

Malayan Forest Records No. 49
Series II: Seed Plants, Volume 7

Flora of Peninsular Malaysia

Edited by
R. Kiew
R.C.K. Chung
L.G. Saw
E. Soepadmo

**FLORA
OF
PENINSULAR MALAYSIA**

Series II: Seed Plants

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Forest Research Institute Malaysia
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NYSSACEAE

R.C.K. Chung

Forest Research Institute Malaysia,
Kepong, Malaysia

Juss. ex Dumort., Anal. Fam. Pl. (1829) 13, *nom. cons.*; Hutchinson, Fam. Flow. Pl. 1, 2nd ed. (1959) 175, Gen. Flow. Pl. 2 (1967) 50; Backer & Bakhuizen *f.*, Fl. Java 2 (1965) 161; Kochummen, Tr. Fl. Malaya 1 (1972) 346; Yii, Tr. Fl. Sabah & Sarawak 1 (1995) 253; Mabberley, Pl. Book, 4th ed. (2017) 638. **Synonyms:** Cornaceae subfam. *Nyssonioideae* Arn., Encycl. Brit. (1832) 128; Brummitt *in* Heywood *et al.*, Flow. Pl. Fam. World (2007) 112; Mastixiaceae Calest., Webbia 1 (1905) 94; Harwood & Chayamarit, Fl. Thailand 10 (2010) 231.

Tree or shrubs. **Stipules** *absent*. **Leaves** *simple*, opposite, subopposite, alternate or spirally arranged, usually entire or rarely serrate or dentate, pinnately veined, usually petiolate. **Inflorescences** many-flowered thyrsoid panicles, heads or few-flowered racemes. **Flowers** usually unisexual, or bisexual, *actinomorphic or nearly so*, 4- or usually 5-merous; calyx 4–5(–10)-lobed or toothed or absent; petals free, valvate or imbricate, apex inflexed, reduced or lacking in female flowers; stamens as many as and alternating with petals, or in 2 isomerous whorls, mostly attached to the edge of an epigynous nectary, filaments free, anthers dorsifixed, 2-locular, dehiscing lengthwise; nectary large, cushion-shaped at top of the ovary, generally persistent in fruit (or absent); ovary *inferior*, 1–4-locular, ovule one in each locule, pendulous, style simple or lobed, or with 2–3 style arms. **Fruit** *a drupe*. **Seed** 1, rarely 2–4, with small elongate embryo embedded in copious oily endosperm.

Distribution. Five genera (*Camptotheca* Decne., *Davidia* Baillon, *Diplopanax* Hand.-Mazz., *Mastixia* and *Nyssa*) and 31 species in Sri Lanka, India, China (Yunnan and Hainan), Myanmar, Thailand, Indo-China, Malesia, SE North America, and C America. In Peninsular Malaysia, represented by *Mastixia* and *Nyssa* with four and one species, respectively.

Ecology. The flowers of Nyssaceae typically produce nectar and attract bees, flies and beetles (Eyde, Bot. Rev. 54 (1988) 233). The drupes are dispersed by birds and mammals (Kubitzki, Fam. Gen. Vasc. Pl. 6 (2004) 84). The drupes of several species of *Nyssa* float well and are probably, at least partly, dispersed by water.

Uses. It is used for timber (*Mastixia*, *Nyssa* and *Diplopanax stachyantus* Hand.-Mazz. of S China and N Vietnam), medicine (*Camptotheca*) and cultivated ornamental trees and shrubs in temperate countries (*Davidia*, *Nyssa* and *D. stachyantus*) (Xiang *et al.*, Fl China 14 (2005) 231; Mabberley, 2017).

Taxonomy. The monophyly of Cornaceae, as broadly defined (i.e., including Nyssaceae and Alangiaceae), is supported by morphology as well as *matK* and *rbcL* sequences (Xiang *et al.*, Amer. J. Bot. 85 (1998) 285). Intrafamilial relationships have been investigated by Eyde (Bot. Rev. 54 (1988) 233), Murrell (Syst. Bot. 18 (1993) 469), and Xiang *et al.* (Ann. Missouri Bot.

Gard. 80 (1993) 723, Syst. Bot. 21 (1996) 515, Amer. J. Bot. 85 (1998) 285, Mol. Phylogenet. Evol. 24 (2002) 35, Taxon 55 (2006) 9, Mol. Phylogenet. Evol. 50 (2011) 123). Two major clades can be recognised within Cornaceae: a cornoid clade (*Cornus* L. and *Alangium* Lam.) with usually bisexual, 4-merous flowers; and a nyssoide-mastixioid clade (*Nyssa*, *Mastixia*, *Camptotheca*, *Davidia* and *Diplopanax*) usually with unisexual, 5-merous flowers.

Kubitzki (2004) recognised a broader circumscription of the family concept of Cornaceae that included *Camptotheca*, *Cornus* Tourn. ex L., *Davidia*, *Diplopanax*, *Mastixia*, Alangiaceae and Nyssaceae, while Brummitt (2007) recognised three subfamilies under Cornaceae: subfam. Cornoideae (only *Cornus*), subfam. Nyssoideae (including the genera of the nyssoide-mastixioid clade), and subfam. Alangioideae (comprising *Alangium* only). Recently, APG (Bot. J. Linn. Soc. 181 (2016) 1) in its update of APG IV and Mabberley (2017) accept Nyssaceae (*Camptotheca*, *Davidia*, *Diplopanax*, *Mastixia* and *Nyssa*) as a family separate from Cornaceae based on the molecular studies of Xiang *et al.* (Mol. Phylogenet. Evol. 50 (2011) 123). Many Nyssaceae are recognisable by the combination of alternate or spirally arranged leaves, 4–10 short petals with an inflexed apex, 8–26 stamens usually arranged in two whorls, uniloculate ovary and a 1-seeded drupes with germination valves. The circumscription of Nyssaceae by APG (2016) and Mabberley (2017) is followed here.

Key to genera

Leaves alternate or opposite. Inflorescences paniculate. Flowers bisexual; stamens as many as petals; petals valvate.....**1. Mastixia**

Leaves spirally arranged. Inflorescences of heads or condensed racemes. Flowers unisexual or bisexual; stamens often more numerous than petals; petals imbricate.....**2. Nyssa**

1. MASTIXIA Blume

(Greek, *mastix* = whip; referring to the whiplike apex of the petals)

tetebu, *tebu-tebu* (Malay)

Bijdr. Fl. Ned. Ind. (1825) 654, Mus. Bot. Lugd. Bat. 1 (1850) 256; Bentham & Hooker *f.*, Gen. Pl. 1 (1867) 950; Hooker *f.*, Fl. Brit. India 2 (1879) 745; King, J. As. Soc. Beng. 71, 2 (1902) 72; Ridley, Fl. Malay Pen. 1 (1922) 889; Danser, Blumea 1 (1934) 47; Backer & Bakhuizen *f.*, Fl. Java 2 (1965) 159; Hutchinson, Gen. Fl. Pl. 2 (1967) 45; Matthew, Blumea 23 (1976) 51, Fl. Malesiana 1, 8 (1977) 85; Kochummen, Tr. Fl. Malaya 3 (1978) 53, Tr. Fl. Pasoh For. (1997) 174; Chung, Tr. Fl. Sabah & Sarawak 1 (1995) 200, Field Guide For. Tr. Brunei 1 (2003) 190; Kubitzki, Fam. Gen. Vasc. Pl. 6 (2004) 87; Harwood & Chayamarit, Fl. Thailand 10 (2010) 231.

