GROUP G: TREES & SHRUBS

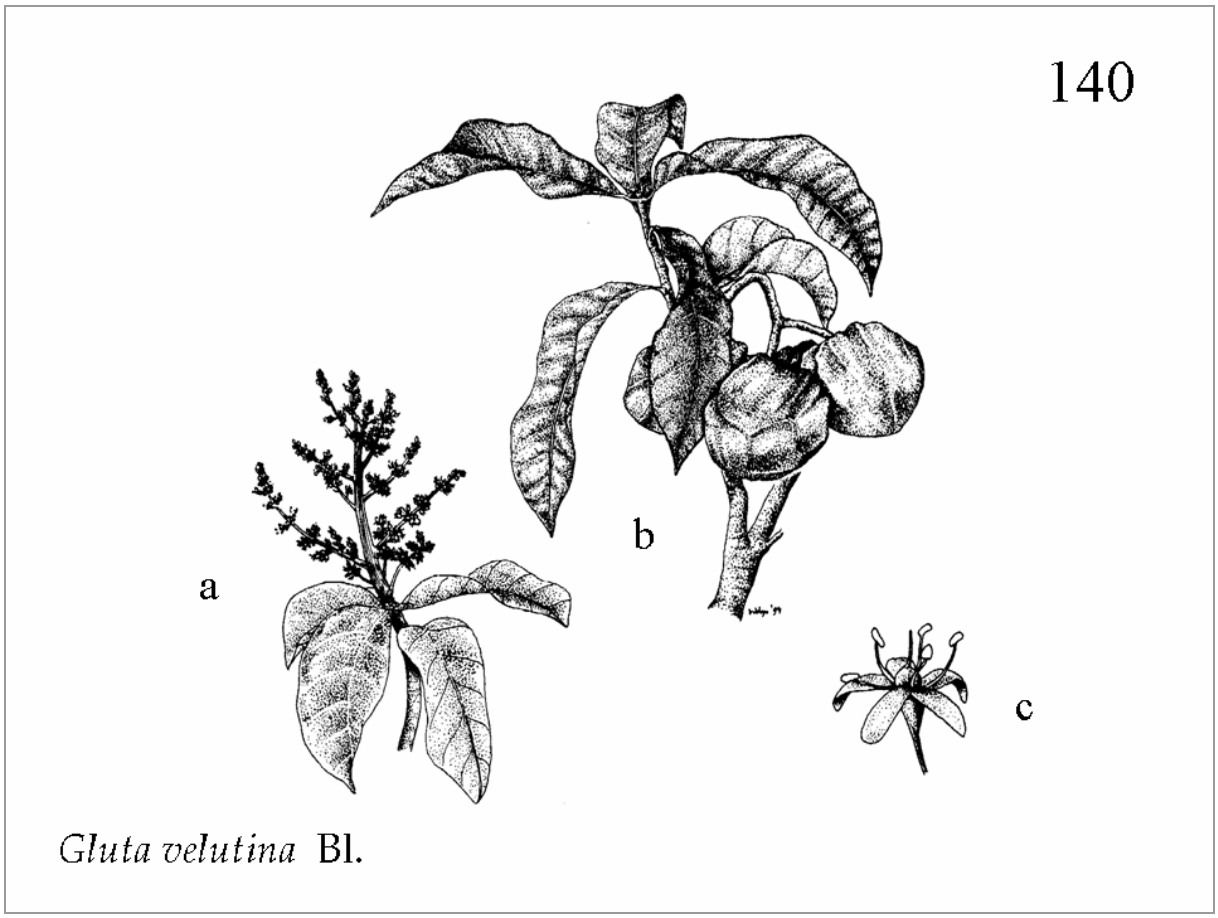

Fig. 140. *Gluta velutina* Bl. (a) Flowering branchlet, (b) fruiting branchlet, and (c) flower.

ANACARDIACEAE

140

***Gluta velutina* Bl.**

Synonyms : *Gluta coarctata* Hook., *Syndesmis coarctata* Griff.

Vernacular name(s) : Pong-pong, Rengas, Rengas Ayer, Rengas Pantai (Mal. & Ind.), Rengas Pendek (Ind.)

Description : Large shrub or small tree up to 10 m tall, sometimes with numerous, branched stilt roots that may be up to 1 m long. Its bark is pinkish-brown, rather smooth, and exudes a clear sap that rapidly turns black after exposure to the air. The leathery, smooth leaves are elliptic-oblong, narrowly elliptic or oblong-lanceolate, measuring 12-32 by 5-8 cm. Veins are slightly raised on both surfaces of the leaf. Finer veins are net-like, distinct below and rather faint above. Older leaves become black-spotted. The flower clusters are 5-12 cm long, and are located at the ends of branches. The calyx is 2 mm long, and is covered with short hairs. Petals are without hairs, white, with some pink along the edges, and measure 7-9 by 2-3 mm. The pale brown, stalked, 1-seeded fruit has irregular tuber-like ridges, especially near the base, and measures 4.5-7.5 cm across.

Ecology : Occurs along banks of tidal rivers on submerged mud bars in the freshwater or slightly brackish zone. Often located standing in the water with its trunk submerged, except at low tide. It is a characteristic tree of the tidal reaches of rivers, just on the landward/freshwater side of the *Nypa* palm stands. Flowering occurs all year round. The clear, irritating sap exudes readily. On exposure to air, this sap rapidly turns black, and, as with other *rengas* trees, the trunk is usually stained with black marks. Trees are often infested with *Crematogaster* ants. Mangrove associate species.

Distribution : Southeast Asian species, recorded from Myanmar, Thailand, Vietnam, Peninsular Malaysia and Indonesia (Sumatra, Borneo and West Java).

Abundance : Common.

Use(s) : Timber. The sap of the *Gluta velutina* is known to cause blisters and blindness. Any tree that has a black-stained trunk should be avoided because it usually indicates a member of the Anacardiaceae. The sap of these species is often irritant and toxic.

Source of illustration : Drawn from live specimen.

Reference(s) : Burkill (1935), Ding Hou (1978), Tomlinson (1986), Corner (1988).

