CORNACEAE (K. M. Matthew, Tiruchirapalli, India)[1]

In the past century *Cornaceae* were mostly delimited in a wide sense and they represented a fairly heterogeneous assemblage. HARMS (Ber. Deut. Bot. Ges. 15, 1897, 28 and in E. & P. Nat. Pfl. Fam. 3, 8, 1898, 255) distinguished 7 subfamilies. Of these *Garryoideae* were later mostly recognized as a separate family *Garryaceae*, *Alangioideae* as *Alangiaceae*, *Nyssoideae* and *Davidioideae* together as *Nyssaceae*, leaving *Cornaceae* with the remaining three subfamilies *Cornoideae*, *Curtisioideae* (monotypic, South Africa) and *Mastixioideae* (monotypic, Indo-Malesian tropics). *Cf.* WANGERIN, Pfl. Reich Heft 41[4] (1910) 18.

In recent years, however, the other genera (6) of the *Cornoideae*, besides *Cornus*, have also been recognized as monotypic families, with the exception of *Corokia* which was transferred to *Saxifragaceae-Escallonioideae*. Notably TAKHTAJAN (Proiskh. Prokruitosem. Rast.: 89, *non vidi*) is in favour of these monotypic families. In his 'Flowering Plants' (ed. C. JEFFREY; 1969: 227) he accepted 7 segregate families besides *Cornaceae sens. str.* (omitting mention of two Madagascan genera, one of which he had formerly also raised to family rank, according to SHAW, 1973). These 7 families he arranged, together with *Araliaceae* and *Umbelliferae*, in the order *Cornales*, a phylogenetic construction of affinity not much different from earlier conceptions. The general impression is thus that the distinction of the segregate families is largely an inflation in rank.

We have not followed this tendency towards inflation advocated by a few contemporary systematists and have accepted *Cornaceae* in the wide sense. We do not feel that inflation has the merit of improving scientific insight in the mutual systematical affinities, which remain as they were, either as tribes or as subfamilies, representing together one phylogenetical whole. In addition the disadvantage of the inflation is that the multiplication of family names becomes unnecessarily a real challenge to our capacity to memorize, and deflates firmly established family concepts.

We briefly mention that further relationships are sometimes suggested with quite remote groups. RENDLE (Class. Fl. Pl. 2, 1952, 422) suggested alliance with *Caprifoliaceae*, *e.g. Viburnum*; affinity has also been suggested with *Saxifragaceae-Escallonioideae*. It falls beyond the scope of the present account to elaborate further the extensive literature on the subject.

Cornaceae are in great majority northern extratropical, in which zone also many fossils are known. There are some stray genera on the southern hemisphere. *Mastixia* is tropical but was found in abundance in the Tertiary in the subtropics and warm-temperate regions of the northern hemisphere. See under the genus.

Note. Besides the native genus *Mastixia* the family is represented in Java by *Aucuba japonica* THUNB. which is sometimes cultivated in the mountains. *Cf.* BACK. & BAKH. *f.* Fl. Java 3 (1965) 159. — Ed.

1. MASTIXIA

BLUME, Bijdr. (1826) 654; HARMS in E. & P. Nat. Pfl. Fam. 3, 8 (1898) 262; WANGERIN, Pfl. Reich Heft 41[4] (1910) 19; HALL. *f.* Beih. Bot. Centralbl. 34, 2 (1916) 40; DANSER, Blumea 1 (1934) 47; MATTHEW, Blumea 23 (1976) 51, f. 1–6. — **Fig. 1, 3.**

(1) Composed from the precursory revision in Blumea 23 (1976) 51–93 by the General Editor.

Thanks are due for the financial assistance by the Netherlands Organization for the Advancement of Pure Research (Z.W.O.).

Unarmed, resinous, evergreen trees up to 40(–60) m; branchlets with pith. *Leaves* simple, exstipulate, entire, acute, alternate or (sub)opposite to decussate, sometimes with domatia. *Thyrses* terminal on the main shoots, sometimes also on the laterals, up to 4(–8) times branched, the branches of the first order either (sub)opposite ('*Oppositae*') or spirally arranged ('*Alternae*'); further branchings with a tendency towards decussate arrangement and terminated by cymes; cymes with the central flower most often sessile and ebracteolate, lateral flowers pedicelled and bracteolate. Bracts and bracteoles ovate to triangular, connate or free, lower bracts sometimes gradually becoming foliaceous. *Flowers* bisexual, greenish to yellowish. *Calyx* 4–5(–6–7)-toothed or -lobed, persistent. *Petals* valvate, 4–5(–6), thick, ovate to oblong-elliptic, inflexed at apex and 2-dentate or fimbriate, sometimes with a

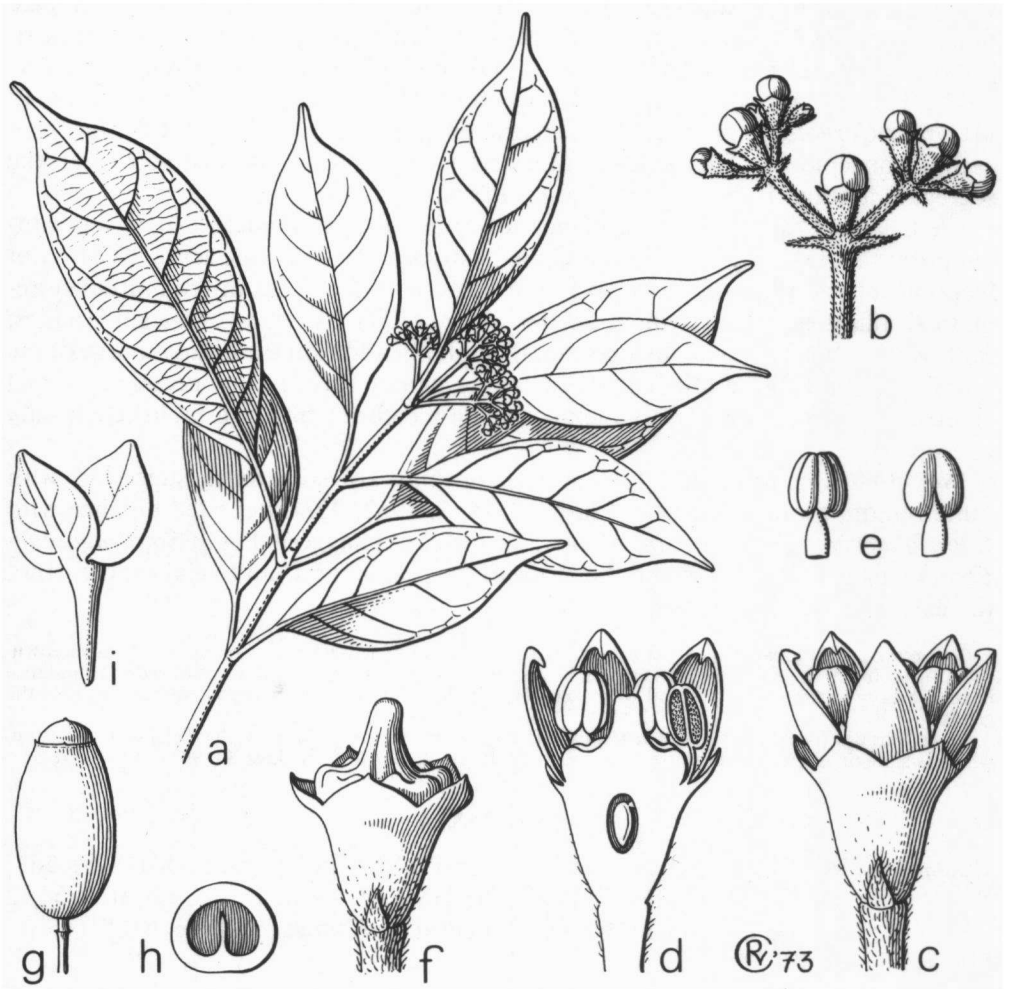

Fig. 1. *Mastixia kaniensis* MELCH. *ssp. kaniensis*. a. Habit, × ²/₃, b. terminal cymes, × 3, c. flower, d. *ditto* in LS, e. stamen in dorsal and frontal view, f. receptacle containing ovary, disk, and style, all × 6, g. fruit, × ²/₃, h. CS of fruit, × ²/₃, i. embryo, × 6 (*a–b* BSIP 3080, *c–f* CLEMENS 1890, *g–i* BSIP 2809).

median ridge inside, spreading or reflexed. *Stamens* 4–5(–6), or 8, alternating with the petals, erect in bud; when 8 in 2 alternate whorls of 4; filaments subulate, flattened; anthers cordate, dorsifixed, abutting on and alternating with the disk lobes, latrorse; connective ± protruding. *Ovary* inferior, turbinate, 1-celled, surmounted by a prominent, fleshy, persistent disk c. $^1/_3$ the height of the receptacle; invaginations of the disk abaxially 4–5 (fitting the filaments) and adaxially 8 or 10 (fitting the thecae), becoming shallower with age; style stout, ribbed; stigma punctiform, sometimes deeply 2-fid or 4–5-lobed, lobes sometimes reflexed. *Ovule* 1, pendulous laterally from the roof of the cell. *Drupe* subglobose to oblong, surmounted by calyx and disk; pericarp thin or thick, dark purple to blue when ripe; endocarp woody, sulcate on one side externally and internally deeply protruding into the fruit cavity as a wedge-shaped or swollen incomplete septum. *Seed* fitting the fruit cavity; testa membranous; endosperm copious; embryo small; cotyledons foliaceous; radicle elongate.