Trees; bole usually without buttresses. **Bark** grey to grey-brown, smooth with horizontal rings, rarely cracked to shallowly fissured, often exuding white resin when cut; inner bark orange-yellow, gritty, granular, *with a strong smell of sugarcane*. **Sapwood** soft, yellowish white or white. **Leaves** *alternate, subopposite or opposite*, margin entire; midrib sunken above, prominent beneath; lateral veins usually distinct beneath. **Inflorescences** terminal or sometimes axillary *panicles*. **Flowers** *bisexual*, in triads, sessile, subtended by tiny, persistent bracts; calyx tube obconical or barrel-shaped or cup-shaped, lobes spreading or not, broader

than long or sometimes appearing as minute sharp tips, *persistent in fruit*; petals thick, concave, *valvate* in bud, apex inflexed and strongly connate in the upper parts; stamens *as many as petals*, in 1 or 2 whorls, attached below the nectary, abutting on and alternating with nectary lobes, opposite the calyx lobes, filaments subulate, flattened and tapered toward the upper part, anthers cordate, introrse-latrorse; ovary turbinate, one-locular, surmounted by a fleshy, lobed and grooved nectary that is sometimes persistent in fruit, style very short, stout, ribbed, stigma punctiform, sometimes bifid or 4–5-lobed, reflexed, persistent in fruit. **Drupes** ovoid, ellipsoid or oblong, *surmounted by calyx tube and crowned by the persistent nectary* (the exposed part of the fruit); fruit wall formed by calyx tube and pericarp (exocarp and mesocarp), thin or thick, ripening dark purple or blue; endocarp woody. **Seed** 1, ovoid or ellipsoid, testa membranous; endosperm large and V-shaped in transverse section; embryo small and straight, cotyledons thin and foliaceous.

Distribution. Nineteen species from Sri Lanka, NE India and the western Ghats, Myanmar, Thailand, Indo-China, China (S Yunnan and Hainan) through Malesia to New Britain and the Solomon Islands. Four species occur in Peninsular Malaysia.

Ecology. In primary and secondary forests. In Peninsular Malaysia found in lowland dipterocarp to montane forests, often in moist habitats, from sea-level to 2200 m.

Uses. Although the trees may reach a considerable size, their scattered occurrence precludes their general use as timber. In addition, the timber is moderately strong and has little commercial value. Therefore, it is only used for packing cases or temporary construction (Chung, PROSEA 5, 3 (1998) 357).

Taxonomy. Wangerin (Pfl. Reich. 41 (1910) 19) distinguished two subgenera, *viz. Tetramastixia* and *Pentamastixia*. Matthew (1976, 1977), on the other hand, established two subgenera, *Manglesia* (2 species) and *Mastixia* (11 species). He recognised two series, the *Oppositae* and *Alternae* within subgenus *Mastixia* based on a single character, *viz.* whether the first branches of the inflorescence are opposite (or subopposite) or alternate.

Kochummen (1978) noted that in the absence of flowers and fruits, the presence of resin in the bole and on the cut ends of logs, means that the genus can easily be confused with some species of the Dipterocarpaceae that have smooth or cracked bark, such as *Vatica* species. However, in *Mastixia* the inner bark is thick and gritty with a strong smell of sugarcane and the wood is soft. Foresters sometimes confuse this genus with those of the Lauraceae (*medang*) because of the gritty inner bark and strong aromatic smell, but *medang* has no resin.

Key to *Mastixia* species

1. Leaves always opposite.....**4. M. trichotoma**
 Leaves alternate or spiral, only sometimes (sub)opposite but then never exclusively so...2
2. Leaves thickly coriaceous; margin recurved; apex acute to acuminate, only sometimes caudate but then never exclusively so; petioles stout, (1–)1.5–2 mm thick.....
**2. M. pentandra**
 Leaves chartaceous or thinly coriaceous; margin not recurved; apex cuspidate or caudate with acumen to 1.5 cm long; petioles slender, 0.4–0.8(–1) mm thick.....3

3. Lateral veins looping near the leaf margin. Flowers 5-merous; calyx tube and petals densely silky hairy outside..... **1. *M. cuspidata***
 Lateral veins not looping near the leaf margin. Flower 4-merous; calyx tube and petals glabrous outside..... **3. *M. rostrata*** (subsp. *caudatifolia*)

1. *Mastixia cuspidata* Blume

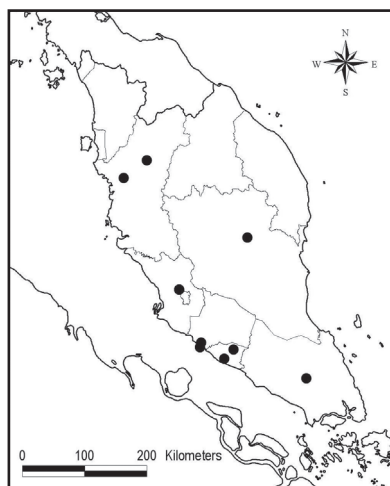
Map 1

(Latin, *cuspidatus* = sharp-pointed; referring to the leaf apex)

Mus. Bot. Lugd. Bat. 1 (1850) 256; Miquel, Fl. Ind. Bat. 1, 1 (1856) 772; Danser, Blumea 1 (1934) 55; Matthew, Blumea 23 (1976) 79, Fl. Malesiana 1, 8 (1977) 95; Kochummen, Tr. Fl. Malaya 3 (1978) 54; Chung, Tr. Fl. Sabah & Sarawak 1 (1995) 201. **Type:** *Korthals s.n.*, Sumatra, W Coast (lectotype L [acc. no. 901.169.373]; isolectotype U). **Synonym:** *Mastixia bracteata* C.B. Clarke, Fl. Brit. India 2 (1879) 746, King, J. As. Soc. Beng. 71, 2 (1902) 73, Ridley, Fl. Malay Pen. 1 (1922) 891. **Type:** *Maingay 2398* (= Kew Distr. No. 710), Peninsular Malaysia, Melaka [Malacca] (holotype K).