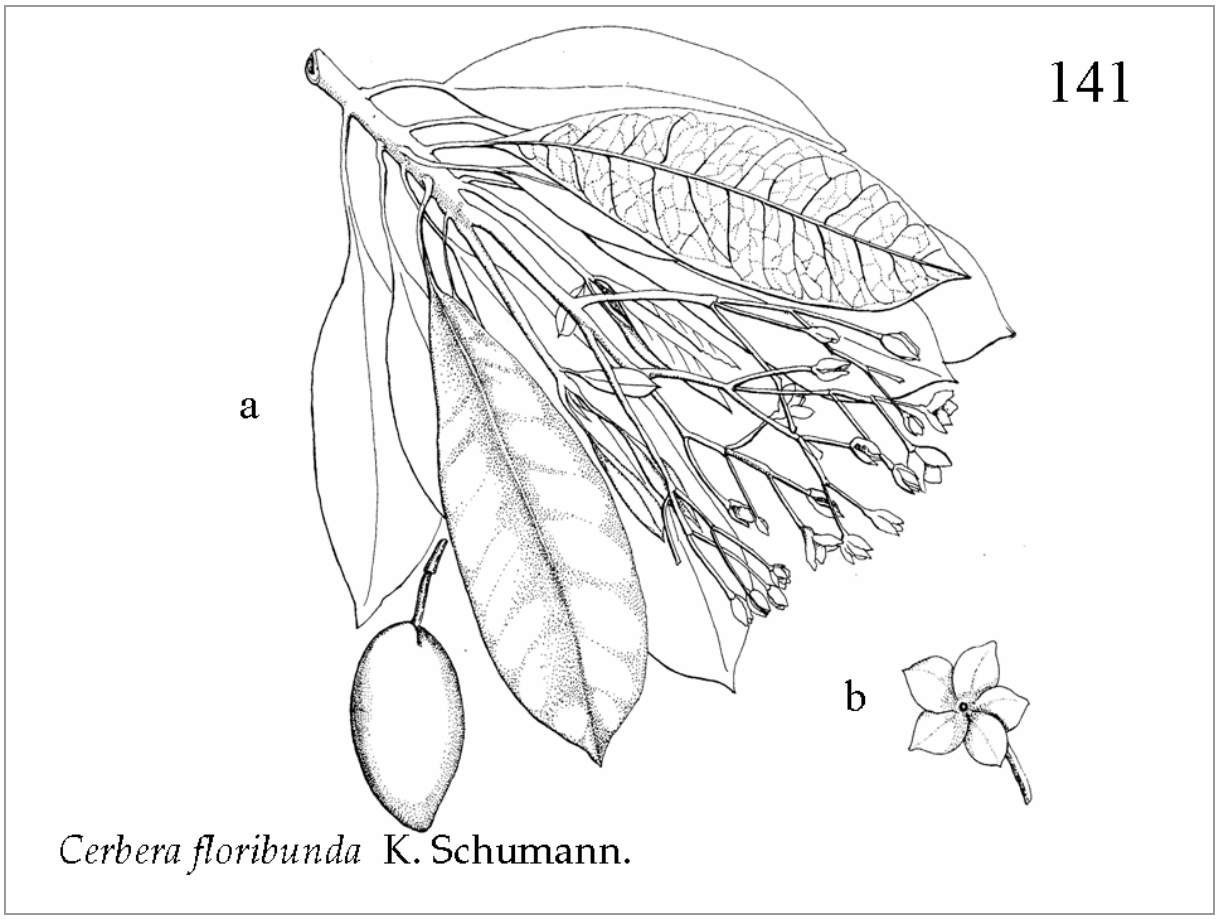

Fig. 141. *Cerbera floribunda* K. Schumann. (a) Branchlet with flowers and fruit, and (b) flower.

APOCYNACEAE

141

***Cerbera floribunda* K. Schumann**

Synonyms : *Cerbera micrantha* Kanehira

Vernacular name(s) : Unknown.

Description : Tree, up to 36 m tall, with a fissured, grey to dark brown or black bark that has lenticels. *Cerbera floribunda* has milky white latex. It has roots that run along the surface of the soil, but lacks aerial roots and pneumatophores. The pointed leaves measure 9-28 by 2.5-5 cm, and are crowded together at the ends of the branches. They are lanceolate, dark, glossy green above and pale green below. Lateral veins are not or only slightly curved and joined. There are usually more than 50 flowers per flower cluster. The 1.5-3 cm-long corolla is hairless and completely white. Sometimes the centre may be tinged pink or yellow. The stigma is elongated. Fruits are egg-shaped, purple, fleshy, fibrous inside and 5-8 cm long. There is clear layering in the fruit, with a thick skin, a fleshy part, a fibrous section and a central pip.

Ecology : Occurs widely, from coastal swamp forest and landward margins of mangroves, up to an altitude of at least 1,800 m. It is usually but not exclusively associated with wet patches in forests. Mangrove associate species.

Distribution : Limited range, from Papua and Papua New Guinea, eastwards to the Solomon Islands.

Abundance : Unknown, but probably relatively common.

Use(s) : Oil extracted from the seeds is rubbed on the skin to cure itches and common colds. It is also used to kill fish. The bark is used as a purgative. See also *Cerbera manghas*.

Source of illustration : Redrawn from Percival & Womersley (1975).

Reference(s) : Percival & Womersley (1975) Tomlinson (1986).

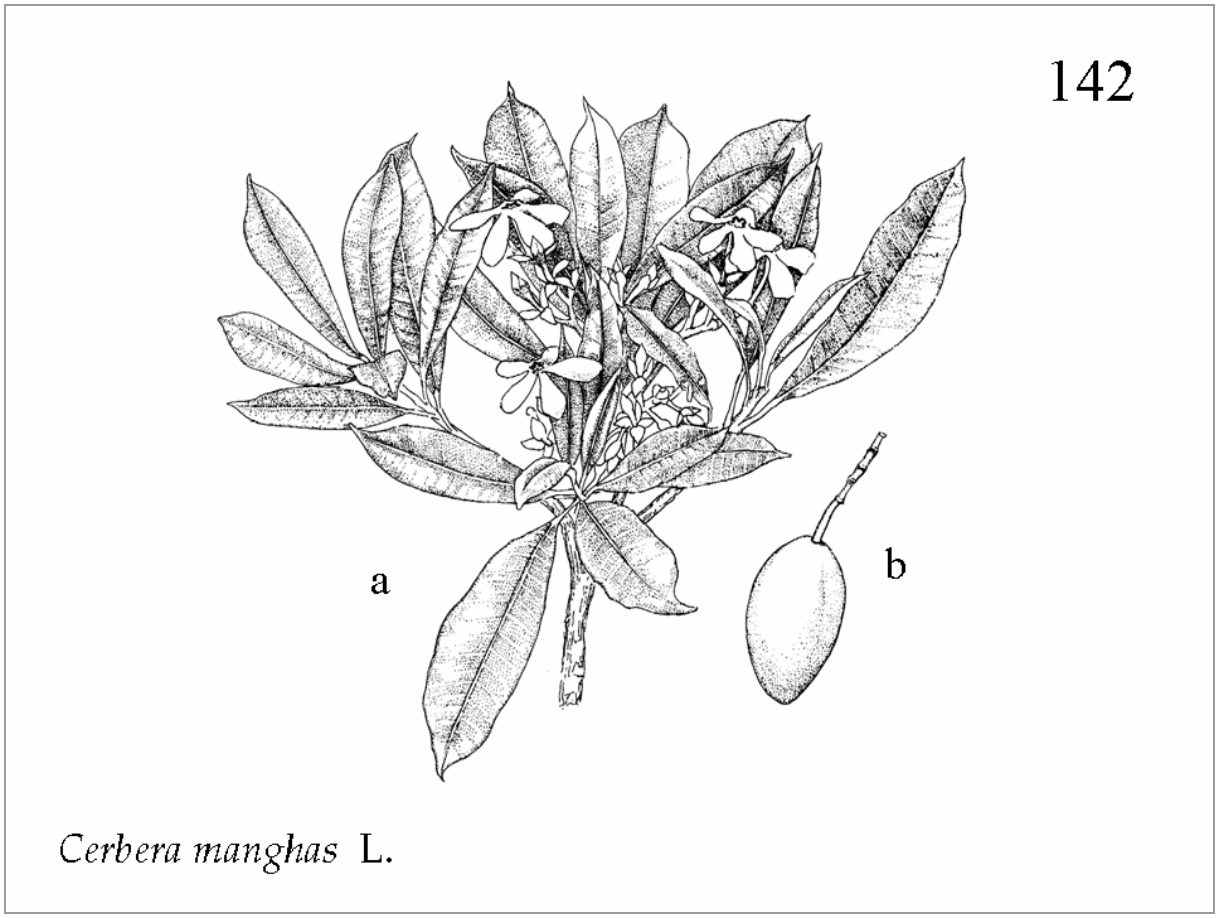

Fig. 142. *Cerbera manghas* L. (a) Flowering branchlet, and (b) fruit.

