

## A REVISION OF THE GENUS MASTIXIA (CORNACEAE)

K. M. MATTHEW

The Rapinat Herbarium, St. Joseph's College  
Tiruchirapalli-620002, India

### CONTENTS

Summary . . . . .	51
Introduction — Previous work . . . . .	52
Present work . . . . .	52
Notes on Characters . . . . .	53
Previous classifications . . . . .	55
Relative value of characters and the present scheme . . . . .	56
The present system and geographical distribution . . . . .	57
Affinities and systematic position . . . . .	57
Acknowledgments . . . . .	60
References . . . . .	60
Special part . . . . .	61

### SUMMARY

A revision of the genus in its entire range of distribution is presented. Out of more than 50 published specific names, 9 species (with 13 subspecies or varieties) are recognized, in addition to 4 new species and one new subspecies. The two subgenera *Pentamastixia* and *Tetramastixia* of Wangerin (1910) are shown to be artificial.

Two new subgenera, *Manglesia* Matthew (2 species) and *Mastixia* (11 species) are established. The former is separated on the basis, among others, of stamens (8), calyx (subtruncate), inflorescence branches (4-angular), and fruits (with swollen septum). The last character is expected to be of value in identifying fossil fruits. This subgenus has a disjunct distribution, broken up into two small areas, one continental, the other W. Mallesian. It is possible that the two species are relics.

Within the subgenus *Mastixia*, the two series *Oppositae* and *Alternae* are proposed, based on the arrangement of the first order branches of the inflorescence. This character has a two-fold merit: 1) that it divides the constituent taxa into 2 clear groups, almost without exception; 2) that this is an obvious character verifiable in flowering and fruiting materials of all ages.

On the basis of this character, the constituent taxa show a clear pattern of distribution, with the eastern part (New Guinea and the Solomon Islands) exclusively occupied by the *Oppositae* and the western part (Ceylon and the Asian Continent except its Malayan extremity) entirely occupied by the *Alternae*, with western and central Malasia being occupied by both. It is claimed that these two series reflect two trends in evolution in the subgenus, as confirmed by the distinct pattern of distribution. From the maximum density of occurrence of members of both series, and the richest development of forms in N. Borneo and the Malay Peninsula, it is suggested that the subgenus radiated from this centre.

Three other notable trends are: 1) *M. rostrata* has its ssp. *rostrata* in Java and the Lesser Sunda Islands with (sub) opposite phyllotaxis while the other ssp. *caudatifolia* in Borneo has alternate phyllotaxis; 2) among the *Oppositae*, its eastern members (New Guinea and the Solomon Islands) have 5-merous flowers while the western counterparts have 4-merous flowers; 3) the tendency to fluctuation of number of sepals, petals, and stamens, frequent in the subgenus, reaches its peak in the New Guinea—Solomon Islands area.

A section devoted to 'Notes on characters' from analysis of numerous specimens is given as a record of information newly obtained. An appreciation of relative value of characters was reached through this search. Among the more diagnostic features in the genus (in the order of usefulness as elaborated in the keys) are: 1) phyllotaxis; 2) number of sepals, petals, and stamens; 3) length/width ratio of sepals; 4) shape and length of bracts; and 5) shape and size of fruits.

## INTRODUCTION

*Mastixia* is a SE. Asian and Malesian genus. Erected by Blume (1826) with two Javan species, its circumscription was enlarged by Blume (1850) and Miquel (1856, 1858). The etymology of the name is uncertain: Miquel (1858) and Wangerin (1910) refer to the resinous fruits; Backer (1936) refers to the recurved apex of the petals that recalls a whip.

Wight (1845) described and illustrated *Bursinopetalum arboreum* (the generic name refers to the leathery petals) from the Western Ghats in Peninsular India. Thwaites (1858) described a variety of the species from Ceylon in addition to another species with two unnamed varieties.

Baillon (1863) reduced *Bursinopetalum* to *Mastixia*, a conclusion followed by Bentham & Hooker (1867). More taxa were added by Clarke (1879), Pierre (1892), Prain (1898), King (1902), Wangerin (1907), and Ridley (1909). In the first survey of the genus, Wangerin (1910) recognized 16 species. Later additions of taxa were by Merrill (1909), Wangerin (1912), Elmer (1915), Hallier f. (1917), and Melchior (1925). Hallier (1917) published useful notes on some taxa.

Danser (1934) revised the Netherlands Indian species using materials from five (B, BO, L, SING, U) herbaria. In spite of inadequate material, he rightly appreciated considerable polymorphism in the genus. Taxa not reviewed by Danser or subsequent to his revision were erected by Merrill (1918, 1925, 1929, 1937), Merrill & Chun (1940), and Tardieu-Blot (1968).

## THE PRESENT WORK

About 700 collection numbers, including all the types, from 30 herbaria have been studied. A complete set of photographs of the types is kept at the Rijksherbarium and another with the author.

Some field work was done in Peninsular India to study living plants in nature, to collect ample materials for further (anatomical, cytological, and phytochemical) work, and to check or complete herbarium observations (see later).

Simultaneously with the present paper, a revision for the Flora Malesiana is being prepared. To avoid duplication the Malesian taxa are presented here without descriptions in English, with shortened citations of literature, and without references to misidentifications.

Before presenting this revision of the genus over its entire range of distribution, four limitations should be mentioned.

1) It is regretted that Berlin materials that formed the nucleus of Wangerin's revision, and had also been seen by Danser, are no longer extant. Dr. R. Bohr of Uniwersytet Mikolaja Kopernika, Torun, Poland (where Wangerin's annotated sheets ought to have been) informed us that no *Mastixia* materials are present there.

2) Undercollecting of materials and poor availability of comparable materials have been another limitation. There are species in which no material has been added for decades; and there are others known only from one or a very few collections. Among the collections themselves, there are relatively few with open flowers and/or fruits. The fact that the members are tall trees with inconspicuous flowers that shed petals and stamens soon after opening seems to account for this situation. This unavailability of comparable materials proved to be a severe limitation in this particularly 'difficult' genus. The following are some of the characters that one would have wished to compare more thoroughly over the whole range: inflorescence: size of the mature inflorescence and its parts; flowers: colour, odour, duration, and mature size; bracts: size and duration, especially

whether taxa with foliaceous bracts form any distinct infrageneric group; calyx: size of the mature lobes; corolla: size, consistency, median ridge, and final position of petals (thinner petals seem to be reflexed while thicker ones seem to be spreading); stigma: whether the bifid condition is general or not; fruit: shape and size of the mature fruit, thickness of the pericarp, and the final shape of the persistent disc.

3) The extensive field of the fossil counterpart — generally occurring as stone-fruits from the Tertiary and referred to as fossil Mastixioids — known from the European continent, Great Britain, and N. America, is excluded from the present survey (see Kirchheimer 1957, Mai 1964).

4) Studies of cytology and seedling morphology are yet to be made; Tj. Reitsma remarked that pollen morphology is so uniform in the genus as to be of little diagnostic value; Eyde's studies on floral anatomy are still at an early stage.

#### NOTES ON CHARACTERS

*Mastixia* is clearly recognizable from its woody habit, phyllotaxis, type of inflorescence, length/width ratio of sepals, structure of petals, number and structure of stamens, form of the disc, and especially the structure of the gynoeceum and fruit, but the species limits are very hard to draw.

1. Shape and texture of leaves have some diagnostic value, though not easily tabulated; the smaller size (up to 10×3 cm) and cuspidate apex are characteristic of *M. cuspidata* and *M. rostrata*; these species are known also for the slender twigs. Leaves are generally dark green above, paler below; they tend to dry black, especially above.

Presence of domatia has little diagnostic value except probably in *M. euonymoides* where one or a pair of elongated domatia towards the base of the leaf is so frequent as to be of some diagnostic value. For the rest, they seem to depend on the age and texture of leaves: older and coriaceous leaves seem to have them more often. *Poore 142B* from Sarawak has domatia along nerves as well.

The nervation pattern is basically camptodromous (nerves not terminating on the margin — Hickey, 1973). In several materials the nerves, after leaving the midrib, run parallel to it for a while before turning towards the margin, but this is not constant enough as to be of diagnostic value. Midrib and nerves are generally impressed above, prominulous below; when prominent, nerves tend to be arcuate. Intersecondary nerves were noticed in subg. *Manglesia*, *M. eugenoides*, and in certain specimens of *M. kaniensis* ssp. *ledermannii*. The number of nerves, though at first sight a handy character, proved to be less reliable, as it often depends on the size of the leaves. *M. trichotoma* var. *rhyngocarpa* generally has 8—15 nerves per side in Sumatra and parts of Borneo, but as leaves become smaller eastwards, the number of nerves becomes as low as 5 per side. However, within a smaller area on the Asian mainland, it is one of the characters used to separate ssp. *cambodiana* and ssp. *chinensis* of *M. pentandra*.

2. I n d u m e n t u m: A few species are nearly glabrous in all parts, but the majority has an indumentum of some sort. This varies from short and appressed to puberulous, villous, and even woolly. The last condition occurs once in each of the two series: *M. trichotoma* var. *maingayi* (*Oppositae*) and *M. macrocarpa* (*Alternae*). The indumentum is best observed on the vegetative buds, nodes, branchlets, petiole, midrib, nerves and veins, and the inflorescence and its parts. On the inflorescence itself, it is more dense at the nodes, on the bracts (in the axils of which a tuft of hairs was noted at times), and on the exterior of the receptacle and petals; the calyx is more often glabrous, especially at the margin. The degree of variation is considerable.

3. **Phyllotaxis.** Two patterns — (sub)opposite, generally also decussate, and alternate (scattered, really spiral) — are basic to the genus. The most constant occurrence was in the arrangement of the branches of the first order of the inflorescence; this pattern is repeated, though not always with the same constancy, by the leaves and branchlets. On the basis of these two patterns, two new series, *Oppositae* and *Alternae*, are established.

4. **Bracts** are of two kinds: the triangular or ovate ones under 3 mm, and the lanceolate ones that may merge into foliage leaves at the base of the inflorescence. Some species have exclusively the former kind, while some species of the *Alternae* have the latter one. These species with foliaceous bracts do not form a distinct group. Bracts are caducous in subg. *Manglesia*; in subg. *Mastixia* they seem to be persistent, though there are specimens where bracts have fallen off, probably because of the manner of drying.

It is tempting to use bracts as a diagnostic character, but this has its pitfalls. The clearest case is in Peninsular India where *M. arborea* ssp. *meziana* of low altitudes has bracts up to 15 mm, while ssp. *arborea* of the hills has bracts under 4 mm. In this case the length of bracts and the size of leaves are correlated with altitude. A parallel case is that of *M. pentandra* ssp. *cambodiana* which may have lanceolate to foliaceous bracts up to over 10 mm while materials formerly known as *M. alternifolia* and *M. poilanei* have small bracts though of varying lengths.

Bracts of the inflorescence branches of the higher order tend to become connate as in *M. trichotoma* var. *trichotoma*, though not all *Oppositae* have connate bracts. In Blume's *M. laxa*, bracts of the lateral flowers of the terminal cyme are boat-shaped and nearly cover the flower bud.

5. The **calyx** has been described as turbinate or campanulate, a term that applies rather to the receptacle; the calyx proper occupies only about the apical third of the total length. Subg. *Manglesia* has a subtruncate calyx with 4 short teeth while subg. *Mastixia* has a lobed calyx with 4 or 5 (or 6 or 7) lobes. As the number of lobes is subject to fluctuation, it is unsafe to conclude to 'pentamery' or 'tetramery' of the flowers from the number of persistent calyx lobes on the fruit. The number of calyx lobes is never less than that of petals and stamens — for instance, if petals and stamens are 5, sepals will never be 4.

Aestivation of calyx lobes has little diagnostic value: when lobes are 4, they occur in 2 subequal pairs (narrower one outside), initially imbricate, later valvate; when they are 5, the pattern is less clear. However, on the basis of the length/width ratio, two fairly clear groups are discernible: 1) calyx lobes almost as long as wide; 2) calyx lobes at most half as long as wide. The limitation in the use of this character is that in specimens with exclusively immature flower buds, it is not easy to judge to which category the calyx belongs; besides, the length/width ratio was less constant in some South Indian materials.

6. **Corolla.** The petals of the genus have a characteristic texture and shape, but there is little known about their colour, relative thickness, prominence of the median ridge, and final position (reflexed or spreading) in the flower, as petals seem to fall off early. These details are not easily ascertained from flower buds. The indumentum on the outside (glabrous, puberulous, or silky) has some diagnostic value.

7. **Androecium.** The structure of the stamens is so uniform as to be of little diagnostic value, but their number, being the same as that of petals (and generally also of sepals), is more useful. As stamens fall off early, it was not possible to compare the lengths of mature filaments.

8. The **gynoecium** has been considered, directly or indirectly, by Wight (1845), Miers (1851), Thwaites (1855), Koch (1859), Seemann (1864), and Bentham and Hooker (1867).

The relative prominence of the disc depends on the age of the flowers; invaginations of the disc are abaxially 4 or 5 (caused by the filaments) and adaxially 8 or 10 (caused by the thecae of the anthers), becoming shallower with age; the disc persists in fruit.

The style is more easily available for examination than the petals and stamens, as the former is persistent. The number of longitudinal ridges corresponds to that of the stamens. Young stigmas appear punctiform because the 4 or 5 lobes initially remain infolded; sometimes the lobes become reflexed later. At times the stigma is deeper bifid, but it is not clear whether this has any diagnostic value, or is simply a stage in the development of all stigmas.

9. The structure of the fruit is rather uniform throughout the genus. Subg. *Manglesia* has oblong fruits with a rather inconspicuous disc and the incomplete septum is swollen so that the seed cavity is hippocrepiform in cross-section. Subg. *Mastixia* has larger, subglobose, ovoid, ellipsoid, or oblong fruits with a rather wedge-shaped septum so that the seed cavity is relatively much larger. This difference in thickness of the septum can be significant in the classification of fossil fruits.

As regards the shape of fruits, the *Oppositae* generally have ovoid fruits while many *Alternae* have ellipsoid or oblong fruits. The difference is not sharp. The shape of the mature fruit and its disc can be a useful character but it should be noted that immature fruits can be unrepresentative as to shape and prominence of the disc. A very few materials showed a thick pericarp, but comparison was not possible.

10. Galls of four kinds are noticed: on stem, leaf, inflorescence, and fruit; a classified entry has been made under the respective species. No galls have been noted in subg. *Manglesia*; within subg. *Mastixia*, they occur rather at random, though there is a conspicuous preponderance in the *Oppositae*, especially in *M. rostrata* ssp. *caudatifolia* and *M. trichotoma* var. *trichotoma*, var. *korthalsiana*, and var. *rhyrachocarpa*.

#### PREVIOUS CLASSIFICATIONS

The number of sepals, petals, and stamens has been the traditional basis for classification in the genus. Though Beddome (1872) has pointed out its weakness, it was too obvious a character to omit, especially as this genus is a taxonomic despair for lack of 'good' characters.

In the first survey of the genus, Wangerin (1910) gave the traditional practice a status by erecting two subgenera *Tetramastixia* and *Pentamastixia*. Danser (1934, p. 48) pointed out that the system was arbitrary; however, he did not propose any alternative.

For a while the present author, too, worked on the traditional basis but several cases like the following showed the unsoundness of the practice.

1. *M. tetrandra* var. *thwaitesii* (Ceylon), *M. subcaudata* (Philippines), and *M. parvifolia* (Borneo) are local 4-merous taxa known from a single or a very few collections from an area occupied by 5-merous taxa and are otherwise hardly distinguishable from the latter. It is suggested that they are local variations, possibly correlated with altitude.

2. *M. tetrandra* var. *tetrandra* has perfectly 4-merous and 5-merous representatives, not distinguishable by any other character.

3. *M. trichotoma* var. *korthalsiana* is very similar to var. *trichotoma* except for, among others, the 5-merous flowers.

4. Above all, it was the considerable degree of fluctuation in the number of parts in the floral whorls (sepals 4-7; petals 4-6; stamens 4-6) even within the same inflorescence that militated strongest against the *Tetramastixia*-*Pentamastixia* classification. It should, however, be noted that except in the above cases 1-3, generally no more than

10% of the flowers were aberrant; the 4-merous and 5-merous flowers in the same inflorescence did not have any definite discernibly constant position-relationship in the inflorescence.

This criticism does not imply that tetramery and pentamery cannot be used as a character at a lower level; in fact it is used in the present system as well.

#### RELATIVE VALUE OF CHARACTERS AND THE PRESENT SCHEME

A new subgenus *Manglesia* (from a MS name for a new genus suggested by G. Watt on *Watt 5899*) is mainly separated on the basis of stamens (8), calyx (subtruncate), inflorescence axes (ribbed), and fruits (with swollen septum).

Within subgenus *Mastixia*, it was found, after a protracted search, that the manner of arrangement of the branches of the first order of the inflorescence, verifiable in flowering and fruiting materials of all stages, offered a reliably constant feature. They are either (sub)opposite, often also decussate, or scattered (more accurately, spiral); this pattern was also found, with less constancy, in the leaves and branchlets. On this basis, the subgenus splits evenly into two coherent series, here named *Oppositae* and *Alternae* respectively (these technically less accurate terms are preferred as their meaning is obvious in dried materials). As these groups are primarily meant to be practical, no higher rank is needed.

Within these two series, further groups are separated on pentamerous or tetramerous flowers (without any of the traditional implications). At a third stage, the length/width ratio of sepals is used. Excluding very young buds, and the acumen of sepals themselves, it is easy to determine whether a flower has 'long' or 'short' sepals. Shape and length of bracts is given a fourth place, and shape and size of fruit a fifth one.

The following table shows how taxa classified under *Tetramastixia* (T) and *Pentamastixia* (P) would get distributed in the present system.

#### MASTIXIA

##### Subgenus *Manglesia*

- |                          |  |   |
|--------------------------|--|---|
| 1. <i>M. euonymoides</i> |  | T |
| 2. <i>M. octandra</i>    |  | T |

##### Subgenus *Mastixia*

###### Series: *Oppositae*

- |                          |                           |   |
|--------------------------|---------------------------|---|
| 3. <i>M. kaniensis</i>   | ssp. <i>kaniensis</i>     | P |
|                          | ssp. <i>ledermannii</i>   | P |
| 4. <i>M. trichotoma</i>  | var. <i>trichotoma</i>    | T |
|                          | var. <i>korthalsiana</i>  | P |
|                          | var. <i>maingayi</i>      | T |
|                          | var. <i>rhyrachocarpa</i> | T |
|                          | var. <i>clarkeana</i>     | T |
| 5. <i>M. eugenioides</i> |                           | T |
| 6. <i>M. rostrata</i>    | ssp. <i>rostrata</i>      | T |
|                          | ssp. <i>caudatifolia</i>  | T |

###### Series: *Alternae*

- |                          |                        |     |
|--------------------------|------------------------|-----|
| 7. <i>M. macrocarpa</i>  |                        | P   |
| 8. <i>M. glauca</i>      |                        | T   |
| 9. <i>M. tetrapetala</i> |                        | T   |
| 10. <i>M. tetrandra</i>  | var. <i>tetrandra</i>  | P/T |
|                          | var. <i>thwaitesii</i> | T   |
| 11. <i>M. cuspidata</i>  |                        | P   |

12. <i>M. pentandra</i>	ssp. <i>pentandra</i>	P
	ssp. <i>moluccana</i>	T
	ssp. <i>chinensis</i>	P
	ssp. <i>cambodiana</i>	P
	ssp. <i>philippinensis</i>	P(T)
	ssp. <i>scortechinii</i>	P(T)
13. <i>M. arborea</i>	ssp. <i>arborea</i>	P
	ssp. <i>meziana</i>	P
	ssp. <i>macrophylla</i>	P

## THE PRESENT SYSTEM AND GEOGRAPHICAL DISTRIBUTION

Subgenus *Manglesia* stands clearly apart morphologically; besides, it has a disjunct distribution, confined to relatively small areas, one on the Asian continent, the other in Sumatra. It is possible that these species with 8 stamens are ancient and of a relic nature.

Within subg. *Mastixia*, over and above the constancy of the phyllotaxis in this notably inconstant genus, significant support comes from geographical distribution. The eastern part of its distribution, New Guinea and the Solomon Islands, is exclusively occupied by the *Oppositae*, while the western part, the Asian continent except its Malayan extremity, is exclusively occupied by the *Alternae*. From the fact that these two groups occur side by side in Central Malesia, and from the fact that the maximum density of occurrence is here, it is suggested that the subgenus radiated from here. It may also be noted that all the new species here described in this subgenus, occur in Sarawak.

