, but it might belong to *K. glomerata* as well. More material from Celebes is needed for a better insight in the taxonomy of *Knema* in that region.

56. **Knema attenuata** (Hook. *f.* & Th.) Warb.

Myristica attenuata Wall. *ex* Hook. *f.* & Th., Fl. Ind. 1 (1855) 157; DC., Prod. 14 (1856) 205; Dalz. & Gibs., Bomb. Fl. (1861) 4; Beddome, Fl. Sylv. 2 (1872) t. 271; Hook. *f.*, Fl. Br. Ind. 5 (1886) 110; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 316, pl. 152; Talbot, Syst. List Trees & Shrubs Bombay Presid. (1894) 165; ed. 2 (1902) 281; Cooke, Fl. Bomb. Presid. 2 (1906) 531. – *K. attenuata* Warb, Mon. Myrist. (1897) 590 (incl. var. *latifrons*); Gamble, Fl. Presid. Madras 2, 7 (1925) 1215; Sinclair, Gard. Bull. Sing. 18 (1961) 166, fig. 2 – T y p e : S. India, ♀ fl., *Wallich Cat. 6791* (K; iso A, G, LE, M, *n.v.*); t y p e of var. *latifrons*: S. India, Canara, ♂ fl., *Beddome s.n.* (B, †; K, *n.v.*).

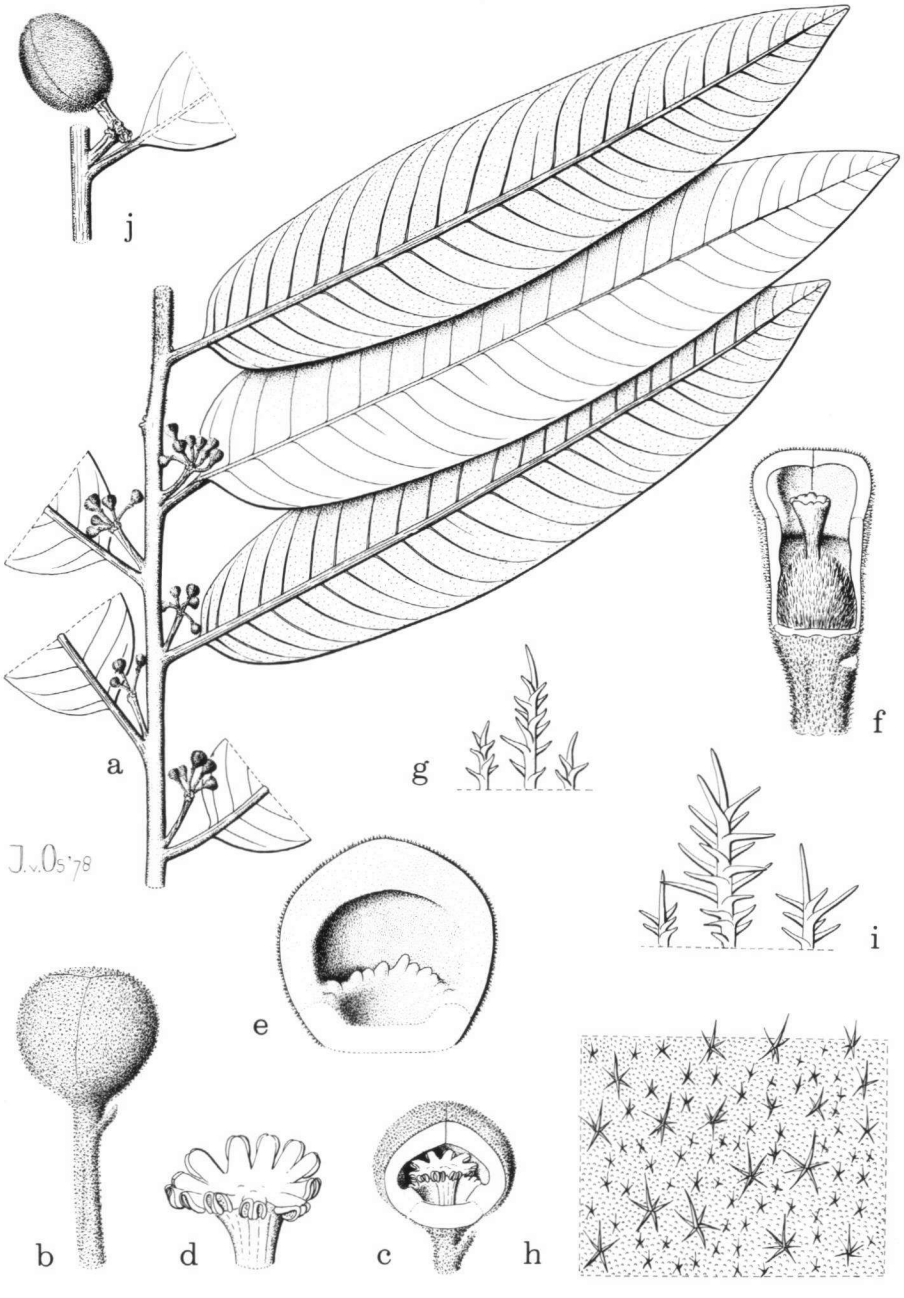
[*K. neglecta* Warb., *nom. nud. in sched.* – T y p e: India, Mysore, *Beddome s.n.* (BM, *n.v.*).]

Myristica amygdalina Grah., Cat. Bomb. Pl. (1839) 175, *non* Wallich (1829; this is *Horsfieldia*). – T y p e: India, Bombay, fr.; ♂ fl., *Dalzell. s.n.* (K).

Myristica corticosa auct. non (Lour.) Hook. *f.* & Th.: Beddome, Fl. Sylv. 2 (1872) 271.

[*Myristica travancoria* Bedd., *nom. nud. in sched.* – T y p e: India, Madras, *Beddome 222* (K, *n.v.*).]

Tree 5–25 m. *Twigs* terete, usually slender, finely striate, in apical portion 1.5–4(–5) mm diam., early or late glabrescent from rather woolly rusty tomentum composed of hairs *c.* 0.3 mm long, lower down grey brown to blackish, the *bark* not or only faintly tending to crack or flake. *Leaves* membranous to thinly coriaceous; above olivaceous to blackish brown; on lower surface greyish, indistinctly finely papillose, largely glabrescent from thin tomentum composed of stellate hairs *c.* 0.3 mm long; *blade* elliptic-oblong to oblong-lanceolate, usually broadest at the middle, or ± parallel-sided, 10–25(–32) × 3–8(–11) cm, top up to 2.5 cm acute-acuminate, base cuneate to rounded; *midrib* flat or slightly prominent above; nerves 12–20 pairs, rather raised above; tertiary venation forming a fine network distinct above; *petiole* rather late glabrescent, 10–15 × 1.5–3 mm. *Inflorescences* sessile or often up to 5 mm peduncled, simple or knobby, up to 5 mm diam.; (2–)4–12-flowered in male, *c.* 1–5-flowered in female; flowers with persistent rusty tomentum of woolly hairs 0.2–0.7 mm long. *Male flower* pedicels 4–10 mm long, the bracteole late caducous, above the middle or usually apically; *perianth* in bud broadly obovoid to globose, 4.5–5 by 4–4.5 mm, inside reddish; valves 3, at sutures 0.5–0.7 mm thick, splitting the bud to (*c.* 2/3? to) 3/4–4/5; *staminal disc*


j
a
J.v.O.'78
g
f
i
e
b
d
c
h

flat, incl. anthers circular or faintly triangular, (1.5–)2–3 mm diam.; *anthers* 9–14, just-sessile to shortly stiped, horizontal, 0.5–0.7 mm long, not touching each other; column 1–2 mm long. *Female flower* pedicels *c.* 2–3 mm long, the bracteole apically; perianth in bud obovoid-oblong, *c.* 6–7.5 mm long; valves 3, splitting the bud to *c.* halfway; pistil *c.* 5 mm long; ovary subglobose to ovoid, 3(–4) mm long; style *c.* 1.5 mm long; *stigma* 2-lobed and each lobe again 2–4-lobulate. *Fruits* 1–3 per infructescence, ellipsoid to oblong, (15–)25–35 × (15–)16–20 mm, top often 2–3 mm apiculate, tomentum composed of hairs 0.5–1.2 mm long, partially glabrescent; pericarp 2–3 mm thick at suture; stalk 2–8 mm long.

Distribution: Peninsular India (Bombay, Mysore, Kerala, Madras; see Sinclair, *o.c.*, p. 168, 169).

INDIA. Peninsular: *Barber 1940 (2940), 5671; Bourdillon 431, 432; Kostermans 26046, 26212; Law s.n. (Hb. Hook. f. & Th. 1104, 1107); Subramanian 1407; Wallich Cat. 6791; Wight 2427 (2487?), 2486, 2487, 2490.*

Ecology. Moist forest of W. and SW. Peninsular India; up to *c.* 1000 m. alt.

Vernacular names: *Chora panu* (Malabar); *chora patthiri* (Tamil); *rukt-maru* (Kanara) (*fide* Sinclair, *l.c.*).

Notes. 1. Fieldnote. Bark recorded as flaking.

2. Probably much related to *K. globularia*, which is distributed from Assam and South China to Malaya and differs by usually smaller leaves with a less distinct reticulation, by smaller fruits, 15–20 mm long, by some flower characters (see the key), and by generally more slender twigs which are usually more coarsely and distinctly striate in the apical portion.

3. This species is presently accepted in the same sense as by Sinclair and previous authors.

57. Knema austrosiamensis de Wilde, *sp. nov.* – **Fig. 14.**

Ramuli ad apices 3–4(–5) mm diam. tomentoque pilis 0.2–0.3 mm longis, deorsum cortice haud lamellari obtecti. Folia chartacea, subtus tomentosa e pilis vario sessilibus atque stipitatis, e statura variabile, tarde glabrescentia. Inflorescentiae ♂ pedunculo 2–10 mm longo. Flores ♂: pedicelli 5–10 mm longi, bracteola ad apicem inserta, perianthio in alabastro subgloboso, 5–5.5 mm diam. Antherae 12–15, semi-sessiles, plus minus obliquae. Discus staminalis planus, antheris inclusis 2.5–3 mm diam.; columna staminalis 1.5–2 mm longa. Pericarpium ad sutura circa 3 mm crassum, tomento e pilis circa 0.5 mm longis ad basin fructus 1–1.5 mm longis formato.

Type: SW. Thailand, E. of Makkam, 12°12'N., 99°35'E, 31 Aug. 1972, ♂ fl., *Larsen, Nielsen, & Santisuk 32242* (AAU).

Fig. 14. *Knema austrosiamensis* de Wilde – a. habit of portion of branchlet with peduncled male inflorescences, × ½; b. mature male flower bud, × 3½; c. opened mature male perianth in bud showing androecium, × 3½; d. androecium in almost lateral view, × 7; e. valve of perianth seen from inside showing irregularly bulged disc-like thickenings at base, × 7; f. opened female flower bud showing pistil, × 3½; g. sample of hairs from female perianth (half-schematic), × 60; h. detail of lower leaf surface with persistent tomentum of scattered dendroid hairs of mixed sizes, × 30; i. sample of hairs from lower leaf surface (half-schematic), × 60; j. piece of branchlet with peduncled infructescence, × ½. – a, h. from *Santisuk 735*; b–e. from *Larsen c.s. 32242* (type); f, g, i, j. from *van Beusekom c.s. 1003.*

Tree 6–20 m. *Twigs* terete, in apical portion 3–4(–5) mm diam., coarsely striate, the *bark* not tending to crack or flake. *Leaves* chartaceous; above olivaceous to brown; on lower surface greyish, faintly finely papillose or not, rather late glabrescent from tomentum composed of sessile-stellate and stellate-dendroid hairs of various sizes; *blade* elliptic-oblong to lanceolate, broadest about the middle, 12–27 × 2.5–7.5 cm, base rounded to attenuate, top subacute to acute-attenuate; *midrib* flat to slightly raised above; nerves 12–27 pairs, slender, flat above; tertiary venation forming a fine network distinct above; *petioles* late glabrescent, 10–15 × 2.5–3.5 mm. *Inflorescences* peduncled for 2–10 mm, simple or forked, 3–5 mm long; 3–15-flowered in male, 1–4-flowered in female; flowers with dull brown to rusty tomentum of hairs 0.2–0.5 mm long. *Male flower* pedicels 5–10 mm long, the bracteole *c.* 1.5 mm long, rather late caducous, at or towards the apex; *perianth* in bud subglobose, (4–)5–5.5 mm diam., inside greenish (or reddish?); valves 3, at sutures *c.* 0.8 mm thick, splitting the bud to *c.* 2/3 to 4/5; *staminal disc* flattish, incl. anthers subtrigonous, 2.5–3 mm diam.; *anthers* 12–15, half-sessile, oblique to suberect, 0.5–0.7 mm long, well-spaced to slightly touching each other; staminal column ± tapering to the base, 1.5–2 mm long. *Female flower* pedicels *c.* 2 mm long, the bracteole caducous, ± median; perianth in bud depressed obovoid-oblong, 6–8 × (3–)3.5–4 mm; valves 3 or 4, at suture *c.* 1 mm thick, splitting the bud to *c.* halfway deep; pistil *c.* 5 mm long; ovary subglobose, *c.* 3 mm diam., densely pubescent with at base longer hairs up to 1 mm.; style 2–2.5 mm long; *stigma* (1- or)2-lobed, with shallowly many-lobulate edge. *Fruits* 1 or 2 per infructescence, broadly ellipsoid, base and top obtuse, 25–30 × 18–22 mm, with dense rusty tomentum of hairs *c.* 0.5 mm long, at base of fruit up to 1–1.5 mm long; pericarp *c.* 3 mm thick at suture; stalk 2–4 mm long.

Distribution: Southern part of Thailand

THAILAND. Peninsular, Prov. Nakhon Si Tammarat: *van Beusekom & Phengkhlai 1003;* Ranong, *Santisuk 735* – S W: *Larsen c.s. 32242* – SE., Dan Chumpan, Krat, *A.F.G. Kerr 17607.*

Ecology: Evergreen forest; 0–1000 m. alt. Flowers in May, Aug., and Nov.; fruits in May and Dec.

Vernacular name: *Lûat kwai* (SE. Thailand).

Notes: 1. This species seems most related to *K. erratica* from NE. India, Yunnan, and Vietnam, a species which differs mainly by the less robust twigs, somewhat smaller flowers, and by the bracteole being inserted more or less median, not apically, on the pedicel. Superficially the present new species resembles much *K. elegans*, but has a quite different tomentum on the lower leaf surface.

2. The flowers of *van Beusekom & Phengkhlai 1003*, a female specimen, were recorded as green inside.

3. Sinclair included the only then known specimen, *Kerr 17607*, in *K. erratica.*

58. **Knema saxatilis** de Wilde, *sp. nov.*

Ramuli ad apices 1.5–3 mm diam. tomentoque pilis circa 0.3 mm longis, deorsum cortice haud lamellari obtecti. Folia coriacea, subtus plus minus citius glabrescentia ab tomentum e pilis vario sessilo-stellates atque dendroides compositum. Inflorescentiae ♂ sessiles vel pedunculo usque ad 1.5 mm longo. Flores ♂: pedicelli 5–8 mm longi, bracteola circa media inserta, caduca; perianthio in alabastro subgloboso, 3.5–5 mm longo, 3.5–4.5 mm diam. Antherae 9 vel 10, semi-sessiles, suberectae. Discus

staminalis plus minus planus, antheris inclusis 1.7 – 2.5 mm diam.; columna staminalis 1.2 – 2 mm longa. Fructus 26 – 33 mm longus; pericarpium ad sutura circa 2 mm crassum, tomento e pilis circa 0.5 mm longis vel brevior formato.

T y p e: Vietnam, Annam, near Tourane (Da Nang), 18 Sept. 1923, ♂ fl., *Poilane 8073* (P; iso K).

Tree 5 – 15 m. *Twigs* slender, subterete, coarsely striate, in apical portion 1.5 – 3 mm diam., glabrescent from bright brown or rusty tomentum composed of hairs *c.* 0.3 mm long, lower down striate, the *bark* not tending to crack or flake. *Leaves* coriaceous; above olivaceous to brown; on lower surface greyish, faintly papillate or not, rather early glabrescent from tomentum composed of sessile-stellate and stellate-dendroid hairs, the coarser hairs leaving distinct hair scars (lens, × 30), the hairs remaining for a somewhat longer period on midrib and nerves; *blade* oblong to lanceolate, ± parallel-sided or broadest at or ± above the middle, 5 – 22 × 1.5 – 4 cm., base cuneate to obtusish, top subobtuse to acute or faintly acute-acuminate; *midrib* slightly raised above; nerves 10 – 22 pairs, little raised or not above; tertiary venation forming a fine network, not distinct above; *petiole* late glabrescent, 5 – 15 × 1 – 2.5 mm. *Inflorescences* sessile or up to 1.5 mm peduncled, simple, 2 – 5 mm long; 3 – 10-flowered in male, 1 – 5(?)-flowered in female; flowers with dense rusty tomentum of hairs 0.2 – 0.3 mm long. *Male flower* pedicels 5 – 8 mm long, the bracteole minute, caducous, situated about halfway; *perianth* in bud broadly depressed obovoid to subglobose, 3.5 – 5 × 3.5 – 4.5 mm, inside reddish (?); valves 3, at sutures (0.5 –)0.7 mm thick, splitting the bud to 3/4 – 4/5; *staminal disc* flat to ± concave, incl. anthers circular, 1.7 – 2.5 mm diam.; *anthers* 9 or 10, suberect, half-sessile, 0.5 – 0.6 mm long, not tightly touching each other; staminal column ± tapering to the base, 1.2 – 2 mm long. *Female flowers* not seen. *Fruits* 1 or 2 per infructescence, broadly ellipsoid, base and top broadly rounded, 26 – 33 × 20 – 25 mm, with dense tomentum of minute hairs *c.* 0.5 mm long or less; pericarp *c.* 2 mm thick at suture; stalk 1 – 4 mm long.

D i s t r i b u t i o n: Vietnam (Annam, vicinity of Da Nang).