APOCYNACEAE

142

***Cerbera manghas* L.**

Synonyms : *Cerbera forsteri* Seem., *Cerbera lactaria* Hamilton, *Cerbera linneai* Montr., *Cerbera odallam* Bl., *Cerbera tanghina* Hook., *Cerbera venenifera* A.J.M., *Cerbera venenifera* (Poir.) Steud., *Elcana seminuda* Blanco, *Tabernaemontana obtusifolia* Poir., *Tanghinia manghas* (L.) G. Don.

Vernacular name(s) : Pink-eyed Cerbera (E), Pong pong, Buta buta, Nyan (Mal.) Bintan, Buta-buta Madang, Goro-goro, Kayu Susu, Kayu Kurita, Bintaro, Kadong, Mangga Brabu, Waba, Jabal, Bilu Tasi – *Buta badak* (Ind.), Arbon, Baraibai, Batano, Buta-buti, Dita, Duñgas, Kaliptan, Lipata, Magkanai, Maraibai, Panabulon, Toktok-kalau, Tabau-tabau – *Barabai* (Phil.), Teenped saai, Tin pet (Thai.)

Description : Tree or shrub, up to 20 m but usually much smaller (4-6m), with a fissured, flaky, grey to brown bark with lenticels and a milky white sap. It has roots that run along the surface of the soil, but lacks aerial roots and pneumatophores. The pointed leaves measure 10-28 by 2-8 cm, and are crowded together at the end of the branches. Leaves are oblong or lanceolate, dark, glossy green above and pale green below. The lateral nerves are curvedly joined. There are usually 20-30 flowers per cluster. The calyx is white to cream-coloured. The corolla is white with a purple to orange-red 'eye', has a pubescent throat and is 2-5 cm long. The stemless stamens are inserted at the mouth of the tube. A hairy, spur-like extension of each stamen more or less closes the throat of the corolla tube. The fruit is oval/oblong, reddish, often paired, smooth, fleshy and 6-8 cm long. In appearance it is shaped much like a mango (hence the scientific name).

Ecology : A tree of coastal swamp forests or beach vegetation, preferring well-drained sandy soils, exposure to sea breezes and places not regularly inundated by tides. According to Whitmore (1972d), a species of sandy and rocky coasts. Flowering occurs all year round (Philippines). Occurs on landward margins of mangroves. Mangrove associate species.

Distribution : A Southeast Asian species that extends into China (Hainan, Guangdong), Taiwan, Japan and eastwards to the Bismarck Archipelago, Australia, and throughout the Solomon Islands. In Southeast Asia recorded from Cambodia, Myanmar, Thailand, Vietnam, Malaysia, the Philippines, East Timor and Indonesia (Java, Sumatra, Sulawesi, Moluccas, Papua) and PNG.

Abundance : Relatively common, but less so than *Cerbera odollam.*

Use(s) : Oil extracted from the seeds and young fruits is rubbed on the skin to cure itches, rheumatism, and also to cure common colds. Seed oil is poisonous and used to kill fish; in Myanmar used as insecticide. The bark, sap and leaves are used as a purgative, and for inducing abortion. Wood used for fuel and charcoal. Green fruit is used to kill dogs. The red fruit, when fresh, is used to rub on the legs in cases of rheumatism. The latex produces blindness when dropped into the eyes. The kernel of the fruit is an irritant poison, producing, when taken internally; vomiting and purging soon followed by collapse and death. Potential pharmacological drug because of the cardiovascular effect (see *Cerbera odollam*).

Source of illustration : Redrawn from *The Common Littoral Plants of Taiwan*.

Reference(s) : Heyne (1950), Backer & Bakhuizen van den Brink (1963-8), Whitmore (1972d), Percival & Womersley (1975), Tomlinson (1986), Said (1990), Aragones *et al.* (1998).

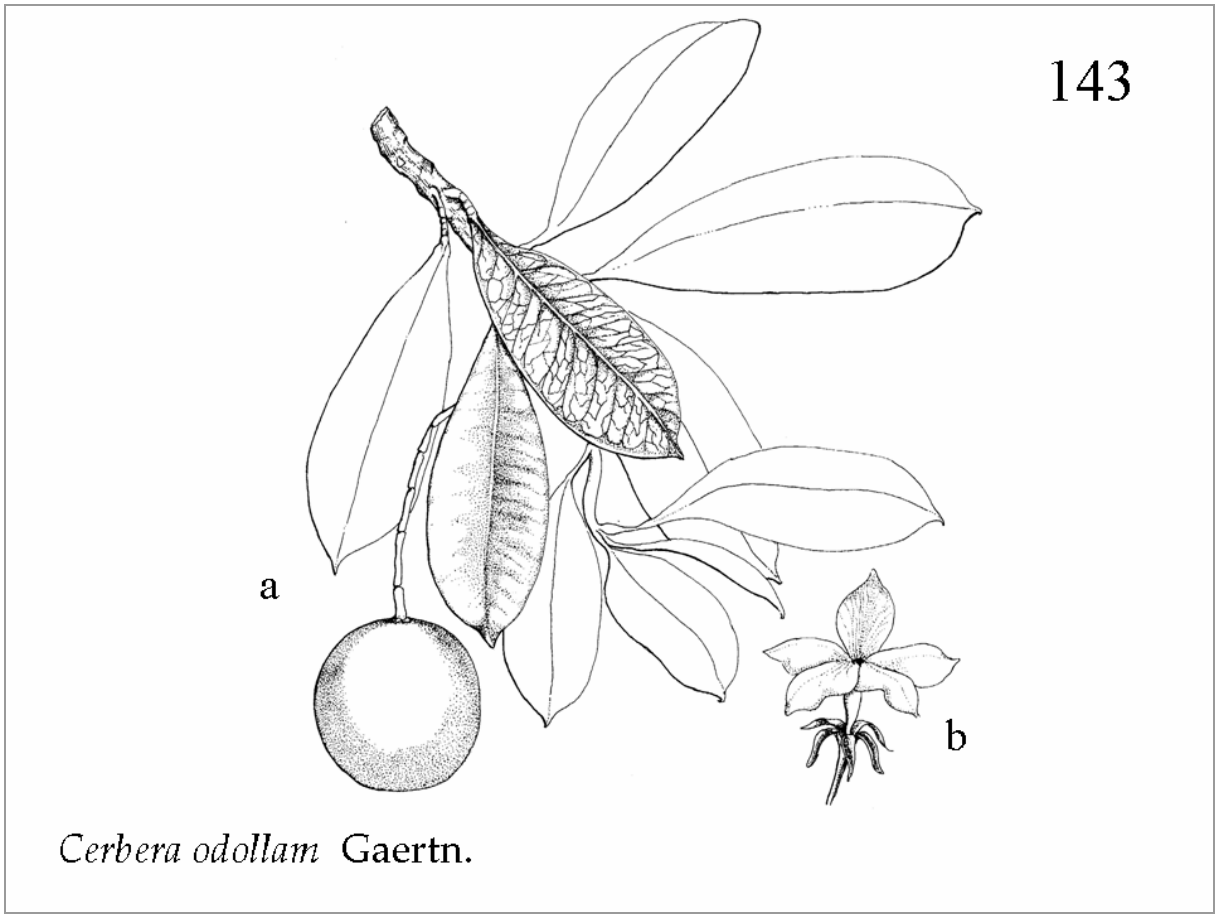

Fig. 143. *Cerbera odollam* Gaertn. (a) Branchlet with fruit, and (b) flower.

APOCYNACEAE

143

Cerbera odollam Gaertn.

Synonyms : Unknown.