Distr. About 13 *spp.* in SE. Asia (Western Ghats & Ceylon, NE. India, Bhutan, Burma, Thailand, Indo-China, S. Yunnan, Hainan) through Malesia to New Britain and the Solomon Islands. Fig. 2.

Ecol. Primary and secondary forest, often in moist habitats, from sea-level up to 1800(–2400) m.

Fossil endocarps of Mastixioids are found in quantity in the warmer Tertiary in Europe, Great Britain and North America. *Cf.* KIRCHHEIMER, Die Laubgewächse der Braunkohlzeit (1957) and D. H. MAI, Paläontol. Abhandl. Deut. 2 (1) (1964). The Pleistocene Glacial Epoch is held responsible for the contraction of the range, similarly as happened to *Symplocos*, *Meliosma*, and so many other genera of the Tertiary mixed mesophytic forest on the northern hemisphere.

Taxon. *Mastixia* was subdivided into two subgenera by WANGERIN (1910) on the 4- and 5-merousness of the flowers respectively. Though this character is still used for discrimination of species, it seems

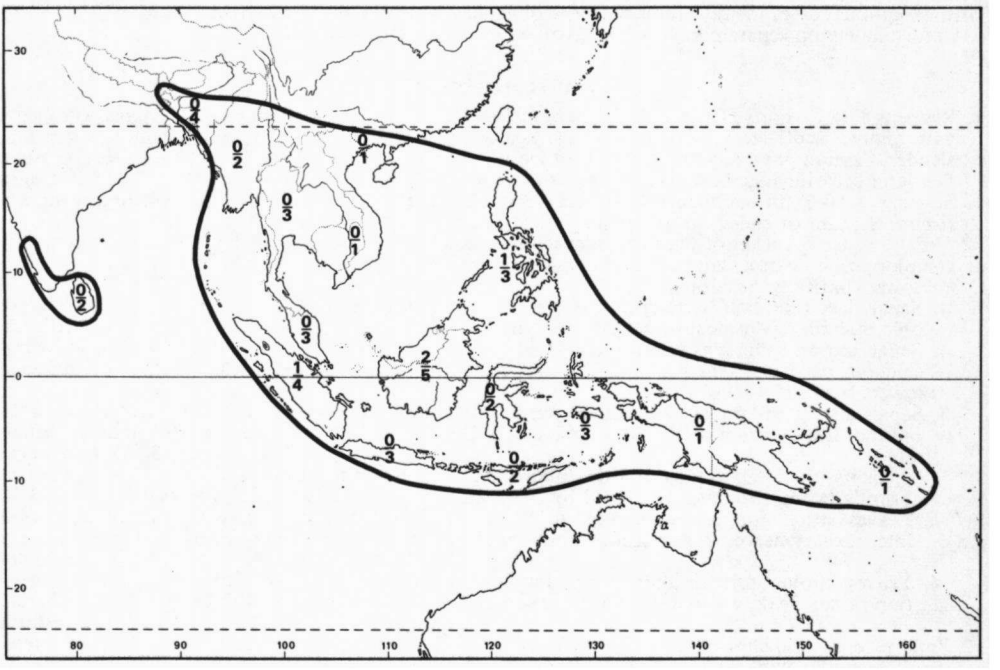

Fig. 2. Range of the living species of the genus *Mastixia* BL. For each district, island or island group the number of species is given, above the hyphen the endemic ones, below the hyphen the non-endemic ones (occurring in more than one district).

artificial for subgeneric rank. Instead, I have proposed another subdivision (1976) into two subgenera, in one of which (*subg. Manglesia*) the stamens number 8 and are arranged into 2 whorls, while in *subg. Mastixia* the stamens number 4–5(–6) and stand in 1 whorl. Other differential characters support this subdivision; see also the key.

Anatomy. For general anatomical surveys also giving the older literature see SOLEREDER, Syst. Anat. Dicot. Stuttgart (1899) 487–495 and ibid. (1908) 171–172; METCALFE & CHALK, Anat. Dicot. Oxford (1950) 735–741. Additional selected references: MOLL & JANSSONIUS, Mikr. 3 (1918) 722–737 (wood anatomy); ADAMS, J. Elisha Mitchell Sci. Soc. 65 (1949) 218–244 (comparative wood anatomy); JANSSONIUS, Blumea 6 (1950) 424 (wood anatomical affinities); VERSTEEGH, Acta Bot. Neerl. 17 (1968) 151–159 (wood anatomy).

The wood of *Mastixia* like that of most other *Cornaceae* is primitive. It has diffuse, exclusively solitary vessels with scalariform perforations (many-barred), fibre-tracheids, diffuse parenchyma, and heterogeneous rays. MOLL & JANSSONIUS *l.c.* reported vertical intercellular canals in *Mastixia rostrata* and *M. trichotoma*. The latter are absent from *M. tetrapetala* studied in Leiden. The leaf and twig anatomy of *Mastixia* is characterized by the occurrence of secretory canals. This important feature is absent from the other genera of the *Cornaceae*. Their presence in *Mastixia* can be used as an argument to stress the affinities of *Cornaceae* with *Araliaceae* and *Umbelliferae* of the *Cornales* for which families they are typical. — P. BAAS.

Galls. Only two galls have been described by DOCTERS VAN LEEUWEN (Ned. Kruidk. Arch. 51, 1941, 207) in the species where they most occur, *viz M. rostrata* and *M. trichotoma*, both caused by aphids. They occur, however, rather random in many species and varieties, with preponderance in *ser. Oppositae*. None have been found yet in species of *subg. Manglesia*. There are four kinds: on the stem, the leaf, the inflorescence, and the fruit. Sometimes they can be quite large, as has been cited under the species. See fig. 3.

Uses. Although trees may reach a considerable size, the scattered occurrence does not contribute to general use as timber; besides, the timber is not of good quality and is only used for minor purposes. *Cf.* BURKILL, Dict. (1935) 1428.

Notes. In key and descriptions the width of the submature flower is that of the corolla.

About the use of the term 'merousness' of the flower it should be remarked that this cannot be used in the strict sense, as 4- and 5-merous flowers often occur in one inflorescence. If it is said 'basically 4-merous', this means that at least 80% of the flowers are 4-merous and the same holds for basically 5-merous flowers, so that the prevalent pattern is obvious.

Moreover it should be remarked that the number of sepals frequently tends to be higher than that of petals and stamens.

In exceptional cases identification of sterile or immature material must remain uncertain.

Unfortunately no separate key can be provided for fruiting material.

KEY TO THE SPECIES

1. Stamens 8, in 2 whorls of 4. Inflorescence branches 4-angular (at least when young). Calyx subtruncate with minute, acute teeth. Bracts caducous. Pedicels of lateral flowers of terminal cymes over 5 mm, slender. Septum of endocarp swollen to at least $^1/_3$ of the diameter of the fruit. Branchlets subterete. Domatia occasional, suborbicular. SUBG. MANGLESIA . . . . . **1. M. octandra**
1. Stamens 4–5(–6), in one whorl. Inflorescence branches terete. Calyx distinctly lobed. Bracts subpersistent. Septum of endocarp wedge-shaped. SUBG. MASTIXIA.
   2. Inflorescence branches of the first order (sub)opposite or decussate. Branchlets and leaves generally (sub)opposite or decussate; nodes flattened. Fruits generally ovoid. *Ser. Oppositae.*
      3. Flowers basically 5-merous.
         4. Sepals less than half as long as wide. Inflorescence subglabrous to puberulous. Fruit ovoid to oblong, with inconspicuous persistent sepals . . . . . **2. M. kaniensis**
         4. Sepals almost as long as wide. Inflorescence velutinous to woolly. Fruit elongate-ovoid, with conspicuous persistent sepals . . . . . **3a. M. trichotoma *var.* korthalsiana**
      3. Flowers basically 4-merous.
         5. Sepals almost as long as wide. Inflorescence puberulous to woolly. Corolla puberulous to villous outside. Leaves acute or shortly acuminate, 5–24 by 2–12 cm. Fruit with conspicuous persistent sepals . . . . . **3. M. trichotoma**
         5. Sepals less than half as long as wide. Inflorescence (sub)glabrous. Corolla glabrous outside. Leaves abruptly caudate to cuspidate, 4–12 by 2–5$^1/_2$ cm. Fruit with obscure calyx teeth.
            6. Leaves strictly opposite; petioles stout. Leaves thick-coriaceous; nervation prominent, with intermediary nerves. Inflorescence stout with lower bracts up to 5 mm. Fruit 1$^1/_2$ cm ⌀ **4. M. eugenioides**
            6. Leaves (sub)opposite or alternate; petioles slender. Leaves chartaceous to subcoriaceous; nervation rather weak, without intermediary nerves. Inflorescence slender with bracts all under 3 mm. Fruit up to 1 cm ⌀. . . . . **5. M. rostrata**
   2. Inflorescence branches of the first order scattered. Branchlets and leaves scattered; nodes terete. Fruit generally ellipsoid or oblong. *Ser. Alternae.*
      7. Branchlets woolly. Leaves 13–30 by 5$^1/_2$–15 cm, with midrib and nerves (even veinlets) woolly to villous; petioles stout, 4 cm or longer, woolly. Fruit over 4 by 2 cm. Flowers 5-merous **6. M. macrocarpa**