VIETNAM. A n n a m, vicinity of Tourane (Da Nang): Ba-Na (Mt. Bani), *Clemens 4191; Poilane 29203*; Col de Nuages (near Tourane), *Poilane 7990, 8073, 8079.*

E c o l o g y: Montane forest, 900 – 1500 m alt. Flowers in May, July, and Sept.; fruits in March and Sept. Several times recorded as growing in very rocky granitic ground.

N o t e s: 1. Fieldnotes. Wood yellowish. Fresh fruits recorded as bright camel coloured.

2. Closely related to *K. erratica* from NE. India, Yunnan, and Vietnam (and Laos?), a species which differs by smaller fruits with longer stalks of 5 – 10 mm; in NE. India the fruits with a more conspicuous tomentum. See also the notes under *K. erratica*.

Several specimens resemble in habit strikingly *K. mixta*, a species from about the same area and habitat; that species differs, however, by quite differently shaped male flower buds, and by the apical bracteole, while its reticulation on the upper leaf surface is very fine and distinct, like that in *K. lenta*.

3. Sinclair determined *Clemens 4191* as *K. cinerea* var. *andamanica*, the Poilane collections as coriaceous forms of *K. globularia*.

59. **Knema erratica** (Hook. *f.* & Th.) Sinclair

Myristica erratica Hook. *f.* & Th., Fl. Ind. 1 (1855) 156; DC., Prod. 14 (1856) 205; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 323, pl. 162. – *Myristica longifolia* Wall. *ex* Bl. var. *erratica* Hook. *f.*, Fl. Brit. India 5 (1886) 110. – *K. erratica* Sinclair, Gard. Bull. Sing. 18 (1961) 205, fig. 9 (excl. syn. *K. siamensis* Warb.). – T y p e: India, Khasia, ♂ fl., fr., *Hooker f. & Thomson s.n.* (K; iso BM, C, L, P; A, BR, CAL, CGE, E, FI, G, LE, U, W, *n.v.*).

[*K. yunnanensis* H. H. Hu, J. Roy. Hort. Soc. 63, 8 (1938) 387, *nom. nud.*; see Sinclair, Gard. Bull. Sing. 16 (1958) 328; 18 (1961) 208, 209. – T y p e: S. Yunnan, *Wang 73168 (n.v.), 78230 (n.v.).*]

Myristica angustifolia auct. non Roxb.: Kanjilal, Fl. Assam 4 (1940) 45.

Myristica glaucescens auct. non (Jack) Hook. *f.* & Th.: Kanjilal, Fl. Assam 4 (1940) 45, *quoad spec.* Sibgagar (*fide* Sinclair).

Tree 5–15 m. *Twigs* subterete, finely or coarsely striate, in apical portion (1.5–)2–4 mm diam., glabrescent from rusty tomentum composed of hairs *c.* 0.5 mm long, lower down striate, the *bark* not tending to crack or flake. *Leaves* thinly coriaceous; above greenish brown to brown; on lower surface greyish, finely papillate, rather early glabrescent from tomentum composed of sessile-stellate and dendroid hairs, *c.* 0.2–0.5 mm long, much more densely set on midrib and nerves; hairs rather easily rubbed off and leaving hair scars; *blade* lanceolate, broadest usually at or above the middle, or ± parallel-sided, 12–25 × 3–5.5 cm, base attenuate to rounded, top acute or up to 2.5 cm acute-acuminate; *midrib* slightly raised above; nerves 22–30 pairs, slightly raised above; tertiary venation forming a fine network, well-visible above; *petiole* 10–15 × 2–3 mm. *Inflorescences* peduncled for up to 4 mm long, simple, 2–4 mm diam.; 2–8-flowered in male, 1–6-flowered in female; flowers with persistent tomentum of hairs 0.2–0.3 mm long. *Male flower* pedicels 5–8 mm long, the bracteole caducous, at about halfway; *perianth* in bud subglobose to broadly obovoid, (3.5–)4–5 mm diam., inside reddish (?); valves 3, at sutures 0.5–0.7(–1) mm thick, splitting the bud to 3/4–4/5; *staminal disc* flat to slightly concave, incl. anthers circular, 2–2.3 mm diam.; *anthers* 11(–13), half-sessile, suberect, 0.5–0.6 mm long, not touching each other; staminal column ± tapering to the base, 1.5–2 mm long. *Female flower* pedicels 3–5 mm long, the bracteole ± median; perianth in bud ellipsoid-obovoid, slightly contracted at the middle, *c.* 7.5–8 × 4 mm; valves 3, at sutures *c.* 0.8 mm thick, splitting the bud to over halfway; pistil *c.* 5 mm long; ovary subglobose, 2.5–3 mm diam., densely tomentose by hairs 0.5–1 mm long; style incl. stigmas 1.5–2 mm long; *stigma* 2 (or 3)-lobed, and each lobe again (3–)4–5-lobulate. *Fruits* 1 or 2 per infructescence, ellipsoid, obtuse, *c.* 15–20 × 12–15 mm, with dense tomentum of hairs *c.* 1–1.5 mm long, largely shed later; pericarp *c.* 1.5 mm thick at suture; stalk 5–10 mm long.

D i s t r i b u t i o n: India (E. Himalaya Mts., Sikkim, Assam, Khasia), Bangladesh (?, no specimens seen), Burma (?; Upper Burma, no specimens seen), China (Yunnan, no specimens seen), Laos and Vietnam (see notes).

INDIA: *Clarke 42348C; Griffith 4347; Hooker f. & Thomson 1040; Koelz 24748.*
LAOS: Exp. du Mekong, 1866–1868, *Thorel 3152.*
VIETNAM. Annam: *Poilane 1007* (in Hb. *Chevalier*).

E c o l o g y: Montane forest, 600–1500 m alt. Flowers Dec. – Febr. For vernacular names see Sinclair, l.c.

N o t e s: 1. This species was included by Warburg, Mon. Myrist., 1897, p. 561, in *K. angustifolia.*

Sinclair included *K. siamensis* in the synonymy of the present species, whereas it is presently regarded as a synonym of *K. elegans*, a species which differs from *K. erratica* by the persistent tomentum on the lower leaf surface composed of dendroid hairs all ± equally long stalked, similar to that e.g. in *K. laurina.*

2. The present species is closely related to *K. saxatilis* from Vietnam (Annam), a species which differs by larger, almost sessile fruits.

3. The collection *Thorel 3152* (P, 3 sheets), possibly from Laos, with mature fruits 15–19 mm long, stalks *c.* 5 mm long, and the specimen *Poilane 1007* (in herb. *Chevalier*), from Vietnam (Annam), with immature fruits, stalks 5–7 mm long, most likely belong in *K. erratica.* The two collections are mutually rather different in the shape of the blades and in the reticulation on the upper leaf surface. Flowering male specimens from Indo-China are lacking; neither have I seen any other specimen of the present species from the much under-collected area in between Vietnam and Assam.

XI. series GLAUCAE de Wilde, *ser. nov.*

Alabastra ♂ circa aequilonga quam lata, plerumque plus minus globosa, in anthesi fissa ad circa 3/4 vel ultra attingentia. Columna staminalis breviore quam disci staminalis diameter (antheris inclusis). Antherae 6–18, horizontales, semisessiles usque stipitatae. Discus staminalis plus minus planus. Flores tomento e pilis brevissime, circa 0.2 mm longis vel brevior, generaliter persistente induti. Folia subtus verrucas suberosas minutas haud obtecta, glabrescentia vel persistenter tomentosa pilis saepe inconspicuis. Ramuli plerumque tenues, ad apicem 0.5–4 mm diam., in partibus vetustioribus cortice haud lamellari.

T y p u s: *Knema glauca* (Bl.) Warb.

Species 60–76.

60. Knema lenta Warb. – Fig. 15.

K. lenta Warb., Mon. Myrist. (1897) 584; Lecomte, Not. Syst. 1, 4 (1909) 101; Fl. Gén. I.-C. 5, 2 (1914) 104. – [*Myristica lenta* Pierre, *in sched.*] – T y p e: S. Vietnam, Baria, Prov. Bien Hoa, 1865, 1866, 1867, ♂ fl., ♀ fl., *Pierre s.n. & coll. bois 26* (P; iso BM, K, L; BO, E, G, LE, *n.v.*).

Myristica corticosa auct. non (Lour.) Hook. *f.* & Th.: Hook. *f.* & Th., Fl. Ind. 1 (1855) 158, *p.p.*; DC., Prod. 14 (1856) 205, *p.p.*; Kurz, For. Fl. Br. Burma 2 (1877) 284, *p.p.*

K. cinerea var. andamanica auct. non (Warb.) Sinclair: Sinclair, Gard. Bull. Sing. 18 (1961) 174, fig. 4, *p.p.* (excl. syn. *K. glauca* var. *andamanica* & *nicobarica*, and *K. angustifolia*).

Tree 8–20 m. *Twigs* rather slender, terete, finely striate or not, in apical portion 1.5–2.5 mm diam., early glabrescent from scurfy to short-woolly tomentum composed of scales and stellate hairs *c.* 0.1 mm long, sometimes mixed with short dendroid hairs up to 0.2 mm long; lower down the *bark* not tending to crack or flake. *Leaves* chartaceous to thinly coriaceous; above olivaceous to bright brown; on lower surface greyish, glabrescent from rather loose tomentum composed of stellate and stellate-dendroid hairs *c.* 0.2(–0.3) mm long, the tomentum often remaining for some longer period towards the base of the blade and on the petiole; *blade* (ovate-)oblong to lanceolate-linear, broadest above to below the middle, 8–24(–33) × 2–8(–9) cm, base subobtuse to long-attenuate, top acute or up to

2.5 cm acute-acuminate; *midrib* raised above; nerves 16–31 pairs, above slender, flat to sunken; tertiary venation forming a very fine network, the areoles less than 0.5 mm diam., distinct above; *petioles* rather early glabrescent, 6–16 × 1.5–4 mm. *Inflorescences* sessile or usually peduncled for 0.5–3 mm, simple or forked, up to 8 mm long; (5–)10–20-flowered in male, 1–5-flowered in female; flowers with persistent or sometimes partially shed, inconspicuous, scurfy to ± woolly tomentum of scales or stellate hairs generally *c.* 0.1 mm long or less, rarely up to 0.3 mm long. *Male flower* pedicels 5–10 mm long, the bracteole minute, early to late caducous, at or above halfway; *perianth* in bud (depressed) globose, sometimes triquetrous in transverse section, *c.* 3–4 × 3.5–4.5 mm, inside reddish (always?); valves 3, at sutures 0.6–0.8 mm thick, splitting the bud to *c.* 4/5; *staminal disc* flat, incl. anthers circular to trigonous, 1.5–2.5 mm diam.; *anthers* (8–)9–16, half-sessile to distinctly stiped, horizontal, 0.3–0.6 mm long, opening to beneath, well-spaced; staminal column slender, 0.5–1.3 mm long. *Female flower* pedicels 2–6(–10) mm long, the bracteole caducous, at or above halfway; perianth in bud ellipsoid-oblong to obovoid, 4–6 × 2–3.5 mm; valves 3, at sutures *c.* 0.8 mm thick, splitting the bud to or slightly over halfway; pistil 3–4.5 mm long; ovary subglobose to ovoid, *c.* 2–3 × 1.5–2.5 mm, comparatively long-hairy by hairs 0.5–1 mm long; style *c.* 1–1.5 mm long; *stigma* 2(or 3)-lobed and each lobe shallowly many-lobulate. *Fruits* 1–3 per infructescence, ellipsoid, sometimes narrowed at the base, 18–35 × 12–20 mm, with conspicuous, yellowish brown to rufous, shaggy tomentum composed of hairs 1–2 mm long, often later on shed except for those at the very base, leaving a finely warty surface of the pericarp; pericarp 1–2 mm thick at suture; stalk 2–8(–12) mm long.

Distribution: Continental SE. Asia; Bangladesh (Chittagong), Burma, Thailand (in Peninsular S. to Krabi), S. Vietnam.

BANGLADESH. E. Bengal and Chittagong: *Hooker f. & Thomson s.n.* (in herb. P: *no. 1041*); *Roxburgh s.n.* (*p.p.*; in BM. the left and lower right hand specimen; see notes).

BURMA. Pegu and Rangoon: *Dickason 6689; Kurz 2431;* Katha Dist., Kadu Hill: *Lace 5093.* – Tenasserim Prov., Moulmein: *Falconer s.n.* (*Anderson, 1866, no. 28*). – Upper Burma: *Brandis s.n.*

THAILAND (various localities): *Geesink 8209; Gram & Syrach-Larsen 43; Hennipman 3359; Kerr 3122, 5159, 5470, 5547, 6446, 6447; Larsen 9290; Winit 265.* – Deviating specimens (see notes): *van Beusekom & Phengkhlai 479; van Beusekom c.s. 3839; Larsen c.s. 31223.*

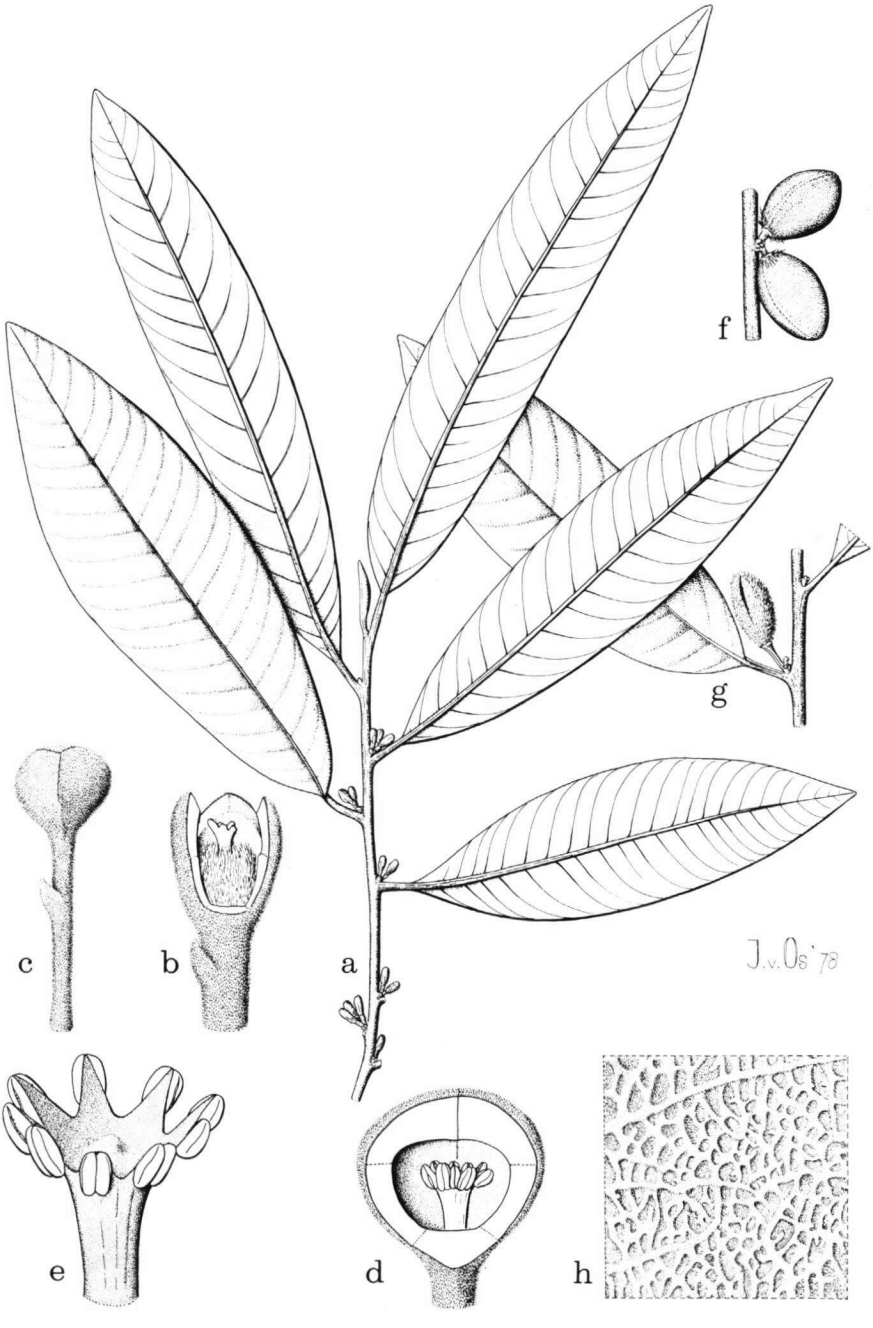
VIETNAM. South (Prov. Bien Hoa): *Pierre sn.; Pierre Coll. bois 26, (66), 260; Poilane 2500.*

Ecology: Mixed evergreen forest, riverine forest, hilly forest; recorded from limestone; 150–1200 m alt. Flowers mainly Sept. – Dec., fruits mainly Jan. – June.

Vernacular names: *Lablú* (Kachin, Burma), *Ma-Muang-Lûat, Ma-Muang-Lûat-Noi* (Chiengmai, N. Thailand), *Ma Làp Lào* (Laos) (see also Sinclair, 1961, under *K. cinerea* var. *andamanica*).

Notes: 1. Fieldnotes. Flowers inside recorded as red or pinkish, filaments

Fig. 15. *Knema lenta* Warb. – a. habit of twig with female inflorescences, × ½; b. opened mature female flower showing the pistil, × 3½; c. mature male flower bud, × 3½; d. opened mature male perianth in bud showing the androecium, × 7; e. androecium in almost lateral view, × 15; f. piece of twig with infructescence (note hairs at the bases of the fruits), × ½; g. piece of twig with infructescence, fruit immature, × ½; h. detail of glabrescent lower leaf surface showing very finely reticulate tertiary venation, × 7. – a, b. from *Kerr 6446*; c–e. from *Hb. Pierre 26* (type); f. from *Kerr 5547*; g, h. from *Geesink 8209*.


f
g
c
b
a
J.v.Os '78
e
d
h

red, anthers light yellow in the short-haired specimens *Hennipman 3359* and *van Beusekom c.s. 3839*, from Thailand; in *Dickason 6689*, from Rangoon, Burma, the flower is annotated as yellow, but it is not clear whether this concerns the colour inside or outside.