Vernacular name(s) : Yellow-eyed Cerbera (E), Pong pong, Buta buta, Nyan (Mal.) Bintaro, Bintan, Buta-buta Madang, Badak, Goro-goro, Kayu Susu, Kayu Kurita, Kenyeri Putih, Kadong, Koyandan, Mangga Brabu, Waba, Jabal, Kenyen Putih, Bilu Tasi (Ind.), Muóp xác vàng (Viet.), Chompouprey Dawm cheungtia, Pilpicht (Camb.), Teenped thale (Thai)

Description : Small tree or shrub, up to 17(-20) m tall, but usually not more than 8 m, with a fissured, flaky, grey to brown bark with lenticels and a milky, white sap; trunk may be up to 45 cm diameter. It has roots that run along the surface of the soil, but lacks aerial roots and pneumatophores. The fine-pointed, leathery leaves measure 10-28 by 2-8 cm, and are crowded together at the ends of the branches. Leaves are oblong or lanceolate, dark, glossy green above and pale green below; withering to orange brown. The lateral veins occur at right angles to the midrib and terminate in a fine, marginal connecting band. There are 20-30 fragrant (and usually ephemeral) flowers per cluster. The calyx is white to cream-coloured. The tube of the trumpet-shaped corolla is swollen at the middle because of the stamens; the tube does not extend (much) beyond the calyx. The corolla is green or white with a yellow centre and is 2-3.5 cm long. The mouth of the corolla tube is open. The fruit is round, solitary, 5-10 cm diameter, without clearly distinguishable layers; green, later turning pink, finally dark purple.

Ecology : In coastal forest and landward margins of mangrove. It has a limited salt tolerance, and occurs on clays or sandy soils. *Cerbera odollam* also occurs in riparian vegetation, especially in tidal areas with limited intrusion of seawater. Typical lowland species, found up to an altitude of 10 m asl. Reportedly fast growing. Mangrove associate species.

Distribution : From Southern India and Sri Lanka through Southeast Asia eastwards to western Polynesia (Fiji).

Abundance : Common.

Use(s) : Sometimes cultivated and its range may have been extended artificially. It is a common roadside tree in Singapore and Kuala Lumpur. Seeds, latex and leaves are toxic, and the active ingredient is a bitter tasting glycoside called cerberin. It is reportedly used to treat intestinal worms. Timber is white to greyish, light, and of poor quality. According to Randerson (2004) the tree is used in South and Southeast Asia 'by more people to commit suicide than any other plant, the toxicologists say'. Cerberin is similar in structure to digoxin, found in foxglove, which kills by blocking calcium ion channels in heart muscles and disrupting the heartbeat. More ominiously, it is also suspected of being used in an increasing number of murder cases (Randerson, 2004). After the flesh of the fruit has rotted and disappeared, an interwined mesh of fibres remains – these retain the shape of the original fruit and are used in Western countries to make dried flower arrangements.

Source of illustration : Redrawn from Tomlinson (1986).

Reference(s) : Backer & Bakhuizen van den Brink (1963-8), Whitmore (1972d), Sastrapradja *et al.* (1979), Tomlinson (1986), Corner (1988), Aksornkoae (1993), Marschke (2000).

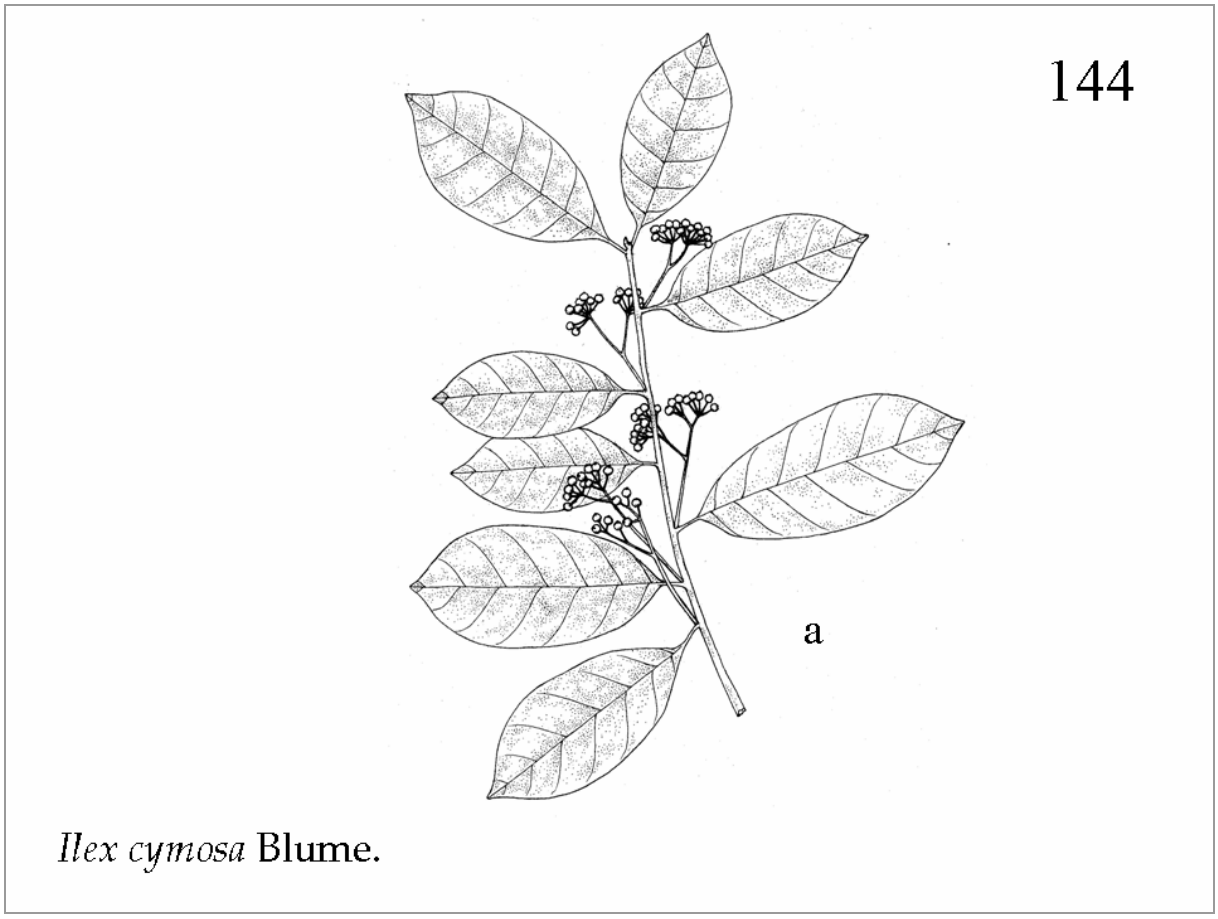

Fig. 144. *Ilex cymosa* Blume. (a) Fruiting branch.

AQUIFOLIACEAE

144

***Ilex cymosa* Blume**

Synonyms : *Ilex singaporeana* Wall.

Vernacular name(s) : Marsh holly (E), Mensirah, Timah-timah, Bubpuk (Mal.)

Description : Small, smooth, evergreen tree up to 16(-25) m tall, rarely with buttresses, bark white or light grey, smooth or pimply because of lenticels, inner bark thick, ochre-brown, and coarsely gritty; wood pink or cream. Young twigs conspicuously white and lenticellate. Leaves entire, alternate, 2.5-6.3 by 5-10(-14) cm, elliptic with a blunt tip, dark green and glossy above, pale beneath, thinly leathery, with 6-8 pairs of side veins; leaf stalk 1-1.5 cm long. Young leaves white or magenta. Flowers 2-3 mm across, greenish-white, in small, rather loose clusters with numerous flowers, located in the axils. Male flowers with 4-5 sepals and petals, stamens 4. Female flowers with 5-6 sepals, 6-8 petals. Fruit an egg-shaped berry, 4(-5) mm long and 3-4 mm wide, pinkish-purple, then black, like small currants, with about 8-10 seeds; fruit stalk 3-6 mm. Fruit is ridged when dry.