7. Branchlets not woolly. Petioles up to 4 cm. Fruit up to 4 cm long.
8. Flowers basically 4-merous.
9. Leaves glaucous and waxy below, thick-coriaceous, with intermediary nerves; apex apiculate. Sepals as long as wide . . . . . **7. M. glauca**
9. Leaves not glaucous and waxy below, without intermediary nerves; apex other than apiculate. Calyx teeth at most half as long as wide.
10. Leaves crowded at apices of branchlets, thick-coriaceous; acute to acuminate. Inflorescence branches stout, compact. Fruit ellipsoid, $1^1/_2$ cm ∅. . . . . **8. M. tetrapetala**
10. Leaves evenly spread, chartaceous to subcoriaceous; apex caudate (over 1 cm). Inflorescence branches rather slender . . . . . **5. M. rostrata**
8. Flowers basically 5-merous.
11. Leaves abruptly cuspidate (over 1 cm); nerves arcuate, clearly impressed above. Inflorescence raceme-like, seldom branched more than twice. Petals densely silky outside. Branchlets slender. Fruit oblong, $1^1/_2$–2 by 0.8–1 cm . . . . . **9. M. cuspidata**
11. Leaves other than abruptly cuspidate; nerves not arcuate but mostly sharply prominent, veins mostly distinct. Inflorescence usually branched twice or more, not terminating into a dichasium. Petals glabrous to appressed hairy. Fruit ovoid to oblong, $2^1/_4$–$3^1/_2$ by 1–$1^1/_4$ cm **10. M. pentandra**

1. Subgenus Manglesia

MATTHEW, Blumea 23 (1976) 64, f. 1 (map) & 2.

Branchlets and leaves decussate. Stamens 8, in 2 whorls. Inflorescence branches 4-angular. Calyx subtruncate. Fruit with swollen septum.

Distr. 2 *spp.*, in NE. India, N. Burma, NW. Thailand, Central Sumatra.

1. Mastixia octandra MATTHEW, Blumea 23 (1976) 65, f. 3 (map).

Tree up to 25 m; d.b.h. up to 90 cm. Branchlets slender, decussate, terete, glabrous. *Leaves* decussate, ovate to elliptic, 4–8 by $1^1/_2$–3 cm, chartaceous, glabrous; base cuneate; apex acuminate; nerves 6–8 pairs, with intermediary ones; veins distinct on both surfaces; an occasional subcircular domatium at the axil of nerves; petiole 1–$1^1/_2$ cm, slender. *Inflorescence* up to 15 cm, slender, glabrous, branched up to 5 times; branches of the first order decussate; pedicels of lateral flowers of terminal cymes over 5 mm, slender. Bracts ovate, under 3 mm, glabrous. Submature flower bud 3 mm ∅. *Calyx* subtruncate, thin; teeth 4, minute, acute, thin. *Petals* 4, thick, glabrous outside. *Stamens* 8. *Ovary* glabrous. *Fruit* turbinate, 1 cm.

Distr. *Malesia:* West Central Sumatra, once found.

Ecol. Mountain forest, 1700–1800 m.

Notes. Easily distinguished from the continental Asian *M. euonymoides* PRAIN by smaller, chartaceous leaves, suborbicular domatia, more slender, lax and elongate inflorescence parts, the thin calyx with acute teeth, and the generally pedicelled middle flower of the cymes.

2. Subgenus Mastixia

Cf. MATTHEW, Blumea 23 (1976) 66, f. 1 (map) & 2. — *Mastixia subg. Tetramastixia et Pentamastixia* WANGERIN, Pfl. Reich Heft 41^4 (1910) 21, 25.

Branchlets and leaves scattered or (sub)opposite. Stamens 4–5(–6), in one whorl. Inflorescence branches terete. Calyx lobed. Septum of the fruit wedge-shaped.

Distr. 11 *spp.*, covering the entire range of the genus.

1. Series Oppositae

MATTHEW, Blumea 23 (1976) 66.

Inflorescence branches of the first order (sub)opposite or decussate. Branchlets and leaves ditto; nodes flattened. Fruit usually ovoid.

Distr. Throughout *Malesia*, in continental Asia only in Pensinsular Thailand.

2. Mastixia kaniensis MELCH. Bot. Jahrb. 60 (1925) 172; DANSER, Blumea 1 (1934) 52. — *M. ledermannii* MELCH. Bot. Jahrb. 60 (1925) 173. — *M. pentandra* (*non* BL.) DANSER, Blumea 1 (1934) 50, *p.p.*; MATTHEW, Blumea 23 (1976) 67. — **Fig. 1, 3a–b** (galls).

Tree up to 31 m; d.b.h. up to 75(–90) cm. Branchlets stout or slender, (sub)opposite, subglabrous to velutinous. *Leaves* (sub)opposite, elliptic, obovate, oblong or oblanceolate, ($3^1/_2$–) $4^1/_2$–18 by 2–8 cm, chartaceous to thick coriaceous, subglabrous, rarely densely velutinous; base attenuate to truncate; apex acuminate to caudate;

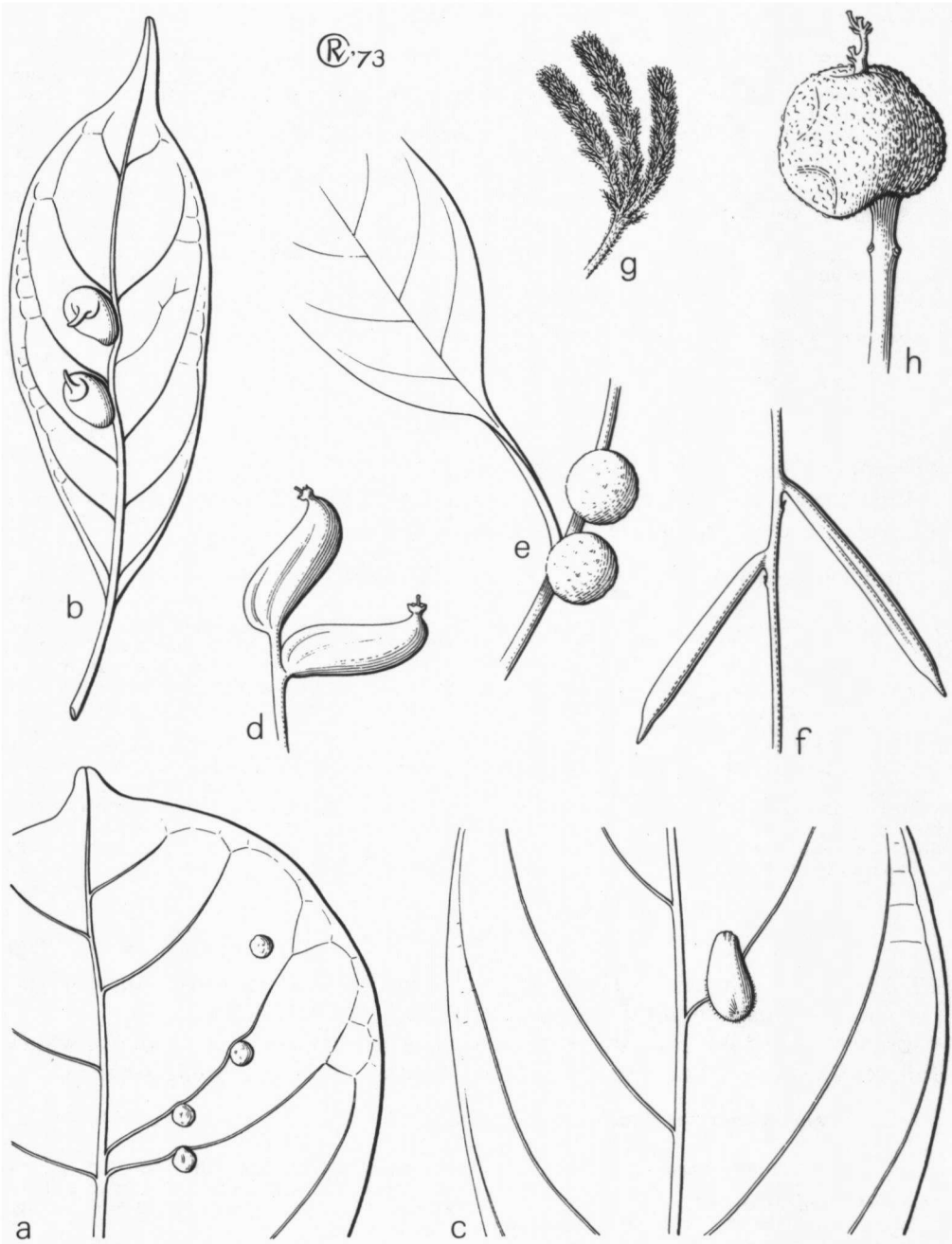

Fig. 3. Galls of *Mastixia*. *a. M. kaniensis* MELCH. *spp. ledermannii* (MELCH.) MATTHEW, b. *M. kaniensis* MELCH. *ssp. kaniensis*, c. *M. pentandra* BL. *ssp. chinensis* (MERR.) MATTHEW, d–e. *M. pentandra* BL. *ssp. philippinensis* (WANGERIN) MATTHEW, f. *M. rostrata* BL. *ssp. caudatifolia* (MERR.) MATTHEW, g. *M. trichotoma* BL. *var. korthalsiana* (WANGERIN) DANSER, h. *M. trichotoma* BL. *var. rhynchocarpa* DANSER. All nat. size, except g × 2 (*a* CLEMENS 5361, *b* SCHLECHTER 17703, *c* LACE 5641, *d* WENZEL 1150, *e* FB 2201, *f* KOSTERMANS 12573, *g* KOSTERMANS 7316, *h* KOSTERMANS 7620).

nerves 3–9(–11) pairs, sometimes arcuate; veins usually obscure; petiole 1–2(–4) cm, stout or slender. *Inflorescence* up to 8 cm, stout or slender, subglabrous to puberulous, branched up to 3–(4) times, at times terminating in a dichasium, branches of the first order (sub)opposite. Bracts triangular to lanceolate, up to 4 mm, puberulous to velutinous. Submature flower bud $1^1/_2$–$2^1/_2$ mm ø. *Sepals* (4–)5(–6–7), broader than long. *Petals* (4–)5(–6), thick or thin, glabrous or puberulous outside. *Stamens* (4–)5(–6). *Ovary* sparsely puberulous. *Fruit* ovoid to oblong, $1^1/_2$–$2^1/_2$ by 1–$1^1/_2$ cm, dull or shining when dry; persistent disk inconspicuous to prominent; sepals inconspicuous.

