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 charac-
ters (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 work-
ing 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 con-
form to a conventional format. The descriptions as presented here are as such in ac-
cordance 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. PI. 1, 1964, 243 & 246) has been generally accepted now.

**ACROCARPUS**


Trees. Stipules small, caducous. Leaves spiral, impari- or paripinnate, pinnae and pinnules mostly opposite; leaflets petiolulate. Inflorescence axillary, in defoliated leaf-axils, solitary, sometimes few-branched near the base and appearing fasciculate or panicleate, 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, exserted; 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


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 round, 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.

Vernacular names — Sumatra: medang parrie or medang parit (Mt Sago region), kalamparik (Padang). Java: delimas or dlimas (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


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–(more-)ovuled; style slender, almost as long as the stamens; stigma small, round. Pods oblong, obliquely oblong, or slightly rhomboidal, compressed, black when ripe, glabrous, 2-valved, valves thick, woody, often 3–(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*

1b. 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


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-)5–6(–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. Butresses 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.


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.


Vernacular names – Sumatra: hataroem or ketaroem (Batak), kataroem (M), mero-bau (Atjeh). Java: djoelang perit (J), kidjoelang or djoelang (S & J), kidjoelang tau-doe 0 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


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, Bloe-œ; Teijsmann 8249 (BO, n.v.), Kali-
mantan, 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 subround, 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 cylindric.
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
(old) 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 tan-
doek (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 col-
lection, 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 acumi-
nata (Merr.) Harms.
Afzelia 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 heterostyloous. These two species are con-specific.

COPAIFERA


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


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 mm, 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 Sibu, 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), sepeter (Brunei & M), sepeter 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


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; petiules 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, discord, 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).
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, airdry), 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; Lanne-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 madagascariensis Thouars ex DC., Prod. 2 (1825) 509. — Type: Based on descr. of *Intsia* Thouars (1806).


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.


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


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 cm. 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.


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, tariuh (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), ferrai (Kowiai), ganam (JaL), gommagome (Kawa), haboe (Noemfoor), haero (Goaribari, Janbwan, Kai-gorin), jep (Bembi), kaboei (Biak), kwila (Pidgin), amele, mep, milimbu (Faita), paseh (Asmat), patoem (Njou), piai (Amherbaken), 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.

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 to 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; stamine nodes 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, 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.


Uses – See under the genus.

Vernacular names – Sumatra: merbau abang, merbau sepong (M), tandoek (Palembang), merbau asam, m. boei, m. gajia, m. insi, merboh (Atjeh), merbau tapah toehvel (M), toeko (Nias). Malay Peninsula: ironwood & Malacca teak (English), merbau, m. ayer, m. kunyit, m. puteh, m. tandoek (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), koboc, 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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IDENTIFICATION LIST

1 = *Acrocarpus fraxinfolius* Arnott 4 = *Copaifera palustris* (Symington) De Wit
2 = *Afzelia javanica* (Miq.) Léonard 5 = *Intsia bijuga* (Colecbr.) Kuntze
3 = *Afzelia rhomboidea* (Blanco) Vidal 6 = *Intsia palembanica* Miq.


Backer 1874: 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: 5; 33898: 5; 35079, 35161, 38376: 6 — Beccari PB 3915: 4 — Beguin 735: 5; 2205: 6; 2216, 2219: 5 —
van Ooststroom 12902: 5.
S series 1210, 5219, 8261, 8565, 8852: 4; 11206: 6; 12268, 12942, 13111, 17257: 4; 25988: 3; 31884: 5 — SAN series A2679 (Kadir): 5; A 2724 (Mail), A 2973 (Melegrito): 3; 6711 (Puasa): 6; 8571 (Lupang): 5; 8572 (Lupang), 15308: 6; 17427: 4; 19871: 6; 24517: 3; 24929, 25757: 5; 25814: 6; 34583: 5; 35909, 36977, 37060: 3; 40477: 6; 42598, 44722, 47199: 3; 54987, 55710: 6; 56187, 56197, 57021: 3; 57252, 70224: 6; 75614, 82664: 3; 83716: 6; 82664, 88889, 89274, 93580: 3 — Saunders 196, 217, 531: 5 — Schlechter 14219 (T): 6 — Schodde 2747, 3082: 5 — Schodde (& Craven) 4545: 5 — SF series 37294 (cult.): 3; 39001: 5 — van Slooten & Backer 35042: 5 — Smith, A.C. 9354: 5 — Stainton 6407: 1 — van Steenis 18240: 5 — Stone 3805, 4747: 5.
Takamine 251: 5 — Teijssmann HB 862 (T), HB 887 (T): 1; HB 2950: 5; HB 3666 (T), HB 3820 (T), HB 3914 (T), HB 4315 (T): 6; HB 4475: 5; 4535 (T): 6; HB 5026, 7800: 5 — Thakur Rup Chand 4204: 1.
Uhl, F. 5953: 2 — Ursch 117: 5.