Ecology : Lowland forest, secondary forest, especially in swamps; also on rice fields, coastal forest, and on landward margins of mangroves. Mangrove associate species.

Distribution : Southeast Asian species, recorded from Vietnam, Malaysia (Peninsular, Sarawak), the Philippines, Thailand, Indonesia (Sumatra, Borneo, Java, Sulawesi, Moluccas), Singapore and Brunei.

Abundance : Common.

Use(s) : No known use.

Source of illustration : Kiew (1978)

Reference(s) : Kiew (1978), Corner (1988)
http://www.nparks.gov.sg/nursery/spe_by_search_details.asp?specode=7071&searchdetail=detail
http://birdlifeindochina.cong-ty.com/source_book/source_book/Mekong%20Delta/SB%20Vo%20Doi.htm.

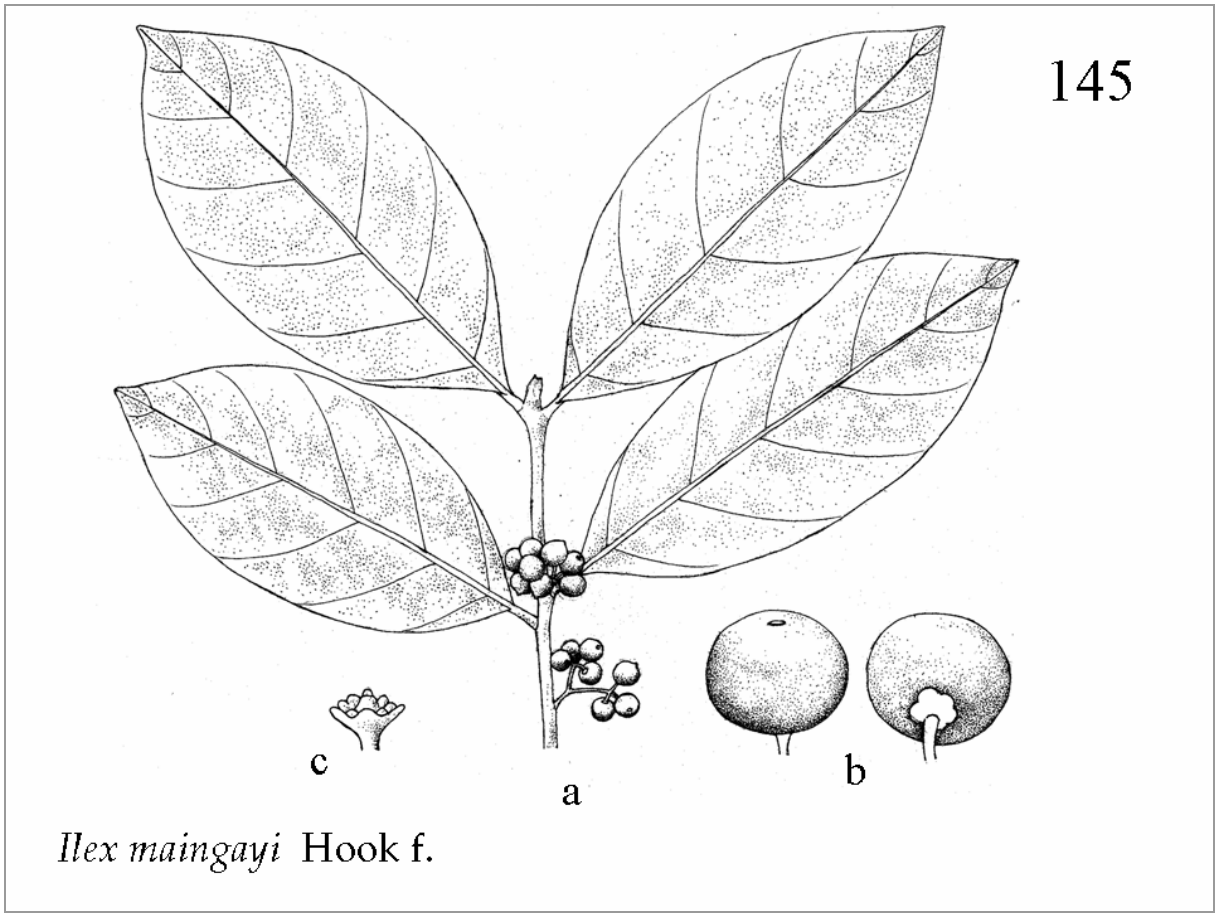

Fig. 145. *Ilex maingayi* Hook f. (a) Fruiting branch, (b) detail of fruit, and (c) flower.

AQUIFOLIACEAE

145

Ilex maingayi **Hook f.**

Synonyms : Unknown.

Vernacular name(s) : Glaucous holly (E)

Description : Small to medium sized tree, 6-15 m tall, bark grey or brown; young twigs also grey or brown. Leaves alternate, leaf edge entire, blade elliptic to obovate, 9-11(-17) by 4.5-6.5 cm, tip pointed, base tapering, dark glossy green above, yellowish-green below, leathery, midrib conspicuously projecting below, 7-9 pairs of nerves. Male flower cluster a panicle located in the axils, main stalk stout, 2.5-3 cm long, and branches 1 cm long, bearing minute, crowded flowers. Female flower clusters on a stout stalk, 2.5-3 cm long, drying black; flowers 4-6 merous, female flowers 5 mm across. Fruit round, 6-7 mm diameter, greenish-yellow, ripening deep red, drying ridged; fruit stalk 5-7 mm, with 5-6 seeds.

Ecology : Lowland forest in swampy areas, including peat swamp forest and mangrove edges. Also found on rich limestone soil. Mangrove associate species.

Distribution : Endemic to Peninsular Malaysia.

Abundance : Uncommon, but widely distributed in Peninsular Malaysia. .

Use(s) : Unknown.

Source of illustration : Kiew (1978), Corner (1988)

Reference(s) : Kiew (1978), Corner (1988).