2. Related and resembling species. *K. globularia*, with partially the same distributional area, differs by the general shape of the male flower buds and by a generally more conspicuous tomentum on the flowers; also, the texture of the leaves is different.

K. lenta keys out together with the group of species around *K. cinerea*, from which it differs by the combination of various smaller characters; the usually long-shaggy tomentum of the fruits is characteristic.

K. lenta was placed by Sinclair, 1961, p. 174, in the synonymy of *K. cinerea* var. *andamanica* a taxon presently treated as a separate species. That resembles *K. lenta*, but generally differs in the shape and architecture of the male flowers.

3. Noteworthy specimens. Specimens from the Chittagong area, Bangladesh, e.g. *Hooker f. & Thomson s.n.* (K), and from Peninsular and SW. Thailand (Kanchanaburi), e.g. *van Beusekom c.s. 479, 3839* (L), and *Larsen 31223* (AAU), have the twig apices and the flowers with only a very thin inconspicuous tomentum of scales *c.* 0.1 mm long, the twigs and leaves being early glabrescent. In these specimens the tomentum of the ovary and the fruits is also relatively short, only *c.* 0.5 mm and 1 – 1.5 mm long respectively. In *van Beusekom c.s. 3839* and *Larsen 31223* the fruit stalks are relatively long, 8 – 12 mm. Possibly these specimens represent a separate taxon.

4. Note on the specimen *Roxburgh s.n.*, in BM. This sheet belongs to the type of *Myristica angustifolia* Roxb., and consists of elements belonging to two species. The upper right hand specimen is a twig with male flowers, selected as the lectotype of *Myristica angustifolia* (see there). The remainder on the sheet *Roxburgh s.n.* in BM. consists of a sterile twig at left hand and a leafless twig with a fruit at right hand below, and both are *K. lenta* Warb.

61. **Knema squamulosa** de Wilde, *sp. nov.*

Ramuli ad apices 3 – 3.5 mm diam., tomentosi tomento e pilis minus quam 0.1 mm longis composito, deorsum cortice haud lamelloso obtecti. Folia rigide coriacea, subtus tomento persistente e pilis stellato-squamiformibus minus quam 0.1 mm longis composito; nervis tertiariis reticulum tenerrimum formantibus; areolae minus quam 0.5 mm diam., in pagina superiore conspicuae. Fructus 35 – 40 mm longi; pericarpium ad suturam circa 3 mm crassum, glabrescentes praeter partem basalem atque ad apicem tomento obtectum e pilis circa 0.5 mm longis vel brevioribus composito.

T y p e: Vietnam, Annam, 25 km. from Nhatrang, at Ninh-Hoa, 17 Oct. 1923, fruits, *Poilane 8262* (P, 2 sheets).

Tree 10 – 12 m. *Twigs* terete, finely striate, in apical portion 3 – 3.5 mm diam., early glabrescent from minute tomentum composed of stellate scales less than 0.1 mm long; *bark* of twigs lower down finely striate, not tending to crack or flake. *Leaves* rigidly coriaceous; above olivaceous; on lower surface some rufous-grey, faintly papillate, with persistent tomentum composed of brown scales less than 0.1 mm long; *blade* (elliptic-)oblong to lanceolate, broadest at or somewhat below the middle, 17 – 31 × 5 – 10.5 cm, base rounded to short-attenuate, top obtusish to subacute; *midrib* flat to little raised above; nerves 13 – 20 pairs, slightly raised or not

above; tertiary venation forming a very fine network with areoles less than 0.5 mm diam., distinct above; *petioles* early glabrescent, 14–20 × 3–4 mm. *Female inflorescences* peduncled for 1–2 mm, few-flowered. *Flowers* not seen. *Fruits* 1 or 2 per infructescence, ellipsoid-obovoid, top broadly rounded, 35–40 × 27–28 mm, glabrescent except at very base and top which are minutely pubescent by hairs *c.* 0.5 mm long or less; persistent style *c.* 0.5 mm long, *stigma* ± 2-lobed and each lobe again 2- or 3-lobulate; pericarp *c.* 3 mm thick at suture; stalk 5–6 mm long, with the bracteole scar towards the top.

Distribution: Vietnam (Annam; only known from the type).

Ecology: Montane forest on rocky-clayey soil; 800 m alt. Fruits in October.

Notes: 1. Although the flowers are not known, this species seems, as judged from the leaf characters, to be related to *K. lenta*, the latter being distinct by the less stout habit, the largely glabrescent leaves with a different tomentum beneath, and by the smaller fruits with long-shaggy tomentum.

2. The type, *Poilane 8262*, in P, was identified by Sinclair as *K.* probably *rigidifolia.*

62. **Knema sessiflora** de Wilde, *sp. nov.*

Ramuli ad apices 1.5–2 mm diam., tomentum e pilis minus quam 0.1 mm longis induti, deorsum cortice haud lamelloso obtecti. Folia chartacea, 6.5–15 cm longa, subtus citius glabrescentia ob pilo minus quam 0.1 mm longo. Inflorescentiae ♂ pedunculo usque ad 0.5 mm longo. Pedicelli florum ♂ 2–2.5 mm longi, pedicelli florum ♀ 0.5–1.5 mm longi; bracteola circa medium inserta, caduca; perianthium in alabastro subglobosum, 2.5–3 mm diam. Antherae 11, brevissime stipitatae, horizontales. Discus staminalis planus, antheris inclusis circa 1.2 mm diam.; columna staminalis circa 0.7 mm longa. Fructus ignotus.

Type: Vietnam, Annam, Ba-Na, near Tourane (Da Nang), ♀ fl., 1 March 1939, *Poilane 29162* (P; iso K).

Tree 10–12 m. *Twigs* slender, terete, smooth or finely striate, in apical portion 1.5–2 mm diam., early glabrescent from inconspicuous greyish tomentum composed of hairs less than 0.1 mm long, lower down the *bark* ± striate, not or indistinctly cracking, not flaking. *Leaves* chartaceous; above olivaceous to dark brown; on lower surface greyish, faintly papillate, rather early glabrescent from inconspicuous tomentum composed of scattered, minute, mainly stellate scales less than 0.1 mm long; blade oblong to lanceolate, parallel-sided or broadest at about halfway, 6.5–15 × 1.5–4.5 cm, top up to 1 cm acute-acuminate, base cuneate-attenuate; *midrib* flattish above; nerves 14–21 pairs, faint, flat above; tertiary venation forming a fine network distinct above; *petioles* early glabrescent, 8–12 × 1–1.5 mm. *Inflorescences* sessile or up to 0.5 mm peduncled, simple, 2–4 mm diam., 5–20-flowered in male, 3–10-flowered in female; flowers with persistent, dense, dark rusty tomentum of hairs less than 0.1 mm long. *Male flower* pedicels 2–2.5 mm long, the bracteole minute, caducous, at or below halfway; *perianth* in bud subglobose, *c.* 2.5 × 2.5–3 mm, inside reddish(?); valves 3, at sutures *c.* 0.5 mm thick, splitting the bud to *c.* 3/4; *staminal disc* flat, incl. anthers circular, *c.* 1.2 mm diam.; *anthers* 11, just stiped, (sub)horizontal, *c.* 0.5 mm long, not touching each other; column *c.* 0.7 mm long. *Female flower* pedicels 0.5–1.5 mm long, the bracteole minute, caducous, situated about halfway; perianth in bud longly obo-

void, 4.5 – 5.5 × 3 – 4 mm; valves 3, splitting the bud to over halfway; pistil 2.5 – 3 mm long; ovary ovoid, 2 – 2.3 mm long; style 0 – 0.5 mm long; *stigma* ± 7- or 8-lobulate (± 2-lobed and each lobe again ± 3- or 4-lobulate). *Fruits* not seen.

Distribution: Vietnam (Annam).

VIETNAM. Annam: *Poilane 5128, 29162.*

Ecology: Montane forest on clayey soil or granitic ground; 300 – 900 m alt. Flowers in March and Nov.

Notes: A species close to *K. globularia*, but here tentatively placed in series *Glaucae* because of its very short tomentum in all parts. *K. globularia* differs by the larger and longer-pedicelled male flowers and by the usually much thicker tomentum on the flowers, composed of hairs generally 0.1 – 0.3 mm long, incidentally up to 0.7 mm long.

Female flowering specimens may recall some specimens of *K. glauca* from Java, which incidentally have subsessile female flowers. For further notes see under *K. globularia*. Sinclair identified the specimens cited above as *K. globularia*.

63. **Knema rubens** (Sinclair) de Wilde, *stat. nov.*

K. glaucescens Jack var. *glaucescens* forma *rubens* Sinclair, Gard. Bull. Sing. 16 (1958) 307, fig. 13 B. – *K. cinerea* (Poir.) Warb. var. *rubens* Sinclair, Gard. Bull. Sing. 18 (1961) 185. – Type: Malay Peninsula, Singapore, ♂ fl., *Ridley 4819* (SING, *n.v.*; iso K; DD, *n.v.*).

Distribution: Malaya, Singapore, northern Sumatra.

MALAYA. Kedah: *Kep. FN 78944.* – Kelantan: *UNESCO Limestone Exp. 1962 no. 200.* – Trengganu: *FRI 14833.* – Pahang: *FRI 3670, 10919, 14393, 14414, 14898, 17247; Kep. FN 97906, 98910; Mohd. Shah MS. 1312, 1754, 1758, 1824, 1896, 2647; Samsuri Ahmad & Shukor SA. 398; Soepadmo 836.* – Johore: *Kep. FN 94842; FRI 16494.* – Penang I.: *Curtis 1559.*

SINGAPORE: *Ridley 4819; SING 35901, 40713.*

SUMATRA. E. Coast: *Krukoff 4087; Lörzing 14588; Yates 1819.* – Tapanuli: *Ramat si Boeea 6022.* – Simaloer I.: *Achmad 206, 840, 1176.*

Notes: 1. Characterized within the series *Glaucae*, in which it is tentatively placed, by the flattened twig apices and various small other characters as given in the keys. Flattened twig apices occur also in *K. luteola* and *K. oblongifolia*. In general habit the species shows much resemblance to certain specimens of *K. latericia*, a species with usually scaly bark of twigs, a distinctly convex staminal disc, thicker tomentum on twig apices and flowers, etc.

2. By Sinclair the present species was recognized as an infraspecific taxon under *K. glaucescens* (1958, as a form), and later under *K. cinerea* (1961, as a variety). The specimens recorded for Sarawak by Sinclair do not belong here.

64. **Knema kinabaluensis** Sinclair

K. kinabaluensis Sinclair, Gard. Bull Sing. 18 (1961) 229, fig. 12. – Type: Borneo, Sabah, Mt Kinabalu, 15 June 1957, ♂ fl., *Sinclair 9224* (SING, *n.v.*; iso K, L; B, E, M, SAN, *n.v.*).

Distribution: Borneo (Sabah: Mt. Kinabalu area).

BORNEO. S a b a h. Mt. Kinabalu and vicinity: *Chew, Corner, Stainton, RSNB. 1885, 4129, 4396, 4423, 4916, 4928, 4968, 7024; Clemens 26697, 26697A, 28354, 29358, 29358-bis, 29515, 30283, 30321, 31406, 32498, 33032 (=33086), 34094, 34292, 40545* (*p.p.*, the ♂ fl., not the fruits), *50012; Darnton 515; Nooteboom 1041; SAN A. 4484, 16449, 20318, 20340, 31759, 32288, 38404 (38405?), 41842, 46512, 50710, 60752, 70142, 74503, 76639; SFN 26913, 27852; Sinclair c.s. 9006, 9224.*

N o t e s: 1. A mountain species from 1000–2300 m alt. from Mt. Kinabalu and vicinity. It clearly belongs in a group of related species with *K. cinerea* and *K. glauca*, and apparently it is most related to the latter from which it differs by the coriaceous leaves, the caducous bracteole, and the shortly pubescent, not early glabrescent fruits.

Because of its coriaceous leaves *K. kinabaluensis* resembles *K. rigidifolia* from Malaya, certain coriaceous-leaved specimens referred to *K. pectinata* from northern Sarawak, and *K. kunstleri* subsp. *alpina* from about the same area; *K. rigidifolia* has differently shaped male flowers and fruits and a different tomentum on the lower leaf surface, *K. pectinata* differs by stouter twigs, larger male flowers, and more globose fruits, and *K. kunstleri* subsp. *alpina* can always be distinguished by the presence of minute, blackish, non-traumatic cork warts on the lower leaf surface.

2. In most of the herbarium material the apparently mature fruits are ridged or partly ridged along the suture, but in a few herbarium specimens with apparently very mature fruits this ridge is entirely lacking.

3. K. kinabaluensis is presently accepted in the same sense as originally conceived by Sinclair.

65. **Knema luteola** de Wilde, *sp. nov.*

Ramuli ad apices subcomplanati, dilute brunneoli, 1.5–2.5(–3) mm diam., tomento e pilis circa 0.1 mm longis vel brevioribus induti, deorsum cortice haud lamelloso obtecti. Folia chartacea, subtus cito glabrescentia, in pagina superiore nervis tertiariis reticulatis distinctis, tenuissimis, areola minus quam 0.5 mm diam. Inflorescentiae ♂ sessiles; flores tomento induti e pilis persistentibus 0.1 mm longis vel brevioribus compositi. Flores ♂: pedicelli 4–7.5 mm longi, bracteola supra medium inserta, caduca; perianthium in alabastro globosum, 2.5–4 mm diam., intus luteum. Antherae 9 vel 10, subsessiles ad stipitates, horizontales. Discus staminalis planus, 1.7–2.3 mm diam. (antheris inclusis); columna staminalis circa 0.5 mm longa. Flores ♀ ignoti.

T y p e: Borneo, Central E. Kalimantan, W. Kutai, ♂ fl., 23 Aug. 1925, *Endert 2822* (L).

Tree 8–20 m. *Twigs* in apical portion somewhat flattened or blunt-triangular, pale brownish, smooth, 1.5–3 mm diam., early glabrescent from tomentum composed of hairs *c.* 0.1 mm long or less, lower down the *bark* not flaking. *Leaves* chartaceous, on lower surface early glabrescent from tomentum composed of minute weak hairs; reticulation on upper surface very fine, distinct, the areoles less than 0.5 mm diam. *Male inflorescences* sessile; flowers with persistent tomentum of hairs 0.1 mm long or less. *Male flower* pedicels 4–7.5 mm long, the bracteole caducous, situated above halfway; *perianth* in bud globose, 2.5–4 mm diam., inside yellow or pale yellow. *Anthers* 9 or 10, just sessile to stiped, horizontal. *Staminal disc* flat, incl. anthers 1.7–2.3 mm diam.; staminal column *c.* 0.5 mm long. *Female flowers* not seen. *Fruits* ellipsoid-oblong, 30–55 × 20–23 mm, often beaked at the top, the tomentum consisting of scales less than 0.1 mm long; stalk stout, 15–20 mm long, the bracteole scar at or below the middle.

Distribution: Borneo (Sarawak; W. and E. Kalimantan).

BORNEO. Sarawak: *Geh & Samsuri GSy 1112, 1114; S. 34021, 36036, 36201, 36272.* – W Kalimantan: *Hans Winkler 724.* – Central E. Kalimantan: *Endert 2822.*

Ecology: Hill forest, often by stream banks; 100–700 m alt.

Notes: 1. This is one of the few species of *Knema*, besides *K. rubens* (from Sumatra and Malaya) and *K. oblongifolia* (from Malaya), with the twigs somewhat flattened in the apical portion. *K. rubens* differs by a distinctly thicker tomentum on the twig apices, usually of a rather reddish colour, by the midrib on the lower leaf surface which remains scaly at the base, and by the less fine reticulation of the leaves, with areoles more than 0.5 mm diam.; *K. oblongifolia* has differently shaped male flowers, etc.

2. Stout sterile or fruiting specimens may recall also *K. ashtonii* var. *ashtonii*, which is obviously much related, but which differs by much larger fruits.

3. Specimens belonging to the present species were determined by Sinclair as *K. cinerea* var. *sumatrana.*

66. Knema glauca (Bl.) Warb.

Myristica glauca Bl., Cat. (1823) 111; Bijdr. 11 (1825) 576; Rumphia 1 (1835) 187, t. 60; Miq., Pl. Jungh. (1852) 171; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 320, pl. 157, *p.p.*; Koord. & Val., Med. Lands Pl. Tuin 17 (1896) 189. – *K. glauca* Warb., Mon. Myrist. (1897) 594, t. 25 fig. 1–3 (for the var. *typica* only); Koord., Exk. Fl. Java 2 (1912) 258. – Type: W. Java, several sheets, ♂ fl., ♀ fl., fr., *Blume s.n.* (L; iso P; BO, *n.v.*).

Myristica corticosa auct. non (Lour.) Hook. *f.* & Th.: Hook. *f.* & Th., Fl. Ind. 1 (1855) 158, *p.p.*; DC., Prod. 14 (1856) 205, *p.p.*; Miq., Fl. Ind. Bat. 1, 2 (1858) 69, *p.p.*

Myristica intermedia Bl. var. *minor* Miq., Fl. Ind. Bat. 1, 2 (1858) 70. – Type: Java, *Teijsmann s.n.* (U; iso K).

Myristica corticosa (Lour.) Hook. *f.* & Th. var. *lanceolata* Miq., Fl. Ind. Bat. Suppl. 1 (1861) 384. – Type: Sumatra, Tapanuli, Tobing, Angkola, ♀, ♂ fl., fr., *Junghuhn s.n.* (L; CAL, *n.v.*).

Myristica palembanica Miq., Fl. Ind. Bat. Suppl. 1 (1861) 384. – *K. palembanica* Warb., Mon. Myrist. (1897) 592, t. 25. – Syntypes: Sumatra, Palembang, *Teijsmann 3640* (U; iso BO, *n.v.*), *3641* (BO, *n.v.*), *3791* (U; iso BO, *n.v.*).