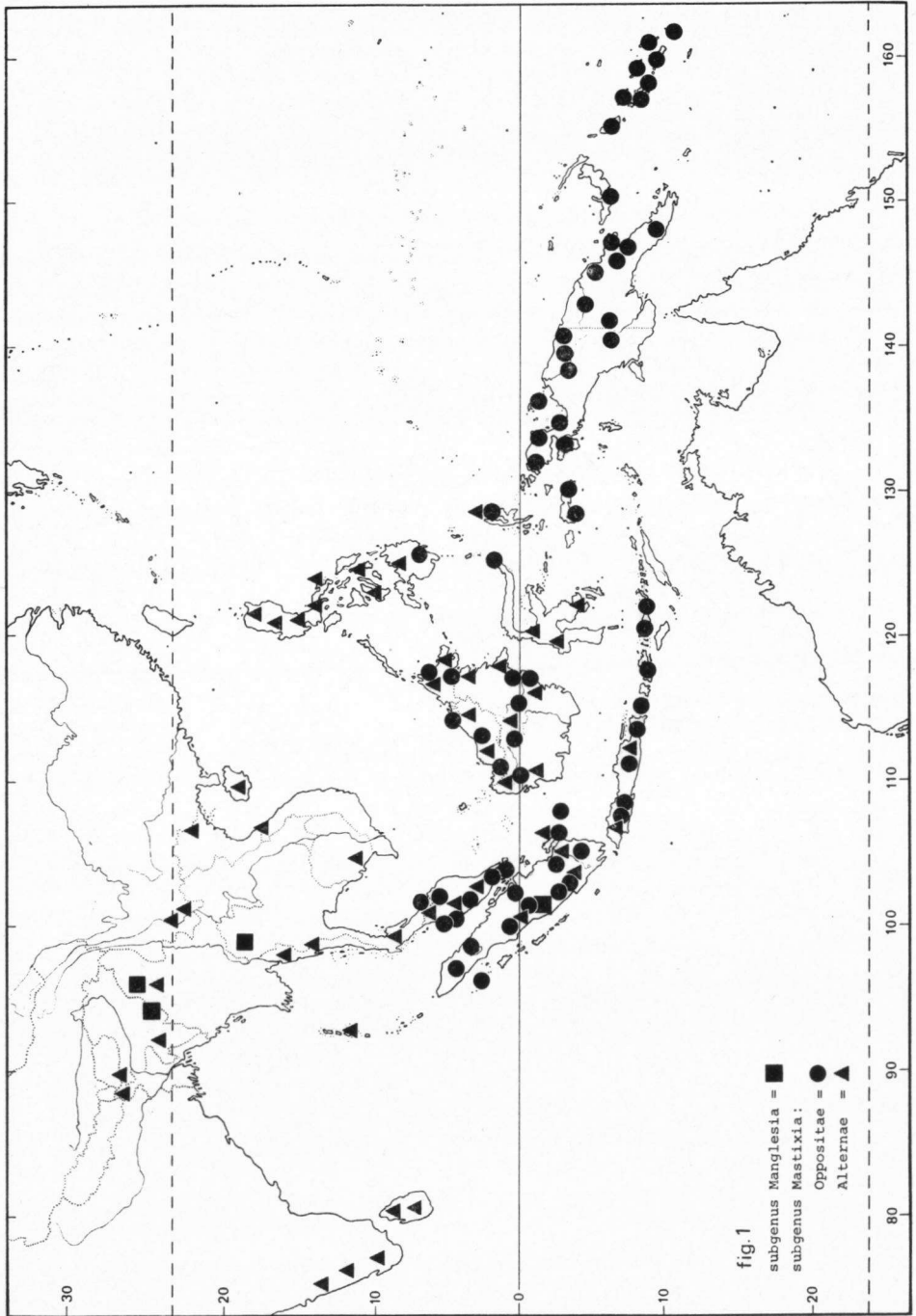
Within the *Oppositae*, the following points should further be noted: 1) the 5-merous *M. kaniensis* has an eastern (New Guinea—Solomon Islands) distribution while the 4-merous *M. trichotoma* (except var. *korthalsiana*) has a western distribution; 2) within the species *M. rostrata*, the ssp. *rostrata* (Java and Lesser Sunda Islands) has (sub)opposite phyllotaxis, while ssp. *caudatifolia* (Borneo) has an alternate phyllotaxis; 3) the fluctuation in the number of parts of each floral whorl, noted throughout, reaches its maximum in the New Guinea—Solomon Islands area.

These points are illustrated in fig. 2 (the number of subspecific taxa within each species is represented by the number of bulges). Only the following points are meant to be illustrated, and no more relationships may be read into the diagram.

1. Subg. *Manglesia* stands apart.
2. Subg. *Mastixia* has 2 parallel developments — the *Oppositae* and the *Alternae* — shown by the two vertical columns.
3. Within the *Oppositae*, the most successful species are the 4-merous *M. trichotoma* and the 5-merous *M. kaniensis*. These seem to be parallel developments.
4. Within the *Alternae* there is a similarly successful group: *M. pentandra* in Central and West Malesia and the adjoining parts of the Asian continent; *M. arborea* is its counterpart in Ceylon and Peninsular India. *M. tetrandra* is close to the latter species.
5. *M. rostrata* (*Oppositae*) and *M. cuspidata* (*Alternae*) are very similar vegetatively, though quite different florally. *M. eugenioides* stands close to *M. rostrata* on floral characters.
6. The affinities of *M. tetrapetala*, *M. glauca*, and *M. macrocarpa* are not clear.

## AFFINITIES AND SYSTEMATIC POSITION

The genus *Mastixia* was originally placed by Blume in *Caprifoliaceae* (1826), but later arranged by him in *Nyssaceae* (1850). Wight (1845) placed *Bursinopetalum* in *Olacineae*, while Miers (1851) referred it to *Aquifoliaceae* on questionable evidence of fruit morphol-





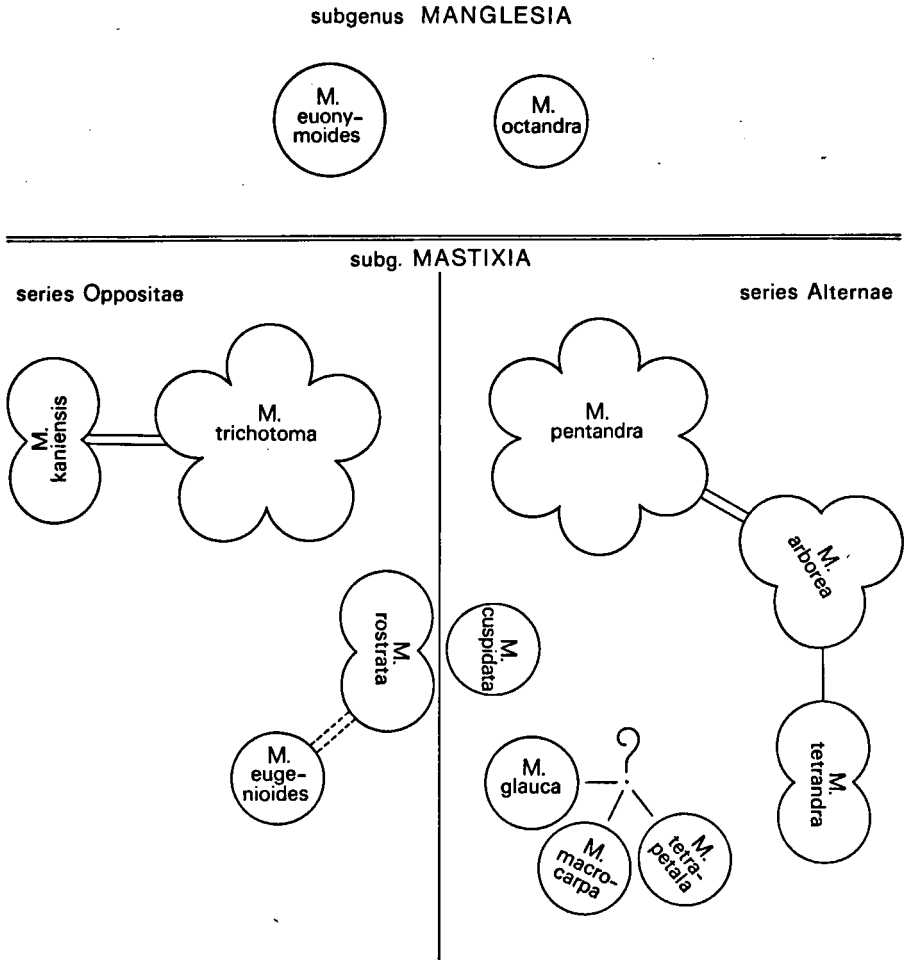


Fig. 2. — Diagrammatic representation of the subgenera *Manglesia* and *Mastixia* with their constituent taxa (for explanation see text).

ogy. Thwaites (1855) referred it to *Araliaceae*, on the basis of similarity of the flowers to those of *Hedera*, but he shifted it to *Icacinaceae* in 1858. Koch (1859) supported its position in *Araliaceae*. Baillon (1863) reduced *Bursinopetalum* to *Mastixia*, and in 1878 referred it back to *Araliaceae*. Bentham & Hooker (1867) placed it in *Cornaceae*; Harms (1898) placed it in *Mastixioideae* of *Cornaceae*, a position accepted by Wangerin (1910). Bullock (1958) refers to Takhtajan (1954) and Dostál (1957) as regards family status for the genus, for which there seems to be insufficient evidence at present. It is generally considered a member of *Cornaceae*, a position also taken by Hutchinson (1967).

## ACKNOWLEDGMENTS

The author thanks the Netherlands Organization for Advancement of Pure Research (Z.W.O.) for financial assistance for eleven months during 1973. The work was carried out at the Rijksherbarium, Leiden, where all facilities were provided for which his thanks are particularly due to the following persons: Prof. C. G. J. van Steenis and Prof. C. Kalkman, former and present directors of the Rijksherbarium, for their interest and helpfulness throughout the work; Dr. M. Jacobs who took the initiative to arrange for the work, assisted in extracting the literature, and commented on the final MS; Dr. P. W. Leenhouts and Dr. C. F. van Beusekom for sustained critical interest during the work; Dr. H. Sleumer for sharing his erudition and helping with the localities; Dr. W. A. van Heel who assisted in the study of fruits; Dr. M. M. J. van Balgooy for preparing the map; Dr. W. Vink who assisted in the preparation of the manuscript; Miss R. van Crevel who very competently prepared the illustrations; Miss M. van Zoelen for the final typing of the MS; the library and technical staffs of the Rijksherbarium for their ready and unstinting helpfulness. He thanks Dr. A. Kostermans (Indonesia), Dr. B. Verdcourt and Dr. I. K. Ferguson (Kew), and Dr. R. H. Eyde (Smithsonian Institution, Washington, DC) for sharing information through correspondence, the latter also for supplying pickled material of flowers and fruits. Special thanks are due to the directors of the following herbaria for promptly sending materials on loan: Arnold Arboretum & Gray Herbarium, Cambridge, Mass.; Botanical Institute, Aarhus; Department of Botany, Aberdeen; Forest Herbarium, Bangkok; British Museum (N.H.), London; Herbarium Bogoriense, Bogor; Jardin Botanique de l'État, Bruxelles; Royal Botanic Gardens, Edinburgh; Instituto Botanico, Firenze; Conservatoire et Jardin Botanique, Geneva; Staatinstitut für allgemeine Botanik und Botanischer Garten, Hamburg; Royal Botanic Gardens, Kew; Forestry Institute, Kepong; Madras Herbarium, Coimbatore; New York Botanical Garden, New York; Forest Herbarium, Oxford; Laboratoire de Phanérogamie, Paris; Botanic Gardens, Singapore; Botanisch Museum & Herbarium, Utrecht; Herbarium of the University of California, Berkeley; U. S. National Museum, Smithsonian Institution, Washington, DC; Naturhistorisches Museum, Vienna; and Institut Botaniczny, Uniwersytetu, Wrocławskiego, Wrocław, Poland; and to the directors of the following herbaria for facilities for work when on visit: Western Circle, Botanical Survey of India, Poona; Central National Herbarium, Calcutta; Southern Forest Research Centre, Coimbatore; and Rapinat Herbarium, Tiruchirappalli.

The following persons contributed to the success of the field work in Peninsular India: Dr. R. Sundaraghavan, Poona, Dr. C. J. Saldanha and Mr. J. P. Mascarenhas, Bangalore, and Dr. J. Joseph, Coimbatore. Mr. H. M. Viswanath, Range Forest Officer, Agumbe, enthusiastically helped with field observations and data on commercial exploitation.

## REFERENCES

(\*) not seen in the original.

- BACKER, C. A. 1936. Verklarend Woordenboek: 357  
 BAILLON, H. 1863. *Adansonia* 3: 80—85.  
 — 1878. *Adansonia* 12: 125—178.  
 BEDDOME, R. H. 1872. *Fl. Sylv.*: 216, t. 216.  
 BENTHAM, G., & J. D. HOOKER. 1867. *Genera Plantarum* 1: 950.  
 BLUME, C. L. 1826. *Bijdr.*: 654—655.  
 — 1850. *Mus. Bot.* 1: 256—258.  
 BULLOCK, A. A. 1958. *Taxon* 7: 161.  
 CLARKE, C. B. 1879. *Fl. Brit. India* 2: 745—746.  
 DANSER, B. H. 1934. *Blumea* 1: 46—74.  
 DOSTÁL, J. 1957. *Bot. Nomenkl.*: 210.\*  
 ELMER, A. D. E. 1915. *Leaf. Philip. Bot.* 8: 2874.  
 EYDE, R. H. 1973. in litt.  
 HALLIER, H. 1917. *Beih. Bot. Centralbl.* 34, II: 40—42.  
 HARMS, H. 1898. in E. & P., *Nat. Pfl. Fam.* III, 8: 262.  
 HICKEY, L. J. 1973. *Amer. J. Bot.* 60: 17—33.  
 HUTCHINSON, J. 1967. *Gen. Fl. Pl.* 2: 45.  
 KING, G. 1902. *J. As. Soc. Bengal* II, 71: 72—76.  
 KIRCHHEIMER, F. 1957. *Die Laubgewächse der Braunkohlzeit.*  
 KOCH, C. 1859. *Wochenschrift*: 372.\*  
 MAI, D. H. 1964. *Die Mastixioideen-Floren im Tertiär der Oberlausitz. Paläontol. Abhdlg., Dtsch., t. 2* (1).  
 MELCHIOR, H. 1925. *Bot. Jahrb.* 60: 167—174.  
 MERRILL, E. D. 1909. *Univ. Calif. Publ. Bot.* 15: 233.  
 — 1918. *Philip. J. Sc.* 13: 42, 43, 325.

- 1925. Philip. J. Sc. 26: 486.  
 — 1929. Pl. Elm. Born.: 233.  
 — 1937. Sunyatsenia 3: 256.  
 MERRILL, E. D., & CHUN 1940. Sunyatsenia 5: 153.  
 MIERS, J. 1851. Ann. & Mag. Nat. Hist. II, 8: 169.  
 MIQUEL, F. A. W. 1856. Fl. Ind. Bat. 1, 1: 770—773.  
 — 1858. Fl. Ind. Bat. 1, 1: 1095.  
 PIERRE, L. 1892. Fl. Coch.: t. 260 B.  
 PRAIN, D. 1898. J. As. Soc. Bengal II, 67: 295.  
 RIDLEY, H. N. 1909. J. Fed. Mal. St. Mus. 4, 1: 25.  
 SEEMANN, B. 1864. J. Bot. 2: 204—205.  
 TAKHTAJAN, A. 1954. Proiskh. Pokruitosem. Rast.: 89.\*  
 TARDIEU-BLOT, M.-L. 1968. Fl. Camb., Laos & Vietnam 8: 16—17.  
 THWAITES, G. H. K. 1855. Hook. J. Bot. & Kew Misc. 7: 242—243.  
 — 1858. Enum. Ceyl. Pl.: 42.  
 WANGERIN, W. 1907. Fedde Rep. 4: 335—337.  
 — 1910. Engler, Pflanzenreich 229, Heft 41: 19—29.  
 — 1912. Fedde Rep. 10: 272.  
 WIGHT, R. 1845. Ic. 3, 3: 4, t. 956.

### MASTIXIA

- Mastixia* Blume, Bijdr. (1826) 654; DC., Prodr. 4 (1830) 275; Meissner, Pl. Vasc. Gen. (1838) 153; Endlicher, Gen. Pl. (1839) 799; Spach, Hist. Vég. Phan. 8 (1839) 88 ('*Mastixia*'); Blume, Mus. Bot. 1 (1850) 256; Baillon, Adansonia 3 (1863) 83; Bentham & Hooker, Gen. Pl. 1 (1867) 950; Baillon, Hist. Pl. 7 (1879) 255; Van Tieghem, Bull. Soc. Bot. Fr. 31 (1885) 392; Boerl., Handl. 1 (1890) 654; Harms in E. & P., Nat. Pfl. Fam. III, 8 (1898) 262; Wangerin in Engler, Pflanzenreich IV, 229 Heft 41 (1910) 19; Danser, Blumea 1 (1934) 47; Hutchinson, Gen. Fl. Pl. 2 (1967) 45. — L e c t o t y p e: *M. pentandra* Bl. (Hutchinson, l.c.).  
*Bursinopetalum* Wight, Ic. 3, 3 (1845) 4; Miers, Ann. & Mag. Nat. Hist. II, 8 (1851) 169; Thwaites, Hook. J. Bot. & Kew Misc. 7 (1855) 242. — T y p e: *B. arboreum* Wight.

Unarmed, resinous, evergreen trees up to 40 (60) m tall; pith about 1/3 of diam. of branchlets. Leaves alternate, (sub)opposite, or decussate, simple, exstipulate; petiole canaliculate; margin entire; base truncate to attenuate; apex acute to caudate; nervation camptodromous; midrib generally impressed above, prominent below. *Thyses* terminal on branches, sometimes also on twigs, branched up to 4(—8) times, with branches of the first order either (sub)opposite (*Oppositae*) or spirally arranged (*Alternae*); further branchings with a tendency to decussate arrangement and terminated by cymes; cymes with central flower most often sessile and ebracteolate, the lateral flowers pedicellate and bracteolate; bracts and bracteoles ovate or triangular, connate or free, lower bracts sometimes gradually becoming foliaceous. *Flowers* bisexual, greenish to yellowish. *Calyx* 4- or 5- (—7-) toothed or lobed, persistent in fruit. *Petals* 4 or 5 (or 6), ovate to oblong-elliptic, thick, inflexed at the apex and bidentate or fimbriate, with or without a median ridge extending from the apex downwards on the inside, spreading or reflexed. *Stamens* 4, 5 (6), or 8, alternating with the petals, erect in bud; when 8, in two alternate whorls; filaments subulate, flattened; anthers cordate, dorsifixed, connivent by the margins in bud, abutting on and alternating with the disc lobes, dehiscent laterally with slits; connective slightly protruding beyond the anthers. *Ovary* inferior; receptacle turbinate, 1-locular, surmounted by a prominent fleshy disc about 1/3 the height of the receptacle; invaginations of the disc abaxially 4 or 5 (fitting the filaments) and adaxially 8 or 10 (fitting the thecae of the anthers), becoming shallower with age; disc persistent in fruit. *Style* stout, ribbed; stigma punctiform, sometimes deeply bifid, 4- or 5-lobed, lobes sometimes reflexed. *Ovule* 1, pendulous laterally from the roof of the generally elongate locule. *Fruit* a drupe, subglobose, ovoid, ellipsoid, or oblong, surmounted by the calyx

and disc; pericarp thin or thick, dark purple to blue when ripe; endocarp woody, sulcate on one side externally, and internally protruding deeply into the locule with a wedge-shaped or swollen incomplete septum. *Seed* conformous to the locule; testa membranous; endosperm copious; embryo small; cotyledons foliaceous; radicle elongate.

**Distribution:** Ceylon, Western Ghats, NE. India, Bhutan, S. Yunnan, Burma, Thailand, Indo-China, Hainan, all over Malesia, Solomon Is. Number of species 13, in two subgenera. — **Fig. 1.**

**Ecology:** Mostly in primary forests, often with Dipterocarps or in mossy forests; also in secondary forests. From low altitude to 1800(—2400) m, in valleys, on slopes or ridges, but generally in moist habitats: water-logged places, river banks, etc.; on a wide variety of soils. Tends to be locally abundant.

**Galls:** Four groups are seen: those on branchlets (stem), leaves, inflorescence, and fruits (Doct. v. Leeuwen, Ned. Kruidk. Arch. 51, 1941: 207).

**Uses:** Burkill, Dict. (1935) 1428; Wealth of India (Raw Materials) 6 (1962) 308. But for a solitary report of 'very strong timber' from New Guinea (*Kajewski 2021*), the timber has little commercial value, except for packing cases and temporary constructions. In southern India, since the 1960's, the wood is being used in the plywood industry. No worthwhile use for the resin is known either.

**Taxonomy:** Generally included in *Cornaceae* after Bentham & Hooker and Hutchinson; given subfamily rank by Harms (1898) and Wangerin (1910). The latter's subgenera *Tetramastixia* and *Pentamastixia* are considered artificial and hence untenable. Family rank given by Takhtajan (1954) is considered premature.

Two subgenera, *Manglesia* (2 species) and *Mastixia* (11 species), are recognized. Within subg. *Mastixia*, the two series *Oppositae* and *Alternae* are erected.

**Notes** to the key and the descriptions.

1. The width of submature flower bud is that of the corolla. This was the only measurement that was found to be suitable to indicate the size of the flower in this genus of 'small' flowers.

2. Two words in the key need special explanation: 'basically' and '-merous'. The word 'merous' is not accurate for 2 reasons: a) the ovary is always unilocular whether the flower is '4'-merous or '5'-merous; b) the number of sepals frequently tends to be higher than that of petals and stamens. Secondly, the word 'basically' refers to the fact that even when '5'-merous flowers occur in a '4'-merous inflorescence, the latter are numerically over 80% so that the prevalent pattern is obvious.