Big tree; bole to 40 m tall, to 40 cm diameter. **Bark** greyish to chocolate-brown, smooth to shallowly fissured; inner bark yellowish to brownish, mottled. **Sapwood** yellowish to brownish. **Twigs** subglabrous, grey-brown. **Leaves** *alternate or sometimes (sub)opposite*; petioles *slender*, 0.5–1.5 cm long, 0.4–0.8(–1) mm thick, glabrous; lamina narrowly obovate, elliptic or oblong, 3.5–9 × 1.5–3.5 cm, *thinly coriaceous*, glabrous, base cuneate, margin *not recurved*, apex *cuspidate*, acumen 0.5–1(–1.5) cm long, oblique; lateral veins (4–)5 pairs, *curving near the margin and joining with the next one to form a looped intramarginal vein*, sunken above; intercostal veins faint or inconspicuous beneath, inconspicuous above. **Inflorescences** to c. 4 cm long, subglabrous to puberulous. **Flowers** 5-merous, green to yellow; buds to 3 mm diameter; calyx tube 5-lobed, lobes broader than long, *densely silky-hairy*; petals 1.5–2 × 0.5–1 mm, *densely silky-hairy outside*; stamens 5, filaments 1–3.2 mm long; nectary yellowish. **Drupe**s greenish, ripening dark purple, oblong, 1.5–3 cm long, 0.5–1.3 cm diameter; fruit wall thin; persistent nectary exposed; persistent calyx lobes inconspicuous. **Seeds** ellipsoid, 1.5–2.5 cm long, 0.4–1 cm diameter.

Distribution. Sumatra, Banka, Peninsular Malaysia, and throughout Borneo. In Peninsular Malaysia known from Perak, Selangor, Negeri Sembilan, Melaka, Pahang and Johor.



Map 1. Distribution of *Mastixia cuspidata*.

Conservation status. Least concern (assessed by C.L. Lim).

Ecology. In primary and secondary lowland and hill dipterocarp forest, to 900 m.

Note. Sterile specimens of small-leaved *Mastixia cuspidata* are difficult to distinguish from *M. rostrata* subsp. *caudatifolia*.

2. *Mastixia pentandra* Blume

(Greek, *penta* = five, *-andros* = male; with 5 stamens)

Bijdr. Fl. Ned. Ind. (1825) 654; Hooker *f.*, Fl. Brit. India 2 (1879) 746; Danser, Blumea 1 (1934) 49; Backer & Bakhuizen *f.*, Fl. Java 2 (1965) 159; Matthew, Blumea 23 (1976) 80, Fl. Malesiana 1, 8 (1977) 95; Kochummen, Tr. Fl. Malaya 3 (1978) 53, Tr. Fl. Pasoh For. (1997) 173; Chung, Tr. Fl. Sabah & Sarawak 1 (1995) 204; Harwood & Chayamarit, Fl. Thailand 10 (2010) 233. **Type:** Blume '1486', W Java (lectotype L [acc. no. 901.169.375]; isolectotypes NY, W).

Medium-sized tree; bole to 30 m tall. **Bark** grey-brown, smooth to shallowly fissured with horizontal rings and lenticels in rows; inner bark yellowish brown to dark yellow. **Sapwood** pale yellow to brownish. **Twigs** glabrous to puberulous. **Leaves** *alternate, spiral or sometimes subopposite*; petioles *stout*, 1–4 cm long, 1–2 mm thick, glabrous; laminae obovate, oblanceolate, elliptic to oblong-elliptic, 4–20 × 2–8 cm, *thickly coriaceous* or rarely chartaceous, glabrous, base cuneate to attenuate, margin *recurved*, apex *acute or acuminate, sometimes caudate*; lateral veins 4–7(–9) pairs; intercostal veins distinct or faint beneath. **Inflorescences** to c. 8 cm long, subglabrous to densely appressed-hairy. **Flowers** 4- or 5-merous; buds to 3.5 mm diameter; calyx tube 4- or 5-lobed, lobes broader than long or as long as wide, thick, puberulous to appressed-hairy; petals 4 or 5, thick, glabrous to appressed-hairy; stamens 4 or 5; ovary puberulous to appressed-hairy. **Drupes** ovoid to oblong, 1.6–3.5 cm long, 0.8–1.2 cm diameter; persistent nectary conspicuous or not; persistent calyx lobes inconspicuous.

Vernacular name. *Medang pisang* (Malay).

Distribution. NE India, Bhutan, Myanmar, Thailand, N Vietnam, China (S Yunnan) and throughout Malesia (except Lesser Sunda Islands and New Guinea).

Taxonomy. In Matthew's treatments (1976, 1977), *Mastixia pentandra* was segregated into six subspecies, *viz. chinensis* (Merr.) K.M. Matthew, *cambodiana* (Pierre) K.M. Matthew, *moluccana* K.M. Matthew, *pentandra*, *philippinensis* (Wangerin) K.M. Matthew and *scortechinii* (King) K.M. Matthew. Of these, only subsp. *chinensis* and subsp. *scortechinii* are known from Peninsular Malaysia.

Key to subspecies

Leaves elliptic to elliptic-ob lanceolate; lateral veins 6–8 pairs, intercostal veins distinct below. Calyx lobes broader than long. Drupes oblong.....**2a. subsp. chinensis**

Leaves oblong or sometimes elliptic; lateral veins 4–6 pairs, intercostal veins faint and inconspicuous below. Calyx lobes as long as wide. Drupes broadly ellipsoid or sometimes ovoid.....**2b. subsp. scortechinii**

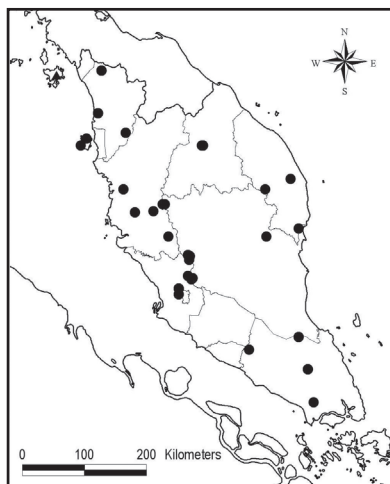
2a. **subsp. chinensis** (Merr.) K.M.Matthew
(Of China)

Map 2

Blumea 23 (1976) 83, Fl. Malesiana 1, 8 (1977) 96, fig. 3c; Kochummen, Tr. Fl. Malaya 3 (1978) 54; Harwood & Chayamarit, Fl. Thailand 10 (2010) 234, fig. 2. **Basionym:** *Mastixia chinensis* Merr., Sunyatsenia 3 (1937) 256, fig. 2. **Type:** *Henry 12414*, China, Yunnan, Szemao (holotype NY; isotypes A, K, NY).