Distr. *Malesia:* Moluccas, New Guinea, New Britain, and the Solomon Islands. Fig. 4.

Note. Two replacing subspecies are distinguished. The maximum degree of fluctuation in the number of flower parts occurs in the New Guinea —Solomons area.

KEY TO THE SUBSPECIES

1. Leaves chartaceous to subcoriaceous; branchlets and inflorescence axes slender; petals thin, glabrous outside. . . . . **a. *ssp.* kaniensis**
1. Leaves thin- to thick-coriaceous; branchlets and inflorescence axes usually stout; petals thick, puberulous outside. . . . **b. *ssp.* ledermannii**

a. *ssp.* kaniensis. — Fig. 1, 3b (galls).

Branchlets slender, subglabrous to velutinous. leaves ($3^1/_2$–)$4^1/_2$–$14^1/_2$ by 2–6 cm, chartaceous to subcoriaceous; base attenuate to cuneate; nerves 3–7 pairs, sometimes arcuate, prominulous below; petiole 1–2 cm. Inflorescence up to 6 cm, slender, branched 2(–3) times, lax. Flowers relatively small. Bracts triangular to lanceolate, under 3 mm. Submature bud $1^1/_2$ mm ø. Petals (4–)5, relatively thin, glabrous outside. Stamens (4–)5. Fruit ovoid to oblong, 2–$2^1/_2$ by $1^1/_4$–$1^1/_2$ cm.

Distr. *Malesia:* East New Guinea, New Britain, and Solomon Islands. Fig. 4.

Ecol. Common in primary forests from low altitude up to 1200 m. *Fl. fr.* Jan.–Dec. Leaf- and fruit-galls occur.

Note. Occasional specimens in New Guinea are densely velutinous, others are less so. The basal branches of the inflorescence of the first order are at times subtended by foliage leaves.

b. *spp.* ledermannii (MELCH.) MATTHEW, Blumea 23 (1976) 67. — *M. ledermannii* MELCH. — **Fig. 3a** (galls).

Branchlets stout, often rusty puberulous when young, subglabrous later. Leaves 6–18 by $2^1/_2$–8 cm, thin- to thick-coriaceous; base attenuate to truncate; nerves 3–9(–11) pairs, sometimes arcuate, obscure to prominent below; petiole $1^1/_2$–2(–4) cm. Inflorescence up to 8 cm, stout, branched 3–(4) times, compact. Flowers relatively large. Bracts lanceolate below, up to 4 mm. Submature flower bud $2^1/_2$ mm ø. Petals (4–)5(–6), thick, puberulous outside. Stamens (4–)5(–6). Fruit ovoid, $1^1/_2$–$2^1/_2$ by 1–$1^1/_4$ cm.

Distr. *Malesia:* Moluccas and New Guinea. Fig. 4.

Ecol. Primary and secondary forests, 100–1800 m. *Fl. fr.* Jan.–Dec. Leaf-galls occur.

Vern. New Guinea: *bie*, *bon*, Muju, *labak-kobilien*, Mooi, *masjiw*, Wandammen, *samuwin*, Biak.

Notes. In some specimens a dense indumentum is found.

Though the two subspecies are clearly replacing, some specimens of *ssp. ledermanii* occur in the area occupied by *ssp. kaniensis*, but at higher altitude than *ssp. kaniensis* in this area.

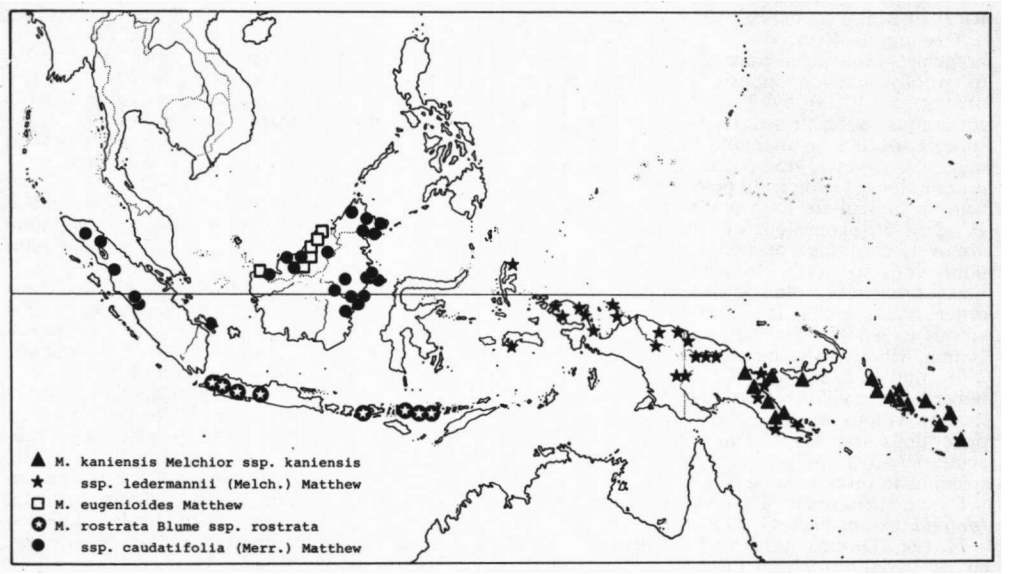

Fig. 4. Localities of three species and two subspecies of *Mastixia*.

3. Mastixia trichotoma BL. Bijdr. (1826) 655; DC. Prod. 4 (1830) 275; BL. Mus. Bot. 1 (1850) 257, f. 58; MIQ. Fl. Ind. Bat. 1, 1 (1856) 772, *incl. var. laxa* MIQ. l.c.; K. & V. Bijdr. 5 (1900) 90; WANGERIN, Pfl. Reich Heft 41⁴ (1910) 24, f. 1A-E; KOORD. Atlas 1 (1913) t. 190; Fl. Tjib. 2 (1923); DANSER, Blumea 1 (1934) 57, *incl. var. tenuis, acuminatissima, clarkeana, korthalsiana, maingayi, benculuana, rhynchocarpa et simalurana* DANSER, l.c. 61–65; BACK. & BAKH. *f.* Fl. Java 2 (1965) 159; MEIJER, Bot. News Bull. Sandakan 8 (1967) 65; *ibid.* 10 (1968) 179, illus.; MATTHEW, Blumea 23 (1976) 68. — *M. laxa* Bl. Mus. Bot. 1 (1850) 257, *incl. var. angustifolia* BL. l.c.; WANGERIN, Pfl. Reich Heft 41⁴ (1910) 24. — *M. acuminatissima* BL. Mus. Bot. 1 (1850) 258; MIQ. Fl. Ind. Bat. 1, 1 (1856) 772, (1858) 1095; WANGERIN, Pfl. Reich Heft 41⁴ (1910) 22, f. 1F. — *M. caesia* BL. Mus. Bot. 1 (1850) 258. — *M. kimanilla* BL. l.c. 258; MIQ. Fl. Ind. Bat. 1, 1 (1856) 772, (1858) 1095, *incl. var. caesia* MIQ. l.c. 772; K. & V. Bijdr. 5 (1910) 94; WANGERIN, Pfl. Reich Heft 41⁴ (1910) 25. — *M. maingayi* CLARKE, Fl. Br. Ind. 2 (1879) 746; KING, J. As. Soc. Beng. 71, ii (1902) 74, *incl. var. subtomentosa* KING, l.c. 75; WANGERIN, Pfl. Reich Heft 41⁴ (1910) 22. — *M. junghuhniana* (*non* MIQ.) CLARKE, Fl. Br. Ind. 2 (1879) 746. — *M. clarkeana* KING, J. As. Soc. Beng. 71, ii (1902) 75 & *var. macrophylla* KING, l.c.; WANGERIN, Pfl. Reich Heft 41⁴ (1910) 24; HALL. *f.* Beih. Bot. Centralbl. 34, 2 (1916) 40. — *M. korthalsiana* WANGERIN in Fedde, Rep. 4 (1907) 335, *incl. var. macrophylla* WANGERIN, l.c. 336 *et* Pfl. Reich Heft 41⁴ (1910) 25, 26; HALL. *f.* Beih. Bot. Centralbl. 34, 2 (1916) 40. — *M. propinqua* RIDL. J. Fed. Mal. St. Mus. 4, 1 (1909) 25; Fl. Mal. Pen. 1 (1922) 890. — *Vitex premnoides* ELMER, Leafl. Philip. Bot. 8 (1915) 2874. — *M. premnoides* HALL. *f.* Beih. Bot. Centralbl. 34, 2 (1916) 41; MERR. Philip. J. Sc. 13 (1918) 43; En. Philip. 3 (1923) 242. — *M. rostrata* (*non* BL.) RIDL. Fl. Mal. Pen. 1 (1922) 890. — **Fig. 3g–h** (galls).