#### KEY TO THE SPECIES

- 1a. Stamens 8; inflorescence branches 4-angular (at least when young); calyx subtruncate with minute teeth; bracts caducous; septum of endocarp swollen to at least 1/3 of the diam. of fruit (Subgen. *Manglesia*) . . . . . 2
- b. Stamens 4 or 5 (or 6); inflorescence branches terete; calyx distinctly lobed; bracts subsistent; septum of endocarp wedge-shaped (Subgen. *Mastixia*). . . . . 3
- 2a. Calyx teeth rounded, thick; pedicels of lateral flowers of terminal cymes under 3 mm, stout; branchlets 4-angular; leaves coriaceous; domatia elongated, frequent. *India, Burma, Thailand*. . . . . **1. M. euonymoides**
- b. Calyx teeth acute, thin; pedicels of lateral flowers of terminal cymes over 5 mm, slender; branchlets subterete when mature; leaves chartaceous; domatia subcircular, occasional. *Sumatra* . . . . . **2. M. octandra**

- 3a. Inflorescence branches of the first order (sub)opposite or decussate; branchlets and leaves generally (sub)opposite or decussate; nodes flattened; fruits generally ovoid. (*Oppositae*) . . . . . 4
- b. Inflorescence branches of the first order scattered; branchlets and leaves scattered; nodes terete; fruits generally ellipsoid or oblong. (*Alternae*) . . . . . 8
- 4a. Flowers basically 5-merous\* . . . . . 5
- b. Flowers basically 4-merous\* . . . . . 6
- 5a. Length of sepals not exceeding half their width; inflorescence subglabrous to puberulous; fruit ovoid to oblong, with inconspicuous persistent sepals. *Moluccas, New Guinea, Solomon Is* . . . . . 3. **M. kaniensis**
- b. Length of sepals almost equal to their width; inflorescence velutinous to woolly; fruit elongate-ovoid, with conspicuous persistent sepals. *Sumatra, Borneo*  
4b. **M. trichotoma** var. **korthalsiana**
- 6a. Length of sepals almost equal to their width; inflorescence puberulous to woolly; corolla puberulous to villous outside; leaves acute or shortly acuminate, 5–24 × 2–12 cm; fruit with conspicuous persistent sepals. *Thailand to Moluccas*  
4. **M. trichotoma**
- b. Length of sepals not exceeding half their width; inflorescence (sub)glabrous; corolla glabrous outside; leaves abruptly caudate to cuspidate, 4–12 × 2–5.5 cm; fruit with obscure calyx teeth . . . . . 7
- 7a. Leaves strictly opposite; petioles stout; leaves thick-coriaceous; nervation prominent, with intersecondary nerves; inflorescence stout with lower bracts up to 5 mm; fruit 1.5 cm across. *Sarawak (Borneo)* . . . . . 5. **M. eugenioides**
- b. Leaves (sub)opposite or alternate; petioles slender; leaves chartaceous to subcoriaceous; nervation rather weak, without intersecondary nerves; inflorescence slender with bracts all under 3 mm; fruit up to 1 cm across. *Sumatra, Java, Lesser Sunda Is., Borneo* . . . . . 6. **M. rostrata**
- 8a. Branchlets woolly; leaves 13–30 × 5.5–15 cm, with midrib and nerves (even veinlets) woolly to villous; petioles stout, 4 cm or more, woolly; fruits over 4 × 2 cm; flowers 5-merous. *Sarawak (Borneo)* . . . . . 7. **M. macrocarpa**
- b. Branchlets not woolly; petioles up to 4 cm; fruit up to 4 cm long. . . . . 9
- 9a. Flowers basically 4-merous\* . . . . . 10
- b. Flowers basically 5-merous\* . . . . . 13
- 10a. Leaves glaucous and waxy below, thick-coriaceous, with intersecondary nerves; apex apiculate. *Sarawak (Borneo)* . . . . . 8. **M. glauca**
- b. Leaves not glaucous and waxy below, without intersecondary nerves; apex not apiculate . . . . . 11
- 11a. Leaves crowded at apices of branchlets, thick-coriaceous; inflorescence branches stout, compact; length of calyx teeth not exceeding half their width; fruit ellipsoid, 1.5 cm across. *Philippines* . . . . . 9. **M. tetrapetala**
- b. Leaves evenly spread, chartaceous to subcoriaceous; inflorescence branches rather slender; fruits oblong, 1 cm across . . . . . 12
- 12a. Leaf apex caudate (over 1 cm), base cuneate; length of calyx teeth not exceeding half their width; submature flower bud up to 2.5 mm across. *Sumatra, Java, Lesser Sunda Is., Borneo* . . . . . 6. **M. rostrata**
- b. Leaf apex rounded, acute to acuminate, never caudate, base attenuate; length of calyx teeth equal to their width; submature flower bud 3 mm across; *Ceylon, India (Andamans)* . . . . . 10. **M. tetrandra**

\* see note on p. 62

- 13a. Leaves abruptly cuspidate (over 1 cm); nerves arcuate, clearly impressed above; inflorescence raceme-like, seldom branched more than twice; lower bracts foliaceous; corolla densely silky outside; branchlets slender; leaves subcoriaceous, mostly under 12 × 4 cm. *Sumatra, Malay Pen., Borneo* . . . . . **11. M. cuspidata**
- b. Leaves not abruptly cuspidate; nerves not arcuate; inflorescence usually branched twice or more . . . . . 14
- 14a. Fruit subglobose or ellipsoid, more than 2 cm across. *Ceylon, S. India* . . . . . **13. M. arborea**
- b. Fruit ovoid to oblong, up to 1(—1.5) cm across . . . . . 15
- 15a. Inflorescence often terminating in a dichasium; nerves slightly prominent, veins obscure. *Ceylon, India (Andamans)* . . . . . **10. M. tetrandra**
- b. Inflorescence not terminating in a dichasium; nerves mostly sharply prominent, veins mostly distinct. *NE. India and Bhutan to Philippines, and Moluccas* . . . . . **12. M. pentandra**

Subgen. MANGLESIA Matthew, *subgen. nov.*

Ramuli decussati. Folia decussata; nervi a costa directe procedentes; nervi intersecundarii adsunt; venae supra prominulae. Inflorescentiae plerumque laterales. Ramuli inflorescentiae primi ordinis decussati, certe juniores quadrangulares; bractee caducae; flos terminalis cymae saepe pedicellatus. Calyx subtruncatus, 4-dentatus. Petala 4. Stamina 8, biseriata. Fructus oblongus; septum usque 1/3 diam. fructus tumidum.

T y p u s: *Mastixia euonymoides* Prain.

Branchlets decussate. Leaves decussate; nerves directly leaving the midrib; intersecondary nerves present; veins prominulous above. Lateral inflorescences common. Inflorescence branches of the first order decussate, 4-angular at least when young; bracts caducous; terminal flower of cyme generally pedicellate. Calyx subtruncate, 4-toothed. Petals 4. Stamens 8, in 2 whorls. Fruit oblong; septum swollen to 1/3 of the diam. of the fruit.

**Distribution:** A few isolated occurrences in continental Asia (India, Burma, Thailand) and in Sumatra. — **Fig. 3.**

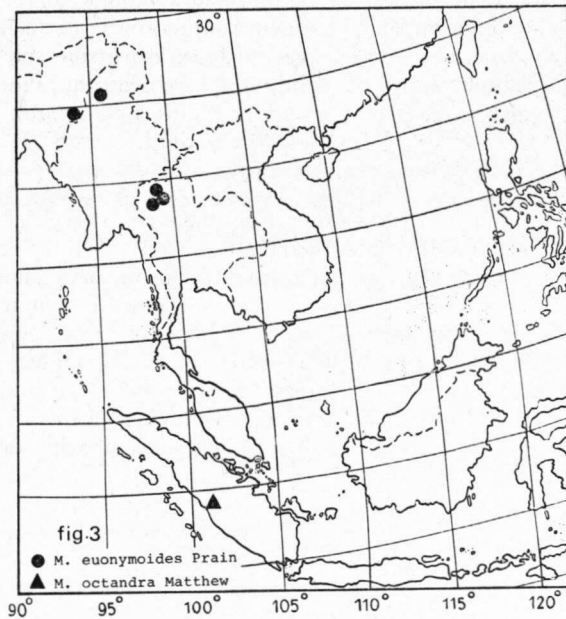
**Ecology:** Evergreen mountain forests, 1200—1800 m alt.

**Taxonomy:** Among the more obvious characters that clearly distinguish this subgenus are: stamens 8, calyx subtruncate, inflorescence branches 4-angular, and fruits with swollen septum.

**1. Mastixia euonymoides Prain**

*M. euonymoides* Prain, J. As. Soc. Bengal II, 67 (1898) 295; Brandis, Ind. Trees (1906) 356; Wangerin in Engler, Pflanzenreich IV, 229, Heft 41 (1910) 29; Craib, Kew Bull. (1922) 237; Évrard, Fl. Gén. I.-C. 2 (1923) 1194; Craib, Fl. Siam. Enum. 1 (1931) 808; Hundley & Chit, Trees Shr. Burma, ed. 3 (1961) 119. — T y p e: *King's Coll. s.n.*, Kachin, Burma (K).

Tree up to 60 m tall and d.b.h. up to 2.5 m (*Watt 5899*); branchlets stout, decussate, 4-angular, glabrous. *Leaves* decussate; petiole 2—2.5 cm, slender; blade ovate-lanceolate, 4—10 × 1.5—4 cm, coriaceous, glabrous; base cuneate; apex acuminate; nerves 5—8 per side, with intersecondary ones; veins distinct on both surfaces; a single or a pair of elongated domatia towards the base of the leaf at the axils of nerves. *Inflorescence* up to 8 cm, rather stout, glabrous, branched up to 5 times; branches of the first order decussate; pedicels of lateral flowers of terminal cymes under 3 mm, stout; bracts ovate, under 3 mm, glabrous; submature flower bud 3 mm across; receptacle glabrous. *Calyx* subtruncate, thick; teeth 4, minute, rounded, thick. *Petals* 4, thick, glabrous outside. *Stamens* 8. *Fruit* oblong, 1.5 × 0.8 cm; persistent disc and calyx inconspicuous.



**Distribution:** NE. India, Burma, Thailand. — **Fig. 3.**

**Ecology:** In evergreen jungles from 1200—1470 ('1700') m; flowers May—June; fruits February.

**Vernacular name:** Thailand: *Se ba do*.

**Notes:** *Put 3877* has a fine golden tomentum on the inflorescence unlike others.

An occasional extra bracteole is seen on the receptacle wall.

*Watt 5899* is a remarkable tree 60 m tall, requiring 5 men hand to hand to grasp the trunk round. *Watt's* ms generic name *Manglesia* is used here at the subgeneric level. The final confirmation of the identity of this fruiting specimen came from the presence of one or a pair of elongated domatia towards the base of the leaf blade, as in other specimens of known identity. This identification conforms to that of Brandis (1906)356. However, on page 711, and again in Indian Forester 33 (1907) 57, Brandis confuses this species with *Haines '916'*. See discussion on *Haines '916'* on page 83.

INDIA. Manipur. Kupra, *Watt 5899* (E, K).

BURMA. Kachin, *King's Coll. s.n.* (K).

THAILAND. P a y a p. Doi Angka, Mc-ka-Pak drainage, *Garrett 961* (E, K, L, P); Doi Sutep, *Kerr 3237* (AAU, ABD, BM, E, K, P). — N a k a w n S a w a n. Kao Pado, *Kerr 6065* (BM, K, P); Chiangmai, Pang Tawn, *Put 3877* (A, ABD, E, K, L).

## 2. *Mastixia octandra* Matthew, *spec. nov.*

**Descriptio typi:** Arbor usque ad 25 m alta, trunco usque ad 90 cm diam.; ramuli tenues, decussati, teretes, glabri. *Folia* decussata; petiolus 1—1.5 cm longus, tenuis; lamina ovata, usque elliptica 4—8 cm longa, 1.5—3 cm lata, chartacea, glabra; basis cuneata; apex acuminatus; nervi utroque latere 6—8, nervis intersecundariis additis; venae utraque facie distinctae; domatia subcircularia interdum nervorum axilla praesentia.

*Inflorescentiae* usque ad 15 cm longae, tenues, usque ad quinquies ramosae; ramuli primi ordinis decussati; pedicelli florum lateralium cymarum terminalium quam 5 mm longiores, tenues; bracteae ovatae, vix 3 mm longae, glabrae; alabastrum submaturum 3 mm diam.; receptaculum glabrum. *Calyx* subtruncatus, tenuis; dentes 4, minuti, acuti, tenues. *Petala* 4, crassa, dorso glabra. *Stamina* 8. *Fructus* turbinatus, 1 cm longus.

**T y p u s:** *Meijer 6316*, Sumatra, W. Coast, Mt. Kerintji, c. 1700—1800 m, 28-7-1956 (L, holo; A, BM).

**D i s t r i b u t i o n:** Sumatra; known only from the type. — **Fig. 3.**

**E c o l o g y:** Mountain forest, 1700—1800 m.

**F i e l d n o t e s:** "Tree, with five individuals till 90 cm diam., noted in this surrounding. Diameter of plant under notice 40 cm, bole 15 m, crown 10 m, outer bark with ridges till 3 cm thick; inner yellow with ochre stone cell groups, very brittle; wood near cambium ochre-watery, further yellow-ochre; . . . corolla yellow green, 8 stamens in two whorls the outer higher-reaching than the inner and partly surrounding them, anthers greenish white, filament yellow green, intrastaminal discus with 8 holes alternating with ridges; . . . fruit turbinate, drupe about 1 cm long with longit. fissure. . ." W. Meijer.

**N o t e s:** Easily distinguished from *M. euonymoides* Prain in the smaller chartaceous leaves; subcircular domatia; generally slender, more elongate, and lax inflorescence parts; the middle flower of cymes generally pedicellate; and the thin calyx with acute teeth. *M. euonymoides* Prain has the terminal cyme subtended by normal cymes, while in the present species there is a tendency for reduction of these subterminal cymes into 2 flowers or even a single flower.

Bark 3 cm thick (given in the field notes) is not known anywhere else in the genus.

#### Subgen. MASTIXIA

subgen. *Tetramastixia* Wangerin in Engler, Pflanzenreich IV, 229, Heft 41 (1910) 20. — **S y n t y p e s p e c i e s:** 9 species.

subgen. *Pentamastixia* Wangerin, l.c. — **S y n t y p e s p e c i e s:** 7 species, including *M. pentandra* Bl.

Branchlets scattered or (sub)opposite. Leaves scattered or (sub)opposite; nerves often running parallel to the midrib before turning towards the margin; intersecondary nerves generally absent; veins impressed above. Lateral inflorescences rare. Inflorescence branches of the first order scattered or (sub)opposite, terete; bracts subsistent; terminal flower of cymes generally sessile. Calyx lobed; sepals 4 or 5 (6—7). Petals 4 or 5 (6). Stamens 4 or 5 (6). Fruit subglobose, ovoid, ellipsoid, or oblong; septum of fruit wedge-shaped.

**D i s t r i b u t i o n:** as the genus.

For notes, see under the genus.

#### Series *Oppositae* Matthew, ser. nov.

Ramuli primi ordinis inflorescentiae (sub)oppositi; folia et ramuli saepissime (sub)oppositi; nodi complanati; fructus normaliter ovoidei.

**T y p u s:** *Mastixia trichotoma* Bl.

Inflorescence branches of the first order (sub)opposite or decussate; branchlets and leaves generally (sub)opposite or decussate; nodes flattened; fruits generally ovoid.

**D i s t r i b u t i o n:** Malesia (excl. Luzon and the Visayas). In New Guinea and the Solomon Is. the only representative of the genus.



### 3. *Mastixia kaniensis* Melchior

*M. kaniensis* Melchior, Bot. Jahrb. 60 (1925) 172. — Type: *Schlechter 17061*, E. New Guinea, Sepik area, Kani Mts., 1000 m, 26-12-1907 (B, holo †; dupl. A, BM, E, G, K, L, NY).

*M. ledermannii* Melchior, Bot. Jahrb. 60 (1925) 173. — Type: *Ledermann 9575*, E. New Guinea, Etappenberg, 850 m, ('30') 23-10-1912 (B, holo †; dupl. L, WRSL).

**Distribution:** Moluccas, New Guinea and New Britain, Solomon Is.

**Notes:** The maximum degree of fluctuation in number of floral parts in the subgenus occurs in the New Guinea—Solomon Is. area.

In spite of the clearly distinct distribution of the two subspecies, the following specimens of ssp. *ledermannii* occur in the area occupied by ssp. *kaniensis*: *Clemens 4597, 5151, 5361* (1800 m), *Clemens 6484* (1350 m), *NGF 21064* (1680 m), *Schodde 3134* (600 m), *Hartley 10795* (600 m), and *Fisher 71*. These generally occupy higher altitudes than those occupied by ssp. *kaniensis* in the same area.

#### KEY TO THE SUBSPECIES

- Leaves chartaceous to subcoriaceous; branchlets and inflorescence axes slender; petals thin, glabrous outside. E. New Guinea, New Britain, Solomon Is. . . **3a. ssp. kaniensis**
- Leaves (thin- to thick-) coriaceous; branchlets and inflorescence axes usually stout; petals thick, puberulous outside. Moluccas, W. New Guinea . . . **3b. ssp. ledermannii**

#### 3a. ssp. *kaniensis*

**Distribution:** Moluccas, New Guinea and New Britain, Solomon Is.

**Galls:** Leaf galls on *Schlechter 17703*; fruit galls on *Clemens 2120* and *NGF 23855*.

**Field notes:** Buttresses occasional, steep, up to 1.2 m; bole columnar, up to 21 m, occasionally crooked; crown dense. Outer bark grey to dark brown, at times fissured; inner bark yellowish; exudate free-flowing, not sticky, cream; wood yellow. Flowers greenish yellow to white, at times said to be scented; disc glistening yellow; stamens cream; style green. *Kajewski 2086* notes that stamens fall off soon after buds open.

**Notes:** *Carr 12183* is densely velutinous; less so is *BSIP 4352*.

The basal inflorescence branches of the first order are at times subtended by foliage leaves.

**NEW GUINEA.** East. Madang Dist.: Kani Mts., *Schlechter 17061* (A, BM, E, G, K, L, NY), *17703* (A, BM, G, K, L, US). — Morobe Dist.: Sattelberg, *Clemens 1890* (A, G, L); Quembung Mission, *Clemens 2120* (A); Boana, *Clemens 8642* (A, L); Oomsis logging area, *NGF 14312* (A, L), *23855* (L); Garaina, *Hartley 10333* (A, L). — Northern Dist.: Kokoda, *Carr 16528* (A, BM, L, SING); Koitaki, *Carr 12183* (A, BM, K, L, SING). N. side of Sibium Ra., S. of Toma, Bariji-Managalese area, *Pullen 5894* (LAE).

**NEW BRITAIN.** Kandrian subdist., Pirilongi, *NGF 21953* (L, SING).

**SOLOMON IS.** Bougainville. Koniguru, Buin, *Kajewski 2021, 2086* (A, BM, BO, G, L, SING, US). — Shortland I. *BSIP 5849* (K, L, SING), *13035, 13133, 13239* (L). — Choiseul. *BSIP 5288, 5381* (K, L, SING), *18944, 18593* (L). — Vella Lavella. *BSIP 11308* (K, L). — Baga. *BSIP 2809, 3080* (K, L, SING). — Kolombangara. *BSIP 1401* (K, L), *8150* (L), *8568, 9776* (L, SING), *11536, 11652* (K, L, SING); *RSS 2556* (K, L). — New Georgia. *BSIP 2516* (K, L), *3155, 3750, 4764, 4776* (K, L, SING), *5987* (K, L), *6432* (K, L, US), *6873, 6898* (K, L, SING, US), *7115* (K, L, SING), *7427* (L, SING). — Rendova. *BSIP 1886* (K, L, SING). — Santa Ysabel. *BSIP 3616* (K, L, SING), *6640* (K, L), *6815* (K, L, SING, US), *8301* (L, SING). — Guadalcanal. *Kajewski 2547* (A, BO, G, L), *BSIP 9338* (L), *10117* (L, SING), *11833, 12089* (K, L). — Malaita. *BSIP 3885* (K, L, SING). — San Cristobal. *BSIP 4352, 10940* (K, L, SING), *12765* (K, L).

#### 3b. ssp. *ledermannii* (Melchior) Matthew, *stat. nov.*

*M. ledermannii* Melchior, Bot. Jahrb. 60 (1925) 172.

**Distribution:** Moluccas and New Guinea.

**Galls:** Leaf galls on *Clemens 5361*, as noted in Melchior l.c.

**Field notes:** Buttresses occasional, up to 1 m; long conical crown of horizontal branches; exudate present; outer bark occasionally fissured superficially, strips 2—3 cm wide; numerous pustular lenticels; inner bark straw or yellow, turning green, up to 20 mm; sapwood yellowish white, 8 cm; heartwood yellow, brownish, or black, with rays visible to the naked eye. Leaves dark green glossy above, lighter below, often turning bluish on drying.

**Notes:** Resin on the twigs of *BW 8170*. Dense indumentum on *Beccari PP 896*, *BW 515*, *6087*, *11219*, and *NGF 48218*.

*Clemens 4597*, *5151*, *5361*, and *6484* form a homogeneous group, noted for stiff coriaceous leaves with nerves almost at right angles to the midrib and strongly marked intersecondary veins, very dense inflorescence, and large flowers.

In several specimens the petiole is notably long.

*Clemens 5361* has 4- and 5-merous flowers; *Clemens 5151* has 5- and 6-merous flowers; *NGF 21064* showed  $K_{5-7} C_6 A_4$ ,  $K_6 C_5 A_5$ , and  $K_5 C_6 A_5$ .

**MOLUCCAS.** **Ambon.** Way, slopes of Mt. Salahutu, *Kuswata & Soepadmo 270* (BM, BO, L, SING). — **Morotai.** G. Pare, *Kostermans 1272* (A, BO, L).

**NEW GUINEA.** **West.** Vogelkop Pen.: Warsamson R., *BW 5927* (L); Wersar, *BW 6087* (L); Prafi R., *BW 515*, *8170* (L); Manokwari, Noeni, *BW 8175* (L); Arfak Mts., *Beccari PP 896* (FI); Wondiwoi Mts., *BW 13441* (L). — Jayapura Dist.: Sidoarsi Mts., *BW 9256* (L), *9265* (G, L); Bernard Camp, *Brass & Versteegh 12578*, *Brass 13153* (A, BM, BO, L); Cycloop Mts., *Van Royen & Sleumer 6331* (A, L, SING). — Digul Dist.: Biakatem, *BW 6480* (L). — Biak I.: *Aet & Idjan 883* (A, BO, L, SING); *Kostermans & Soegeng 920* (L). — Japen I.: Seroci, *bb 30385* (A, BO, L, SING); Woda, *BW 11219* (L); Wassabori, *Aet & Idjan 384* (A, BO, L). — **East.** Western Dist.: Kiunga, *Pullen 7294* (L); Yat, *NGF 31964* (L); Ingembit, *NGF 31822* (L, SING); Opka, *BW 6453* (BO, L). — Sepik Dist.: Amanab subdist., Kilifas, *NGF 48218* (L); Telefomin subdist., Frieda R., Prospect Cr., *NGF 42589* (L); Kokoma Cr., *NGF 42692* (L); Etappenberg, *Ledermann 9575* (L, WRSL). — Morobe Dist.: Ogeramngang, *Clemens 4597* (A), *5151*, *5361* (A, L); Yunzaing, *Clemens 6484* (A); Edie Cr. Road, *NGF 21064* (L). — Central Dist.: Sogeri Plateau, Subitana, *Schodde 3134* (A, BO, K, L), *Hartley 10795* (L). — Milne Bay Dist.: Baniara subdist., between Agam and Bonenau, *Fisher 71* (L).

#### 4. *Mastixia trichotoma* Blume

*M. trichotoma* Bl., *Bijdr.* (1826) 655. — **Lectotype:** *Blume s.n.* (L, sheet no. 901, 169—393; dupl. BM).

*M. laxa* Bl., *Mus. Bot.* 1 (1850) 257. — *M. trichotoma* var. *laxa* Miq., *Fl. Ind. Bat. 1*, 1 (1856) 772. — **Lectotype:** *Blume s.n.* (L, sheet no. 901, 169—395; dupl. BM, W), Burangrang.

*M. laxa* var. *angustifolia* Bl., o.c. 258. — **Lectotype:** *Herb. Van Hasselt s.n.* (L, sheet no. 901, 169—363; dupl. BM), Mt. Pulassari.

*M. acuminatissima* Bl., o.c. 258. — *M. trichotoma* var. *acuminatissima* Danser, *Blumea* 1 (1934) 62. — **Lectotype:** *Pr(aetorius) s.n.* (L, sheet no. 901, 169—343).

*M. caesia* Bl., o.c. 258. — *M. kimanilla* Bl. var. *caesia* Miq., o.c. 772. — **Lectotype:** *Van Hasselt s.n.* (L, sheet no. 901, 169—347).

*M. kimanilla* Bl., o.c. 258. — **Lectotype:** *Reinwardt 212* (L).

*M. maingayi* Clarke, *Fl. Brit. India* 2 (1879) 746. — *M. trichotoma* Bl. var. *maingayi* Danser, *Blumea* o.c. 63. — **Type:** *Maingay 2680* = *Kew Distr. 711* (K, holo; BM, GH, L, dupl.).

*M. maingayi* Clarke var. *subtomentosa* King, *J. As. Soc. Bengal* II, 71 (1902) 75. — **Type:** *Maingay 2436* = *Kew Distr. 709* (K).