Medium-sized tree; bole to 20 m tall. **Twigs** glabrous. **Leaves:** petioles stout, 1.8–2.5 cm long, to *c.* 2 mm thick; laminas *elliptic to elliptic-oblongate*, 8–20 × 4–8 cm, *thickly coriaceous*, base attenuate, apex acute; lateral veins *6–8 pairs*, flat above; intercostal veins *distinct beneath*. **Inflorescences** to 3 cm long, subglabrous to appressed-hairy. **Flowers** 5-merous; calyx tube 5-lobed, *lobes broader than long*, puberulous; petals 5, appressed-hairy outside; stamens 5. **Drupes** *oblong*, 2–2.5 cm long, 1–1.4 cm diameter; persistent nectary conspicuous.

Distribution. NE India, Bhutan, Myanmar, Thailand, Vietnam, S China and Peninsular Malaysia (only from Langkawi Is., Kedah).



Map 2. Distribution of *Mastixia pentandra* subsp. *chinensis* (▲) and subsp. *scortechinii* (●).

Conservation status. Critically Endangered B2ab(iii). This is a very rare species in Peninsular Malaysia, collected only once from G. Raya, Langkawi Is., Kedah (*Kerr 21726*). Many parts of the summit area of G. Raya have been cleared for tourism infrastructure and a telecommunication tower (assessed by C.L. Lim).

Ecology. In lower montane forest to 1500 m.

2b. **subsp. scortechinii** (King) K.M.Matthew
(Father B. Scortechini, 1845–1886, a Roman Catholic missionary; 1884–1886 government botanist stationed in Taiping, Perak)

Map 2

Blumea 23 (1976) 86, Fl. Malesiana 1, 8 (1977) 97; Kochummen, Tr. Fl. Malaya 3 (1978) 54, fig. 1; Chung, Tr. Fl. Sabah & Sarawak 1 (1995) 204, Field Guide For. Tr. Brunei 1 (2003) 194, fig. 41d;

Harwood & Chayamarit, Fl. Thailand 10 (2010) 234; Gardner *et al.*, For. Tr. S. Thailand 1 (2015) 389, fig. 607. **Basionym:** *Mastixia scortechinii* King, J. As. Soc. Beng. 71, 2 (1902) 73; Ridley, Fl. Malay Pen. 1 (1922) 891. **Type:** *Scortechini* 1971, Peninsular Malaysia, Perak (lectotype K; isolectotypes BM, CAL, G, L, P). **Synonym:** *Mastixia megacarpa* Ridl., Fl. Malay Pen. 1 (1922) 891. **Type:** *Curtis* 919, Peninsular Malaysia, Penang, Pulau Betong Reserve (holotype SING; isotype K).

Medium-sized tree; bole to 36 m tall, 80 cm diameter; buttresses short. **Twigs** glabrous, dark brown to black. **Leaves:** petioles stout, 1–3 cm long, (1–)1.5–2 mm thick; laminas *oblong or sometimes elliptic*, 5–16.5 × 2.5–6 cm, thickly coriaceous, drying greenish grey or greenish brown, often glaucous beneath, base cuneate, apex acute or acuminate but sometimes caudate; lateral veins 4–6 pairs, flat above; intercostal veins and reticulations *faint to inconspicuous on both surfaces*. **Inflorescences** to 8 cm long, puberulous to villous. **Flowers** (4-) or 5-merous, greenish yellow; buds *c.* 2 mm diameter; calyx tube (4-) or 5-lobed, *lobes as long as wide*, puberulous; petals (4) or 5, 1.2–1.5 × 0.8–1 mm, appressed-hairy outside; stamens (4) or 5, filaments 0.5–0.7 mm long. **Drupes** green, ripening purple to bluish black, *broadly ellipsoid or sometimes ovoid*, 1.6–3.5 cm long, 1.2–1.5(–1.7) cm diameter; fruit wall thick; persistent nectary exposed. **Seeds** ovoid, 0.9–1.2 cm long, 0.5–0.8 cm diameter.

Distribution. Thailand (Narathiwat), Sumatra, Banka, Peninsular Malaysia, Borneo (Sabah and Kalimantan) and Sulawesi. In Peninsular Malaysia, recorded from all states except Perlis Negeri Sembilan and Melaka.

Conservation status. Least Concern (assessed by C.L. Lim).

Ecology. Common and widely distributed from hill dipterocarp forest over 350 m to lower montane forest to 1500 m.

3. *Mastixia rostrata* Blume

(Latin, *rostratus* = with a beak or narrowed into a slender tip or point; referring to the leaf apex)

Mus. Bot. Lugd. Bat. 1 (1850) 258; Ridley, Fl. Malay Pen. 1 (1922) 890, *p.p.*; Danser, Blumea 1 (1934) 52; Backer & Bakhuizen *f.*, Fl. Java 2 (1965) 159; Matthew, Blumea 23 (1976) 73, Fl. Malesiana 1, 8 (1977) 94; Chung, Tr. Fl. Sabah & Sarawak 1 (1995) 204. **Type:** *Blume* ‘2244’, W Java (lectotype L, acc. no. 901.169.384).

Distribution. Sumatra, Peninsular Malaysia, Borneo, Java and Lesser Sunda Islands.

Taxonomy. In Matthew’s treatments (1976, 1977), *Mastixia rostrata* was segregated into two subspecies: subsp. *rostrata* occurs in Java and Lesser Sunda Islands and subsp. *caudatifolia* in Sumatra, Peninsular Malaysia and Borneo.

subsp. *caudatifolia* (Merr.) K.M. Matthew

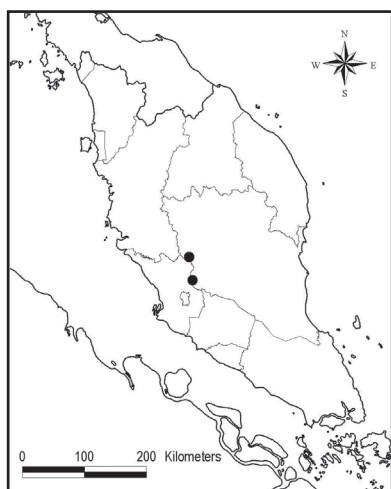
Fig. 1, Map 3

(Latin, *caudatus* = ending with a tail-like appendage, *-folius* = leaf; referring to the leaf apex)

Blumea 23 (1976) 74, Fl. Malesiana 1, 8 (1977) 94, fig. 3f; Chung, Tr. Fl. Sabah & Sarawak 1 (1995) 205, fig. 1; Chung & Latiff, J. Trop. For. Sci. 9 (1996) 271, fig. 1. **Basionym:** *Mastixia caudatifolia* Merr., Pl. Elm. Born. (1929) 233. **Type:** *Elmer* 21584, Borneo, Sabah, Tawau (holotype UC; isotypes A, BM, BO, GH, HBG, K, L, NY, P, SING, U, UC, US).