K. glaucescens Jack var. *glaucescens auct. non* Jack: Sinclair, Gard. Bull. Sing. 16 (1958) 304, fig. 12, 13A., *p.p.* – *K. cinerea* (Poir.) Warb. var. *sumatrana auct. non* (Bl.) Sinclair: Sinclair, Gard. Bull. Sing. 18 (1961) 185, *p.p.*; Backer & Bakh. van den Brink *jr.*, Fl. Java 1 (1963) 140.

Distribution: Peninsular Thailand, Malaya, Sumatra, Java, Bali I., Borneo.

THAILAND. Peninsular: *Haniff & Nur 2736; Kerr 17078.*

MALAYA. Perak: *Shah & Kadim 283.* – Trengganu: *FRI 11809.* – Pahang: *FRI 15862, 19294.* – Johore: *Kadim & Noor KN. 251; Shah & Kadim (MS.) 359; SFN 28962, 31951, 32384.*

SUMATRA. Tapanuli: *Junghuhn s.n.* – W. Coast: *Meijer 57.* – E. Coast: *Yates 1715.* – Indragiri: *Buwalda 6782.* – Benkulu: *de Vriese 69.* – Palembang: *bb. TB. 656; Endert 59; Forbes 2466, 2606, 2718, 2916, 3141.* – Lampong Districts: *Iboet 400.* – Simaloer I.: *Achmad 1139, 1459* – Siberoet I.: *Iboet 164.* – Bangka: *Kostermans & Anta 652.*

JAVA. (mainly W. and C. Java): *Backer 1918, 25964; Bakhuizen van den Brink 438; van Borssum Waalkes 587; Brinkman 655; Buwalda 3583, 3625; Dransfield 1166; Forbes 486, 592; bb. Ja. 2036, 2448, 2505, 2533, 2919, 6171, 6192, 6202, 6428, 6574, 6610, 6611, 6615, 6676, 6688, 6786, 7135 (Oetja & Wariwat 609); Hb. Helfer 4349 (Hb. of the late East India Company); Junghuhn 561; Koorders 3491β, 5245β, 5253β, 5254β, 5255β, 5263β (192*), 5276β, 5278β, 5279β, 5281β, 5282β, 5285β, 5287β, 5290β, 5291β, 5293β, 5295β, 13335β, 14616β, 14617β (4107t), 15670β, 20084β, 21607β, 21634β, 22777β, 22838β, 23943β, 24291β, 24686β, 25620β, 25635β, 25732β, 25779β, 26938β, 26940β, 27184β, 27481β, 28613β, 33889β, 38902; Kostermans 19322, 23882, Kostermans (UNESCO) 8, 29; Kuswata 293; Mousset 1139;*

Reinwardt 6, 7, 9; Sinclair 10010; Warburg 1739, 3184; Wirawan 393; Zollinger 809 Z, 1398 Z, 2650.
BALI. I.: *Kostermans c.s. 238, 285, 298.*
BORNEO. Sarawak: *Beccari 1094; Clemens 21600; Nielsen 97; Purseglove P. 5188; S. 10111, 13363, 16278, 16376, 17776, 18947, 21106, 21852, 27597, 37625, 37748; Sinclair 10361; SFN 36081.* – Sabah: *Amdjah 938, 941; SAN 22768, 74350.* – W. Kalimantan: *Hallier 8.* – E. Kalimantan: *Endert 2557; Kostermans 10387, 10451, 10559, 13900, 21030, 21151, 21761; Wiriadinata 627.*
BORNEO (deviating specimens, tentatively included in *K. glauca;* see notes). Sarawak: *Jacobs 5081; S. 18949, 22023, 33247.* – W. Kalimantan: *Hallier 1125, 1192.*

Notes: 1. Variation. It will be seen that the present *K. glauca* is much narrower in circumscription as compared to Sinclair's equivalent *K. cinerea* var. *sumatrana.* Even after several varieties and synonyms had been segregated again from *K. cinerea* as accepted by Sinclair, the remaining present species *K. glauca* is still a very polymorphous entity. Especially there is considerable variation in the following features: (a) the number of anthers, (b) the colour of the flowers inside (reddish or yellowish), (c) the size of the fruits; also there seems to be variation in (d) the mode of attachment of the anthers, i.e. whether these are stiped or not, whether the upper side of the connectivum is broad or narrow and, hence, whether the thecae open more downwards or rather laterally. These features need more detailed study, especially in the field and from pickled material.

2. Number of anthers. Specimens from Central and East Java, as well as those from Bali and from Borneo, which in all other aspects agree with 'average' *K. glauca*, often have as many as 12 – 15 anthers, as compared to 8 – 10(– 12) generally in W. Java and other areas; in W. Java, Sumatra, and Malaya 12 – 18 anthers is regarded as diagnostic for the related species *K. sumatrana.*

3. Related species. *K. glauca* is one of the more common species of a group of closely allied species within the series *Glaucae.* Of these, *K. sumatrana* is perhaps the one most closely related to *K. glauca*, and in fact, in most regions there can be found specimens which in certain characters approach *K. sumatrana.* Some of these specimens are discussed below under deviating specimens.

4. Deviating specimens. The following specimens deviate from 'average' *K. glauca*, and possess certain characters as found in the related *K. sumatrana.*

Malaya: *Shah & Kadim 283*, and some similar specimens have relatively large fruits, up to 40 mm long; in other respects, incl. the twigs and leaves, these specimens agree with good *K. glauca.*

Sumatra: *PB. 1078* is a female flowering specimen with a stout habit; the leaves are relatively large and membranous, reminiscent of those of *K. sumatrana.*

The specimens *Achmad 1139* (in fruit) and *1459* (male fl., 12 anthers) from Simaloer I., and *Iboet 164* (in fruit) from Sibéroet I., hence from the islands west of Sumatra, are only tentatively included in *K. glauca.* They deviate by their twigs that are at the apices only little or not striate and possess a more pronounced tomentum, the reticulation on the upper leaf surface is finer than in 'true' *K. glauca*, and the tomentum on the lower leaf surface is somewhat more persistent and mixed of rather stouter hairs, 0.2 – 0.3 mm long, leaving rather distinct hair scars. In these characters the specimens approach *K. glaucescens* (with a still more developed tomentum on the lower leaf surface) as well as *K. losirensis* (with larger flowers and fruits, stouter hairs on the lower leaf surface, etc.).

Java: Some sterile collections have large leaves and are reminiscent of *K. sumatrana.*

Borneo: Besides specimens with 'average' fruits of *c.* 20 – 25 mm length, also

specimens with larger fruits, of 25 – 30 mm or even up to 40 mm long, are frequently found. Like in Malaya, such specimens generally agree in all vegetative characters with *K. glauca*.

The following Bornean specimens, deviating from 'average' *K. glauca*, deserve special mention and discussion. When more material becomes available these may appear to represent one or more separate taxa.

Hallier 1125, from W. Kalimantan, has normal-sized mature fruits, but the leaves are large and membranous, reminiscent of those of *K. sumatrana; Hallier 1192*, from about the same area, has somewhat smaller leaves, though large mature fruits of up to *c.* 40 mm long.

Jacobs 5081, from Sarawak lst. Div., resembles the foregoing specimens in general habit. It has male flowers with 9 or 10 anthers only. These three specimens may represent a separate taxon.

S. 18949, 22023, and *33247*, from Sarawak 3rd and 4th Div., are in fruit. They deviate from 'average' *K. glauca* by the fairly large membranous leaves, the fruits 20 – 25 mm long and 8 – 10 mm long stalked, and by various aspects of the general habit that are difficult to define. These specimens may also represent a separate taxon, possibly in the vicinity of *K. luteola*, although the reticulation of the leaves is much finer in that species.

67. **Knema sumatrana** (Bl.) de Wilde, *comb. nov.*

Myristica sumatrana Bl., Rumphia 1 (1835) 187. – *Myristica glauca* Bl. var. *sumatrana* Miq., Pl. Junghuhn. (1852) 171.; Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 92. – *Myristica corticosa* (Lour.) Hook. *f.* & Th. var. *sumatrana* Miq., Fl. Ind. Bat. Suppl. 1 (1861) 384. – *K. glauca* (Bl.) Warb. var. *sumatrana* Warb., Mon. Myrist. (1897) 597. – *K. cinerea* (Poir.) Warb. var. *sumatrana* Sinclair, Gard. Bull. Sing. 18 (1961) 185, *p.p.*, for the basionym only. – Type: Sumatra, Padang, ♂ fl., *Korthals s.n.* (L; iso P; CAL. *n.v.*).

Myristica wrayi King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 315, pl. 151. – *K. wrayi* Warb., Mon. Myrist. (1897) 572, t. 24 fig. 1 & 2; Gamble, Mat. Fl. Mal. Pen. 5, 23 (1912) 243; Ridley, Fl. Mal. Pen. 3 (1924) 70. – Syntypes: Malaya, Perak, ♂ fl., fr.; *Wray s.n.* (K); *King's Coll. 8277* (K, L), *10444* (BM, K, L), *5299* (P), *6514* (P).

K. glaucescens auct. non Jack: Sinclair, Gard. Bull. Sing. 16 (1958) 304 (var. *glaucescens, p.p.*).

Distribution: Peninsular Thailand, Malaya, Sumatra.

THAILAND. Peninsula: *A. F. G. Kerr 15309.*
MALAYA. Perak: *King's Coll. 5299, 6514, 8277. 10444.* – Kelantan: *Whitmore FRI 4402.*
SUMATRA. Aceh: *de Wilde & de Wilde-Duyfjes 16556.* – W. Coast: *Korthals s.n.* – E Coast: *Lörzing 17232; Rahmat si Boeea 9131; Rahmat si Toroes 3230.* – Indragiri: *Buwalda 6968.* – Benkulu: *b.b. 7290.* – Palembang: *van Steenis 3433.* – Simaloer I.: *Achmad 198, 685, 1579.*

Notes: This is one of the species included by Sinclair, l.c., in his large taxon *K. cinerea* var. *sumatrana*. It is segregated in the present treatment again as a species, in order to bring more balanced differentiation in the complex group of closely allied species around *K. cinerea*, etc.

K. sumatrana is most closely related to *K. glauca* in the original sense of Blume, and as also accepted presently.

Several stouter specimens of *K. glauca* are sometimes difficult to separate from *K. sumatrana;* possibly these are hybrids with an intermediate general habit. In most instances, however, *K. glauca* is readily distinguished by the smaller twigs and

leaves, smaller male flowers with fewer anthers (8 – 11, or in E. Java up to 14), and by the usually smaller fruits, *c.* 18 – 25(– 40) mm long, as against 30 – 40 mm in *K. sumatrana*.

Other characters of diagnostic value of *K. sumatrana* are the early glabrescent apex of the twigs and lower surface of the leaves, the persistent bracteoles, the many, 12 – 18, distinctly stiped anthers, the somewhat convex finely papillate staminal disc, the connectivum which is narrow above, and the thecae opening almost laterally.

See also the comments on deviating specimens under the notes to *K. glauca*.

68. Knema kostermansiana de Wilde, *sp. nov.*

Ramuli apice tereti, 2 – 4 mm diam., tomentosi, tomento e pilis minus quam 0.1 mm longis composito, deorsum cortice haud lamelloso obtecti. Folia membranacea ad chartacea, 12 – 30 cm longa, 5.5 – 12 cm lata, subtus cito glabrescentia; nervis lateralibus in pagina superiore planis vel impressis. Inflorescentiae ♂ sessiles; flores tomento e pilis persistentibus minus quam 0.1 mm longis compositis induti. Flores ♂: pedicelli 2.5 – 6 mm longi, bracteola ad apicem inserta, caduca; perianthium in alabastro globosum, 3 – 3.2 mm diam. Antherae 8 – 10, subsessiles ad brevissime stipitatae, horizontales. Discus staminalis planus usque leviter mamillatus, 1.5 – 2 mm diam. (antheris inclusis); columna staminalis 0.6 – 0.7 mm longa.

T y p e : Borneo, Sabah, ♂ fl., 13 Dec. 1962, *James Ah Wing SAN 19047* (SING; iso K?, SAN, *n.v.*).

Tree 6 – 12 m. *Twigs* in apical portion terete, 2 – 4 mm diam., early glabrescent from tomentum of hairs less than 0.1 mm long, the *bark* lower down not flaking. *Leaves* membranous to chartaceous, 12 – 30 × 5.5 – 12 cm, on lower surface early glabrescent from weak hairs 0.1 mm long or less; lateral nerves on upper surface flat or sunken. Male *inflorescences* sessile; flowers with persistent tomentum of scales less than 0.1 mm long. *Male flower* pedicels 2.5 – 6 mm long, the bracteole caducous, apically on the pedicel; *perianth* in bud globose, 3 – 3.2 mm diam. Anthers 8 – 10, subsessile to just stiped, horizontal. *Staminal disc* flat to faintly mamillate, incl. anthers 1.5 – 2 mm diam.; staminal column 0.6 – 0.7 mm long. *Fruit c.* 27 × 17 mm, with tomentum of hairs 0.1 mm long or less; stalk 4 – 5 mm long.

D i s t r i b u t i o n : Borneo (Sarawak, Sabah, NE. Kalimantan).

BORNEO. S a r a w a k : *Richards 1107; S. 20000.* – S a b a h : *SAN 19047.* – N E . K a l i m a n t a n : *Amdjah 309.*

E c o l o g y : Pole forest on basalt plateau, secondary forest, rocky forest; 250 – 1000 m alt.

N o t e s : 1. Specimens seen by Sinclair were identified by him as *K. cinerea* var. *sumatrana* and var. *cordata*.

2. Variation and related species. The specimens *SAN 19047*, the type, and *Amdjah 309* have male flowers and are very similar; both have non-papillate undersurfaces of the leaves. The specimen *S. 20000* is in fruit; *Richards 1107* is sterile and matches the latter specimen.

The new species is closely related to *K. glauca*, from which it differs in a number of smaller characters; of these the broad leaves with usually sunken lateral nerves, and the male flowers with the bracteole caducous and apically on the pedicel seem the

most important. Other differences with *K. glauca* are small, because that species, even in its present restricted sense, is very variable and still a rather heterogeneous entity.

The specimens of *K. kostermansiana* recall in general habit *K. pulchra*, a species with essentially differently shaped male flowers.

69. **Knema patentinervia** (Sinclair) de Wilde, *stat. nov.*

K. glaucescens Jack var. *patentinervia* Sinclair, Gard. Bull. Sing. 16 (1958) 308, fig. 13 C. – *K. cinerea* (Poir.) Warb. var. *patentinervia* Sinclair f. *patentinervia* Sinclair, Gard. Bull. Sing. 18 (1961) 182, 120, 261, 276; fig. 5 F–H. – Type: Malaya, Negri Sembilan, Selaru, ♂ fl., *Ludin C.F. 1873* (SING, *n.v.*; iso K; KEP, *n.v.*).

Distribution: Malaya, Sumatra.

MALAYA. Perak: *Kep. 99839.* – Kelantan: *FRI 4175, 4279, 5369; Shah & Kadim MS. 471, 520.* – Trengganu: *FRI 3912, 3920, 8262, 14886; Kep. 10683, 10755; Soepadmo 9208.* – Pahang: *FRI 8613, 17864; Kep. 97843, 104390, 104434, 108959, 108960, 108973; Shah MS. 1370, 1514, 1572, 1625.* – Malacca: *Derry 1038; Maingay 1299.* – Johore: *Chew Wee-lek 722; FRI 1033, 17610, 17618; Kep. 104962; Shah & Kadim 370; Sinclair 10164; Corner SFN 28649; Sinclair SFN 39518, 39524.*
SUMATRA. Tapanuli: *Rahmat si Toroes 5593.* – Palembang: *Grashoff 737* (*p.p.*). – Bangka: *Kostermans & Anta 922* (*p.p.*, the lower specimen).

Notes: 1. This species is identical with Sinclairs *K. cinerea* var. *patentinervia* f. *patentinervia*; the forma *longipedicellata*, *l.c.*, p. 182, is presently referred to *K. stenophylla*.

2. The number of stamens is rather variable, 11–17, average 13 or 14; *Grashoff 737*, from Sumatra, has 11, *Shah MS. 1370*, from Malaya, has 17 anthers. In the tomentum of the twig apex there seem to be two types of hairs, 0.1–0.2 mm long (e.g. *FRI 17610, 17618*), or less than 0.1 mm long (e.g. in *FRI 14886, 17864*).

70. **Knema malayana** Warb.

K. malayana Warb., Mon. Myrist. (1897) 570, tab. 25 fig. 1 & 2; Gamble, Mat. Fl. Mal. Pen. 5, 23 (1912) 242; Ridley, Fl. Mal. Pen. 3 (1924) 69; Sinclair, Gard. Bull. Sing. 16 (1958) 293, fig. 9; 18 (1961) 260. – *Myristica malayana* Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 91. – Syntypes: Malaya (Perak, Malacca, Singapore), ♂ fl., fr.; *Wray 176* (BM); *King's Coll. 5706* (B†; iso K, P), *6128* (B†; iso K, P), *8541* (B†; iso G, *n.v.*), *10594* (BM, L); *Cantley 20* (K); *Griffith 4343* (K); not *Curtis s.n.* (Perak) and specimens from Burma.
Myristica glaucescens auct. non (Jack): Hook.*f.* & Thomson, Fl. Ind. 1 (1855) 157, *p.p.*; Hook.*f.*, Fl. Brit. Ind. 5 (1886) 111, *p.p.*; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 323, pl. 161, *p.p.*
Myristica corticosa auct. non (Lour.) Hook.*f.* & Th.: Hook.*f.* & Thomson, Fl. Ind. 1 (1855) 158, *p.p.*; DC., Prod. 14, 1 (1856) 205, *p.p.*; Miq., Fl. Ind. Bat. 1, 2 (1858) 69, *p.p.*

Distribution: Peninsular Thailand, Malaya, Singapore.