*M. clarkeana* King, l.c. — *M. trichotoma* Bl. var. *clarkeana* Danser, o.c. 62. — **Lectotype:** *Scortechini 869* (K, holo; dupl. CAL, G, L, P); **syn types:** *Scortechini 98* (G), *625* (BR, SING); *King's Coll. 10861* (K).

*M. clarkeana* King var. *macrophylla* King, l.c. — **Lectotype:** *King's Coll. 10575* (K; dupl. BM, CAL, P).

*M. korthalsiana* Wangerin var. *typica*, *Fedde Rep.* 4 (1907) 335. — *M. trichotoma* Bl. var. *korthalsiana* Danser, o.c. 63. — **Lectotype:** *Korthals s.n.* (L, sheet no. 901, 169—413).

*M. korthalsiana* Wangerin var. *macrophylla* Wangerin, o.c. 336. — **Lectotype:** *Korthals s.n.* (L, sheet no. 901, 169—399).

*M. propinqua* Ridley, *J. Fed. Mal. St. Mus.* 4, 1 (1909) 25. — **Type:** *Ridley 13899* (SING; dupl. BM).

- Vitex premnoides* Elmer, Leaf. Philip. Bot. 8 (1915) 2874. — *Mastixia premnoides* Hallier f., Bot. Centralbl. 132 (1916) 42. — Lectotype: Elmer 11644 (L; dupl. A, BM, BO, G, NY).
- Mastixia trichotoma* Bl. var. *rhynchocarpa* Danser, o.c. 64. — Lectotype: Ender 4769 (L; dupl. A, BO, K); syntype: Ender 2572 (BO, K, L, P, SING).
- M. trichotoma* Bl. var. *benculuana* Danser, o.c. 64. — Lectotype: bb 2446 (L); syntypes: bb 2254, 2255; Bünnemeyer 9572 (L).
- M. trichotoma* Bl. var. *simalurana* Danser, o.c. 65. — Lectotype: Achmad 1183 (L; dupl. BO, P); syntypes: Achmad 109, 500, 510, 588, 696 (BO, L).
- M. trichotoma* Bl. var. *tenuis* Danser, o.c. 61. — Lectotype: Hallier B. 1836 (L; dupl. BO, UC).

**Distribution:** Peninsular Thailand and Sumatra to Mindanao and Moluccas.

**Notes:** 1) In his paper Danser (pages 59—61) adequately discusses variations within the species; the pages 72—73 contain an index of vernacular names most of which belong to the present species.

2) Fig. 1 E of Wangerin in Engler, Pflanzenreich IV, 229, Heft 41 (1910) is rather schematic. The position of ovule attachment and the length of the sepals are inaccurate.

#### KEY TO THE VARIETIES

- 1a. Inflorescence villous to woolly . . . . . 2  
 b. Inflorescence subglabrous to puberulous . . . . . 3  
 2a. Twigs woolly; leaves 9—20 cm long, thick coriaceous, villous to woolly; nerves often arcuate; base obtuse to truncate; fruit ovoid, more than 1.5 cm across. *Sumatra, Malay Peninsula, Borneo* . . . . . 4c. var. **maingayi**  
 b. Twigs not woolly; leaves 5—15 cm long, chartaceous to subcoriaceous, subglabrous to puberulous; nerves seldom arcuate; base attenuate to cuneate; fruits elongate-ovoid, up to 1.5 cm across. . . . . 4  
 3a. Fruits with prominent persistent disc, above  $2.5 \times 1.5$  cm; leaves  $10-24 \times 5-12$  cm; inflorescence robust, up to 15 cm, branched 5 (to 6) times, not terminating in a dichasium. *Sumatra, Borneo, Moluccas* . . . . . 4d. var. **rhynchocarpa**  
 b. Fruits without prominent persistent disc, up to  $2 \times 1$  cm; leaves usually  $5-12 \times 2-4.5$  cm; inflorescence slender, up to 10 cm, branched 3 (or 4) times, often terminating in a dichasium. *Thailand, Malay Pen., Borneo, Philippines* . . . . . 4e. var. **clarkeana**  
 4a. Inflorescence compact; sepals, petals, and stamens 4. *Sumatra, Java, Borneo, Lesser Sunda Is.* . . . . . 4a. var. **trichotoma**  
 b. Inflorescence very lax; sepals, petals, and stamens 5. *Sumatra, Borneo* . . . . . 4b. var. **korthalsiana**

#### 4a. var. **trichotoma**

*M. laxa* Bl. — *M. laxa* Bl. var. *angustifolia* Bl. — *M. acuminatissima* Bl. — *M. caesia* Bl. — *M. kimanilla* Bl.

**Distribution:** Sumatra, Java, Borneo, Lesser Sunda Is.

**Galls:** Stem galls on *Koorders 12487*; those on *Junghuhn s.n.*, (L, sheet no. 908, 186—371) had caused it to be erroneously mounted on the type sheet of *Cudrania sumatrana* (*Moraceae*); *Junghuhn s.n.* (L, sheet 908, 328—653) too, has similar stem galls. Fruit galls on *Alston 14726*, *Jacobs 4851*, and *Koorders 12487, 30598*.

**Field notes:** Outer bark densely lenticellate, grey or brownish; inner bark up to 20 mm, whitish; wood yellowish white. Flowers yellowish; fruit glaucous when young, green later, and violet when ripe.

SUMATRA. No locality given (?Palembang) *Pr(aetorius) s.n.* (L). — A t j e h. Penosan, Gajolands, *bb 22384* (A, BO, L, NY), *22397* (L), *van Steenis 10037* (A, L, P); Blangkedjeren, *Alston 14726* (BM, L); G. Leuser Nat. Res., *de Wilde & de Wilde-Duyfjes 14185* (L). — W. C o a s t. Oud-Agam, *bb 2932* (L). — R i o u w. Indragirische Bovenlanden, Pagaroembei, *bb 26082* (L). — B e n k u l e n. Kroe, Kota Banglai, *bb 10297* (BO).

BILLITON. Tandjong Pandam, *bb 9171, 10237* (BO).

JAVA. W e s t. No locality given, *Reinwardt '212'* (L), *houtsoorten no. 125* (L); Bantam, *van Hasselt s.n.* (L); Mt. Pulasari, *van Hasselt s.n.* (BM, L), *Koorders 913* (BO), *914* (BO, CAL, L, U); Mt. Karang, *Ja. 2413* (A, BO, L); Mt. Pajung, Udjung Kulon, *Wirawan 336* (L, P, SING); Tjiampea, *Koorders 30598* (BO, K, L); Mt. Salak, *Blume s.n.* (L), *Koorders 24478* (BO); *Beccari 49*, culta in Hort. Bog. (FI); Bobodjong, *Koorders 24459* (BO, L); Mt. Gedeh, *Junghuhn s.n.* (L), *Junghuhn, houtsoorten no. 47* (BO, L), *227* (A, L), *652* (L, SING); Tjibodas, *Koorders 2191* (BO, L), *2200* (BO), *12487, 13231, 25860, 25909* (BO, L), *32188, 41820, 41874* (BO); Takoka, *Koorders 15227* (BO, L, UC), *25680* (BO); Tjidatoc, *Kalshoven 7* (BO, L); Bodjong, near Tjisulak, *Koorders 39459* (BO, L); Mt. Beser, near Tjibeber, *Winckel 264* (L, UC), *289* (L, P, U, W); Mt. Burangrang, *Blume s.n.* (L), *Korthals s.n.* (L); Bandung, *Ja. 1368* (BO), *3983* (L); Garoet, *Ja. 2310* (BO, L); Tasikmalaja, lake Telagabodas, *Ja. 4643* (L); Pasir Djamboe, Tjigenteng, *Koorders 26248* (A, BO, L, P). — C e n t r a l. Mt. Slamet, *den Berger 122* (BO, L), *Koorders 9980* (BO); Magelang, Ngasinan, *Koorders 27699* (A, BO, L, P); Mt. Oengaran, Medini, *Junghuhn 86* (L, U), *s.n.* (L). — E a s t. Pasuruan, *Koorders 23754* (BO, L); Besuki, Mt. Raung, *Jacobs 4851* (L, SING); Rogodjampi, *Koorders 28894* (BO, L).

BORNEO. S. I n d o n. B o r n e o. Lower Dajak R., Teroesan, *bb 9888* (BO).

LESSER SUNDA IS. B a l i. Mt. Batukan, *Wirawan 451* (A, L); Negara, Mt. Sangjang, *KK & SS 288* (A, K, SING).

#### 4b. var. *korthalsiana* (Wangerin) Danser

*M. korthalsiana* Wangerin

**Distribution:** Sumatra, Borneo.

**Galls:** of the inflorescence on *Kostermans 7316*; of the fruits on *SAN 30584, 71014, Kostermans 6867, 7508, and 13273*.

**Field notes:** Large tree of virgin forest; outer bark grey to brown, smooth, rugose, or scaly, lenticellate, brittle; inner bark orange, granular, 20 mm; wood yellowish white. Flowers yellowish; fruit pale blue with almost white markings.

**Notes:** Rather prone to galls.

The lax and few-flowered inflorescence, the 5-merous flowers, and elongate fruits distinguish this variety from var. *trichotoma* to which it is closely allied. *SAN 30699* (var. *korthalsiana*) is almost indistinguishable from *bb 22384* (var. *trichotoma*) except for the 5-merous flowers.

SUMATRA. B e n k u l e n. Redjang, *bb 2286* (BO, L). — P a l e m b a n g. Tandjong, Ning, Bliti R., *Forbes 2744* (BM, FI, GH, L, SING); Lamatang Ulu R., *Lambach 1261* (BO, L).

BORNEO. S a b a h. Sandakan, Sg. Binuang, *SAN 30699* (K, L, SING); Tawau Dist., Kalabakan R., *SAN 30584* (K, L, SING); Lahad Datu Dist., Sg. Segama, *SAN 71014* (L). — W. I n d o n. B o r n e o. Melawi Tjatit, B. Tengkojoeng, *bb 26043* (BO, L). — E. I n d o n. B o r n e o. W. Kutei: near Long Petah, *Enderit 3429* (A, BO, K, L, NY, P), *3465* (BO), *4091* (A, BO, L). — E. Kutei: Sangkulirang Dist., G. Medalem, *Kostermans 13273* (BO, K, L, SING); Sangkulirang I., *Kostermans 4943* (A, BO, L, P, SING); Samarinda, *Kostermans 6867* (A, BO, L, NY, P, SING). — Balikpapan: G. Beratus, *Kostermans 7316, 7508* (A, BO, L, SING). — Bandjermasin: G. Sakoembang, *Korthals s.n.* (L).

#### 4c. var. *maingayi* (Clarke) Danser

*M. maingayi* Clarke — *M. maingayi* Clarke var. *subtomentosa* King — *M. propinqua* Ridley.

**Distribution:** Sumatra, Malay Peninsula, Borneo.

**Galls:** Leaf galls on *bb 17024*; fruit galls on *Fox. s.n., S 28495, and S 28626*.

**Field notes:** Crown dense, spreading; outer bark smooth or slightly fissured,

greyish yellow; inner bark orange yellow, soft, 10 mm thick, brownish; exudate present; wood yellowish, fragrant. Leaves stiff, shining above, subglaucous below, turning yellow before shedding. Flowers greenish (?) pink. Disc and pistil yellow. Drupes pendulous, greenish with a glaucous tinge.

**Notes:** Easily recognized by the woolly indumentum, large and stiff leaves with prominent veins, and the numerous massive fruits. The following three groups of specimens form an ascending series towards the typical var. *maingayi* as regards the density of indumentum: 1) **P e r a k:** *King's Coll. 2907, Scortechini s.n., Fox s.n.*; 2) **P a h a n g:** *Ridley 13899* (type of *M. propinqua* Ridley), *FRI. 15565, FMS 45405*; 3) **S i n g a p o r e.** *Maingay 709* (type of *M. maingayi* Clarke var. *subtomentosa* King).

Clarke l.c., records *Maingay 711* from Singapore while the type sheet has 'Penang' stuck to it. The duplicates of '711' at L, BM, and GH (all without locality), though identical among themselves and true var. *maingayi*, are not identical to the holotype. *Anderson 142* is very similar to these duplicates.

**SUMATRA.** **T a p a n u l i.** Sibolga, Baroes, *bb 31579* (A, BO, L, NY, SING). — **E a s t C o a s t.** Pakanbaru, *bb 35341* (BO). — **W e s t C o a s t.** Padang, *Teijsmann 16670* (BO). — **B e n k u l e n.** Redjang, G. Kaba, *bb 17024* (BO, NY). — **P a l e m b a n g.** Lematang Ilir, *EPT 98 T 3P 261* (A, BO, K, L — 5 sheets, P, SING); Tjaban For. Res., *Kostermans S. 34* (L); dusun Seleman Enim, nr. Muaraenim, *de Vogel 1249* (BO, L), also seedlings.

**BANKA.** Muntok, *bb 7826* (BO); Rindik, *bb 11578* (BO); Toboali, *Teijsmann 18670* (BO); Lobok Besar, *bb 34184* (A, L, SING); *Kostermans & Anta 291* (A, BO, L, P), *1154* (A, BM, BO, K, L, NY, P, SING).

**MALAY PENINSULA.** **P e n a n g.** Govt. Hill, *Curtis 1564* (CAL, K, SING). — **P e r a k.** Larut, *King's Coll. 2907, 6239* (A, CAL, K); *Kunstler 6441* (CAL); *Scortechini s.n.* (K); *Fox s.n.* (SING). — **P a h a n g.** Ulu Telom, *Ridley 13899* (BM, SING); Cameron Highlands, *FRI 15565* (KEP); Fraser's Hill, *FMS 45405*. — **S e l a n g o r.** Kuala Lumpur, *FRI 52235* (KEP); Gading For. Res., *FRI 13388* (KEP, L). — **M a l a c c a.** Derry 584, 1036 (SING). — **J o h o r e.** S. Kayu, *SF 32417* (A, BO, K, KEP, SING); Soga For. Res., Batu Pahat, *FRI 2139* (K, KEP, L). — **S i n g a p o r e.** *Maingay 2436* = *Kew Distr. 709* (K), *2680* = *Kew Distr. 711* (BM, G, GH, K, W); *Anderson 142* (CAL); *Ridley 6293* (BM), *6340* (BM, CAL, W); *SF 36952* (BO, K, KEP, SING); *Corner s.n.*, 1940 (SING); Lunga Talong For. Res., *FMS 22615* (SING); Mentigi For. Res., *FMS 34149* (KEP); *Cantley's Coll. s.n.* (SING sheets *046881* & *046882*).

**BORNEO.** **S a r a w a k.** 3rd Div.: Kapit, B. Batu Tibang, *S 28495* (E, L), *S 28626* (A, L). — 5th Div.: Kota For. Res., Ulu Lawas, *S 31114* (L). — **B r u n e i.** B. Teraja, *BRUN 5* (BO, K, L, SING). — **S a b a h.** Tawau, Baradaya For. Res., *SAN 30048, 30058* (K, L); Balong area, *SAN 17163* (K, L, SING); Sipitang, *SAN 16279* (A, BO, L); Quoin Hill, *SAN 16490* (L, SING); Quoin Hill Road, *SAN 34134* (K, L); Ranau, B. Kolung, *SAN 64131* (K, L). — **W. I n d o n.** **B o r n e o.** Kapuas, *Teijsmann 8379* (BO). — **E. I n d o n.** **B e r a o.** Nunukan I., *Kostermans 8930* (A, BO, L, SING), *Meijer 2245* (A, BO, L, P, SING). — **B e r a u.** Berao Betumu, *bb 19064* (BO). — **W. K u t e i:** Mt. Palimasan near Tabang on Belajan R., *Kostermans 12810* (L, SING); Kelindjan R., near Bentuk, *Kostermans 9683* (BO, L). — **B a l i k p a p a n:** Sg. Wain Region, *Kostermans 4281, 4587* (BO, L).

#### 4d. var. *rhynocharpa* Danser

*M. trichotoma* Bol. var. *benculuana* Danser — *M. trichotoma* Bl. var. *simalurana* Danser

**D i s t r i b u t i o n:** Sumatra, Java, Borneo, Celebes, Moluccas.

**G a l l s:** This variety is very prone to fruit galls and the largest ones in the subgenus (over 1.5 cm across) occur here: *bb 2254; Clemens 30477; Kostermans 7550, 7620, 7678; Meijer 7595; RSNB 5725; S 19981; SAN 25224.*

**F i e l d n o t e s:** Buttresses up to 60 cm; outer bark shallowly fissured, inner bark yellowish brown, 25 mm thick; cambium pale yellow; wood white. Leaves glossy above, paler below. Flowers cream. Fruit ink-blue when ripe, bitter in taste.

**Notes:** Two imperfectly known varieties of Danser (1934), from Simalur and Benkulen, are added here. Though no new collections from these areas have since been made, recent material from other parts of Malesia shows that these form but one entity.

This variety is noted for the generally large leaves and inflorescences, though there is a reduction in size from Borneo to the Moluccas.

Merrill had proposed two ms names for certain specimens from this variety: *M. simalurana* for Danser's var. *simalurana* and *M. danseri* for *Clemens 30477*. The Mt. Kinabalu specimens, of which *Clemens 30477* is typical, appear quite distinct with large, thick, and stiff leaves up to 15—22 × 6—10 cm, with over 10 nerves per side; certain fruits showed 5 sepals, but these characters are insufficient for recognizing the species proposed.

SUMATRA. Simalur. Achmad 109 (BO, L), 500 (BO, L, P, U), 510 (A, BO, L, P, SING), 588 (BO, L, P, SING, U), 696 (A, BO, K, L, P, SING), 1183 (BO, L, P), Bünnemeyer 9572 (BO, L, SING). — E. Coast. Karolanden, Tongkah, bb 6234 (BO). — W. Coast. Padang, Mt. Singalang, Beccari PS 46 (BM, BO, CAL, FI, K, L); Oud Agam, Malalak, near Padangpendjang, bb 6666 (BO). — Benkulen. Redjang, G. Kaba, bb 2254, 2255, 2446 (BO, L), Endert 1053 (BO, L); Tandjocng Heran, bb 19517 (A, BO, L).

JAVA. West. Depok, Burck & de Monchy s.n. (BO); Tjampea, Koorders 30597 (BO).

BORNEO. Sarawak. 3rd Div.: Ulu Mujong, Carapa Pila, S 19981 (L, SING). — Sabah. Ranau Dist., North of Kulimpisan, SAN 25224 (K, L); Lahad Datu Dist., Madai For. Res., SAN 27018, 29335 (BO, K, L, SING), 29330 (BO); Mt. Kinabalu, Penibukan, Kiau, Clemens 30477 (A, BM, BO, K, L, NY, UC), RSNB 5725 (SING); Sandakan, Bolungen Hill, Kinabatangan, SAN 36506 (L). — E. Indon. Borneo. Nunukan I., bb 18230 (BO, NY), bb 34562 (BO), bb 34563 (L), Kostermans 8731 (A, BO, L, SING), 9181 (BO, SING). — Boeloengan: Salimbatoc, bb 11287 (BO). — W. Kutei: Endert 2572 (BO, K, L, P, SING), 4769 (A, BO, K, L); Upper Mahakam R., bb 20631 (A, BO, K, L). — E. Kutei: Sg. Susuk, Kostermans 5666 (A, BO, L, P, SING); Sg. Kerajan, Kostermans 5836 (A, BO, L, P, SING); Samarinda, Sg. Sangasanga, Kostermans 7750 (A, BO, L). — Balikpapan: G. Beratus, Kostermans 7550, 7620 (A, BO, L, NY, SING), 7678 (A, BO, L, SING).

CELEBES. Minahasa, Manado, Koorders 16977, 17474, 17518, 17519 (BO); Klabat, bb 14153, 14155 (BO).

MOLUCCAS. Ambon. Poeta, bb 14267 (BO). — East Ceram. Mt. Kilia, Buwalda 5603 (L, P, SING); Artafela, bb 25802 (A, BO, L, NY, SING).

#### 4e. var. *clarkeana* (King) Danser

*M. clarkeana* King — *M. clarkeana* King var. *macrophylla* King — *M. korthalsiana* Wangerin var. *macrophylla* Wangerin — *Vitex premnoides* Elmer — *M. trichotoma* Bl. var. *tenuis* Danser

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

Galls: Stem galls in *FRI 9266* and *9342*; fruit galls in *Haviland 957* and *Sanghachand & Nimanong 1295*.

Field notes: Slender tree up to 18 m tall (*Haviland 3020*: shrub; *Jacobs 5043*: big tree or liana); outer bark greyish white, scaly, flaking off transversely; inner bark brownish, fibrous, juicy; exudate absent; some aroma; wood white. Flowers greenish; disc orange.

Notes: bb 26461, *FRI 93*, *9266*, *9342*, *Hallier B. 1836* (lectotype of *M. trichotoma* Bl. var. *tenuis* Danser), and *Jacobs 5043* form a homogeneous group with small leaves and prominulous veinlets on both surfaces. At the other extreme is *Korthals s.n.* (including the lectotype of *M. korthalsiana* Wangerin var. *macrophylla*) with leaves up to 18 × 8.5 cm. *Elmer 11644* from the Philippines has occasional 5-merous flowers.

THAILAND. Patani. Narathiwat, Sangkhachand & Nimanong 1295 (L).

SUMATRA. W. Coast. Pajakumbuh, bb 6710 (BO). — Palembang, T.B. 208 (BO).

BANKA. Pangkal Pinang, Teijsmann s.n., 1897 (BO).

MALAY PENINSULA. Kedah. Ina, Kedah-Thailand border, *FRI 9266* (L, KEP), *9342* (KEP). — Perak. Larut, King's Coll. 6876 (CAL); Ulu Bubong, King's Coll. 10575 (BM, CAL, K, P), 10861 (BM, CAL, K, W); Gunong Batu Pateh, Lower Camp, Wray 1238 (CAL). — No locality given, *Scortechini 98* (CAL, G), 625 (BR, SING), 869 (CAL, G, K, L, P); King's Coll. 8306, 8436 (CAL). — Selangor. Ulu Langat For. Res., *FRI 93* (KEP, L, SING). — Johore. Sg. Berassau, SF 28974 (SING); Kota Tinggi-Mawai Road, SF 28696 (A, BO, L, SING), 29299 (BO, L, SING); Sg. Kayu, east of Johore, SF 32204 (A, L, SING); Endau, Kadim & Noor 316 (A, L, SING). — Singapore. Mandai Road, SF 37746 (L, NY, SING).