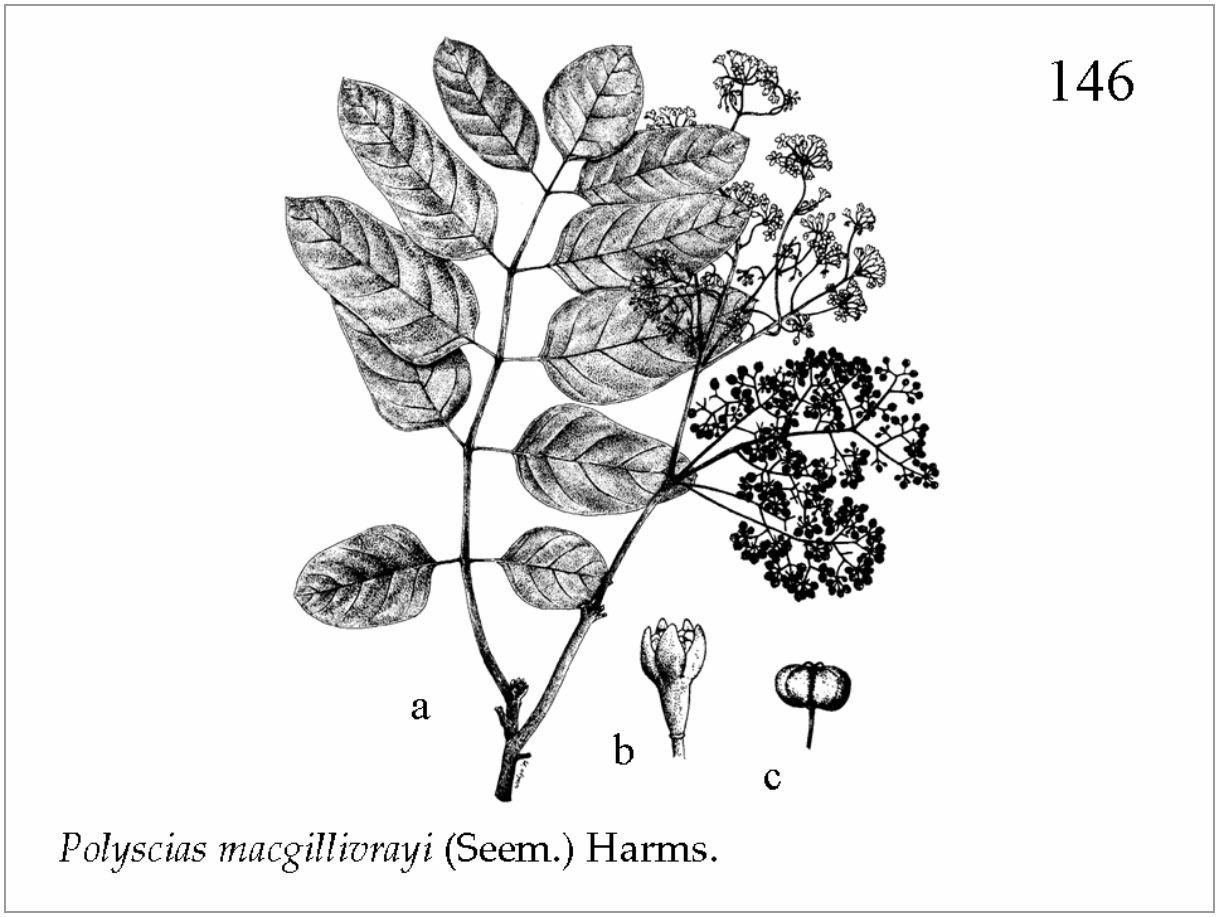

Fig. 146. *Polyscias macgillivrayi* (Seem.) Harms. (a) Branchlet with flowers and fruit, (b) flower, and (c) fruit.

ARALIACEAE

146

***Polyscias macgillivrayi* (Seem.) Harms.**

Synonym(s) : *Nothopanax macgillivrayi* Seem., *Panax grandifolia* Volkens, *Panax macgillivrayi* (Seem.) Benth., *Tieghemopanax macgillivrayi* Viguier

Vernacular name(s) : Aikove, Gambou, Raumonas, Naikaigwoo (PNG)

Description : Shrub or small tree, up to 15 m tall, with a few branches bearing clusters of large leaves. Leaves have a total length of up to 1m. Leaf stalks measure 15 cm, with a sheath around the base that extends up to 6-10 cm along the stalk. Leaflets are oblong, about 20-25 by 8-10 cm, and succulent. Leaf margins are entire, or occasionally slightly toothed, with a rounded tip that has a short point. Stalk of each leaflet measures 10-15 mm. There is one, unpaired, terminal leaflet. Middle and lateral veins are clearly visible. Flowers are borne in a large cluster, with a stout primary stalk, 3-10 cm long, that often bears reduced leaves. Lateral branches of the flower cluster measure 40-50 cm, and the secondary branches are 6-12 cm long. The calyx consists of a minute rim, while the five petals are 2.5 mm long. There are five stamens. Fruits are fleshy, black and compressed, 5 by 6 mm, with a persistent style.

Ecology : Occurs in beach vegetation and in coastal, lowland rain forest, and landward margins of mangroves. Mangrove associate species.

Distribution : Indonesia (Papua), Papua New Guinea, Micronesia, Solomon Islands and Queensland (Australia). Recorded in beach forest near Manokwari in Papua, Indonesia, by first author (Giesen) in May 1997.

Abundance : Locally common.

Use(s) : Unknown.

Source of illustration : Drawn from herbarium specimen, Rijksherbarium Leiden.

Reference(s): Philipson (1979).

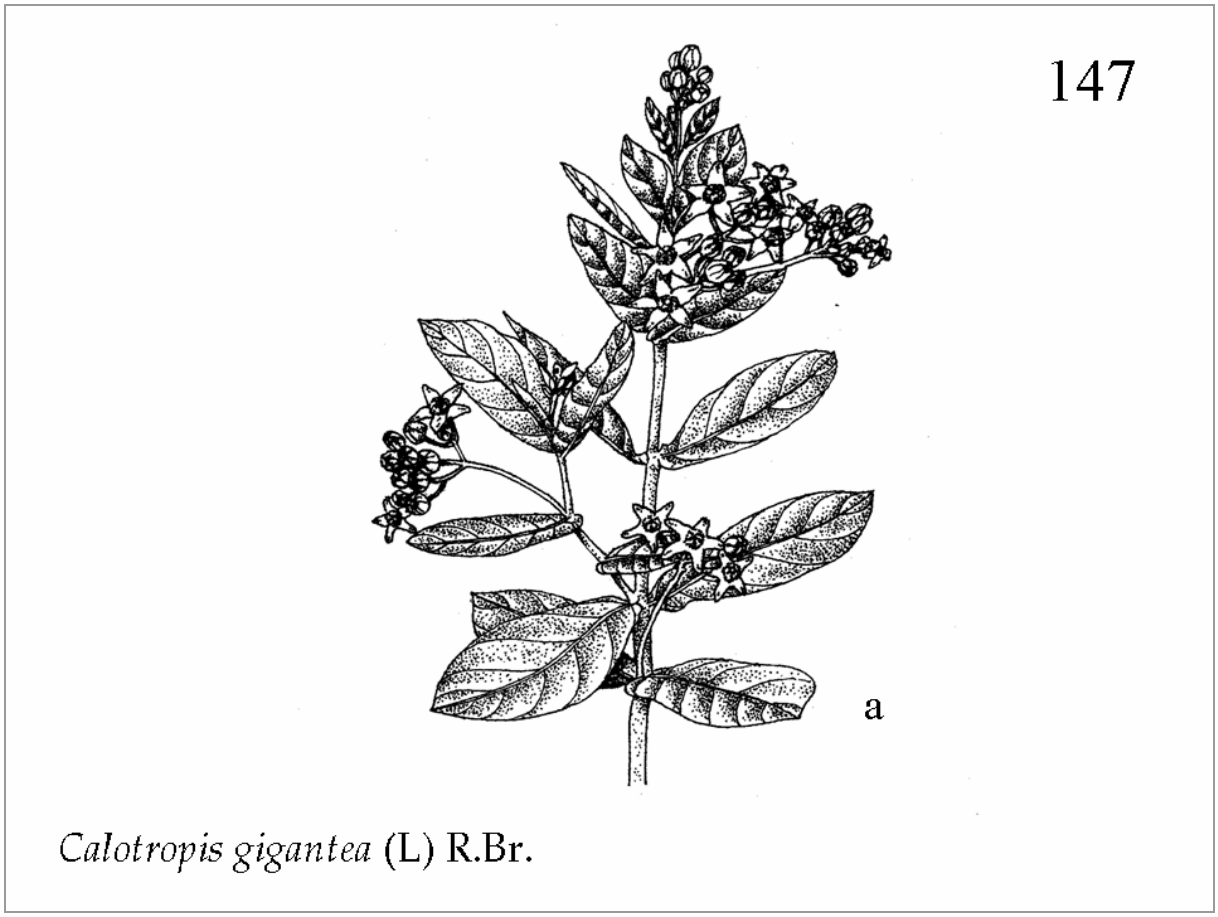

Fig. 147. *Calotropis gigantea* (L) R.Br. (a) Terminal branch with flowers.