THAILAND. Peninsula (Pattani): *BKF 34621, 57526, 57527; A.F.G. Kerr 7088, 17078; Lakshnakara (in Herb. Kerr) 754; Pinnin c.s. 435; J. Schmidt 581.*
MALAYA. Kedah: *FRI 0406, 6710; Kep. (FRI) 11502, 11535.* – Perak: *Kep. FN. 39280; King's Coll. 5706, 5726, 6128, 7599, 8541, 10594; Wray 176.* – Kelantan: *Kep. 104562; Shah & Kadim MS. 535.* – Trengganu: *FRI 3943, Kep. (FRI) 10504, 10696; SFN 40493; Phytochemical Survey (T. & P.) 13 (Fl. of Malaya 2613).* – Pahang: *van Balgooy 2425, 2535; FRI 3490, 4730, 8130; Kep. FN. 76669, 104990; Kadim & Mahmud KM. 8, 107; Shah & Noor MS. 1825.* – Selangor: *FRI 3455; Gadoh & Millard KL. 1496; Kep. (FRI) 11219.* – Negri Sembilan: *Kep. (FRI) 11299, 17080.* – Malacca: *Griffith 4343; Maingay 1299.* – Johore: *FRI 7888; Corner SFN 28440.*
SINGAPORE: *Sinclair 8925; SFN 32209, 39563, 40714.*

N o t e: This species is accepted almost in the same sense as done by Sinclair; the Sumatran specimens enumerated by him are presently referred to *K. glaucescens*.

71. **Knema cinerea** (Poir.) Warb.

Myristica cinerea Poir., Dict. Encycl. Suppl. 4 (1816) 35; Spreng., Syst. 3 (1826) 65; DC., Prod. 14, 1 (1856) 207; Miq., Fl. Ind. Bat. 1, 2 (1858) 72. – *K. cinerea* Warb., Mon. Myrist. (1897) 611, t. 25 fig. 1 & 2; Sincl., Gard. Bull. Sing. 18 (1961) 169, fig. 3A–G (*p.p.*, for the var. *cinerea* only). – *Myristica uviformis auct. non* Lamk: Labillardière (*fide* Sinclair, *o.c.* p. 173). – T y p e: Pulau Bouton (SE. of Celebes), immature fr., *Labillardière* (P; iso BM, K; FI, G, *n.v.*).

Myristica peltata Roxb., Fl. Ind. 3 (1832) 846; DC., Prod. 14, 1 (1856) 207; Miq., Fl. Ind. Bat. 1, 2 (1858) 72. – *K. peltata* Warb., Mon. Myrist. (1897) 599. – T y p e: ♂ fl., *Roxburgh s.n.*, date 1802 (Cult. Hort. Calc. *ex* Banda), (BR, *n.v.*).

[*Myristica caesia* Zipp. *ex* Spanoghe, Linnaea 15 (1841) 346 [Icon. 15], *nom. nud.*]

D i s t r i b u t i o n: Lesser Sunda I. east of Bali (Lombok, Sumbawa, Flores), Celebes, Moluccas (Sulu I., Banda, Tanimbar), 1 collection Philippines (Zamboanga Prov., Mindanao) (see notes).

LESSER SUNDA I. L o m b o k: *Elbert 1950; de Voogd 1640.* – S u m b a w a: *Elbert 3812; Kostermans 18202, 19108.* – F l o r e s: *bb. 14356; Kostermans & Wirawan 238, 920; Kostermans 22102; Schmutz 117, 629, 722, 801, 3321, 3593; Verheijen 3086, 3239, 3325.*

CELEBES: *Alston 16205; Buwalda 3804; Elbert 3396; Koorders 17498β, 18135β; Noerkas* (exp. *van Vuuren) 447; Teijsmann 11733, 12187, 12555; de Vogel 2548.* – B o u t o n I. (Butung): *bb. 5429, 5430.*

MOLUCCAS. S o e l a I.: *Atjè* (exp. *van Hulstijn) 368.* – T e n i m b a r I.: *bb. 24279, 24426; Buwalda 4158, 4801.*

PHILIPPINES. M i n d a n a o, Zamboanga Dist.: *For. Bur. 23328.*

N o t e s: 1. This species agrees with Sinclair's *K. cinerea* var. *cinerea*.

2. Variation. Specimens from the Lesser Sunda I. have the leaves densely scaly beneath, whereas those from Celebes usually are much more remotely scaly or remotely fine-stellately hairy on the lower leaf surface.

3. Related species. Closely related to *K. stenophylla*, *K. patentinervia*, and especially to *K. glauca* with almost similar habit and flowers. *K. cinerea* is mainly characterized by the persistent tomentum of minute, scale-like, stellate hairs on the lower leaf surface and by the small fruits; in *K. glauca* the lower leaf surface is early glabrescent from a tomentum composed of weak, more stellate hairs, and the fruits are usually much larger. Specimens from Bali I. of *K. glauca* usually have rather small fruits, *c.* 22 mm long, and may much resemble *K. cinerea*.

4. Distribution. The specimen *For. Bureau 23328*, from Zamboanga Prov., Mindanao, the only collection from the Philippines, most probably belongs to *K. cinerea*. It is in fruit, *c.* 18 by 13 mm, stalk 12–13 mm, and has on the lower leaf surface very minute persistent scales. The tomentum in the much resembling *K. glomerata*, which is common in the Philippines, consists of much softer stellate hairs, which are either persistent or rather early shed; also the flowers and twig apices in *K. glomerata* have a tomentum of much longer, rather woolly, dendroid hairs up to 0.5 mm long.

72. **Knema stenophylla** (Warb.) Sinclair

Gymnacranthera stenophylla Warb., Mon. Myrist. (1897) 364, tab. 20 fig. 1 & 2. – *Myristica stenophylla* Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 88. – *K. stenophylla* Sinclair, Gard. Bull. Sing. 16 (1958) 300, fig. 11; 18 (1961) 276. – T y p e: Malaya, Malacca, Klang, fr., *Kehding 150* (in Hb. *Beccari*) (FI, *n.v.*).

Myristica geminata auct. non Miq.: King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 322, pl. 160, *p.p.*
K. cinerea (Poir.) Warb. var. *patentinervia* Sinclair f. *longipedicellata* Sinclair, Gard. Bull. Sing. 18 (1961) 182, fig. 5A – E. – Type: Borneo, Sarawak, Mount Poi, immature fr., *Clemens 20345* (K; iso L; A, BO, G, NY, SAR, *n.v.*).

Distribution: Malaya, Sumatra (Indragiri), Borneo (Sarawak, Sabah, W. and E. Kalimantan).

MALAYA. Kedah: *FRI 4697, 6955; Kep. FN. 13724, 13767.* – Perak: *FRI 0881, 3024, 3071, 3095, 17599; Scortechini 1527* (BM). – Kelantan: *FRI 2338.* – Trengganu: *Corner SFN 30043, 30088.* – Pahang: *FRI 4926; Shah MS. 1510.* – Negri Sembilan: *Shah MS. 72, 88.* – Malacca: *Kep. FN. 71059.* – Johore: *FRI 8034; SFN 30339.* – Penang I.: *Haniff 260.*
SUMATRA. Indragiri: *Buwalda 6448, 6736.*
BORNEO (specimens with proportionally long pedicels, as discussed in the notes, are indicated with*). Sarawak: *Beccari 1709, 2003; Clemens 20345*, 21206; Purseglove P. 5041*; S. 3757, 12984, 15656, 16484, 18611*, 21495*, 21826, 21852, 21860, 21894, 21924, 23602*, 23633, 23678*, 23722*, 24307, 24836, 25245*, 26222*, 27039*, 27683*, 28165, 28173, 34410, 36730, 37529, 38430; Sinclair (& Kadim) 10289*, 10376*; SFN 35627.* – Sabah: *SAN 17401, 26864*, 31172*, 36300, 72219.* – W. Kalimantan: Pulau Tekemeng, *Main* (exp. *Polak*) *2065**. – E. Kalimantan: *Kostermans 4327, 5351, 9948.*
BORNEO (a larger fruited form). Sarawak: *S. 3624, 3738, 16382, 19213, 21966, 22484, 35119.* – Sabah: *SAN 16733, 66033.*

Notes: 1. A particularly polymorphous species, largely agreeing with the taxon as conceived by Sinclair, but in addition including Sinclair's *K. cinerea* var. *patentinervia* forma *longipedicellata* (see notes below).

2. Closely related to *K. cinerea*, *K. patentinervia*, *K. malayana*, *K. hirtella*, and *K. glauca*; for differences see the key to the species.

The variability in *K. stenophylla* abounds in (1) the tertiary venation as seen on the upper leaf surface, which can be either distinct or indistinct, or even invisible; (2) the length of the male and female flower pedicels, and (3) the diameter of the male flower buds and the number of anthers, varying from 6 to 11. All these characters show some overlap with specimens assigned to *K. malayana*, a species which differs by generally thinner and broader leaves, with a very distinct tertiary venation on the upper leaf surface, and generally considerably larger male flowers with longer pedicels, and the tomentum of the fruits more farinose. Also the resembling *K. patentinervia* has larger male flowers.

Furthermore, in *K. stenophylla* there is much variation in (4) the size of the fruits, as pointed out below.

3. Specimens with proportionally large fruits. The specimens with a more tiny general habit, i.e. with slender twigs of 0.5 – 1.5 mm diam. and with relatively small leaves, have also relatively small fruits of 12 – 19 mm long. Such specimens include the types of *K. stenophylla* and *K. cinerea* f. *longipedicellata*.

Tentatively included in the present species is also a number of specimens of a somewhat stouter habit, with the fruits measuring up to 25(–30!) × 20 mm, and with a relatively short fruit stalk of 4 – 6 mm long. The twigs of these specimens are generally somewhat thicker, up to 2.5(–3) mm diam. at the apex and covered by somewhat longer hairs (to 0.3 mm), and the leaves may be as large as up to 20 × 5 – 8 cm or narrower; also the tomentum on the lower leaf surface appears to be a shade coarser. It is not quite clear what flowering specimens belong precisely to this larger-fruited form, but possibly this includes part of the specimens with 10 or 11 anthers. Specimens in fruit of the large-fruited form are enumerated separately above; all are from Borneo. They may easily be confused with *K. hirtella* and *K.*

glauca, the latter being distinguished by the tomentum on the lower leaf surface which is generally weaker and early shed. Possibly they originated from hybridization with *K. glauca*. Closer study in the complex species *K. stenophylla s.l.* may reveal that the above mentioned larger-fruited collections represent a separate taxon.

4. Number of anthers. A fair amount of the specimens from Borneo, e.g. *Purseglove P. 5041* from Sarawak 1st Div., has relatively large male flowers, the mature buds *c.* 3 mm diam., with (10 or) 11 anthers. *Kostermans 4327* from E. Kalimantan has small male flowers, also with 11 anthers. Other specimens examined by me have small flowers with only 6–9, or, in Sumatra, 10 anthers. The leaves of e.g. *Purseglove P. 5041* are comparatively broad, with a well-visible reticulation on the upper surface, so that it recalls *K. malayana*, a species presently accepted as confined to the Malay Peninsula.

5. Length of pedicels. Specimens with proportionally long flower pedicels are enumerated above with an asterisk. These include, for instance, *Clemens 20345*, the type of f. *longipedicellata*, from Sarawak. It has fruits as well as old female flowers, the latter with extremely long pedicels, *c.* 15 mm long. The fruits of the same specimen, however, are stalked only *c.* 8 mm, and this length falls well within the wide variation found in the many specimens available from Borneo and the Malay Peninsula.

73. **Knema hirtella** de Wilde, *sp. nov.*

Ramuli apice subtereti, 2–3.5 mm diam., tomentosi, tomento e pilis circa 0.1 mm longis vel brevioribus composito, deorsum cortice haud lamelloso obtecti. Folia chartacea, 10–23 cm longa, subtus tomentosa tomento e pilis persistentibus circa 0.1 mm longis obtecto vel glabrescentia; nervis in pagina superiore planis ad impressis. Inflorescentiae ♂ sessiles; flores tomento e pilis persistentibus circa 0.1 mm longis vel brevioribus induti. Flores ♂: pedicelli 5–7 mm longi, bracteola ad apicem vel 1–2 mm infraeum inserta, persistens vel caduca; perianthium in alabastro plus minus globosum vel obovoideum, 3–3.5 mm diam. Antherae 10–13(–15), stipitatae vel semisessiles. Discus staminalis plus minus planus, 1.5–1.7 mm diam. (antheris inclusis); columna staminalis 1–1.5 mm longa, in var. *hirtella* ad basin columnae minute pubescens.

T y p e: Borneo, W. Sabah, Beaufort Dist., 27 June 1962, ♂ fl., *Mikil SAN 30235* (L); a representative ♀ fl. specimen is: *SAN A 4578* (L).

Tree 5–25 m. *Twigs* in apical portion 2–3.5 mm diam., with minute tomentum of hairs *c.* 0.1 mm long or less, lower down the *bark* not tending to crack or flake. *Leaves* chartaceous, 10–23 cm long; beneath either with persistent tomentum of scattered stellate scales *c.* 0.1 mm long, or glabrescent; nerves at upper surface sunken to flattish. Male *inflorescences* sessile; flowers with persistent tomentum of hairs *c.* 0.1 mm long or less. *Male flower* pedicels 5–7 mm long, the bracteole caducous or persistent, situated apically or 1–2 mm below the perianth; *perianth* in bud ± globose or broadly obovoid, 3–3.5 mm diam. *Anthers* 10–13(–15), half-sessile or just stiped. *Staminal disc* flattish, incl. anthers 1.5–1.7 mm diam.; staminal column 1–1.5 mm long, in var. *hirtella* minutely pubescent at base. *Female flower* pedicels 4–7.5 mm long; perianth in bud 4.5–6 × 3.5–4 mm. Style either 0–0.5 mm or *c.* 1 mm long; *stigma* 2-lobed and each lobe again 6–8-lobulate. *Fruits* ellipsoid to ovoid, 20–40 × 17–26 mm, with tomentum of hairs up to 0.5 mm long, persistent; stalk 4–10 mm long.

Distribution: Borneo (Sarawak, Sabah, E. Kalimantan).

Ecology: Lowland and lower montane forest; 0–1000 m alt.

Notes: 1. A variable species which can easily be confused with *K. glauca* and *K. stenophylla*; the former species differs by a very weak and early shed tomentum on the lower leaf surface, by usually persistent bracteoles, and by a glabrous staminal column; *K. stenophylla s.l.* differs by a less stout overall habit, by generally smaller fruits, and a glabrous staminal column. *K. piriformis* also resembles the present species, but has differently shaped male flower buds.

Somewhat arbitrarily 3 largely sympatric varieties can be recognized, mainly based on the tomentum and the length of the style.

There is also a considerable variation in the size and shape of the fruits, but this could not be used in any other satisfactory subdivision.

The exact status of the three taxa, presently accepted as varieties, is not quite clear, also because male flowers are not known in the var. *pilocarpa*.

2. Most specimens belonging to the present species were not yet collected when Sinclair published his revision, others were included by him in his *K. cinerea* var. *sumatrana*, presently largely *K. glauca*.

KEY TO THE VARIETIES

1a. Lower leaf surface with persistent tomentum composed of scattered, fine, yellowish hairs *c.* 0.1 mm long. Style 0–0.5 mm long . . . . . 2.

b. Lower leaf surface early glabrescent from a tomentum composed of scattered, very minute, weak, greyish hairs less than 0.1 mm long. Style *c.* 1 mm long. **b.** var. **stylosa**

2a. Fruits with tomentum composed of stellate(-dendroid) hairs *c.* 0.1 mm long or less. Staminal column at base minutely pubescent. . . . . **a.** var. **hirtella**

b. Fruits with tomentum composed of rather rough dendroid hairs *c.* 0.5 mm long, especially towards the base of the fruit. (Male flowers not known). **c.** var. **pilocarpa**

a. var. **hirtella**

BORNEO. Sarawak. 4th Div.: *Anderson 4100; S. 33742, 36579.* – Sabah: *Wood & Wyatt-Smith SAN A 4578; SAN 30235, 30502, 35164, 37775, 63282.*

b. var. **stylosa** de Wilde, *var. nov.*

Folia subtus tomentosa, tomento e pilis cinereis dispersis, minutissimis atque infirmis, minus quam 0.1 mm longis compositis, cito glabrescentia. Stylus circa 1 mm longus. Fructus pilis circa 0.1 mm longis vel brevioribus obtecti. Perianthium ♂ in alabastro obovoideum; antherae 11, semisessiles; bracteola ad pedicello apicem inserta.

Type: Borneo, Sabah, Beaufort Dist., ♀ fl., 22 June 1962, *Mikil SAN 30179* (L).

Twigs at apex with tomentum composed of hairs *c.* 0.1 mm long or less. *Leaves* beneath rather early glabrescent from tomentum composed of minute greyish stellate hairs less than 0.1 mm long, sparsely mixed with some coarser hairs very early shed and leaving hair scars (lens, × 30). *Male flowers*: perianth in bud broadly obovoid, *c.* 4 × 3.5 mm; pedicels *c.* 5 mm, the bracteole apical, persistent. *Anthers* 11, half-sessile, half-erect; staminal column ± tapering, *c.* 1 mm long, glabrous. *Style*

persistent in fruit, *c.* 1 mm long. *Fruits* obtuse at apex; the tomentum composed of minute stellate(-dendroid) hairs *c.* 0.1 mm long or less.

BORNEO. Sarawak: Bintulu, Labang F.R., *Ilias Paie S. 15868*; 5th. Div., *Ilias Paie S. 31137*. – Sabah: *SAN 22768, 28082, 30179, 30394, 31288, 31403, 36467, 41947, 72014, 78197* (♂ fl.), *84385*.

Note: This variety may be confused with 27. *K. piriformis* (in series *Obovoideae*), in which the male perianth in bud is more narrowly pyriform and the staminal column longer and more slender.

c. var **pilocarpa** de Wilde, *var. nov.*

Folia subtus tomento e pilis dispersis luteolis minutis circa 0.1 mm longis vestita. Stylus 0–0.5 mm longus. Fructus pilis circa 0.5 mm longis obtecti.

Type: Borneo, E. Sabah, Lahad Datu Dist., fr., 26 Aug. 1976, *Cockburn SAN 85084* (L; iso K; KLU, SAR, *n.v.*).