BORNEO. Sarawak. 1st Div.: Kuching, *Haviland 957, 3020* (K, SING); *Haviland & Hose 3625* (A, BM, K, L); Mt. Penrissen, *Jacobs 5043* (K, L, US). — No locality given, *BS 1856* (A, L), *Beccari PB 1225* (A, BM, FI, G, K, L, U). — W. Indon. Borneo. Melawi Tjatih, *bb 26461* (A, BO, L); Kapuas R., G. Kenepai, *Hallier B 1836* (BO, K, UC). — No locality given, *Korthals 1745* (BO), *s.n.* (L).

PHILIPPINES. Mindanao. Davao, Todaya (Mt. Apo), *Elmer 11644* (A, BM, BO, G, L, NY).

### 5. *Mastixia eugenioides* Matthew, *spec. nov.*

**Descriptio typi:** Ramuli crassi, oppositi, glabri. *Folia* opposita; petiolus 1.5—2.5 cm longus, crassus; lamina elliptica usque oblongo-elliptica, 4—12 cm longa, 2—5.5 cm lata, valde coriacea, glabra; basis cuneata; apex acuminatus usque caudatus; nervi utroque latere 5—7, cum nervis intersecundariis, subtus prominentes; venae subtus distinctae. *Inflorescentiae* usque ad 8 cm longae, sat crassae et compactae, glabrae, usque ad quarties ramosae, interdum dichasio terminatae; ramuli primi ordinis oppositi; bractae superiores triangulares, usque ad 3 mm longae, inferiores vero lanceolatae, usque ad 5 mm longae, omnes glabrae; alabastrum submaturum 2 mm diam.; receptaculum glabrum. *Sepala* 4, quam longa latiora, crassa, glabra. *Petala* 4, tenui, extus glabra. *Stamina* 4.

**T y p u s:** Borneo, Sarawak, 1st. Div., Mt. Mattang, *Beccari PB 2033* (FI, holo; L).

**D i s t r i b u t i o n:** Borneo (Sarawak, Brunei).

**E c o l o g y:** In primary (often Dipterocarp) forests, from low alt. to 400 m. Flowers July—August; fruits September.

**N o t e s:** Leaf scars conspicuous; inflorescence notably erecto-patent when young, spreading later. The inflorescence and flowers somewhat resemble those of *M. rostrata* ssp. *rostrata*, but the stout branchlets with strictly opposite leaves and stout petiole, prominent intersecondary veins, and fruits of different shape with thick pericarp, in addition to considerable geographical separation, make this species quite distinct. It should be noted that all the 9 collections are from a restricted area.

Phyllotaxis, leaf texture, and venation recall *Clemens 4597, 5151, 5361, and 6484* (*M. kaniensis* ssp. *ledermannii*) from New Guinea; I consider this to be the result of parallel development.

BORNEO. Sarawak. 1st. Div.: Mt. Mattang, *Beccari PB 2033* (FI, L), *2043* (FI). — 4th Div.: Similajau For. Res., *S 32029* (L); Bintulu Dist., Nyabau For. Res., *S 15949* (BO, L). — No locality given, *BS 261* (A, L), *687* (A, K). — Sebeyau Dist.: Lankan lori, *S 4679* (L). — B r u n e i. 3 km south of Miri, *Fuchs 21311* (K, L). Seria Dist., Bt. Terajan For. Res., *Hotta 12891* (L).

### 6. *Mastixia rostrata* Blume

*M. rostrata* Bl., Mus. Bot. 1 (1850) 258. — **L e c t o t y p e:** *Blume 2244* (L, sheet 901, 169—384).

*M. junghuhniana* Miq., Fl. Ind. Bat. 1, 1 (1856) 772. — **T y p e:** *Junghuhn s.n.* (U, sheet 06764 A).

*M. margarethae* Wangerin, Fedde Rep. 4 (1907) 335. — *M. cuspidata* Bl. var. *margarethae* Hallier f., Beih. Bot. Centralbl. 34, II (1917) 41. — **T y p e:** *Beccari PS 956* (L, holo; BM, BO, FI, K).

*M. caudatifolia* Merrill, Pl. Elm. Born. (1929) 233. — **T y p e:** *Elmer 21584* (UC, holo; A, BM, BO, GH, HBG, K, L, NY, P, SING, U, UC, US).

**D i s t r i b u t i o n:** Sumatra, Java, Lesser Sunda Is., Borneo.

#### KEY TO THE SUBSPECIES

1a. Submature flower bud 2.5 mm across; inflorescence compact, branches of the first order (sub)opposite; leaves (sub)opposite; galls absent. *Java, Lesser Sunda Is.*

6a. ssp. *rostrata*

- b. Submature flower bud 1 mm across; inflorescence lax, branches of the first order scattered; leaves scattered; galls frequent. N. *Sumatra, Borneo*. **6b. ssp. caudatifolia**

**6a. ssp. rostrata**

*M. rostrata* Blume — *M. junghuhniana* Miq.

**Distribution:** Java, Lesser Sunda Is.

**Galls:** absent.

**Field notes:** Outer bark smooth, chocolate, 1 mm; inner bark pale brown, 10 mm; wood yellowish. Fruits dark blue when ripe.

**Notes:** The specimens from the Lesser Sunda Is. have larger leaves.

The reference in Kanjilal & Das, Fl. Assam 2 (1938) 371, to this species seems erroneous, as this species is not known from anywhere on the Asian continent. If 'stamens 3' is correct, their plant does not even belong to this genus.

JAVA. West. No locality given, *Blume s.n.* (L), *Junghuhn s.n.* (U). — 'Progran': *Blume s.n.* (L). Bogor, Onderneming Nirmala, *Heyne 41, 193* (BO); Mt. Salak, *Koorders 24218* (A, BO, L, SING), *33268* (BO); Mt. Gedeh, *houtsoorten 654* (A, G, L, SING). Priangan, Takoka, *Koorders 915* (BO, L), *9885, 11914* (BO) *11915, 11916* (BO, L), *11917* (BO, CAL, K, L, P, SING, UC, W), *14081* (BO), *25556* (BO, L, W), *25634* (BO, CAL, K, L), *25755* (BO, K, L, P), *32681, 32860, 37260* (BO); Pasir Padakati, *Koorders 9901* (L); Pasir Djamboe, *Koorders 26319* (BO, L, SING, U, UC); Tjigenteng, *Koorders 30123* (BO); Pengalengan, *Junghuhn 168* (L, U). — Central. Banjumas, Pringombo, *Koorders 38076, 39016* (BO, L).

LESSER SUNDA IS. Sumbawa. Western Part, Mt. Batulanteh, *Kostermans 18720* (A, BO, L, P), *18722* (A, BM, BO, L, NY, P, SING). — Flores. Western Part, Wae Mao-Potjokongkong, *Kostermans & Wirawan 795* (L); Ende, *bb 8922, 8925* (BO, L), *bb 12609* (BO). No locality given, *Verheijen 2677* (L).

**6b. ssp. caudatifolia** (Merrill) Matthew, *stat. nov.*

*M. caudatifolia* Merrill, Pl. Elm. Born. (1929) 233. — *M. margarethae* Wang.

**Distribution:** Sumatra, Borneo.

**Galls:** Stem gall in *S 16318*; fruit galls globose to elongate, very abundant: *A 4276; bb 31388; Kostermans 5250, 12573, 12984; Lörzing 14602; Pascual 1086; S 21951; SAN 46112*. Galls on *Kostermans 12573* resemble a legume and are up to 3.5 cm long.

**Field notes:** Branches horizontal; outer bark smooth, dark, under 1 mm; inner bark yellowish, 7 mm; sapwood yellowish; cambium whitish; heartwood pale brown. Flowers greenish-yellow; disc yellow.

**Notes:** *SAN 18516* is under 2 m tall; terminal cymes often with 2 flowers instead of 3. Galls occur frequently in this subspecies unlike in *ssp. rostrata*.

This subspecies clearly demonstrates a geographical shift in phyllotaxis from opposite to scattered within the same species: whereas *ssp. rostrata* (Java and Lesser Sunda Is.) has generally opposite phyllotaxis, the *ssp. caudatifolia* (Sumatra and Borneo) has clearly scattered phyllotaxis.

It is almost impossible to separate sterile materials of *ssp. caudatifolia* from *M. cuspidata*, though their flowers are entirely different.

SUMATRA. A t j e h. Redelong, *van Steenis 6447* (A, BO, L, NY). — E. C o a s t. Bandjalengi, *Lörzing & Jochems 7504* (A, BO, L); *Lörzing 14602* (L). — T a p a n o e l i. Panobasan, *bb 31388* (A, L, NY, SING). — W. C o a s t. Soeliki, Moekikiki, *bb 3988* (BO). Padang, *bb 8283* (BO); S. Bulu, *Beccari PS 956* (BM, BO, FI, K, L).

BANEA. Perlang, *bb 11638* (BO).

BORNEO. S a r a w a k. 1st. Div.: G. Penrissen, *S 16318* (BO, L); Sg. Anap, Bt. Mersing, *S 21951* (L, SING). — 3rd. Div.: Bt. Iju Ulu, Sg. Arip, Balingian, *S 23740* (L, SING). — 4th Div.: Bintulu Segan For.



Res., S 32130 (L); Kapit Dist., Indon. border, S 28629 (A, L). — 5th Div.: Lawas, path to G. Murut, S 26341 (K, L). — S a b a h. Tawao Dist.: Elphinstone Prov., *Elmer* 21584 (A, BM, BO, GH, HBG, K, L, NY, P, SING, U, UC, US), 21870 (A, BM, BO, GH, HBG, K, L, NY, P, SING, U, UC); Sg. Serudong, SAN 26153 (L); Kalabakan, SAN 30572 (K, L), A 4136 (A, L); Semawang R., *Pascual* 1086 (A, NY); Merutai Besar, SAN 31337 (K, L, SING); Ulu Kinabutan, SAN 34106 (K, L, SING); Apas Road, SAN 19340, 19342 (BO, K, L, SING), 19343, 19432 (BO, K, L); Ulu Apas, SAN 28609 (K, L); Quoin Hill Road, SAN 18637 (NY), 30378 (K, L); Sg. Balung, SAN 16456 (A, BO, L, SING), 32417 (K, L, SING), 33012 (K, L); Ulu Balung, SAN 32509 (K, SING); Kelumpang Balung, S. 18516 (K, L, SING); Kelumpang For. Res., SAN 40858 (K, L, SING); Mat. Paton, SAN 37036 (K, L). No locality given, SAN 46112 (K, L). — Lahad Datu Dist.: SAN 15543 (K, L), 33401 (L), A. 4276 (A, L, SING). — Mt. Kinabalu. Penibukan, Dusan, *Clemens* 30514, 32101 (A, BM, BO, K, L, NY, UC), 40609 (A, BM, K, L). — E. I n d o n. B o r n e o. E. Kutei: Sg. Menubar region, *Kostermans* 5250 (A, BM, BO, L, P, SING); Sangkulirang, Pelawan, *bb* 11963 (BO); Sg. Susuk region, *Kostermans* 5546 (A, BO, L, SING), 5595 (BO). — W. Kutei: *Ender* 2577 (A, BO, L, P), 4317 (BO, L); Mt. Palimasan near Tabong on Belajan R., *Kostermans* 12984 (BO, K, L, SING); Mt. Maranga on Tundjung Plateau, *Kostermans* 12573 (K, L). — Balikpapan: G. Mentawir, *Kostermans* 10145 (BM, L, NY, P, SING); G. Beratus, *Kostermans* 7435 (A, BO, L, SING).

Series *Alternae* Matthew, *ser. nov.*

Ramuli primi ordinis inflorescentiae dispersi; folia et ramuli dispersi; nodi teretes; fructus normaliter ellipsoidei vel oblongi.

T y p u s: *Mastixia pentandra* Bl.

Inflorescence branches of the first order scattered; branchlets and leaves scattered; nodes terete; fruit generally ellipsoid or oblong.

D i s t r i b u t i o n: As the genus, except New Guinea and the Solomon Is. In continental Asia (excl. Malay Pen.) the only representative of the genus.

7. *Mastixia macrocarpa* Matthew, *spec. nov.*

D e s c r i p t i o t y p i: Arbor usque ad 21 m alta, trunco usque ad 20 cm diam.; ramuli crassi, dispersi, lanati. *Folia* dispersa; petiolus 4—7 cm longus, crassus, lanatus; lamina elliptico-oblonga usque oblonga, 13—30 × 5.5—15 cm, subcoriacea, praesertim subtus villosa; basis cuneata, interdum leviter obliqua; apex acuminatus; nervi utroque latere 7—10, subtus prominentes, villosi; venae prominulae, puberulae usque villosae. Ramuli primi ordinis (*infructescentiae*) dispersi. *Fructus* oblongo-ovoideus, 4—4.5 cm longus, 2 cm latus, discus inconspicuus persistens; sepala prominentia, usque ad 5 mm longa.

T y p u s: Borneo, Sarawak, Miri, Bakam Road, Ridge top, 75 m, 3-6-1966, *Benang ak Bubuong* S 24745 (A, holo; L, NY, SING).

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

E c o l o g y: Yellow, sandy soil. Flowers October; fruits June.

F i e l d n o t e s: Sticky resin on the branches; fruits very pale green.

N o t e s: Leaves and fruits are the largest known in the genus; lenticels up to 3 × 1 mm; leaf scars up to 4 × 4 mm; bark fibrous; peduncles of terminal cymes up to 6 mm; pedicels 2 mm; sepals 2 mm broad at the base; filaments 3 mm; anthers 1.5 mm; receptacle 3—3.5 × 2 mm; style 4 mm; stigma 5-lobed, appearing bifid.

The type, from Sarawak, is in fruit. The Forest botanist, Kuching, informs us that the area from where the fruiting specimen was collected has since been cleared, so that flowers from the same tree cannot be had.

However, I consider the flowering specimen (*BS* 12389) from the Philippines to be

conspecific on account of the general appearance, dimensions of parts, nervation pattern, and indumentum.

BORNEO. Sarawak. Miri, Bakam Road, S 24745 (A, L, NY, SING).

PHILIPPINES. Luzon. Rizal Prov.: Montalban, 10-9-1909, *Loher BS 12389* (UC).

### 8. *Mastixia glauca* Matthew, *spec. nov.*

**Descriptio typi:** Arbor usque ad 15 m alta; ramuli crassi, dispersi, glabri. *Folia* dispersa; petiolus 2—3.5 cm longus, crassus, glaber; lamina obovata, 7—11 cm longa, 4.5—7 cm lata, valde coriacea, glauca subtusque ceracea, glabra; basis obtusa; apex apiculatus; nervi utroque latere 4—5, intermediis additis, omnes obscuri; venae obscurae. *Inflorescentiae* usque ad 5 cm longae, sat crassae et compactae, subglabrae vel sparsim puberulae, usque ad quinties ramosae; ramuli primi ordinis dispersi; bractee triangulares, quam 3 mm breviores; alabastrum submaturum 3 mm diam.; receptaculum sparse puberulum. *Sepala* 4 (5), aequilonga ac lata, sparse puberula. *Petala* 4 (5), crassa, extus appresseciliata. *Stamina* 4 (5). *Fructus* ignotus.

**T y p u s:** Borneo, Sarawak, 1st. Div., Kuching, G. Santubong east, 90 m, May 1961, *Hj. Bujang S 13481* (L; dupl. K).

**Distribution:** Borneo (Sarawak).

**Field notes:** Flowers greenish yellow, April—May.

**Notes:** Tender bark of branchlets yellowish; inflorescence clearly broader than long; 5-merous flowers only occasional.

It is doubtful whether *Hewitt s.n.* of 29-4-1893 (K) was collected by J. Hewitt who was then only 13 years old. The specimen is more robust than the type and more densely puberulous.

BORNEO. Sarawak. Kuching, G. Santubong east, S 13481 (K, L); Kalaka, *Hewitt (?) s.n.*, 1893 (K).

### 9. *Mastixia tetrapetala* Merrill

*M. tetrapetala* Merrill, Philip. J. Sc. 13 (1918) 42. — **T y p e:** *Ramos & Edaño BS 28575* (PNH †; dupl. BO, K, NY, P, US).

*M. pachyphylla* Merrill, Philip. J. Sc. 13 (1918) 325. — **T y p e:** *Ramos BS 30399* (PNH †; dupl. BO, NY, P, US).

*M. crassifolia* Merrill, Philip. J. Sc. 26 (1925) 486. — **T y p e:** *Ramos & Edaño BS 40377* (PNH †; dupl. A, BO, K, L, P, US).

**Distribution:** Philippines. — **Fig. 5.**

**Notes:** Branchlets stout with conspicuous leaf scars and fibrous bark. Phyllotaxis tends to be obscured owing to congestion of parts: leaves are generally crowded towards the apices of branchlets; inflorescence branches do not always elongate as in other species.

This species is quite distinct and stands rather isolated from others in the stoutness of parts, 4-merous flowers, large size of flowers, and the large ellipsoid fruits.

Two other species of Merrill, *M. pachyphylla* and *M. crassifolia*, are considered conspecific with *M. tetrapetala*. There are indeed certain differences: leaves of *M. crassifolia* generally have 8—12 nerves per side prominent below, and massive fruits. *M. pachyphylla* (*BS 30399*) has (sub)opposite leaves and primary inflorescence branches. However, when examined together, it is seen that both *M. pachyphylla* and *M. crassifolia* are extreme variations of *M. tetrapetala*.

*McLean & Catalan 117* and *FB 25208* bear the ms name *M. oblonga* Merrill. Material is scanty, in immature fruits. They are more closely related to *M. tetrapetala* than to any other species of *Mastixia*.

Collections of this species are very few and incomplete, with hardly any field data.

PHILIPPINES. Luzon. Mountain Prov.: Ifugao subprov., Mt. Tabayoc, *Jacobs 7518, 7518A* (A, K, L); Benguet subprov., Mt. Pulog, *BS 40377* (A, BO, K, L, P, US); Tayabas: Mt. Binuang, *BS 28575* (BO, K, NY, P, US), *28628* (BM, CAL, L, US), Mt. Tulaog, *29088* (A, K, P, US). — Catanduanes. *BS 30399* (BO, NY, P, US), *30413* (K, US).

Dubious specimens: Mindanao. Cagayan: Claveria, Summit of W. Mountain, *McLean & Catalan 117* (US); Lanao Dist., *FB 25208* A, US).

## 10. *Mastixia tetrandra* (Thwaites) Clarke

*M. tetrandra* (Thwaites) Clarke, Fl. Brit. Ind. 2 (1879) 745 Trimen.; Fl. Ceyl. 2 (1894) 287, t. 47; Wangerin in Engler, Pflanzenreich IV, 229, Heft 41 (1910) 21; Danser, Blumea 1 (1934) 56, p.p. — *Bursinopetalum tetrandrum* Wight ex Thwaites, En. Pl. Zeyl. (1858) 42. — *Mastixia lanceolata* Baill., Adansonia 3 (1862) 83, nomen. — Type: *Thwaites CP 2441* (BM, holo; BO, CAL, FI, G, GH, K, L, MH, NY, P, US, W). *M. tetrandra* var. *thwaitesii* Clarke, Fl. Brit. Ind. 2 (1879) 745; Trimen, Fl. Ceyl. 2 (1894) 287. — *Bursinopetalum tetrandrum* var.  $\beta$  Wight ex Thwaites, l.c. — Type: *Thwaites CP 2542* (K, holo; CAL). *M. arborea* (Wight) Beddome *sensu* Beddome p.p., Fl. Sylv. (1872) 216.

Tree up to 20(—30) m tall; branchlets rather slender, scattered, subglabrous to puberulous. Leaves scattered; petiole 0.5—2(—2.5) cm, slender; blade elliptic, oblong to oblanceolate, 2—10(—14)  $\times$  1—5(—6) cm, chartaceous to subcoriaceous, glabrous; base cuneate to attenuate; apex rounded, acute, or acuminate; nerves 4—6(—8) per side, obscure below; veins obscure. Inflorescence up to 8 cm, slender or stout, compact or lax, glabrous or densely puberulous, branched up to 2(—4) times, often terminating in a dichasium; branches of the first order scattered; bracts triangular, under 3 mm, glabrous to villous; submature flower bud 3 mm across; receptacle glabrous to villous. Sepals 4 or 5, as long as broad, glabrous to appressed-hairy. Petals 4 or 5, glabrous to appressed-hairy outside. Stamens 4 or 5. Fruit oblong, 1.5—2  $\times$  1—1.2 cm; persistent disc and sepals inconspicuous.

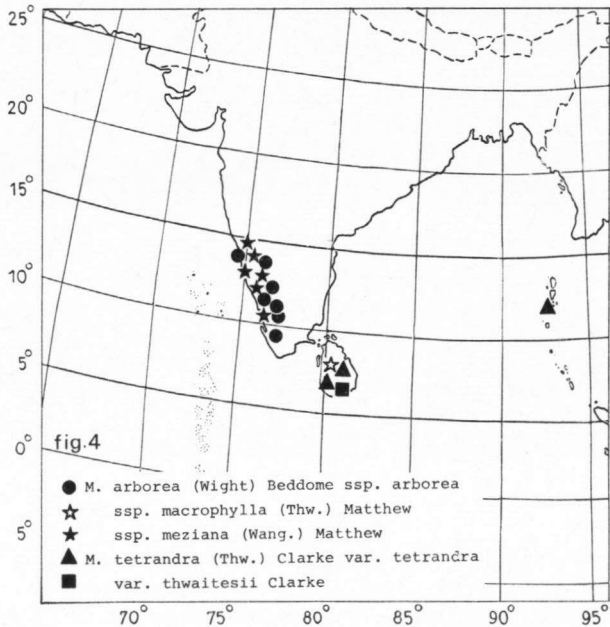
Distribution: Ceylon, India (Andamans). — Fig. 4.

Notes: The delimitation of this species is not quite clear owing to a certain overlapping of characters with *M. arborea*: whereas the narrow oblong fruits and the lax inflorescence often terminating in a dichasium and with generally 4-merous flowers, seem to set this off sharply from *M. arborea* with massive ellipsoid fruits and compact inflorescence generally not terminating in a dichasium and always with 5-merous flowers, vegetative features and the occasional occurrence of exclusively 5-merous flowers in certain specimens of *M. tetrandra* var. *tetrandra* render the delimitation less clear. Further, *M. tetrandra* var. *thwaitesii* comes very close to *M. arborea* except for the 4-merous flowers. However, Beddome's combining of *M. arborea* and *M. tetrandra* is not tenable.

Danser referred here *bb 5229* and *Endert 850*, both from Sumatra, the only records of this species from Malesia; of these the former is sterile and the latter is in buds and equally referable to *M. rostrata* ssp. *rostrata*. It is not possible to refer either of these to the present species with certainty.