ASCLEPIADACEAE

147

***Calotropis gigantea* (L) R.Br.**

Synonyms : *Asclepias gigantea* L., *Calotropis gigantea* (Willd.) Dryand.

Vernacular name(s) : Sodom's Apple (E), Widuri (Ind.)

Description : Small shrub or tree, up to 1.5 m talll. Stems are slightly woody and much branched at the base, bark greyish, longitudinally cracked. Young stems and leaves are densely covered with white, cottony hairs on the lower side. Leaves are simple, opposite, without stalk or with a very short stalk; blade is 9.5-18cm long by 6-9 cm wide, broadly ovate or ovate-oblong, fleshy, with 6-7 lateral nerves. All parts abound in copious amounts of white juice, that exudes from the plant when cut or otherwise damaged. Flowers usually hang in flat topped or round topped clusters, there usually being only one cluster per stem node. Flower stalks are 6-10 cm long. Calyx lobes are broadly ovate, 4-6 by 2-3 mm, covered with white cottony hairs. The corolla is smooth, white, lilac or purple, with a short tube and wide, ovate-lanceolate lobes with pointed tips, 1-1.5 by 0.5-0.8 cm. The fruit is an inflated vessel, rounded to boat-shaped, greenish, 6.5-8 by 3-5 cm. Seeds are rounded, and covered with many soft, long, silky hairs. It is very similar to *Calotropis procera* (Aiton) R.Br., which occurs from East Africa eastward to Bangladesh, and has been introduced to Australia.

Ecology : Flowering and fruiting occurs throughout the year. Occurs as a weed on open waste ground, along roadsides and railway lines, drier localities, in beach and dune vegetation, and occasionally in mangroves. The juice is an irritant and can cause blindness. Mangrove associate species.

Distribution : From India eastward to Southeast Asia, including Myanmar, Peninsular Malaysia, Thailand and western Indonesia (Java).

Abundance : Common throughout its range.

Use(s) : A fibre is obtained from the stem, and floss from the seeds is used to stuff pillows. Used for medicinal purposes: i) fresh leaves are used for treating swellings and rheumatic pains; ii) extract from the roots is used as a tonic, and iii) milky juice is used as a remedy for leprosy, as a purgative, treating worm infections, or used as a disinfectant to treat wounds.

Source of illustration : Ahmed (1997)

Reference(s) : Afriastini (1988), Rahman & Wilcock (1995).

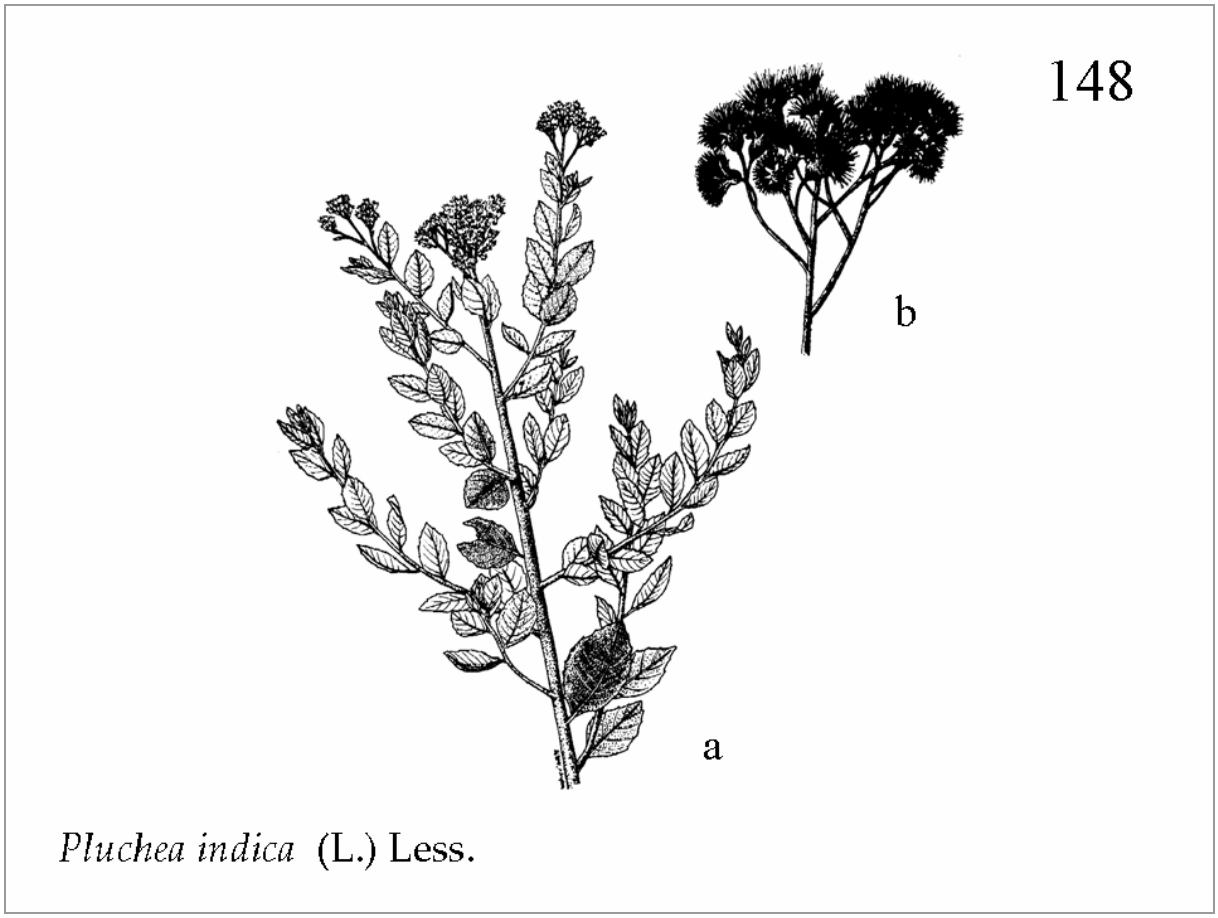

Fig. 148. *Pluchea indica* (L.) Less. (a) Branches with terminal flower clusters, and (b) flower cluster.

ASTERACEAE

148

***Pluchea indica* (L.) Less.**

Synonyms : *Baccharis indica* L., *Erigeron denticulatum* Burm. *f.*

Vernacular name(s) : Indian fleabane, Indian Pluchea, Indian camphorweed (E), Beluntas (Mal.), Beluntas, Lamutasi, Lenabou – *Beluntas* (Ind.), Khluu (Thai), Lú'c cây (Viet.)

Description : Erect shrub or shrublet, up to 2 m, rarely taller, covered with short, soft hairs, later becoming smooth. It has ribbed, finely crispy, hairy branches. The very short-stalked or almost stemless pale green leaves are arranged alternatively. Leaves are obovate with a tapering base, 2.5-9 by 1-5.5 cm. They have a few small, inconspicuous glands, are very aromatic (especially when crushed) and have a sharp, fine-toothed edge. The flat-topped flower heads are 2.5-12.5 cm wide, and are located at the ends of branches or in the axils; the dense, flowering branchlets are directed upwards. The narrowly-cylindrical flower heads occur on a stalk or are almost stemless, up to 5-6 mm long. The base of the flower head is flanked by several leaflets in 6-7 rows. The outer leaflets are ovate in shape, green, persistent, with fine, crispy hairs. The inner ones are membranous, with a surface covered with fine hairs, lanceolate in shape, and are shed together with the many ripe fruits. There are numerous, violet (with a pale base), thread-like marginal flowers, 3-3.5 mm long, occurring in many rows. There are 2-6 disk-shaped flowers with a violet, 3-5 mm long, tubular corolla with a 5-lobed, outwardly-spreading part at the top. Anthers are also violet and extend beyond the petals. Fruits are top-shaped, brown with pale angles, 1 mm long. The ring of hairs around the top of the fruit is white, 3-3.5 mm long.