Twigs at apex with a rusty granulose tomentum composed of stellate-dendroid hairs 0.1–0.2 mm long. *Leaves* beneath with persistent tomentum consisting of yellowish hairs *c.* 0.1(–0.2) mm long, intermixed with early shed coarser hairs leaving distinct hair scars. *Male* and *female flowers* not seen. *Style* persistent in fruit, 0–0.5 mm long. *Fruits* obtuse to acute(-acuminate) at apex; the tomentum, especially towards the base of the fruit, consisting of rather stout rusty dendroid hairs *c.* 0.5 mm long.

BORNEO. E. Sabah: *SAN 37043, 85084*. – E. Kalimantan: *Kostermans 12577, 21547; Soegeng 738*.

74. Knema communis Sinclair

K. communis Sinclair, Gard. Bull. Sing. 16 (1958) 297, fig. 10, plate IX B; 18 (1961) 193, *p.p.*, excl. spec. from Borneo and *Shah & Kadim 526* from Malaya. – Type: Singapore, Garden's Jungle, ♂ fl., 7 Jan. 1955, *Sinclair SFN 40522* (SING, *n.v.*; iso K, L, P; BKF, BO, DD, Delhi Univ., E, KEP, M, PNH, SAN, *n.v.*).

Distribution: Malaya and Singapore.

MALAYA. Perak: *Burn-Murdoch 380; Whitmore FRI 0985, 3111, 3118; Kochummen KEP 99924*. – Trengganu: *FRI 10547; SFN 40417*. – Pahang: *FRI 3628*. – Johore: *FRI 6607, 7741, 14113*.
SINGAPORE: *Noor SRMN 6; Ridley 1833, 6447; SFN 39570, 40320, 40522; Samsuri SA 1237*.

Notes: 1. Closely related to *K. glaucescens* in its present restricted sense mainly because of the rather conspicuous persistent or late falling tomentum on the lower leaf surface; for differences see the key to the species.
The resembling *K. malayana* has larger and longer-pedicelled male flowers, with 9–13 (in *K. communis* 7–9) anthers, a different tomentum on the lower leaf surface, etc.
2. Apparently restricted to the Malay Peninsula. The records for Borneo by Sinclair, 1968, p. 163, are presently referred to *K. glaucescens*. The specimen *Shah &*

Kadim 526, from Kelantan, Malaya, from which Sinclair drew the emended description of the female flowers of *K. communis*, is presently referred to *K. glaucescens* as well.

75. Knema glaucescens Jack

K. glaucescens Jack, Mal. Misc. 7 (1821) 35; Warb., Mon Myrist. (1897) 616 (neglected species); Sinclair, Gard. Bull. Sing. 16 (1958) 302 (incl. var. *glaucescens*, for the type only) – *Myristica glaucescens* Hook.*f.* & Th., Fl. Ind. I (1855) 157, for the type only; Fl. Brit. Ind. 5 (1886) 111, for the type only. – T y p e: Sumatra, Bencoolen, 1821, ♂ fl., *Jack s.n.* (L).

Myristica geminata Miq., Fl. Ind. Bat. Suppl. 1 (1861) 385; King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 322, for the type only. – *K. geminata* Warb., Mon. Myrist. (1897) 604, *p.p.*; Gamble, Mat. Fl. Mal. Pen. 5, 23 (1912) 247, *p.p.*; Ridley, Fl. Mal. Pen. 3 (1924) 72, *p.p.* – S y n t y p e s: Sumatra, Batu Radja, *Teijsmann 3620* (U; iso L; A, BO, CAL, LE, MEL, *n.v.*); Kebur-lehat, *3924* (U; iso BO, CAL, *n.v.*).

K. cinerea (Poir.) Warb. var. *sumatrana auct. non* (Bl): Sinclair, Gard. Bull. Sing. 18 (1961) 185, *p.p.*

D i s t r i b u t i o n: Malaya, Singapore, Sumatra (incl. Bangka), Borneo.

MALAYA. K e l a n t a n: *Shah & Kadim MS. 526.* – J o h o r e: *Hassan & Kadim H. 33, 43; Kadim & Noor K. 353.*

SINGAPORE: *Sinclair SFN 40280, 40368, 40717.*

SUMATRA. I n d r a g i r i: *Buwalda 6490.* – B e n k u l u: *Jack s.n.* – P a l e m b a n g: *bb. T. 683; bb. E. 905; Forbes 2916; Thorenaar 189 E.* – B a n g k a: *Kostermans & Anta 922* (upper specimen in L), *1299.*

BORNEO. S a r a w a k: *S. 23624, 23644, 25367, 27203, 34221, 38323, 38431.* – S a b a h: *SAN 31303, 31332.* – N W . K a l i m a n t a n: P. Lemoekoetan, *Hallier 323.* – S E . K a l i m a n t a n: *Hubert Winkler 2466, 2467.*

N o t e s: 1. Sinclair, 1958 & 1961, united this species with *K. glauca* and *K. cinerea*, now treated separately. Some specimens presently included in *K. glaucescens* were identified by Sinclair as *K. communis* or as *K. malayana*.

2. Stouter specimens of *K. glaucescens* may recall *K. scortechinii*, a species now regarded as confined to the Malay Peninsula, differing by larger flowers; *K. communis*, also confined to the Malay Peninsula, differs by smaller male flowers and smaller fruits. See further under note 4, deviating specimens.

3. In the original description Jack mentions 12 – 15 anthers; in the type, *Jack s.n.*, in L, I counted 9 – 13 anthers.

4. Variation and deviating specimens. As compared to the specimens from Sumatra and the Malay Peninsula, the specimens from Borneo have the fruits on the whole more broadly obovoid or subglobose (as against ellipsoid) and shorter stalked, 3 – 5 mm (as against 6 – 11 mm in Sumatra). In general, also the leaves of the Borneo specimens are somewhat more coriaceous and have a slightly coarser reticulation above.

The specimens *S. 23624* and *23644* from Sarawak 3rd. Div., and *S. 27203, 38323*, and *38431* from 4th Div., have rather subcoriaceous leaves with particularly coarse reticulation on the upper surface, and broadly obovoid to subglobose fruits, all rather deviating from the rest of the material. Possibly, these specimens represent a separate taxon; however, because matching male flowering material is lacking, they have been treated tentatively under *K. glaucescens*.

76. **Knema losirensis** de Wilde, *sp. nov.* – **Fig. 16.**

Ramuli apice tereti, 1.5–2.5 mm diam., tomentosi, tomento e pilis circa 0.1 mm longis composito, deorsum cortice haud lamelloso obtecti. Folia membranacea usque chartacea, 13–26 cm longa, subtus tomento e pilis subpersistentibus staturae variabilis 0.1–0.5 mm longis composito vestita. Inflorescentiae ♂ sessiles vel pedunculo usque ad 1 mm longo; flores tomento e pilis persistentibus circa 0.1 mm longis vel brevioribus induti. Flores ♂: pedicelli (3–)5–9 mm longi, bracteola circa 1–3 mm infra apicem inserta, caduca; perianthium in alabastro subglobosum, 3–4 mm longum, (3–)3.5–5 mm diam., intus viridi-flavum. Antherae 10–15, (sub)sessiles usque stipitatae. Discus staminalis plus minus planus usque leviter convexus, 2–2.5 mm diam. (antheris inclusis); columna staminalis 1.2–1.5 mm longa. Fructus late ellipsoidei, plus minus porcatus, 20–27 mm longi.

T y p e: Sumatra, Prov. Aceh, Gunung Leuser Nature Reserve, Ketambe, *c.* 35 km. NW. of Kutacane, primary forest on alluvial soil, *c.* 300 m. alt., ♂ fl., 4 May 1975, *de Wilde & de Wilde-Duyfjes 16578* (L; iso BO, K) (also spirit mat.).

Tree 10–20 m. *Twigs* in apical portion 1.5–2.5 mm diam., with minute tomentum composed of hairs *c.* 0.1 mm long, lower down the *bark* not cracking nor flaking. *Leaves* membranous to chartaceous, 13–26 cm long, on lower surface late glabrescent from tomentum of dense to scattered, greyish, stellate hairs *c.* 0.1 mm long, mixed with larger, earlier shed, dendroid hairs leaving hair scars. Male *inflorescences* up to 1 mm peduncled; flowers with tomentum of hairs 0.1 mm long or less. *Male flower* pedicels (3–)5–9 mm long, the bracteole caducous, above the middle, usually 1–3 mm below the perianth; *perianth* in bud subglobose, 3–4 × (3–)3.5–5 mm, in anthesis inside greenish-yellow. *Anthers* 10–15, just sessile to stiped. *Staminal disc* flattish to slightly convex, incl. anthers 2–2.5(–3) mm diam.; staminal column 1.2–1.5 mm long. *Female flower* pedicels 1.5–5 mm long; perianth in bud 4–6 × 2.5–5 mm; *stigma* 4–8-lobulate. *Fruits* broadly ellipsoid, ± ridged, 20–27 × 15–20 mm, with tomentum of hairs 0.1–0.2 mm long; stalk 2–5 mm long.

D i s t r i b u t i o n: northern Sumatra.

SUMATRA. A c e h (Ketambe, G. Leuser Nature Res.): *de Wilde & de Wilde-Duyfjes 12565, 13877, 15688, 16517, 16577, 16578.* – E. C o a s t: Serdang (Deli), *Lörzing 5780*; Sibolangit, *Lörzing 12616, 16110.*

E c o l o g y: Forest, forest edges; 200–600 m alt. Flowers and fruits throughout the year.

N o t e: 1. The Lörzing specimens had been identified by Sinclair as *K. cinerea* var. *sumatrana.*

2. Closely related to *K. glaucescens* and particularly resembling the Sumatran specimens of that species. These differ mainly in the less stout habit of the plants, with smaller male flowers and smaller fruits. The proportionally large and ridged fruits of *K. losirensis* are quite different especially from the fruits of *K. glaucescens* as found in the Malay Peninsula and Borneo. The stouter habit of *K. losirensis* is possibly partly due to more favourable conditions in dense rain forest on rich soil.

See also the notes on deviating specimens from Sumatra under *K. glauca.*

XII. series PUNCTATAE de Wilde, *ser. nov.*

Alabastra ♂ circa aequilonga quam lata, vulgo globosa, in anthesi plus quam 3/4 attingentia fissa. Columna staminalis breviora quam disci staminalis diameter

(antheris inclusis). Antherae 7–18, horizontales, subsessiles usque stipitatae. Discus staminalis planus, vel convexus, vel breviter mamillatus. Flores tomento vario persistente obtecti. Folia subtus glabrescentia vel tomento persistente obtecta, subtus semper verrucis suberosis nigricantibus minutis dispersis obtecta. Ramuli plerumque tenues, prope apicem 1–6 mm diam., in partibus vetustioribus cortice haud lamelloso.

T y p u s: *Knema conferta* (King) Warb.

Species 77–83.

77. **Knema celebica** de Wilde, *sp. nov.*

Ramuli ad apices 2–4 mm diam., tomentosi, tomento e pilis 0.5–1 mm longis composito, cortice laevigato deorsum haud lamelloso obtecti. Folia coriacea, subtus cito glabrescentia, verrucis suberosis minutis saturate brunneis dispersis instructa. Inflorescentiae ♂ pedunculo 1–4 mm longo. Flores ♂ tomento pilis 0.5–0.7(–1.0) mm longis induti; pedicelli 2 mm longi, bracteola persistens, ad apicem instructa; perianthium in alabastro subglobosum, 2.5–3 mm diam. Antherae 7–9, distincte stipitatae. Discus staminalis planus, 1.2–1.5 mm diam. (antheris inclusis); columna staminalis 0.5–0.7 mm longa. Flores ♀ ac fructus non vidi.

T y p e: Central Celebes, Malili-Oesoe, 18 Feb. 1931, ♂ fl., *Boschproefstation No. Cel./II-318* (L; iso K; BO, *n.v.*).

Tree. *Twigs* in apical portion smooth, 2–4 mm diam., glabrescent from tomentum of hairs 0.5–1 mm long, lower down the *bark* not cracking nor flaking. *Leaves* coriaceous, beneath early glabrescent, with scattered, minute, dark brown spots. Male *inflorescences* 1–4 mm peduncled; flowers with persistent tomentum consisting of hairs 0.5–0.7(–1.0) mm long. *Male flower* pedicels *c.* 2 mm long, the bracteole persistent, apical; *perianth* in bud subglobose, 2.5–3 mm diam. *Anthers* 7–9, distinctly stiped. *Staminal disc* flat, incl. anthers 1.2–1.5 mm diam.; staminal column 0.5–0.7 mm long. *Female flowers* and *fruits* not seen.

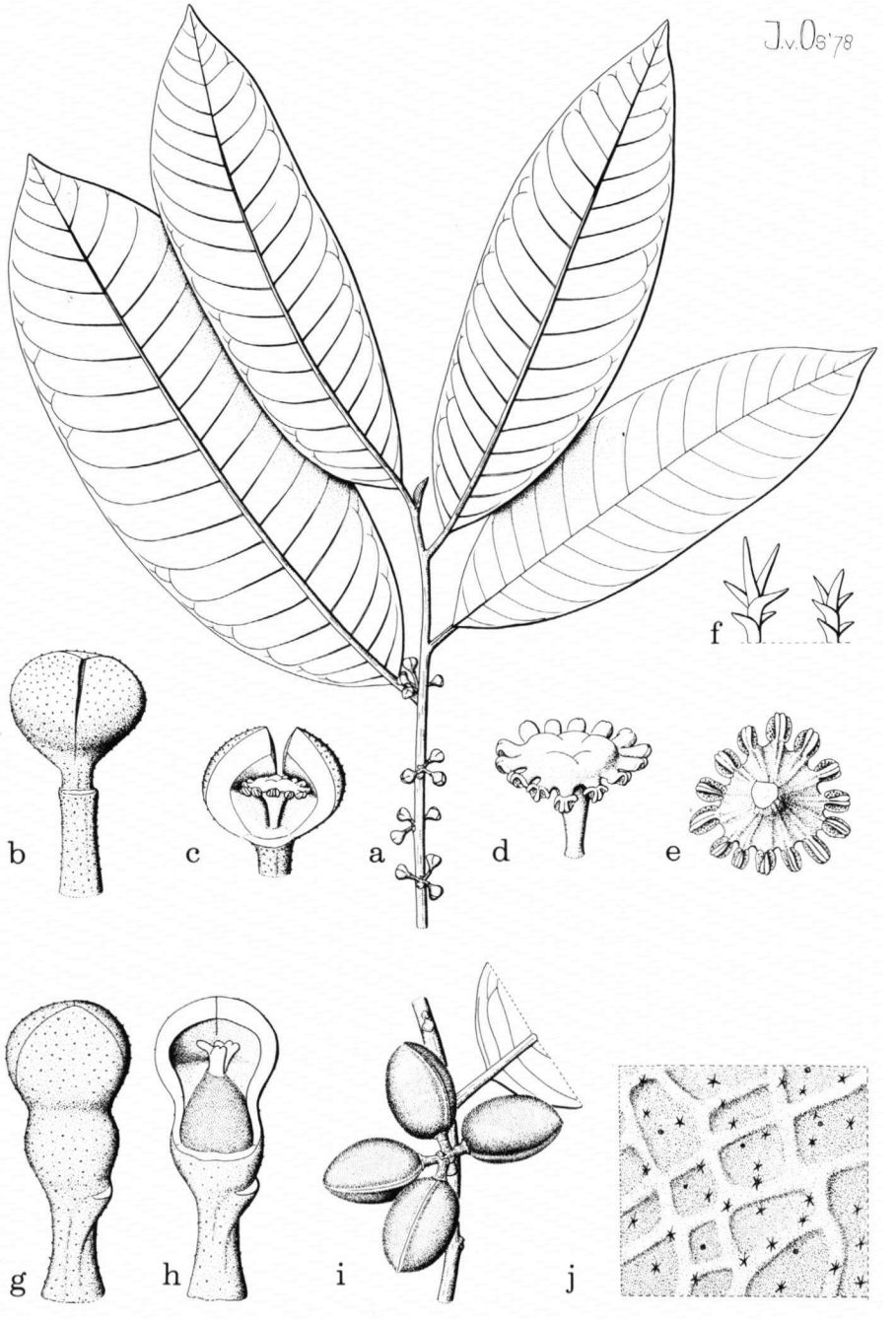
D i s t r i b u t i o n: Central Celebes.

CELEBES. C e n t r a l, Malili-Oesoe: *Boschproefstation No. Cel./II-318; Neth. Ind. For. Service Cel./III-112.*

E c o l o g y: Lowland forest, *c.* 10 m alt. Fl. in Feb. and April.

N o t e s: 1. The two specimens on which the present new species is based were included by Sinclair (1961, p. 279) in *K. tomentella.* Although placed in series

Fig. 16. *Knema losirensis* de Wilde – a. habit of twig with male inflorescences, × ½; b. mature male flower bud (note scar of fallen bracteole), × 3½; c. opened mature male perianth in bud showing the androecium, × 3½; d. androecium, almost lateral view, × 7; e. androecium seen from below, × 7; f. sample of hairs from tomentum of male perianth (half-schematic), × 60; g. mature female flower bud (note scar of fallen bracteole), × 3½; h. opened mature female perianth showing pistil, × 3½; i. portion of branchlet with infructescence, × ½; j. detail of lower leaf surface showing tertiary venation and scattered small (sub)sessile stellate hairs, × 30. – a–f, j. from *de Wilde & de Wilde-Duyfjes 16578* (type); g, h. from *de Wilde & de Wilde-Duyfjes 16577*; i. from *de Wilde & de Wilde-Duyfjes 12565*. Male and female flowers drawn after spirit material.


J.v.Os '78
a
b
c
d
e
f
g
h
i
j

Punctatae, it is certainly also much related to that species; *K. tomentella* differs by sessile inflorescences, usually striate twigs, chartaceous (not coriaceous) leaves with less distinct and less prominent reticulation above, the rather late glabrescent lower leaf surface without minute blackish spots.

2. The leaf apices in both specimens cited are irregularly truncate; possibly this is due to some disease, although no traces of diseased tissue are visible.

78. Knema muscosa Sinclair

K. muscosa Sinclair, Gard. Bull. Sing. 18 (1961) 264, fig. 19. – Type: Borneo, Sarawak, Mt. Majau, Ga(a)t, Upper Rejang R., ♂ fl., 1929, *J. & M. S. Clemens 22120* (K; iso BM, L, P; A, BO, NY, PNH, SAR, SING, *n.v.*).