Tree up to 40 m; d.b.h. up to 50(–150) cm; branchlets stout or slender, opposite, puberulous to woolly. *Leaves* opposite, ovate, elliptic to oblong, 5–24(–28) by 2–12 cm, thin- to thick-coriaceous, subglabrous to villous below; base cuneate, obtuse or attenuate; apex acute to acuminate; nerves 5–15 pairs, impressed above, prominulous to prominent below, at times arcuate; veins prominulous to prominent below; petiole $1^1/_4$–$2^1/_2(-3^1/_2)$ cm, stout or slender. *Inflorescence* up to 15 cm, stout or slender, compact or lax, puberulous to woolly; branched up to 5 (or 6) times; branches of the first order opposite; higher order bracts triangular, more or less connate, villous to woolly; lower bracts lanceolate, up to 10 mm, villous to woolly. Submature flower bud 2–$3^1/_2$ mm ∅. *Sepals* 4 or 5, as long as wide, thick, puberulous to villous. *Petals* 4 or 5, thick, puberulous to villous outside. *Stamens* 4 or 5. *Ovary* puberulous to villous. *Fruit* ovoid to elongate, acute, $1^1/_2$–$3^1/_4$ by $^1/_2$–2 cm; persistent disk inconspicuous to prominent; sepals prominent.

Distr. Peninsular Thailand and throughout *Malesia*, except New Guinea. Fig. 5.

Notes. DANSER (*l.c.* 59–61) adequately discussed variations within the species; most of the vernacular names he listed (*l.c.* 72–73) belong to the present species.

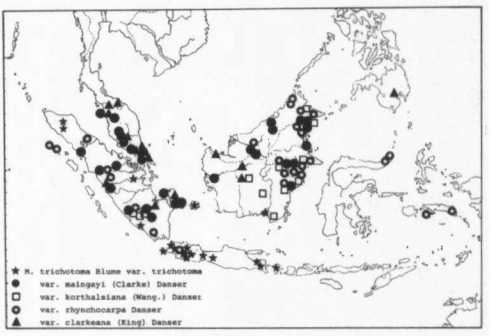

Fig. 5. Localities of *Mastixia trichotoma* BL. and its varieties.

Figure 1 of WANGERIN (*l.c.* 23) is rather schematic. The position of ovule attachment and the length of the sepals are inaccurately drawn.

KEY TO THE VARIETIES

1. Inflorescence villous to woolly.
2. Twigs woolly. Leaves 9–20 cm long, thick-coriaceous, villous to woolly; nerves often arcuate; base obtuse to truncate. Fruit ovoid, more than $1^1/_2$ cm ∅ . . . . **c. *var.* maingayi**
2. Twigs not woolly. Leaves 5–15 cm long, chartaceous to subcoriaceous, subglabrous to puberulous; nerves seldom arcuate; base attenuate to cuneate. Fruit elongate-ovoid, up to $1^1/_2$ cm ∅.
3. Inflorescence compact. Sepals, petals, and stamens 4. . . . . **a. *var.* trichotoma**
3. Inflorescence very lax. Sepals, petals, and stamens 5. . . . . **b. *var.* korthalsiana**
1. Inflorescence subglabrous to puberulous.
4. Fruit with prominent persistent disk, over $2^1/_2$ by $1^1/_2$ cm. Leaves 10–24 by 5–12 cm. Inflorescence robust, up to 15 cm, branched 5 (to 6) times, not terminating in a dichasium. **d. *var.* rhynchocarpa**
4. Fruit without prominent persistent disk, up to 2 by 1 cm. Leaves usually 5–12 by 2–$4^1/_2$ cm. Inflorescence slender, up to 10 cm, branched 3(–4) times, often terminating in a dichasium **e. *var.* clarkeana**

a. *var.* trichotoma — *M. laxa* BL. — *M. trichotoma* BL. *var. laxa* MIQ. — *M. laxa* BL. *var. angustifolia* BL. — *M. acuminatissima* BL. — *M. trichotoma* BL. *var. acuminatissima* DANSER — *M. caesia* BL. —*M. kimanilla* BL. *incl. var. caesia* MIQ.

Branchlets rather slender, yellowish, puberulous to velutinous. Leaves elliptic to oblong, 5–15 by 3–8 cm, chartaceous to subcoriaceous, subglabrous to puberulous; base cuneate to attenuate; apex acute to acuminate; nerves 5–8 pairs, prominulous to prominent below, seldom arcuate; petiole $1^1/_4$–$2(-2^1/_2)$ cm, rather slender. Inflorescence up to 8 cm, compact, branched 3(–4) times, villous to woolly; basal bracts under 5 mm; terminal bracts often deeply boat-shaped. Sepals 4. Petals 4. Stamens 4. Fruit elongate-ovoid, $1^1/_2$–3 by

1–1½ cm; persistent disk inconspicuous; sepals prominent.

Distr. *Malesia:* N. Sumatra, W.-E. Java, Borneo, Lesser Sunda Is. (Bali). Fig. 5.

Ecol. In primary forest from low altitude up to 1800 m. *Fl.* May–Jan., *fr.* July–March. Galls occur on stem and fruit.

Vern. Java: *djĕrĕt, huru hiris, h. minjak, kĕndu, kibĕntĕli, kibunting, kidĕdak, kilumlum, kilun glum, kimĕnjan, kitĕnjo, (huru) mèhmal, mèmah, palaglar minjak, tĕnggau, tĕnju.*

b. *var.* korthalsiana (WANGERIN) DANSER, Blumea 1 (1934) 63; MATTHEW, Blumea 23 (1976) 70. — *M. korthalsiana* WANGERIN. — Fig. 3g (galls).

Branchlets rather slender, yellowish, subglabrous to velutinous. Leaves subovate-elliptic, 10–12 by 3–5 cm, subcoriaceous; base long attenuate; apex acuminate; nerves 5–6 pairs, seldom arcuate; petiole 1¼–1¾ cm, rather slender. Inflorescence up to 10 cm, very lax, branched 3(–4) times, few-flowered, velutinous to woolly; bracts under 3 mm. Sepals 5. Petals 5. Stamens 5. Fruit elongate-ovoid, 2½–3 by 1–1½ cm, persistent disk inconspicuous, sepals prominent.

Distr. *Malesia:* Sumatra, Borneo. Fig. 5.

Ecol. In primary forest from low altitude up to 640 m, often scattered. Rather prone to galls.

Vern. Sumatra: *mĕdang kladi.* E. Borneo: *sĕrgam pipit,* Sangkulirang I.

Note. The lax and few flowered inflorescence, the 5-merous flowers, and elongate fruit distinguish this variety from *var. trichotoma* to which it is closely allied.

c. *var.* maingayi (CLARKE) DANSER, Blumea 1 (1934) 63; MATTHEW, Blumea 23 (1976) 70. — *M. maingayi* CLARKE, *incl. var. subtomentosa* KING — *M. junghuhniana* (*non* MIQ.) CLARKE — *M. rostrata* (*non* BL.) RIDL. — *M. propinqua* RIDL.

Branchlets very stout, yellowish, woolly. Leaves ovate to elliptic, 9–20 by 4–11 cm, thick coriaceous, tough and stiff; base obtuse to truncate; apex acute to acuminate; nerves 5–6 pairs, deeply impressed above, very prominent below, often arcuate, numerous parallel intermediary veins conspicuous; petiole 1½–2½ cm, stout, villous to woolly. Inflorescence up to 15 cm, compact, branched 4(–5) times, velutinous to golden woolly; basal bracts up to 1 cm, persistent. Sepals 4. Petals 4. Stamens 4. Fruit ovoid, 2½–3½ by 1½–2 cm; persistent disk inconspicuous, sepals prominent.

Distr. *Malesia:* Sumatra, Malay Peninsula (also Penang), Banka, Borneo. Fig. 5.

Ecol. In primary forests with Dipterocarps; also in secondary or marsh forests, from the lowland to 1400 m. *Fl.* Febr.–Aug. (Nov.), *fr.* April–Dec. Galls occur on leaves and fruit.

Vern. Malaya: *karu nuri, kayu bĕngkal bukit, kayu maura, mĕdang.* Banka: *mĕdang puntung, m. pusĕr.* Borneo: *mĕdang kanigara.*

Note. Easily recognized by the woolly indumentum, large and stiff leaves with prominent veins, and the numerous massive fruits.

d. *var.* rhynchocarpa DANSER, Blumea 1 (1934) 64; MATTHEW, Blumea 23 (1976) 71. — *M. trichotoma* BL. *var. benculuana et var. simalurana* DANSER. — Fig. 3h (galls).