### KEY TO THE VARIETIES

- 1a. Blade 4—10(—14) cm long; apex acuminate; petiole longer than 1.2 cm; inflorescence appressed-hairy, up to 8 cm, often terminating in a dichasium; corolla puberulous outside. Ceylon, India (Andamans) . . . . . 10a. var. *tetrandra*



b. Blade up to 5 cm long; apex rounded to acute; petiole up to 0.8 cm; inflorescence glabrous, up to 3 cm, not terminating in a dichasium; corolla glabrous outside.  
*Ceylon* . . . . . **10b. var. thwaitesii**

**10a. var. tetrandra**

*Bursinopetalum tetrandrum* Wight ex Thwaites — *M. arborea* (Wight) Beddome, p.p.

Branchlets puberulous; petiole 1.2–2(–2.5) cm; blade 4–10(–14) × 1.5–2(–2.5) cm, chartaceous; apex acuminate; nerves 5–6(–8) per side. *Inflorescence* up to 8 cm, branched 3 (or 4) times, slender, lax, densely puberulous. *Sepals* 4 or 5. *Petals* 4 or 5, appressed-hairy outside, *Stamens* 4 or 5.

**Distribution:** Ceylon, India (Andamans). — **Fig. 4.**

**Ecology:** In moist forest, along rivers, etc., from low altitude to 1200 m. Flowers January–May; fruits June–October.

**Galls:** Inflorescence galls on *Worthington* 4862.

**Field notes:** Branches horizontal; whole stem waved and undulated; bark grey, smooth or slightly fissured; cambium yellow; flowers white; disc yellow.

**Vernacular name:** Ceylon: *Mahatwara*.

**Notes:** This variety is distinguished from *M. arborea* ssp. *arborea* by the thinner leaves, notably slender and elongated inflorescence branches often terminating in dichasia, uniformly short bracts, petals with appressed indumentum outside, and the narrow oblong fruits.

The name *tetrandra* is misleading as there are specimens with exclusively 5-merous flowers as in *Balasubramanian* 986 and *d'Alleizette* 2975.

There is a striking resemblance of the inflorescence to that of *Elmer 11644* (*M. premnoides* Hallier f.), now referred to *M. trichotoma* Blume var. *clarkeana* (King) Danser.

CEYLON. No locality given, *Thwaites CP 2441* (BM, BO, CAL, FI, G, GH, K, L, MH, NY, P, US, W). — Southern Prov. Galle Dist.: Labugama Res., *Worthington 3477* (BM); Denyaya Dist., Beverley Estate, *Worthington 2588* (BM); Bambarabotuwe, *Worthington 3195* (BM). — Sabagaramuwa Prov. Balangoda Dist.: Walboda, *Worthington 3285*; Rásagalla, *Worthington 4861, 4862* (BM). — Central Prov. Kandy Dist.: Adam's Peak, *d'Alleizette 2975* (L); Matale Dist.: Kalupana, near Hemachandra Estate, *Balasubramaniam 986* (L).

INDIA. Andaman s. Port Blair, *King's Coll. 210* (CAL).

CULTIVATED. Java, Hort. Bog. Cult. (407) tree III G 56a (US).

### 10b. var. *thwaitesii* Clarke

Branchlets glabrous; petiole up to 0.8 cm; blade 2—5(—6) × 1—2 cm, coriaceous; apex acute or rounded; nerves 4 (or 5) per side. *Inflorescence* up to 3 cm, branched once or twice, stout, compact, glabrous. *Sepals* 4. *Petals* 4, glabrous outside. *Stamens* 4.

*Distribution*: Ceylon. — **Fig. 4.**

*Ecology*: Montane zone, 1200—2100 m; scattered to rather common. Flowers March—August; fruits August.

*Galls*: Stem galls on *Thwaites CP 2542*.

*Field notes*: 'Wood red, rather heavy, liable to split. The leaves have a resinous odour and dry black, and the bark yields a scented resin. The inflorescence is sometimes monstrous, the flowers being converted into short twigs, set with minute imbricated bracts' *Thwaites, l.c.*

*Vernacular name*: Ceylon: *Diya-taleya*.

*Notes*: The plant was recognized as a variety of *M. tetrandra* presumably on the 4-merous flowers. Apart from this single character, so variable in the genus, the plant has several characters that clearly set it off from *M. tetrandra*: the notably stout and glabrous inflorescence, the large flowers, the shape, margin, and venation of leaves, all of which bring it closer to *M. arborea* ssp. *macrophylla*. Though it is possible that this 'variety' is a variation of *M. arborea* ssp. *macrophylla*, I leave its present status unchanged on account of scanty material.

CEYLON. Central Prov. Badulla Dist.: Maturata, *Thwaites CP 2542* (CAL, K); Nuwara Eliya Dist.: forest behind Hakgala Bot. Gardens, *Theobald & Grupe 2398* (US).

## II. *Mastixia cuspidata* Blume

*M. cuspidata* Blume, Mus. Bot. 1 (1850) 256. — *M. pentandra* Bl. var. *cuspidata* Miq., Fl. Ind. Bat. 1, 1 (1858) 1095. — *Lectotype*: *Korthals s.n.* (L, sheet no. 901, 169—373).

*M. bracteata* Clarke, Fl. Brit. Ind. 2 (1879) 746. — *Type*: *Maingay 2398* = *Kew Distr. 710* (K).

*Distribution*: Sumatra, Malay Peninsula, Borneo.

*Field notes*: Outer bark grey to chocolate, smooth or shallowly fissured, 0.5 mm; lenticels elongate, 2 mm; inner bark yellow to brownish, mottled, 15 mm, fibrous; wood yellowish to brownish. Leaves minutely pellucid punctate; axillary buds elongate, woolly. Flowers green, yellow, or orange, notably large; petals reflexed; disc yellow; style elongated.

*Notes*: The inflorescence and its parts are relatively elongate in comparison to other species. Domatia on *Amdjah 55*. Juvenile leaves notably larger than those from fertile

branchlets. The silky indumentum on the outside of the receptacle and petals is characteristic.

The plant has generally been known under *M. bracteata* Clarke. Blume's type specimen of *M. cuspidata* has but one detached fruit. In spite of the larger leaves of the latter specimen (larger leaves are the rule in sterile materials) there is no doubt that the two belong together.

Clarke, after examining *Beccari 1559* (K), commented: '*Mastixia* sp. near *bracteata* but has not the bracts'; *Beccari 1559* (UC) has a full ms description under a new name *M. rhynchophylla* (probably by Merrill); *Beccari 1559* (FI) carries the collector's provisional autograph reference to *M. cuspidata* Bl.

Small-leaved sterile materials of *M. cuspidata* are not easily distinguished from *M. rostrata* ssp. *caudatifolia*.

SUMATRA. West coast: *Korthals 1222* (L), s.n. (L, U). — Palembang. Tjaban For. Res. near Muaraenim, *Kostermans S 29* (G, L, P); Banju-Asin & Kubu areas, *FRI 68-T 1-P 124* (L).

BANKA. Lobok Besar, *bb 34075* (L).

MALAY PENINSULA. Perak. K. Kangsar, *KEP 99792* (KEP, L); Larut, *King's Coll. 6830* (BM, BO, CAL, G, K, L, P, SING). — Negri Sembilan. Port Dickson, *SF 40157* (L). — Malacca. *Maingay 2398* = *Kew Distr. 710* (K); Selandau, *Holmberg 840* (BM, CAL, K, SING).

BORNEO. Sarawak. 1st. Div.: Mt. Mattang, *Beccari PB 1559* (BM, BO, FI, K, NY, UC). — 4th Div.: Mt. Dulit near Long Kapa, *Richards 1966* (K, L). — E. Indon. Borneo. Boeloengan: Bt. Kasian, *Amdjah 55* (BO, L). — W. Kutei: Belajan R., near Long Bleh, *Kostermans 10221* (L, P), *10307* (BM, K, L, NY, P); Belajan R., Tabang, *Forman 520* (G, K, L, NY, P, SING); Mt. Maranga, *Kostermans 12543* (BM, L, NY, P, SING). — E. Kutei: Sg. Susuk region, *Kostermans 5516* (BO, L, P, SING).

## 12. *Mastixia pentandra* Blume

*M. pentandra* Bl., Bijdr. (1826) 654. — Lectotype: Blume '1486' (L, sheet no. 901, 169—375; dupl. NY, W).

*M. arborea* auct. non (Wight) Beddome: Clarke, Fl. Brit. Ind. 2 (1879) 745, p.p.; Kanjilal & Das, Fl. Assam 2 (1938) 370; Hurdley & Chit, Trees Shr. Burma, ed. 3 (1961) 119.

*M. cambodiana* Pierre, Fl. Coch. (1892) t. 260 B; Wangerin in Engler, Pflanzenreich IV, 229, Heft 41 (1910) 29; Évrard, Fl. Gén. L.-C. 2 (1923) 1195. — T y p e: *Pierre 689* (P, holo; A, K, L).

*M. scortechinii* King, J. As. Soc. Bengal II, 71 (1902) 73. — Lectotype: *Scortechini 1971* (K, holo; BM, CAL, G, L, P).

*M. philippinensis* Wangerin, Fedde Rep. 10 (1912) 273. — T y p e: *Whitford 222* (B †; dupl. BO, K, US).

*M. parvifolia* Hallier f., Beih. Bot. Centralbl. 34, II (1917) 41. — T y p e: *Hallier B 569* (L, holo; BO).

*M. subcaudata* Merrill, Philip. J. Sc. 13 (1918) 43. — T y p e: *Ramos BS 23353* (PNH †; dupl. A, BO, CAL, GH, K, L, NY, P, US).

*M. megacarpa* Ridley, Fl. Mal. Pen. 1 (1922) 891. — T y p e: *Curtis 919* (SING, holo; K).

*M. chinensis* Merrill, Sunyatsenia 3 (1937) 256; Li, Taiwania 1 (1938) 94. — T y p e: *Henry 12414* (NY, holo; A, K, NY).

*M. alternifolia* Merrill & Chun, Sunyatsenia 5 (1940) 153. — T y p e: *How 72875* (A, holo; SING).

*M. poilanei* Tard., Fl. C. L. & V. 8 (1968) 16. — T y p e: *Poilane 10312* (P, holo).

Tree up to 37 m tall; d.b.h. up to 75 cm; branchlets slender or stout, scattered, subglabrous to puberulous. *Leaves* scattered; petiole stout or slender, 1—4 cm; blade obovate; elliptic to oblong-elliptic, 4—16 × 2—8 cm, chartaceous to thick coriaceous, subglabrous, base cuneate to attenuate; apex acute or acuminate to caudate; nerves 4—7(—9) per side, distinct below; veins distinct below. *Inflorescence* up to 8 cm, slender or stout, subglabrous to densely appressed-hairy, branched up to 3 (or 4) times; branches of the first order scattered; bracts either all triangular, under 3 mm, or lower ones lanceolate, up to 15 mm; basal inflorescence axes of the first order subtended by ordinary bracts or by foliaceous leaves; submature flower bud up to 3.5 mm across; receptacle puberulous to appressed-hairy. *Sepals* 4 or 5, broader than long or as long as broad, thick, puberulous to appressed-

hairy. *Petals* 4 or 5, thick, glabrous to appressed-hairy. *Stamens* 4 or 5. *Fruit* ovoid to oblong, 2.2—3.5 × 1—1.2 cm; persistent disc conspicuous or not; sepals inconspicuous.

**Distribution:** From NE. India, Bhutan, S. Yunnan, and Hainan, to the Philippines, the Moluccas, and Java — **Fig. 5.**

## KEY TO THE SUBSPECIES

- 1a. Flowers basically 4-merous. Inflorescence stout, ferruginous-puberulous; corolla glabrous outside. Leaves obovate, coriaceous; apex acute; base attenuate. *Moluccas*  
**12b. ssp. moluccana**
- b. Flowers basically 5-merous . . . . . 2
- 2a. Leaves up to 8—20 × 4—8 cm; nerves 6 or more per side; veins distinct below; fruit ovoid . . . . . 3
- b. Leaves up to 4—12 × 1.5—5 cm; nerves up to 6 per side; veins obscure below; fruit oblong. . . . . 4
- 3a. Basal bracts lanceolate, up to 15 mm; fruit above 3 × 1.2 cm. *Java* **12a. ssp. pentandra**
- b. All bracts triangular, under 3 mm; fruit up to 2.5 × 1 cm. *NE. India to Malay Peninsula*  
**12c. ssp. chinensis**
- 4a. Length of sepals not exceeding half their width; leaves chartaceous to subcoriaceous; fruit 2.5—3 cm long. *Philippines*. . . . . **12e. ssp. philippinensis**
- b. Length of sepals almost equal to their width; leaves coriaceous to thick-coriaceous; fruits up to 2.5 cm long . . . . . 5
- 5a. Basal bracts lanceolate; fruits 1—1.2 cm across. *Cambodia, Vietnam, Hainan*  
**12d. ssp. cambodiana**
- b. Bracts uniformly triangular, under 3 mm; fruits 1.8—2 cm across. *Thailand, Malay Peninsula, Sumatra, Borneo, Celebes* . . . . . **12f. ssp. scortechinii**

**12a. ssp. pentandra**

**Distribution:** Java. — **Fig. 5.**

**JAVA.** West. No locality given, *Blume* '1486' (L, NY, W), s.n. (L); 'Harriang', *Van Hasselt* s.n. (L); in hort. Bog. culta (L); Mt. Tangkoebanprahoe, *Korthals* s.n. (L); Pelosari, *Koorders* 9922 (BO, L). — **E a s t.** Pasuruan, *Koorders* 23785, 23801 (BO, L).

**12b. ssp. moluccana** Matthew, *subsp. nov.*

Ramuli crassi, dispersi, puberuli. *Folia* dispersa; petiolus 2.5—3 cm longus, crassus, puberulus; lamina obovata, 8—15 cm longa, 3—8 cm lata, coriacea; basis attenuata; apex acutus; nervi utroque latere 5 vel 6; venae subtus distinctae. *Inflorescentiae* usque ad 5 cm longae, crassae, ferrugineo-puberulae; bractae inferiores usque ad 4 mm longae. *Sepala* 4 (5), quam longa latiora. *Petala* 4 (5), glabra extus. *Stamina* 4 (5).

**T y p u s:** Moluccas, Morotai, 1949, *Kostermans* 1513 (L, holo; A, BO, P, SING).

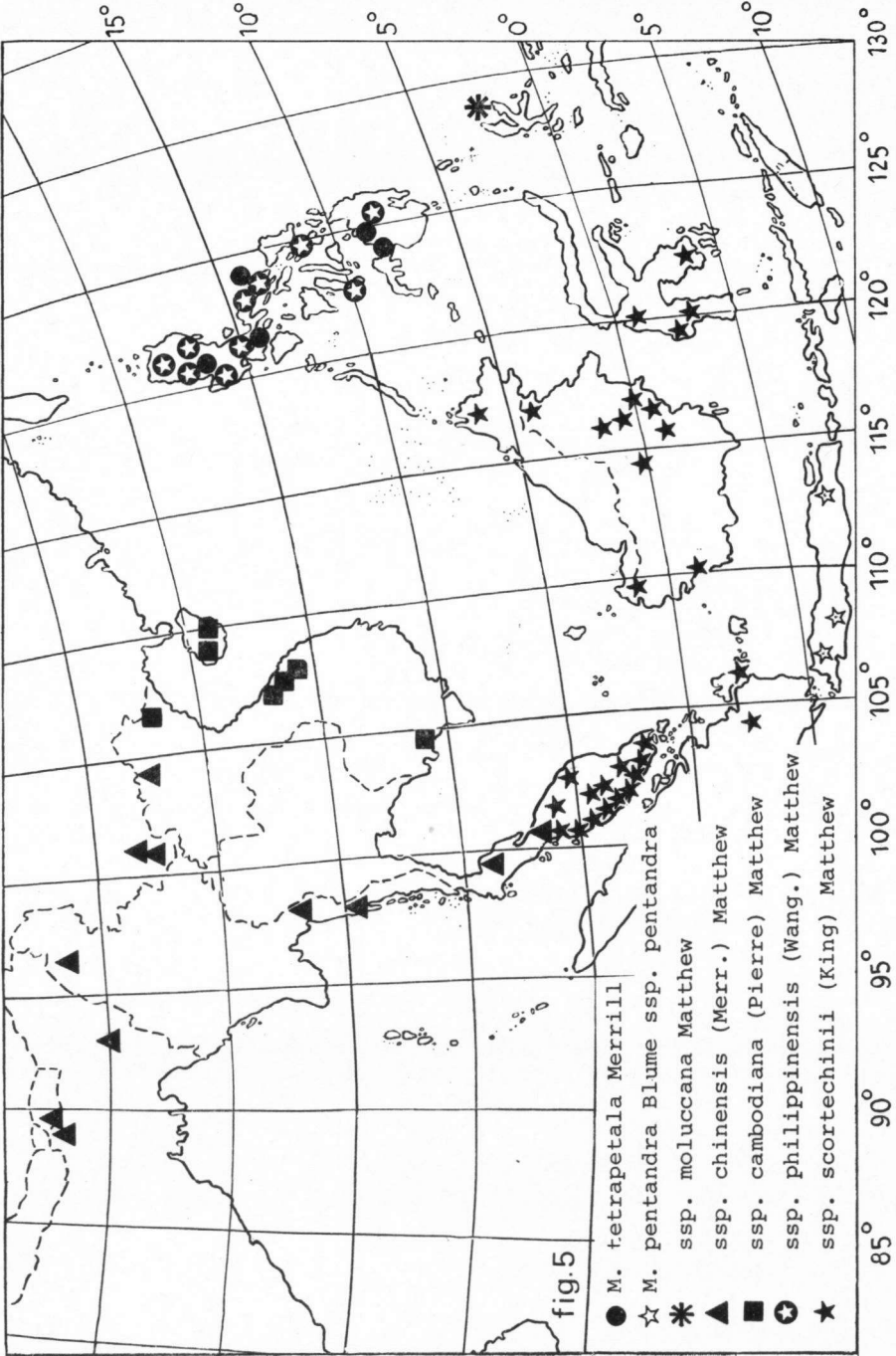
**Distribution:** Moluccas. — **Fig. 5.**

**E c o l o g y:** Scattered to locally common, up to 1000 m. Flowers May

**G a l l s:** Leaf gall on *Kostermans* 1145 (L).

**N o t e s:** Notably low tree; d.b.h. 20 cm; bark green; wood hard; leaves soft, dark above, paler below; nervation and venation rather obscure.

The basal pair of lateral inflorescence branches often occurs at the axils of normal leaves,





a tendency noted in *ssp. philippinensis*. Flowers relatively large, yellowish to greenish; corolla dome-shaped (in bud). Calyx margin wavy; petals  $4 \times 3$  mm; filaments 3 mm; anther 1 mm; style 1.5 mm. The only fruit seen is a detached immature one in *Kostermans 1145* (L).

The arrangement of the primary inflorescence branches is at times obscure.

Whereas occasionally 5-merous flowers have been seen in other materials, such flowers are the rule in *Kostermans 1010*.

The soft coriaceous texture of the leaves, which are dark above and pale below, the stout inflorescence with ferruginous indumentum, and the few large 4-merous flowers with glabrous dome-shaped corolla (in bud) distinguish this *ssp.* from the others.

MOLUCCAS. Morotai. G. Sangawo, *Kostermans 1010* (A, BO, L, SING); G. Pare Pare, *Kostermans 1145, 1281* (A, BO, L, SING), *1282* (BO, L, SING). — No locality given, *Kostermans 1513* (A, BO, L, P, SING).

**12c. *ssp. chinensis* (Merrill) Matthew, *stat. nov.***

*M. chinensis* Merrill, *Sunyatsenia* 3 (1937) 256.

Tree up to 20 m tall; branchlets stout; petiole stout, 1.8—2.5 cm; blade elliptic to elliptic-oblanceolate,  $8-20 \times 4-8$  cm, coriaceous; base attenuate; apex acute; nerves 6—8 per side; veins distinct below. *Inflorescence* up to 8 cm, subglabrous to appressed-hairy; all bracts uniform, under 3 mm. *Sepals* 5, broader than long. *Petals* 5, appressed-hairy outside. *Stamens* 5. *Fruit* oblong,  $2-2.5 \times 1$  cm.

**Distribution:** NE. India, Bhutan, S. China, Vietnam, Burma, Thailand, Malay Peninsula. — **Fig. 5.**

**Ecology:** In mixed woods or dense forests up to 1900 m. Flowers: May—June; fruits: August—May.

**Galls:** Leaf galls on *Lace 5641* and *Wang 78528* are identical; inflorescence galls on *Russell 2003*, in which foliaceous bracts develop which closely resemble the bracts of *M. arborea ssp. mezziana*.

**Vernacular name:** NE. India: *Bolong jigri* (Garó).

**Notes:** *Cowan s.n.* in flower is under 3 m tall. Domatia occur in the Chinese and Burmese material.

A *ms* name *M. cheliensis* with description accompanies *Wang 78528*; the material is only in fruit and the diagnostic features are tenuous.

There are 8 sheets of '*Haines 916*' (between E & K) from 'Mal Forest, Bengal', collected between August 1904 and July 1905. The data seem unreliable. These sheets were presumably distributed by D. Brandis and initially labelled *M. euonymoides* Prain. One of these sheets (K) has (probably) the authentic notes of Haines: 'British Bhotan, in evergreen forest; elevation 1000 ft; evergreen; renews leaves in February; flowers in May; fruit ripens August—September; the inflorescence is often monstrous from the attack of an insect. H.H. Haines'. This particular sheet is special in having 2 lateral flowering axes. Accompanying the sheet is copious Haines-Craib-Prain correspondence on the identity of the plant. Craib in *Kew Bull.* (1922) 237 briefly alludes to this point.

INDIA. West Bengal. Darjeeling Dist.: *Cowan s.n.* (E). — Assam. Cachar, Shapore, *Keenan s.n.*, 1874 (K).

BHUTAN. Mal Forest, *Haines '916*' (E, K).

CHINA. Yunnan. Szemao, *Henry 12414* (A, K, NY); Meng-soong, Dahmeng-lung, Che-li-Hsien, *Wang 78443, 78528* (A).



Fig. 6. — *Mastixia pentandra* ssp. *cambodiana* (Series *Alternae*). — a. habit X  $2/3$ ; b—e. bracts from four successive nodes, X 6; f. part of inflorescence, X  $3\ 1/3$ ; g. longitudinal section of flower, X 6; h. stamens, frontal and dorsal views, X 6; i. transection of (ovary) receptacle, X 6; j. fruit, X  $2/3$ ; k. fruit galls, X  $2/3$  (a—i: Poilane 10447; j, k: Poilane 11080).

VIETNAM. Tonkin. Laokai, Chappa, *Fenzl s.n.*, 1929 (W).