Distribution: Borneo (Sarawak).

BORNEO. Sarawak: Mt. Majau, Gat, Upper Rejang R., *Clemens 21599, 22120.*

Note: Superficially, the present species resembles slenderly built *K. kinabaluensis*, or also *K. tomentella*, *K. malayana*, and especially *K. stenophylla*, but from all these it is distinguished by the blackish spots on the lower leaf surface and by the leaves that are glabrescent from a conspicuous rather dense tomentum composed of hairs of various sizes. Besides this, *K. kinabaluensis*, for instance, has much larger fruits; *K. tomentella* has more distincly striate twigs, etc; *K. malayana* possesses larger flowers; and *K. stenophylla* shows much less distinct reticulation on the upper leaf surface, etc.

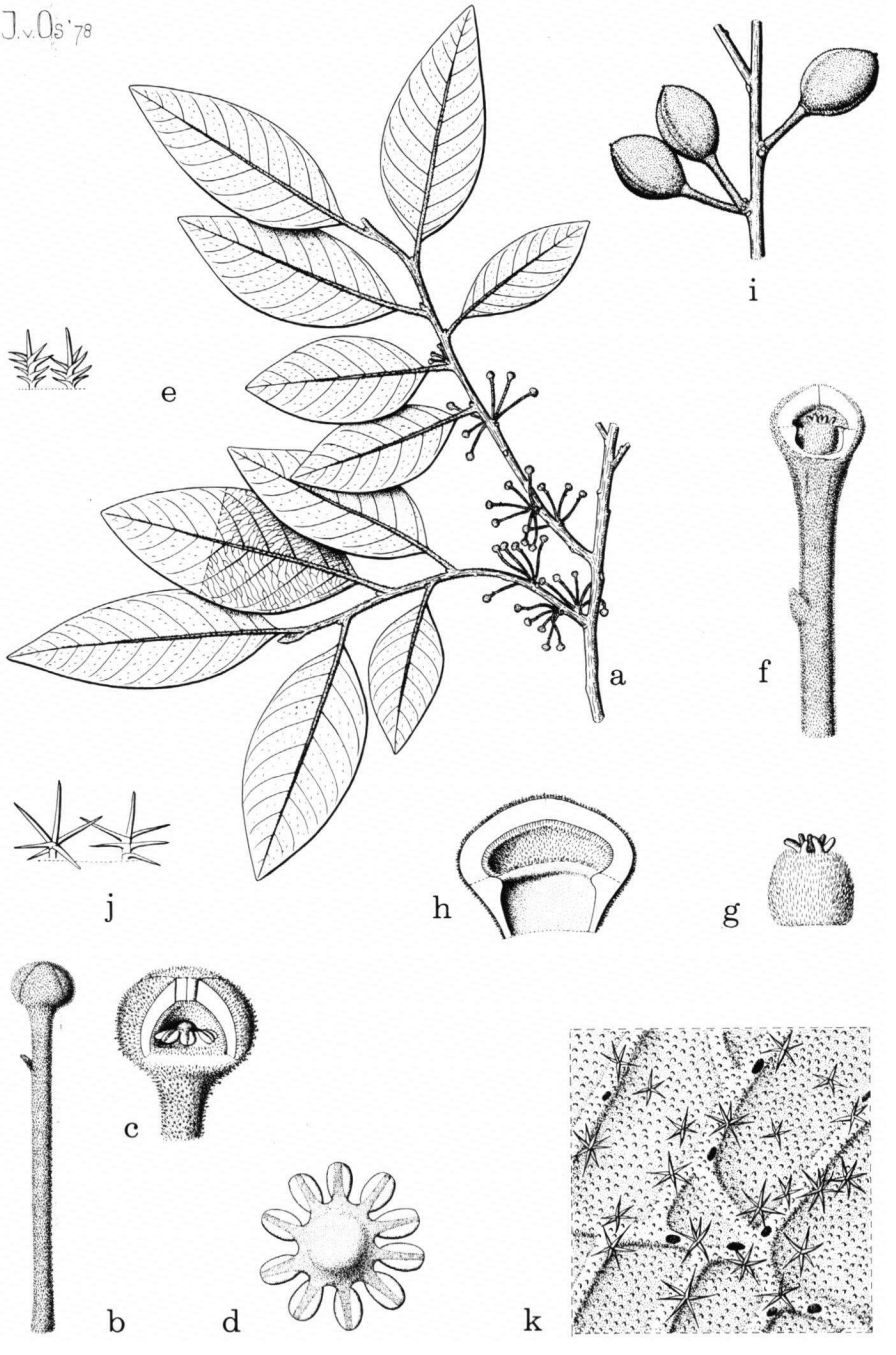
79. Knema pubiflora de Wilde, *sp. nov.* – Fig. 17.

Ramuli ad apices 1.5–3 mm diam., tomentosi tomento e pilis circa 0.1–0.2 mm longis composito, deorsum cortice haud lamelloso obtecti. Folia chartacea usque tenuiter coriacea, 4–15 cm longa, in sicco ad paginam superiorem saturate brunnea, subtus verrucis suberosis minutis saturate brunneis dispersis instructa, atque tomento e pilis (sub)persistentibus staturae variabilis 0.2–0.5 mm longis obtecta. Inflorescentiae ♂ sessiles vel pedunculo usque ad 2 mm longo; flores tomento e pilis circa 0.1 mm longis composito induti, perianthium intus dense stellato-tomentosum. Flores ♂: pedicelli 10–15 mm longi; bracteola (sub)persistens, ad medium vel cum paulo supra inserta; perianthium in alabastro depresso-globosum, circa 2–2.5 mm longum, 2.5–3 mm diam. Antherae 11–13, subsessiles. Discus staminalis convexus, 1.2–1.5 mm diam. (antheris inclusis); columna staminalis 0.3–0.6 mm longa.

Type: Borneo, Sabah, Beluran Dist., ♂ fl., 9 May 1961, *W. Meijer SAN 25105* (L; iso BO, SING).

Tree 10–40 m. *Twigs* in apical portion 1.5–3 mm diam., glabrescent from tomentum composed of hairs *c.* 0.1–0.2 mm long, lower down the *bark* not tending

Fig. 17. *Knema pubiflora* de Wilde – a. habit of branchlet with male inflorescences, × ½; b. mature male flower bud, × 3½; c. opened mature male perianth in bud showing hairy inner surface and androecium, × 7; d. androecium seen from above, × 15; e. sample of hairs from tomentum on the outer surface of male perianth (half-schematic), × 60; f. opened mature female flower bud showing pistil, × 3½; g. pistil, × 7; h. valve of female perianth showing hairy inner surface, × 7; i. portion of branchlet with infructescences, × ½; j. sample of hairs from lower leaf surface (half-schematic), × 60; k. detail of lower leaf surface with scattered stellate-dendroid hairs and minute blackish cork warts, × 30. – a–e, j. k. from *Meijer SAN 25105* (type); f–h. from *Kostermans 8634*; i. from *Kostermans 10359.*


J.v.Os '78
e
a
i
f
j
h
g
b
c
d
k

to crack or flake. *Leaves* chartaceous to thinly coriaceous, 4–15 cm long, drying brown above; on lower surface with scattered, minute, blackish spots and with (sub)persistent tomentum composed of hairs of mixed sizes, 0.2–0.5 mm long. Male *inflorescences* sessile or up to 2 mm peduncled; flowers outside with persistent tomentum of hairs *c.* 0.1 mm long. *Male flower* pedicels 10–15 mm long, the bracteole (sub)persistent, at or somewhat above the middle; *perianth* in bud (depressed) globose, *c.* 2–2.5 × 2.5–3 mm, inside densely stellate-hairy. *Anthers* 10–13, just sessile. *Staminal disc* convex, incl. anthers 1.2–1.5 mm diam; staminal column 0.3–0.6 mm long. *Female flower* pedicels 7–10 mm long; perianth in bud ± pear-shaped, 3–4 × 3–4 mm, inside densely hairy; *stigma* 6–10-lobulate. *Fruits* subglobose to short-ellipsoid, 15–22 × 15–23 mm, with tomentum of hairs *c.* 0.1–0.2 mm long; stalk 10–14 mm long.

Distribution: Borneo.

BORNEO. Sarawak: Kapit (3rd. Div.), *S. 23834, 23992.* – Sabah: *SAN 25105, 36831 (N.T. 280), 44519, 46644 (N.T. 201), 83603.* – E. & SE. Kalimantan: *bb. 16738; Kostermans 4046, 10286, 10359.* – Nunukan I.: *bb. 26188, 29300, 29340, 29356; Kostermans 8634, 8934, 9130; Meijer 1874; Paymans 1, 74, 127; Sutan Pennek 101.*

Ecology: Forest, often on sandy soils; 0–300 m. alt. Flowers and fruits throughout the year.

Notes: 1. Specimens of this new species were included by Sinclair (1961, p. 195) mainly in *K. conferta.*

2. The leaves of *K. pubiflora* usually have a remarkable dark brown drying colour. It is the only species with the perianth inside entirely hairy. Superficially, it may be confused with *K. kunstleri* and *K. conferta*; the latter differs by a stouter habit, a flat staminal disc, the flowers glabrous inside, etc., *K. kunstleri* has a quite different tomentum on the lower leaf surface, the perianth glabrous inside, a flat staminal disc, etc.

80. Knema kunstleri (King) Warb.

K. kunstleri (King) Warb., Mon. Myrist. (1897) 568, tab. 25.

Distribution: Five subspecies, with different geographical areas or ecology in Malaya, Sumatra, Borneo, and the Philippines.

KEY TO THE SUBSPECIES

1a. Leaves 13–28 × 5.5–10 cm. Twigs at apex *c.* 4 mm diam. *Swamp forest; Sumatra* . . . . . **b.** subsp. **macrophylla**

b. Leaves up to 20 × 8.5 cm. Twigs at apex 1.5–3 mm diam. . . . . 2.

2a. Twigs rather slender, towards apex 1.5–2 mm diam., distinctly striate. Leaves chartaceous to thinly coriaceous, above drying greenish or brownish, with coarse or fine, prominent reticulation. Leaf base usually attenuate. Anthers 8–11. Fruit 15–25 mm long; stalk 7–15 mm long. *Lowland, but not in peat swamp forest* . . . . . 3.

b. Twigs usually stouter, towards apex 2–3 mm diam., not or but little striate. Leaves thinly to thickly coriaceous, above drying brownish, with fine or coarse reticulation prominent or not. Leaf base usually ± rounded, or sometimes attenuate. Anthers 10–14. Fruit 17–40 mm long; stalk 3–9(–12) mm long. *Lowland peat swamp forest, or montane forest* . . . . . 4.

3a. Leaves above drying usually greenish, with the nerves and reticulation usually distinctly paler and contrasting. *Malay Peninsula*. . . . **a.** subsp. **kunstleri**

b. Leaves above drying more brownish, the nerves and reticulation not or but faintly paler and little contrasting. *Philippines*. . . . . **c.** subsp. **parvifolia**

4a. Reticulation on upper leaf surface usually little prominent, distinct or indistinct. Fruits 17–20 mm long. *Lowland peat swamp forest, once in 'karengas' forest. Borneo* . . . . . **d.** subsp. **coriacea**

b. Reticulation on upper leaf surface usually prominent and distinct. Fruits 30–40 mm long. Usually in montane forest at (100–)900–2000 m alt. *Borneo* **e.** subsp. **alpina**

a. subsp. **kunstleri**

Myristica kunstleri King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 314, pl. 149. – *K. kunstleri* Warb., Mon. Myrist. (1897) 568, tab. 25; Gamble, Mat. Fl. Mal. Pen. 5, 23 (1912) 241; Ridley, Fl. Mal. Penins. 3 (1924) 69; Sinclair, Gard. Bull. Sing. 16 (1958) 291, fig. 8; 18 (1961) 236 (as var., *p.p.*, excl. syn. *Gymnacranthera cryptocaryoides* and all specimens from Borneo and the Philippines; excl. var. *surigaoensis*). – Syntypes: Malaya, Perak, 500–2000 ft, all numbers of *King's Coll.*, *Scortechini*, and *Wray*, as listed below.

Distribution: Malaya.

MALAYA. s. loc.: *FRI 10780; KEP 99578, 104868; Strugnell 12104.* – Perak: *Chew Wee-lek CWL 1190, 1200; FRI 0747, 2232, 2252; KEP 104603; King's Coll. 3372, 3393, 3570, 4216, 4605, 4949, 5867, 6440, 7180, 10022, 10826; Scortechini 175, 175a; Wray 3985.* – Kelantan: *FRI 4456, 5421, 7193, 7233, 7480, 7494, 20602, 20692; KEP 98804, 98819; Soepadmo & Mahmud 117 (1174).* – Trengganu: *FRI 2407.* – Pahang: *FRI 4756, 15243, 17264, 17282; Shah & Noor MS. 2007, 2009.* – Selangor: *Burkill HMB 1071; FRI 12555, 13389; KEP 95077, 99454.* – Negri Sembilan: *Shah MS. 62; KEP 104903 B.* – Johore: *Whitmore FRI 8806.*

Notes: 1. *K. kunstleri* is easily distinguished by its minute tomentum on the lower leaf surface, and the scattered minute blackish brown dots, caused by non-traumatic cork warts, at both surfaces of the leaves, visible with a lens.

2. Specimens of subsp. *kunstleri* may resemble certain specimens of the subsp. *parvifolia* from the Philippines.

3. Deviating specimens. *MS. 2009*, from Pahang, deviates by the rather oblong shape and by the brown drying colour of the leaves, but especially by its large fruits, measuring 30–32 × 25–28 mm; the specimen *MS. 2007*, from the same locality, is typical subsp. *kunstleri*.

The specimen *Whitmore FRI 8806*, from N. Johore, is probably of hybrid origin; it is collected at an altitude of *c.* 600 m., has immature flowers, and deviates mainly by its oblong-lanceolate leaf shape.

b. subsp. **macrophylla** de Wilde, *subsp. nov.*

Subsp. *kunstleri* similis sed differt ramulis ad apices crassioribus, circa 4 mm diam., foliis majoribus, 13–28 cm longis, 5.5–10 cm latis, nervis ac venis tertiariis haud distincte pallidis atque colore vix dissimilis.

T y p e: Central Sumatra, Indragiri Uplands, S. of Pekan Heran, ♂ fl., 28 May 1939, *Buwalda 6782* (L; iso BO; A, K, PNH, SING, *n.v.*).

Twigs stout, at apex *c.* 4 mm diam., rather coarsely striate. *Leaves* chartaceous, elliptic-oblong, broadest at or somewhat below the middle, 13 – 28 × 5.5 – 10 cm, base rounded, top acute-acuminate; above drying (greenish-)brown, the *nerves* (not the reticulations) sometimes paler; nerves 8 – 15 pairs; reticulation rather fine, prominent above. *Inflorescences* sessile. *Male flower* pedicels 10 – 12 mm long; *perianth* in bud 2 – 2.3 × 2.8 – 3 mm; valves inside reddish (?); *anthers* 10. *Female flowers* and *fruits* not seen.

D i s t r i b u t i o n: C. Sumatra (Indragiri Uplands); known only from the type.
E c o l o g y: Lowland swamp forest. Flowers in May.
N o t e s: 1. Closely related to the subsp. *kunstleri*, though quite distinct by its stout habit with the twigs considerably thicker and the leaves much larger than all the abundant material of subsp. *kunstleri* from the Malay Peninsula. Also, the leaves of subsp. *macrophylla* have a more brownish drying colour, and the contrasting paler colour of the tertiary venation is absent. The male flowers are similar to those of the subsp. *kunstleri*.
2. The type specimen was identified by Sinclair as *K. cinerea* var. *sumatrana*, presently *K. sumatrana*.

c. subsp. **parvifolia** (Merr.) de Wilde, *stat. nov.*

K. parvifolia Merr., Phil J. Sc. Bot. 13 (1918) 287; Enum. Phil. Fl. Pl. 2 (1923) 184. – T y p e: Philippines, Luzon, Albay Prov., ♂ fl., June 1908, *Curran For. Bur. 10573* (PNH, *n.v.*; iso K).

D i s t r i b u t i o n: Philippines (Luzon, Samar).

PHILIPPINES. L u z o n: *Bur. Sc. 13358, 33631; For. Bur. 10573, 22641; Vidal 3568.* – S a m a r I.: *Phil. Nat. Herb. 6092, 14324 (Field no. 4130).*

N o t e: This subspecies may resemble very much the subsp. *kunstleri*, from which it differs by a number of rather ill-defined characters of which the thinner leaves and the lack of the paler and contrasting reticulation are perhaps the most important. *K. parvifolia* was by Sinclair included in the type variety of *K. kunstleri*.

d. subsp. **coriacea** (Warb.) de Wilde, *stat. nov.*

K. coriacea Warb., Mon. Myrist. (1897) 614. – *Myristica coriacea* Boerl., Handl. Fl. Ned. Ind. 3, 1 (1900) 92. – T y p e: Borneo, Sarawak, Kuching, fr., *Beccari 670* (B, *n.v.*; iso P; FI, G, K, *n.v.*).

D i s t r i b u t i o n: Borneo (Sarawak, Brunei, Sabah).

BORNEO. S a r a w a k: *Anderson 8518, 9019; Beccari 670; Elias 8030; Purseglove P. 5009; Sar. For. Dept. 12252; Zehnder S. 16801, S. 16962, 17405; Sitan 9502; Su'ut Ali 7747; Tahir 9249; Zehnder 9584.* – B r u n e i: *Brunei 686, S. 5847; Sinclair 10465.* – S a b a h: *SAN 15857, 17428, 24326, 31980, 33750, 66659, 84351.*

E c o l o g y: Mainly in peat swamp forest; once recorded from forest on 'karengas' soil.; 0 – 100 m alt.
N o t e s: 1. Flowers recorded as cream, not reddish inside. Stem with stilt roots.
2. With Sinclair (1961, p. 236) the present subsp. was included in *K. kunstleri* var. *kunstleri*.

e. subsp. **alpina** (Sinclair) de Wilde, *stat. nov.*

K. cinerea (Poir.) Warb. var. *alpina* Sinclair, Gard. Bull. Sing. 18 (1961) 287. – Type: Borneo, Sarawak, Baram Dist., G. Mulu, fr., 30 June 1961, *Anderson 4514* (SAR, *n.v.*; iso K, L; A, SAN, SING, *n.v.*).