Branchlets stout, dark, subglabrous. Leaves elliptic to oblong, 10–24(–28) by 5–12 cm, coriaceous, tough and stiff; base cuneate to obtuse; apex acute, acuminate to caudate; nerves 8–15 pairs, very prominent below, seldom arcuate; petiole 1½–2½(–3½) cm, stout. Inflorescence up to 15 cm, compact, profusely branched up to 5(–8) times, not terminating in a dichasium, subglabrous to puberulous; basal bracts up to 5 mm. Sepals 4(–5). Petals 4. Stamens 4. Fruit ovoid to elongate-ovoid, 2½–3¼ by 1½–2 cm; persistent disk prominent, bulging; sepals prominent.

Distr. *Malesia:* Sumatra (incl. Simalur I.), W. Java, Borneo, NE. Celebes, Moluccas (Ambon, Ceram). Fig. 5.

Ecol. Common in primary lowland and mossy forest, up to 1800 m. *Fl.* April–Aug., *fr.* June–March.

Galls. This variety is very prone to fruit galls and the largest ones in the genus (over 1½ cm ∅) occur here.

Vern. Sumatra: *ahĕlât, awa ahĕlat uding, awa ĕnti, awa simangurach, tutun simangurah,* Simalur I.; *bung, mĕdang tima, tanah,* Bencoolen. Borneo: *mĕdang aima.* Moluccas: *soya.*

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

e. *var.* clarkeana (KING) DANSER, Blumea 1 (1934) 62; MATTHEW, Blumea 23 (1976) 72. — *M. clarkeana* KING, *incl. var. macrophylla* KING — *M. korthalsiana* WANGERIN *var. macrophylla* WANGERIN — *Vitex premnoides* ELMER — *M. premnoides* HALL. *f.* — *M. trichotoma* BL. *var. tenuis* DANSER.

Branchlets slender, grey, subglabrous. Leaves oblong to elliptic-oblong, 5–12(–18) by 2–4(–8½) cm, coriaceous; base cuneate to obtuse; apex acute to acuminate; nerves 5–7 pairs, seldom arcuate; petiole 1–1½ cm, slender. Inflorescence up to 10 cm, compact, branched 3(–4) times, often terminating in a dichasium. Sepals 4. Petals 4. Stamens 4. Fruit ovoid, 1½–2 by ½–1 cm; persistent disk inconspicuous; sepals prominent.

Distr. Peninsular Thailand (Pattani) and *Malesia:* Sumatra, Banka, Malay Peninsula, Borneo, Philippines (Mindanao). Fig. 5.

Ecol. Primary forest, from low altitude to 1100 m. *Fl.* Jan.–Aug., *fr.* July–Febr. Galls occur on stem and fruit.

Vern. Philippines: *lamog.*

4. Mastixia eugenioides MATTHEW, Blumea 23 (1976) 73.

Tree up to 30 m; d.b.h. up to 30 cm; branchlets stout, opposite, glabrous. *Leaves* opposite, elliptic to oblong-elliptic, 4–12 by 2–5½ cm, thick-coriaceous, glabrous; base cuneate; apex acuminate to caudate; nerves 5–7 pairs, prominent beneath, with intermediary ones and distinct veins; petiole 1½–2½ cm, stout. *Inflorescence* up to 8 cm, rather stout and compact, glabrous, up to 4 times branched, at times terminating in a dichasium; branches of the first order opposite; higher order bracts triangular, under 3 mm; lower bracts lanceolate, up to 5 mm, all glabrous. Submature flower bud 2 mm ∅. *Sepals* 4, broader than long,

thick, glabrous. *Petals* 4, thin, glabrous outside. *Stamens* 4. *Ovary* glabrous. *Fruit* (unripe) ovoid, $2^1/_2$ by $1^1/_2$ cm; persistent disk and sepals inconspicuous.

Distr. *Malesia:* Borneo (Sarawak, Brunei). Fig. 4.

Ecol. Primary (often Dipterocarp) lowland forests, up to 400 m. *Fl.* July–Aug., *fr.* Sept.

Notes. 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 intermediary veins, and fruits of different shape with thick pericarp, make this species quite distinct.

All the 9 collections are from a restricted area.

5. Mastixia rostrata BL. Mus. Bot. 1 (1850) 258; MIQ. Fl. Ind. Bat. 1, 1 (1856) 773, (1858) 1095; K. & V. Bijdr. 5 (1900) 92; WANGERIN, Pfl. Reich Heft 41⁴ (1910) 22; KOORD. Atlas 1 (1913) t. 191; DANSER, Blumea 1 (1934) 52; BURK. Dict. (1935) 1428; DOCT.V.LEEUWEN, Ned. Kruidk. Arch. 51 (1941) 207; BACK. & BAKH. *f.* Fl. Java 2 (1965) 159; MEIJER, Bot. News Bull. Sandakan 8 (1976) 65; MATTHEW, Blumea 23 (1976) 73. — *M. junghuhniana* MIQ. Fl. Ind. Bat. 1, 1 (1856) 772. — *M. margarethae* WANGERIN in Fedde, Rep. 4 (1907) 335; Pfl. Reich Heft 41⁴ (1910) 21. — *M. cuspidata* BL. *var. margarethae* HALL. *f.* Beih. Bot. Centralbl. 34, 2 (1916) 41. — *M. caudatifolia* MERR. Pl. Elm. Born. (1929) 233.

Tree up to 30 m; d.b.h. up to 50 cm; branchlets slender, (sub)opposite or scattered, glabrous. *Leaves* (sub)opposite or scattered, elliptic to oblong-elliptic, 4–10 by 2–5 cm, chartaceous to subcoriaceous, glabrous; base cuneate; apex caudate over 1 cm; nerves 4–6 pairs, prominulous beneath; veins obscure; petiole 1–$2^1/_2$ cm, slender. *Inflorescence* up to 6 cm, slender, compact or lax, subglabrous, up to 4 times branched, branches of the first order (sub)opposite or scattered; bracts triangular, under 3 mm, glabrous. Submature flower bud 1–$2^1/_2$ mm ∅. *Sepals* 4, broader than long, thin, glabrous. *Petals* 4, glabrous outside. *Stamens* 4. *Ovary* glabrous. *Fruit* ovoid to oblong, $1^1/_2$–3 by $^3/_4$–1 cm, persistent disk prominent or inconspicuous, sepals inconspicuous.

Distr. *Malesia:* Sumatra, Banka, Java, Borneo, Lesser Sunda Is. (Sumbawa, Flores). Fig. 4.

KEY TO THE SUBSPECIES

1. Submature flower bud $2^1/_2$ mm ∅. Inflorescence compact, branches of the first order (sub)opposite. Leaves (sub)opposite. Galls absent **a. *ssp.* rostrata**
1. Submature flower bud 1 mm ∅. Inflorescence lax, branches of the first order scattered. Leaves scattered. Galls frequent. **. b. *ssp.* caudatifolia**

a. *ssp.* rostrata — *M. junghuhniana* MIQ.

Branchlets (sub)opposite. Leaves (sub)opposite, less often scattered; petiole $1^1/_2$–2 cm. Inflorescence compact, generally under 4 cm, glabrous; primary branches (sub)opposite. Submature flower bud $2^1/_2$ mm ∅.

Distr. *Malesia:* West & Central Java, Lesser Sunda Is. (Sumbawa, Flores). Fig. 4.

Ecol. Moist forest, from low altitude up to 1400 m. *Fl.* March, very fragrant, *fr.* May–July. Galls absent. Ripe fruit dark blue.

Vern. Java: *daun kaju tèndjo, daun kitadjas, huru gading, kilburoy, kilèjas, kitèndjo, kitindjo, lalakina, tjangkar.* Flores: *bumis, rau, tapaäeke.*

Notes. Specimens from the Lesser Sunda Is. have larger leaves than those from Java.

The reference in KANJILAL & DAS (Fl. Assam 2, 1938, 371) to this species seems erroneous, as it does not occur on the Asian continent. If the statement "stamens 3" is correct, the plant can even not belong to *Mastixia*.

b. *ssp.* caudatifolia (MERR.) MATTHEW, Blumea 23 (1976) 74. — *M. margarethae* WANGERIN — *M. caudatifolia* MERR. — Fig. 3f (galls).

Branchlets scattered. Leaves scattered; petiole up to $1^1/_2$ cm. Inflorescence very lax, up to 6 cm, puberulous at the nodes; primary branches scattered. Submature flower bud 1 mm ∅.

Distr. *Malesia:* northern half of Sumatra, Banka, Borneo. Fig. 4.

Ecol. Primary forest, from the lowland up to 1600 m. *Fl.* June–Oct., *fr.* Aug.–March. Globose to elongate galls are common, specially those on fruits. Sometimes they resemble a legume and can be up to $3^1/_2$ cm long.

Vern. Borneo: *patoli entelit*, Iban lang.

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

2. Series Alternae

MATTHEW, Blumea 23 (1976) 75.

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

Distr. Ceylon and continental Asia; through *Malesia*, but absent in New Guinea and Solomon Is.

6. Mastixia macrocarpa MATTHEW, Blumea 23 (1976) 75.

Tree up to 21 m; d.b.h. up to 20 cm; branchlets stout, scattered, woolly. *Leaves* scattered, elliptic-oblong to oblong, 13–30 by $5^1/_2$–15 cm, subcoriaceous, villous, especially below; base cuneate, at times slightly oblique; apex acuminate; nerves 7–10 pairs, prominent below, villous; veins prominulous, puberulous to villous; petiole 4–7 cm, stout, woolly. *Inflorescence* up to 9 cm, stout, woolly, branched up to 4 times; branches of the first order scattered; bracts triangular to lanceolate, up to 8 mm, densely woolly. Submature flower bud 4 mm ∅. *Sepals* 5, broader than long, villous. *Petals* 5, velvety outside. *Stamens* 5. Ovary densely villous. *Fruit* oblong-ovoid, 4–$4^1/_2$ by 2 cm; persistent disk inconspicuous, sepals prominent, up to 5 mm.