Small tree; bole to 15 m tall, *c.* 10 cm diameter. **Bark** greyish to chocolate-brown, smooth to occasionally shallowly fissured; inner bark yellowish to pale orange-yellow, fibrous, soft. **Sapwood** yellowish. **Twigs** glabrous to subglabrous, grey or grey-brown. **Leaves** *alternate*, *sometimes (sub)opposite* but then never exclusively so; petioles *slender*, to *c.* 1.5 cm long, *0.4–0.8(–1) mm* thick, appressed hairy to glabrescent; laminae elliptic-oblong to elliptic, *4–8(–10) × 2–5* cm, *chartaceous to thinly coriaceous*, glabrescent beneath but hairy on the midrib, glabrous above, base cuneate to acute, margin *not recurved*, apex *caudate with acumen* to *c.* 1.5 cm long; lateral veins 4–6 pairs, *not looping toward leaf margin*, sunken above; intercostal veins faint or conspicuous beneath. **Inflorescences** to 6 cm long, subglabrous. **Flowers** *4-merous*, green-yellow; buds to *c.* 2 mm diameter; calyx tube 4-lobed, lobes broader than long, *glabrous*; petals 4, *1.1–1.3 × 0.7–0.9* mm, *glabrous outside*; stamens 4, filament 1–1.3 mm long; nectary yellowish. **Drupes** ovoid to ellipsoid, 1.5–2.2 cm long, 0.5–1.3 cm diameter; fruit wall thick; persistent nectary exposed; persistent calyx lobes inconspicuous. **Seeds** ellipsoid, 1.3–2 cm long, 0.4–0.8 cm diameter.

Distribution. Sumatra, Banka, Peninsular Malaysia and Borneo. In Peninsular Malaysia recorded only from Pahang (Fraser’s Hill and Genting Highlands).



Map 3. Distribution of *Mastixia rostrata* subsp. *caudatifolia*.

Conservation status. Endangered B2ab(iii). Despite occurring in areas above 1000 m altitude, localities in Fraser’s Hill and Genting Highlands are impacted by human activities (assessed by C.L. Lim).

Ecology. Locally common at Fraser’s Hill, in lower montane forest at 1100–1500 m.

4. *Mastixia trichotoma* Blume

(Greek, *trichotomus* = having divisions always in threes; referring to the inflorescence)

Bijdr. Fl. Ned. Ind. (1825) 655; Danser, *Blumea* 1 (1934) 57; Backer & Bakhuizen *f.*, *Fl. Java* 2 (1965) 159; Matthew, *Blumea* 23 (1976) 68, *Fl. Malesiana* 1, 8 (1977) 92; Kochummen, *Tr. Fl. Malaya* 3 (1978) 54; Chung, *Tr. Fl. Sabah & Sarawak* 1 (1995) 205; Harwood & Chayamarit, *Fl. Thailand* 10 (2010) 234. **Type:** *Blume s.n.*, W Java, Mt Salak (lectotype L [acc. no. 901.169.393]; isolectotypes BM, W).

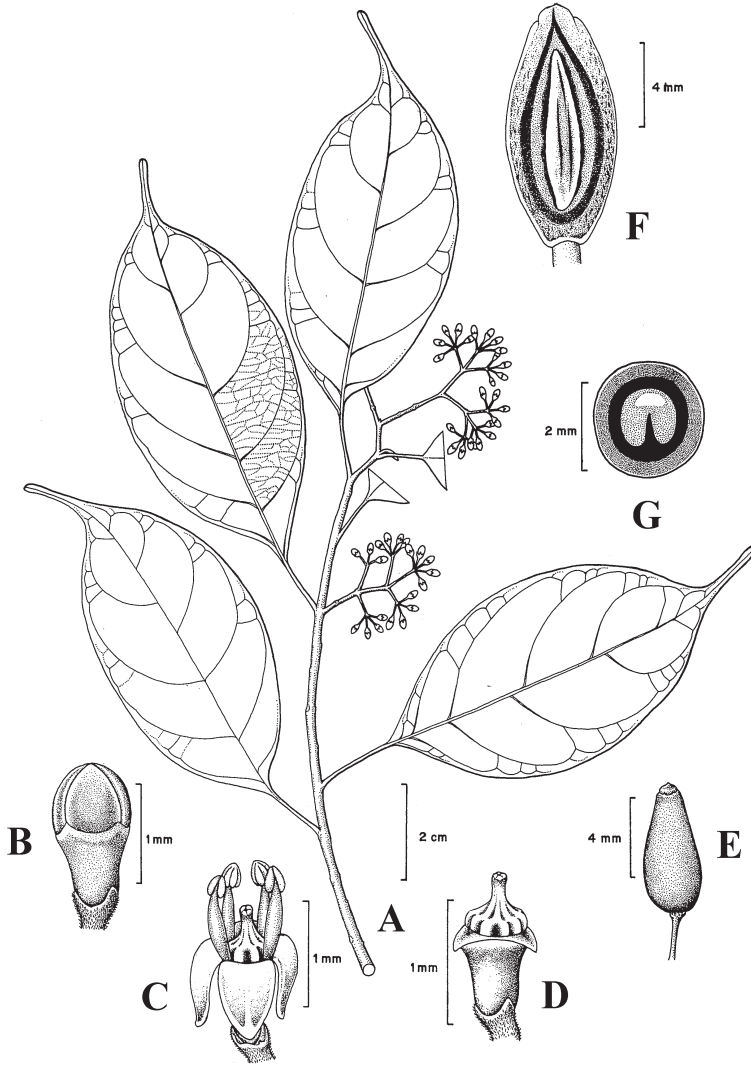
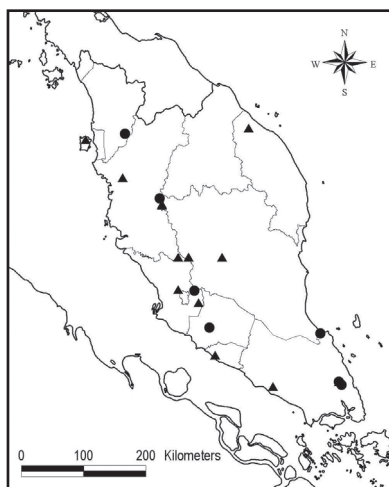


Figure 1. *Mastixia rostrata* subsp. *caudatifolia*. A, flowering leafy twig; B, flower bud; C, open flower; D, open flower with petals and stamens removed; E, fruit; F, fruit in longitudinal section; G, fruit in cross section. (Reproduced with permission from Tr. Fl. Sabah & Sarawak 1 (1995) 207.)

Big tree; bole to 40 m tall, to 50 cm diameter. **Bark** yellowish grey to grey-brown, smooth to shallowly fissured; inner bark yellowish brown to pale brown. **Sapwood** pale white. **Twigs** yellowish brown to pale brown, puberulous to woolly. **Leaves** *always opposite*; petioles stout or slender, 1–3.5 cm long, 0.6–3 mm thick, puberulous to woolly; laminas ovate, elliptic, lanceolate to oblong, 5–24 × 2.5–12 cm, thinly to thickly coriaceous, subglabrous to velvety hairy beneath, base acute, cuneate, obtuse or attenuate, apex acute to acuminate; lateral veins 5–15 pairs, prominent beneath, sunken or flat above; intercostal veins reticulate, faintly visible or prominent beneath. **Inflorescences** to c. 15 cm long, puberulous to woolly. **Flowers** 4- or 5-merous, green to yellowish green; buds 1–2.5 mm diameter; calyx tube 4 or 5-lobed, lobes as long as wide, puberulous to villous; petals 4 or 5, puberulous to villous outside; stamens 4 or 5. **Drupes** ovoid to ellipsoid, 1.5–3 cm long, 0.6–1.5 cm diameter, fruit wall thin; persistent nectary exposed; persistent calyx lobes inconspicuous to slightly prominent. **Seeds** ovoid to ellipsoid, 1.3–2.9 cm long, 0.4–1.4 cm diameter.

Distribution. Peninsular Thailand and throughout Malesia (except New Guinea).



Map 4. Distribution of *Mastixia trichotoma* var. *clarkeana* (●) and var. *maingayi* (▲).

Taxonomy. This species is highly variable and was subdivided by Matthew (1976, 1977) into five varieties (*clarkeana* (King) Danser, *korthalsiana* (Wangerin) Danser, *maingayi* (C.B. Clarke) Danser, *rhynchocarpa* Danser and *trichotoma*). Of these, only two occur in Peninsular Malaysia.

Key to varieties

Twigs and petioles finely tomentose. Leaf lateral veins not looping, flat above; intercostal veins faintly visible beneath, flat above. Inflorescences subglabrous to puberulous.....**4a. var. clarkeana**

Twigs and petioles woolly hairy. Leaf lateral veins looping to form a marginal vein, sunken above; intercostal veins distinct and prominent beneath, sunken above. Inflorescences woolly hairy.....**4b. var. maingayi**

4a. **var. clarkeana** (King) Danser

Map 4

(C.B. Clarke, 1832–1906, British botanist, superintendent of Calcutta Botanic Garden 1869–1871)

Blumea 1 (1934) 62; Matthew, Blumea 23 (1976) 72, Fl. Malesiana 1, 8 (1977) 93; Kochummen, Tr. Fl. Malaya 3 (1978) 54, fig. 1, Tr. Fl. Pasoh For. (1997) 174; Chung, Tr. Fl. Sabah & Sarawak 1 (1995) 208; Harwood & Chayamarit, Fl. Thailand 10 (2010) 235, fig. 3; Gardner *et al.*, For. Tr. S. Thailand 1 (2015) 389, fig. 608. **Basionym:** *Mastixia clarkeana* King, J. As. Soc. Beng. 71, 2 (1902) 75; Ridley, Fl. Malay Pen. 1 (1922) 890. **Type:** *Scortechini 869*, Peninsular Malaysia, Perak (lectotype K; isolectotypes CAL, G, L, P). **Synonym:** *Mastixia clarkeana* King var. *macrophylla* King, J. As. Soc. Beng. 71, 2 (1902) 75. **Type:** *King's Coll. 10575*, Peninsular Malaysia, Selangor [Perak], Ulu Bubong (lectotype K; isolectotypes BM, CAL, P).

Medium-sized tree; bole to 24 m tall, to 30 cm diameter. **Twigs** covered with a fine pale brown powdery tomentum. **Leaves:** petioles slender, 1–1.5 cm long, 0.6–0.8(–1) mm thick, covered with powdery brown hairs; laminas elliptic, 7.5–15 × 2.5–6 cm, on drying pale yellow beneath, subglabrous; lateral veins 4–5(–7) pairs, *not looping near the margin*, flat above; intercostal veins faintly visible beneath, flat above. **Inflorescences** to 10 cm long, subglabrous to puberulous. **Flowers** 4-merous. **Drupes** ovoid, 1.5–2 × 0.5–1 cm, without exposed persistent nectary; persistent calyx lobes prominent, 0.5–1 mm long.

Distribution. Peninsular Thailand (Pattani and Narathiwat), Sumatra, Banka, Peninsular Malaysia, Singapore, Borneo and the Philippines (Mindanao). In Peninsular Malaysia, known from Kedah, Perak, Selangor, Negeri Sembilan and Johor.

Conservation status. Near Threatened (assessed by C.L. Lim).

Ecology. In primary lowland and hill dipterocarp forest, from low altitudes to 900 m.

4b. **var. maingayi** (C.B. Clarke) Danser

Map 4

(A.C. Maingay, 1836–1869, British physician and botanist, 1862–1867 warden of the Melaka jail, Peninsular Malaysia)

Blumea 1 (1934) 63; Matthew, Blumea 23 (1976) 70, Fl. Malesiana 1, 8 (1977) 93; Kochummen, Tr. Fl. Malaya 3 (1978) 54, fig. 1; Chung, Tr. Fl. Sabah & Sarawak 1 (1995) 206, Field Guide For. Tr. Brunei 1 (2003) 194, fig. 41e. **Basionym:** *Mastixia maingayi* C.B. Clarke, Fl. Brit. India 2 (1879) 746; King, J. As. Soc. Beng. 71, 2 (1902) 74; Ridley, Fl. Malay Pen. 1 (1922) 890. **Type:** *Maingay 2680* (= Kew Distr. No. 711), Singapore (holotype K; isotypes BM, GH, L). **Synonyms:** *Mastixia maingayi* C.B. Clarke var. *subtomentosa* King, J. As. Soc. Beng. 71, 2 (1902) 75. **Type:** *Maingay 2436* (= Kew Distr. No. 709), Singapore (holotype K); *M. propinqua* Ridl., J. Fed. Mal. St. Mus. 4, 1 (1909) 25. **Type:** *Ridley 13899*, Peninsular Malaysia, Pahang, Ulu Telom (holotype SING; isotype BM); *M. junghuhniana auct. non* Miq.: Clarke, Fl. Brit. India 2 (1879) 746; *M. rostrata auct. non* Blume: Ridley, Fl. Malay Pen. 1 (1922) 890.

Medium-sized tree; bole to 24 m tall, to 40 cm diameter. **Twigs** woolly with long yellowish brown hairs. **Leaves:** petioles stout, 2–3.5 cm long, 1.5–3 mm thick, woolly brown-hairy; laminas elliptic, oblong or lanceolate, (8.5–)13–17.5(–22) × (3.5–)5–10(–10.5) cm, thickly coriaceous, woolly brown-hairy beneath, glabrous above except the midrib and veins; lateral veins 5–6 pairs, *looping to form intramarginal vein beneath, prominently sunken above; intercostal veins prominent beneath, conspicuously sunken above*. **Inflorescences** woolly

hairy. **Flowers** 4-merous. **Drupes** ovoid, $2.5\text{--}3.5 \times 1.5\text{--}2$ cm, with *exposed persistent nectary*; persistent calyx lobes prominent, 1.5–2 mm long.

Distribution. Sumatra, Banka, Peninsular Malaysia, Singapore and Borneo. Recorded in Peninsular Malaysia from Penang, Perak, Selangor, Melaka, Terengganu, Pahang and Johor.

Conservation status. Least Concern (assessed by C.L. Lim).

Ecology. In primary lowland dipterocarp to lower montane forest, to 1500 m.

Excluded Species

Mastixia gracilis King, J. As. Soc. Beng. 71, 2 (1902) 74. **Type:** *Wray 1528*, Peninsular Malaysia, Perak (CAL) = *Vaccinium bancanum* Miq. var. *tenuinervium* J.J.Sm. (Ericaceae) (Matthew, 1977).

2. NYSSA Gronov. ex L.

(A legendary town in India where Bacchus, the Greek God of Wine, was brought up by nymphs)

Sp. Pl. (1753) 1058; Bentham & Hooker *f.*, Gen. Pl. 1 (1867) 952; Hooker *f.*, Fl. Brit. India 2 (1879) 747; King, J. As. Soc. Beng. 71, 2 (1902) 79; Ridley, Fl. Malay Pen. 1 (1922) 895; Wasscher, Blumea 1 (1935) 343, Fl. Malesiana 1, 4 (1948) 29; Backer & Bakhuizen *f.*, Fl. Java 2 (1965) 161; Hutchinson, Fam. Flow. Pl. (1959) 175, Gen. Fl. Pl. 2 (1967) 51; Kochummen, Tr. Fl. Malaya 1 (1972) 346; Yii, Tr. Fl. Sabah & Sarawak 1 (1995) 253; Kubitzki, Fam. Gen. Vasc. Pl. 6 (2004) 86.

Polygamous (having bisexual and unisexual flowers on separate individuals) or monoecious (flowers unisexual but the male and female ones borne on the same plant) trees or less often shrubs. **Leaves** *spirally arranged* or (alternate), margin entire. **Inflorescences** axillary, *often in heads or condensed racemes*, pedunculate; flowers in the axils of a bract and with 2 bracteoles together enclosing the flower-base. **Male flowers** in stalked heads or short racemes; calyx tube campanulate, rim smooth or 4–5-toothed; petals 4–5 or (absent), free, recurved, *imbricate* in bud, alternate with the calyx lobes; *stamens often more numerous than petals*, in 2 alternating whorls, anthers nearly elliptic; nectary cushion-like; ovary and style rudimentary. **Bisexual or female flowers** in stalked heads; calyx tube campanulate, entire or 4–5-toothed; petals 5–8, as in male flowers but smaller; *stamens often more numerous than petals*, inner whorl partly sterile; ovary 1- or (3–10)-locular, adnate to the calyx tube, ovule 1, anatropous, flat, pendent, inserted near the top of the ovary, style with 1–2(–3) curving, arms, stigmatic surface undulate. **Fruit** a drupe, ovoid to broadly ellipsoid, surmounted by calyx tube and crowned by a small persistent nectary; exocarp coriaceous, glabrescent, mesocarp fleshy. **Seed** 1 or more rarely 3–5, obovoid, flat, grooved on one side and knobably on the other, testa membranous; endosperm smooth; embryo rather large, cotyledons flat, leafy.

Distribution. About 8 species, 3 in SE North America, 1 in Costa Rica, and 4 in East and South-east Asia.

Ecology. In Peninsular Malaysia found mainly in primary and lower montane forest where it occurs on slopes and ridge tops. Elsewhere preferably on flooded ground.

Uses. The wood is heavy and occasionally used for construction, interior finish, furniture, packing cases and tea boxes, and for the production of veneer and plywood on a local scale only (Yii, PROSEA 5, 3 (1998) 411).

***Nyssa javanica* (Blume) Wangerin**
(Of Java)

Fig. 2, Map 5

in Engler, Pfl. Reich. 41 (1910) 15; Wasscher, Blumea 1 (1935) 344, Fl. Malesiana 1, 4 (1948) 29, fig. 1; Backer & Bakhuizen *f.*, Fl. Java 2 (1965) 161; Kochummen, Tr. Fl. Malaya 1 (1972) 346; Yii, Tr. Fl. Sabah & Sarawak 1 (1995) 255, fig. 1; Gardner *et al.*, For. Tr. S. Thailand 1 (2015) 390, fig. 609. **Basionym:** *Agathisanthes javanica* Blume, Bijdr. Fl. Ned. Ind. (1825) 645. **Type:** *Blume* '1781', Java (holotype L (acc. no. 944.234.39); isotypes K, L (acc. no. 944.234.38)). **Synonym:** *Nyssa sessiliflora* Hook.*f.* & Thomson *in* Bentham & Hooker *f.*, Gen. Pl. 1 (1867) 952, C.B. Clarke, Fl. Brit. India 2 (1879) 747, King, J. As. Soc. Beng. 71, 2 (1902) 79, Ridley, Fl. Malay Pen. 1 (1922) 895. **Type:** *Hooker f.* & *Thomson s.n.*, S Himalaya, Khasia Mts (K *n.v.*).

Polygamous tree; bole to 36 m tall, to 60 cm diameter, sometimes with very small buttresses; crown with Terminalia branching. **Bark** grey to pale brown, smooth to slightly flaky, lenticellate; inner bark dull yellow or pale brown, fibrous or laminated, staining dark blue upon exposure. **Sapwood** yellowish white. **Twigs** pale brown to dark brown, with large scattered lenticels and leaf scars, often covered with brown tomentum when young, gradually becoming glabrous. **Leaves** typically crowded towards the end of the twigs; petioles 1.5–2.5 cm long, 1–2.5(–3) mm thick, glabrous; lamina lanceolate to elliptic, or obovate, (5–)8–20 × 2–7(–9) cm, slightly glaucous beneath, thinly coriaceous, glabrous on both surfaces but sometimes glabrescent beneath the midrib and veins, base gradually narrowed towards petioles, margin entire to slightly wavy, apex abruptly pointed; midrib flushed reddish; lateral veins 8–11 pairs. **Inflorescences** globose stalked heads, 12–18 mm diameter, in the axils of the leaves; peduncles slightly angular, 0.8–2(–5) cm long, slightly hairy or glabrous, bracteate; flowers yellowish or greenish white. **Male flowers** pedicellate, 0.5–4 mm long, in 20–40-flowered heads; calyx tube with 4–5 rounded teeth, 0.5–0.75 mm long, appressed-hairy outside; petals 4–5, 3–5 mm long, recurved, shortly hairy on both sides; stamens 8–10, outer whorl 3–5 mm long, slightly flat at the base, inner whorl 2–4 mm long, anthers 1.5 mm long; nectary 1–2 mm diameter, 8–10-lobed at the margin. **Bisexual flowers** sessile, in 3–9(–18)-flowered heads; calyx tube with 4–5 irregularly rounded or minute lobes, lobes 2–3 mm long, densely appressed-hairy outside; petals 4–5, 3–4 mm long, appressed-hairy outside; stamens 8–10, outer whorl 2–2.5 mm long, inner whorl 1–2 mm long, anthers all sterile, little developed and *c.* 1 mm long or none; nectary *c.* 2 mm diameter, slightly lobed at the margin, impressed in the middle; ovary 1-locular, style 1.5–2 mm long, with 2 curving arms. **Drupes** ripening dark red, mesocarp sourish juicy, ellipsoid, 15–22 mm long, 10–15 mm diameter, persistent nectary conspicuous; persistent calyx lobes inconspicuous. **Seeds** obovate, 10–20 mm long, 5–12 mm diameter.

Distribution. Peninsular Thailand (Nakhon Si Thammarat), Sumatra, Peninsular Malaysia, Java and Borneo. Very rare in Peninsular Malaysia, known from Pahang, G. Benom and the Main Range in Perak (G. Batu Puteh) and Pahang (Cameron Highlands, Genting Highlands and Fraser's Hill).

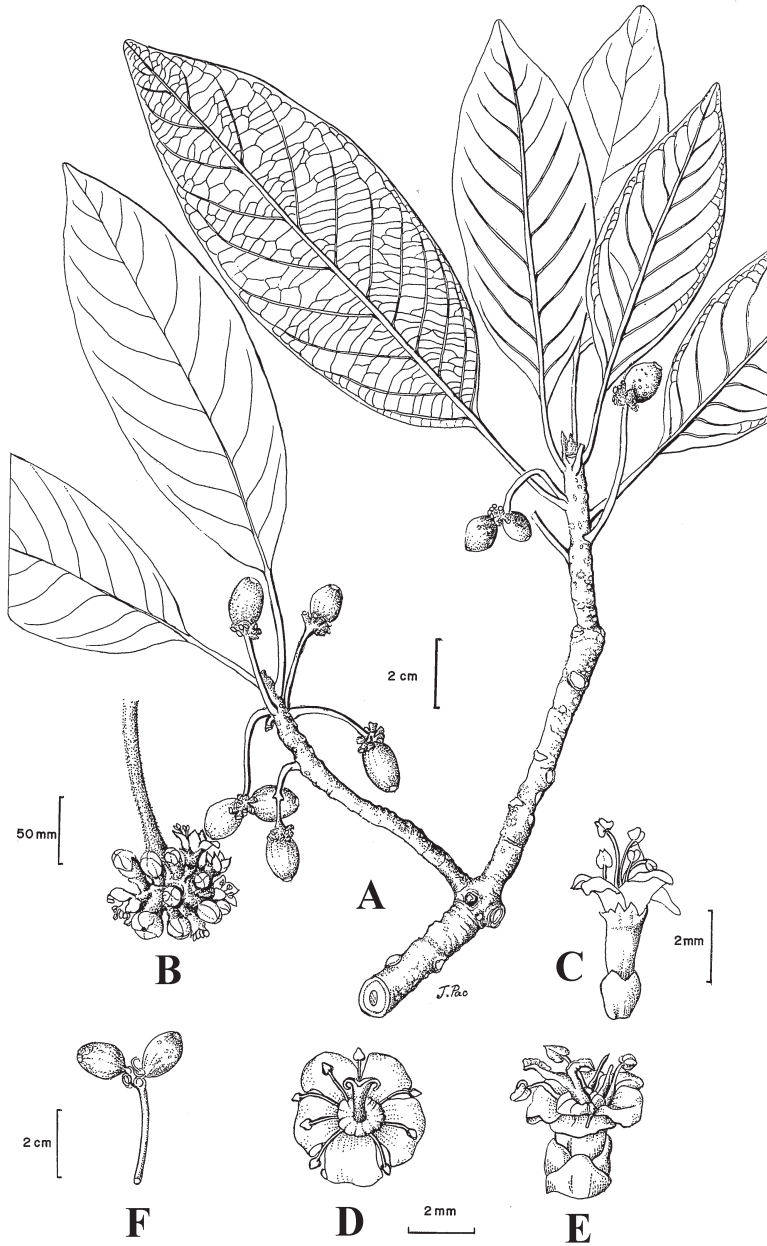
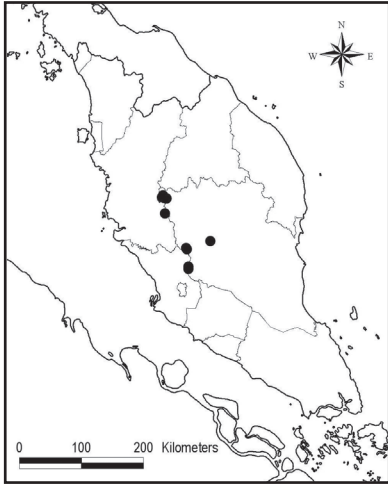


Figure 2. *Nyssa javanica*. A, fruiting leafy twig; B, inflorescence; C, male flower; D & E, female flowers; F, fruits. (Reproduced with permission from Tr. Fl. Sabah & Sarawak 1 (1995) 254.)



Map 5. Distribution of *Nyssa javanica*.

Conservation status. Least Concern (assessed by C.L. Lim).

Ecology. On gentle slopes and ridge tops in primary lower montane forest at about 1200–1700 m.



Flora of Peninsular Malaysia

The Flora of Peninsular Malaysia Series II provides revisions of seed plant families that occur in Peninsular Malaysia. Volume 7 includes revisions of 119 species in 6 families, namely Aizoaceae, Anisophyllaceae, Elaeocarpaceae, Myristicaceae, Nyssaceae and Passifloraceae. Conservation status and distribution maps are provided for indigenous species. Representative species are illustrated by botanical plates and colour photographs.

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