Distribution: Borneo (Sarawak, Sabah, W. and S. Kalimantan).

BORNEO. Sarawak: *Anderson 4233, 4510, 4514, 4566, 4600; Chew Wee-lek CWL 349; S. 15552, 16621, 19082, 19633, 27923, 28682, 32884, 33796, 38856, 38885, 38916.* – Sabah: *Clemens 31608; S 16669, 44326.* – W. Kalimantan: Melawi, *bb. 26354.* – S. Kalimantan: *de Vogel 851.*

Ecology: Montane and submontane forest, (100–)900–2000 m alt.

Notes: 1. Specimens may resemble *K. kinabaluensis*, a species differing by various smaller characters, but easily distinguished by the lack of the minute blackish-brown spots on the upper and lower leaf surface.

2. Deviating specimens. *Ilias Paie S. 27923*, from Kota F.R., 5th Div., Sarawak, deviates by the rather thinly (not thickly) coriaceous leaves, and the comparatively long fruit stalks, measuring 7–9(–12) mm. It was collected at *c.* 500 m alt., growing on sandstone-derived soil. The specimen *de Vogel 851*, from S. Kalimantan at *c.* 250 m alt., rather deviates by non-striate twig apices, rather membranous leaves, and a slightly convex staminal disc. The male perianth was recorded as pale yellow inside.

81. **Knema stellata** Merr.

K. stellata Merr., Phil. J. Sc. Bot. 11 (1916) 182; Enum. Phil. Fl. Pl. 2 (1923) 184; for synonyms and references see under the subspecies. – Type: Philippines, Samar I., Feb.–March 1916, st., fr., *Ramos Bur. Sc. 24276* (PNH, *n.v.*; iso BM, K, P; A, NY, US, *n.v.*).

Distribution: Three subspecies in the Philippines and northern Celebes.

KEY TO THE SUBSPECIES

1a. Fruit covered by either a thin scurf composed of scaly hairs *c.* 0.1 mm long, or a tomentum of hairs 0.5–1 mm long. Fruit stalks 5–10 mm long. . . . . 2.

b. Fruit with scurfy tomentum of hairs *c.* 0.1–0.2 mm long. Fruit stalks *c.* 3 mm long. *N. Celebes* . . . . . **c.** subsp. **minahassae**

2a. Hairs on fruit 0.5–1 mm long. Lower leaf surface with persistent tomentum or late glabrescent. *Samar I* **a.** subsp. **stellata**

b. Hairs on fruit *c.* 0.1 mm long. Lower leaf surface rather sooner glabrescent, except for midrib and nerves. *Mindanao, Sibuyan I., Luzon* **b.** subsp. **cryptocaryoides**

a. subsp. **stellata.**

Distribution. Philippines (Samar I.).

PHILIPPINES. Samar I.: *Ramos Bur. Sc. 1706, 24276, 24430; Sablaya 52; Sulit PNH 14580.*

Note: *K. stellata* was by Sinclair (1961, p. 277) included in *K. tomentella.*

b. subsp. **cryptocaryoides** (Elmer) de Wilde, *stat. nov.*

Gymnacranthera cryptocaryoides Elmer, Leafl. Philip. Bot. 3 (1911) 1060; Sinclair, Gard. Bull. Sing. 17

(1958) 115. – Type: Philippines, Sibuyan I., Capiz Prov., April 1910, fr., *Elmer 12262* (PNH, *n.v.*; iso BM, K, L; A, BO, BRI, CAL, E, G, LE, NSW, NY, US, *n.v.*).

K. kunstleri (King) Warb. var. *surigaoensis* Sinclair, Gard. Bull. Sing. 18 (1961) 238, fig. 14. – Type: Philippines, Mindanao, Surigao Prov., ♂ fl., *Wenzel 2680* (UC, *n.v.*).

Distribution: Philippines (Luzon, Sibuyan I., Mindanao).

PHILIPPINES. Luzon: *Loher Bur. Sc. 12390.* – Sibuyan I.: *Elmer 12262.* – Mindanao: Prov. Surigao, *Ponce For. Bur. 25076*; Prov. Agusan, *Stern 2096.*

Note: *Gymnacranthera cryptocarioides* was by Sinclair included in *K. kunstleri* var. *kunstleri.*

c. subsp. **minahassae** (Warb.) de Wilde, *stat. nov.*

K. laurina (Bl.) Warb. var. *minahassae* Warb., Mon. Myrist. (1897) 620. – *Myristica laurina* Bl. var. *minahassae* Boerl., Handl. Pl. Ned. Ind. 3, 1 (1900) 92. – Syntypes: N. Celebes, Minahassa, *Koorders 18167β* (BO, *n.v.*, fr., lectotype), *18169β* (BO, *n.v.*, sterile).

Distribution: N. Celebes (Minahassa).

CELEBES. Minahassa: *bb. 15087; Koorders 18152β; de Vogel 2617.*

Ecology: Montane forest; 900–1000 m alt.

Notes: 1. The syntype specimens, *Koorders 18167β* and *18169β*, both in BO, have not been seen by me. Warburg, *l.c.*, described the fruits as 25 mm long and the leaves as attaining 27 × 7 cm. The present taxon was included by Sinclair (1961, p. 277) in *K. tomentella.*

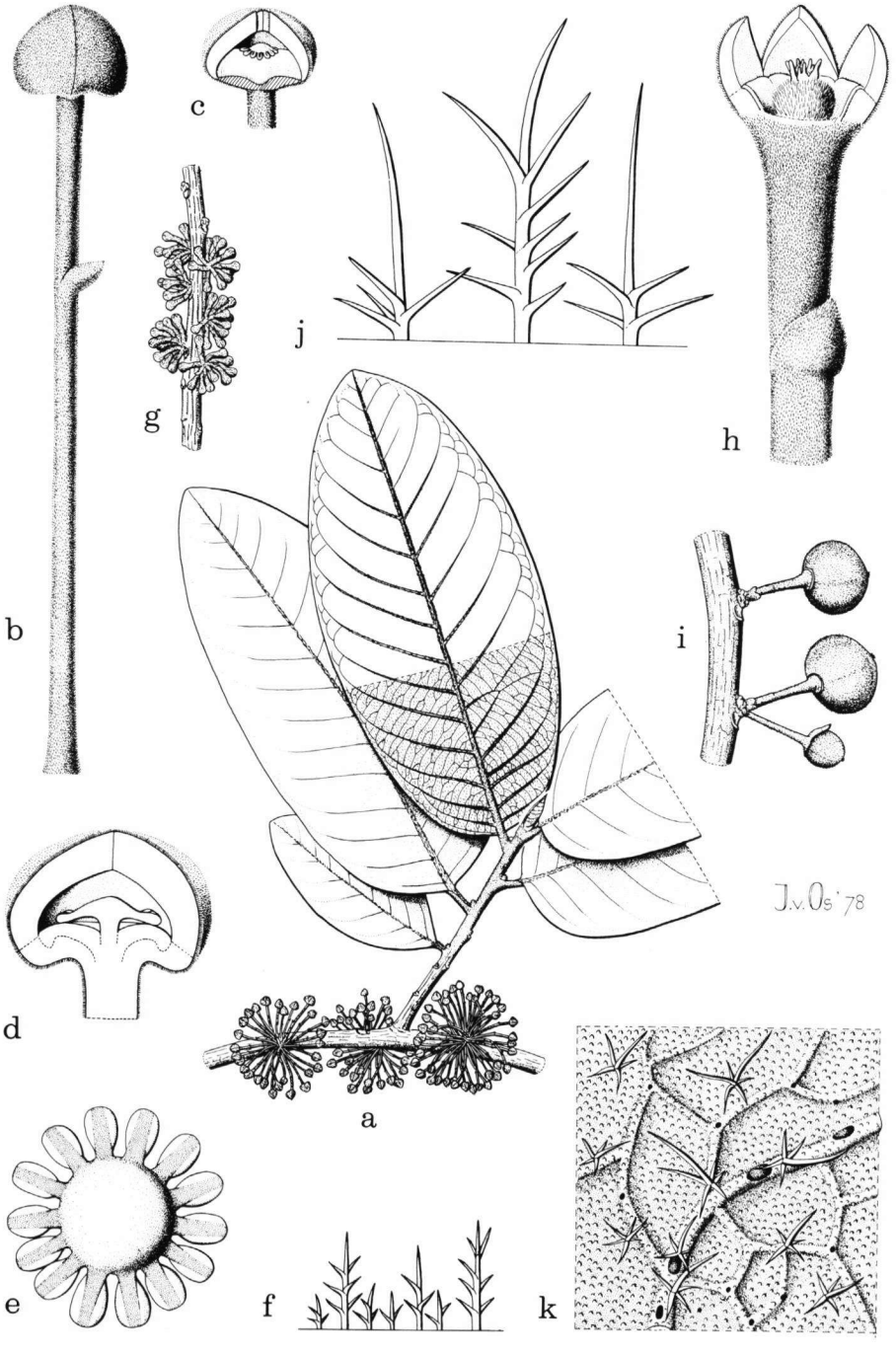
2. The specimen *de Vogel 2617* was annotated as a tree *c.* 35 m tall, collected in montane forest at *c.* 1000 m altitude.

82. Knema conferta (King) Warb.

Myristica conferta King, Ann. Roy. Bot. Gard. Calc. 3 (1891) 315, pl. 150. – *K. conferta* Warb., Mon. Myrist. (1897) 578, t. 24 fig. 1 & 2, excl. vars. *scortechinii*, *borneensis*, and *tonkinensis*; Gamble, Mat. Fl. Mal. Penins. 5, 23 (1912) 243; Ridley, Fl. Mal. Penins. 3 (1924) 70; Sinclair, Gard. Bull. Sing. 16 (1958) 286, fig. 6; 18 (1961) 194. – Syntypes: Malaya, Perak, *King's Collector 6211* (fr., lectotype) (CAL, *n.v.*; iso K, L; FI, G, *n.v.*), *10295* (fr.; CAL, *n.v.*; iso K; SING, *n.v.*), *Wray 2377* (CAL, K, SING, *n.v.*); Malacca, ♂ fl., *Griffith 4345* (CAL, *n.v.*; iso K, P; A, *n.v.*), *Maingay 1294*, (CAL, *n.v.*), 1297 (♀ fl.; CAL, *n.v.*; iso K); Singapore, *Ridley 442* (SING, *n.v.*).

Distribution: Malaya, Singapore, Sumatra, Borneo.

Fig. 18. *Knema pedicellata* de Wilde – a. habit of branchlet with male inflorescences, × ¼; b. mature male flower bud, × 3½; c. opened mature male perianth in bud showing disc at bottom and androecium, perianth valves 4 or 5, × 3½; d. halved mature male perianth showing disc and androecium with convex staminal disc, × 7; e. androecium seen from above, × 14; f. sample of hairs from tomentum of male perianth (half-schematic), × 60; g. portion of branchlet with female inflorescences, × ¼; h. opened mature female flower, showing disc at the bottom of the perianth and pistil, × 3½; i. portion of branchlet with infructescences, fruits submature, × ½; j. sample of hairs from lower leaf surface (half-schematic), × 60; k. detail of lower leaf surface with scattered persistent stellate-dendroid hairs and minute blackish cork warts on the veinlets, × 30. – a–f, j, k. from *Ilias Paie S. 16626* (type); g, h. from *S. 34477*; i. from *S. 16682.*


c
j
h
g
b
i
J.v.Os '78
d
a
e
f
k

MALAYA. Perak: *Whitmore FRI 0885; King's Collector 6211, 10295; Scortechini 831.* – Pahang: *Everett FRI 14542.* – Malacca: *Griffith 4345; Maingay 1297.* – Johore: *Ng FRI 5223, 7936; Kadim & Noor KN. 180, 281; SFN 32034.*

SINGAPORE: *Langlassé 307, 322; Maingay 2694; SFN 33145, 37129, 37254, 37256, 39505, 40026, 40046.*

SUMATRA. Tapanuli: *bb. 19392, 26984, 29518.* – E. Coast: *bb. 16406* – Palembang: *Dumas 1617.* – Bangka: *Grashoff 101.* – Belitung: *van Rossum 63.* – Riouw Arch.: *bb. 20376, 27497, 27591; Soepadmo 51.*

BORNEO. Sarawak: *Abang Muas S. 16456.* – Sabah: Sandakan Dist., *SAN 25344, 26381.* – E. Kalimantan: W. Kutai, *Endert 5063; Kostermans 12800.* – Nunukan I.: *Kostermans 8662, 8686, 8772, 9017, 9059; Paymans 2.*

Notes: 1. Resembling species. Vegetatively, this may be confused with *K. laurina*, *K. oblongata*, *K. scortechinii*, and *K. pubiflora*, all with, for instance, different male flowers or tomentum, and the first three species without the characteristic minute blackish spots on the lower leaf surface, caused by non-traumatic cork warts; *K. pubiflora* has an almost identical tomentum on the lower leaf surface, but has the perianth inside hairy.

2. Variation. A rather homogeneous species, except for the fruits which are variable in size as well as in shape. Usually the fruits are more or less ellipsoid, but certain specimens from Nunukan I. (e.g. *Kostermans 8772*) and from Sabah, Leila Forest Reserve, Sandakan Dist. (e.g. *SAN 25344, 26381*) somewhat deviate by nearly globose fruits *c.* 25 – 35 mm diam., with conspicuously thick pericarp, 4 – 5 mm thick at suture.

3. K. conferta as presently conceived largely coincides with the circumscription by Sinclair (*l.c.*) and earlier authors, though several specimens cited by Sinclair have presently been referred to a new species, *K. pubiflora.*

83. Knema pedicellata de Wilde, *sp. nov.* – Fig. 18.

Ramuli ad apices 4 – 6 mm diam., tomentosi, tomento e pilis 0.5 – 1 mm longis composito obtecti, deorsum cortice haud vel raro lamelloso. Folia chartacea, (12 –)17 – 36 cm longa, (5 –)7 – 13 cm lata, subtus verrucis suberosis minutis nigrescentibus dispersis instructa atque tomento e pilis (sub)persistentibus staturae variabilis 0.3 – 1.2 mm longis composito vestita. Inflorescentiae ♂ sessiles; flores tomento e pilis 0.1 – 0.5(– 0.8) mm longis composito induti; lobi perianthii (3 vel) 4 vel 5. Flores ♂: pedicelli 20 – 30 mm longi, bracteola circa medium inserta, persistens; perianthium in alabastro depresso-globosum, basi saccatum, 3 – 4 mm longum, 4 – 5 mm diam. Antherae 14 – 18, brevissime stipitatae. Discus staminalis mamillatus, 2 – 3 mm diam. (antheris inclusis); columna staminalis 0.6 – 1 mm longa.

Type: Borneo, Sarawak, Miri Dist., G. Lambir, 8 July 1962, ♂ fl., *Ilias Paie S. 16626* (L; iso A, K, S, *n.v.*).

Tree 15 – 30 m. *Twigs* in apical portion 4 – 6 mm diam., glabrescent from tomentum composed of hairs 0.5 – 1 mm long, lower down the *bark* not or very rarely somewhat tending to crack or flake. *Leaves* chartaceous, (12 –)17 – 36 × (5 –)7 – 13 cm; on lower surface with scattered, minute, blackish spots, and with (sub)persistent tomentum composed of hairs of mixed sizes 0.3 – 1.2 mm long. Male *inflorescences* sessile; flowers with persistent tomentum of hairs 0.1 – 0.5(– 0.8) mm long. *Male flower* pedicels 20 – 30 mm long, the bracteole persistent, situated about halfway; *perianth* in bud depressed globose and sagged at base, 3 – 4 × 4 – 5 mm; inside at base with a conspicuous disc; valves (3 or) 4 or 5. *Anthers* 14 – 18, just stiped. *Staminal disc* mamillate or strongly convex, incl. anthers 2 – 3 mm diam.; staminal column 0.6 – 1 mm long. *Female flower* pedicels 10 – 12 mm long; perianth in bud ellipsoid-obovoid, *c.* 6 × 5 mm; valves 4 or 5; *stigma* consisting of *c.* 5 lobes

and each lobe again shallowly 2 – 8-lobulate. *Fruits* subglobose, *c.* 20 – 30 × 28 mm, with tomentum of hairs *c.* 0.3 – 0.5 mm long; stalk 18 – 30 mm long.

Distribution: Borneo (Sarawak, Sabah).

BORNEO. Sarawak: *S. 16626, 16682, 27780, 34220, 34477, 37005, 37983, 38494.* – Sabah: Sandakan Dist., *SAN 28416, 75930*; Beaufort Dist., *SAN 36855 NT. 304.*

Ecology: Mixed Dipterocarp forest on sandstone, sandy soil, or sandy clay; ridges; 0 – 700 m alt. Flowers May – July, fruits Nov. – Dec.

Notes: 1. A species in general habit resembling *K. conferta* and *K. pubiflora*, with which it has the minute blackish spots (caused by nontraumatic cork warts) on the lower leaf surface in common. It is characterized by its stoutish twigs with broad chartaceous leaves, the long flower pedicels, the mamillate staminal disc, the conspicuous disc at the base of the perianth (in male and female flowers), and the broad subglobose fruits.

2. The tomentum on the male flowers consists of hairs 0.1 – 0.3 mm long, that on the only female specimen seen (*S. 34477*) of hairs 0.2 – 0.5(– 0.8) mm long.

3. Most flowers have 4 or 5 perianth lobes; all other species usually have 3 perianth lobes.

4. As an exception, the older bark in *S. 37005* is finely flaking.

5. All cited specimens of the present new species have been collected after the publication of Sinclair's monograph of 1961.

INDEX

New names, incl. new species, are printed in **bold-faced** type, synonyms in *italics*. Numbers refer to the number of the species as treated in this article.