Distr. *Malesia:* Borneo (Sarawak), Philippines (Luzon); 2 collections. Fig. 6.

Ecol. Lowland forest. *Fl.* Oct., *fr.* June. Sticky resin on the branches; fruits very pale green.

Note. Leaves and fruits are the largest known in the genus; lenticels up to 3 by 1 mm; leaf scars up

to 4 by 4 mm; peduncles of terminal cymes up to 6 mm; pedicels 2 mm; sepals 2 mm broad at the base; filaments 3 mm; anthers $1^1/_2$ mm; receptacle $3–3^1/_2$ by 2 mm; style 4 mm; stigma 5-lobed, appearing bifid.

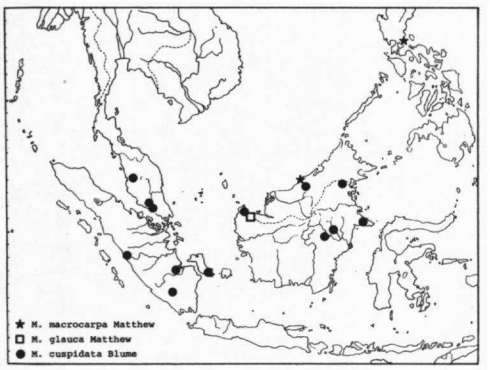

Fig. 6. Localities of three species of *Mastixia*.

7. Mastixia glauca MATTHEW, Blumea 23 (1976) 76.

Tree up to 15 m; branchlets stout, scattered, glabrous. *Leaves* scattered, obovate, 7–16 by $4^1/_2–8^1/_2$ cm, thick-coriaceous, glaucous and waxy below, glabrous; base obtuse; apex apiculate; nerves 4–5 pairs, with intermediary ones, all obscure; veins obscure; petiole $2–3^1/_2$ cm, stout, glabrous. *Inflorescence* up to 5 cm, rather stout and compact, subglabrous to sparsely puberulous, branched up to 5 times; branches of the first order scattered; bracts triangular, under 3 mm. Submature flower bud 3 mm ø. *Sepals* 4(–5), as long as broad, sparsely puberulous. *Petals* 4(–5), thick, appressed-hairy outside. *Stamens* 4(–5). *Ovary* sparsely puberulous.

Distr. *Malesia:* Borneo (Sarawak: Mt Santubong), 3 collections Fig. 6.

Ecol. Lowland forest. *Fl.* April–May.

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

8. Mastixia tetrapetala MERR. Philip. J. Sc. 13 (1918) Bot. 42; En. Philip. 3 (1923) 242; MATTHEW, Blumea 23 (1976) 76, f. 5 (map). — *M. pachyphylla* MERR. Philip. J. Sc. 13 (1918) Bot. 325; En. Philip. 3 (1923) 241. — *M. crassifolia* MERR. Philip. J. Sc. 26 (1925) 486.

Tree up to 8(–15) m; branchlets very stout, scattered to subopposite, subglabrous. *Leaves* scattered to subopposite, crowded at apices of branchlets, obovate to oblanceolate, 5–15 by 2–7 cm, thick coriaceous, glabrous; base cuneate; apex acute to acuminate; nerves 6–8(–12) pairs, usually prominent below; veins prominulous below; petiole $1–2^1/_2$ cm, stout, glabrous. *Inflorescence* up to 3–(6) cm, stout, very compact, puberulous to villous, 2(–3) times branched; branches of the first order scattered; higher order bracts triangular, under 3 mm; lower ones lanceolate up to 5 mm, puberulous. Submature flower bud 5 mm ø. *Sepals* 4, broader than long, glabrous to appressed-hairy. *Petals* 4, thick, glabrous to appressed-hairy. *Stamens* 4. *Ovary* glabrous to appressed-hairy. *Fruit* ellipsoid, 2–3 by $1^1/_4–1^1/_2$ cm; persistent disk and sepals inconspicuous.

Distr. *Malesia:* Philippines (Luzon, Catanduanes), 7 collections.

Ecol. Primary forest, from low altitude up to 2300 m. *Fl.* Febr.–March, *fr.* Sept.–Febr.

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.

The species is quite distinct and stands rather isolated from others in the stoutness of parts, the large, 4-merous 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* 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*.

9. Mastixia cuspidata BL. Mus. Bot. 1 (1850) 256; MIQ. Fl. Ind. Bat. 1, 1 (1856) 772; HALL. *f.* Beih. Bot. Centralbl. 34, 2 (1916) 41; DANSER, Blumea 1 (1934) 55, *excl. var. margarethae*; MATTHEW, Blumea 23 (1976) 79. — *M. pentandra* BL. *var. cuspidata* MIQ. Fl. Ind. Bat. 1, 1 (1858) 1095; WANGERIN, Pfl. Reich Heft 41^4 (1910) 26. — *M. bracteata* CLARKE, Fl. Br. Ind. 2 (1879) 746; KING, J. As. Soc. Beng. 71, ii (1902) 73; WANGERIN, Pfl. Reich Heft 41^4 (1910) 26, f. 1 G-K, N-O; DANSER, Blumea 1 (1934) 54.

Tree up to 24 m; d.b.h. up to 40 cm; branchlets very slender, scattered, subglabrous. *Leaves* scattered, obovate, elliptic or oblong, 4–12(–16) by 2–4(–6) cm, subcoriaceous, glabrous; base cuneate; apex abruptly cuspidate (over 1 cm), oblique; nerves 4 (or 5) pairs, arcuate, impressed above; veins obscure; petiole $1–1^1/_4$ cm, slender. *Inflorescence* up to 4 cm, rather slender, subglabrous to puberulous, 2(–3) times branched; branches of the first order scattered; higher order bracts subulate, lower ones foliaceous, over 10 mm, passing into foliage leaves. Submature flower bud 3 mm ø. *Sepals* 5, broader than long, subglabrous. *Petals* 5, thick, densely appressed-hairy outside. *Stamens* 5. *Ovary* densely appressed silky-hairy. *Fruit* oblong, $1^1/_2–2$ by $^3/_4–1$ cm; persistent disk and sepals inconspicuous.

Distr. *Malesia:* Sumatra, Banka, Malay Pensinula, Borneo. Fig. 6.

Ecol. Primary and secondary forests, from low altitude up to 900 m.

Vern. Sumatra: *bĕbung*, *kundur*. Banka: *mĕnkapas*. Malay Peninsula: *dadaru*. Borneo: *biansugunong*, Sarawak.

10. Mastixia pentandra BL. Bijdr. (1826) 654; DC. Prod. 4 (1830) 275; BL. Mus. Bot. 1 (1850) 256; MIQ. Fl. Ind. Bat. 1, 1 (1856) 771, (1858) 1095;

K. & V. Bijdr. 5 (1900) 88; MERR. Philip. J. Sc. 1 (1906) Suppl. 111; DANSER, Blumea 1 (1934) 49; BACK. & BAKH. *f.* Fl. Java 2 (1965) 159; MATTHEW, Blumea 23 (1976) 80, f. 5 (map), 6. — *M. arborea* [*non* (WIGHT) BEDD.] CLARKE, Fl. Br. Ind. 2 (1879) 745, *p.p.*; KANJILAL & DAS, Fl. Assam 2 (1938) 370; HUNDLEY & CHIT, Trees Shr. Burma ed. 3 (1961) 119. — *M. cambodiana* PIERRE, Fl. Coch. (1892) t. 260 B; WANGERIN, Pfl. Reich Heft 41⁴ (1910) 29; ÉVRARD, Fl. Gén. I.-C. 2 (1923) 1195. — *M. scortechinii* KING, J. As. Soc. Beng. 71, ii (1902) 73; WANGERIN, Pfl. Reich Heft 41⁴ (1910) 27, f. 1 L-M; DANSER, Blumea 1 (1934) 56. — *M. philippinensis* WANGERIN in Fedde, Rep. 10 (1912) 273; MERR. En. Philip. 3 (1923) 241; CHAO, Taiwania 5 (1954) 94, 99, f. 37; LI & CHAO, Quart. J. Taiwan Mus. 7 (1954) 124, f. 19. — *M. parvifolia* HALL. *f.* Beih. Bot. Centralbl. 34, 2 (1916) 41; DANSER, Blumea 1 (1934) 51. — *M. subcaudata* MERR. Philip. J. Sc. 13 (1918) 43; En. Philip. 3 (1923) 242. — *M. megacarpa* RIDL. Fl. Mal. Pen. 1 (1922) 891. — *M. chinensis* MERR. Sunyatsenia 3 (1937) 256; LI, Taiwania 1 (1938) 94. — *M. alternifolia* MERR. & CHUN, Sunyatsenia 5 (1940) 153. — *M. poilanei* TARDIEU, Fl. Camb. Laos & Vietnam 8 (1968) 16. — **Fig. 3c–e** (galls).