BURMA. Kachin. Myitkynia Dist.: Mawhan, *Ba Pe 12141* (K). — Tenasserim. Amherst Dist.: Dawna Ra., *Lace 5641* (A, E, K); Tavoy, Heinze Chaung Headwaters, *Gage 13* (CAL, K); *Russell 1919, 2001, 2003* (K).

THAILAND. Pitsanulok. Kao Luang, Sukotai, *Kerr 5933* (ABD, BM, SING).

MALAY PENINSULA. Kedah. Gunong Raza, *Kerr 21726* (BM, K).

**12d. ssp. cambodiana** (Pierre) Matthew, *stat. nov.* — **Fig. 6.**

*M. cambodiana* Pierre, Fl. Coch. (1892) t. 260 B. — *M. alternifolia* Merrill & Chun — *M. poilanei* Tard.

Tree up to 15 m tall; branchlets slender or stout; petiole slender or stout, 1.2—2.2 cm; blade ovate to elliptic, 4—12(—16) × 2—5(—6.5) cm, coriaceous; base cuneate; apex acuminate; nerves 3—6(—8) per side; veins obscure below. *Inflorescence* up to 8 cm, slender or stout, subglabrous to appressed-hairy; basal bracts lanceolate, up to 15 mm. *Sepals* 5, as long as broad. *Petals* 5, subglabrous to appressed-hairy outside. *Stamens* 5. *Fruit* oblong, 1.8—2.5 × 1—1.2 cm.

**Distribution:** Cambodia, Vietnam, China (Hainan). — **Fig. 5.**

**Ecology:** Common in forests up to 1700 m; the rocky ground and dry clayey soil seem to account for 3—4 m tall trees, the smallest reported in the genus. Flowers: May—June; fruits: July—October.

**Galls:** Fruit galls on *Pierre 689*, *How 72875*, and *Poilane 11080*.

**Vernacular name:** Vietnam: *Búi lua*.

**Notes:** Free bole 12—14 m; buttresses 1 m; bark grey; scars and lenticels prominent; wood soft, white to reddish, good for beams and for construction not directly in contact with soil; usually not attacked by termites; leaves deep green above, paler and lustrous beneath; domatia on *How 72976*; flowers green, purple, yellow, or white! Fruit pale green, purple, or black.

CAMBODIA. Tpong (Kas Kuang), Kuang Repou Mts., *Pierre 689* (A, K, L, P).

VIETNAM. Tonkin. Kwantung-Tonkin border, *Tsang 26948* (A, E, K, P); Chapa, *Pételot 5377* (NY, P, US). — Thua Thien Prov. Nui Bach Ma, near Hue, *Poilane 27644* (P). — Quang Tri Prov. Dent du Tigre, *Poilane 10312* (P); Dong Tri, *Poilane 11009* (P); Lang Khue, *Poilane 11080* (A, AAU, E, K, L, P); Mai Lanh, *Poilane 10447* (K, L, P); Haut Donnaï, *Poilane 22590* (A, K, P). — No locality given, *Poilane 10391* (P).

CHINA. Hainan. Po-Ting Dist.: Tai-Ping Kong, Ta-Chung, Sheng-Pik, *How 72875* (A, SING); Ling, Ta-Sui Village, *How 72976* (BO, G, SING); Hing-Lung 73153 (A, BM, SING). — Loktung. Lau 27157, 27272 (A). — Yachow. Nam-Lum Ling, *Wang 34707* (E, K, NY).

**12e. ssp. philippinensis** (Wangerin) Matthew, *stat. nov.*

*M. philippinensis* Wangerin, Fedde Rep. 10 (1912) 273. — *M. subcaudata* Merrill.

**Distribution:** Philippines. — **Fig. 5.**

**Galls:** Rather frequent. Stem galls: BS 33380, 78479; FB 2108, 2201; bb 28265; leaf galls: BS 38841; fruit galls: *Wenzel 1150*; FB 2773.

**Field notes:** 3 m height is noted for a tree in flower; bark smooth; freshly cut wood turns yellow green; fruits bright caerulean blue, covered with tan corky warts.

**Notes:** Ssp. *philippinensis* is distinguished from ssp. *scortechinii* in the generally smaller size, smaller and thinner leaves, more slender inflorescence axis, the lower 1 or 2 inflorescence axis (axes) at the axil(s) of vegetative leaves, and the oblong fruits.

In spite of a large number of collections, flowering material is scarce, and field data are scanty.

This subspecies is considerably polymorphic. I have grouped the materials into 5 lots.

1. *BS 33380, 78450, 78479* (northernmost distribution): Leaves obovate, up to  $6 \times 2.5$  cm, coriaceous, rugose; apex acute; stem galls present; flowers and fruits not seen.
2. *BS 1005, 14921, 16548, 23667, 76188; FB 151, 207, 735, 1355, 23467; Merrill 2982, 3740; PNH 6762; Wenzel 1007, 1150; Whitford 208, 222; Williams 395*. Leaves elliptic, up to  $10 \times 4$  cm, coriaceous, smooth; apex acuminate to caudate; domatia common; flowers relatively large.
3. *BS 20587, 23000, 29877, 29961, 44714, 75918; FB 17653, 19670, 23830*. Larger dimensions and grey colour of parts; leaves elliptic, up to  $12 \times 5$  cm, coriaceous; apex acuminate. Flowers not known.
4. *BS 1090, 28214, 38841; Elmer 14779, 17801, 17971, 18452; FB 2108, 2201, 2773, 20592, 24939, 29840*. Leaves obovate, up to  $10 \times 5$  cm, chartaceous; apex acute; inflorescence diffuse, villous; flowers relatively small. Ms. names such as *M. ardisioides*, *Symplocos atrocyanea*, and *Urandra plumbea* occur here.
5. *BS 23352*. *M. subcaudata* Merrill. Apart from the 4-merous flowers, this plant very closely resembles this ssp. Leaves oblong-obovate,  $4-7 \times 1.5-2.5$  cm, subcaudate-acuminate, chartaceous. Inflorescence up to 3 cm; flowers very small. Fruits not known. I suggest that this is a high altitude form of this ssp.

*Loher 14443* (A, UC) with mostly opposite leaves, winged petioles, and relatively large flowers, is a deviating specimen.

PHILIPPINES. Luzon. Ilocos Norte Prov., Mt. Palimlin, *BS 33380* (A, BM, BO, P). — Cagayan. Mt. Bawa, *BS 78450* (BO, K, NY, SING), *78479* (BO, NY, SING). Mountain Prov.: Apayo subprov., *BS 28214* (A, BM, BO, CAL, P, SING, US). — Pangasinan: Mt. San Isidoro, *BS 29877* (A, BM, BO, K, L, P, US), *29961* (BO, L, NY). — Zambales: Mt. Tapulao, *BS 44714* (A, BM, BO, G, NY, UC, W); Botolan, *Merrill 2982* (US); Acoje Mining Co., *PNH 91896* (L). — Bataan Prov.: Lamo R., *FB 151* (BM, K, NY, US), *207* (BM, BO, G, K, NY, P, SING, US), *2108* (E, K, NY, US); Mt. Marivales, *FB 735* (BO, K, NY, SING, US), *1355* (BM, K, NY, US), *2201* (K, NY, US), *2773* (BO, K, NY, SING, US); *Whitford 208* (BR, SING), *222* (BO, K, US); *Williams 395* (K, NY, US); *Merrill 3740* (BM, K, NY, P, US). — Rizal Prov.: Tanai, *Merrill 2275* (K, NY, US); Balaebae, *Loher 14956* (BO). — Languna: San Antonio, *BS 14921* (BM, L, P), *15120* (BM, CAL), *16548* (BM, BO, G, K, L, P, US), *23830* (A, GH, US), *20587* (US); Los Baños, Mt. Maquiling, *BS 1090* (BM, FI, G, U, US, WRSL); *Elmer 17801, 17971* (A, BM, BO, FI, G, GH, K, L, NY, U, UC, US, W), *18452* (A, BM, BO, FI, G, GH, K, L, U, UC, US, W); *FB 20592* (BM, P); Paete, *BS 10057* (US). — No locality given, *BS 23000* (A, US), *FB 17653* (BM, BO, CAL, L, P, US), *19670* (BM, CAL, K, L, NY, P, US), *23467* (US), *24939* (A, BO). — Laguna Batangas Prov.: Mud Spring, *Stern 2147, 2147a* (L). — Camarines Sur. Mt. Potianay, *BS 75918* (G, NY), *76188* (A, K, NY, US). — Sorsogon. Irosin, Mt. Bulusan, *Elmer 14679* (A, BM, BO, K, L, NY, UC, US); *BS 23667* (BO, CAL, K, L, SING, UC, US); Mt. Lalao, *BS 23353* (A, BO, CAL, GH, K, L, NY, P, US). — Leyte. *Wenzel 1007, 1150* (A, BM, G). — Negros Occidental. *FB 29840* (UC); Sibulan, *PNH 6762* (BO, SING, UC). — Mindanao. Bukidnon subprov.: Mt. Candon, *BS 38841* (K, L, P, US).

## 12f. ssp. *scortechinii* (King) Matthew, *stat. nov.*

*M. scortechinii* King, J. As. Soc. Bengal II, 71 (1902) 73. — *M. megacarpa* Ridley — *M. parvifolia* Hallier.

Distribution: Thailand, Sumatra, Malay Peninsula, Borneo, Celebes. — Fig. 5.

Galls: Of the inflorescence on *FRI 12413*; of the fruits *bb 26275, FRI 9006, 10816*.

Field notes: Buttresses up to 60 cm; outer bark thin, patched, smooth or shallowly fissured; lenticels in rows; inner bark brownish to dark yellow, 10 mm; wood whitish to brownish; exudate slow to appear, whitish. Some leaves have a glaucous tinge below; domatia occasional. Flowers greenish or yellowish white. Fruit purple to bluish black when ripe.

**Note:** Ssp. *scortechinii* is distinguished from ssp. *pentandra* by the generally obovate and smaller leaves, less stout inflorescence, uniformly short bracts and oblong fruit with thick pericarp.

In spite of numerous collections cited, representative sheets are but few. The incompletely known *M. scortechinii* King and *M. megacarpa* Ridley are combined; so is the tetramerous *M. parvifolia* Hallier f. known from immature fruits. *RSNB 1077*, conspecific with *Hallier B 569*, has 4-merous, glabrous flowers. It is possible that these two latter are high altitude forms of the ssp. *scortechinii*.

- THAILAND. Narathiwat. Waeng, *BKF 44640* (L).  
 SUMATRA. Palembang. Banjar-asin and Kubu areas, *EPT 158-E 1-F 850* (BO, L); *Grashoff 895* (BO)  
 BANKA. Lobok besar, *bb 34186*; Rundik, *bb 11581* (BO).  
 MALAY PENINSULA. Penang. Bootong Res., *Curtis 919* (K, SING); Pulau, *SF 3759* (CAL, K, SING);  
 Jalan Peninjir, *FMS 22552* (KEP, SING). — Kedah. Kedah Peak, *KEP 94415* (K, KEP, L). — Perak.  
*Scortechinii 1971* (BM, CAL, G, K, L, P); Medang, Slim Hills For. Res., *FRI 815* (K, KEP, L). — Kelantan.  
 G. Stong, *FRI 12412, 12483* (KEP, L). — Pahang. Fraser's Hill, *FRI 9006* (KEP, L); *FMS 7840, 23395* (KEP, SING); *FRI 15711* (KEP); *SF 11291* (A, K, SING); Cameron Highlands, *FRI 15677* (KEP). —  
 Selangor. S. Buloh For. Res., *FMS 44002* (KEP); Kuala Lumpur, *FRI 52282, KEP 94726* (KEP);  
 Selangor-Pahang border, Genting Highlands Rd., *FRI 12574* (A, KEP, L); G. Mandi Angin, *FRI 10816*  
 (K, KEP, L). — Johore. Kluang For. Res., *KEP 98014* (KEP, L, SING); Bt. Paloh Estate, *Shah 393*  
 (A, BO, L, SING); G. Ledang, *FRI 19230* (KEP).  
 BORNEO. Sabah. Mt. Kinabalu, *SF 26912, 26964* (SING), *RSNB 1077* (K, L, SING); Mesilau Hill,  
*Poore 142 B* (L, SING). — W. Indon. Borneo. Sambas R., G. Damas, *Hallier f. B 569* (BO, L);  
 Sukadana, *bb 35208* (BO, L). — E. Indon. Borneo. Tidoeng: Tanah Merah, *bb 18273* (L). — Boe-  
 loengang: Salimbatoo, *bb 11177, 11180* (BO). — W. Kutei: Loa Pelak, *Endert 3310* (BO, K, L, P, SING);  
 Loa Lempong on Belajan R., *Nedi 764* (A, BO, L, SING). — E. Kutei: Balikpapan-Samarinda Road,  
 Loa Djaman region, *Kostermans 6749* (A, BO, L, NY, SING), *10212* (L). — Balikpapan: Sg. Wain region,  
*Kostermans 4574* (A, BO, L, P, SING). — Poeroektjaoe: Moeara Laoeng, *bb 10028* (BO).  
 CELEBES. Manado, Paloe, G. Ngilalaki, *bb 28265* (BO, L, NY, SING); Mamasa, Oeloesaloe, *bb 20871*  
 (A, BO, L); Mukale-Rantepao Road, *bb 26275* (A, BO, L, NY, SING).

### 13. *Mastixia arborea* (Wight) Beddome

- M. arborea* (Wight) Beddome, Fl. Sylv. (1872) 216, t. 216; Clarke, Fl. Brit. Ind. 2 (1879) 745, p.p.; Trimen,  
 Fl. Ceyl. 2 (1894) 287; Harms in E. & P., Nat. Pl. Fam. III, 8 (1898) 262, fig. 81; Gamble, Man. Ind.  
 Timbers (1902) 391; Bourdillon, For. Tr. Travancore (1908) 208; Wangerin in Engler, Pflanzenreich IV,  
 229, Heft 41 (1910) 27, fig. 2, 3; Rama Rao, Fl. Pl. Travancore (1914) 200; Gamble, Fl. Madras I (1919)  
 573; Chowd. & Ghosh, Ind. For. Rec. 4 (1946) 14, t. 4. — *Bursinopetalum arboreum* Wight, Ic. 3, 3 (1845),  
 t. 956; Dalzell & Gibson, Bombay Fl. (1861) 28; Drury, Handb. Fl. Ind. 1 (1864) 124. — Type: *Wight*  
*s.n.*, Sispara, Nilgherries (K; Kew neg. 9917).  
*M. pentandra* auct. non Bl.: Clarke, Fl. Brit. Ind. 2 (1879) 746; Gamble, Man. Ind. Timbers (1902) 391; Cooke,  
 Fl. Bombay I (1903) 576; Bourdillon, For. Tr. Travancore (1908) 208; Wangerin in Engler, Pflanzen-  
 reich IV, 229, Heft 41 (1910) 26, p.p.; Talbot, For. Fl. Bombay & Sind 2 (1911) 80; Rama Rao, Fl. Pl.  
 Travancore (1914) 200; Gamble, Fl. Madras I (1919) 574.  
*Bursinopetalum arboreum* Wight var. *macrophyllum* Thwaites, En. Pl. Zeyl. (1858) 42. — *B. gardnerianum*  
 Baillon, Adansonia 3 (1862) 83, nomen. — *Mastixia gardneriana* Baillon, l.c., nomen. — *M. thwaitesii*  
 Baillon, l.c., nomen; Wangerin, l.c. 27. — Lectotype: *Thwaites CP 637* (BM, holo; BO, CAL, FI,  
 G, GH, K, P, W). — Syn type: *Thwaites CP 2440* (BM, FI, P).  
*M. meziana* Wangerin, Fedde Rep. 4 (1907) 336; in Engler, Pflanzenreich IV, 229, Heft 41 (1910) 27; Gamble,  
 Fl. Madras I (1919) 573. — Type: *Stocks, Law etc. s. n.* (B †; dupl. GH, K, W).

Tree up to 21 m tall; branchlets stout, scattered, subglabrous to villous. *Leaves* scattered; petioles stout, 1.5—3 cm; blade obovate, elliptic to elliptic-lanceolate, 4—20 × 2—10 cm, coriaceous, subglabrous; base cuneate to attenuate; apex acute to caudate; nerves 3—9 per side, prominulous below; veins rather obscure. *Inflorescence* up to 10 cm, stout, appressed-hairy to ferruginous-velvety when young, sparsely so later, branched up to 4 times; branches of the first order scattered; higher order bracts triangular, under 3 mm, lower

ones lanceolate, up to 15 mm, thin or thick; submature flower bud 3—8 mm across; receptacle subglabrous to appressed-hairy. *Sepals* 5, broader than long and valvate or as long as broad and imbricate, puberulous to appressed-hairy outside. *Petals* 5, thin to thick, appressed-hairy to glabrous outside. *Stamens* 5. *Fruit* subglobose or ellipsoid, 1.8—3.8 × 2 cm, persistent disc and sepals inconspicuous.

**Distribution:** S. India, Ceylon. — **Fig. 4.**

**Note:** Harms in Nat. Pfl. Fam. III, 8 (1898) 262, fig. 81 A (reproduced in Wangerin, o.c. 28, fig. 3 A) shows incorrectly the ovule as attached near the base of the locule.

KEY TO THE SUBSPECIES

- 1a. Length of sepals equal to their width; basal bracts above 10 mm; leaves 10—20 × 5—10 cm; inflorescence densely ferruginous-velvety when young. *S. India*.
  - 13b. ssp. **meziana**
- b. Length of sepals not exceeding half their width; basal bracts generally under 8 mm; inflorescence subglabrous to rusty-tomentose when young . . . . . 2
- 2a. Leaves 8—20 cm long; nerves 5—9 per side; corolla of submature bud 8 mm across. *Ceylon* . . . . . 13c. ssp. **macrophylla**
- b. Leaves 6—12 cm long; nerves 4—6 per side; corolla of submature bud under 5 mm. *S. India* . . . . . 13a. ssp. **arborea**

**13a. ssp. arborea**

*Bursinopetalum arboreum* Wight — *M. pentandra* auct. non Blume

Branchlets subglabrous; leaf blade obovate to elliptic, 6—12 × 3—6 cm, coriaceous; nerves 4—6 per side. *Inflorescence* up to 6 cm, rusty-tomentose when young, subglabrous later; lower bracts lanceolate, up to 5 mm, thick, subglabrous; submature flower bud under 5 mm across; *sepals* broader than long, valvate; *petals* appressed-hairy to subglabrous outside, rather thick.

**Distribution:** Peninsular India. — **Fig. 4.**

**Ecology:** Moist evergreen forest, (500) 1000—1800 m. At Agumbe, Shimoga district, Karnataka (formerly Mysore) State, India, trees were found locally abundant, in association with *Pandanus* sp., *Elaeocarpus* sp., and *Calophyllum* sp., but not really widely distributed. Percentage of seed germination is high though the duration of seed viability is short (a few weeks at most) as for other evergreen species. Saplings stand transplantation well and even improve in the process. Cut stumps do not coppice.

Little is known about seed dispersal. Among the 25 old seeds collected from the ground (under *Matthew 14471*) more than half had the endocarp gnawed open by some rodent (a dispersal agent?).

**Galls:** Leaf galls on *Barber 5460*.

**Field notes:** (on *Matthew 14471*). Young tree 15 m tall; d.b.h. 20 cm. Outer bark 2—3 mm thick, shallowly fissured and with white patches outside; inner bark 10—15 mm thick, whitish, exudate insignificant but staining the cutting blade black in course of time; wood whitish.

Tree densely foliaceous; leaves dark green and shining above, whitish below. *Inflorescence* terminal on the branchlets, stout, terete on the higher order branches, obscurely 3-angled towards the base, white-fluffy. The order of development of flowers for each

inflorescence and even for the whole tree seems to be from apex downwards. Flowers greenish, 5-merous, occasional 4-merous ones. Sepals spreading; petals spreading, fleshy, with an apical notch but without a median ridge. Stamens erect. Disc yellow, shining.

**Commercial exploitation:** Trees over girth of 1.8 m are being felled for plywood industry; each tree yields about 2 cubic metres of timber.

The Indian Plywood Research Institute, Bangalore, has recommended it with reservations. The wood may be used only for the face veneers. Logs should be peeled within a week of felling, and the sheets need a special adhesive. Owing to these limitations, this species fetches only less than half the price of other softwood species.

**Notes:** This subspecies is separated from ssp. *meziana* altitudinally; the latter occurs from low altitude up to (c. 900) 300 m, while ssp. *arborea* occurs at higher altitudes.

**INDIA.** Kerala (including former Travancore). Idikki Dist.: Devicolam, Lower Vagavurrai, *MH 27365, 27372* (MH); ?Chimungu, *Bourdillon 544* (CAL, K, MH). — T a m i l n a d u (formerly Madras). Tirunelveli (formerly Tinnevely) Dist.: near Neterikal, *Anonymous MH 23779* (MH); Tricknagoody Hills, *Beddome 3340* (MH); Coimbatore Dist.: Anai Malais, *Beddome 3439* (BM, s.n. (MH); *Villoni MH 23664, 23666* (MH); Iyerpadi, *Barber 5640* (K, MH), Sirukunnu, *Barber 5778* (CAL, K, MH); between Poonachi and Monica, *Barber 5989* (MH); Nilgiri Dist.: Sispara, *Wight s.n.* (K; Kew neg. 9917), 423 (BM, GH, K, L). — K a r n a t a k a. Shimoga Dist.: Agumbe, Barakhana, *BSI 97268* (BSI); Someshwar Road, *BSI 62650* (BSI); *Matthew 14471* (RHT); Someshwar Ghat, *BSI 86381* (BSI); Balehalli, *BSI 97317* (BSI), *Matthew 14472, 14477* (RHT); Doddanala-Minahalli, *BSI 69540* (BSI); Balehoddu, *BSI 97296* (BSI); Chyatrampone, *BSI 80590* (BSI); Vanakeabbi, *BSI 97218* (BSI); Emkalkare, *BSI 97203* (BSI); Ghatibagh, *BSI 97207* (BSI); Hulical, Varahi-Yedur route, *BSI 80894* (BSI); Varahi forests, *BSI 80781, 86338* (BSI), *H 3979/66* (K).

### 13b. ssp. *meziana* (Wangerin) Matthew, *stat. nov.*

*M. meziana* Wagerin, Fedde Rep. 4 (1907) 336. — *M. pentandra* auct. non Bl.

Branchlets densely ferruginous-villous when young, subglabrous later; blade elliptic to oblong-elliptic, 10—20 × 5—10 cm, chartaceous to coriaceous; nerves 5—6 per side. *Inflorescence* up to 10 cm, densely ferruginous-velvety when young, sparsely so later; lower bracts foliaceous, rather thin, up to 15 mm, villous; submature flower bud 5 mm across; *sepals* as long as broad, imbricate; *petals* appressed-hairy outside, rather thin.

