

LEGUMINOSAE

201

Sindora siamensis var. *maritima* (Pierre) K. & SS. Larsen

Synonyms : *Sindora conchinchinensis* Baillon, *Sindora maritima* Pierre, *Sindora siamensis* Teijsm. ex Miq., *Sindora siamensis* Teysm. ex Miq., *Sindora wallichii* var. *siamensis* (Teijsm.) Bak.

Vernacular name(s) : Ma-kba-ling (Thai.), Sepetir mempelas (Mal.)

Description : Tree, 10-15 m tall, deciduous, with brownish bark. Leaves alternate, with 3(-5) pairs of opposite leaflets (no terminal leaflet); leaflets oblong-ovate, rounded tip or with a slight notch at the tip, 6-15 cm by 3-8 cm; main axis of compound leaf (7-)8-15(-20) cm long; petiole 3-7 mm long. Upper surface of leaflet is dull, the veins very thinly velvety, faint net-like lines on both surfaces. Flowers densely clustered in a compound terminal panicle, 10-17(-35) cm long, stalks golden coloured, finely hairy. Flowers are bisexual and have a short, 2-3 mm long stalk; flowers small, 3-5 mm by 3-5 mm, with leaflets at the base. Sepals 4, separate, green, ovate, 3-3.5 by 7.5-9 mm long, outside hairy, often warty, with a few spines on the ends. Petals 1, boat-shaped, variable in colour from light yellow to red or brown, 2.5-3 by 7-9 mm, woolly outside, smooth inside. Stamens 10 (9+1), pink, fused unevenly, with curved filaments, pink, 3-5 mm long; style 10-12 mm; 5 stigmas. Fruit consists of a pod, which is flat, irregularly round or ovate, rather diffusely spiny (spines up to 4 mm), 5-7 by 6-10 cm; stalks are very short. Seeds number 1-3 and are ovate, 10-15 mm. Two varieties of *Sindora siamensis* are recognised: var. *siamensis*, which has a hairy upper surface of the leaflet, and var. *maritima*, which has a smooth leaflet.

Ecology : Lowland forest species, up to 400 m asl (in Thailand). Pollination is carried out by flies. Also in beach forests and occasionally on landward margins of mangroves. Mangrove associate species.

Distribution : Southeast Asian species; recorded from Cambodia, Laos, Thailand, Vietnam (endangered) and the Malay Peninsula (Kelantan, collected once). The mangrove associate variety *maritima* is known from Cambodia, Thailand and Vietnam only.

Abundance : Uncommon to rare.

Use(s) : Planted as ornamental, for example, in Singapore Botanic Garden. Wood is used for planking.

Source of illustration : <http://www.ku.ac.th/AgrInfo/plant/plant1/p23.html>

Reference(s) : Whitmore (1972a), Hou *et al.* (1996),
<http://www.wcmc.org.uk/infoserv/countryp/vietnam/app5.html>
http://www.wildlifefund.or.th/07_Habitats/02_beach_forest/beach_forest00.html
<http://flora.sut.ac.th/st154.html>

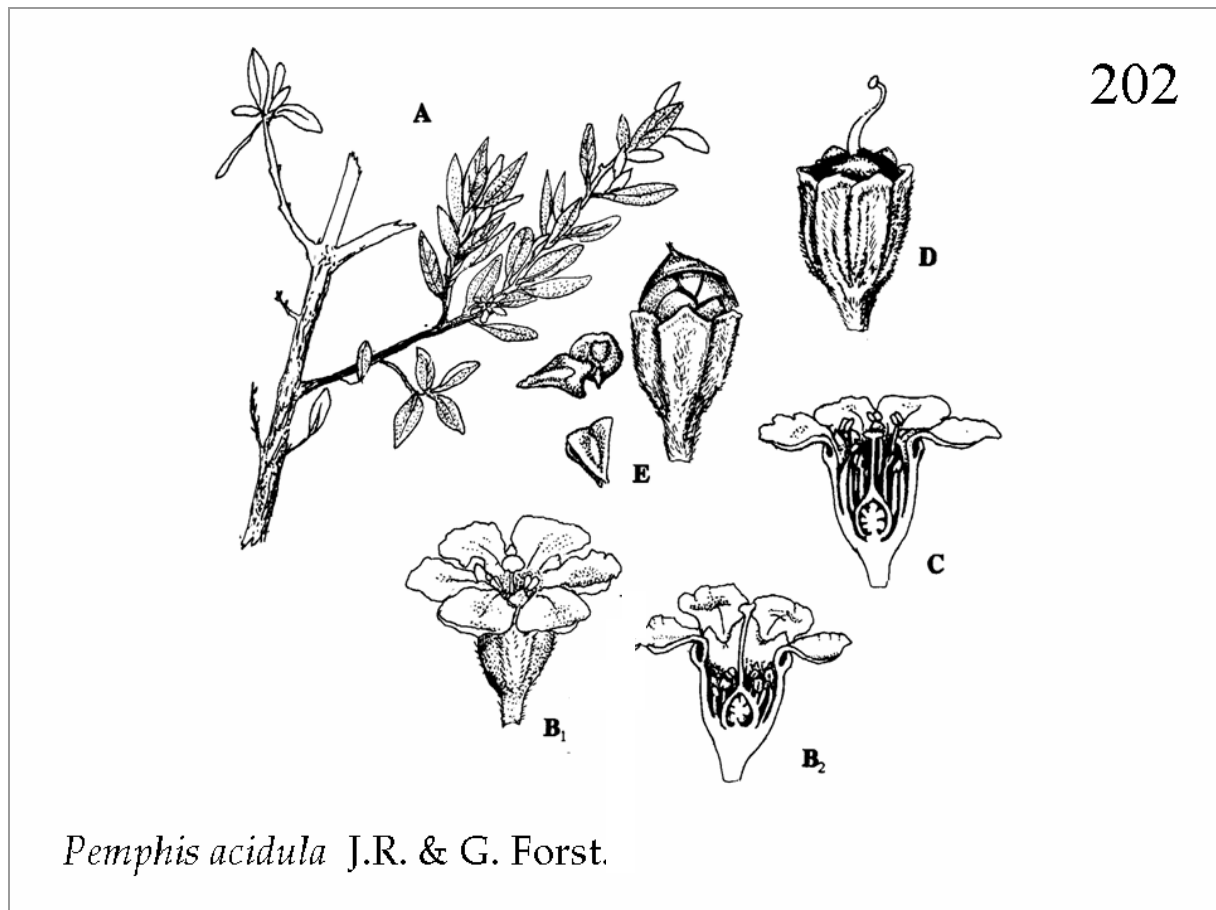


Fig. 202. *Pemphis acidula* J.R. & G. Forst. (a) Branchlet, (b1) flower, (b2, c) longitudinal sections of flower (long-styled and short-styled, respectively), (d) fruit, and (e) fruit with seeds emerging.

LYTHRACEAE

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Pemphis acidula J.R. & G. Forst.

Synonyms : *Lythrum pemphis* L., *Mangium ferreum* Rumph., *Mangium procellanicum* Rumph., *Melanium fruticosum* Spreng., *Millania rupestre* Zipp., *Pemphis angustifolia* Roxb., *Pemphis setosa* Blanco

Vernacular name(s) : Bungor (Mal.), Kayu sentigi, Cantinggi, Mentigi, Wakat Besi, Cantigi, Sentigi, Keneas, Silu Tasi (Ind.), Kabantigi, Ligad, Ligat, Palupa, Pantigi, Pilit, Uaduat – *Bantigi* (Phil.), Thian le (Thai)

Description : Evergreen shrub or small tree, up to 2-4(-8) m tall, often spreading. It has a light grey to brown bark that is fissured in older specimens. Stems may measure up to 20 cm diameter at breast height and are usually short and crooked. Leaves are densely covered with silky hairs and slightly acidic (taste!); leaves alternate, ovate to obovate, occasionally fleshy, 9-20 by 4-8 mm, with a 1-2 mm long leaf stalk. The bisexual flowers are solitary and of two different morphological types, both located in the axils. The more common 'pin' flowers are short-styled (1 mm long) and the stamens enclose the stigma. The so-called 'thumb' flowers are long-styled (3-4 mm long) and the stamens extend beyond the stigma. The densely hairy base of the calyx is tubular, 6-8 mm long, 12-angled, and green to yellow or green, with red or purple tips. The persistent calyx lobes are triangular, 1 mm long, with accessory lobes alternating with clefts. The crumpled, obovate petals are white, 6 by 5 mm, located at points that alternate with the calyx lobes. The fruit is reddish (to brown on maturity), round, 4-5 mm across, enveloped by the persistent calyx and topped by the style. Each fruit has 10-20 seeds that are circular and flattened, with a corky margin or wing.

Ecology : Coastal, occurs at the landward margin of mangroves, often above the high tide level, and on beaches. Occurs on sand, laterite, limestone and gravel; rocky outcrops above normal tidal influences are often colonised. Flowers and fruits are produced all year round. Flowers are pollinated by bees. The corky margin of the seed aids buoyancy and hence water dispersal. It shows a high degree of variation depending upon habitat. The species varies from low, spreading shrubs to trees with a single straight trunk. Leaves vary from nearly orbicular, small and fleshy to larger, obovate and non-fleshy. Mangrove associate species.

Distribution : From East Africa (Tanzania, Zanzibar) through South and Southeast Asia to Hong Kong, tropical Australia and the western Pacific. In Southeast Asia recorded from Thailand, Malaysia (Johore), Singapore, the Philippines, Indonesia (Papua, Sumatra, Moluccas, Java, Madura) and Papua New Guinea. Perhaps overlooked elsewhere in Southeast Asia.

Abundance : Uncommon, but locally abundant (e.g. in Java); widespread in Australia.

Use(s) : Favoured for its very hard, durable wood, which is used for hand tools, anchors, walking canes, fence posts and novelties. The wood is extremely heavy, very hard and very strong. It seasons well with very little checking or warping; it is very difficult to work, but takes a high finish.

Source of illustration : Based on Wightman (1989).

Reference(s) : Heyne (1950), van Steenis *et al.* (1951), Backer & Bakhuizen van den Brink (1963-8), Everett & Whitmore (1972), Percival & Womersley (1975), Tomlinson (1986), Wightman (1989), Aksornkoae (1993), Aragones *et al.* (1998).

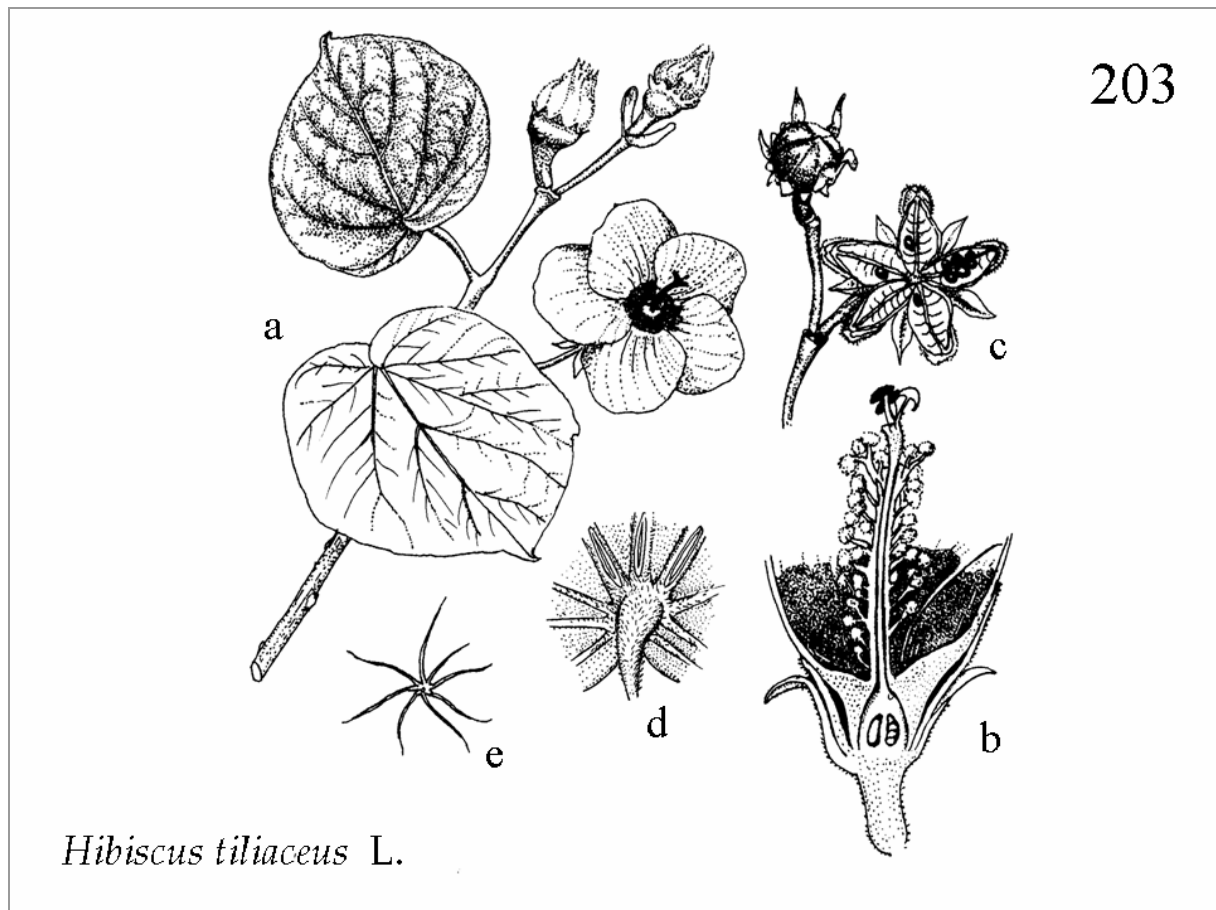


Fig. 203. *Hibiscus tiliaceus* L. (a) Branchlet with buds and flower, (b) longitudinal section of flower, (c) fruit, ripe and open, (d) base of leaf, and (e) stellate hair from leaf.

MALVACEAE

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Hibiscus tiliaceus L.

Synonyms : *Hibiscus abutiloides* Willd., *Hibiscus celebicus* Koord., *Hibiscus cuspidatus* Sol. ex Park., *Hibiscus elatus* (non Sw.) Miq., *Hibiscus hastatus* L., *Hibiscus similis* Blume, *Hibiscus tricuspidatus* Sol. ex Park., *Novella repens*, *Novella rubra*, *Paritium tiliaceum* (L.) St. Hil.

Vernacular name(s) : Sea Hibiscus (E), Baru, Baru-baru, Bebaru, Bebaru bulu (Mal.), Waru Laut, Siron, Waru Lot, Waru Lenga, Waru Lengis, Baru, Kabar, Bahu, Molowahu, Fau, Kasjanaf, Iwal, Wakati – Waru (Ind.), Bago, Balabago, Balibago, Bauan, Dangliu, Danglog, Hanot, Laogo, Lambagu, Malibago, Marakapas, Mayambago, Ragindi - *Malubago* (Phil.), Tra nhó't (Viet.), Pho thale, Po thale (Thai.), Dawm-beus, Kab-baspreyteukbray (Camb.)

Description : A spreading tree, up to 15(-30) m tall, with a greyish-brown, mottled, smooth bark and a trunk that may measure up to 30 cm diameter at breast height. The leathery leaves, 7.5-15 by 7.5-14.5 cm, are usually densely covered with short hairs underneath. They have 1-3 glands and large (1-6 cm), broad leaflets at the base of the leaf stalk. Flowers occur singly or in groups of 2-5 in the axils of leaves. The base of the elongated flower cluster stalk is enclosed by a pair of enveloping leaflets that later fall and leave a conspicuous, ring-like scar. The bisexual flowers are typically 'hibiscus-like', with the surfaces of the petals, stamen tube and style covered with glandular hairs. The (pale) yellow flowers have a dark brownish-purple centre, and are large (5-7.5 cm across) and showy. They are yellow on the evening they open but turn purple at the end of the following day, when they fall off before withering. Flowers have a conspicuously 5-toothed calyx, the remains of which occur on the shortly-beaked fruit. Fruit measures about 2 cm across, splits open into five segments, and has minutely hairy seeds. Differences between the two mangrove Malvaceae are given on the next page, with the description of *Thespesia populnea*.

Ecology : Characteristic of tropical seashores and often associated with mangroves. Common on all sandy and rocky shores in Southeast Asia. Also common along riverbanks in the lowlands. Flowering occurs all year round. The seed is buoyant due to an air cavity and is capable of germination after seawater immersion. In old leaves the sugar-excreting glands are often black because they are invaded by a fungus. Sometimes a coastal subspecies is recognised: *Hibiscus tiliaceus* subspecies *tiliaceus*. Mangrove associate species.

Distribution : Pantropical, at least in cultivation, and occurs throughout Southeast Asia. Its precise natural ecological and geographic distribution is uncertain.

Abundance : Widespread and common.

Use(s) : Planted as a shade tree in gardens and timber yards. Roots are used as medicine to treat fever. Fibre of bark used to produce rope, and for caulking of boats. Leaves are sometimes used for fodder. Timber used to make inner parts of boats (Lombok, Indonesia). Lopped forms often occur near villages, and cuttings are planted to make living fences. Wood is soft and weak, but seasons well, finishes highly and is easy to work. Used for utensils and musical instruments.

Source of illustration : Based on Tomlinson (1986) and Wightman (1989).

Reference(s) : Heyne (1950), Backer & Bakhuizen van den Brink (1963-8), van Borssum Waalkes (1966), Kochummen (1972), Tomlinson (1986), Afriastini (1988), Wightman (1989), Aksornkoae (1993), Aragones *et al.* (1998), Marschke (2000).

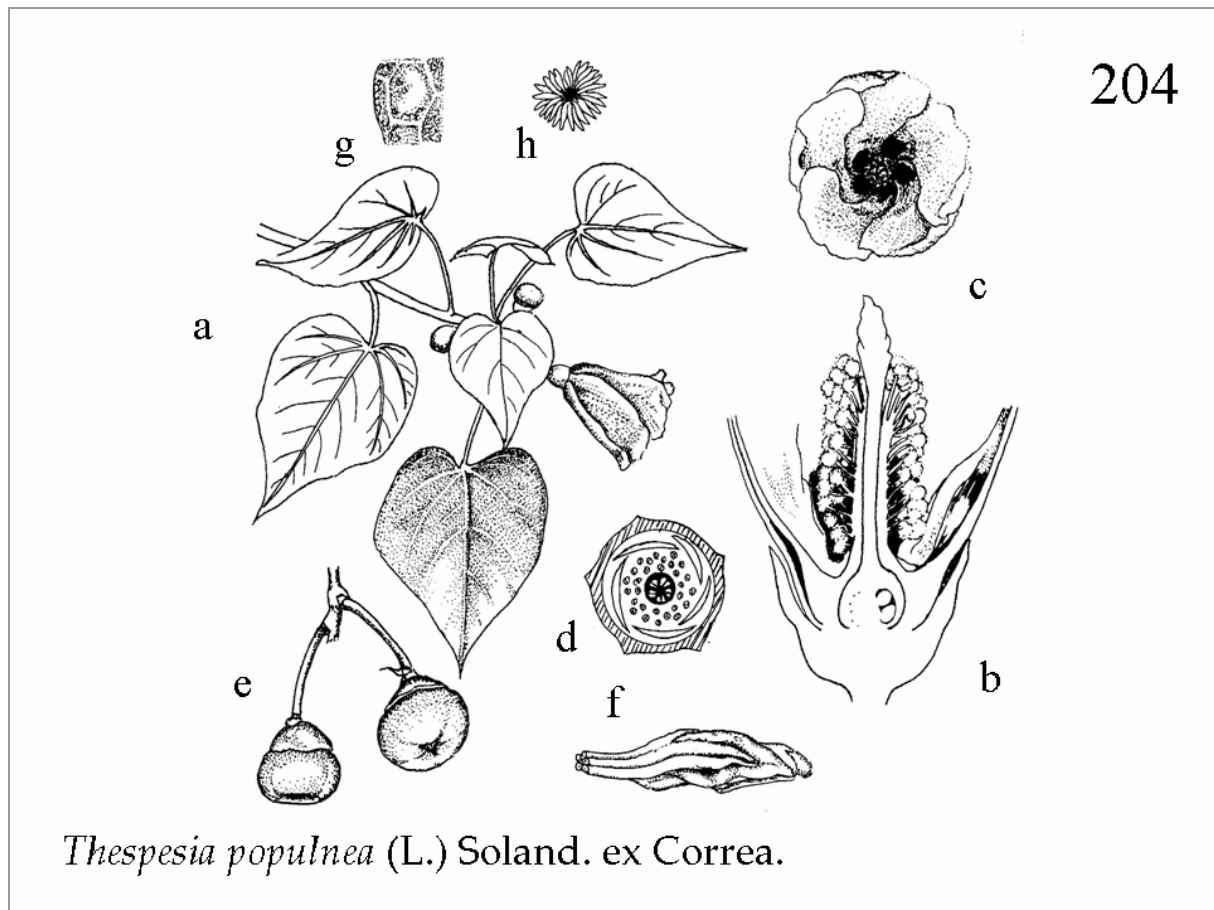


Fig. 204. *Thespesia populnea* (L.) Soland. ex Correa. (a) Branchlet with buds and flower, (b) longitudinal section of flower, (c) flower, (d) flower diagramme, (e) fruits, (f) stigma, and (g) detail of leaf surface, with (h) enlarged, star-shaped scale.

MALVACEAE

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Thespesia populnea (L.) Soland. ex Correa

Synonyms : *Bupariti populnea* (L.) Rothmaler, *Hibiscus bacciferus* Forster, *Hibiscus macrophyllus* (Bl.) Oken, *Hibiscus populneus* L., *Malvaviscus populneus* (L.) Gaertn., *Novella litorea* Rumph., *Thespesia banalo* Blanco, *Thespesia howii* Hu, *Thespesia macrophylla* Blume, *Thespesia populneoides* Roxb.

Vernacular name(s) : Bebaru (Mal.), Waru Laut, Waru Pantai, Waru Lot, Salimuli – *Baru laut* (Ind.), Balu, Banag, Banago, Banaro, Bango-pula, Ba-ot, Iden, Tuba-tuba, Valo - *Banalo* (Phil.), Tra bô' dê (Viet.), Porhteukprey (Camb.), Pho thale (Thai)

Description : Tree, 2-10(-20) m tall, with a trunk that may attain a diameter at breast height of about 15 cm. Leaves are spirally arranged and initially densely covered with brown scales that are later shed. Older leaves are thus smooth, and glandless on midrib of the under surface, but often having small hollows (that may house ants) between the main veins at the base of the leaf. Leaves are leathery, without lobes, ovate to heart-shaped, occasionally with a pointed tip, and measuring 7-24 cm by 5-16 cm. Leaf stalks measure 6-16 cm. Flowers are solitary, with a scaly stalk of 2.5-10 cm. The corolla is 6-7 cm, bell-shaped, light yellow with a purple centre. Flower buds and young fruit contain a yellow, milky juice that turns red. Ovaries also have a yellow latex. There are 3-8 minute leaflets on the outer calyx. Fruit is compressed round to broadly egg-shaped, 2.5-4.5 cm across; fruit does not usually open while still on the tree. There are 3-4 seeds, covered with dense, short hairs, in each compartment of the fruit. In the Philippines literature (e.g. Aragones *et al.*, 1998), *Thespesia populneoides* is often still recognised as a separate species (in contrast to *T. populnea*, it has coppery leaves and smooth branches). Differences between the two mangrove Malvaceae are:

<i>characteristic:</i>	<i>Hibiscus tiliaceus</i>	<i>Thespesia populnea</i>
<i>calyx</i>	5-lobed	not lobed
<i>leaf pubescence</i>	usually present	absent
<i>main veins on leaf</i>	9-11, indistinct	7, distinct & yellowish
<i>brown scales on young leaves</i>	absent	present
<i>fruit readily opening while on tree</i>	yes	no

Ecology : Occurs on beaches, sandy and rocky coasts, in the *Barringtonia* formation and the landward margin of mangroves. Wide distribution due to floating seeds that can stay alive in seawater for many months (tested up to 12 months). May be found inland, where it has been planted. Mangrove associate species.

Distribution : Pan-tropical; occurs throughout Southeast Asia.

Abundance : Common.

Use(s) : Light timber; bark in the past used as a source of fibre. Leaves and fruits used as medicine. Planted as roadside tree or in villages.

Source of illustration : Based on Tomlinson (1986) and Wightman (1989).

References : Heyne (1950), Backer & Bakhuizen van den Brink (1963-8), van Borssum Waalkes (1966), Kochummen (1972), Tomlinson (1986), Afriastini (1988), Wightman (1989), Said (1990), Aksornkoae (1993), Aragones *et al.* (1998), Marschke (2000).

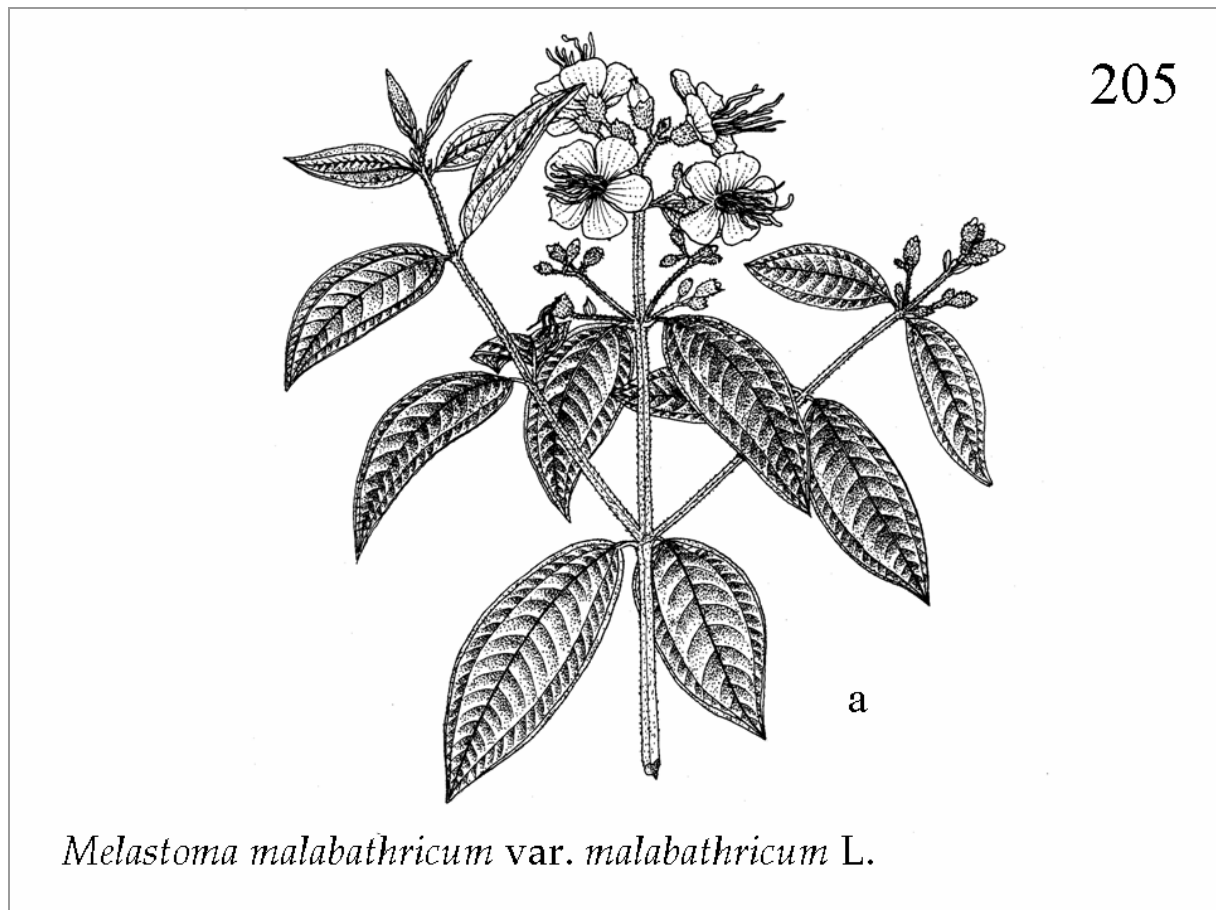


Fig. 205. *Melastoma malabathricum* var. *malabathricum* L. (a) Terminal branch with flowers and immature fruit.

MELASTOMATACEAE

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***Melastoma malabathricum* var. *malabathricum* L.**

Synonyms : *Fragarius niger* Rumph., *Melastoma adpressum* Wall., ex Triana, *Melastoma affine* D.Don., *Melastoma asperum* Bl., *Melastoma baumianum* Naud., *Melastoma candidum* D.Don., *Melastoma imbricatum* var. *longipes* Craib., *Melastoma malabathricum* var. *grandiflorum* Craib. *Melastoma malabathricum* var. *polyanthum* (Bl.) Benth., *Melastoma oliganthum* Naud., *Melastoma polyanthemum* (Bl.) G.Don., *Melastoma polyanthum* Blume, *Melastoma polyanthum* Burm., *Melastoma pusillum* Bl., *Melastoma royeri* Bl., *Melastoma scabrum* Ridl., *Melastoma setigerum* Bl., *Melastoma tondanense* Bl., *Osbeckia royeri* (Bl.) Miq.

Vernacular name(s) : Singapore Rhododendron (E), Senduduk (Mal.), Senduduk, Kluruk, Senggani, Harendong, Kemanden (Ind.), Mua (Viet.)

Description : Shrub, often much branched, 0.5-1.5 m, rarely up to 3(-4) m tall. Branches (slightly) quadrangular, or (rarely) round, covered with small scales, and covered with bristles on the nodes, up to 2 mm long. Leaves simple, opposite, very variable in shape and degree of hairiness, opposite or rarely in threes, oblong-lanceolate, ovate-oblong, elliptic or almost rhomboid, 0.8-8.5 by 2-19(-20) cm, rounded to pointed at the base, hairy on both sides, either 5-nerved or 3-nerved with 2 thin marginal ones; leaf stalk 7-35 mm. Flowers more than 10 grouped together in a 2-3 cm long panicle; flower stalks 8 mm long. Calyx tube bell-shaped, 7 mm long, covered with 1-2 mm long scales, with 5 teeth, triangular, 1-4 by 3-7 mm. Petals 5, narrowly to broadly obovate, 5-20 by 10-24 mm, purple, pink or white. Stamens 10, unequal; the larger ones with 4-8 mm long filaments and linear, shortly beaked 6-9 mm long anthers, provided with a 6-12 mm long connective; the shorter ones with 3-7 mm long filaments. Berry widened at the top, (4-)8-9(-10) mm long, stalk 5-20 mm long, turning a very deep (almost black) purple when ripe. An extremely variable species, with many subspecies, varieties and forms recognised.

Ecology : From sea level to about 1650 m asl., in sunny and moist locations. Found in many ruderal and disturbed areas, secondary scrub, river banks and landward margins of mangroves. Mangrove associate species.

Distribution : Found from Madagascar and India through Yunnan and Southeast Asia to Australia. In Southeast Asia it is common throughout.

Abundance : Very common.

Use(s) : A poultice of the leaves is used to treat burns. Leaves are also used to treat diarrhoea and vaginal infections. Young leaves eaten as vegetable, and fruit is reportedly tasty and fit for human consumption. Roots are used to treat rheumatism and arthritis.

Source of illustration : Drawn from live specimen.

Reference(s) : Heyne (1950), Bakhuizen van den Brink (1943-45), Corner (1988), Hong (2000).

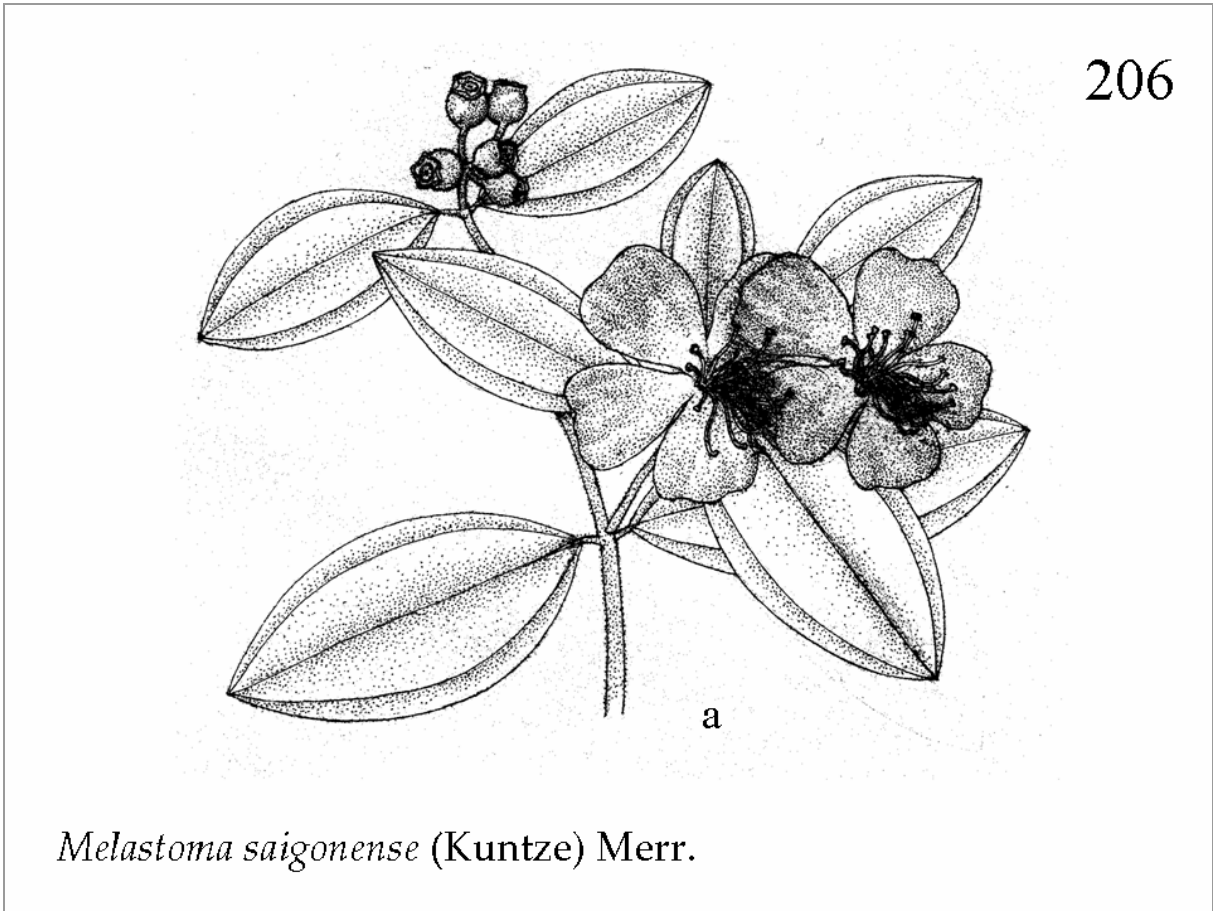


Fig. 206. *Melastoma saigonense* (Kuntze) Merr. (a) Flowering and fruiting terminal branchlet.

MELASTOMATACEAE

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***Melastoma saigonense* (Kuntze) Merr.**

Synonyms : *Melastoma villosum* Sims [non Aublet], *Osbeckia saigonense* Kuntze

Vernacular name(s) : Khlongkleng khon, Klong-kleng, Eng-air, Ti tang (Thai)

Description : Shrub, up to 3m tall, with quadrangular branchlets that are densely covered with reddish-brown stiff hairs. Leaves are simple, opposite, elliptical to lanceolate, 3-9 by 1.3-2.5 cm, base rounded, with a short pointed tip and a blade with (1-) 2 pairs of lateral primary veins; densely hairy on both sides, with a 6-20 mm long leaf stalk. Flowers are 4- or 5-merous, hairy on the outside; leaflets at base of flower stalk about 5 mm long. The hypanthium (a cup shaped base of the flower formed by the fusing of the calyx and petals) is 9-13 mm long and densely covered with star-shaped bristles. Calyx lobes triangular, about 7 mm long. Petals 15-20 mm long, purple. Stamens (8-) 10; outer anthers 9-10 mm long, purple, with a 9-10 mm long connective prolongation; inner anthers about 9 mm long, yellow, connective not prolonged. Fruit a reddish-purple capsule, 12-14 mm long.

Ecology : Common in scrubby vegetation in wet places, but also in evergreen or deciduous forests. Occasionally recorded on landward margins of mangroves. Mangrove associate species.

Distribution : Southeast Asian species, recorded from Myanmar, Laos, Thailand, Cambodia and southern Vietnam.

Abundance : Locally common.

Use(s) : Unknown.

Source of illustration :

http://www.dld.go.th/nutrition/exhibition/native_grass/other/Melastoma%20%20saigone%20nse.htm

Reference(s) : Aksornkoe (1993), Larsen & Nielsen (2001).

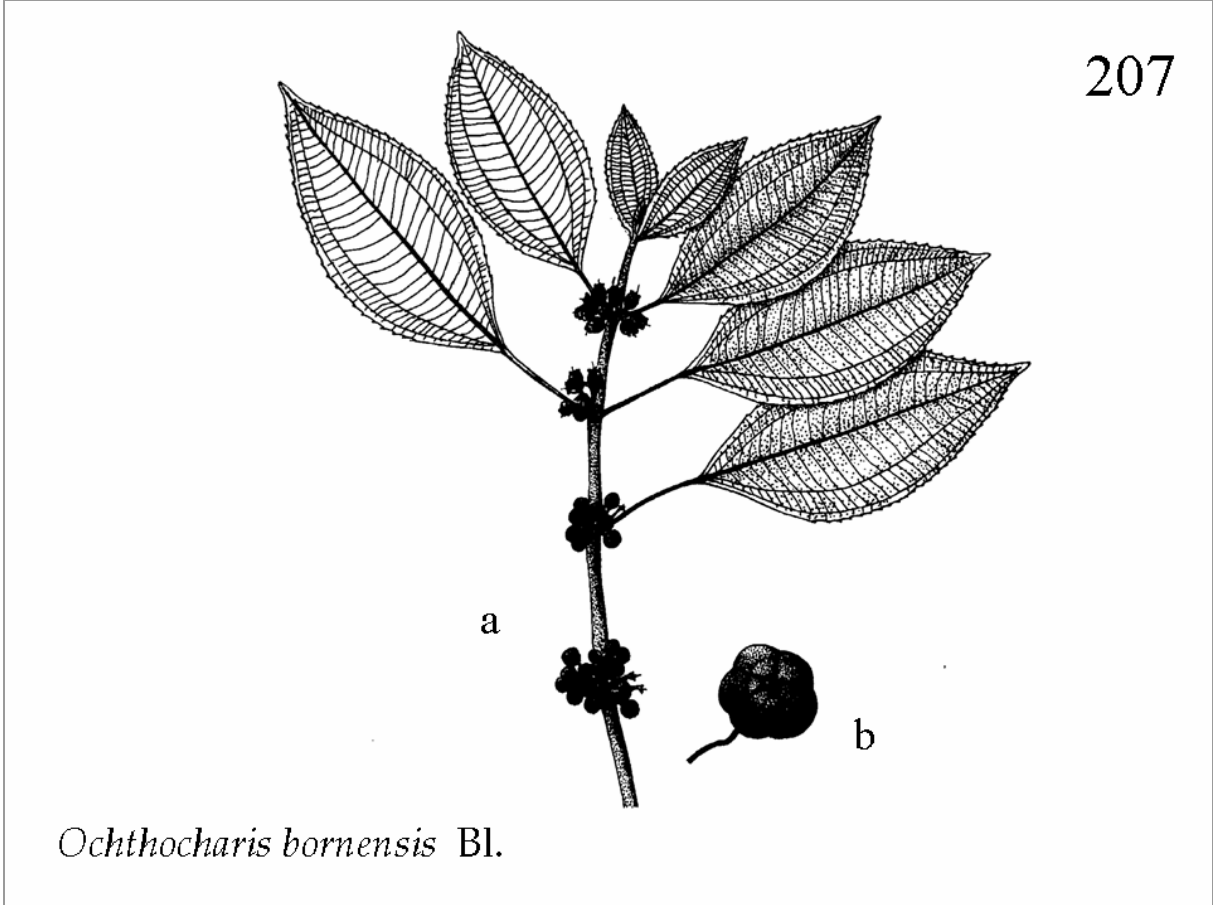


Fig. 207. *Ochthocharis bornensis* Bl. (a) Flowering and fruiting branchlet, and (b) fruit.

MELASTOMATACEAE

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Ochthocharis bornensis Bl.

Synonyms : *Ochthocharis attenuata* Backh. f., *Ochthocharis buruensis* T. & B., *Ochthocharis javanica* (haud Bl.), *Ochthocharis borneensis* (sic)

Vernacular name(s) : Karamunting, Sendudok Air (Mal., Ind.)

Description : A sparsely-branched, erect shrub, up to about 1.5 (-6) m tall, branches rounded-quadrangular, younger ones covered with short, brownish hairs. Leaves are opposite, ovate to narrowly-ovate or lanceolate leaves that measure 5-10(-14) by 2-4(-6) cm, rounded at the base and with a pointed tip. Like most other members of this family it has five conspicuous principal veins (three central, two along leaf margin) connected by numerous transverse, parallel, secondary veins. The leaf stalk is slender, 1-5(-6.5) cm long. Flower clusters are without a stalk, or with only a very short stalk. The 5-merous flowers are small, only 3 mm across, and are located in the axils. The calyx tube is 1.5 mm long, smooth, with five short (0.2 mm) triangular lobes. Petals are ovate, 1 by 2 mm, white with pink tips. The 10 stamens are spurred. The spherical fruits are light green, with the calyx persisting as a rim, 3-4 mm across, and with 10 longitudinal ribs. The 3-sided seeds are irregularly keeled. The name is often incorrectly written as *Ochthocharis 'borneensis'*. Note that '*Karamunting*' is the generic Malay/Indonesian name for many members of Melastomataceae.

Ecology : Occurs on landward margins of mangroves. Mangrove associate species. In adjacent communities there may be other members of the family, that are often present as 'weed' species. Most notably these may be *Melastoma malabathricum* L. with much larger, reddish-purple flowers and bright-yellow stamens. Mangrove associate species.

Distribution : Southeast Asian species, recorded in Brunei, Cambodia, Thailand (as *Ochthocharis javanica*), throughout the Malay Peninsula and in Indonesia (Sumatra, Bangka, Borneo and the Moluccas). Used to occur in mangroves of Singapore, but is now extinct. Also reported from Thailand, the Philippines and Papua New Guinea (www.rbgekew.org/herbarium/brunei/fams/68.htm), but this appears to be erroneous.

Abundance : Uncommon.

Use(s) : Both leaves and fruit (berries) are sour but eaten raw are prepared as a vegetable.

Source of illustration : Drawn from herbarium specimen, Bogor Herbarium.

Reference(s) : Heyne (1950), Bakhuizen van den Brink (1943-5), Tomlinson (1986), Ng & Sivasothi (1999), http://www.forest.go.th/Botany/Flora/species%20list/volume7_3/Melastomataceae.htm.

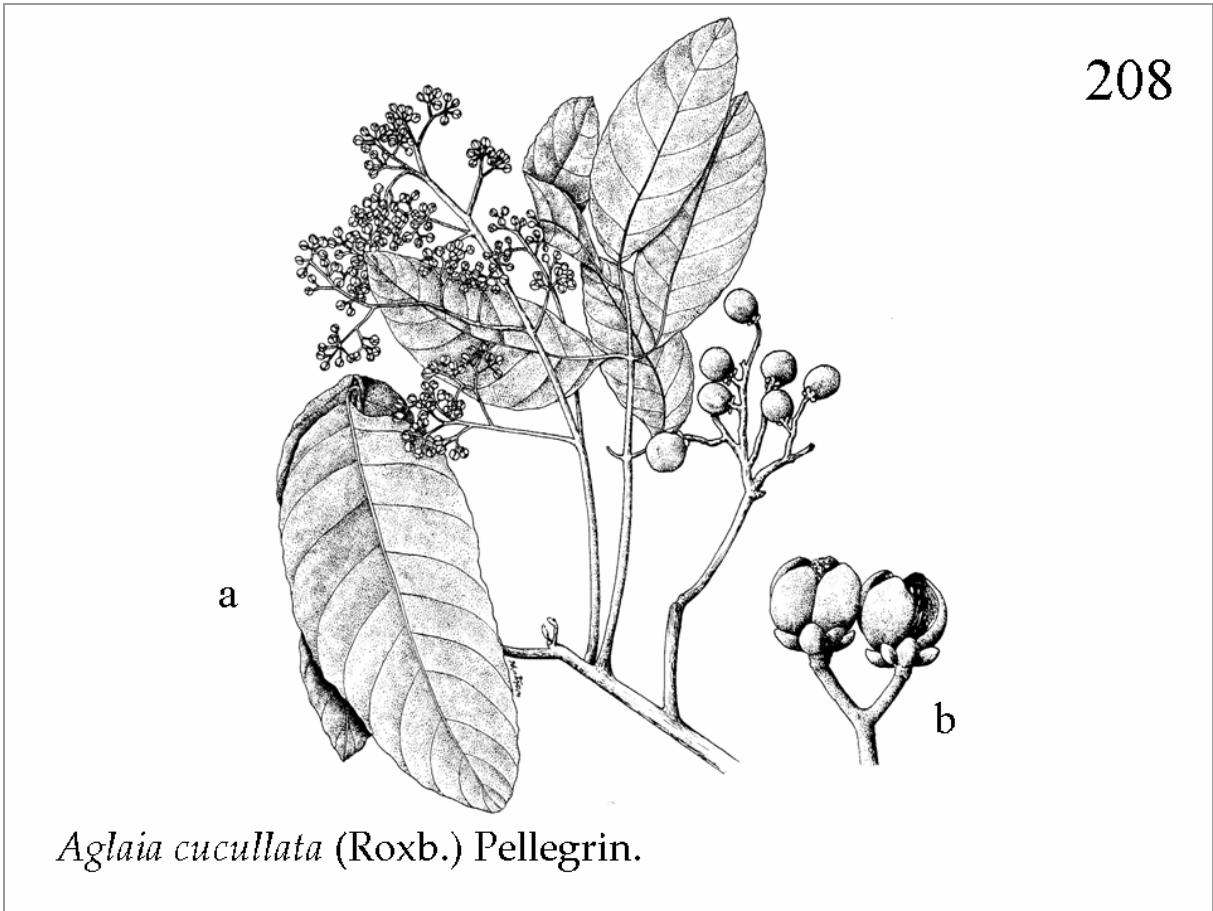


Fig. 208. *Aglaia cucullata* (Roxb.) Pellegrin. (a) Branchlet with flowers and fruit, (b) flowers.

MELIACEAE

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Aglaia cucullata (Roxb.) Pellegrin

Synonym(s) : *Aglaia conduplicifolia* Elmer, *Aglaia tripetala* Merr., *Amoora aherniana* Merr., *Amoora auriculata* Miq., *Amoora cucullata* Roxb., *Andersonia cucullata* Roxb.

Vernacular name(s) : Dái ngu' a nu' ó 'c (Viet.), Daeng nam (Thai)

Description : Small to medium sized tree up to 15 m tall and 130 cm girth; sometimes with plank buttresses. In muddy, tidal areas pneumatophores emerge from the mud. Bark is smooth, brown or pale orange, sometimes flaking in small brittle scales. Wood is pale yellowish brown to orange-brown, with white latex. Twigs are slender, and towards their tips they have pale brown to almost white scales. Leaves are up to 45 cm long with 5-9 leaflets that measure 7-20 by 3-6 cm. Leaflets are asymmetrical and may be sickle-shaped. Flowers are arranged in clusters in leaf and branch axils. Each cluster usually has numerous small, yellowish flowers, with three petals, that measure 1.5 mm across, and with 6 slightly protruding anthers. Fruits are round, measuring 6 by 7 cm, with a leathery skin. The fruit splits into three parts, each with one seed surrounded by a shiny red aril.

Ecology : Lowland forests and tidal river banks; first recorded in Ganges Delta. Terminal leaflets are sometimes developed into a 'pouch' occupied by ants. The fleshy aril of the fruit suggests that it might be distributed by animals (probably birds). It is the only species of the genus that occurs in mangroves and has pneumatophores. Mangrove associate species.

Distribution : Recorded from India, Nepal and Bangladesh through Southeast Asia, where it has been recorded in Vietnam, Thailand, Myanmar, the Philippines, Malaysia, Singapore, Brunei and Indonesia (Borneo, Sumatra, Java, Papua) and Papua New Guinea.

Abundance : Scarce to rather common.

Use(s) : Wood used for posts and firewood, plus boat-building (Brunei, Papua). Resinous outer fruit used for lamps in the Philippines.

Source of illustration : Whitmore, Tantra & Sutisna (1990)

Reference(s) : Mabberly & Pannell (1989), Whitmore, Tantra & Sutisna (1990), Hong & San (1993), Aksornkoae (1993), Mabberley *et al.* (1995), Maung (2003).

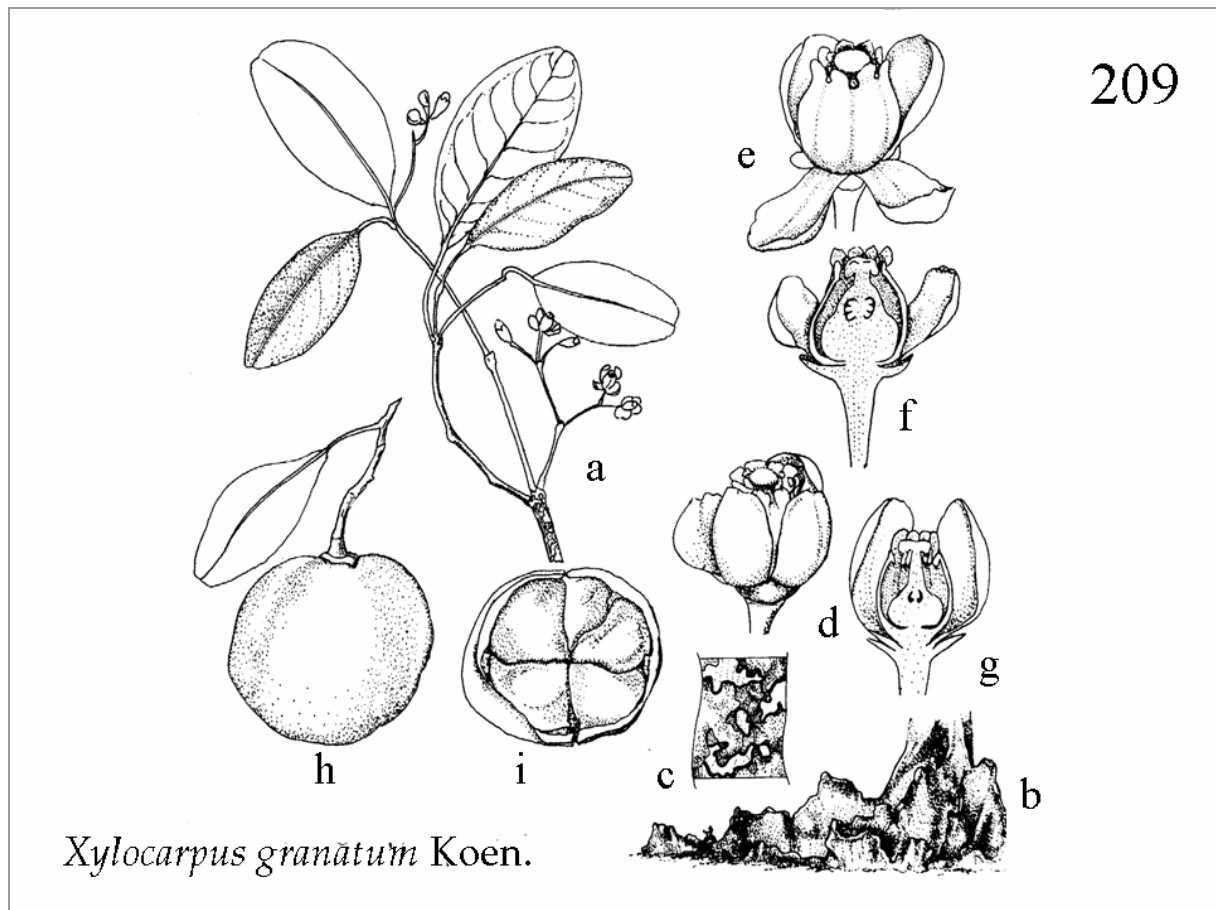


Fig. 209. *Xylocarpus granatum* Koen. (a) Branchlet with flowers, (b) base of tree trunk, showing roots raised above the soil, (c) detail of bark, (d, e) flowers, (f, g) longitudinal sections of flowers, (h) fruit, and (i) opened fruit showing the seeds.

MELIACEAE

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Xylocarpus granatum Koen.

Synonyms : ?*Amoora salomoniensis* C. DC., *Carapa granatum* (Koen.) Alston, *Carapa indica* A. Juss., *Carapa moluccensis* auct. non Lam., *Carapa obovata* Blume, *Granatum littoreum parvifolium* Rumph., *Granatum obovatum* (Blume) Kunzite, ?*Guarea oblongifolia* Griff., *Monosoma littorata* Griff., *Xylocarpus bednadirensis* Mattei, *Xylocarpus carnulosus* Zoll. & Mor., *Xylocarpus minor* Ridley, *Xylocarpus moluccensis* auct. non M. Roem., *Xylocarpus obovatus* (Blume) A. Juss.

Vernacular name(s) : Niri, Nyireh, Nyiri, Nyireh Bunga, Nyireh hudang (Mal.), Nyiri Udang, Nyiri Hutan, Pohon Kira-kira, Jomba (Ind.), Awol, Ecahi, Kaav, Mokkaemoffe (PNG), Kyana (Myan.), Bigi, Binoil-ure, Kalimbabau, Kolimbauing, Lubanayong, Nigi, Pagatpat-babae, Piagao, Pulit, Tambo-tambo, Tambubunot, Tangi, Tangile, Tangkuyon – *Tabigi* (Phil.), Su ô'i (Viet.), Ta bun khao (Thai.), Tabonsor (Camb.).

Description : Tree, usually (1-)6-20 m tall, with horizontal pneumatophores (aerial roots) that are saucer-shaped and raised above the soil. Trunks are often hollow, especially in older trees, and may be up to 80 cm diameter at breast height. Bark is (yellowish-) light brown, thin and flaking, while on young stems it is wrinkled. Branching is low, often beginning at 2-5 m above the ground. Leaves are compound, spirally arranged, with 1-2 (rarely 3) pairs of leaflets, no terminal leaflet (=paripinnate). Leaflets are usually round to egg-shaped, thick and leathery, measuring 4.5-17 cm by 2.5-9 cm. Leaf tips are usually rounded to very blunt; rarely with a short point. Stalks of leaflets are 2-9 mm long. Flowers occur in clusters that are 2-7 cm long, located in the axils, and bearing flowers of both sexes or female only. The calyx is tinged with red, flat and deeply 4-lobed. It is 4-petaled, with eight stamens and a 2 mm long style. Individual flower stalks are 4-8 mm long. Calyx lobes are rounded, up to 3 mm long, with a very short, blunt point. Petals are oval-shaped, white and 5-7 mm long, while stamen tubes are 3-5 mm long. Fruits are large, very woody and round, usually 10-25 cm in diameter and yellowish-green in colour. The fruit has four compartments filled with large, tetrahedrally-shaped, woody seeds. To the distress of those trying to establish a herbarium collection, the fruit breaks up upon drying.

Ecology : A true mangrove species, that also occurs along banks of tidal creeks, landward margins of mangroves, and other brackish-water environments that are not too saline. Often fairly gregarious. Older specimens may abound in epiphytes. Mangrove species.

Distribution : Found throughout Old World mangroves and in Australia (rare), from East Africa to the Tonga islands. Found throughout Southeast Asia.

Abundance : Locally abundant, in particular after mangrove forest exploitation and other disturbance has eliminated competing species.

Use(s) : Timber only available in small sizes; sometimes used for parts of boats. Wood is comparatively heavy, moderately hard, but prone to splitting. Used for high grade furniture and cabinet works. Bark is collected for its high tannin content (> 24% dry weight) and red dye. Oil may be obtained from the seed for use as lamp oil and in hair grooming. Bark used to treat cholera, while fruit and seed are used to treat diarrhoea.

Source of illustration : Based on Tomlinson (1986) and Wightman (1989).

References : Burkill (1935), Heyne (1950), Backer & Bakhuizen van den Brink (1963), Tomlinson (1986), Wightman (1989), Mabberley *et al.* (1995), Aragonés *et al.* (1998), Marschke (2000).

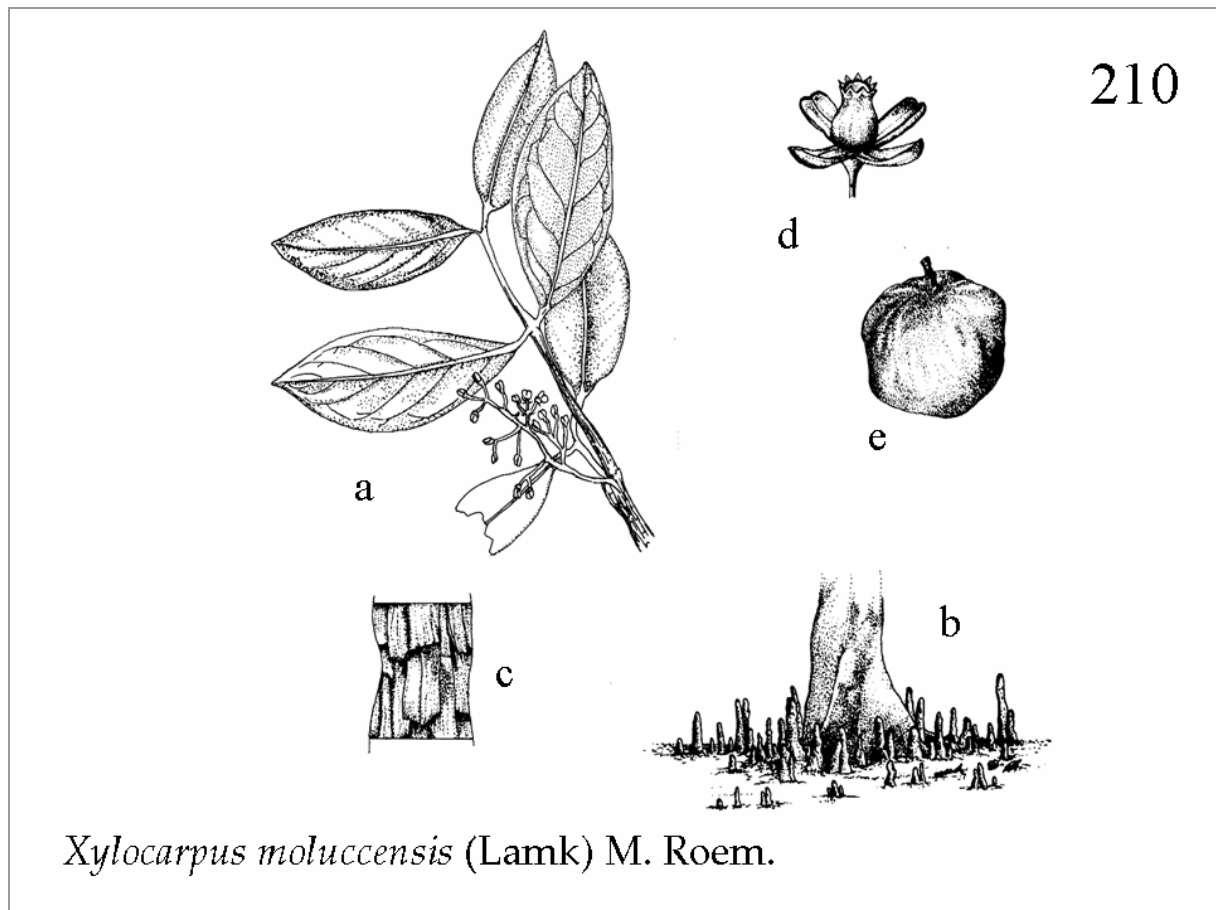


Fig. 210. *Xylocarpus moluccensis* (Lamk) M. Roem. (a) Branchlet with flowers, (b) base of tree trunk, showing the pneumatophores, (c) detail of bark, (d) flower, and (e) fruit.

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***Xylocarpus moluccensis* (Lamk) M. Roem.**

Synonyms : *Carapa borneensis* Becc., *Carapa mekongensis* (Pierre) Pellegr., *Carapa moluccensis* Lam., *Carapa obovata* auct. non Blume, *Granatum litoreum parvifolium* Rumph., *Granatum moluccensis* (Lam.) Kuntze, *Xylocarpus australiasicus* Ridley, *Xylocarpus gangeticus* (Prain.) C.E. Parkinson, *Xylocarpus mekongensis* Pierre, *Xylocarpus parvifolius* Ridley

Vernacular name(s) : Nyireh batu (Mal.), Niri Batu, Raru, Nyiri Gundik, Nyuru, Mojong Tihulu, Pamuli, Loleso (Ind.), Lagut-ut, Pindak, Puyugan, Sangkuyong, Tabigi, Tibigi – *Piagau* (Phil.), Su sú'ng (Viet.), Ta bun dam (Thai.), Tabonkmao (Camb.)

Description : Tree, 5-20(-30) m tall, with small buttresses and a trunk up to 70(-210) cm diameter. Many pointed, conical- and saucer-shaped pneumatophores. Leaves are spirally arranged, and have 2-3 pairs of leaflets (rarely 1 or 4), each leaflet measuring 4-12 by 2-6.5(-7) cm; leaflets paired (=paripinnate). They are usually oval to egg-shaped, thin-leathery, with a broadly rounded to sharply tapered base. Stalks of leaflets are 1-3 mm long, while the leaf stalk and rachis measures up to 10 cm. Bark of branchlets is smooth, while that of the main trunk has a deeply fissured surface. Flowers occur in clusters located in the axils, and are either bisexual or female. Flower clusters are 6-18.5 cm long with a 2-10 mm-long stalk. The calyx is flat and deeply 4-lobed, lobes 1-1.7 mm long; four petals, eight stamens and a 2 mm-long style. Calyx lobes are rounded, white and about 1.5 mm long. Petals are yellowish, oblong to egg-shaped, and 2-3 by 3.5-4 mm long. Fruit is broadly ellipsoid, brown, and (6-)8-11(-15) cm in diameter, with 5-10 seeds, 4-6.5 cm long.

Ecology : Occurs in tidal forests, banks of tidal creeks, and along coastal fishponds. Often found along oepn shores. A true mangrove species.

Distribution : Tropical Asia, from India (Sunderbans) to Southeast Asia and northern Australia. In Southeast Asia recorded from Cambodia, Thailand, Malay Peninsula, Singapore, the Philippines, Singapore, Vietnam, Indonesia (Sumatra, Java, Moluccas) and Papua New Guinea.

Abundance : Locally common.

Use(s) : Construction wood for houses and boats, but also for small tools such as handles for the famous 'Kris' (Java). Also used as firewood. Seeds are used as medicine to treat stomachaches. Fruits used in the Indonesian 'Jamu' (traditional medicine) for womb contraction, and to increase the appetite. Bark tannin is used to treat fishing nets, but also as medicine to treat intestinal problems. Wood is moderately light, soft, but moderately strong and seasons well.

Source of illustration : Based on Walker (1976).

Reference(s) : Heyne (1950), Backer & Bakhuizen van den Brink (1963-8), Tomlinson (1986), Mabblerley *et al.* (1995), Aragones *et al.* (1998), Ng & Sivasothi (1999), Marschke (2000), Maung (2003).

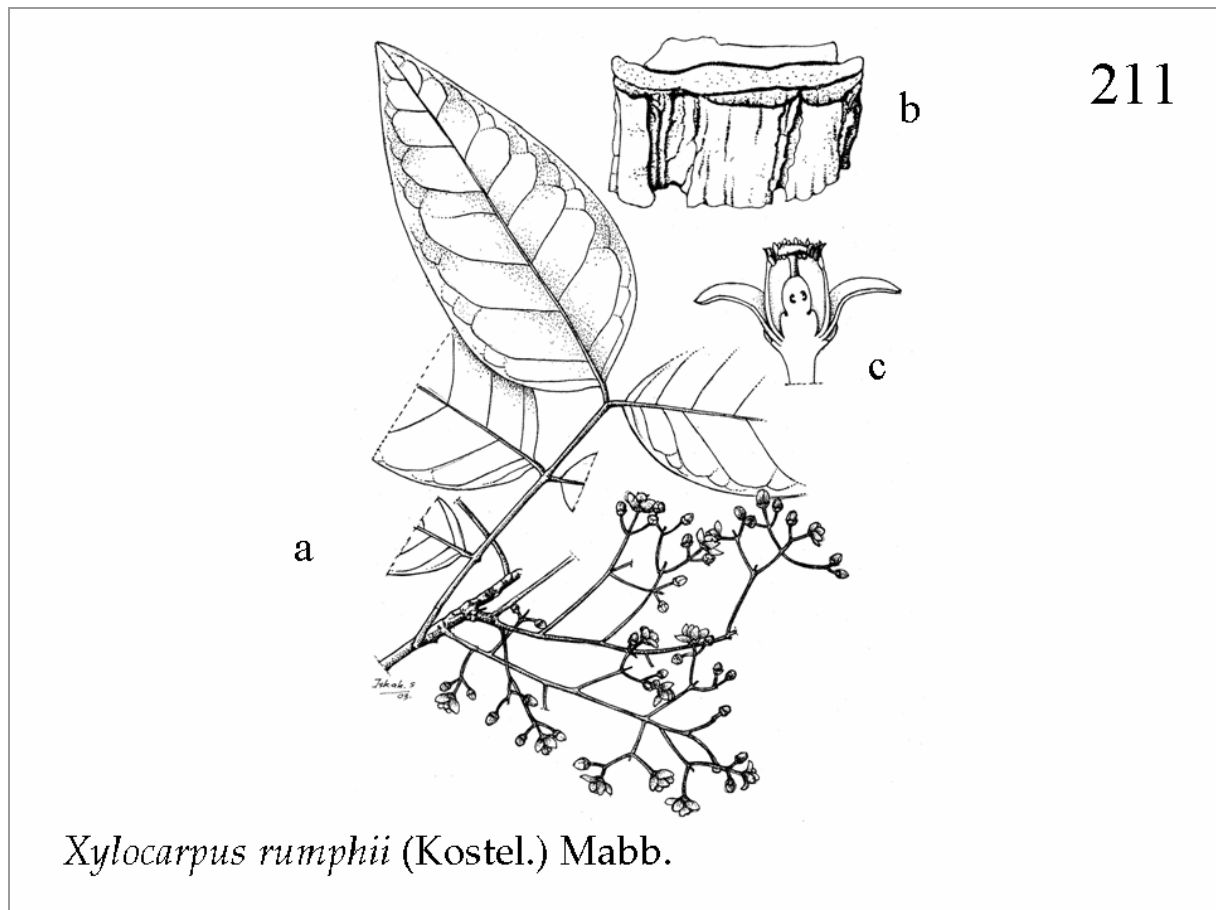


Fig. 211. *Xylocarpus rumphii* (Kostel.) Mabb. (a) Flowering branch, with one leaf (leaflets partially removed), (b) detail of bark, and (c) longitudinal section of flower.

MELIACEAE

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***Xylocarpus rumphii* (Kostel.) Mabb.**

Synonyms : *Aglaia zollingeri* C.DC., *Amoora naumannii* sensu C.DC., *Amoora zollingeri* (C.DC.) Koord., *Carapa moluccensis* auct. non. Lam., *Carapa rumphii* Kostel., *Xylocarpus forstenii* Miq., *Xylocarpus granatum* auct. non. Koen., *Xylocarpus moluccensis* auct. non M. Roem.

Vernacular name(s) : Niri, nyireh (Mal, I), pigau (P), kabahai, tawihi, wadawada (PNG), Tabann (Camb.)

Description : Tree, 4-12 (-18) m, with neither conspicuous buttresses nor pneumatophores. Trunk up to 50 cm diameter, frequently of poor form. Bark finely fissured, greyish, inner bark bright pink to red. Leaf stalk (including the rachis) up to 22 cm, leaflets in 2-4(-5) pairs, 5-10(-16) by (2-)3-5(-9.5) cm, ovate to heart shaped, with pointed tip; venation prominent on both sides; stalk of leaflet 1-3(-5) mm; leaflets paired (=paripinnate). Flower clusters 10-18 (-28) cm long, lax and hanging. Calyx 4 lobes 1-1.5 mm long. 4 petals 3.5-6 by 2-2.5 mm, elliptic-oblong, creamy white. Fruit 6-8 cm diameter, round. Seeds 8-16, 3.6-7 cm long.

Ecology : Exposed shores, rocky cliffs, often near the surf, and sandy substrates above the high water mark. Mangrove species.

Distribution : From East Africa to Tonga, and found throughout Southeast Asia. So far not recorded in Borneo.

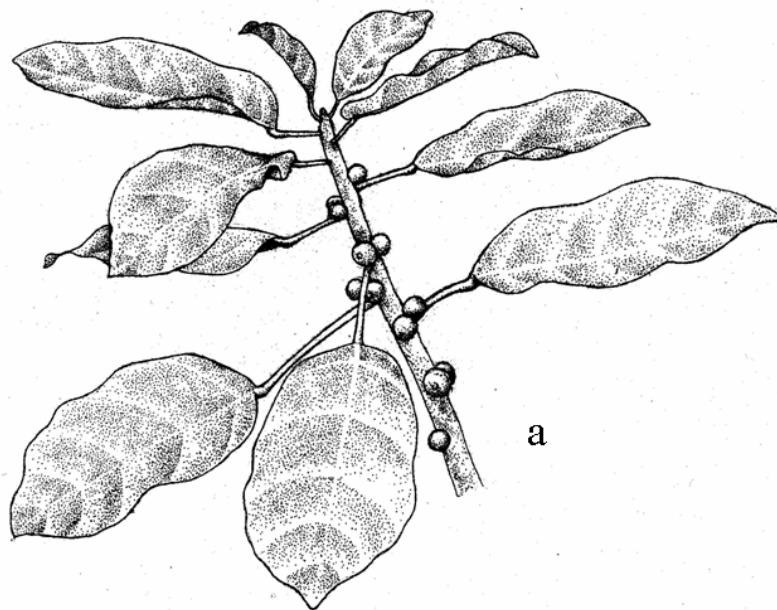
Abundance : Locally common but scattered; rare in Sumatra, absent in Borneo.

Use(s) : Patterned wood used for handles of traditional knives (*kris*). Bark used for tanning and for dyeing cloth. Kernel of seeds used to treat stomach aches. Wood used for boat building.

Source of illustration : Mabberly *et al.* (1995)

Reference(s) : Heyne (1950, Mabberly & Pannell (1989), Mabberly *et al.* (1995), Marschke (2000).

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Ficus curtipes Corner

Fig. 212. *Ficus curtipes* Corner. (a) Terminal branch with fruit.

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Ficus curtipes Corner

Synonyms : *Ficus obtusifolia* Roxb., *Urostigma obtusifolia* (Roxb.) Miq.

Vernacular name(s) : Da-ba (Viet.).

Description : Trees, 5-10 m tall, stems often basally many branched, epiphytic when young; may also be scrambling or climbing. Bark pale greyish, smooth. Branchlets green, 5-8 mm in diameter, smooth. Stipules lanceolate to ovate-lanceolate, 1-2 cm. Leaves thick and leathery, (narrowly-) elliptic-oblong to obovate, 5.5-7 by 10-17.5 cm, tip squared as if cut off or rounded, base wedge-shaped; secondary nerves numerous (8-12), faint, tri-nerved at the base, joining at the leaf edge to form a distinct nerve running parallel to the leaf edge; leaf stalk stout, 1.25(1.5-2.0) cm long. Figs occur in pairs in the axils on leafy branchlets, without a visible stalk, round, yellow or yellow-tinged pink, dark red to purplish-red when mature, (7-) 10-15 mm across, round to flattened/globular, with three persistent leaflets at the base, 3-4 mm.

Ecology : In China and Vietnam it is usually recorded from limestone hills (500-1400m). Recorded from landward edge of mangrove in Myanmar. Fruiting occurs late autumn to early winter in southern China. Mangrove associate species.

Distribution : Found from Northeast India to Yunnan (China). In Southeast Asia is has been recorded in Myanmar, Thailand, Cambodia, Vietnam, Peninsular Malaysia and Indonesia (Sumatra, Borneo).

Abundance : Uncommon to rare.

Use(s) : This species may be cultivated as an ornamental tree (China).

Source of illustration : Missouri Botanical Garden TROPICOS database (www.mobot.org)

Reference(s) : Corner (1959), Kochummen (1978a); Flora of China database (<http://flora.huh.harvard.edu/china/>) <http://users.bart.nl/~edcolijn/florapalung.html>.

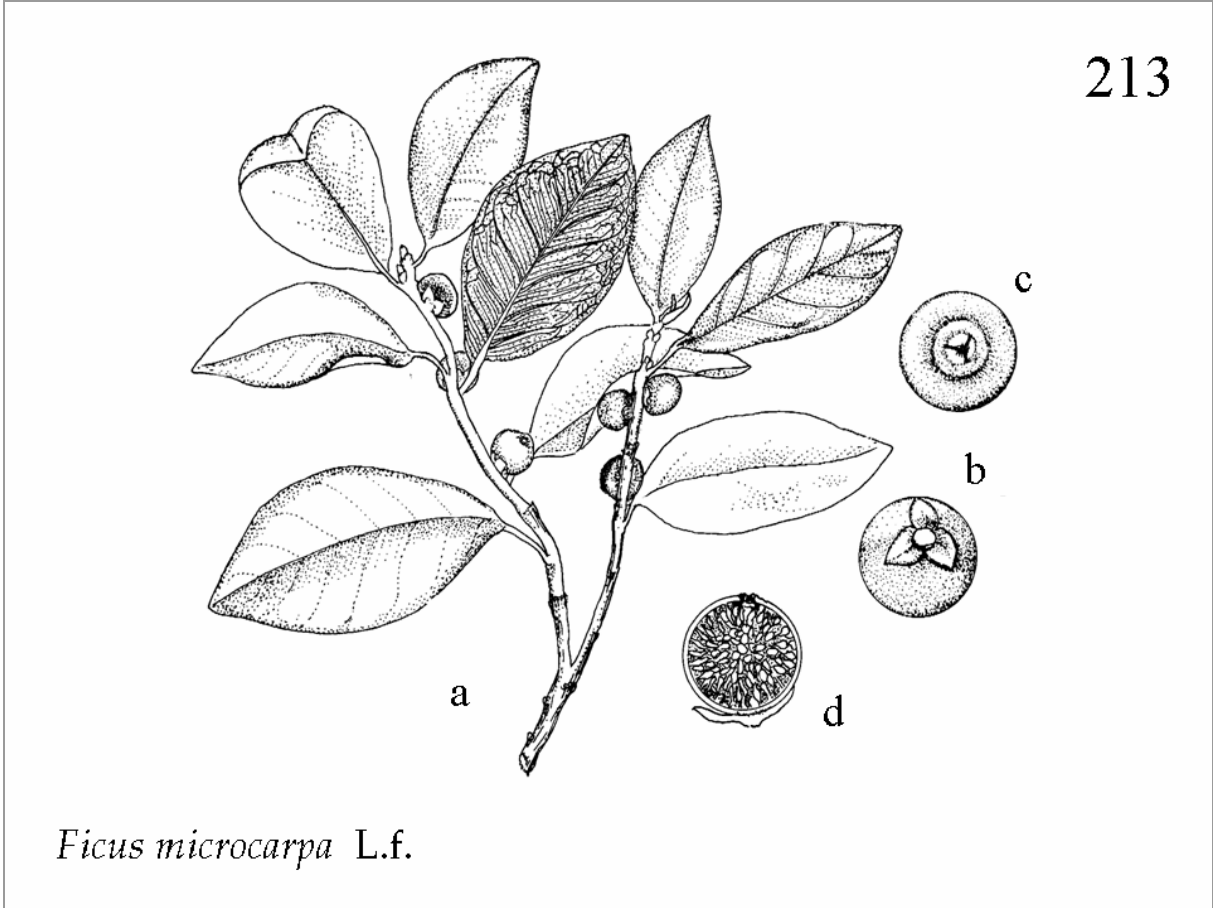


Fig. 213. *Ficus microcarpa* L.f. (a) Branchlet with fruits, (b) fruit seen from stem, (c) fruit seen from bottom, and (d) cross-section of fruit.

MORACEAE

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Ficus microcarpa L.f.

Synonyms : *Ficus retusiformis* H. Lévl, *Urostigma microcarpum* (L.f.) Miq.

Vernacular name(s) : Malayan banyan (E), Jawi jawi, Jejawi, Lunok (Mal.), Jejawi, Fikus, Jabai (Ind.), Sai yoi bai thuu (Thai), Gú'a (Viet.)

Description : Medium sized strangler tree, up to 30 m tall, and with a crown that may spread up to 60 m diameter. In a young stage it is epiphytic, and in older stages it is usually multi-stemmed, the original stem sometimes disappearing in very old trees. The tree often has a spidery appearance, with no real main trunk being discernable. At an early stage, the trunk is divided into upwardly curved branches, with many drooping, tasselled aerial roots, often hanging in festoons. These aerial roots may later develop into pillar roots. The leathery, smooth and hairless leaves are soft and flexible; measure 3-10 by 1.5-5 cm, are elliptic to egg-shaped, and droop. They are densely covered with fine, transverse, upwardly directed lines, in 7-9 pairs of distinct nerves; sometimes leaves may have a reddish tinge. The almost stemless figs (fruits) are small and round, located in the axils of leaves or recently fallen leaves. They are at first pale green, later turning bluish-black, and measure 3-7 mm (up to almost 1 cm) across. Often confused with *Ficus retusa* (a distinct and separate species), especially in the older literature. *Ficus retusa* is a small strangler fig occurring in swamp forests that has 'retuse' leaves, i.e. with a small notch in the rounded or blunt leaf tip; this is not or only very rarely the case with *Ficus microcarpa*.

Ecology : In swamp forest, riparian forest, coastal swamps or along the landward margin of mangroves. Up to 1,200 m but more frequently in lowlands below 100 m. Flowering occurs all year round. On rocky headlands the species may be dwarfed and take on a creeping habit. In Southeast Asia, the fig wasps are *Blastophaga (Paraprística) verticillata*. Mangrove associate species.

Distribution : From India and Sri Lanka to South China, the Marianas and Australia (New South Wales). Throughout Southeast Asia, recorded from the Philippines, Malaysia, Thailand, Vietnam, Brunei, Indonesia (Sumatra, Java, Borneo, Papua) and Papua New Guinea.

Abundance : Common.

Use(s) : Often cultivated and planted as an ornamental. Burkill (1935) reports that in India the tree has a wide medical application, including treatment of toothache (roots), headache (bark and leaves), and the juice of the leaves used externally to treat colic.

Source of illustration : Based on Sastrapradja & Afriastini (1984).

Reference(s) : Burkill (1935), Backer & Bakhuizen van den Brink (1963-8), Kochummen (1978a), Primack (1983), Sastrapradja & Afriastini (1984), Corner (1988), Aksornkoae (1993), http://www.mekonginfo.org/mrc_en/contact.nsf.

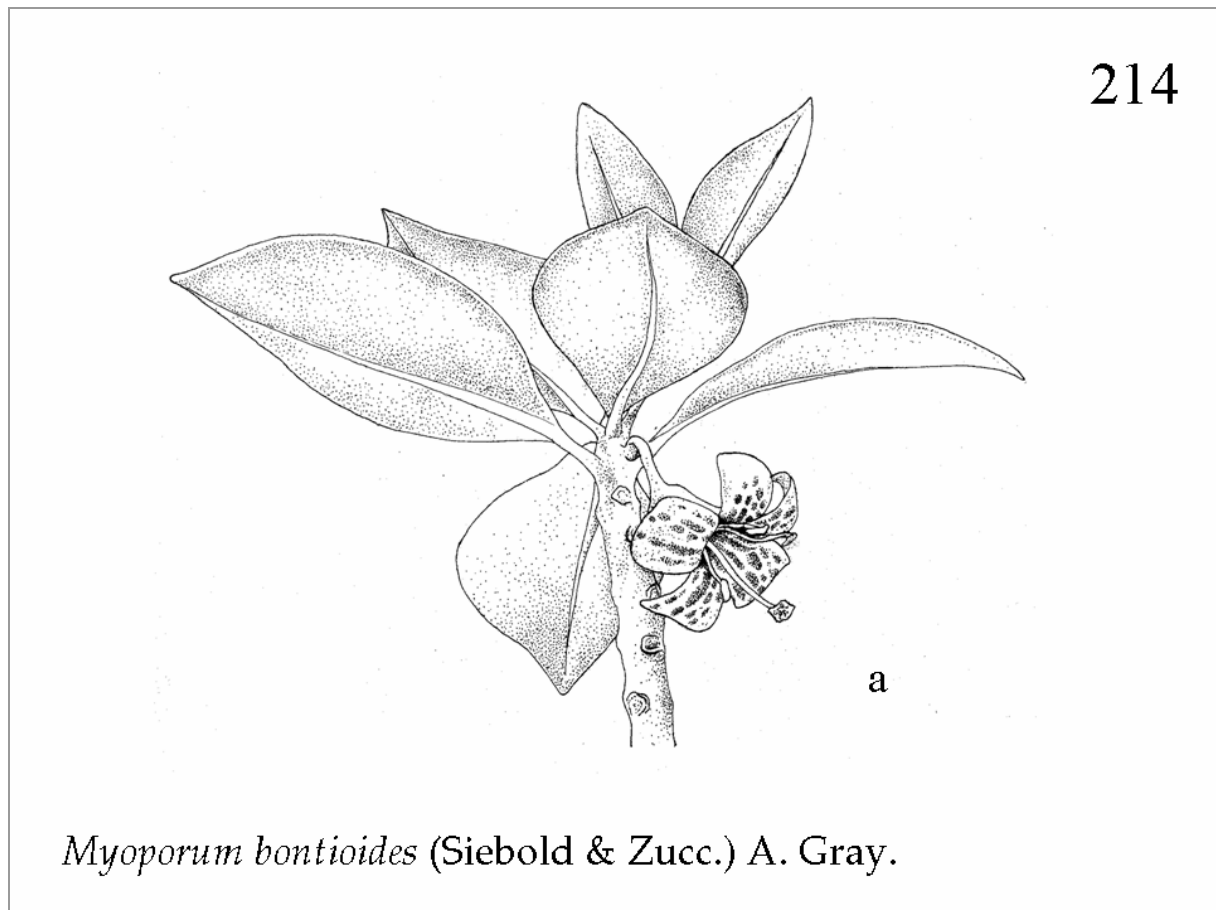


Fig. 214. *Myoporum bontioides* (Siebold & Zucc.) A. Gray. (a) Detail of flowering branchlet.

MYOPORACEAE

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Myoporum bontioides (Siebold & Zucc.) A. Gray

Synonyms : *Pentacoelium bontioides* Sieb. et Zucc.

Vernacular name(s) : Unknown.

Description : Evergreen erect shrubs about 1 m tall, smooth throughout. Branches round and fleshy, with swollen leaf scars. Leaves simple, alternate, leathery, fleshy, with a 1-2 cm long leaf stalk; leaf blade oblong to elliptic, 2-4 by 5-12 cm, with a pointed tip; leaf base gradually tapering into the leaf stalk; leaf blade entire, upper surface lustrous, midrib slightly raised on lower surface, lateral nerves obscure. The flowers are grouped in clusters of 2-4 located in the leaf axils. The flower stalk is slender, about 2 cm long when in full flower, and up to about 3 cm long in fruit. Calyx bell-shaped, about 10 mm long, deeply 5-lobed; lobes lanceolate, pointed, about 5 mm long. Corolla bell-shaped to funnel-like, white, with purple spots, 2-2.5 cm long, more or less fleshy; tube stout, 10-15 mm long, 5-lobed; lobes elliptic, obtuse or pointed, about 10 mm long and recurved. Stamens 2-4 pairs of unequal length and projecting beyond the rest of the flower, 18-25 mm long. Style thread-like, also projecting beyond the rest of the flower, 18-25 mm long. Fruit fleshy and non-opening, egg-shaped to round, pointed, 10-15 mm long, 8-10 mm across, reddish brown when ripe.

Ecology : In Vietnam it is regularly recorded in mangroves; otherwise it is recorded along (sandy) seashores. In Vietnam it is particularly found in mangroves of the northeastern zone, where it may be recorded along with *Scyphiphora hydrophyllacea* under the canopy of other trees (Hong, 1993). Flowers from January to May. Mangrove associate species.

Distribution : South Japan, Taiwan, Central to Southern China and northern Vietnam.

Abundance : Uncommon.

Use(s) : Unknown.

Source of illustration :

http://www.city.himi.toyama.jp/~35210/tokusyuu/toku_hamajintyo/hamajintyo_tokusyuu.htm

Reference(s) : Hong (1993), Flora of Japan (website: <http://foj.c.u-tokyo.ac.jp>).

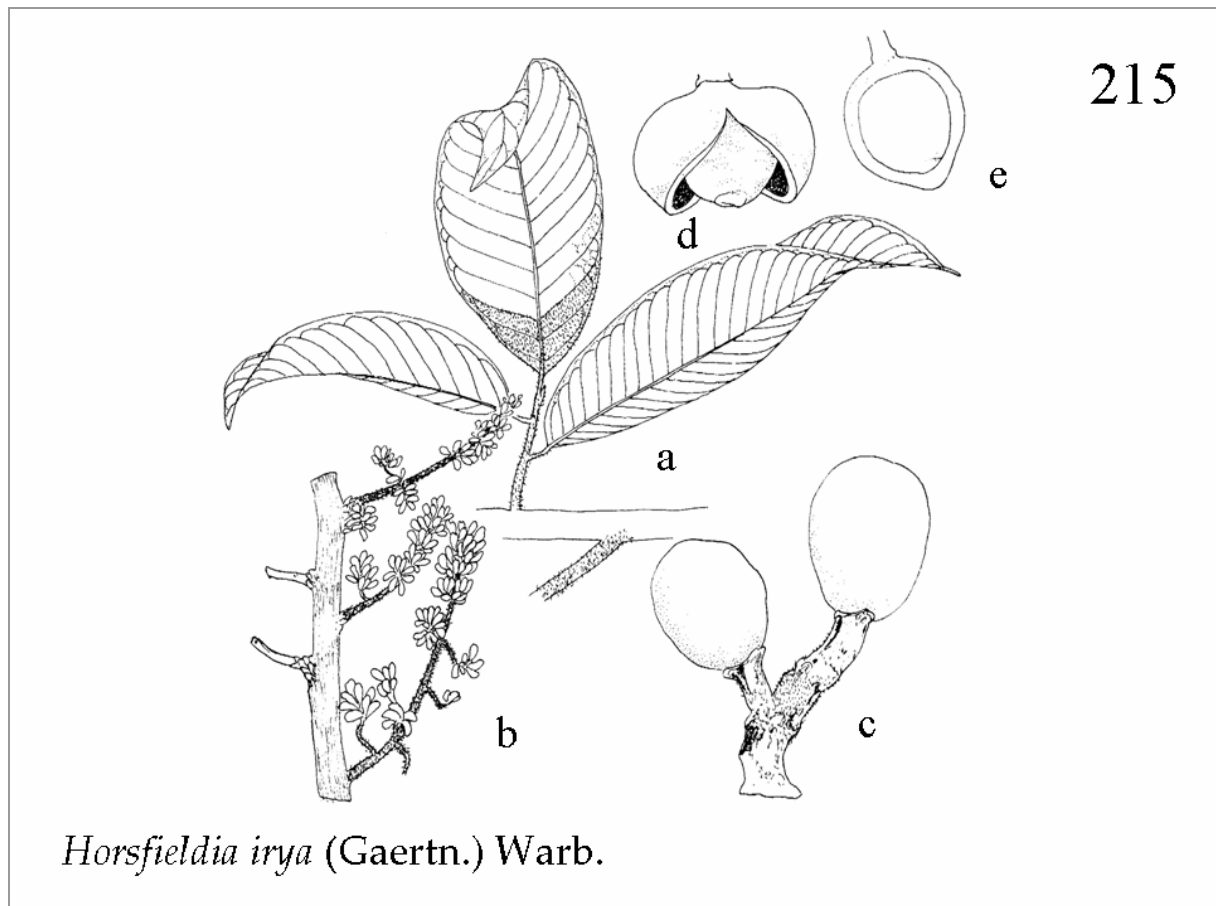


Fig. 215. *Horsfieldia irya* (Gaertn.) Warb. (a) Branchlet with leaves, (b) inflorescence, (c) two fruits, (d) ripe fruit opening, and (e) longitudinal section of fruit.

MYRISTICACEAE

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***Horsfieldia irya* (Gaertn.) Warb.**

Synonym(s) : *Horsfieldia acuminata* Merr., *Horsfieldia amklaal* Kaneh., *Horsfieldia congestiflora* A.C. Sm., *Horsfieldia labillardieri* Warb., *Horsfieldia lemnniana* (A.DC.) Warb., *Horsfieldia nunu* Kaneh., *Horsfieldia subglobosa* (Miq.) Warb., *Myristica globularia* Blume, *Myristica irya* Gaertn., *Myristica javanica* Blume, *Myristica lemnniana* A. DC., *Myristica micrantha* Wall., *Myristica sphaerocarpa* Wall., *Myristica subglobosa* Miq., *Myristica vrieseana* Miq.

Vernacular name(s) : Pianggu, Penggu (Mal.), Penarahan, Lempoyan Paya, Simaralah, Peredah Burung, Kalapa tiyung (Ind.), Kruai (Thai)

Description : Medium sized to tall tree, up to 10-25(-40) m tall, girth up to 2 m, often with a fluted trunk, steep buttresses, and occasionally with stilt roots. Produces aerial knee-roots, especially in tidal areas. The crown often has drooping limbs. Bark is brown or grey, smooth to slightly fissured, marked by diamond-shaped short fissures. Twigs are slender, dark brown to almost black, with pale lenticels. Leaves are arranged in two rows. Leaves have a 5-7 mm stalk, flattened or grooved above, oblong-lanceolate to narrowly oblong, 4.5-5.5 by 16-21 cm, with a pointed tip. Flower clusters, measuring 10-13 cm, are located between and behind the leaves. Flowers are very small, 1mm across, bright orange-yellow and sweet lemon-scented. Fruit is round, up to 2.5 cm across, smooth, with a 5-10(20) mm stalk; 2-8 fruits per cluster. Fruit is at first ochre yellow, then bright pinkish orange or reddish, pink inside, with a bright red aril (=tissue between the seed and the skin of the fruit).

Ecology : Occurs along rivers and near the coast, especially in swampy places and in the tidal zone and margins of mangroves. Also grows well in well-drained areas. Primary and (old) secondary forest, most frequently in swampy coastal or riparian habitats, on alluvial (sandy, loamy or clayey) soils. Seeds contain an air chamber and float. From sea level up to an altitude of 450 m. Fruits are eaten by monkeys. Mangrove associate species.

Distribution : Occurs from India, Sri Lanka and the Andaman Islands to Southeast Asia and the Solomon Islands. In Southeast Asia recorded from Cambodia, Myanmar, Thailand, Malaysia, Singapore, the Philippines, Indonesia (Borneo, Sumatra, Moluccas, Papua) and Papua New Guinea.

Abundance : Common, but never gregarious.

Use(s) : Wax extracted from fruit, and found suitable for making candles. Timber is attractive dark olive green and hard, but not durable and thus seldom used.

Source of illustration : Based on Whitmore (1972), Corner (1988), Polunin (1988), de Wilde (2000)

Reference(s) : Heyne (1950), Whitmore (1972), Corner (1988), Polunin (1988), Hong & San (1993), Aksornkoae (1993), De Wilde (2000).

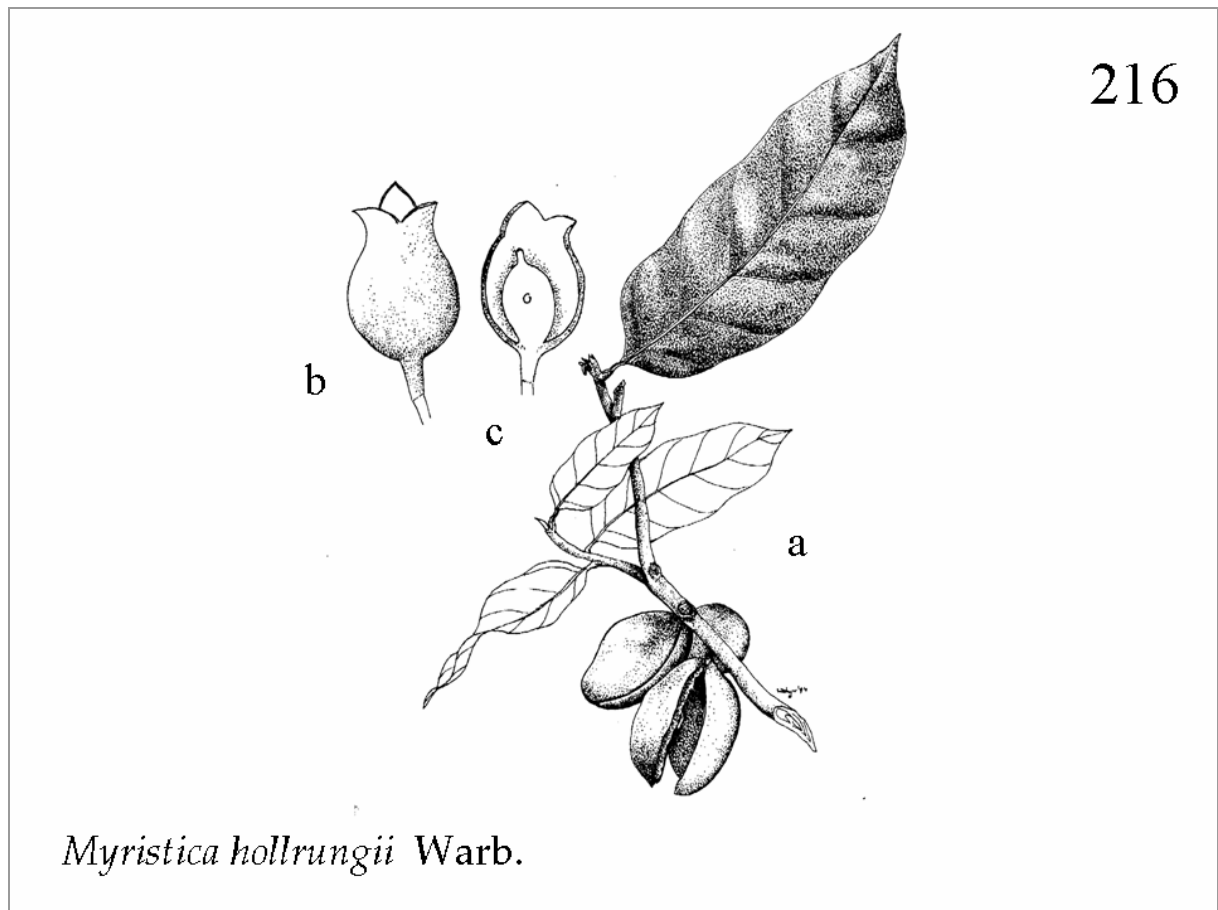


Fig. 216. *Myristica hollrungii* Warb. (a) Branchlet with three fruits, one ripe and open, (b) flower, and (c) longitudinal section of flower.

MYRISTICACEAE

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Myristica hollrungii Warb.

Synonyms : *Myristica albertisii* Warb., *Myristica euryocarpa* Warb., *Myristica heterophylla* K. Schum.

Vernacular name(s) : Unknown.

Description : A large tree, 6-36(-42) m tall, with a diameter of up to 113 cm. Usually with stilt roots, a copious red sap and a dark grey to reddish-brown, smooth, or finely fissured, flaking bark. The oblong to oblong-lanceolate leaves measure 9-35 by 3-13 cm, are smooth and green above, and smooth, shiny, pale green below. The flower clusters occur in the axils of (fallen) leaves. They are short, thick, scar-covered, woody and 2-5 branched. The female flower clusters are often shorter than the male clusters. Male flowers are 4-10 mm long, leathery, nearly round or egg-shaped, pale yellow and hairy on the outside, white and hairless on the inside; tips flushed pink. Female flowers are similar, but smaller. The yellow to orange fruit is oblong or oblong-egg-shaped, sometimes hairy, and 3-5 cm across. The single dark brown seed has a white (unripe) to red (ripe) aril (=tissue between the seed and the skin) of the fruit.

Ecology : It usually occurs in the (slightly) brackish regions of mangrove swamps, on muddy river banks near the sea, sago swamps, and along frequently inundated beaches, 0-500 m. In alluvial coastal forest with *Barringtonia*. Flowering and fruiting throughout the year. One of the commonest wild nutmegs in the region. Mangrove associate species.

Distribution : Throughout Papua New Guinea, Indonesian Papua and the Bismarck Archipelago.

Abundance : Locally common.

Use(s) : Unknown.

Source of illustration : Drawn from herbarium specimen, Bogor Herbarium.

Reference(s) : Percival & Womersley (1975), de Wilde (2000).

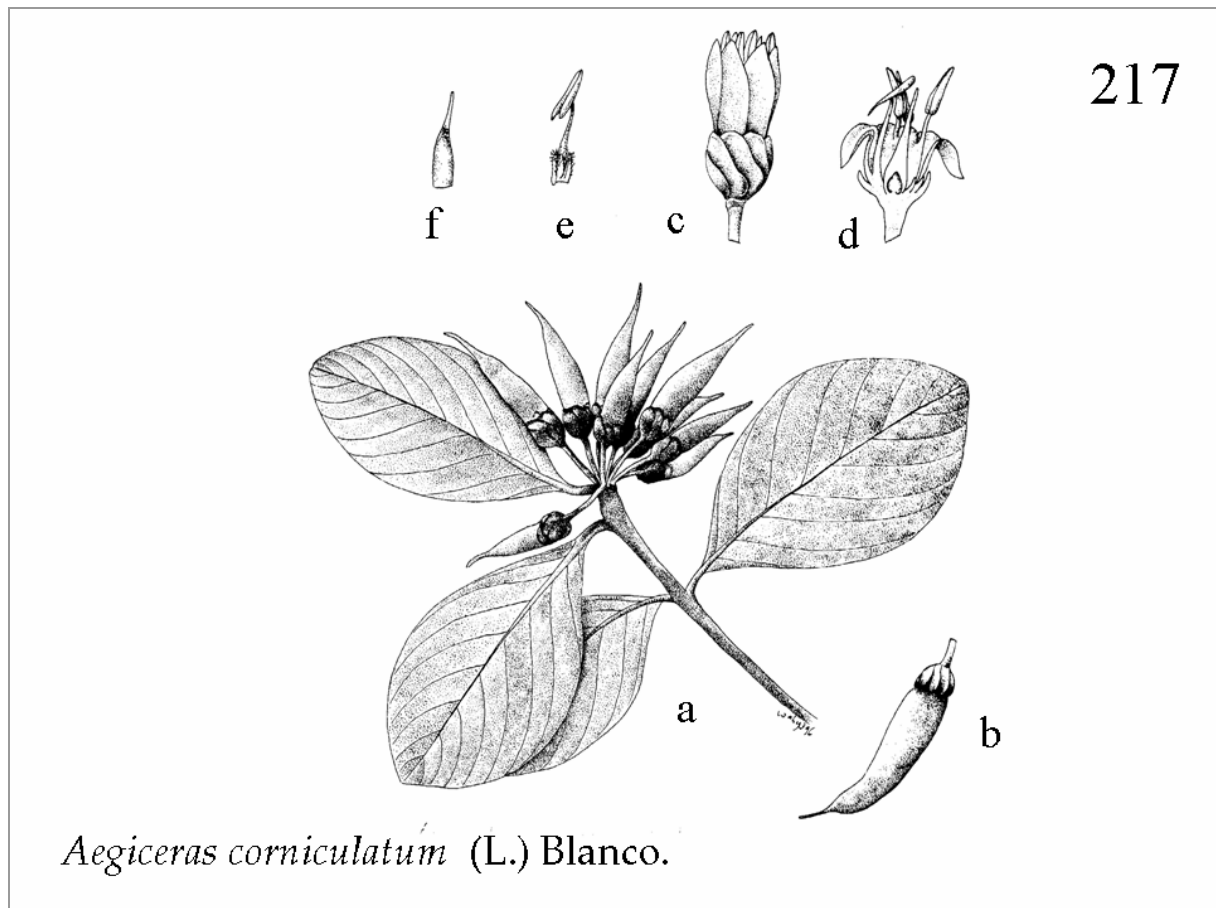


Fig. 217. *Aegiceras corniculatum* (L.) Blanco. (a) Branchlet with cluster of fruits, (b) fruit, (c) flower, (d) longitudinal section of flower, (e) stamen, and (f) stigma.

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Aegiceras corniculatum (L.) Blanco

Synonyms : *Aegiceras fragrans* König, *Aegiceras majus* Gaertn., *Aegiceras malaspinaea* A.DC., *Malaspinae lamifolia* Presl., *Rhizophora corniculata* L., *Umbraculum corniculatum* (L.) Kuntze.

Vernacular name(s) : Kachang kachang (Mal.) Teruntun, Gigi Gajah, Perepat Tudung, Perpat Kecil, Tudung Laut, Duduk Agung, Teruntung, Kayu Sila (Ind.), Kaya (Myan.), Batag-batag, Bulali, Dumanai, Kindug-kindug, Pagatput, Pilapil, Pipisik, Saging-saging, Sulasig, Tayokon, Timbabukis, Tindok-tindok, Tinduk-tindukan – *Saging-saging* (Phil.), Sú (Viet.)

Description : Erect, evergreen shrub or small tree, up to 6 m tall, with roots running along the soil surface. Outer bark is grey to brown, to almost black, fissured, and has numerous lenticels. The 7.5-11 cm long, rounded-notched leaves are spirally arranged and leathery. They are bright, glossy green above and a paler green below, often with a slightly red, prominent midrib below. Salt-excretion glands are located on the leaf surface and stalk, which may be whitish and covered with salt. The flower cluster is umbrella-shaped, with a short stalk that is at most 5 mm long. Flowers are located on first-order branches only. They are very sweet-scented, white, rich in nectar, and with protruding anthers; flower stalks are 8-12 mm long. The persistent calyx is white to green. The white corolla tube is covered with short, soft hairs, 5-6 mm long, and its mouth has a dense tuft of fine hairs. Fruit is green to red, strongly curved and pointed like two miniature bananas or horns (hence the scientific name), 5-7.5 cm long, with a single, elongated seed. It is surrounded at the base by the persistent calyx. Fruit is rapidly shed after ripening.

Ecology : Tolerant of a wide range of salinity, soil and light conditions. It most commonly occurs along the landward margins of mangroves that are inundated by normal high tides, and fringes of seasonally brackish waterways. Prefers sandy substrates. Flowering occurs all year round in Indonesia (October-March in Philippines), and flowers are probably pollinated by insects. Seeds develop semi-viviparously, with the embryo projecting through the skin of the fruit when the enlarged fruit is shed. There is usually a dense group of seedlings immediately under the mature plant. Fruits and seeds are well adapted to water dispersal. Mangrove species.

Distribution : From India and Sri Lanka through Southeast Asia – where it is found throughout – to Southern China, Australia, Polynesia and the Solomon Islands.

Abundance : Common, in many localities rather numerous, often growing gregariously.

Use(s) : The saponin-containing bark is used to stupefy fish. Flowers are used as ornamentals because of their fragrance. Wood used for charcoal production. Young leaves are edible. The flowers of this species are an important source of nectar, and may be important for local honey industries (Howes *et al.*, 2004).

Source of illustration : Based on Tomlinson (1986) and Wightman (1989).

Reference(s) : Burkill (1935), Backer and Bakhuizen van den Brink (1963), Percival & Womersley (1975), Tomlinson (1986), Corner (1988), Wightman (1989), Said (1990), Aragones *et al.* (1998), Missouri Botanical Garden TROPICOS database (www.mobot.org).

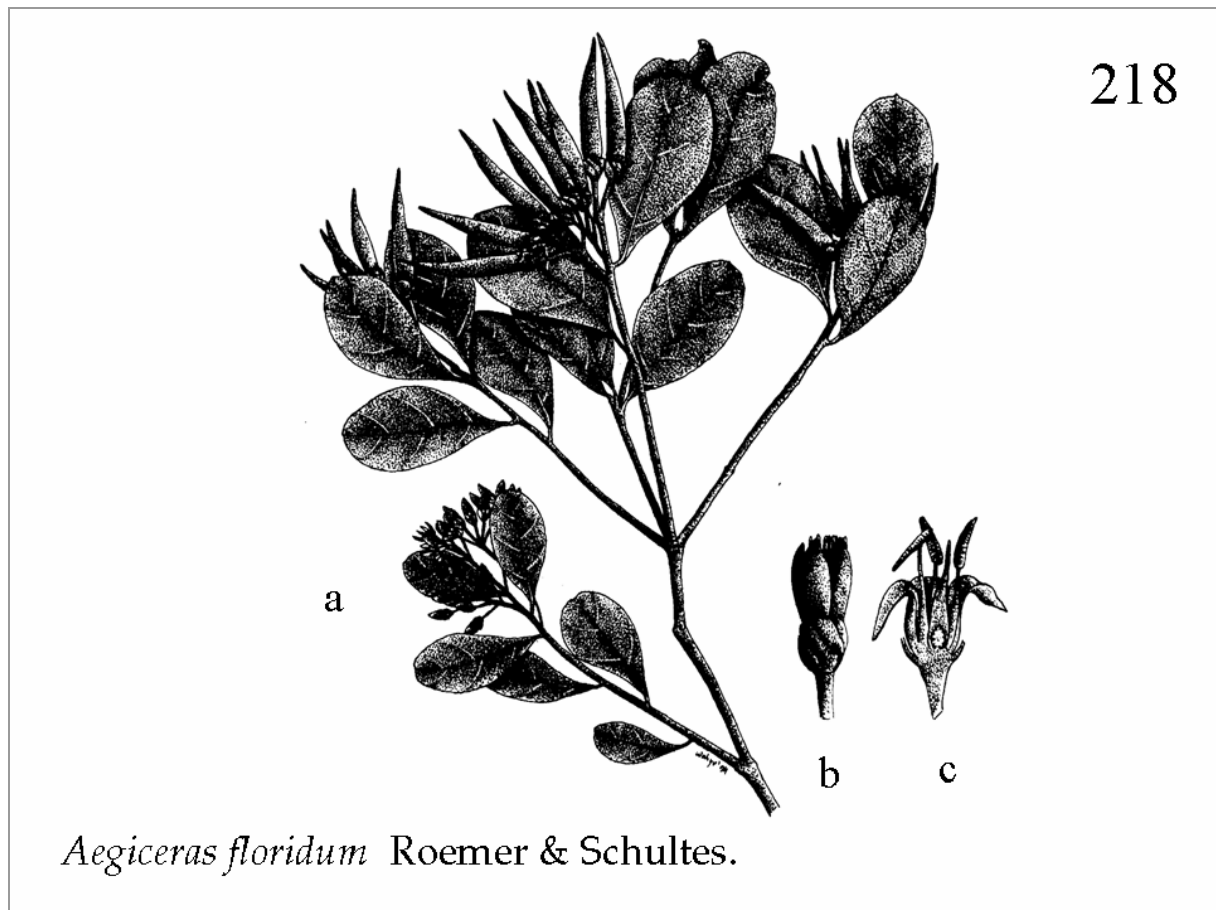


Fig. 218. *Aegiceras floridum* Roemer & Schultes. (a) Branchlet with fruits, (b) flower (half closed) and (c) longitudinal section of flower.

MYRSINACEAE

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Aegiceras floridum Roemer & Schultes

Synonyms : *Aegiceras ferreum* Blume, *Aegiceras nigricans* A. Rich.

Vernacular name(s) : Teruntun (Ind.), Batag-batag, Bulali, Dumanai, Kindug-kindug, Pagatput, Pilapil, Pipisik, Saging-saging, Sulasig, Tayokon, Timbabukis, Tindok-tindok, Tinduk-tindukan – *Saging-saging* (Phil.)

Description : Erect, evergreen shrub or small tree, up to 4 m, with roots running along the soil surface. Outer bark grey to brown, fissured and with numerous lenticels. The broadly rounded or abruptly terminated leaves are spirally arranged, leathery, a bright, glossy green above and a paler green below with an often slightly red, prominent midrib below, 3-6 cm long. Salt excretion glands are located on the leaf surface and stalk and excreted salt give the leaf a pale appearance. The larger flower clusters are elongated, while the smaller ones are nearly umbrella-shaped and located at the top of second-order branches. Stalks of the flower clusters are up to 2 cm long, while those of the individual flowers are 4-6 mm. Flowers have a sour odour and are white; the persistent calyx is white to green; corolla tubes are about 4 mm long and have a thin tuft of hairs at its mouth. Fruit is green to red, only slightly curved, and 3 cm long. It is rapidly shed and contains one elongated seed. Similar to *Aegiceras corniculatum*, but differs with its smaller leaves (3-5 cm long, versus 7.5-11 cm) and its branched (compound) flower clusters and only slightly curved fruit.

Ecology : In mangroves, and has been recorded on rocky or gravelly substrates. Little is known about this species. Flowering occurs all year round. Mangrove species.

Distribution : Southeast Asian species, recorded in Malaysia (Sabah), Indonesia (Java, the Moluccas, Sulawesi, Borneo, Papua), Cambodia, Vietnam, the Philippines and Papua New Guinea

Abundance : Uncommon, with a scattered distribution.

Use(s) : Wood as construction materials and fuel wood.

Source of illustration : Drawn from herbarium specimen, Bogor Herbarium.

Reference(s) : Backer & Bakhuizen van den Brink (1963-8), Tomlinson (1986), Aragonés *et al.* (1998), www.unepscs.org/ProjectComponents/Mangroves.htm; ARCBC BISS species database (<http://arcbc.org>).

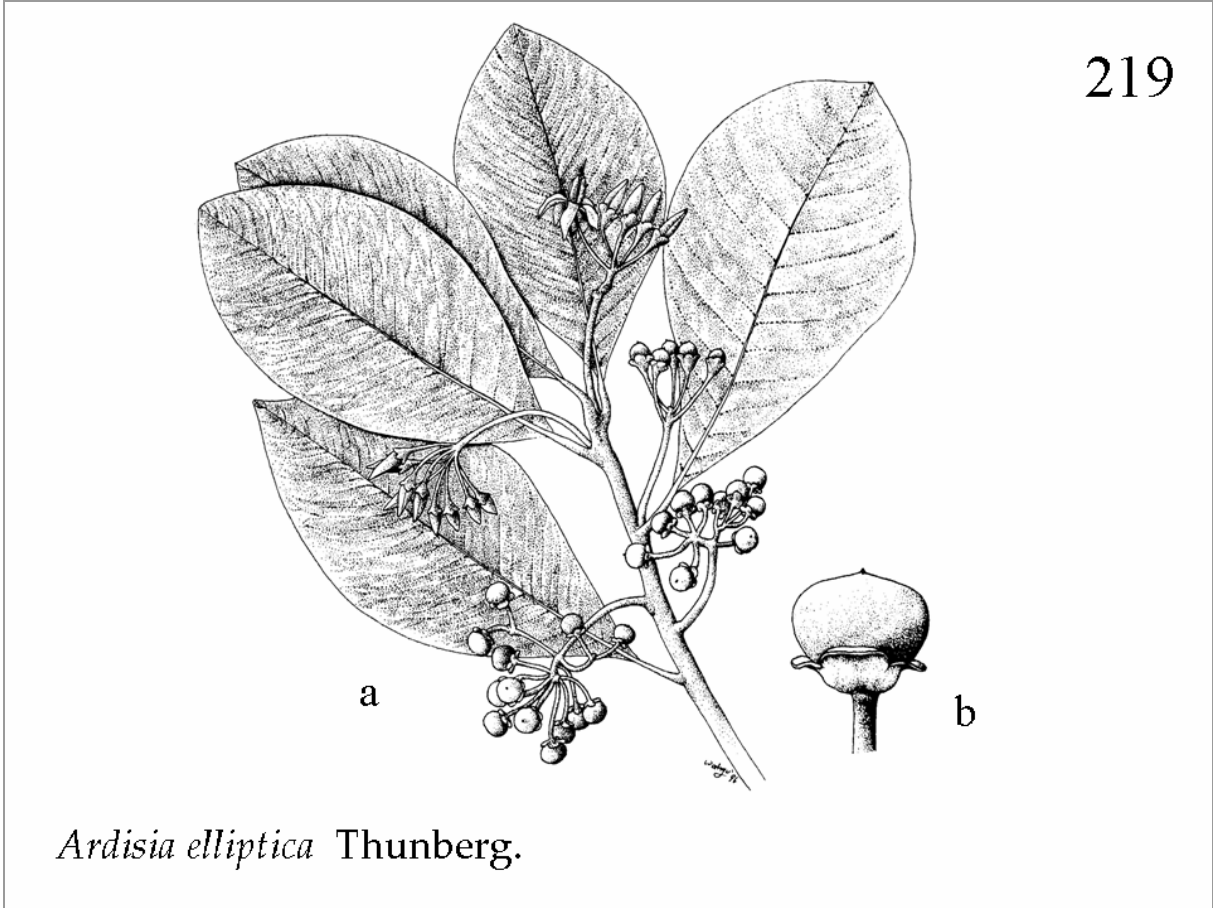


Fig. 219. *Ardisia elliptica* Thunberg. (a) Branchlet with flowers and fruit, and (b) fruit.

MYRSINACEAE

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Ardisia elliptica Thunberg

Synonyms : *Ardisia humilis* Vahl., *Ardisia kotoensis* Hayata, *Ardisia littoralis* Andr., *Ardisia squamulosa* C. Presl., *Bladhia kotoensis* (Hayata) Nakai, *Climacandra obovata* Miq., *Climacandra salicifolia* Miq., *Tinus squamulosa* (C.Presl.) Kuntze

Vernacular name(s) : Sea-shore *Ardisia* (E), Jambulan pantai, Mata pelanduk, Mata itek, Mata ayam, Penah, Periah (Mal.), Rampansi, Lampeni, Lempeni, Fanasa, Buah letus, Kayu lampiko (Ind.), Co'm nguôi (Viet.), Raamyai (Thai)

Description : A shrub, up to 5 m tall, with twigs that are swollen at the base and are easily detached. The elliptic to obovate, somewhat fleshy leaves are 2.5-5 cm by 8-12 cm and are spirally arranged. At the base they are narrowed and gradually taper to a short, 1 cm long stalk. Flowers measure about 1 cm across, and have five petals and five calyx lobes. They are located in umbell-shaped or condensed clusters located in the axils, with flowers arranged in groups of 8. The calyx has rounded, overlapping lobes, and the pointed petals are white or pink. There are five stamens, and the anthers are many-chambered. Flowers are not fragrant. The ovary is round and has a simple style. The round, few-seeded berry measures about 5-12 mm across, first reddish-purple, turning black when ripe. Most commonly recorded as *Ardisia littoralis* in mangrove literature.

Ecology : Shrubs of tidal, semi-mangrove and estuarine habitats. Common on all sandy and muddy coasts in Peninsular Malaysia. Occurring in plant communities only occasionally inundated by the highest tides. Mangrove associate species.

Distribution : From Sri Lanka, southern India to Southeast and East Asia (Southeast China). In Southeast Asia recorded in Myanmar (as *Ardisia littoralis*), Thailand, the Philippines, Singapore, Malaysia (Peninsular), Brunei and Indonesia (Java, Kalimantan, Sulawesi). Possibly also in Cambodia and Vietnam, but not recorded to date.

Abundance : Locally common.

Use(s) : Used medicinally to treat scabies (leaves) and intestinal worms (fruit).

Source of illustration : Corner (1988), Stone (1989).

Reference(s) : Burkill (1935), Heyne (1950), Tomlinson (1986), Corner (1988), Stone (1989), Said (1990), Aksornkoe (1993), Maung (2003), <http://www.rbgekew.org.uk/herbarium/brunei/bclhome.htm>.

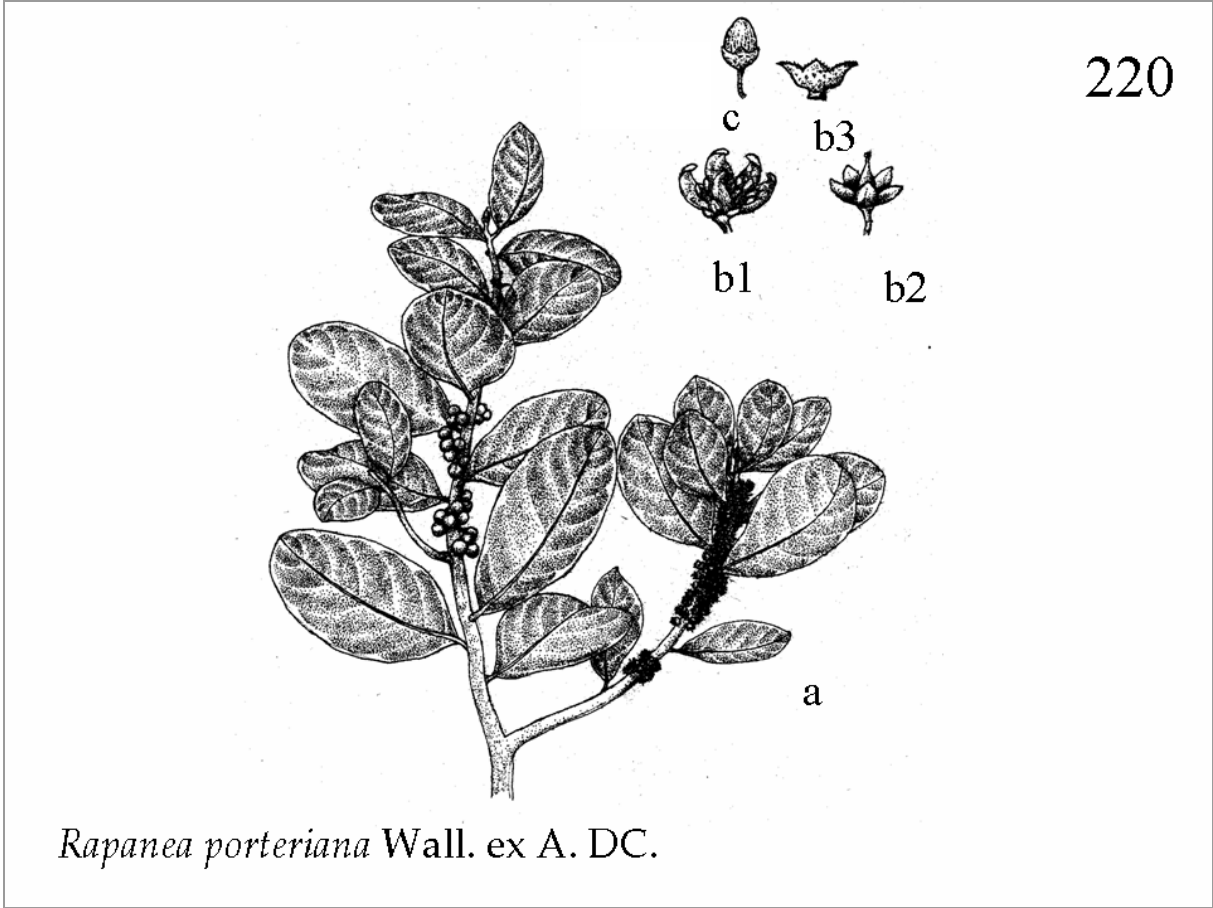


Fig. 220. *Rapanea porteriana* Wall. ex A. DC. (a) Flowering and fruiting branches, (b) flowers, and (c) fruit.

MYRSINACEAE

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Rapanea porteriana Wall. ex A. DC.

Synonyms : *Myrsine avensis* (Blume) Mez., *Myrsine porteriana* Wall. ex A. DC., *Myrsine umbellulata* A. DC.

Vernacular name(s) : Dedahruang (Mal.)

Description : Shrub or small tree, 7-10 m tall. Leaves spirally arranged, simple, leaf blades stiff, with a leathery texture, narrowly elliptic to ovate-elliptic, 12-25(-30) by 36-80 mm, tapering to the 5-6 mm long leaf stalk, dark green, pointing upward and with the sides slightly recurved, veins more or less invisible; leaf tip rounded. Flowers are located in axils of present or fallen leaves, tiny, 3(-5) mm wide, hairy at the mouth, 5-merous, sepals free or shortly fused; petals white, ephemeral, shortly fused at the base. Fruit a 1-seeded berry, clustered on the older wood, well below the leaf-bearing portion of the shoot, 5-6 mm wide, pale green, turning pinkish purple.

Ecology : Found in diverse habitats, including coastal mud (mangroves), coastal heath, rocky headlands, open swamps, limestone hills and crests of hills and mountains up to 1700 m asl. Mangrove associate species.

Distribution : Southeast Asian species, recorded in Thailand, Malaysia (Peninsular and Sarawak), Brunei and Indonesia (Sumatra, Borneo).

Abundance : Locally common, but with a limited distribution.

Use(s) : Unknown.

Source of illustration : Archive, Royal Botanic Garden, Kew.

Reference(s) : Tomlinson (1996), Corner (1988), Stone (1989)

<http://www.forest.go.th/Botany/Flora/species%20list/volume6/Myrsinaceae.htm>

<http://www.rbgkew.org.uk/herbarium/brunei/bclhome.htm>.

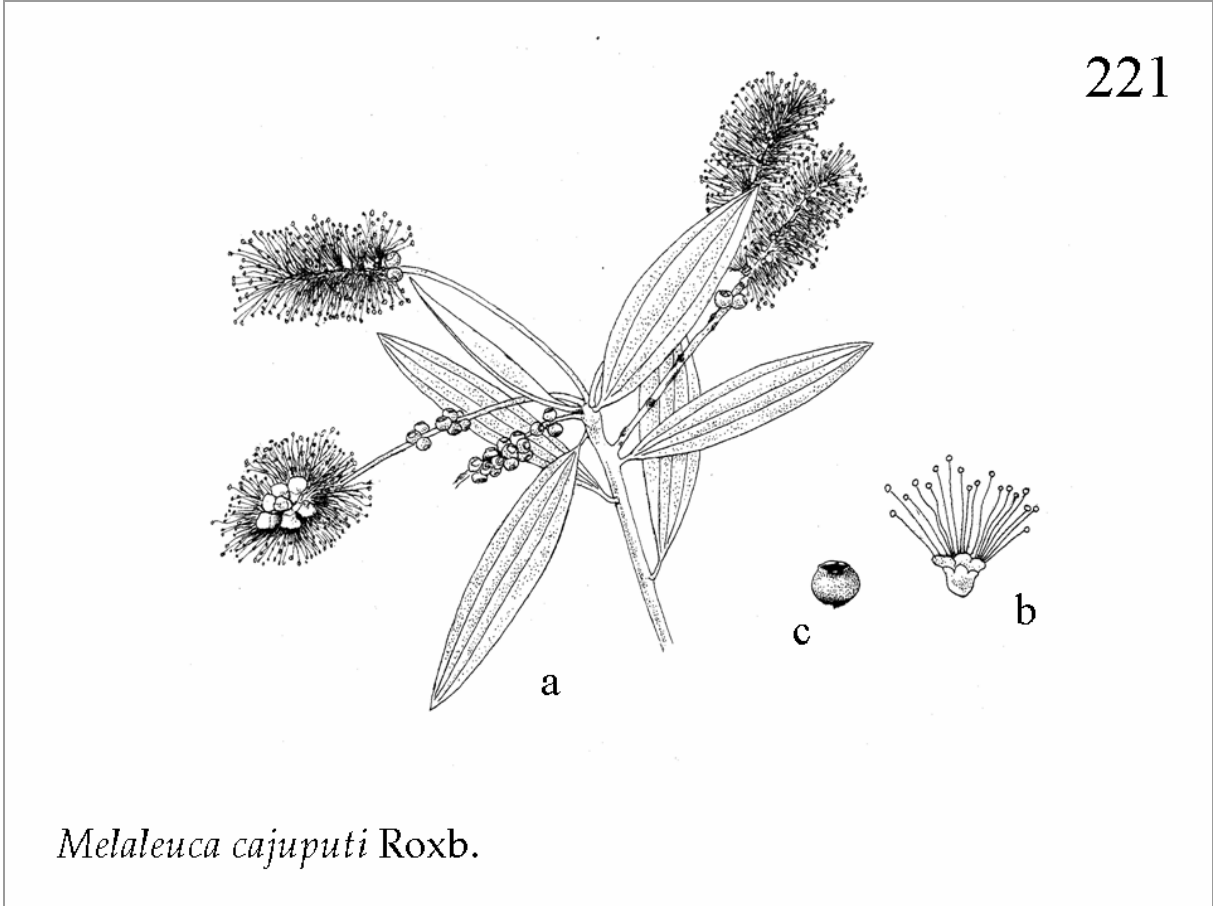


Fig. 221. *Melaleuca cajuputi* Roxb. (a) Branchlet with flower and fruit clusters, (b) flower, and (c) fruit.

MYRTACEAE

221

***Melaleuca cajuputi* Roxb.**

Synonyms : *Melaleuca cajuputi* subsp. *cajuputi* Roxb., *Melaleuca cajuputi* subsp. *cumingiana* (Turcz.) Barlow, *Melaleuca leucadendra* L., *Melaleuca leucadendron* (sensu lato)

Vernacular name(s) : Paperbark tree, White-wood, Melaleuca (E), Gelam, Kayu Puteh (Mal.), Gelam, Kayu puti, Inggolom, Baru galang, Waru galang Iren, Bus, Irono Ngelak, Sakelan, Ai kelane, Ai elane (Ind.), Kayu gelang (ET), Samed (Thai), Tràm (Viet.)

Description : Large shrub to tall evergreen tree, up to 24 m tall but usually 5-15 m, with a narrow, dense, greyish-green bushy crown and a stout, often twisted trunk. Bark whitish to light grey or greyish-brown, often tinged with orange-brown, fissured and papery flaky in coarse elongate shaggy pieces. Young twigs covered with silky hairs. Leaves spirally arranged, leaf stalk 6-12.5 mm long, leaf blade 5-12.5 by 1.25-3.75 cm, greyish-green, lanceolate, often slightly curved, base tapered, with 5-7 longitudinal nerves, young leaves silky hairy. Flowers white, without a stalk, arranged in groups of three along a terminal spike, 7.5-15 cm long, fluffy because of the many stamens, fragrant; petals 5, stamens numerous. Fruit a small, 3 mm wide woody capsule, without a stalk, cushion-shaped, greyish-brown, with a narrow groove round the top surrounding a small crater-like cup marked with 5 radial grooves, long persistent on the twigs. Seeds: many and tiny. The terminal 'spike' is really the leafless part of an axillary shoot, and after flowering the end bud continues growth to produce a flush of leaves before dropping. Leaves have a high content of highly aromatic cajuput oil (*minyak angin* in Malaysia and Indonesia).

Ecology : On swampy ground near the coast, but also planted on roadsides. Occurs on heavy, deeply flooded acid sulphate soils (e.g. in Mekong Delta in Vietnam; Ogan-Komering floodplain in South Sumatra, and Negara River floodplain in South Borneo), coppices readily, and can withstand repeated fires. As a result, dense stands dominated by this species may be formed. Insect pollinated. Also occurs on landward margins of mangroves. Mangrove associate species.

Distribution : From Myanmar (Tenasserim) eastwards to Thailand, Cambodia, Vietnam, Malaysia, Singapore, Indonesia (Sumatra, Borneo, Java, Lesser Sundas, Moluccas), East Timor, PNG and northern Australia. Absent from the Philippines and Brunei.

Abundance : Locally common to very common.

Use(s) : Wood is considered excellent fuel wood. Poles used for construction, as they last well in moist conditions and are not readily attacked by termites. Papery bark is used for caulking boats. Leaves yield cajuput oil, which is commercially exploited. Timber is moderately hard to hard, heavy (sinker), and the sapwood is light pink-brown. Reportedly good for honey production.

Source of illustration : Drawn from live specimen.

Reference(s) : Blake (1968), Heyne (1950), Kochummen (1978c), Corner (1988), Doran & Gunn (1994), <http://www.uc.pt/timor/florafauna.html>.

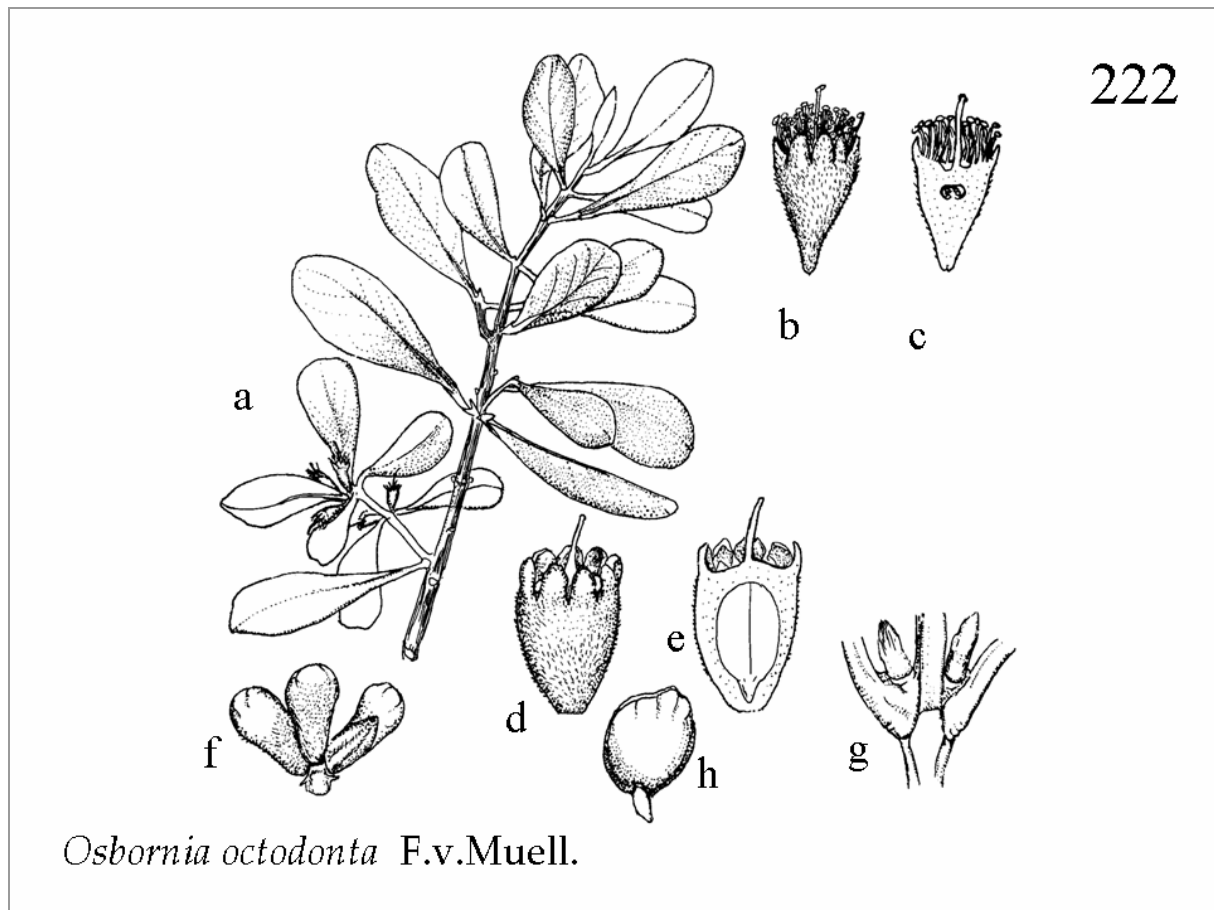


Fig. 222. *Osbornia octodonta* F.v.Muell. (a) Branchlet with flowers, (b) flower, (c) longitudinal section of flower, (d) fruit, (e) longitudinal section of fruit, (f) cluster of 3 buds, (g) node with axillary flower buds, and (h) embryo.

MYRTACEAE

222

Osbornia octodonta F.v.Muell.

Synonyms : Unknown.

Vernacular name(s) : Myrtle mangrove (E), Monot-bonot, tualis, dulok-dulok (Ind.), Dik-duk, Dulok-dulok, Gumilum, Gullum, Kulasi, Manotbonot, Maligang, Sagasa, Tiuyayos, Toauis, Tuauis – *Tualis* (Phil.)

Description : Single or multi-stemmed evergreen tree or, more usually, a shrub, up to 7 m tall; roots may run along the surface. Does not have a regular form; occasionally it has pneumatophores, but usually these are absent. *Osbornia octodonta* has a fibrous, stringy, grey or brown bark and smooth, pale-grey twigs, quadrangular when young; larger specimens have a fluted stem. The opposite, thin-leathery leaves are aromatic when crushed, and have an obovate blade measuring 2.5-5 by 1-3 cm. These are marked by small, translucent oil glands and a swollen, 2 mm long leaf stalk, both occasionally tinged red. Flowers are located in groups of 1-3 in the axils, and have two elliptic leaflets, 6 mm long, at the base of the flower stalk; these leaflets are later shed. The stalk of the flower cluster is 5 mm long. Individual flowers are stemless, bisexual, about 5 mm long, with two soft, hairy, 3 mm long leaflets at their base. The silky, bell-shaped calyx is 3-6 mm long with a spirally-rolled tube. The eight obovate calyx lobes (hence the name *octodonta*) are 1-3 mm long, and white. There are no petals. The numerous yellow stamens are longer than the calyx lobes. The fruit, 5-10 mm across, is enclosed by the calyx tube and does not open when ripe. The 1-2 seeds are obovate and flat, measuring 7 by 5 mm. This tree belongs to the same family as the eucalypts (Myrtaceae), and its crushed leaves have the same distinctive smell; this is a good way to positively identify the species as it is the only true mangrove species having this characteristic.

Ecology : Occurs on exposed sites on landward margin of mangroves or fringing tidal waterways. It appears to be non-specific to substrate and is found on soft mud, rock, sand and calcareous dunes. However, it is absent from areas frequently flooded by fresh water. Often associated with *Avicennia* and *Sonneratia* species, usually on sandy or gravelly shores. Flowering (in Australia) from June to December with a peak in November. Fruit occurs in February. The small flowers with protruding stamens are insect-pollinated. The fruit is adapted to water dispersal because of its silky hairs, which trap air and give it its buoyancy. Mangrove species.

Distribution : Has a disjunctive distribution, being found in the Philippines, Malaysia (Sabah), Indonesia (Borneo, Java, Sulawesi), Papua, Papua New Guinea and tropical Australia.

Abundance : Uncommon.

Use(s) : Fisherman use the crushed leaves as insect repellent. The bark is sometimes used for caulking wooden boats. The timber is durable and extremely heavy, very hard and strong. Difficult to work because of its hardness, but finishes well. Durable, even in contact with soil, and used as railroad sleepers, posts and housing construction. Bark used for caulking boats. Used to treat toothache, and as a cooking herb.

Source of illustration : Based on Tomlinson (1986) and Wightman (1989).

Reference(s) : van Steenis (1936), Backer & Bakhuizen van den Brink (1963-8), Percival & Womersley (1975), Tomlinson (1986), Wightman (1989), <http://www.aims.gov.au/pages/reflib/fg-mangroves/pages/fgm-3435.html>.

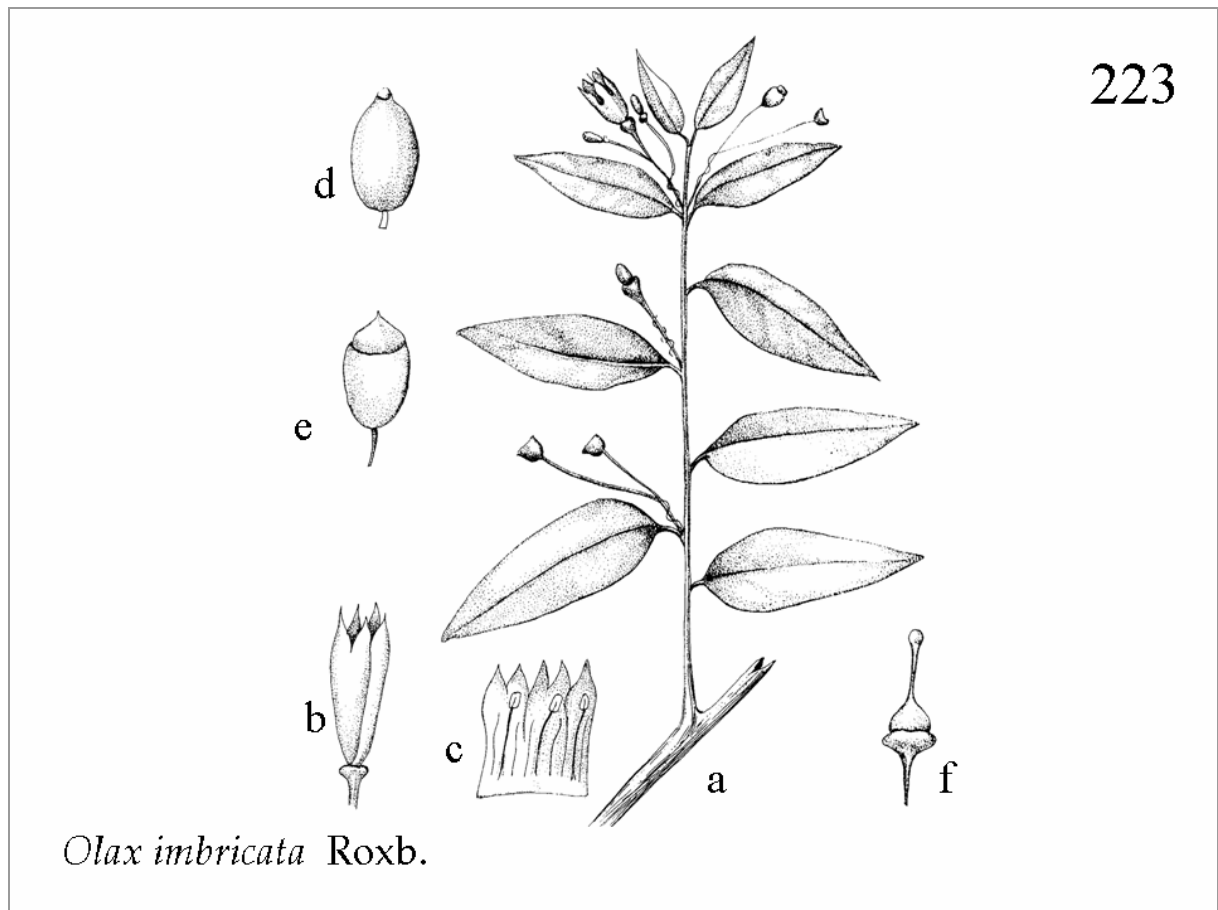


Fig. 223. *Olax imbricata* Roxb. (a) Branchlet with flowers, buds and fruit, (b) flower, (c) corolla (opened, to reveal stamens), (d, e) fruit, and (f) stigma.

OLACACEAE

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Olax imbricata Roxb.

Synonyms : *Olax laxiflora* Ridl., *Olax multiflora* A. Rich., *Olax multiflora* Ridl., *Olax rosea* Ridl., *Olax semiinfera* Valet., *Olax wightiana* Wall. ex Wight & Arn., *Pseudaleia imbricata* (Roxb.) Hassk., *Pseudaleia longistylis* Hassk., *Ximenia olacoides* Wight & Arn.

Vernacular name(s) : Lenteng, Kaya Kil (Ind.), Balagon, Labnot, Biton, Malabagio, Malabutong, Ubet-ubet (Phil.), Kodak acing, Meribut (Mal.), Lumnok (Thai), Du'ong dâù kêt ho'p (Viet)

Description : Shrub, often climbing, up to 10 m, with finely grooved, initially somewhat hairy, but later practically smooth branchlets. Thorns and spines are absent. The latter are dark reddish-brown when dry and have lenticels. The leathery, smooth leaves are ovate- to elliptic-oblong, shiny above, and measure 4-18 by 2-7.5 cm. Leaves have (4-)6-9 pairs of nerves that are a little raised on the underside of the leaf. The wrinkled leaf stalk is 5-10 mm long. The many-flowered clusters measure 0.5-3.5 cm, are branched from the base and are densely covered with short hairs. The calyx is very small. The 3 linear-oblong petals are white or pinkish and 10-12 mm long. The round berry measures 1.7-2.5 cm in diameter, and is almost completely covered by the thin, orange calyx, which grows in size with the berry.

Ecology : In primary and secondary forests, in dry brushwood, on coral limestone, but also in mangroves and peat swamps. Occurs at low elevations, and rarely up to 900 m. Mangrove associate species.

Distribution : From India, Sri Lanka and the Andaman Islands eastwards through Southeast Asia to Micronesia and the Solomon Islands, and northeast to South China and Taiwan. In Southeast Asia recorded from Myanmar, Thailand, Malaysia, the Philippines, Indonesia (Sumatra, Java, Madura, Borneo, Sulawesi, the Lesser Sunda Islands, the Moluccas and Papua), East Timor and Papua New Guinea.

Abundance : Locally common, but on the whole rare or uncommon.

Use(s) : Edible fruit.

Source of illustration : Icones Rijksherbarium Leiden.

Reference(s) : Heyne (1950), Backer & Bakhuizen van den Brink (1963-8), Sleumer (1984), Verhey & Coronel (1991).

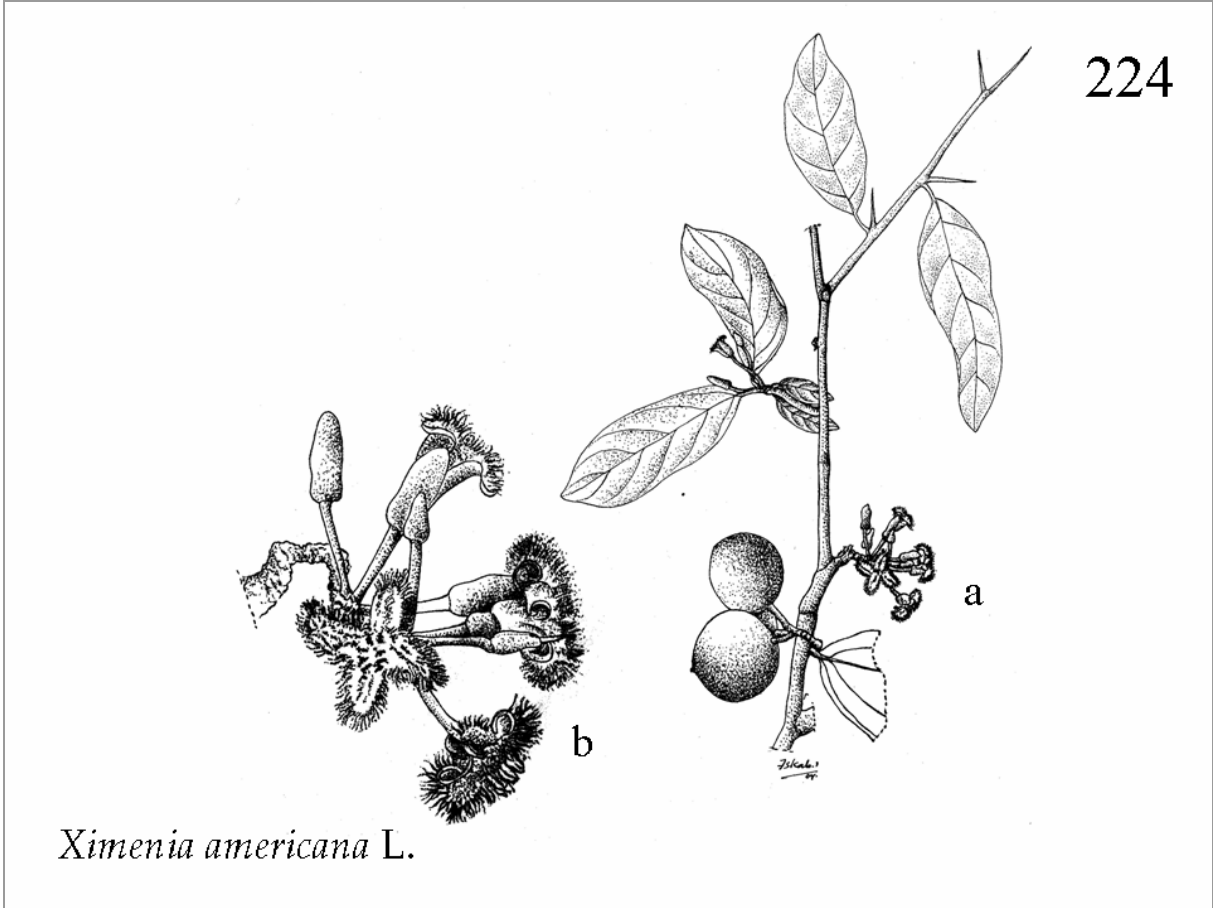


Fig. 224. *Ximения americana* L. (a) Flowering and fruiting branch, and (b) detail of flower cluster.

OLACACEAE

224

Ximения americana L.

Synonyms : *Amyris arborescens* P. Browne, *Heymassoli inermis* Aubl., *Heymassoli spinosa* Aubl., *Pimecaria odorata* Raf., *Vidara littorea* Rump., *Ximения aculeata* Crantz, *Ximения americana* fo. *inermis* (Aubl.) Engl., *Ximения americana* var. *ovata* DC., *Ximения arborescens* Tussac ex Walp., *Ximения fluminensis* M.Roem., *Ximения inermis* L., *Ximения loranthifolia* Span., *Ximения montana* Macfad., *Ximения multiflora* Jacq. *Ximения oblonga* Lam. ex Hemsl., *Ximения spinosa* Salisb., *Ximения verrucosa* M. Roem., *Zizyphus littorea* Teysm.

Vernacular name(s) : Tallow wood (E), Prunier de me (F), Bedara laut, bidari, pidaroh (Mal.), Bidaro, Wama-wama, Bidara – *Bidara laut* (Ind.), Bo-o, Bual (Phil.), Pin-lay-see (Myan.), Phutsa-tha-le (Thai.)

Description : Thorny shrubs or small trees, 2-4(-10) m tall, low branching, smooth, sometimes sprawling, with thorns in the leaf axils. Bark greyish brown. Branchlets usually spiny, covered with red cork and rounded lenticels. Leaves simple, spirally arranged, 2.5-5(-10) cm by 1.2-2.5(-6) cm, usually elliptic but variable in shape, with a short, 3-5(-7) mm stalk; leaf nerves 3-5(-7) pairs. Flowers small, greenish-white in shortly stalked (up to 1.5 cm) clusters or panicles, located in the axils, with 3-9 flowers. Calyx is cup-like with 4-5 teeth, 0.5-1.5 mm; petals 4(-5), recurved, (5-)8-10(-12) mm by 1.5-2 mm, thickly hairy on the inside; stamens 8(10). Fruit a plum-like drupe, rounded, pulpy and with a hard stone, yellow to orange (occasionally bright red or scarlet), with green flesh, 15-25(-35) mm by 12-20(-30) mm.

Ecology : In thickets immediately behind the beach, along the sea-shore (*Barringtonia asiatica* formation). Also in dry savannah or forest, sometimes in light rain forest, scattered, on stony or sandy ground, and at landward edges of mangroves on sandy soil. Occasionally a root parasite, also on its own species (auto-parasitic). Seeds are distributed by birds and by sea currents. Numerous local forms exist. Mangrove associate species.

Distribution : Pan-tropical and subtropical. Found throughout Southeast Asia.

Abundance : Locally common, but with a scattered distribution.

Use(s) : Wood is hard and close grained, and used as a substitute for white Sandalwood because of its yellowish-brown colour, and pleasant smell when freshly cut. The sour pulp of the fruit is eaten. Sometimes the skin is removed and steeped in brine, to be eaten with rice. The kernels contain 67% oil and are purgative, a fact already stated by Rumphius. Kernels taste of hazelnut, but because of purgative property only 2-3 can be consumed. If boiled and steeped in water for 1-2 days, it loses this characteristic. Root used to treat colic. Leaves used as vegetable.

Source of illustration : Based on photograph by Tim Motley (Missouri Botanical Garden TROPICOS database (www.mobot.org)).

Reference(s) : Heyne (1950), Sleumer (1984), Afriastini (1988), Corner (1988), Verhey & Coronel (1991), Missouri Botanical Garden TROPICOS database (www.mobot.org).

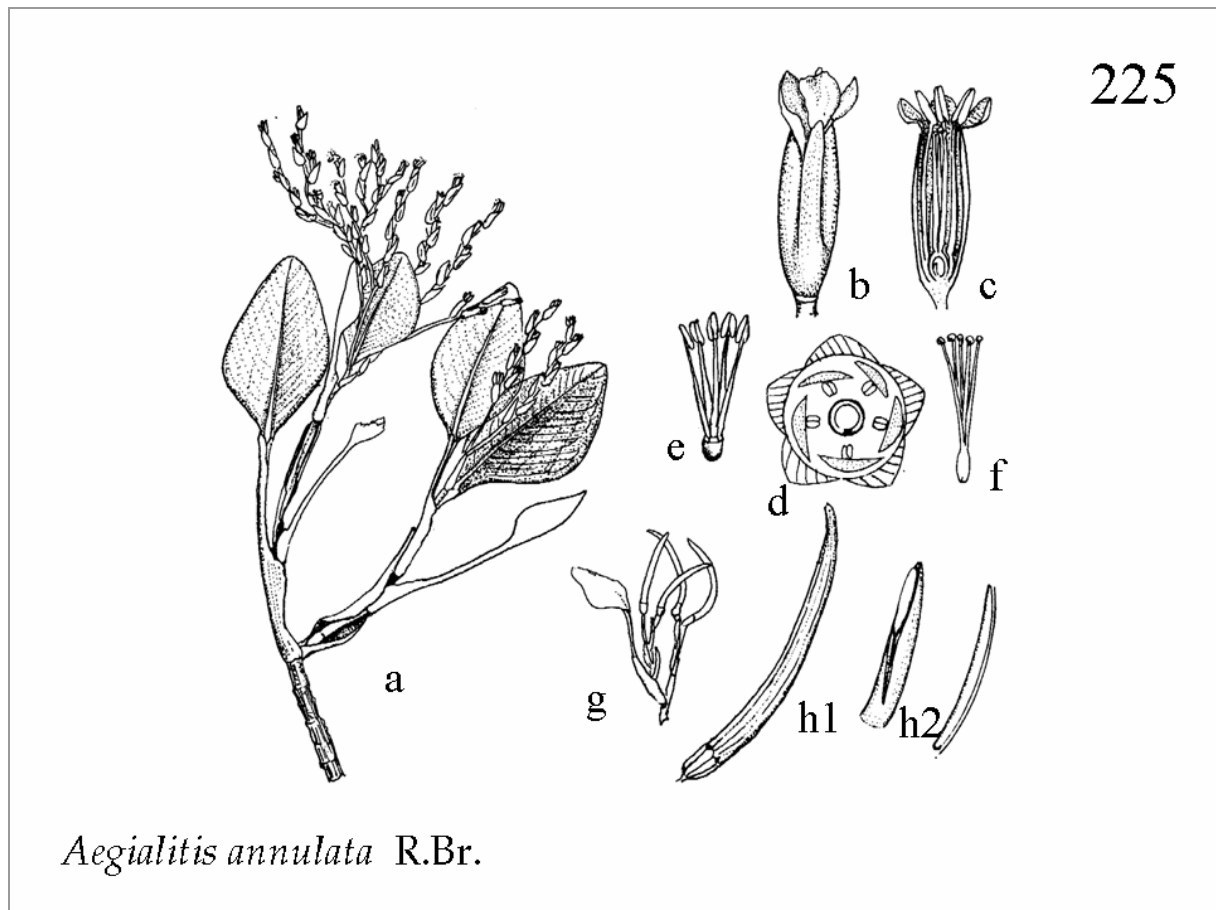


Fig. 225. *Aegialitis annulata* R.Br. (a) Branchlet with flowers, (b) flower, (c) longitudinal section of flower, (d) flower diagramme, (e) stamens, (f) stigma, (g) cluster of fruit, and (h-j) fruit.

PLUMBAGINACEAE

225

Aegialitis annulata R.Br.

Synonyms : *Aegialites annulata* (sic), *Aegianilites* Presl.

Vernacular name(s) : Club mangrove (E)

Description : Slender shrub, up to 1.5-3 m tall, occasionally to 7 m, usually with spreading roots which run along the soil surface, and twigs with conspicuous, ring-shaped leaf scars. Occasionally with stilt roots. The outer bark is black, smooth, fissured or flaking with age. The stem is up to 20 cm diameter, swollen at the base and with a very spongy texture. Leaves are spirally arranged, clustering terminally on the shoots, winged and sheathing the stem. Leaf blades, 6-9 by 2-5 cm, are marked by longitudinal depressions and salt glands. Leaf stalks are 8 cm long. The asymmetrical flower clusters have many white (occasionally pale blue) flowers, and are located at the ends of branches. The tubular, fluted calyx is 7-8 mm long, persistent and has five lobes. The five overlapping, 5-8 mm long petals form a tube with 9-10 lobes. The fruit is a curved capsule, 5-angled and about 3-5 by 4-5 cm, dull reddish when mature. *Aegialitis annulata* and *Aegialitis rotundifolia* have a discontinuous distribution. *Aegialitis rotundifolia* occurs in India, Bangladesh, Myanmar, Thailand and the Andaman Islands, in low mangroves on muddy substrate, while *Aegialitis annulata* is found to the east (see below).

Ecology : Occurs in open mangrove as isolated specimens or in small groups. Also occurs on more sandy and rocky places inundated by waters with a salinity that is at least that of seawater (at the end of dry season). Pollination is reportedly mediated by ants. In Australia, flowering occurs from September-November, and mature fruit appears in January-March. They have rather unimportant differences in characteristics of the flower. Mangrove species.

Distribution : Found in eastern Indonesia and East Timor to northern Australia and Papua New Guinea. In Indonesia it has been recorded from the Lesser Sunda Islands, the Moluccas and Papua.

Abundance : Locally common, but listed as rare in Indonesia (Mogea *et al.*, 2001; recorded as *Aegialitis 'angulata'*).

Use(s) : Has a very high tannin content, but use has not been recorded (Burkill, 1935).

Source of illustration : Based on Tomlinson (1986) and Wightman (1989).

Reference(s) : Burkill (1935), van Steenis (1949), Percival & Womersley (1975), Tomlinson (1986), Wightman (1989), Prakash & Lim (1995).

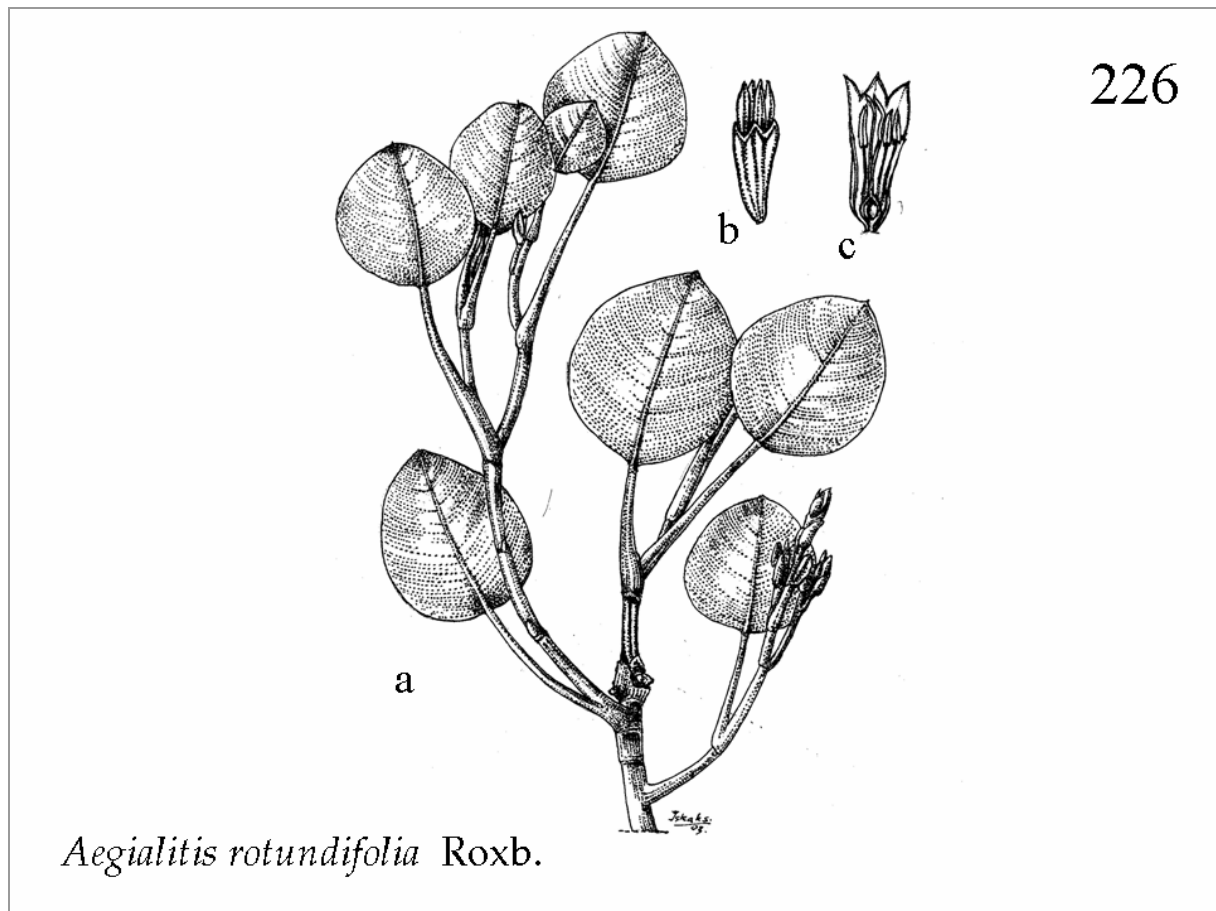


Fig. 226. *Aegialitis rotundifolia* Roxb. (a) Flowering terminal branch, (b) flower, and (c) opened flower, revealing the stamens.

PLUMBAGINACEAE

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Aegialitis rotundifolia Roxb.

Synonyms : *Aegialites annulata* var. *rotundifolia*, *Aegianilites rotundifolia*

Vernacular name(s) : Samae (Thai)

Description : Shrub or under-shrub, up to 3 m tall, branches more or less spongy and bearing annular leaf scars, stem base usually swollen. Leaves are spirally arranged, orbicular and entire, clasping the stem, shiny above, with parallel nerves and prominent net-like markings, 4-8 by 4-8.5 cm, base rounded to truncate, apex rounded to shortly pointed, leaf stalk (4)5-7.5 cm, winged, clasping the stem. Bract 10-11 mm, bracteoles 8-9 mm. Flowers with pedicels of up to 13 mm length. Sepals 13 mm long, tubular, lobes narrowly triangular and pointed. Petals white, 12-lobed, 5-7 mm longer than the sepals. Anthers 3 mm, stamens 13-18 mm, styles 9-10 mm. Fruit a capsule, 8-10 by 0.5 cm, 5-angular, pale brown, more or less shining, with a short pointed tip. Leaf stalks and leaflets exude a viscose fluid. *Aegialitis annulata* and *Aegialitis rotundifolia* have a discontinuous distribution. *Aegialitis annulata* occurs in Lesser Sunda Islands, the Moluccas, New Guinea and northern Australia, in low mangroves on sandy and rocky substrate, while *Aegialitis rotundifolia* is found further west. They have rather unimportant differences in characteristics of the flower.

Ecology : Occurs in 'low muddy mangrove' (van Steenis, 1949) or 'maritime swamps and littoral forests, usually in open situations' (Khan & Khan, 1989) including rocky beaches and exposed shorelines, on the outermost mangrove belt, on sandy soil but also in muddy locations. Locally occurring in pure groves. Less common in landward mangrove zones. Characteristic mangrove associate, but like *Aegialitis annulata* does not occur within closed mangrove communities, preferring exposed muddy sites (Tomlinson, 1986). Mangrove species.

Distribution : Occurs in India (West Bengal and Andaman Islands), Bangladesh, Myanmar, Cambodia and Thailand. Not yet recorded, but possibly occurs in Peninsular Malaysia, Vietnam and perhaps northern Sumatra.

Abundance : Patchy distribution, but locally common.

Use(s) : As *Aegialitis annulata*, this species has a very high tannin content, but use has not been recorded (Burkill, 1935).

Source of illustration : Based on Khan & Khan (1989).

Reference(s) : Burkill (1935), van Steenis (1949), Tomlinson (1986), Khan & Khan (1989), Aksornkoae (1993).

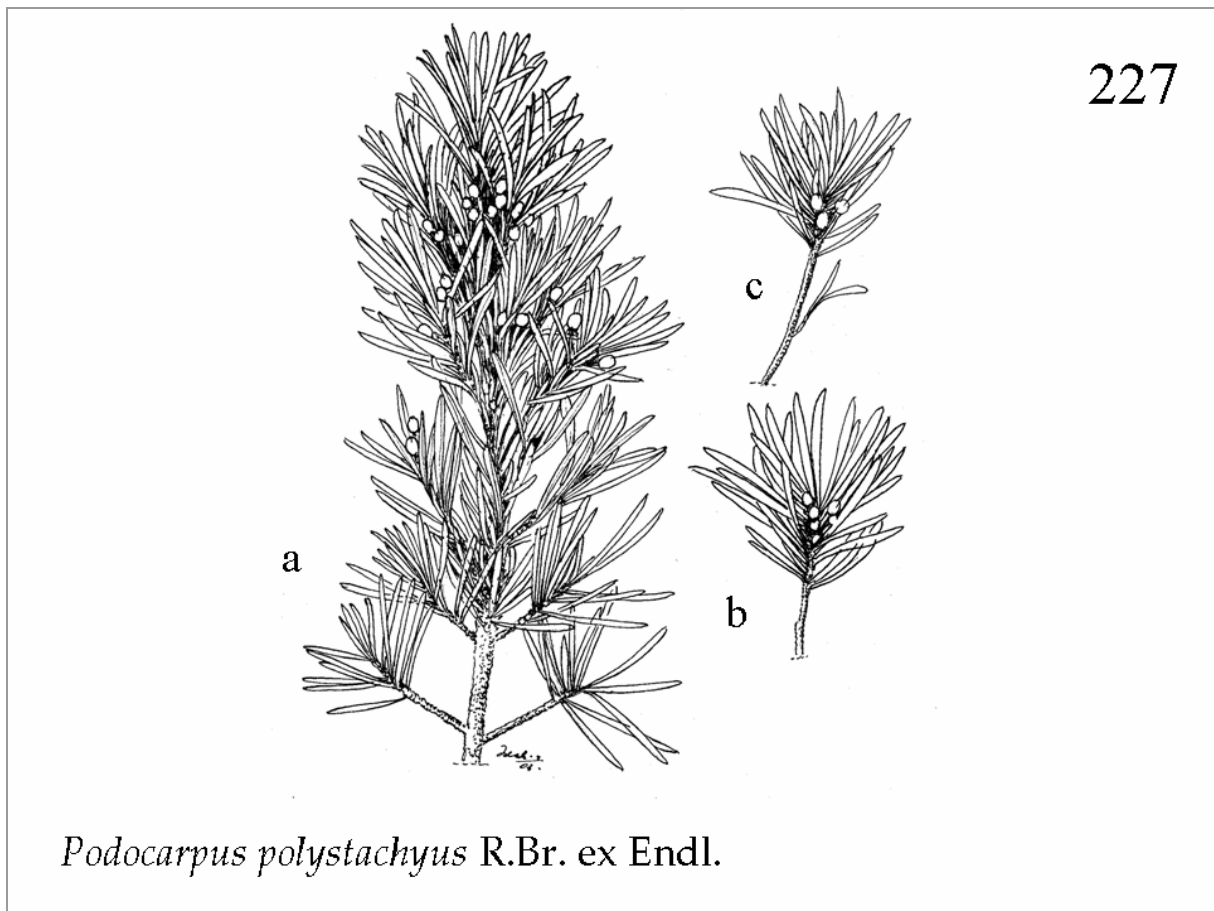


Fig. 227. *Podocarpus polystachyus* R.Br. ex Endl. (a, b, c) Fruits, near the ends of branches.

PODOCARPACEAE

227

***Podocarpus polystachyus* R.Br. ex Endl.**

Synonyms : *Nageia polystachyus* (R.Br. ex Endl.), *Nageia thevetiaefolia* (Blume) F.v.M., *Podocarpus neriifolius* D.Don., *Podocarpus thevetiifolia* Blume, *Podocarpus thevetiifolius* D.Don.

Vernacular name(s) : Podo laut, jati bukit (Mal), kayu keramat, mayu serai – *Ki putri* (Ind.)

Description : Shrub or small tree, 1-20 (very occasionally 40) m tall, commonly about 6m, trunk 30-45 cm diameter, sometimes with buttresses 1 by 1.5 m. The trunk is sometimes fluted. Crown domed, often irregular. Leaves are spirally arranged, often crowded at the twig tips. Young leaves are linear to linear-lanceolate, pointed; mature leaves linear to oval, 3-10 by 6-13 mm, pointed, with a 1-3 mm leaf stalk. Pollen cones are 2-4 cm long, clustered in groups of up to at least five (or 3-5). The seed-bearing structure occurs on a 1-6 mm stalk. Seeds (with covering) measure 7-9 by 5-7 mm.

Ecology : Principle habitat is described as being sandy beaches, where it often occurs gregariously at the high tide mark. Also occurs on sandy coastal bluffs and low outcrops, swampy forest, and sandy ridges or inland edges of mangrove areas. On coastal granites and limestone the trunks are gnarled. It also occurs in coastal heath forests (on poor sandy soils, in *kerangas* vegetation), and limestone hills inland. Mangrove associate species.

Distribution : Endemic to Southeast Asia. Occurring in southern Thailand, Philippines, Malaysia (Peninsular Malaysia, Sarawak, Sabah), Brunei and Indonesia (Kalimantan, Lingga, Sulawesi, Moluccas, Papua). Planted in Sumatra (Medan).

Abundance : Locally common.

Use(s) : Cultivated in gardens. Excellent timber, used for furniture and house interior.

Source of illustration : Keng (1972), Corner (1988)

Reference(s) : Keng (1972), Afriastini (1988), Corner (1988), de Laubenfels (1988).

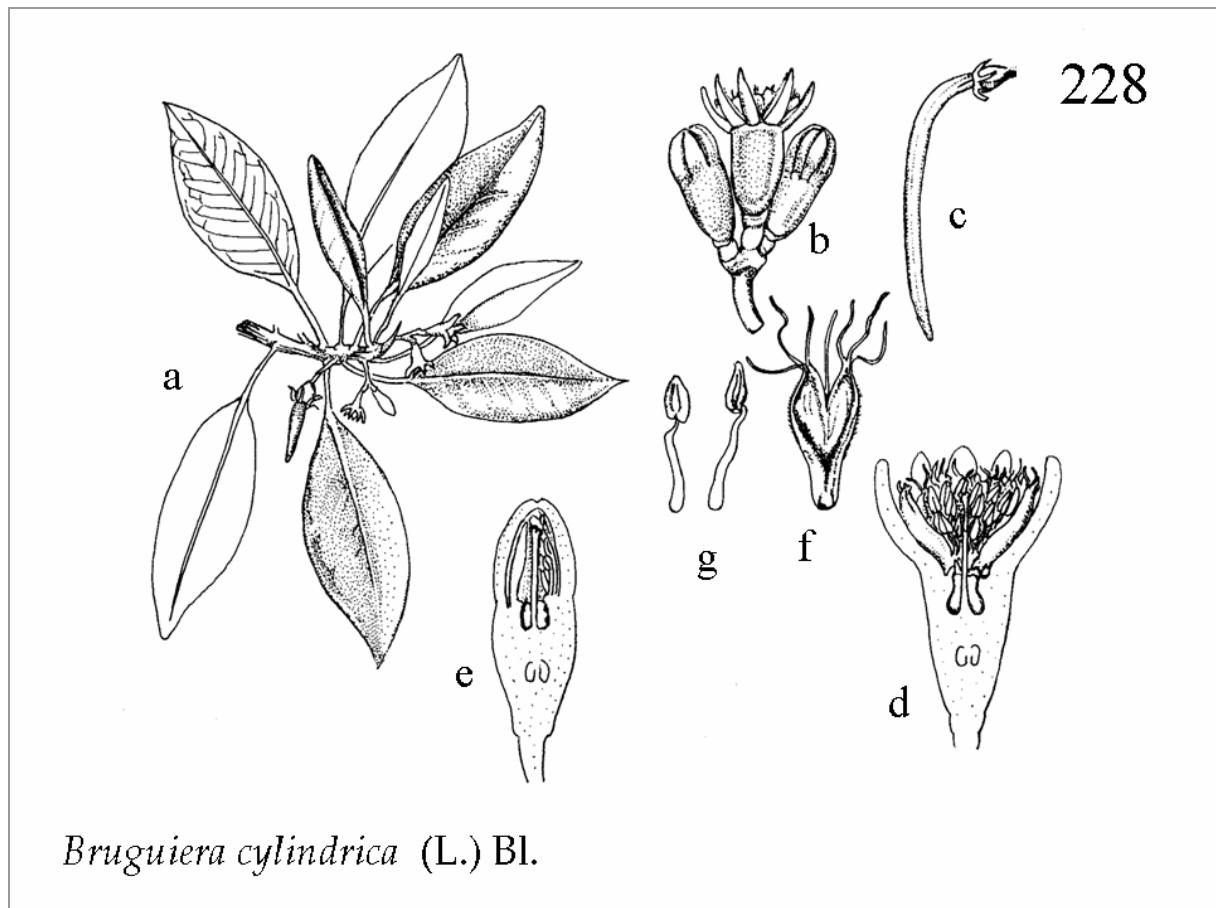


Fig. 228. *Bruguiera cylindrica* (L.) Bl. (a) Branchlet with flowers and immature 'fruit' (hypocotyl), (b) cluster of three flowers, (c) hypocotyl ('fruit'), (d) longitudinal section of flower, (e) longitudinal section of bud, (f) petal, and (g) stamens.

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***Bruguiera cylindrica* (L.) Bl.**

Synonyms : *Bruguiera caryophylloides* Bl., *Bruguiera malabarica* Arn., *Kanilia caryophylloides* Bl., *Mangium caryophylloides* Rumph., *Mangium minus* Rumph., *Rhizophora caryophylloides* Burm., *Rhizophora ceratophylloides* Gmel., *Rhizophora cylindrica* Linné

Vernacular name(s) : Bakau belukap, Bakau berus, Bakau puteh, Bakau kecil, Bosang (Mal.), Burus, Tanjung, Tanjung Sukim, Lindur (Ind.), Bakauan, Biris, Biuis, Bius, Busain, Kalapinai, Langarai, Magtangud, Magtongog, Pototan, Pututan, Tangalan, Tangal-babae, – *Pototan lalaki* (Phil.), Vet thâng (Viet.), Thua khao (Thai.), Basac, Omlann (Camb.)

Description : Small-buttressed, evergreen tree up to 15 m, occasionally to 23 m tall, with a grey bark that has a few small, corky lenticels. The pointed leaves are thin and elliptic, measuring 7-17 by 2-8 cm. The calyx tube is smooth, 4-6 by 2 mm, with eight lobes that are as long as the tube. The flower cluster consists of groups of three flowers, which are greenish and 10-12 mm long. Petals are 3-4 mm long, each lobe having 2-3 bristles at the top; they are white, but rapidly turn brown with age. The outer margins of the flowers are usually fringed with white hairs along the lower part. The hypocotyl (often mistaken for the 'fruit') is cylindrical, often curved, 8-15 cm long and 5 mm wide.

Ecology : Grows gregariously, usually on firm clay behind the *Avicennia* zone, on the seaward side of mangrove vegetation. It gives way to other species on better-drained soils, and has the ability to grow in newly-formed soils that are unsuitable for other mangrove species. The firm clay makes the tree more than usually dependent on its pneumatophores for an adequate supply of oxygen, and is therefore particularly susceptible to prolonged submer-sion. It is an abundant seed bearer with a high regeneration potential, but growth is slow. Flowering occurs all year round. Mangrove species.

Distribution : Found from Southeast Asia to northern Australia. It is recorded throughout Southeast Asia.

Abundance : Usually common, although rare in Singapore and uncommon in the Philippines.

Use(s) : Used as firewood. Wood is heavy, reddish and cross-grained. The young roots of the embryos are eaten with sugar and coconut in some areas. Fisherman do not use the wood for making fish traps, reportedly because it has a peculiar odour that repels fish.

Source of illustration : Based on Ding Hou (1958) and Tomlinson (1986)

Reference(s) : Heyne (1950), Ding Hou (1958), Backer & Bakhuizen van den Brink (1963-8), Tomlinson (1986), Aksornkoae (1993), Aragones *et al.* (1998), Ng & Sivasothi (1999), Yao (2000), Marschke, M. (2000).

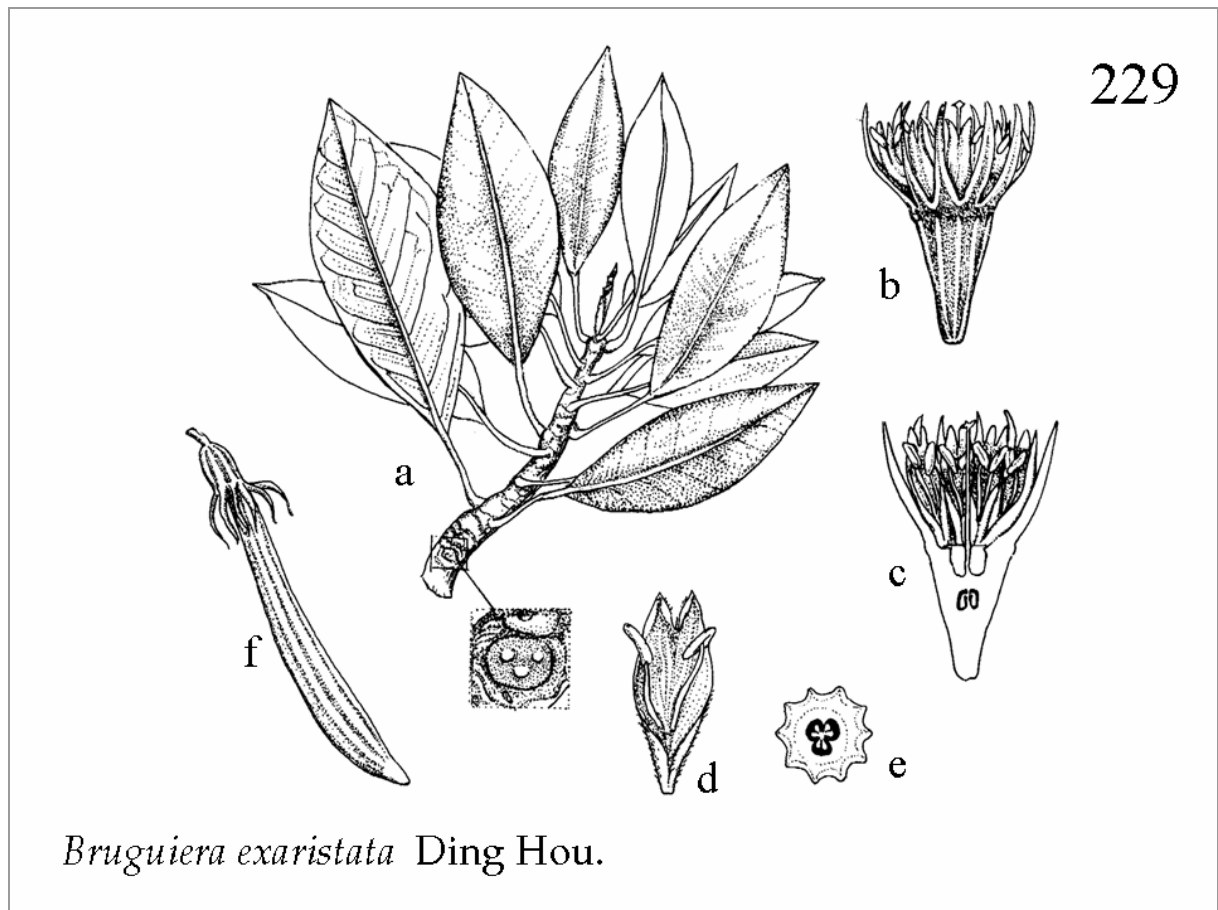


Fig. 229. *Bruguiera exaristata* Ding Hou. (a) Branchlet showing leaf scars (inset), (b) flower, (c) longitudinal section of flower, (d) petal and two stamens, (e) cross section of stigma and embryo, and (f) hypocotyl ('fruit').

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Bruguiera exaristata* Ding Hou*Synonyms :** Unknown.**Vernacular name(s) :** Bakau (Mal./Ind.)

Description : Evergreen shrub or tree, up to 10 m tall, with a dark grey, cracked bark, a flanged stem base and numerous knee-like pneumatophores. The pointed, obovate leaves, 5.5-11.5 by 2.5-4.5 cm, are black dotted beneath and often have in-rolled margins. Flowers occur solitarily in axils, hanging downwards. The 8(-10) calyx lobes are 10-15 mm long. The 8-10 petals, 10-13 mm long, are bilobed, having hairy margins and a hairy base. Flowers are yellowish-green, while petals have whitish hairs and are soon shed. The fruit is spirally coiled and about 1.5 cm long. The blunt hypocotyl (often mistaken for the 'fruit') is cylindrical and slightly ridged, 5-7 cm long and 6-8 mm wide. *Bruguiera sexangula* has been confused with this species in the past.

Ecology : Occurs along tidal waterways or towards the back of mangroves. Occasionally mono-specific stands are formed. Suitable substrates include clay-loams, sands and gravels. Very high salinities are tolerated. The hypocotyl/fruit is relatively small and is easily dispersed by tide or flood. Seedlings appear to perish under shaded conditions. This species flowers and fruits throughout the year. Mangrove species.

Distribution : Limited distribution, known only from East Timor, Indonesia (southern Papua), Papua New Guinea and northern Australia.

Abundance : Locally common, but on the whole uncommon to rare, and listed as rare in Indonesia (Mogea *et al.*, 2001).

Use(s) : Fuelwood and construction.

Source of illustration : Based on Ding Hou (1958), Wightman (1989).

Reference(s) : Ding Hou (1958), Wightman (1989).

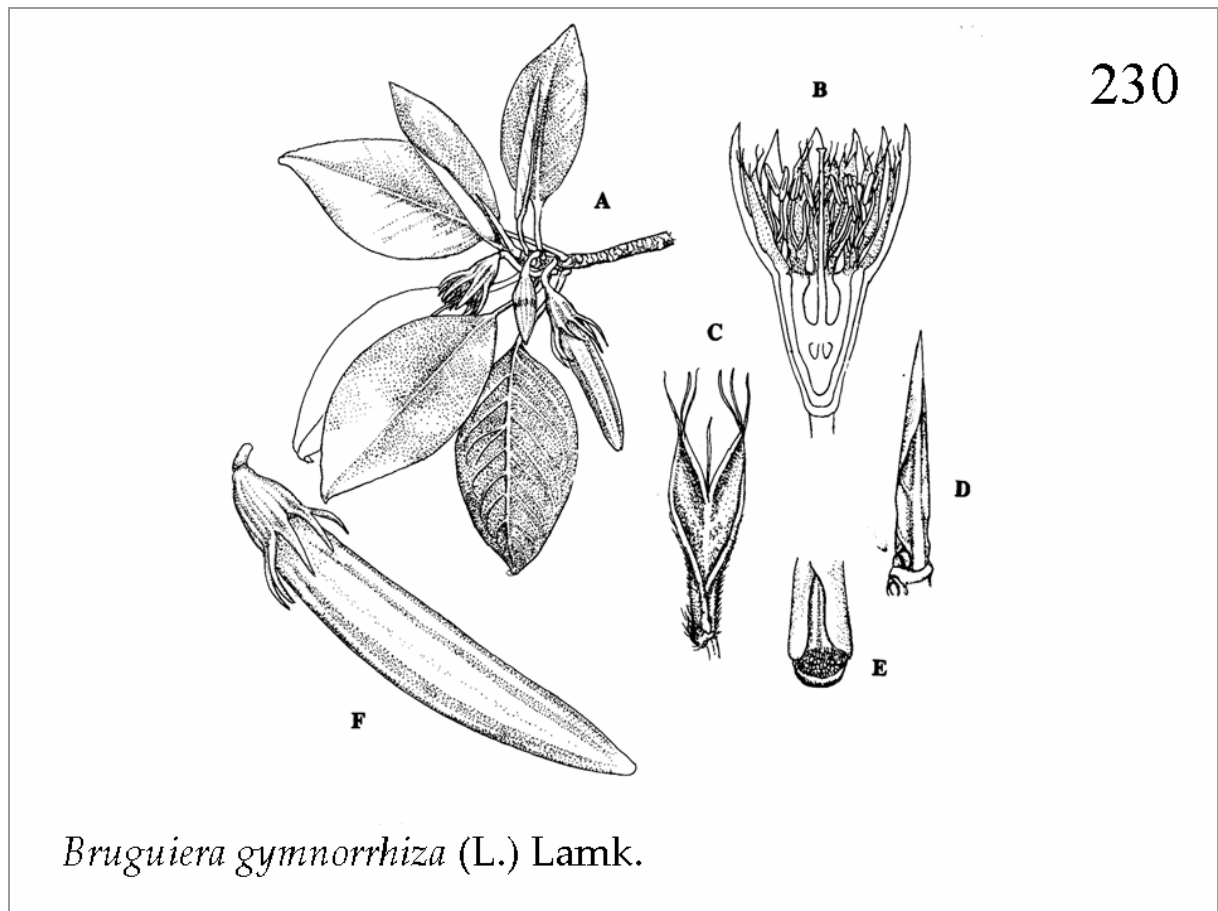


Fig. 230. *Bruguiera gymnorrhiza* (L.) Lamk. (a) Branchlet with flowers and immature 'fruit', (b) longitudinal section of flower, (c) petal, (d) terminal bud with stipules, (e) detail of stipule (detached) from inside, and (f) hypocotyl ('fruit').

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Bruguiera gymnorrhiza (L.) Lamk.

Synonyms : *Bruguiera capensis* Bl., *Bruguiera conjugata* (non *Rhizophora conjugata* L.) Merr., *Bruguiera cylindrica* (non Bl.) Hance, *Bruguiera gymnorrhiza* (with one 'r'), *Bruguiera rheedii* Bl., *Bruguiera rumphii* Bl., *Bruguiera wightii* Bl., *Bruguiera zippelii* Bl., *Mangium celsum* Rumph., *Mangium minus* Rumph., *Rhizophora gymnorrhiza* L., *Rhizophora palun*, *Rhizophora rheedii* Steud., *Rhizophora tinctoria* Blanco

Vernacular name(s) : Bakau besar, Betut, Tumbus, Tumu, Tumus (Mal.), Pertut, Taheup, Tenggel, Putut, Tumu, Tomo, Kandeka, Tanjung, Lindur, Sala-sala, Dau, Tongke (Ind.), Bakau, Bakauan, Busiin, Patotan, Petutan, Pototan, Pututan – *Busaing* (Phil.), Arara, Mapeke (PNG), Vet dù bông dó (Viet.), Prasak, Pangka hua sum dok khao (Thai.), Basac kroahom (Camb.)

Description : Column-shaped, evergreen tree up to 15 m, occasionally up to 30 m, with a dark grey to brown, chequered, usually smooth, lenticelled bark. The stem base is buttressed, and knee roots are numerous. Leaves are leathery, 4.5-7 by 8.5-22 cm, elliptic to elliptic-lanceolate, black dotted beneath, and with a pointed tip; often reddish beneath; stipules may also be reddish. Flowers occur singularly on a pendulous flower stalk, 9-25 mm long, light to bright red, covered with 'powder'. Calyx lobes number 10-14(16) and are pink to red. Under sunny conditions the calyx may be bright red. The 10-16 white petals are 13-16 mm long and have 2-3 white bristles, 3 mm long, on the apex of the lobes and one conspicuous bristle in the notch. Their margins and base are shaggy. Petals soon turn brown with age. Fruit is spirally-rolled, round in cross-section and 2-2.5 cm long. The straight, blunt hypocotyl (often mistaken for the 'fruit') is 12-25 cm long, 1½-2 cm wide, round in cross-section or slightly ridged.

Ecology : Often dominating in tall mangrove forest, marking the final stage in the development of the littoral forests and the beginning of the transition to inland vegetation types. Occurs in areas of low salinity and on somewhat dry, well-aerated soil; it can tolerate both shaded and sunny sites. It also occurs at the landward margin of mangroves, along coastal fish ponds and brackish, tidal rivers. It is found directly along the coastline only following erosion. Substrates on which it is found include mud, sand and occasionally black, peaty soils. Occasionally this species has been found growing at elevations above the tidal influence in riparian situations, the propagules probably dispersed by storm surges. Regeneration is often very restricted. Flowers and fruit are present throughout the year. The relatively large flowers, which have a reddish calyx, are pendulous and attract birds for pollination. Mangrove species.

Distribution : From South and East Africa and Madagascar through Sri Lanka and Southeast Asia to tropical Australia and the west Pacific region. Found throughout Southeast Asia.

Abundance : Common and widespread.

Use(s) : A sweet-meat (*manisan kandeka* in Indonesia) made of the inner hypocotyl flesh plus sugar is eaten. The hard, red timber is used for foundation piling, mine timbers, house posts, furniture and cabinet works; also as firewood and for making charcoal.

Source of illustration : Based on Ding Hou (1958), Tomlinson (1986), Wightman (1989).

Reference(s) : Ding Hou (1958), Backer & Bakhuizen van den Brink (1963-8), Tomlinson (1986), Wightman (1989), Aksornkoae (1993), Aragones *et al.* (1998), Marschke, M. (2000).

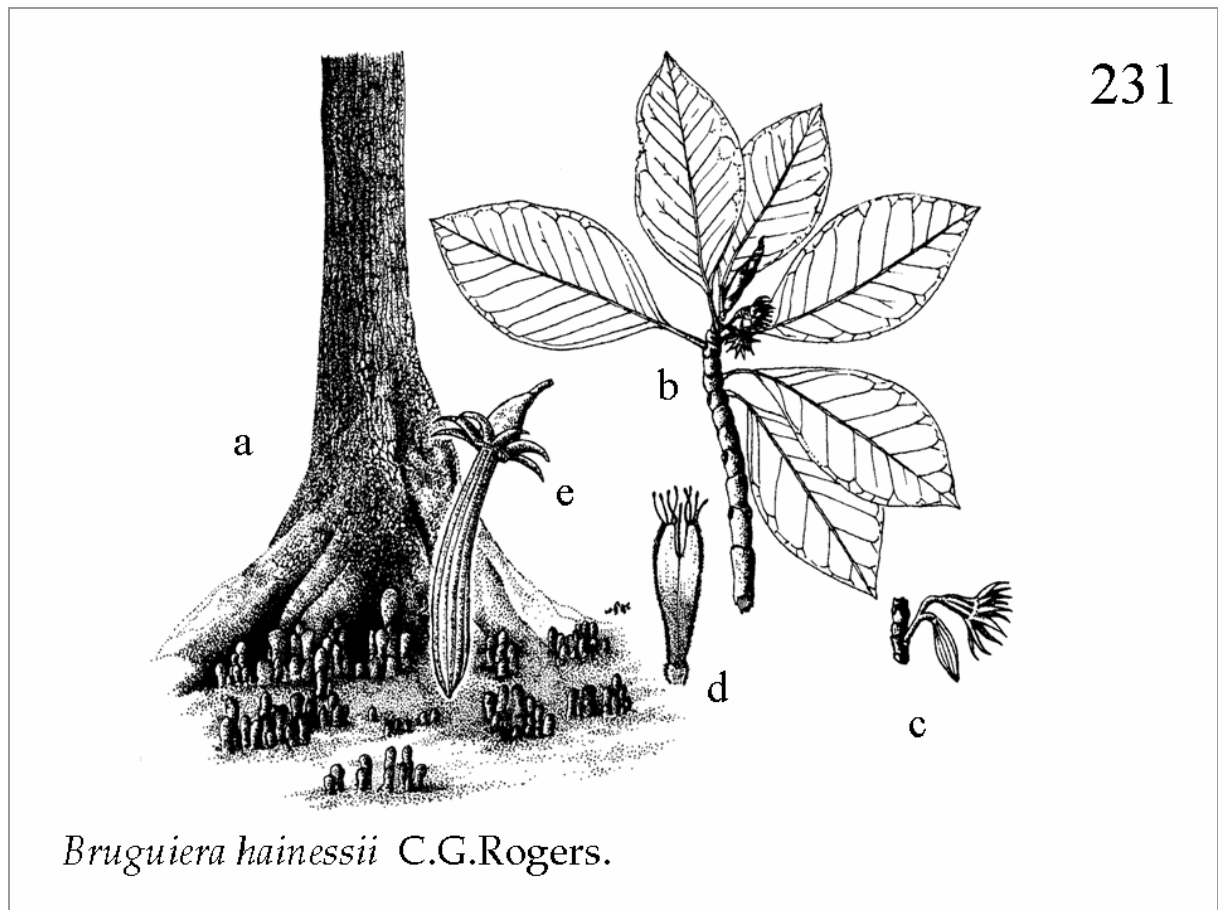


Fig. 231. *Bruguiera hainessii* C.G.Rogers. (a) Base of tree trunk showing the pneumatophores, (b) branchlet with flowers and immature 'fruit', (c) flower and bud, (d) petal, and (e) hypocotyl ('fruit').

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Bruguiera hainessii* C.G.Rogers*Synonyms :** *Rhizophora caryophylloides* (non Burm. f) Griff.**Vernacular name(s) :** Berus Mata Buaya (Mal.)**Description :** Evergreen tree up to 33 m tall, with a trunk of up to 70 cm in diameter. Bark is brown to grey, with large, corky, yellowish-brown lenticels from base to top. The pointed leaves are elliptic-oblong, 9-16 by 4-7 cm. The flower cluster is 2-3-flowered, and flowers are 18-22 mm long when fully expanded. The calyx is pale green, 10-lobed, with a 5 mm wide tube, and lobes the same length as the tube. Petals are white, 7-9 mm long, hairy on the lower margins and only slightly so on the upper part of the lobes. Lobes have 2-4 bristles at the tip and the bristle in the notch far exceeds the length of the tip of the lobe. The hypocotyl (often mistaken for the 'fruit') is cigar-shaped or slightly thickened towards the end, slightly curved, up to 1.1 by 9 cm.**Ecology :** Occurs on the landward margins of mangroves, in relatively dry areas that are inundated for a only a few hours a day during spring tides. Mangrove species.**Distribution :** From India through Southeast Asia, where it has been recorded from Myanmar (Mergui), Thailand, Malaysia, Indonesia and Papua New Guinea.**Abundance :** Rather uncommon.**Use(s) :** Fuelwood and construction.**Source of illustration :** Based on Ding Hou (1958), Tomlinson (1986).**Reference(s) :** Ding Hou (1958), Tomlinson (1986).

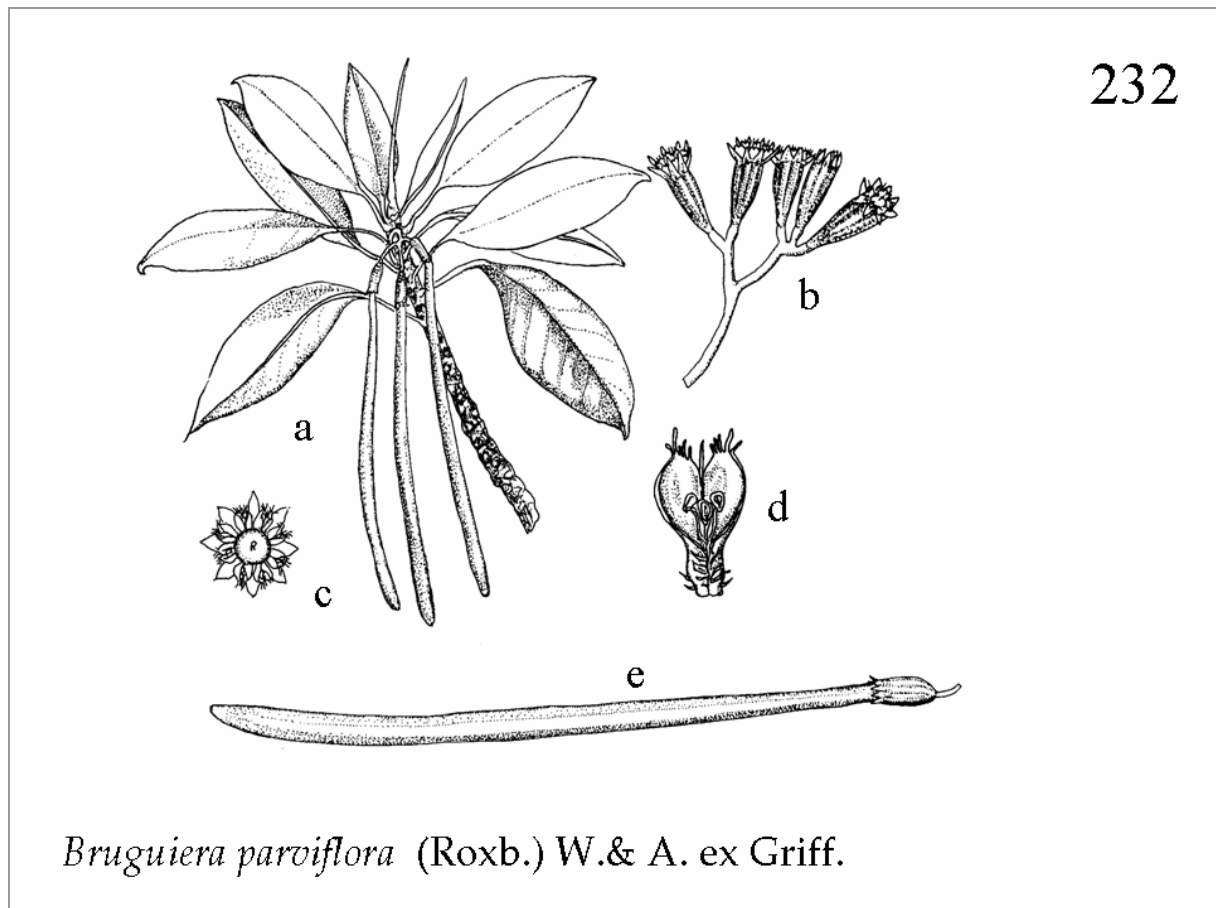


Fig. 232. *Bruguiera parviflora* (Roxb.) W.& A. ex Griff. (a) Branchlet with hypocotyls ('fruits'), (b) cluster of five flowers, (c) flower seen from above, (d) petal, and (e) hypocotyl ('fruit').

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Bruguiera parviflora (Roxb.) W.& A. ex Griff.

Synonyms : *Bruguiera ritchiei* Merr., *Kanilia parviflora* Bl., *Rhizophora cylindrica* (non L.) Roxb., *Rhizophora parviflora* Roxb.

Vernacular name(s) : Lenggadai, Lenggadis, Mengkadai (Mal.), Langgade, Mengelangan, Lenggadai, Tanjung (Ind.), Bakauan-lalaki, Bubutigan, Biosan, Hangalia, Hangarai, Langarai, Langari, Magalai, Pototan – *Langarai* (Phil.), Vet tách (Viet.), Thua dam (Thai.)

Description : Slender evergreen shrub or small tree, up to 5 m (rarely even up to 24 m) tall, with a grey, fissured bark and a slightly flanged base. The trunk may attain a diameter at breast height of up to 50 cm. The knee roots may be up to 30 cm tall. Leaves are pointed, 5.5-13 by 2-4.5 cm, elliptic, black dotted beneath and turning yellowish-green with age. The flower cluster consists of a 3-7(-10) flowered group. Calyx tubes are ridged, 7-9 mm long, 8-lobed, each lobe about 1/4 to 1/5 of the length of the tube; calyx lobes are straight, not curved. The 8 oblong, yellowish-green petals are 1.5-2mm long and have three bristles on each lobe and one bristle in the notch that far exceeds the length of the lobes. The fruit is narrowly, spirally-rolled and 2 cm long. The hypocotyl (often mistaken for the 'fruit') is cylindrical, smooth, curved 8-15 cm long and 0.5 cm wide.

Ecology : This species typically forms single species stands in areas that are infrequently inundated. Isolated individuals also occur along tidal waterways and coastal fish ponds. Often found in solid stand in the interior of mangroves, inhabiting mostly firm mud flats. It is often associated with *Rhizophora* species. *Bruguiera parviflora* increases as a result of exploitation of immature mangrove vegetation. Suitable substrates include consolidated mud, sands, calcareous sands, brackish and hypersaline soils. In Australia, flowering has been recorded from June to September, and fruiting from September to December. The light hypocotyls are easily dispersed in water, and seem to establish themselves better in areas receiving much to moderate sunlight. Day-flying insects such as butterflies pollinate its small, erect flowers. The leaves are characteristically scalloped due to predation by insects. Can be very common in logged-over areas (e.g. Karang Gading-Langkat Timur Laut reserve in North Sumatra; Giesen & Sukotjo, 1991). Mangrove species.

Distribution : From India and Bangladesh eastwards to Samoa, Solomon Islands and northern Australia; found throughout Southeast Asia. Introduced in Hawaii.

Abundance : Scattered, but locally abundant.

Use(s) : The wood is heavy to very heavy, and hard and strong, but as it checks and shrinks more than other timbers. It is easily worked and finishes well, but is perishable when exposed to weather or when in contact with the ground. Produces good charcoal, firwood and pulp. Because of its small size, its timber is usually not of much use except for firewood, mining- and fishing-stakes. The germinating seedling is sometimes used as a vegetable.

Source of illustration : Based on Ding Hou (1958), Tomlinson (1986) and Wightman (1989).

Reference(s) : Ding Hou (1958), Backer & Bakhuizen van den Brink (1963-8), Tomlinson, (1986), Wightman (1989), Aksornkoae (1993), Aragones *et al.* (1998), <http://www.uc.pt/timor/florafauna.html>.

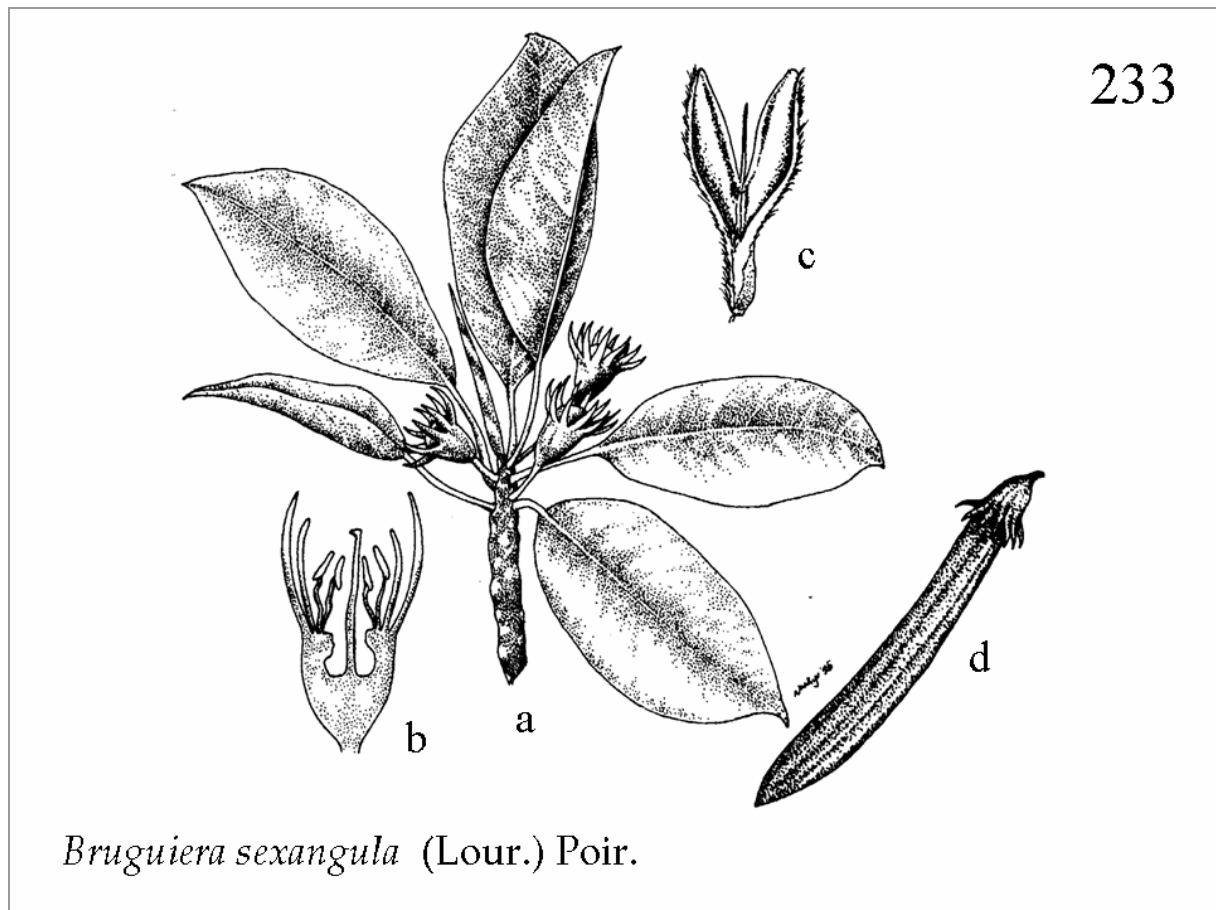


Fig. 233. *Bruguiera sexangula* (Lour.) Poir. (a) Branchlet with three flowers, (b) longitudinal section of flower, (c) petal, and (d) hypocotyl ('fruit').

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***Bruguiera sexangula* (Lour.) Poir.**

Synonyms : *Bruguiera angulata* Griff., *Bruguiera australis* A. Cunn., *Bruguiera cylindrica* (non *Rhizophora cylindrica* L.) Bl., *Bruguiera eriopetala* W. & A. ex Arn., *Bruguiera malabarica* (non Arn.) F.-Vill., *Bruguiera oxyphylla* Miq., *Bruguiera parietosa* Griff., *Bruguiera sexangularis* Spreng., *Mangium digitatum* Rumph., *Rhizophora angula* Lour., *Rhizophora australis* Steud., *Rhizophora eriopetala* Steud., *Rhizophora plicata* Blanco, *Rhizophora polyandra* Blanco, *Rhizophora sexangula* Lour.

Vernacular name(s) : Tumu berau, Tumu mata buaya, Busing (Mal.), Busing, Busung, Mata Buaya, Tumu, Bakau Tampusing, Tanjung, Lindur, Ting, Tongke Perampuan, Ai Bon (Ind.), Alai, Bakauan, Bakauan lalaki, Balinsarayan, Busain, Busaing, Kalabayuan, Lagasak, Langari, Pototan, Pututan, Sagasa, Sagasak, Tagasa – *Pototan* (Phil.), Vet dù (Viet.), Prasak nu, Pangka hua sum dok khao (Thai.), Basacsor (Camb.)

Description : Evergreen tree, up to 12 m tall, occasionally to 30 m, with a smooth, light brown-grey bark with a few large, corky lenticels, and an often flanged stem base. The trunk may have a diameter of up to 80 cm at breast height. Knee roots, and occasionally also stilt roots, occur. The leathery leaves measure 8-16 by 3-6 cm, are narrowly elliptic to elliptic and black-dotted beneath. Flowers are located solitary, on single-flowered stalks. The calyx is 10-12 lobed, yellow, yellowish-brown or reddish, with a tube 10-15 mm long. The 10-11 petals are 15 mm long, have a blunt tip with 1 or 2 short bristles, or are hairless altogether. The bristle in the notch does not exceed the length of the lobe. The margins and base of the lobes are covered with soft hairs. Petals are white, but rapidly turn brown with age. The fruit is spirally-rolled and ridged. The angular hypocotyl (often mistaken for the 'fruit') measures 1.5 by 6-12 cm, and is narrowed at both ends. Similar to both *Bruguiera exaristata* and *Bruguiera gymnorrhiza*, and has been confused with them in the past. Safest identification is via the petals.

Ecology : Occurs along tidal waterways and coastal fish ponds, on a variety of substrate types that are infrequently submerged. Usually in wetter conditions than *Bruguiera gymnorrhiza*. Occasionally occurs on mixed, sandy shores. Salinities tolerated vary from fully saline to brackish and freshwater. Flowering occurs all year round. The large, downward pointing flowers are pollinated by birds. The hypocotyls are dispersed by water. Mangrove species.

Distribution : From Sri Lanka and India eastward throughout Southeast Asia to northern Australia and New Caledonia; introduced to Hawaii.

Abundance : Common.

Use(s) : The wood is heavy to very heavy, hard and strong, but checks and shrinks more than ordinary wood. Use for firewood, poles and charcoal. Fruit is said to be used in an application for shingles (*herpes* virus disease), and root and leaves are used to treat burns. In Sulawesi (Indonesia) the fruits are eaten after having been soaked and boiled.

Source of illustration : Based on Ding Hou (1958), Tomlinson (1986) and Wightman (1989).

Reference(s) : Ding Hou (1958), Backer & Bakhuizen van den Brink (1963-8), Tomlinson (1986), Wightman (1989), Aksornkoe (1993), Aragones *et al.* (1998), Yao (2000), Marschke (2000).

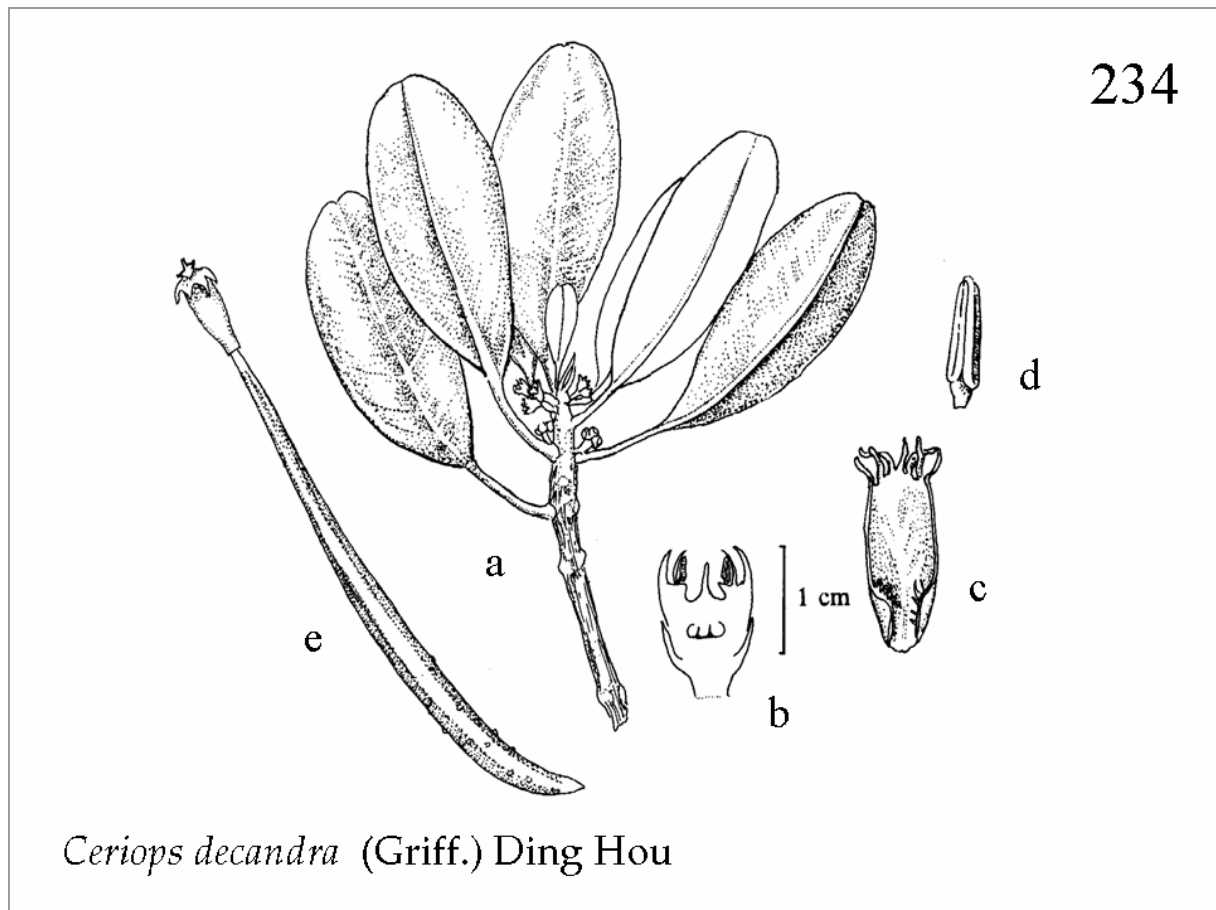


Fig. 234. *Ceriops decandra* (Griff.) Ding Hou. (a) Branchlet with flowers, (b) longitudinal section of flower, (c) petal, (d) stamen, and (e) hypocotyl ('fruit').

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***Ceriops decandra* (Griff.) Ding Hou**

Synonyms : *Bruguiera decandra* Griff., *Ceriops roxburghiana* Arn., *Ceriops zippeliana* Bl., *Rhizophora decandra* Roxb., *Rhizophora glomerulata* Zipp. ex Bl.

Vernacular name(s) : Tengal, Tengar, Landing-landing (Mal.), Tingi, Palun, Parun, Bidobido (Ind.), Bakauan, Bulubadiang, Matangal, Tangal, Tungug, Tungung – *Malatangal* (Phil.), Madame (Myan.), Đà quánh (Viet.), Prong, Prong khao (Thai.), Smairsor (Camb.)

Description : Small tree or shrub up to 5 m tall, occasionally to 15 m, with a brown, rarely grey or cream, smooth to flaky bark and a flanged stem base. The trunk may attain a diameter of 15-20 cm at breast height. The rounded, glossy-green leaves measure 3-10 by 1-4.5 cm and are elliptic-oblong to slightly bifacial. The condensed flower head, up to 10 mm by 3-4 mm, has 2-4 sessile flowers and a short, stout, angular stalk located in the axils of the upper parts of branches. The corolla is 2.5-4 mm long, white, and has a fringe of 0.75 mm long hairs. The corolla quickly ages and turns a brownish colour. Stamens have a short filament, equal to or shorter than the anther, which ends in an appendage. The fruit is 1-1.5 cm long, with a distinctly rounded tip, and erect or ascending sepals. The calyx is covered with lenticels or is warty. The slender hypocotyl (often mistaken for the 'fruit') is sharply ridged, only warty towards the tip, measuring 9-15 cm. Leaf shape and size are highly variable depending on the light and water regimes experienced by individual plants.

Ecology : Occurs scattered throughout tidal forests, but more commonly towards the landward margins of tidal waterways and bordering coastal ponds. Sand or mud substrates are preferred. Flowering occurs all year round. Mangrove species.

Distribution : From India to Southeast Asia and Australia. In Southeast Asia it has been recorded in Cambodia, Myanmar, Malaysia, the Philippines, Brunei, Thailand, Vietnam, Indonesia (Banka, Java, Borneo, Sulawesi, the Mollucas, Papua) and Papua New Guinea. Possibly occurs in East Timor, but not reported.

Abundance : Relatively common, but less so than *Ceriops tagal*.

Use(s) : *Ceriops* species are the most durable of all the mangroves and are used for house construction, railway sleepers, paving blocks and tool handles. Also used for firewood. The bark is a good source of tannin and a dye is also obtained from it – this is used to tint rice and a local wine in the Philippines called 'tuba'. The bark is also used as a substitute for quinine.

Source of illustration : Based on Ding Hou (1958), Tomlinson (1986) and Wightman (1989)

Reference(s) : Ding Hou (1958), Backer & Bakhuizen van den Brink (1963-8), Percival & Womersley (1975), Tomlinson (1986), Wightman (1989), Aksornkoae (1993), Aragonés *et al.* (1998), Marschke (2000).

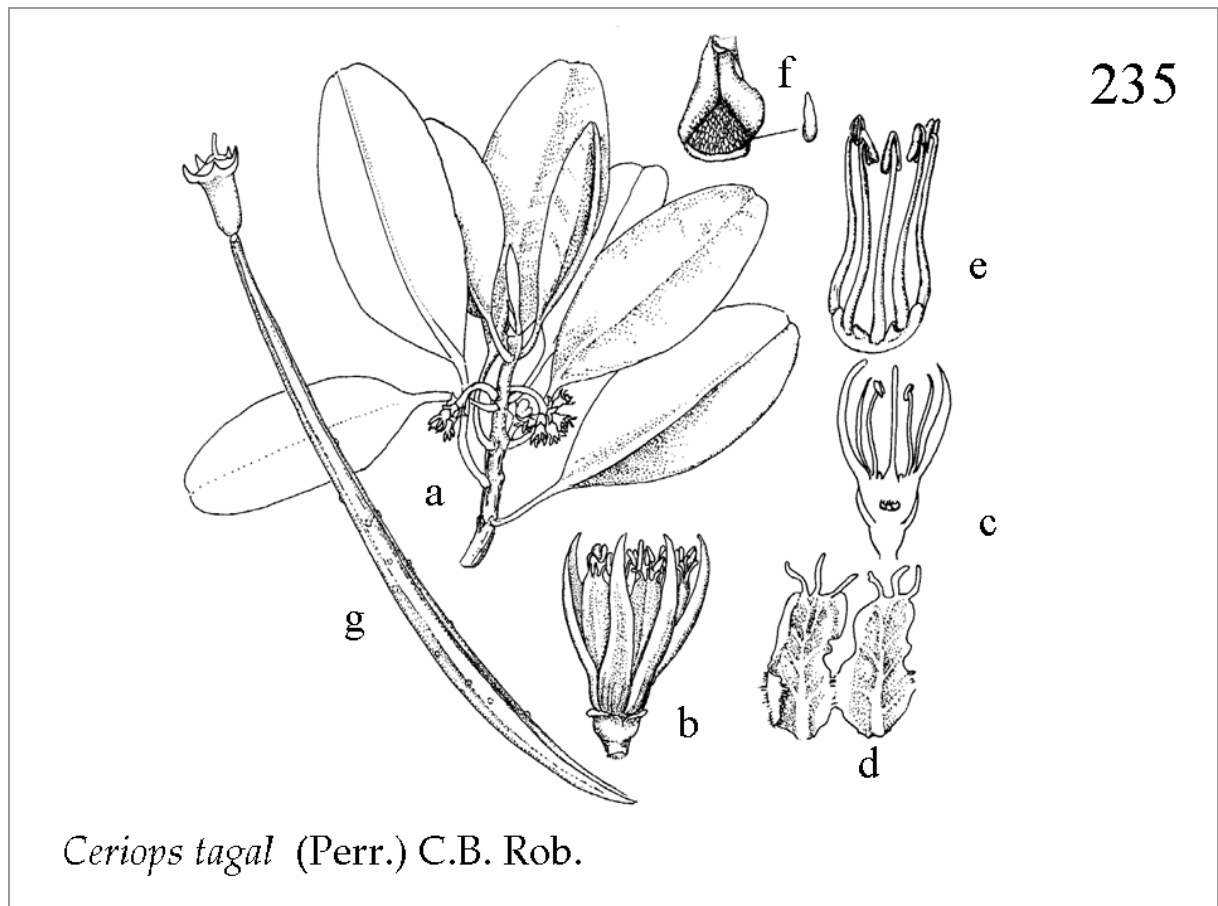


Fig. 235. *Ceriops tagal* (Perr.) C.B. Rob. (a) Branchlet with flowers, (b) flower, (c) longitudinal section of flower, (d) petals, (e) stamens, (f) stipules, from within, and (g) hypocotyl ('fruit').