Tree up to 37 m; d.b.h. up to 75 cm; branchlets slender or stout, scattered, subglabrous to puberulous. *Leaves* scattered, obovate, elliptic to oblong-elliptic, 4–16 by 2–8 cm, chartaceous to thick-coriaceous, subglabrous; base cuneate to attenuate; apex acute or acuminate to caudate; nerves 4–7(–9) pairs, distinct below; veins distinct below; petiole stout or slender, 1–4 cm. *Inflorescence* up to 8 cm, slender or stout, subglabrous to densely appressed-hairy, up to 3(–4) times branched; 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 leaves. Submature flower bud up to $3^1/_2$ mm ∅. *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* 4–5. *Ovary* puberulous to appressed-hairy. *Fruit* ovoid to oblong, $2^1/_4$–$3^1/_2$ by 1–$1^1/_4$ cm; persistent disk conspicuous or not; sepals inconspicuous.

Distr. Continental SE. Asia (NE. India, Bhutan, Burma, Thailand, Tonkin, S. Yunnan) and throughout *Malesia*; not yet recorded from the Lesser Sunda Is. and New Guinea.

KEY TO THE SUBSPECIES

1. Flowers basically 4-merous. Inflorescence stout, rusty-puberulous. Corolla glabrous outside. Leaves obovate, coriaceous; apex acute; base attenuate . . . . . **b. *ssp.* moluccana**
1. Flowers basically 5-merous.
2. Leaves up to 8–20 by 4–8 cm; nerves 6 or more pairs; veins distinct beneath. Fruit ovoid.
3. Basal bracts lanceolate, up to 15 mm. Fruit larger than 3 by $1^1/_4$ cm . **a. *ssp.* pentandra**
3. All bracts triangular, under 3 mm. Fruit up to $2^1/_2$ by 1 cm . . . . . **c. *ssp.* chinensis**
2. Leaves up to 4–12 by $1^1/_2$–5 cm; nerves up to 6 pairs; veins obscure beneath. Fruit oblong.
4. Length of sepals up to half as long as wide. Leaves chartaceous to subcoriaceous. Fruit $2^1/_2$–3 cm long . . . . **d. *ssp.* philippinensis**
4. Length of sepals almost as long as wide. Leaves coriaceous to thick-coriaceous. Bracts uniformly triangular. Fruit $1^3/_4$–2 cm long **e. *ssp.* scortechinii**

a. *ssp.* pentandra.

Tree up to 34 m; branchlets stout. Leaves elliptic to oblong-elliptic, 8–16 by 4–8 cm, coriaceous; base cuneate; apex acuminate; nerves 6–7(–9) pairs; veins distinct below; petiole stout, 2–4 cm. Inflorescence up to 8 cm, stout, densely appressed-hairy; basal bracts lanceolate, up to 15 mm. Sepals 5, broader than long. Petals 5, appressed-hairy outside. Stamens 5. Fruit ovoid, 3–$3^1/_2$ by $1^1/_4$–$1^1/_2$ cm.

Distr. *Malesia:* West & East Java.

Ecol. In humid, mixed forest, 400–500 m. *Fl.* July–Dec.

Vern. Java: *huru lilin, tenjau.*

b. *ssp.* moluccana MATTHEW, Blumea 23 (1976) 81.

Tree up to 15 m; d.b.h. 20 cm; branchlets stout. Leaves obovate, 8–15 by 3–8 cm, coriaceous; base attenuate; apex acute; nerves 5–6 pairs; veins distinct below; petiole stout, $2^1/_2$–3 cm. Inflorescence up to 5 cm, stout, rusty puberulous; basal bracts up to 4 mm. Sepals 4(–5), broader than long. Petals 4(–5), glabrous outside. Stamens 4(–5). Fruit (immature) ovoid, $1^1/_4$ by $^3/_4$ cm.

Distr. *Malesia:* Moluccas (Morotai).

Ecol. Mixed rain-forest, up to 1000 m. *Fl.* May. Once a leaf-gall was noted.

Notes. The basal pair of lateral inflorescence branches often occur in 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 by 3 mm; filaments 3 mm; anther 1 mm; style $1^1/_2$ mm. The only fruit seen is detached and immature.

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

The soft, coriaceous texture of the leaves, dark above, and pale below, the stout inflorescence with rusty indumentum and the few, large, 4-merous flowers with glabrous dome-shaped corolla (in bud) distinguish this subspecies from the others. It is yet only known from Morotai I.

c. *ssp.* chinensis (MERR.) MATTHEW, Blumea 23 (1976) 83. — *M. chinensis* MERR. — **Fig. 3c** (galls).

Tree up to 20 m; branchlets stout. Leaves elliptic to elliptic-oblanceolate, 8–20 by 4–8 cm, coriaceous; base attenuate; apex acute; nerves 6–8 pairs; veins distinct below; petiole stout, $1^3/_4$–$2^1/_2$ cm. 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–$2^1/_2$ by 1 cm.

Distr. NE. India, Bhutan, N. Burma, Thailand, S. China (Yunnan), Tonkin; in *Malesia:* Malay Peninsula (Kedah, once).

Ecol. Mixed forests up to 1900 m. *Fl.* May–June, *fr.* Aug.–May. In India galls and domatia occur.

d. *ssp.* philippinensis (WANGERIN) MATTHEW, Blumea 23 (1976) 85. — *M. philippinensis* WANGERIN —*M. subcaudata* MERR. — Fig. 3d–e (galls).

Tree up to 22½ m; brachlets slender. Leaves obovate to elliptic, 4–12 by 1½–5 cm, chartaceous to subcoriaceous; base attenuate; apex acuminate; nerves 4–6 pairs; veins obscure beneath; petiole slender, 1–2 cm. Inflorescence up to 7 cm, slender, subglabrous to puberulous; all bracts triangular, under 3 mm. Sepals (4–)5, broader than long. Petals (4–)5, glabrous to appressed-hairy outside. Stamens (4–)5. Fruit oblong, 2½–3 by 1¼–1½ cm.

Distr. *Malesia:* throughout the Philippines.

Ecol. In forests, from low altitude up to 1350 m. *Fl.* May–Sept., *fr.* Jan.–Dec. Galls are rather frequent on stem, leaf and fruit.

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

e. *ssp.* scortechinii (KING) MATTHEW, Blumea 23 (1976) 86. — *M. scortechinii* KING — *M. megacarpa* RIDL. — *M. parvifolia* HALL. *f.*

Tree up to 37 m; branchlets stout. Leaves obovate to oblong, 4–12(–15) by 3–5(–6) cm, thick-coriaceous; base cuneate to attenuate; apex acute to acuminate; nerves 4–6 pairs; veins obscure beneath; petiole stout, 1½–2½ cm. Inflorescence up to 8 cm, stout, puberulous to villous; all bracts triangular, under 3 mm. Sepals (4–)5, as long as broad. Petals (4–)5. Stamens (4–)5. Fruit oblong, 2¼–2½ by 1¾–2 cm.

Distr. Thailand (once); in *Malesia:* S. Sumatra, Banka, Malay Peninsula, Borneo, Celebes.

Ecol. Primary forests, from low altitude up to 2400 m. *Fl. fr.* Jan.–Dec. Inflorences and fruit galls occur.

Vern. Malaya: *mĕdang pisang.* Banka: *mĕnkapas.* Borneo: *kaju wulu, mĕdang surugan.*

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

Excluded

Mastixia cuneata BL. Mus. Bot. Lugd. Bat. 1 (1850) 257 = *Notaphoebe umbelliflora* (BL.) BL. *Cf.* HALL. f. Beih. Bot. Centralbl. 34, 2 (1916) 42; DANSER, Blumea 1 (1934) 68.

Mastixia gracilis KING, J. As. Soc. Beng. 74, ii (1902) 73; WANGERIN, Pfl. Reich Heft 41⁴ (1910) 28; DANSER, Blumea 1 (1934) 68; MATTHEW, Blumea 23 (1976) 90 = *Vaccinium bancanum* MIQ. *var. tenuinervium* J. J. S. (*Ericaceae*), according to the type number WRAY 1528 mentioned by SLEUMER, Blumea 11 (1961) 76. — Ed.

Mastixia heterophylla BL. Mus. Bot. Lugd. Bat. 1 (1850) 257; WANGERIN, Pfl. Reich Heft 41⁴ (1910) 28; DANSER, Blumea 1 (1934) 69; MATTHEW, Blumea 23 (1976) 90. — HALLIER *f.* suggested this to be *Gomphandra capitulata* BECC., but this was questioned by SLEUMER, Blumea 17 (1969) 193. According to us this sterile sheet (L 901, 169-350) collected by PRAETORIUS in Palembang, is not a *Mastixia* but we cannot give a proper identification.

Mastixia tetrandra (THW.) CLARKE. — DANSER, Blumea 1 (1934) 56, referred two Sumatran specimens to this species, which is hitherto only found in Ceylon and the Andaman Is. One of these is sterile and the other is in bud; they can equally well be referred to *M. rostrata ssp. rostrata*, and their identification remains doubtful. *Cf.* MATTHEW, Blumea 23 (1976) 77.

Excluded

Cornus caudata HASSK. & ZOLL., *nom. illeg.*, *C. ilicifolia* (BL.) HASSK. & ZOLL., *C. serrulata* (BL.) HASSK. & ZOLL., and *C. stricta* ZOLL. & MOR. are all combinations or names made by HASSKARL and ZOLLINGER based on *Polyosma* BL., because of their opinion that this genus of the *Saxifragaceae* would be synonymous with *Cornus* L. *Cf.* HASSKARL, Cat. Hort. Bog. (1844) 168 and ZOLLINGER, Natuur- & Geneesk. Arch. Neêrl. Ind. 2 (1845) 10.