**Distribution:** Peninsular India. — Fig. 4.

**Ecology:** In wet deciduous, semi-evergreen, or evergreen forests, especially near streams, at times in the shade of larger trees, from low altitude up to (c. 900) 300 m. Flowers: (November) January—March; fruits: May; apparently rare.

**Notes:** Bark grey, fibrous; lenticels up to 2.5 mm; domatia occasional; 6-merous flowers seen at times; an occasional bracteole on the receptacle; sepals 2.5 × 2 mm are about the largest in the genus, and are imbricate. Petals 2.5—3 × 2—2.5 mm; filaments 1.5—2 mm; anthers 1 mm; style 1—1.5 mm; disc yellow. Wangerin, l.c., considered a bifid stigma as a character for the taxon, but I could not verify this in all the flowers examined. The pale wood has no important commercial value.

The dense, ferruginous, velvety indumentum of the young inflorescence, the foliaceous bracts up to 1.5 cm, the subpetaloid imbricate sepals, and the relatively large leaves at first seem to warrant specific status for the taxon, but a comprehensive comparison of materials (especially those from Agumbe, 552 m alt.) shows how each of these characters merge into those of *M. arborea* ssp. *arborea* which I consider the high altitude counterpart of the present taxon.

It is clear that the '*M. pentandra* Bl.' of Clarke, Fl. Brit. Ind. 2 (1879) 746, refers to this taxon.

INDIA. Kerala. (including former Travancore). Trivandrum Dist.: Kottur F. R., *MH 44214* (MH); Quilon Dist.: Colatoorpalay, *Bourdillon 110, 530* (CAL, HBG, K, MH, SFR.C, Coimbatore); no locality given, *Bourdillon 43* (MH) 958 (SFR.C, Coimbatore), *Calder & Narayanaswami 1472* (CAL). Kozhikode Dist.: Vaitry, *Anonymous MH 23774* (MH); Canannore Dist.: Chandanathode, Peria R. F., *MH 27162* (MH). — K a r n a t a k a (formerly Mysore). Hassan Dist.: Bisle Ghat, *HFP 106* (US); Shiradi Ghat, *HFP 1475* (US); Agumbe, *BSI 62650* (K); Hulical, Varahi forests, *BSI 86338* (K); Kanara (Canara), Yellapore, *Talbot 955* (E, K); Amnode, *Talbot s.n.*, 1889 (K); Malemane Ghat, *Sedgwick & Bell 7228* (K); without precise locality, *Beddome s.n.* = *MH 23786* (MH), *s.n.*, 1869 (K), *Dalzell s.n.*, 1878 (K), *Law s.n.*, 1872 (K), *Stocks s.n.* (CAL, K, Kew neg. 9916; GH, W).

### 13c. ssp. *macrophylla* (Thwaites) Matthew, *stat. nov.*

*Bursinopetalum arboreum* Wight var. *macrophyllum* Thwaites, *En. Pl. Zeyl.* (1858) 42.

Branchlets subglabrous; blade obovate to elliptic, 8—20 × 2.5—7 cm, thick coriaceous; nerves 5—9 per side. *Inflorescence* up to 6 cm, ferruginous-puberulous when young, subglabrous later; lower bracts up to 6 mm, thick, subglabrous; submature flower bud 8 mm across; *sepals* broader than long, valvate; *petals* appressed-hairy, glabrescent.

*Distribution*: Ceylon. — **Fig. 4.**

*Ecology*: Montane zone, 1200—2100 m, in forests; rather rare. Flowers: March—April; fruits November (Thwaites, l.c.).

*Notes*: Bark fibrous; lenticels 2.5—3 mm; dried exudate at cut ends; margin of young leaves revolute; intersecondary nerves present; flowers, the largest in the genus, are sessile and aggregated on the axis; petals 4 × 3 mm, spreading, not reflexed; filaments 3 mm, stout; anthers 1.2 mm; ovary 5 mm across; disc yellow.

This subspecies is separated from *M. arborea* ssp. *arborea*, in addition to geographical isolation, on the basis of the considerably larger dimensions of parts, especially those of the flowers.

Only a few collections are available, all from the 19th century.

CEYLON. Central Prov. Nuwara Eliya Dist.: *Thwaites CP 637* (BM, BO, CAL, FI, G, GH, K, P, W), 2440 (BM, BO, FI, G, K, P, W); Ranibodda, *Gardner 100* (BM, FI, K); *Thomson s.n.* (L); *Walker 175* (E) 'ASIA'. *Hügel 3209* (W).

#### EXCLUDED SPECIES

1. *Mastixia* ? *cuneata* Blume, *Mus. Bot. Lugd. Bat.* 1 (1850) 257 = *Nothaphoebe umbelliflora* (Bl.) Bl. (*Laur.*). T y p e: *Anonymous s.n.* (L, sheet no. 901, 169—349). See Danser, *Blumea* 1 (1934) 68, for references.
2. *Mastixia* ? *heterophylla* Blume, *Mus. Bot. Lugd. Bat.* 1 (1850) 257, is not *Mastixia* (see Danser, o.c. 69 for earlier references). Hallier's identification as *Gomphandra capitulata* Becc. (*Isac.*) is questioned by Sleumer in *Blumea* 17 (1969) 193. T y p e: *Praetorius s.n.* (L, sheet no. 901, 169—350). It is not possible to name this sterile material.
3. *Mastixia gracilis* King, *J. As. Soc. Bengal* 71, II (1902) 73—74. (See Danser, o.c. 68 for a copy of the original description and some notes). T y p e: *Wray 1528* (CAL); see also *Wray 358* (CAL). Not a *Mastixia*, true identity unknown to me.

#### UNNAMED SPECIMENS

Sumatra: *bb 5229, bb 5499, bb 18757, bb 18761, E 850, Forbes 1813, Meijer 6618*. Malay Pen.: *FMS 27639, FRI 52259, KEP 83638*. Borneo: *bb 35255, bb 35389, Clemens s.n.* (Kinabalu), *Nedi 745*. Java: *Koorders 9978*. Philippines: *Loher 14443, McLean & Catalan s.n.* (31.12.1919). Aru Is.: *bb 25352*.



## INDEX TO THE COLLECTIONS STUDIED

Numbers between brackets refer to numbering of taxa in this paper; E refers to excluded species. Unnamed specimens are listed above.

- A* 4136, 4276 (6b); *Achmad* 109, 500, 510, 588, 696, 1183 (4d); *Aet & Idjan* 384, 883 (3b); *d'Alleizette* 2975 (10a); *Alston* 14726 (4a); *Amajah* 55 (11); *Anderson* 142 (4c).
- Balasubramaniam* 986 (10a); *Ba Pe* 12141 (12c); *Barber* 5460, 5778, 5989 (13a); *bb* 2254, 2255 (4d), *bb* 2286 (4b), *bb* 2446 (4d), *bb* 2932 (4a), *bb* 3988 (6b), *bb* 6234, 6666 (4d), 6710 (4c), *bb* 7826 (4c), *bb* 8283 (6b), *bb* 8922, 8925 (6a), *bb* 9171, 9888 (4a), *bb* 10028 (12f), *bb* 10237, 10297 (4a), *bb* 11177, 11180 (12f), *bb* 11287 (4d), *bb* 11578 (4c), *bb* 11581 (12f), *bb* 11638, 11963 (6b), *bb* 12609 (6a), *bb* 14153, 14155, 14267 (4d), *bb* 17024 (4c), *bb* 18230 (4d), *bb* 18273 (12f), *bb* 19064 (4c), *bb* 19517, 20631 (4d), *bb* 20871 (12f), *bb* 22384, 22397 (4a), *bb* 25802 (4d), *bb* 26043 (4b), *bb* 26082 (4a), *bb* 26275 (12f), *bb* 26461 (4c) *bb* 28265 (12f), *bb* 30385 (3b), *bb* 31579 (4c), *bb* 34075 (11), *bb* 34184 (4c), *bb* 34186 (12f) *bb* 34562, 34563 (4d), *bb* 35208 (12f), *bb* 35341 (4c); *Beccari* PB 1225 (4c), 1559 (11), *Beccari* PP 896 (3b), 2033, 2043 (5), *Beccari* PS 46 (4d), 956 (6b), *Beccari* (?) 49 (4a); *Beddome* 3340, 3439, s.n. (13a), s.n. (13b); *den Berger* 122 (4a); *BKF* 44640 (12f); *Blume* (see under type citations — 4, 6, 12); *Boschproefstation* 68 TI P 124 (11); *Bourdillon* 43, 110, 530, 958 (13b), 544 (13a); *Brass* 13153 (3b); *Brass & Versteegh* 12578 (3b); *BRUN* 5 (4c); *BS* 261, 687 (5), 1090 (12c), 1856 (4c), 10057 (12c), 12389 (7), 14921, 15120, 16548, 20587, 23000, 23353, 23667, 23830, 28214 (12c), 28575, 28628, 29088 (9), 29877, 29961 (12c), 30399, 30413 (9), 33380, 38841 (12c), 43077 (9), 44714, 75918, 76188, 78450, 78479 (12c); *BSI* 62650, 69540, 80590, 80781, 80894, 86338, 86381, 97203, 97207, 97218, 97268, 97296, 97317 (13a); *BSIP* 1401, 1886, 2516, 2809, 3080, 3155, 3616, 3750, 3885, 4352, 4764, 4776, 5288, 5381, 5849, 5987, 6432, 6640, 6815, 6873, 6898, 7115, 7427, 8150, 8301, 8568, 9338, 9776, 10117, 10940, 11308, 11536, 11652, 11833, 12089, 12765, 13035, 13133, 13239, 18593, 18944 (3a); *Bünnemeijer* 9572, *Buwalda* 5603 (4d); *BW* 515, 5927, 6087, 6453, 6480, 8170, 8175, 9256, 9265, 11219, 13441 (3b).
- Calder & Narayanawami* 1472 (13b); *Cantley's Coll.* s.n. (4c); *Carr* 12183, 16528, *Clemens* 1890, 2120 (3a); *Clemens* 4597, 5151, 5361, 6484 (3b), 8642 (3a), 30477 (4d), 30514, 32101, 40609 (6b); *Corner* s.n. (4c); *Cowan* s.n. (12c); *Curtis* 919 (12f), 1564 (4c).
- Dalzell* s.n. (13b); *Derry* 584, 1036 (4c).
- Elmer* 11644 (4c), 17801, 17971, 18452 (12c), 21584, 21870 (6b); *Endert* 1053, 2572 (4d), 2577 (6b), 3310 (12f), 3429, 3465, 4091 (4b), 4317 (6b), 4769 (4d); *EPT* 98 T 3P 261 (4c).
- FB* 151, 207, 735, 1355, 2108, 2201, 2773, 17653, 19670, 20592, 23467, 24939 (12c), 25208 (9), 29840 (12c); *Fenzel* s.n. (12c); *Fisher* 71 (3b); *FMS* 7840, 22552 (12f), 22615 (4c), 23380, 38841 (12c), 34149 (4c), 44002 (12f), 45405 (4c); *Forbes* 2744 (4b), *Forman* 520 (11); *FRI* 93 (4c), 815 (12f), 2139 (4c), 9006 (12f), 9266, 9342 (4c), 10816, 12412, 12438, 12574 (12f), 13388, 15565 (4c), 15677, 15711, 19230 (12f), 52235 (4c), 52282 (12f); *Fox* s.n. (4c); *Fuchs* 21311 (5).
- Gage* 13 (12c); *Gardner* 100 (13c); *Garrett* 961 (1); *Grashoff* 895 (12f).
- H* 3979/66 (13a); *Haines '916'* (12c); *Hallier* B.569 (12f), B.1836 (4c); *Hartley* 10333 (3a), 10795 (3b); *van Hasselt* s.n. (4a); *Haviland* 957, 3020 (4c); *Haviland & Hose* 3625 (4c); *Henry* 12414 (12c); *Hewitt* s.n. (7); *Heyne* 41, 193 (6a); *HFP* 106, 1475 (13b); *Holmberg* 840 (11); *Hotta* 12891 (5); *Houtsoorten* Gedeh 47, 125, 227, 652 (4a), 654 (6a); *How* 72875, 72976, 73153 (12d); *Hugel* s.n. (13c).
- Ja* 1368, 2310, 2413, 3983, 4643 (4a), 6570 (4d); *Jacobs* 4851 (4a), 5043 (4c), 7518, 7518 A (9); *Junghuhn* 86 (4a), s.n. (4a, 6a).
- Kadim & Noor* 316 (4c); *Kajewski* 2021, 2086, 2547 (3a); *Kalshoven* 7 (4a); *Keenan* s.n. (12c); *KEP* 94415, 94726, 98014 (12f), 99792 (11); *Kerr* 3237 (1), 5933 (12c), 6065 (1), 21726 (12c); *King's Coll.* 210 (10a), 2907, 6239 (4c), 6830 (11), 6876, 8306, 8436, 10575, 10861 (4c), s.n. (1); *Kjellberg* 1088 (12f); *Koorders* 913, 914 (4a), 915 (6a), 2191, 2200 (4a), 9885, 9901 (6a), 9922 (12a), 9980 (4a), 11914, 11915, 11916, 11917 (6a), 12487, 13231 (4a), 14081 (6a), 15227 (4a), 16977, 17474, 17518, 17519 (4d), 23754 (4a), 23785, 23801 (12a), 24218 (6a), 24459, 24478 (4a), 25556, 25634 (4c), 30598, 32188 (4a), 32681, 32860, 25909, 26248 (4a), 26319 (6a), 27699, 28894 (4a), 30123 (6a), 30597 (4d), 30598, 32188 (4a), 32681, 32860, 33268, 37260, 38076, 39016 (6a), 39459, 41829, 41874 (4a); *Korthals* 1222 (11), s. n. (4a, 4b, 4c, 11, 12a); *Kostermans* S 29 (11), S 34 (4c), 1010, 1145 (12b), 1272 (3b), 1281, 1282, 1513 (12b), 4281 (4c), 4574 (12f), 4587 (4c), 4943 (4b), 5250 (6b), 5316 (11), 5546, 5595 (6b), 5666, 5836 (4d), 6749 (12f), 6867, 7316 (4b), 7435 (6b), 7508 (4b), 7550, 7620, 7678, 7750, 8731 (4d), 8930 (4c), 9181 (4d), 9683 (4c), 10145 (6b), 10212 (12f), 10221, 10307, 12543 (11), 12573 (6b), 12810 (4c), 12984 (6b), 13273 (4b), 18720, 18722 (6a); *Kostermans & Anta* 291, 1154 (4c); *Kostermans, Kuswata, Soegeng & Soepadmo* 288 (4a); *Kostermans & Soegeng* 920 (3b); *Kostermans & Wirawan* 795 (6a); *Kunstler* 6441 (4c); *Kuswata & Soepadmo* 270 (3b).
- Lace* 5641 (12c); *Lambach* 1261 (4b); *Lau* 27157, 27272 (12d); *Law* s.n. (13b); *Ledermann* 9575 (3b); *Loher* 14443 (aff. 12c) 14956 (12c), *Lörzing* 14602 (6b); *Lörzing & Jochems* 7504 (6b).
- Maingay* 709 (4c), 710 (11), 711 (4c), 2398 (11), 2436 (4c), 2680 (4c); *Matthew* 14471, 14472, 14477 (13a); *McLean & Catalan* 117 (9); *Meijer* 2245 (4c), 6316 (2); *Merrill* 2275, 2982, 3740 (12c); *MH* 23664, 23666 (13a), 23774 (13b), 23779 (13a), 23786 (13b), 27162 (13b), 27365, 27372 (13a), 44214 (13b).

- Nedi* 764 (12f); *NGF* 14312 (3a), 21064 (3b), 21953, 23855 (3a), 31822, 31964, 42589, 42692, 48218 (3b).  
*Pascal* 1086 (6b); *Pételot* 5377 (12d); *Pierre* 689 (12d); *PNH* 6762, 91896 (12e); *Poilane* 10312, 10391, 10447, 11009, 11080, 22590, 27644 (12d); *Poore* 142 B (12f); *Praetorius s.n.* (4a, E2); *Pullen* 5894 (3a), 7294 (3b); *Put* 3877 (1).  
*Reinwardt* 212 (4a); *Richards* 1966 (11); *Ridley* 6293, 6340, 13899 (4c); *van Royen & Sleumer* 6331 (3b); *RSNB* 1077 (12f), 5725 (4d); *RSS* 2556 (3a); *Russell* 1919, 2001, 2003 (12c).  
*S* 4679 (5), 13481 (7), 15949 (5), 16318 (6b), 19981 (4d), 21951, 23740 (6b), 24745 (7), 26341 (6b), 28495, 28626 (4c), 28629 (6b), 31114 (4c), 32029 (5), 32130 (6b); *SAN* 15543 (6b), 16279 (4c), 16456 (6b), 16490, 17163 (4c), 18516, 18637, 19340, 19342, 19343, 19432 (6b), 25224 (4d), 26153 (6b), 27018 (4d), 28609 (6b), 29330, 29335 (4d), 30048, 30058 (4c), 30378, 30572 (6b), 30584, 30609 (4b), 32417, 32509, 33012, 33401, 34106 (6b), 34134 (4c), 36506 (4d), 37036, 40858, 46112 (6b), 64131 (4c), 71014 (4b); *Sangkhechand & Nimanong* 1295 (4c); *Schlechter* 17061, 17703 (3a); *Schodde* 3134 (3b); *Scortechini* 98, 625, 869 (4e), 1971 (12f), s.n. (4c); *Sedgwick & Bell* 7228 (13b); *SF* 3759, 11291, 26912, 26964 (12f), 28696, 28974, 29299, 32204 (4e), 32417, 36952 (4c), 37746 (4e), 40157 (11); *Shah* 393 (12f); *Shah* 393 (12f); *van Steenis* 6447 (6b), 10037 (4a); *Stern* 2147, 2147a (12e); *Stocks s.n.* (13b); *Stocks & Law s.n.* (13b).  
*Talbot* 955, s.n. (13b); *T. B.* 208 (4e); *Teijsmann* 8379, 16670, 18670 (4c); *Theobald & Grupe* 2398 (10b); *Thomson s.n.* (13c); *Thwaites CP* 637, 2440 (13c), 2441 (10a), 2542 (10b); *Tsang* 26948 (12d).  
*Verheijen* 2677 (6a); *de Vogel* 1249 (4c).  
*Walker* 175 (13c); *Wang* 34707 (12d), 78443, 78528 (12c); *Watt* 5899 (1); *Wenzel* 1007, 1150 (12e); *Whitford* 208, 222 (12e); *Wight* 423, s.n. (13a); *de Wilde & de Wilde-Duyfjes* 14185 (4a); *Williams* 395 (12e); *Winckel* 264, 289 (4a); *Wirawan* 336, 451 (4a); *Worthington* 2588, 3195, 3285, 3477, 4861, 4862 (10a); *Wray* 358 (E3), 1238 (4e), 1528 (E3).

#### INDEX TO SCIENTIFIC NAMES IN SPECIAL PART

Accepted names are in plain type, synonyms in *italics*, new names in **bold** type.

- Bursinopetalum* Wight:  
*arboreum* Wight:  
 var. *macrophyllum* Thw.:  
*gardnerianum* Baill.:  
*tetrandrum* Wight ex Thw.:  
 var.  $\beta$  Wight ex Thw.:  
*Gomphandra capitulata* Becc.:  
*Mastixia* Bl.:  
 Subgen. *Manglesia* Matthew:  
 Subgen. *Mastixia*:  
 Series *Alternae* Matthew:  
 Series *Oppositae* Matthew:  
 Subgen. *Pentamastixia* Wang.:  
 Subgen. *Tetramastixia* Wang.:  
*acuminatissima* Bl.:  
*alternifolia* Merr. & Chun:  
*arborea* (Wight) Bedd.:  
 ssp. *arborea*:  
 ssp. *macrophylla* (Thw.) Matthew:  
 ssp. *meziana* (Wang.) Matthew:  
*bracteata* Clarke:  
*caesia* Bl.:  
*cambodiana* Pierre:  
*caudatifolia* Merr.:  
*chinensis* Merr.:  
*clarkeana* King:  
 var. *macrophylla* King:  
*crassifolia* Merr.:  
*cuneata* Bl.:  
*cuspidata* Bl.:  
 var. *margarethae* (Wang.) Hall. f.:  
*eugenioides* Matthew:  
*euonymoides* Prain:  
*gardneriana* Baill.:  
*glauca* Matthew:  
*gracilis* King:  
*heterophylla* Bl.:  
*junghuhniana* Miq.:  
*kaniensis* Melchior:  
 ssp. *kaniensis*:  
 ssp. *ledermannii* (Melchior) Matthew:  
*kimanilla* Bl.:  
 var. *caesia* (Bl.) Miq.:  
*korthalsiana* Wang.:  
 var. *macrophylla* Wang.:  
*lanceolata* Baill.:  
*laxa* Bl.:  
 var. *angustifolia* Bl.:  
*ledermannii* Melchior:  
*macrocarpa* Matthew:  
*maingayi* Clarke  
 var. *subtomentosa* King:  
*margarethae* Wang.:  
*megacarpa* Ridl.:  
*meziana* Wang.:  
*octandra* Matthew:  
*pachyphylla* Merr.:  
*parvifolia* Hall. f.:  
*pentandra* Bl.:  
 ssp. *cambodiana* (Pierre) Matthew:  
 ssp. *chinensis* (Merr.) Matthew:  
 var. *cuspidata* (Bl.) Miq.:  
 ssp. *moluccana* Matthew:  
 ssp. *pentandra*:  
 ssp. *philippinensis* (Wang.) Matthew:  
 ssp. *scortechinii* (King) Matthew:

*philippinensis* Wang.:

*poilanei* Tard.:

*premnoides* (Elmer) Hall. f.:

*propinqua* Ridl.:

*rostrata* Bl.:

ssp. *caudatifolia* (Merr.) Matthew:

ssp. *rostrata*:

*scortechinii* King:

*subcaudata* Merr.:

*tetrandra* (Thw.) Clarke:

var. *tetrandra*:

var. *thwaitesii* Clarke:

*tetrapetala* Merr.:

*thwaitesii* Baill.:

*trichotoma* Bl.:

var. *acuminatissima* (Bl.) Danser:

var. *benculuana* Danser:

var. *clarkeana* (King) Danser:

var. *korthalsiana* (Wang.) Danser:

var. *laxa* (Bl.) Miq.:

var. *maingayi* (Clarke) Danser:

var. *rhynchocarpa* Danser:

var. *simalurana* Danser:

var. *tenuis* Danser:

var. *trichotoma*:

*Mastixia*:

*Notaphoebe umbelliflora* (Bl.) Bl.:

*Vitex premnoides* Elmer: