

**STUDIES IN MALESIAN CAESALPINIOIDEAE (LEGUMINOSAE). I.
THE GENERA ACROCARPUS, AFZELIA, COPAIFERA, AND INTSIA**

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SUMMARY

A partial, Malesian revision of the above listed four genera is given with special remarks on their taxonomy, nomenclature, typification, relationship, distribution, etc. An Identification List is given.

Acrocarpus is so far known with only one species, *A. fraxinifolius*.

Afzelia has two widely distributed, variable species both occurring in Malesia: *A. javanica* and *A. rhomboidea*.

Pseudosindora has been reduced to *Copaifera*, which consists of 20–30 species mostly occurring in tropical America and Africa. One interesting species, *C. palustris*, is found in Malesia.

Intsia consists of two or more species. In Malesia there are two widely distributed, very variable, difficult species, *I. bijuga* and *I. palembanica*. Information on their regeneration and uses have been reviewed.

INTRODUCTION

The Caesalpinioideae have been chosen by L. Watson and M.J. Dallwitz (Australia) for an automated data bank. They have prepared a comprehensive list of 134 characters (Numbers 1–80 for general morphology). Their book, entitled 'The Genera of Leguminosae–Caesalpinioideae, 1983', with descriptions and keys for 177 genera, has been produced by computer from that data bank. They have also noted under each genus those characters which have not yet been coded (or recorded) for lack of data. The descriptions are consistent and all characters are compared in parallel. For details concerning their computer system and programs used, the reader is referred to the Introduction and References of above mentioned book.

Before the publication of that book, on my request, one of the authors, Dr Watson, sent me a detailed printout of the list of characters, keys, descriptions, etc. especially for those genera (incl. cultivated ones) occurring in Malesia. In the course of working in a traditional way on this subfamily in Malesia, I have applied many of those general morphological characters for species to facilitate using the DELTA system and associated programs which are now also available for MS-DOS microcomputers.

After having finished the descriptions I have made modifications in order to conform to a conventional format. The descriptions as presented here are as such in accordance with the general generic treatment of Watson and Dallwitz; they are far too detailed for a Flora Malesiana treatment and seem superfluous especially in case of small genera.

Four small genera, viz. *Acrocarpus*, *Afzelia*, *Copaifera*, and *Intsia*, consist of tall (timber) tree species in Malesia. These trees resemble one another and are seldom in flower or fruit. They may be recognized without much difficulty in the field. Vegetative characters of the Malesian species of these genera have been described rather more in detail, together with a separate paragraph for compiled field notes or recorded vernacular names, which may be helpful for identification of sterile material.

Afzelia J.E. Sm. (Africa), *Pahudia* Miq. (Malesia), and *Intsia* Thouars (Madagascar) are three closely allied genera. Prain (Sci. Mem. Med. Off. Army India 12, 1901, 33–49, f. A–D) made a comprehensive study of *Afzelia* and its related genera *Pahudia* and *Intsia* on the generic delimitation, relationship, distribution, and nomenclature. He concluded that *Afzelia* and *Pahudia* are congeneric, and *Intsia* is a distinct genus. Because *Afzelia* is a later homonym, he adopted the generic name *Pahudia*. This treatment has been either followed or ignored for a long time. In the botanical literature there are samples that one species has been treated under these three generic names.

Fortunately, in 1935 the generic name *Afzelia* J.E. Sm. has been adopted and added to the Nomina Conservanda by the Botanic Congress, Amsterdam (see Sprague, Kew Bull. 1940, 81 & 104). Hutchinson's treatment of *Afzelia* and *Intsia* (Gen. Fl. Pl. 1, 1964, 243 & 246) has been generally accepted now.

ACROCARPUS

Acrocarpus Wight ex Arnott, Mag. Zool. Bot. 2 (1838) 547; Koord. & Val., Bijdr. Boomsort. Java 1 (1894) 320; Polhill & Vidal in Polhill & Raven (eds.), Adv. Legume Syst. 1 (1981) 88; Watson & Dallwitz, Gen. Leg.—Caesalp. (1983) 7. — Type species: *Acrocarpus fraxinifolius* Arnott.

Trees. Stipules small, caducous. Leaves spiral, impari- or paribipinnate, pinnae and pinnules mostly opposite; leaflets petiolulate. Inflorescence axillary, in defoliated leaf-axils, solitary, sometimes few-branched near the base and appearing fasciculate or paniculate, branches with spike-like racemes, erect, bottle-brush-like; bracts and bracteoles small, caducous. Flowers bisexual, pedicelled. Hypanthium cupular. Calyx lobes 5, imbricate. Petals 5, imbricate. Disk cupular, completely united with the hypanthium. Stamens 5, alternating with the petals, exerted; anthers versatile, introrse. Ovary with a free stipe, oblong or linear, 10–20-ovuled; style and stigma not sharply distinct from the ovary, incurved, pointed at the apex. Pods erect, elongate, flattened, long-stipitate, narrowly winged along the adaxial suture, 2-valved; valves straight, thin-coriaceous, (3–)10–18-seeded. Seeds slightly lens-shaped, smooth, not arillate, albuminous.

Distribution – So far known with one species in eastern India, Burma, Thailand, Laos, China, and Malesia.

Note – In the original publication of the genus, Arnott (1838) distinctly cited it as '*Acrocarpus*, Wight MSS', and therefore the authorship of the genus *Acrocarpus* should be cited as 'Wight ex Arnott' (International Code Botanical Nomenclature, Art. 46.3, 1988).

Acrocarpus fraxinifolius Arnott

- Acrocarpus fraxinifolius* Arnott, Mag. Zool. Bot. 2 (1838) 547; Wight, Icon. Pl. Ind. Orient. 1 (1840) t. 254; Miq., Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 87; Bedd., Fl. Sylv. (1869) 44, t. 44; Kurz, For. Fl. Burma 1 (1877) 410; Baker in Hook. f., Fl. Brit. India 2 (1878) 292; Koord. & Val., Bijdr. Boomsoort. Java 1 (1894) 321; Prain, J. Asiat. Soc. Bengal 66, 2 (1897) 506; Koord., Exk. Fl. Java 2 (1912) 369; Koord.-Schum., Syst. Verz. 1, 1, Fam. 128 (1912) 33; Koord., Atlas Baumart. Java 1 (1913) f. 12; Heyne, Nutt. Pl. Ned.-Ind. 2 (1916) 251; Craib, Fl. Siam. En. 1 (1928) 507; Burkill, Dict. 1 (1935) 38; Backer & Bakh. f., Fl. Java 1 (1964) 542; Brenan, Fl. Trop. E. Africa, Caesalp. (1967) 17; K. & S.S. Larsen, Fl. Camb. Laos Vietn. 18 (1980) 76, t. 13: 7–10; Fl. Thailand 4 (1984) 50, f. 10: 6–9, & t. 3: 1; C. C. Hu, Fl. Reipubl. Popul. Sin. 39 (1988) 90, t. 30; Gunn, Techn. Bull. U.S.D.A. 1755 (1991) 42, f. A–H. — Type: *Wight 2466* (n.v.); isotype?: distributed by K under Herb. Wight n. 845 (K, L), India.
- Mezourum grande* Miq., Fl. Ned. Ind., Suppl. (1860) 108, nom. nud.; (1861) 291. — *Acrocarpus grandis* (Miq.) Miq., Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 87. — Lectotype (here chosen): *Teijsmann HB 887* (U); syntype: *Teijsmann HB 862* (U), W Sumatra.
- Acrocarpus combretiflorus* Teijsm. & Binn., Nat. Tijds. Ned. Indië 29 (1866) 258, nom. illeg.; Cat. Hort. Bot. (1866) 269. — Syntypes: *Teijsmann s.n.* (iso L, under HLB no. 908.3-1008 & 1079), W Sumatra.

Leaves rather large, in the herbarium often represented by young ones or part(s) of a mature one; petiole and main rachis up to 80 cm long, pubescent and glabrescent; pinnae (2 or) 3–5 pairs, secondary petiole and rachis up to c. 45 cm long, basal pair(s) usually shorter. Leaflets 4–7(–9) pairs per pinnule, chartaceous, ovate or ovate-oblong, 3.5–11(–18) by 1.5–5(–8.5) cm; shortly acuminate or acute; base cuneate, obtuse, or rotund, rarely obscurely cordate, sometimes slightly asymmetric; pubescent beneath when young, glabrescent, often slightly hairy along the midrib and on the petiolules, sometimes almost glabrous when old; lateral nerves 5–9(–12) per side; petiolules 2–4 mm. Inflorescences up to 32 cm long, flowering axis pubescent especially towards the apical part, glabrescent; pedicels 4–10 mm, puberulous. Flowers patent or deflexed at anthesis. Hypanthium 2.5–8 mm long. Calyx puberulous outside; lobes ovate or triangular, 2.5–4 mm long, glabrous inside. Petals oblong or slightly oblanceolate, 5–9 by 1–2.5 mm, puberulous on both surfaces. Disk hairy on the lower half inside. Stamens: filaments 15–18 mm; anthers 2–3 mm long. Ovary 12–15 mm long, loosely hairy except the apical part. Pods (8–)10–12(–17) by (1–)1.5–2 cm (incl. stipe); wing 3–5 mm wide, rather smooth; valves glabrous outside, inner surface glabrous except white hairy on and around the depressions of the seeds. Seeds c. 6.5 by 5 mm.

Field notes – Rare, fast growing, lofty tree, 20–30(–50) by 0.6–1(–4) m. Bole columnar, often with small buttresses; first massive branches (3.5–)10 m above the ground, ultimate or young branches often with prominent lenticels. Bark whitish-grey or brown, smooth or somewhat rough. Petals dark red. Stamens with filaments red on the upper half, green at the base. Seeds brown.

Distribution – See under the genus. In Malesia: Sumatra (Mt Sago, Padang, Solok and near Batu Sangka) and Central Java (Semarang, Banjoemas and Tegal). Cultivated in Hortus Bogoriensis sub no. I-L-30 & 31 and XI-B-XV-11, native of India.

Habitat – In constantly wet and fertile ground in the forest, sometimes found in abandoned fields, alt. 600–1200 m.

Ecology – Flowering in Feb., March, May and Dec. Fruiting in March, April, Sept., Oct. and Nov.

Vernacular names – Sumatra: medang parrie or medang parit (Mt Sago region), kalamparik (Padang). Java: delimas or klimas (J).

Notes – The authorship of *Acrocarpus fraxinifolius* has been ascribed to Wight (e.g. Baker, 1878), Wight & Arnott (e.g. Hutchinson, 1964) or Wight ex Arnott (e.g. C.C. Hu, 1988). However, in 1838, when this species was published in a paper by Arnott, it was cited as “*A. fraxinifolius*, Arn. in Wight Cat. n. 2466”. It is evident that Arnott is the sole author of this species.

The collection of Wight no. 2466 was not listed in the lithographed copy of ‘Wight, Cat. Ind. Pl., 1833–37’ in Kew (photocopy in L), which consists of the pages 1–144 with the collection numbers 1–2403. The specimen which bears the Kew distribution number *Wight 845* in K (one duplicate in L) may be a part of the authentic material.

The name *Acrocarpus combretiflorus* Teijsm. & Binn. is illegitimate because these two authors cited an earlier validly published legitimate name, i.e. *Mezoneurum grande* Miq., in the synonymy.

There are two syntypes of *Mezoneurum grande* Miq. in U, and I have chosen *Teijsmann HB 887* as the lectotype. There is one specimen collected from W Sumatra by *Teijsmann (s.n. in L, under HLB no. 903.3-1086)*, bearing this name in Miquel’s handwriting, which may be a duplicate separated from one of the syntypes.

Miquel (1867) recognized the priority of the name of his new species, i.e. *Mezoneurum grande*, over *Acrocarpus combretiflorus* Teijsm. & Binn. and also found that these two species are conspecific. He made a new combination, *Acrocarpus grandis* (Miq.) Miq. (1861), and treated *A. combretiflorus* as its synonym.

Baker (1878) correctly reduced *Acrocarpus combretiflorus* to *A. fraxinifolius*, followed by Koorders & Valeton (1894), and others (e.g. Koorders, 1912). As a result the present genus is known with only one species.

AFZELIA

Afzelia J.E. Smith, Trans. Linn. Soc. 4 (1798) 221, nom. cons., non J.E. Gmelin, 1791 (= *Seymeria* Pursh, Scrophulariaceae); Taub. in Engl. & Prantl, Nat. Pflanzenfam. 3, 3 (1894) 140, sub *Intsia*; De Wit, Bull. Bot. Gard. Buitenzorg III, 17 (1941) 151; Léonard, Reinwardtia 1 (1950) 63; Brenan, Fl. Trop. E. Afr., Caesalp. (1967) 124; Cowan & Polhill in Polhill & Raven (eds.), Adv. Legume Syst. 1 (1981) 128; Watson & Dallwitz, Gen. Leg.–Caesalp. (1983) 7. — Type species: *Afzelia africana* J.E. Smith ex Pers.

Pahudia Miq., Fl. Ned. Ind. 1, 1 (1855) 85; Prain, Sci. Mem. Med. Off. Army India 12 (1901) 45; Meijer Drees, Bull. Jard. Bot. Buitenzorg III, 16 (1938) 96; De Wit, Bull. Bot. Gard. Buitenzorg III, 17 (1941) 151. — Type species: *Pahudia javanica* Miq.

Trees. Stipules with their basal interpetiolar parts connate. Leaves paripinnate; leaflets chartaceous, shortly petiolulate, petiolule often turned or twisted. Inflorescences terminal or axillary, racemose, often fasciculate or paniculate; bracts and bracteoles small, often caducous. Flowers bisexual, zygomorphic, pedicelled. Hypanthium cupular, narrowly infundibuliform or cylindric, puberulous outside, glabrous inside. Calyx lobes 4, imbricate, puberulous on both surfaces. Petals only one fully devel-

oped, large, flabellate, lower half narrowed into a claw, the others small or absent. Disk 0. Stamens 9, usually (5–)7 fertile, almost equal, the others reduced; anthers dorsifixed. Ovary stipitate (stipe adnate to the hypanthium), 3–8- (or more-)ovuled; style slender, almost as long as the stamens; stigma small, round. Pods oblong, obliquely oblong, or slightly rhomboid, compressed, black when ripe, glabrous, 2-valved, valves thick, woody, often 3- (or more-)seeded. Seeds ellipsoid, ovoid-oblong or broadly ellipsoid, smooth, exalbuminous; aril yellow, orange, or red, often 2-lobed, covering the seed for up to half or more of its length.

Distribution – About 12 species, in tropical Africa, Asia and S China; two species in Malesia.

Habitat – In forest at low and medium altitudes, 0–400(–1400) m.

Note – *Afzelia* is very closely allied to *Intsia* (see note under the latter). It is difficult to identify incomplete or sterile herbarium collections of these two genera.

KEY TO THE MALESIAN SPECIES

- 1a. Leaves usually pubescent, sometimes densely pubescent on the petiole, rachis, petiolules, and especially on the midrib of the lower surface of leaflets. Petals not papillate. Stamens with filaments united along the lower (1.5–)2–2.5 cm
 1. *A. javanica*
- b. Leaves often glabrous, sometimes sparsely (very rarely densely) pubescent on the petiole, rachis, petiolules, and especially on the midrib of the lower surface of leaflets. Petals often papillate at least on the inner surface. Stamens with filaments united at the base (or almost free) 2. *A. rhomboidea*

1. *Afzelia javanica* (Miq.) Léonard

Afzelia javanica (Miq.) Léonard, Reinwardtia 1 (1950) 63; Gunn, Techn. Bull. U.S.D.A. 1755 (1991) 252, f. G. — *Pahudia javanica* Miq., Fl. Ned. Ind. 1, 1 (1855) 86; Koord. & Val., Bijdr. Boomsoort. Java 2 (1895) 28; Prain, Sci. Mem. Med. Off. Army India 12 (1901) 46, f. 6–11; Heyne, Nutt. Pl. Ned.-Ind. 2 (1916) 239; ed. 2, 2 (1927) 736; Meijer Drees, Bull. Jard. Bot. Buitenzorg III, 16 (1938) 98, f. 2a; De Wit, Bull. Bot. Gard. Buitenzorg III, 17 (1941) 145. — *Pahudia javanica* subsp. *javanica*; Backer & Bakh. f., Fl. Java 1 (1964) 530. — *Pahudia javanica* subsp. *eujavanica* De Wit, Bull. Bot. Gard. Buitenzorg III, 17 (1941) 146, f. 2: 1. — *Afzelia javanica* subsp. *javanica*; Léonard, Reinwardtia 1 (1950) 63. — Type: *Th. Horsfield 'L 147'* (K, iso BM, photo of both types in L), Central Java, near Prowoto.

Intsia puberula Miq., Fl. Ned. Ind. Suppl. (1860) 107, nom. nud.; (1861) 290. — *Pahudia puberula* (Miq.) Meijer Drees, Bull. Jard. Bot. Buitenzorg III, 16 (1938) 97; De Wit, Bull. Bot. Gard. Buitenzorg III, 17 (1941) 145. — Type: *Diepenhorst s.n.* (U, sh. 038678, photo in L), Sumatra, Priaman.

Pahudia javanica subsp. *longiflora* De Wit, Bull. Bot. Gard. Buitenzorg III, 17 (1941) 146, f. 2: 2. — *Afzelia javanica* subsp. *longiflora* (De Wit) Léonard, Reinwardtia 1 (1950) 63. — Type: *bb 31600* (iso L), Sumatra, East Coast.

Young twigs, rachides, leaflets especially on the midrib of the lower, sometimes also on the upper, surface, sparsely, sometimes densely pubescent or glabrescent. Leaves (4-) 5- or 6(–8)-jugate; petiole and rachis up to c. 20(–30) cm. Leaflets oblong-elliptic or -ovate, rarely ovate or broadly elliptic, 6–9(–16) by 2.5–4(–5.5) cm; apex

shortly acuminate, obtuse, rarely retuse; base rounded or obtuse, slightly subcordate, or acute; lateral nerves 7–14 per side; veins loosely reticulate; petiolules 2–3 mm. Inflorescences with main axis often 4–12(–24) cm, pubescent; bracts and bracteoles 3–5 mm long; pedicels 8–12 mm, puberulous. Hypanthium 5–7 mm long. Calyx lobes broadly elliptic or suborbiculate, 6–10 by 4–7(–9) mm. Developed petal 8–10 by 7–9 mm. Stamens: filaments (4.5–)5.5–6.5 cm long, united along the lower (1.5–)2–2.5 cm, glabrous except towards the base inside thinly hirsute; anthers 1–1.5 mm long; staminodes c. 4 mm, glabrous. Ovary c. 6 mm long, densely puberulous along the margin; style 4–5.5 cm. Pods 7–14 by 5–7.5 cm, 1.5–2 cm thick. Seeds 1–8, 2–3 by 1.5–2.2 cm, c. 1.3 cm thick.

Field notes – Tree up to 42 m tall, 0.7(–1.3) m d.b.h., often much smaller. Buttresses up to 5 m high, 1.25 m wide, and 8 cm thick. Bark thin, grey with brown or black, without grooves; inner bark 10–15 mm thick, white or brown. Petals white. Aril yellow, orange, or red.

Distribution – Sumatra: Atjeh and E Coast. W & C Java: Preanger, Panandjung, Prowoto (= Prawata), Banjoemas, Cheribon, and Pekalongan.

Habitat – In primary and secondary forests, in dry places, rarely occurring on limestone, usually found at 0–100 m, sometimes up to 400(–800) m alt.

Ecology – Flowering in April, Oct. Fruiting in Jan., Feb., March, May, Aug.

Vernacular names – Sumatra: hataroem or ketaroem (Batak), kataroem (M), merbau (Atjeh). Java: djoelang perit (J), kidjoelang or djoelang (S & J), kidjoelang tau-dock or k. kapas (S).

Note – The developed petal often falls off at anthesis, so it is often lacking in the herbarium.

2. *Afzelia rhomboidea* (Blanco) Vidal

Afzelia rhomboidea (Blanco) Vidal, Cat. Pl. Prov. Manila (1880) 28; Phan. Cuming. Philipp. (1884) 26, 110; Rev. Pl. Vasc. Filip. (1886) 117; Léonard, Reinwardtia 1 (1950) 63; Gunn, Techn. Bull. U.S.D.A. 1755 (1991) 256, f. B. — *Eperua rhomboidea* Blanco, Fl. Filip., ed. 2 (1845) 260; ed. 3, 2 (1878) 119, t. 281. — *Intsia rhomboidea* Kuntze, Rev. Gen. Pl. 1 (1891) 192. — *Pahudia rhomboidea* Prain, Sci. Mem. Med. Off. Army India 12 (1901) 46; Merr., Philipp. J. Sc. 1 (1906) Suppl. 63; 5 (1910) Bot. 41; Whitford, Bull. Bur. For. Philipp. 10 (1911) 39; Merr., Fl. Manila (1912) 236; Sp. Blanc. (1918) 171; Enum. Philipp. Fl. Pl. 2 (1923) 257; Univ. Calif. Publ. Bot. 15 (1929) 101 (as *Afzelia javanica* Miq.); Meijer Drees, Bull. Jard. Bot. Buitenzorg III, 16 (1938) 99; De Wit, Bull. Bot. Gard. Buitenzorg III, 17 (1941) 147. — Neotype (here chosen): *Merrill Sp. Blanc. no. 862* (L; iso BO), Luzon, Laguna Prov.

Eperua falcata auct. non Aublet: Blanco, Fl. Filip. ed. 1 (1837) 369; Merr., Sp. Blanc. (1918) 171.

Intsia acuminata Merr., Publ. Gov. Lab. Philipp. 17 (1904) 20; Enum. Philipp. Fl. Pl. 2 (1923) 257. — Type: *Merrill 1108* (iso K), Luzon.

Afzelia borneensis Harms in Fedde, Rep. Sp. Nov. 14 (April 1916) 256; 15 (1917) 19; Léonard, Reinwardtia 1 (1950) 63; Meijer, Field Guide Trees W. Mal. (1974) 179, f. 41; Cockb., Trees Sabah 1 (1976) 157, f. 32. — *Pahudia acuminata* Merr., Philipp. J. Sc. 11 (June 1916) Bot. 86. — *Afzelia acuminata* (Merr.) Harms in Fedde, Rep. Sp. Nov. 15 (1917) 19. — *Pahudia borneensis* Merr., J. Str. Br. R. As. Soc. 76 (1917) 84; Bibl. Enum. Born. Pl. (1921) 297; Meijer Drees, Bull. Jard. Bot. Buitenzorg III, 16 (1938) 100, f. 2c; De Wit, Bull. Bot. Gard. Buitenzorg III, 17 (1941) 148, f. 2: 4. — Lectotype (vide Harms, 1917): *Hose 93* (iso L), Sarawak, Baram.

Pahudia rhomboidea var. *praetermissa* De Wit, Bull. Bot. Gard. Buitenzorg III, 17 (1941) 151, f. 2: 3a. — *Afzelia rhomboidea* Prain var. *praetermissa* Léonard, Reinwardtia 1 (1950) 63. — Syn-types: *Clemens* 21289 (L), Sarawak, Kapit; *bb* 8981 (BO, n. v.), Sumatra, East Coast; *Exp. Nieuwenhuis* 1424 & 1509 (BO, n. v.), Kalimantan, Bloeo; *Teijsmann* 8249 (BO, n. v.), Kalimantan, Mt Singkadjang.

Young twigs, rachides, petioles, petiolules, and leaflets often glabrous, sometimes sparsely, very rarely densely pubescent, especially on the midrib of the lower (sometimes also on the upper) surface. Leaves (3-) 4- or 5-jugate; petiole and rachis 10–14(–19) cm. Leaflets ovate, elliptic, 3.5–10(–15) by 2.5–4.5(–6) cm; apex (shortly) acuminate; base acute or obtuse, rarely more or less truncate or shallowly concave; lateral nerves 5–8 per side and veins rather closely reticulate; petiolules 1.5–4.5 mm. Inflorescences with main axis up to 12–14(–15) cm long, both main axis and branches puberulous; pedicels 4.5–5.5 mm. Hypanthium c. 3 mm long. Calyx lobes broadly ovate or subrotund, 5–12 by 5–9 mm. Developed petal 7–10 by 5–9 mm. Stamens: filaments 4.5–6 cm, united at the base (or almost free), slightly hairy near the base; anthers c. 1.5 mm long; staminodes (0.5–)1–3 cm, sparsely hairy. Ovary 1.5–4 mm long, puberulous along the margin; style two kinds: long (40–50 mm), or very short (1–2 mm), slightly hairy at the base. Pods 9–12(–20) by 5–7(–10) cm, c. 1.5 cm thick. Seeds 1.7–3 by 1.5–2.5 cm, c. 1 cm thick.

Field notes – Tree 25–30(–36) m tall, 0.4–0.8(–1.2) m d.b.h. Bole cylindrical. Buttresses sometimes present up to 2 m high, 1–2.5 m wide and c. 8 cm thick. Leaves fall once a year, but not at the same time in all individual trees. Flowering during 2 or 3 weeks, probably annually, not after falling of leaves. Petals yellowish red, red or (older) dark red. Aril orange or yellow, orange-red.

Distribution – Malesia: Sumatra (East Coast and Palembang), Sabah (Kalabakan, Mt Kinabalu, Mostyn, and Tawau), Kalimantan (Berouw: Mt Ilas Bungaan), and Philippines (N Luzon to Mindanao).

Habitat – In primary forests, occasionally occurring on limestone or sandstone, up to 350 m alt., once found at c. 1400 m (Mt Kinabalu: *SAN* 42722, L).

Ecology – Flowering and fruiting almost all year round.

Uses – Valuable timber tree.

Vernacular names – Sumatra: merbau tandoek (Palembang). Sabah: merbau tandoek (Tawau). Philippines: see Merrill (1923: 257, under *Pahudia rhomboidea*).

Notes – *Afzelia borneensis* was published by Harms (April 1916: 256), cited with two specimens: *Hose* 93 (in fl., L) and *H. Winkler* 3236 (in buds). One year later Harms (1917: 19) stated that his species was based on *Hose* 93, so this specimen should be treated as the lectotype (vide Intern. Code Bot. Nom., Art. 7.4 & 7.5, 1988).

Pahudia acuminata was described by Merrill (1916: 86) based also on *Hose* 93. It was published in June (not March) 1916 (vide Merrill, 1917: 84).

Harms (1917: 15) found that the above two species were based on the same collection, i.e. *Hose* 93, but misquoted the publication date of Merrill's species as one month earlier than his, so he made an unnecessary combination, i.e. *Afzelia acuminata* (Merr.) Harms.

Azelia borneensis and *A. rhomboidea* had been treated as two distinct species by using the length of styles as the main character: style 1–2 mm in the former against 40(–50) mm in the latter. However, after having examined many collections of these two species, their flowers appeared to be heterostylous. These two species are conspecific.

COPAIFERA

Copaifera L., Sp. Pl. ed. 2 (1762) 557, nom. cons.; De Wit, Webbia 9 (1954) 459; Léonard, Mém. Acad. R. Belg. Cl. Sci. 30 (1957) 84; Hutch., Gen. Fl. Pl. 1 (1964) 253; Cowan & Polhill in Polhill & Raven (eds.), Adv. Legume Syst. 1 (1981) 132; Watson & Dallwitz, Gen. Leg.—Caesalp. (1983) 20. — Type species: *Copaifera officinalis* (Jacq.) L.

Pseudosindora Symington, Proc. Linn. Soc. Lond. 155 (1944) 285; Léonard, Mém. Acad. R. Belg. Cl. Sci. 30 (1957) 86; Cowan & Polhill in Polhill & Raven (eds.), Adv. Legume Syst. 1 (1981) 132. — Type species: *Pseudosindora palustris* Symington.

Trees. Stipules caducous. Leaves imparipinnate, petiolate; leaflets alternate, petiolulate. Inflorescences axillary, paniculate; bracts and bracteoles small, caducous. Flowers bisexual, actinomorphic, pedicelled. Hypanthium 0. Calyx lobes 4, narrowly imbricate or subvalvate. Petals 0. Disk 0. Stamens 10, free; anthers dorsifixed. Ovary stipitate, 2-ovuled; style slender; stigma small, capitellate. Pods ellipsoid, rather smooth, 2-valved, valves thick coriaceous, 1- or 2-seeded. Seeds oblong, arillate, exalbuminous.

Distribution – Species 25–30, mostly in tropical America, 4 in tropical Africa, and 1 in Malesia (Borneo).

Habitat – See under the species.

Notes – The genus *Copaifera* is allied to *Sindora* but differs from it by the alternate leaflets (against opposite leaflets) and lacking petals (against with a well developed petal). It is also related to *Crudia* but differs from it by the paniculate inflorescences, the lack of a turbinate hypanthium, and distinctly arillate seeds.

De Wit (1954: 459–464) compared *Pseudosindora* with the related genera *Copaifera*, *Crudia*, and *Sindora*. He reduced *Pseudosindora* to *Copaifera*.

Léonard (1957: 84) expressed the opinion that it is preferable to maintain *Pseudosindora*, because it differs from *Copaifera* by various characters, especially by the arrangement of flowers in more than two ranks. I have examined flowering specimens of *Copaifera*; the flowers are not always distichously arranged but are sometimes shown in more than two ranks.

Léonard (1957: 84 & 86) studied also the seedlings of four species: one American species, *Copaifera officinalis* L., type species of the genus, with the first two leaves alternate; three African ones with the first two leaves opposite. The fruits open completely in two valves in the American species but dehisce from the apex towards 1/2–3/4 of their length in the African ones.

The seedlings of the Malesian species, *Copaifera palustris*, are similar to those of the African ones, while the dehiscence of the fruits is like that of the American one (cf. Symington, 1944: 285–288, f. 1 & 2).

Hutchinson (1964: 253) also placed the genus *Pseudosindora* in the synonymy of *Copaifera*.

Cowan and Polhill (1981: 132) kept *Pseudosindora* and *Copaifera* as two distinct genera but stated that the former is: "Debateably distinct from *Copaifera*, differing in the spirally arranged flowers and larger fruits with medially inserted seeds." I have examined some flowering collections (e.g. *Beccari PB 3915*, L, cited also by Symington; *S 12268*, L), which bear the young flower buds more or less distichously arranged; however, the old buds appear more or less spirally arranged due to the slightly twisted rachides. The infructescences are slightly twisted so the fruits or their scars appear spirally arranged. The ovary often contains 2 ovules which are medially inserted. A fruit may contain 1 or 2 developed seed(s); the seeds are more or less medially inserted especially when young, but are in the upper half or subapical when old.

The arrangements of the flowers and seeds are developmental features but alter with age. I agree with De Wit and Hutchinson in reducing the genus *Pseudosindora* to *Copaifera*.

***Copaifera palustris* (Symington) De Wit**

Copaifera palustris (Symington) De Wit, *Webbia* 9 (1954) 462. — *Pseudosindora palustris* Symington, *Proc. Linn. Soc. Lond.* 155 (1944) 285, f. 1 & 2. — Type: *C. O. Flemmich FMS 32600* (KEP, n. v.), Brunei.

Stipules auriculate to subfalcate, up to 1.5 by 1 cm. Leaves (2–)4(–6)-foliolate; petiole and rachis 4.5–12 cm, glabrous. Leaflets coriaceous, elliptic-oblong, often unequally sided, 5–9(–14) by 3.5–6(–8) cm; apex acute or shortly acuminate; base rotund; glossy, pellucid-dotted, glabrous except sometimes sparsely hairy on the midrib or at the base on the lower surface, glabrescent; nerves many, distinct or visible on both surfaces; often with 1–3 elliptic, slightly depressed glands towards the basal part of the margin; petiolule 4–7 mm. Inflorescences 4–11 cm long, pubescent; pedicels 3–4 mm, puberulous. Calyx lobes elliptic, 4–7.5 by 2–4 mm, puberulous outside, densely tomentose inside. Stamens alternately long and short; filaments 7–10 mm, glabrous; anthers c. 2 mm long. Ovary 2–3 by 1–1.5 mm, pilose along the ventral suture and on the stipe; stipe 1–2 mm; style 4.5–5 mm. Pods 4.5–7.5 by 3.5–4 cm. Seeds 2.4–2.7 by c. 1.5 cm, glossy brown or black; aril narrowly 2-lobed, enclosing the seed.

Field notes – Tall unbuttressed tree, up to 30(–39) m high, up to 40(–180) cm d. b. h.; bark minutely fissured. Flowers pearl-fawn coloured. Aril pink.

Distribution – Malesia: Brunei; Sabah (Temburong); Sarawak (Igan near Sibul, Betong, Miri, Binatong, and Baram); Kalimantan (Sekadau).

Habitat – In freshwater peat swamp forest near the coast, sometimes also found in dry forest, once found in secondary heath forest, 0–30 m alt.

Ecology – Flowering in April, Oct. Fruiting in July.

Vernacular names – Emputir (Dajak-Malay), sepetir (Brunei & M), sepetir paya (Baram & Miri), tepih (Miri).

Uses – Symington (1944: 288) reported that the "timber is neither durable nor decorative and the only recorded use is for the masts of boats." Because of its moderate hardness, good shape, and local abundance, he suggested that it may be used in plywood manufacture. It is also used for roof tiles.

INTSIA

Intsia Thouars, Gen. Nov. Madag. (1806) 22; Prain, Sci. Mem. Med. Off. Army India 12 (1901) 43; Meijer Drees, Bull. Jard. Bot. Buitenzorg III, 16 (1938) 87; De Wit, Bull. Bot. Gard. Buitenzorg III, 17 (1941) 139; Léonard, Reinwardtia 1 (1950) 61; Hutch., Gen. Fl. Pl. 1 (1964) 245; Cowan & Polhill in Polhill & Raven (eds.), Adv. Legume Syst. 1 (1981) 128; Watson & Dallwitz, Gen. Leg.—Caesalp. (1983) 35. — *Intsia* sect. *Euintsia* Taub. in Engl. & Prantl, Nat. Pflanzenfam. 3, 3 (1894) 140, nom. illeg. — *Afzelia* auct. non J.E. Smith: Koord. & Valeton, Bijdr. Boomsort. Java 2 (1895) 30; Prain, J. Asiat. Soc. Bengal 66, 2 (1897) 207. — Type species: *Intsia madagascariensis* Thouars ex DC. (vide Hutch., 1964) = *Intsia bijuga* (Colebr.) Kuntze.

Macrolobium Zipp., nom. nud., pro syn., Walp., Ann. Bot. Syst. 4 (1857) 610, non Schreb., 1789.

Trees often with buttresses. Stipules intrapetiolar connate. Leaves paripinnate. Leaflets chartaceous to subcoriaceous, usually with 1 or 2 small crateriform glands at the basal part on lower surface; petiolules twisted. Inflorescences terminal or axillary, simply racemose, often fasciculate, or paniculate; bracts caducous. Flowers bisexual, zygomorphic. Hypanthium cupular, narrowly infundibuliform or cylindric. Calyx lobes 4. Petals: only 1 fully developed, flabellate, lower half narrowed into a claw, the others rudimentary or absent. Disk 0. Stamens 3 or very rarely 4 fertile; staminodes 4–7; filaments and staminodes connate at the base; anthers dorsifixed. Ovary stipitate (stipe adnate to the hypanthium except the apical part), puberulous; style slender; stigma small, capitellate. Pods oblong, rarely obcordate, straight, or falcate, flattened, glabrous, dehiscent, 2-valved (valves leathery or slightly woody), often 3- (or more-)seeded. Seeds ovoid, oblong, discoid, or sublenticular, flattened, not arillate, scurfy, exalbuminous.

Distribution – Two or more species, from Madagascar, the islands of the Indian Ocean, tropical Asia, through Malesia to N Australia, Melanesia and Micronesia. In Malesia two species occur, see Figure 1 (cf. De Wit, 1941: f. 1; Whitmore, 1972: f. 9).

Habitat – The Malesian species of *Intsia* are of the ‘long-lived secondary’ type (see below), occurring from coastal, salty regions up to about 1000 m altitude.

Regeneration – Seeds have a period of dormancy, requiring pre-germination treatment (e.g. puncturing of the testa) in silviculture. Seedfall might be very good, but abundant regeneration takes place only in forest gaps, after fires, or after felling. Saplings tend to loose branches and fail to develop a leading shoot. Growth is slow. Because of lack of regeneration under closed canopy, the distribution over diameter classes is not regular, but reflects earlier disturbances in the forest. Zieck (internal report West New Guinea) described gregarious occurrences of *Intsia bijuga* on steep slopes of raised coral reef almost without any soil, but this species also occurs in swampy, even salty, habitats.

Intsia palembanica generally reaches larger sizes, maybe because it has a narrower ecological amplitude, avoiding wet and very dry soils. In Vanimo (Papua New Guinea) good stands have been produced after forest fires—apparently after a good seed-fall—in the 1880’s, with 23% net volume of the total stand. Rotation would thus at least be 80 years.

International trade name – Merbau (in Papua New Guinea: Kwila).

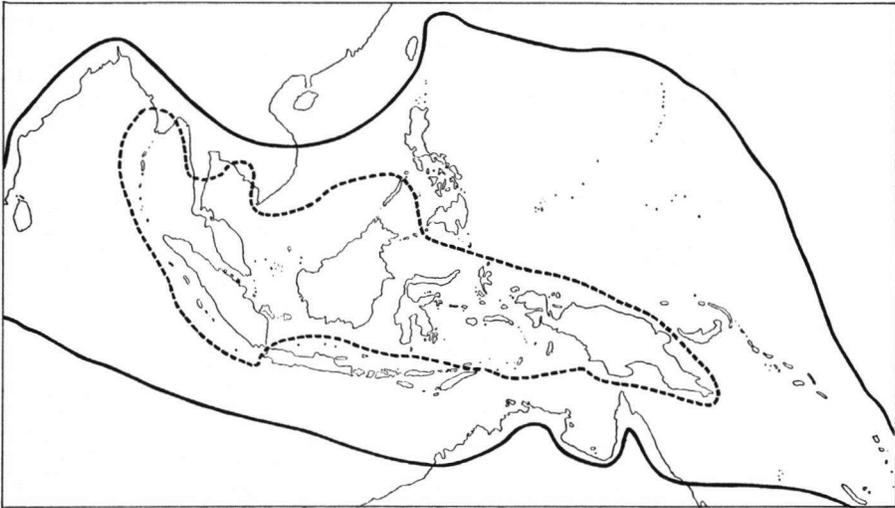


Fig. 1. Distribution range of *Intsia bijuga* (Colebr.) Kuntze (solid line) and *Intsia palembanica* Miq. (dashed line).

Uses – Trees of exploitable size (diam. 60 cm and up) have rather little, white to yellowish brown sapwood, which is sensitive to early deterioration, e.g. by powder-post beetles (*Lyctis*) and fungi. The heartwood is reddish brown, weathering to dark brown, heavy (S.G. 0.71–1.05, air-dry), hard, very strong, durable, resistant to termites but not to marine borers. Yellowish deposits in the vessels are often conspicuous, often showing on longitudinal surfaces, water-soluble and therefore cause staining of non-sealed timber surfaces exposed to water. Silica absent, but saw teeth can become gummy. Shrinkage and movement very low. Grain straight or slightly interlocked. The wood finishes well. Pre-boring for nailing and screwing is advisable.

Intsia timber has a wide range of uses both indoors and outdoors (if not in contact with seawater), e.g. (heavy) constructions, flooring, doors, posts, poles, sleepers, etc.

Literature – Den Berger, Meded. Proefstation Thee 97 (1926) 53; Glifford, Timber identification (1957) 122; Eddowes, Commercial timbers of PNG (not dated) 20, 116; Species notes on the major commercial timbers of PNG (not dated, not paged); Foxworthy, Malayan Forest Rec. 3 (1927) 88; Johns, Blumea 31 (1986) 342; Lane-Poole, Forest resources Papua & New Guinea (1925) 92b; Versteegh, Meded. LH Wageningen 17–19 (1971) 40; Whitmore, Tree Fl. Malaya 1 (1972) 262; Trop. rainforests Far East (1975) 182. — W. Vink.

Notes – The genus *Intsia* is very closely allied to *Afzelia*. It differs from the latter mainly by having 3 or very rarely 4 (against usually 7) fertile stamens and not arillate (against prominently arillate) seeds.

There are many Malesian collections of the two widely distributed, very variable species treated here. Sterile material is very difficult to identify.

KEY TO THE SPECIES

- 1a. Leaves 2- (or 3-)jugate, rarely 1-jugate towards the top of twigs or below the inflorescences. Hypanthium 6–10(–16) mm long, usually about the same length as the calyx lobes. Style c. 4 cm. Pods 8.5–15(–28) by 4–5(–7.2) cm
1. I. bijuga
- b. Leaves 4-jugate, rarely associated with some 2-, 3- or 5-jugate ones. Hypanthium 3–4 mm long, shorter than the calyx lobes (usually 6–8 mm long). Style 2–3.5 cm. Pods 15–19(–40) by 6–7(–9) cm **2. I. palembanica**

1. *Intsia bijuga* (Colebr.) Kuntze

Intsia bijuga (Colebr.) Kuntze, Revis. Gen. Pl. 1 (1891) 192; Merr., Int. Rumph. (1917) 255; Sp. Blanc. (1918) 171; Brown, Minor Prod. Philipp. For. 2 (1921) 393, f. 1; Merr., En. Philipp. Fl. Pl. 2 (1923) 257; Kanehira, Bot. Mag. Tokyo 45 (1931) 285; Fl. Micron. (1933) 142, f. 48; Burkill, Dict. 2 (1935) 1264; Meijer Drees, Bull. Jard. Bot. Buitenzorg III, 16 (1938) 89, f. 1b, incl. f. *hirsuta* Meijer Drees and f. *glabra* Meijer Drees; De Wit, Bull. Bot. Gard. Buitenzorg III, 17 (1941) 140, f. 1; Holthuis & Lam, Blumea 5 (1942) 192, as f. *glabra* Meijer Drees; Kanehira & Hatusima, Bot. Mag. Tokyo 56 (1942) 362; Corner, Ways. Trees ed. 2, 1 (1952) 396; Walker, Important Trees Ryukyu Is. (1954) 124, f. 65; Backer & Bakh. f., Fl. Java 1 (1964) 529; Whitm., Guide For. Brit. Solom. Is. (1966) 80; Brenan, Fl. Trop. E. Afr., Caesalp. (1967) 128, f. 23; Zuijderh., Blumea 15 (1967) 425; Hatusima, Fl. Ryukyus (1971) 343; Whitm., Tree Fl. Mal. 1 (1972) 262, f. 9; Cockb., Trees Sabah 1 (1976) 170, f. 36; Walker, Fl. Okinawa S. Ryukyu Is. (1976) 542, f. 72; Verdc., Man. N. G. Legumes (1979) 91; K. & S. S. Larsen, Fl. Camb. Laos Vietn. 18 (1980) 144, t. 25: 5–9; Fl. Thailand 4 (1984) 125, f. 31: 5–9, pl. 4: 4; A. C. Sm., Fl. Vitién. Nova 3 (1985) 134, f. 26; Gunn, Techn. Bull. U.S.D.A. 1755 (1991) 258, f. B, C, E–H. — *Macrobium bijugum* Colebr., Trans. Linn. Soc. 12 (1818) 359, t. 17. — *Outea bijuga* DC., Prod. 2 (1825) 511. — *Afzelia bijuga* (Colebr.) A. Gray, U.S. Expl. Exped., Phan. 1 (1854) 467, nom. illeg., non *Afzelia bijuga* (Willd.) Spreng., 1827 (= *Erioglossum cauliflorum* Guill. & Perr., Sapindaceae); U.S. Expl. Exped., Atlas Phan. 1 (1856) t. 51; Seemann, Fl. Viúensis (1865) 69; Kurz, For. Fl. Burma 1 (1877) 412; Baker in Hook. f., Fl. Brit. Ind. 2 (1878) 274; Kuntze, Revis. Gen. Pl. 1 (1891) 192; Koord. & Val., Bijdr. Boomsoort. Java 2 (1895) 31; Prain, J. Asiat. Soc. Bengal 66, 2 (1897) 208; Pulle, Nova Guinea 8 (1912) 650; Ridley, Fl. Mal. Pen. 1 (1922) 639. — Type: No collection cited; based on a plant cultivated in the Calcutta Botanic Garden, no certainly authentic material seen; based on Colebrooke's descr. & pl. (see under Note).

Intsia madagascariensis Thouars ex DC., Prod. 2 (1825) 509. — Type: Based on descr. of *Intsia* Thouars (1806).

Intsia? amboinensis DC., Prod. 2 (1825) 509; Miq., Fl. Ned. Ind. 1, 1 (1855) 80; Fl. Ned. Ind., Suppl. (1860) 107 & 288. — *Metrosideros amboinensis* Rumph., Herb. Amb. 3 (1750) 21, t. 10. — *Macrobium amboinense* Teijsm. ex Hassk., Abh. Naturf. Ges. Halle 9 (1866) 189. — Type: Based on descr. and pl. of *Metrosideros amboinensis* Rumph.

Jonesia triandra Roxb., Fl. Ind. ed. 2, 2 (1832) 220. — *Saraca triandra* Baker in Hook. f., Fl. Brit. Ind. 2 (1879) 272. — Type: Plant from the Malay Archipelago, maybe cultivated in the Calcutta Bot. Gard.; authentic specimen(s) not seen; based on descr.

Eperua decandra Blanco, Fl. Filip. (1837) 368; ed. 2 (1845) 259; ed. 3, 2 (1878) 118. — Neotype (here chosen): *Merrill Sp. Blanc. no. 376* (L; iso in BO), Malampaya Bay, Palawan.

Jonesia monopetala Hassk., Retzia 1 (1855) 199. — *Pahudia hasskarliana* Miq., Fl. Ned. Ind. 1, 1 (1858) 1080, nom. illeg. — Type: *A. Boachi s.n.* (BO, n.v.), Java: Bantam.

Saraca obtusifolia Miq., Fl. Ned. Ind. 1, 1 (1855) 85 & (1858) 1080. — Type: *Horsfield 'L 187'* (K, photo in L; iso U, photo in L), Java (Banjoemas).

Intsia moelebei Vieillard, Bull. Soc. Linn. Normand. 9 (1865) 339. — Type: *Vieillard 386* (iso in L), New Caledonia.

Intsia retusa (Kurz) Kuntze, Revis. Gen. Pl. 1 (1891) 192; Prain, Sci. Mem. Med. Off. Army India 12 (1901) 44; Merr., Philipp. J. Sc. 11 (1916) Bot. 85; Bibl. Enum. Born. Pl. (1921) 296; Philipp. J. Sc. 30 (1926) 399; Burkill, Dict. 2 (1935) 1265; Meijer Drees, Bull. Jard. Bot. Buitenzorg III, 16 (1938) 88, f. 1a. — *Afzelia retusa* Kurz, J. Asiat. Soc. Bengal 42, 2 (1873) 73; Fl. Burma 1 (1877) 412; Baker in Hook. f., Fl. Brit. Ind. 2 (1878) 274; Prain, J. Asiat. Soc. Bengal 66, 2 (1897) 207 & 494; Ridley, Fl. Mal. Pen. 1 (1922) 639. — Type: From the Andamans, maybe collected by Kurz, no specimen cited; authentic material not seen, based on description.

Intsia tashiroi Hayata, Ic. Pl. Formos. 3 (1913) 85. — Type: *Y. Tashiro s.n.* (n.v.), S Ryukyu: Yaeyama Archipelago.

Intsia bijuga f. *hirsuta* Meijer Drees, Bull. Jard. Bot. Buitenzorg III, 18 (1938) 91. — Syntypes: *bb 2990* (BO, n.v.), Celebes: Salejjer; *bb 3918* (L), Celebes: Moena; *bb 3712* (BO n.v.), Moluccas: Ternate.

Leaves 2- (or 3-)jugate, rarely 1-jugate towards the top of twigs or below the inflorescences; petiole and rhachis (1.5–)2.5–11.5 cm long, glabrous. Leaflets (broadly) elliptic, ovate, obovate, rarely suborbiculate, (2.5–)5–10(–18) by (1.5–)4–6(–12) cm; apex obtuse, rounded, sometimes shortly acuminate, rarely slightly notched; base acute, cuneate, or obtuse, often slightly asymmetric; petiolules 2–6 mm. Inflorescences up to 10(–17) cm long, pubescent, glabrescent, or more or less glabrous; pedicels 7–12 mm. Hypanthium usually about the same length as the calyx lobes. Calyx lobes elliptic, 6–10(–16) by 4–5(–7.5) mm. Petal: lamina 6–10(–30) by 10–15(–35) mm; claw c. 5 mm long. Fertile stamens: filaments c. 3 cm; anthers c. 2 mm long; staminodes up to 10 mm. Ovary c. 7.5 mm long; style c. 4 cm. Pods 8.5–15(–28) by 4–5(–7.2) cm. Seeds 2–3.5 cm long and wide, c. 0.8 cm thick.

Field notes – Tree up to 40 m high; bole straight, sometimes crooked, up to 24 m long and 1 m d.b.h., but usually smaller. Buttresses when present up to 2(–4) m high, extending outwards c. 2 m. Bark covered with small shallow circular depressions. Petals white, later turning pink, red, or purple. Fertile stamens with red or purple filaments. Style red or purple. Pods brown or black when ripe.

Distribution – As under the genus.

Cultivated in Africa (Zanzibar and Tanzania, fide Brenan, 1967), in India (Calcutta Bot. Gard.), and in Java (Hort. Bog. sub no. I-I-2, died in 1959; I-C-16a).

Habitat – Along (sandy) sea coasts, edges of rivers, tidal or temporarily inundated places with (salty) water, back-mangroves, in primary and secondary forests, in Kalimantan once found on acid sandy soil; recorded from western New Guinea as rather common (Adi I., *BW 9825*, L) or very common (Japen I., *BW 7009*, L), from sea-level up to c. 600 m alt.

Ecology – Flowering and fruiting all year round.

Uses – See under the genus.

Vernacular names – Sumatra: merkau (M), merkau ajer (East Coast). Malay Peninsula: ipil (or ipeh), ipil tandok, malapari, merbau, merbau ayer, merbau changkat, merbau laut (M). Java: merbae, merbau, merbo, taritih (Sundanese). Lesser Sunda Islands: ibla (Sumba), ipi (Flores). Brunei: ipil-ipil (M). Sabah: epil, merbau paya, ipil (Bajan), moebau (M), talolonandim (Beaufort). Kalimantan: ipil merbau suglai (Sesajap). Philippines (see Merrill, 1923: 257). Celebes: bajani (bajang or bajam) (Makassar), gefi (or ogifi), ipi, ipilo (Moena), ipi (Koeli & Taa), kintom (Banggai),

lan ggiri (Tobela-To Tambei), loroeroe (Tobela-To Padoe). Moluccas: dowora (Morotai & Ternate-Tidore), fraa (Kai), kajoe besi merah or kajoe besi panti (Ceram), sikata'a (Talaud), kajoe tea (or k. besi) (Soela), aakonal, tahai hoboi or takai koboi (= aakomal = besi koening) (Aru). New Guinea: arir (Wanigela), ariri (Onjob), babibi (Sentani), babrie (Sentani), bat (Kemtoek), bauw (Atam), bendoro (Oro Bay & Orokaiva), bon (Madang), duhum (Mawan), epna (Labu), ferraai (Kowiai), ganam (Jal), gommagome (Kawa), haboe (Noemfoor), haero (Goaribari, Janbwank, Kai-gorin), jep (Bembi), kaboei (Biak), kwila (Pidgin), amele, mep, milimbu (Faita), paseh (Asmat), patoem (Njou), pian (Amberbaken), pota (Mimika), rang & raung (Sko), rong (Ambai), seka (Manikiong), tangibe (Sko), wohne (Waskuk), yambwan (Dunpu). New Britain: bana (Garumaia).

Notes – Colebrooke (1818) published his new species *Macrolobium bijugum*, based on a plant of unknown origin and date of introduction, cultivated in the Calcutta Botanic Garden. He gave a detailed description and one well-prepared plate (with drawings of habit, flowers, pod, and seed) of the plant, but did not cite any collection. I have not seen any publication indicating that the authentic material has ever been preserved or is extant. However, one well-preserved specimen, i.e. *Wallich Cat. no. 5823A* (K-W; K, photo in L; on IDC microfiche) is from the Calcutta Bot. Gard. (cf. Brenan, 1967: 130). From his description and plate the identity of this species had been correctly interpreted by Kuntze (1891), followed by others, as belonging to *Intsia*, as *I. bijuga* (Colebr.) Kuntze.

Saraca obtusifolia Miq. was treated as a synonym of *Saraca declinata* (Jack) Miq. by Zuijderhoudt (Blumea 15, 1967: 419). The type of this species is in Kew bearing three labels: 1) 'Herb. Javanicum Dr. Horsfield L 187'; 2) name of this new species in Miquel's handwriting; and 3) a special printed label of Kew for the specimens collected by Thomas Horsfield from Java (in 1802–1818). This specimen had been annotated, as the type of Miquel's species and as belonging to *Intsia bijuga* (Colebr.) Kuntze. There is also one duplicate of this collection in U, which had been annotated by G.J.H. Amshoff as belonging to *Intsia*.

Intsia tashiroi Hayata (1913) was based on a plant from S Ryukyu: Yaeyama (as Yaemaya) Archipelago. I have not seen the type, but have studied the detailed original description and examined well-prepared specimens, both in flower and in fruit, from Ishigaki I., belonging to the same Archipelago, collected by S. Hatusima (1888, L), and Furuse (2837, 3712 & 4577, K, photos in L; 3727 & 3974, K). In the Index Kewensis this species was erroneously listed as from Formosa (Taiwan); as far as known plants of this genus have not yet been found there in the wild (cf. Leguminosae in Fl. Taiwan, vol. 3, 1977: 148–421). Walker (1954) already rightly reduced this species to *Intsia bijuga*, so its distribution is now known to extend further north to southern Ryukyu (Fig. 1) (cf. De Wit, 1941: f. 1; Whitmore, 1972: f. 9).

2. *Intsia palembanica* Miq.

Intsia palembanica Miq., Fl. Ned. Ind., Suppl. (1860) 107, nom. nud.; (1861) 289; Prain, Sci. Mem. Med. Off. Army India 12 (1901) 45; Meijer Drees, Bull. Jard. Bot. Buitenzorg III, 16 (1938) 92, f. 1c; De Wit, Bull. Bot. Gard. Buitenzorg III, 17 (1941) 142, f. 1; Corner, Ways. Trees ed. 2, 1 (1952) 396; Whitm., Tree Fl. Mal. 1 (1972) 262, f. 1, 2, 9; Meijer, Field Guide Trees W. Mal. (1974) 185, f. 44; Cockb., Trees Sabah 1 (1976) 170, f. 36; Verdc., Man. N.G.

Legumes (1979) 93; K. & S. S. Larsen, Fl. Thailand 4 (1984) 126; Gunn, Techn. Bull. U.S.D.A. 1755 (1991) 258, f. A & D. — *Afzelia palembanica* Baker in Hook. f., Fl. Brit. Ind. 2 (1878) 275; K. Schum. & Lauterb., Nachtr. Fl. Deut. Schützgeb. (1905) 276; Ridley, Fl. Mal. Pen. 1 (1922) 640; Burkill, Dict. 2 (1935) 1243, as *I. bakeri* Prain. — Lectotype (here chosen): *Teijsmann* 4535 (U, photo in L), Sumatra (Lamong, near Kebang); syntypes: *Teijsmann* (all HB no.) 3666, 3820, 3914 & 4315 (U, photos in L), Sumatra (Palembang & Lampong).

Intsia plurijuga Harms, Bot. Jahrb. 55 (1917) 54; Meijer Drees, Bull. Jard. Bot. Buitenzorg III, 16 (1938) 95, f. 1d; Kanehira & Hatusima, Bot. Mag. Tokyo 56 (1942) 363. — Syntypes: *Leder-mann* 7441 & 8652 (K, photos in L), *Schlechter* 14219 (iso K, photo in L), New Guinea.

Intsia acuminata auct. non Merr.: Verdc., Man. N.G. Legumes (1979) 90.

Leaves 4-jugate, rarely associated with some 2-, 3-, or 5-jugate ones; petiole and rachis (3.5–)9.5–17.5(–26) cm, both puberulous, glabrescent. Leaflets ovate, elliptic, sometimes broad-ovate or -elliptic, or suborbicular, rarely obovate or lanceolate, (3–)10–13.5(–18.5) by (3–)5–7.5(–10.5) cm; apex obtuse or rounded, sometimes slightly notched, (shortly) acuminate; base obtuse, rounded, cuneate, rarely slightly truncate or subcordate, often somewhat asymmetric; nerves 6–10 per side; petiolules 2–5 mm. Inflorescences up to c. 10 cm long, pubescent, glabrescent; pedicels 3–12 mm. Hypanthium 3–4 mm long. Calyx lobes (broadly) elliptic, ovate, or slightly obovate, 6–8(–12) by 3–6.5(–8) mm. Petal: lamina 3–6(–10) by 3–6.5(–8) mm; claw 2–5 mm long. Fertile stamens: filaments 2–4 cm; anthers c. 2 mm long; staminodes 4–10 mm. Ovary 5–6 mm long; style 2–3.5 cm. Pods 15–19(–40) by 5.5–7(–9) cm. Seeds 3–4.5 by 1.5–3 cm, 0.5–1.2 cm thick.

Field notes – Tree up to 45 (rarely more) m high, bole straight or slightly sinuous, up to 22(–30) m long, and up to 1(–4) m d.b.h. Big trees often with buttresses up to 7 m high, extending outwards 6 m, and 30 cm thick. Bark often rather smooth, not fissured, scaly. Petals pale yellow or white, pink, or red. Pods brown or black when ripe, smooth. Seeds reddish or dark brown.

Distribution – India (Andamans), Burma, Thailand, and Malesia: throughout (except Java ?). Fig. 1.

Cultivated in Java (Hort. Bog., sub no. I-I-7 and I-C-10, from Sumatra).

Habitat – Widespread, in coastal regions, edges of seasonal swamps, on inundated lands, locally common to very common (e.g. in Japen I., New Guinea), in lowland primary or older secondary forests, sometimes on sandstone and limestone hills, from sea-level up to 850 m alt.

Ecology – Flowering from Jan.–April and Aug.–Nov. Fruiting from Feb.–Dec.

Uses – See under the genus.

Vernacular names – Sumatra: merbau abang, merbau sepang (M), tandoek (Palembang), merbau asam, m. boei, m. gatja, m. insi, merboh (Atjeh), merbau tapah toehvel (M), toeko (Nias). Malay Peninsula: ironwood & Malacca teak (English), merbau, m. ayer, m. kunyit, m. puteh, m. tandok (M). Lesser Sunda Islands: rai (Wetar). Brunei and Sarawak: merbau, m. ayer, m. bukit (Iban). Sabah: merbau (M), polomok (Api-Api River). Kalimantan: alai, a. anglai (Dajak), djembai, kerek (Kutai), ipil (M & Dajak), maharan (M). Celebes: ipi hout (Bone). Moluccas: dowora (Morotai), dowora kome (Halmahera). New Guinea: bau (Atam), bauw, bouwa, sekka, (Manikiong), bidjam, piam (Kebar), koboe, midek (Mooi), kwila (Madang & Northern Dist.), mer (Arfak), mewit, ngoeit (Karoon), ndirin (Tehid), pase (Asmat), piam (Amberbakan), rompi (Japen), rong (Nemo), temmen (Tor).

Notes — There are two specimens from Sumatra collected by Teijsmann (s.n.) in L (under HLB 908.3-306 & 307), annotated in Miquel's handwriting as *Intsia palembanica*. These may be duplicates of the syntypes from U.

Podzorski (Palawan Bot. Exp. 1984, t. 2) published a photograph of the basal part of a tree, named as *Intsia bijuga*, from Palawan, the Philippines, and indicated that it is c. 4 m (four metres!) d.b.h. I have seen *Ridsdale 366* (L), a specimen in fruit, which belongs to the present species and thus extends its geographic range to the Philippines.

Swollen branchlets occasionally have been observed, which may be caused by ants (vide *Brass & Versteegh 13542*, L).

Meijer Drees (1938: 93) recorded that the trees flower usually after the fall of leaves, so fruiting specimens have nearly always young fleshy leaves whereas sterile collections bear more or less leathery ones.

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My appreciation is due to my colleagues: Dr W. Vink for preparing the reviews on the regeneration and uses of the genus *Intsia*; Dr Peter van Welzen for giving me his very useful computer programs of Herbarium Database Utilities; Dr P.W. Leenhouts, Dr M.C. Roos, and Dr C. Kalkman for their critically going through the manuscript and helpful remarks; and Mr Jan van Os for preparing the outline distribution map.

IDENTIFICATION LIST

- | | |
|---|---|
| 1 = <i>Acrocarpus fraxinifolius</i> Arnott | 4 = <i>Copaifera palustris</i> (Symington) De Wit |
| 2 = <i>Azelia javanica</i> (Miq.) Léonard | 5 = <i>Intsia bijuga</i> (Colebr.) Kuntze |
| 3 = <i>Azelia rhomboidea</i> (Blanco) Vidal | 6 = <i>Intsia palembanica</i> Miq. |

Aet & Idjan 789: 5; 811: 6 — Agama 8856: 6 — Ahern 146: 3; 208: 5; 704: 3 — d'Alleizette 1951: 5 — Anang 381: 5 — Anderson, D. 987, 1201, 3703, 3739: 5 — Atasrip 79: 5 — Atje 132: 5; 272: 6; 402: 5.

Backer 18747: 2; 33486: 5 — Balakrishnan, N.P. 3816: 5 — van Balgooy 2262: 6 — bb series 2226, 2700: 5; 3073: 6; 3918 (T), 4064: 5; 6124: 1; 6346: 2; 6380, 6381: 6; 6998: 5; 7003: 4; 7070: 6; 7187: 2; 7993: 6; 8365, 9142, 9353: 5; 9435: 6; 10125: 5; 13422, 15053, 15057: 6; 15063, 15081, 15370, 15968: 5; 16323, 16523, 16536, 16686: 6; 17624: 5; 19692: 6; 20412: 2; 20414, 21095, 21111: 6; 21476: 5; 22523: 6; 23038: 5; 23181, 23301: 6; 23828: 5; 24312: 6; 24454: 5; 24565: 6; 25012, 25074: 5; 25343: 6; 25489: 5; 25677, 25704: 6; 26003: 5; 26232, 27238, 28376: 6; 28734, 28764: 5; 28909: 6; 28998: 5; 29714: 2; 29800, 29845: 6; 30585, 30597: 5; 31066: 6; 31424, 31493, 31524: 5; 31600 (T): 2; 31663, 31731: 6; 31861, 31902: 5; 31991, 32171, 32206, 32375, 32460, 32580, 32581, 32583, 32588, 32589, 32590, 32591, 32592, 32593, 32594: 6; 32744: 2; 32763, 32764, 32765, 32767: 6; 32823, 32853, 33034: 5; 33253, 33280, 33378: 6; 33670, 33692, 33799, 33804: 5; 33826: 6; 33898: 5; 35079, 35161, 38376: 6 — Beccari PB 3915: 4 — Beguin 735: 5; 2205: 6; 2216, 2219: 5 —

- Bernier(?) 12034: 5 — BKF series 28699: 1; 40255: 5; 40259: 6 — Brass 2975, 24293, 28550: 5 — Brass & Versteegh 13542: 6 — BRUN series 114: 6; 5075: 5; 5102, 5642, 5643, 7851: 6 — BS series 801: 5; 6982: 3; 17428, 26740: 5 — BSIP series 109, 1081, 1934, 2689, 2924, 2951, 3158, 3930, 4236, 4716, 4996, 5330, 6240, 6546: 5; 6982: 3; 8643, 8883, 8998, 9420, 9670, 9728, 9791, 10376, 10467, 10672, 10813, 11384, 11662, 12344, 12619, 13103, 13639, 13700, 13804, 13927, 13975, 14037, 14333, 14424, 14543, 14596, 14741, 14945, 15361, 15485, 15706, 16397, 16508, 17192, 17549, 17601, 17671, 17951, 18248, 18458, 18949, 19499: 5 — BW series 47, 504, 693, 849, 1088: 5; 1160: 6; 1292, 1302, 1325: 5; 1388, 1428: 6; 1567: 5; 1598, 1746, 1895: 6; 1999: 5; 2079, 2087, 2092, 2096, 2201, 2288, 2292, 2618, 2631: 6; 2697, 2713, 2725: 5; 2742, 2786, 2823, 2824, 2825, 2826, 2828, 2829, 2830: 6; 2831, 2835, 2836: 5; 2838: 6; 2839, 2840, 2855: 5; 2916, 2970: 6; 3161: 5; 3244: 6; 3248, 3435, 3604, 3674, 3704, 3853, 3923: 5; 3976, 3980, 4247: 6; 4423: 5; 4654: 6; 4721, 4748, 4769: 5; 5606, 5748, 5875, 6308, 6744: 6; 6911, 7009: 5; 7206, 7239: 6; 7617: 5; 7667, 7707, 7845, 8088: 6; 8118: 5; 9005, 9083, 9098: 6; 9595, 9774, 9825, 9950: 5; 10015, 11000, 11084: 6; 11092, 11158: 5; 11628, 11765, 11852, 11998, 12340, 12907: 6; 14897, 15010: 5.
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- Elmer 11144: 3; 12102, 12953: 5; 15317, 16803, 20878: 3 — Endert 39E.1P.120, 39E.1P.366, 39E.1P.431, 39E.1P.473, 39E.1P.476, 39E.1P.480, 39E.1P.973, 39E.1P.974, E1351: 6 — Eyma 2837: 5.
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Uhl, F. 5953: 2 — Ursch 117: 5.

Verheijen 3384: 5 — Vidal 1282, 1287, 1297, 2635, 2670: 3 — Vieillard 386 (T): 5 — de Vogel 4254: 5 — Voyce 24: 5.

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