Ecology : Occurs on clayey, often saline soils. Never in the centre of the mangroves, but often on bunds and low ridges crossing it (e.g. those of brackish water fishponds) or on the landward margins of mangroves. Occurs in sunny or slightly shaded localities. Flowering occurs throughout the year. The species is confined to lowland habitats, particularly wetlands and fishponds, and may affect water bird habitats as it crowds out more desirable species. Often found in brackish marshes and other saline habitats including mangroves; occasionally found in forested land at low elevations. Mangrove associate species.

Distribution : Occurs from India to southern China and Taiwan, throughout Southeast Asia south to Australia and through Polynesia, including Guam, Kiribati and Hawaii. Not (yet) recorded in Brunei.

Abundance : Common.

Use(s) : Sometimes cultivated as a medicinal or as a hedge plant. Used for lowering fevers, as a tonic against ulcers, diuretic ingredient for herbal baths. Juice of leaves is used for treating dysentery. There are many more medical applications.

Source of illustration : Drawn from a live specimen.

Reference(s) : Burkill (1935), Heyne (1950), Backer & Bakhuizen van den Brink (1963-8), Tomlinson (1986), Afriastini (1988), Said (1990), Aksornkoae (1993), Peng (1998).

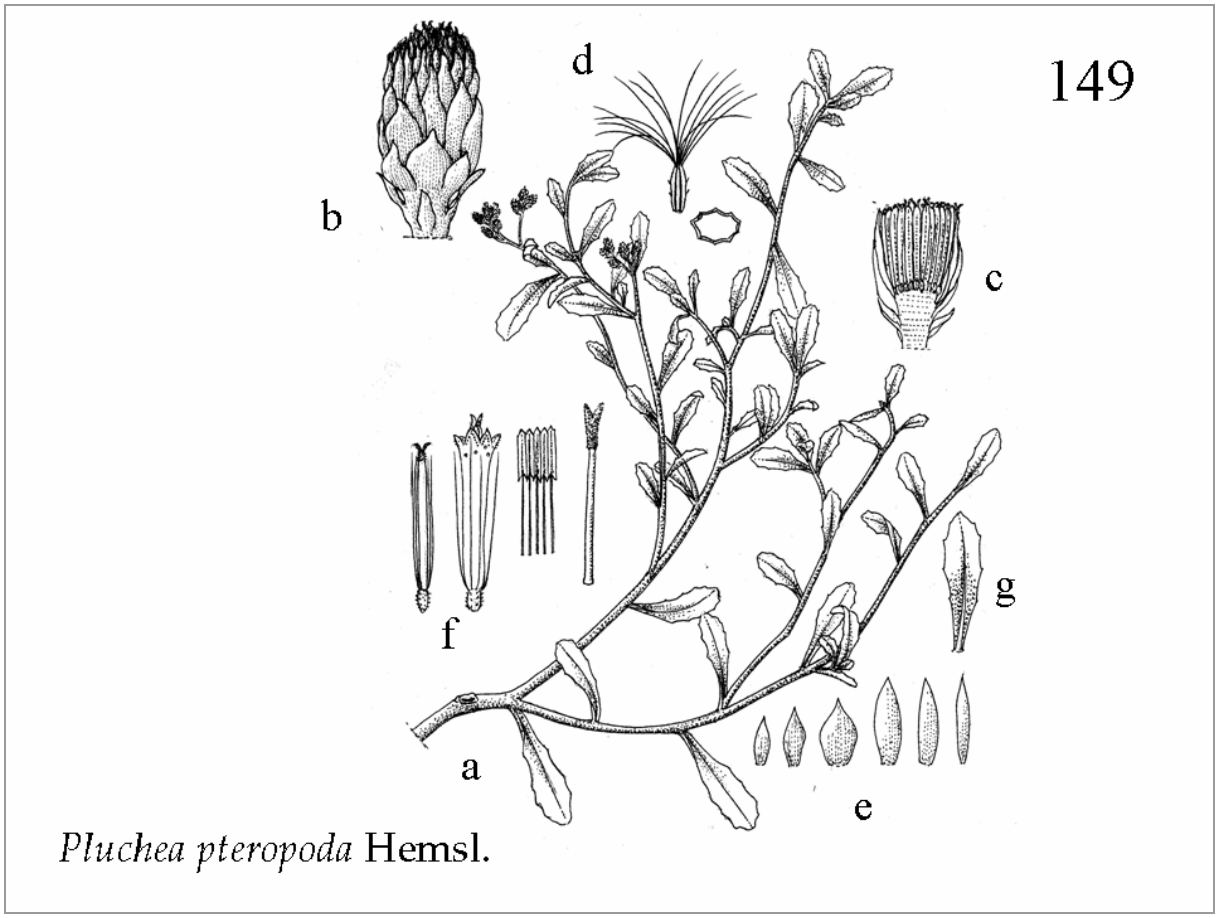

Fig. 149. *Pluchea pteropoda* Hemsl. (a) Flowering plant, (b) flower head, (c) longitudinal section of flower head, (d) seed, (e) outer flower parts, (f) inner flower parts, and (g) leaf.

ASTERACEAE **149**

***Pluchea pteropoda* Hemsl.**

Synonyms : *Pluchea leptophylla* Hong & Chen

Vernacular name(s) : (Cây Lú'c) Có sài hô' (Viet.)

Description : A much branched shrub or shrublet, sprawling to ascending, stems smooth or (rarely) sparsely covered with hairs; branches ascending; up to about 1.5 m tall. Leaves are simple, alternate, obovate to oblong-lanceolate, 3-5 cm by 0.7-1.7 cm, with a blunt to rounded leaf tip; apparently without a stalk, leaf edges irregularly and sparsely toothed, leaf blade smooth on both sides; upper leaves smaller and narrower. Flower head 6-8 mm diameter (when fresh) or 10 mm (dried specimens), 7 mm long and with a short flower stalk, occurring in dense, terminal clusters. Each flower head consists of numerous 'florets', reddish brown, with pale ribs. The circle of leaflets at the base of each flower head is more-or-less round to widely bell-shaped, and each leaflet is smooth, arranged in fives or sixes, the outer broadly ovate, the tips blunt to rounded, 2.5-4 mm by 2-3 mm; the inner linear to lanceolate, tips pointed, 4-5 mm by 0.5-1 mm. The top of the flower head is flattened. Outer small florets are numerous, corolla threadlike, narrowed towards the tip, 3.5-4 mm long. Central florets number 18-22, corolla 4-5 mm long, 5-lobed at tip, lobes triangular.

Ecology : Occurs in a wide variety of habitats, including sand dunes, dikes along the coast, abandoned fields, (degraded) mangroves, and ruderal areas. In Thailand, mangrove forests degraded by cattle grazing, are gradually taken over by salt-loving grasses such as *Cynodon dactylon* and *Sporobolus virginicus*, along with *Pluchea pteropoda* and sedges such as *Scirpus* species or *Cyperus stoloniferus*. Mangrove associate species.

Distribution : East and Southeast Asia. Recorded in Southeast Asia in Thailand and Vietnam.

Abundance : Locally common.

Use(s) : Medicinal plant, with a variety of active ingredients.

Source of illustration : Peng *et al.* (1998)

Reference(s) : Peng *et al.* (1998), Luger *et al.* (2000)
http://ratree.psu.ac.th/~bnoparat/MANGROVE.html.

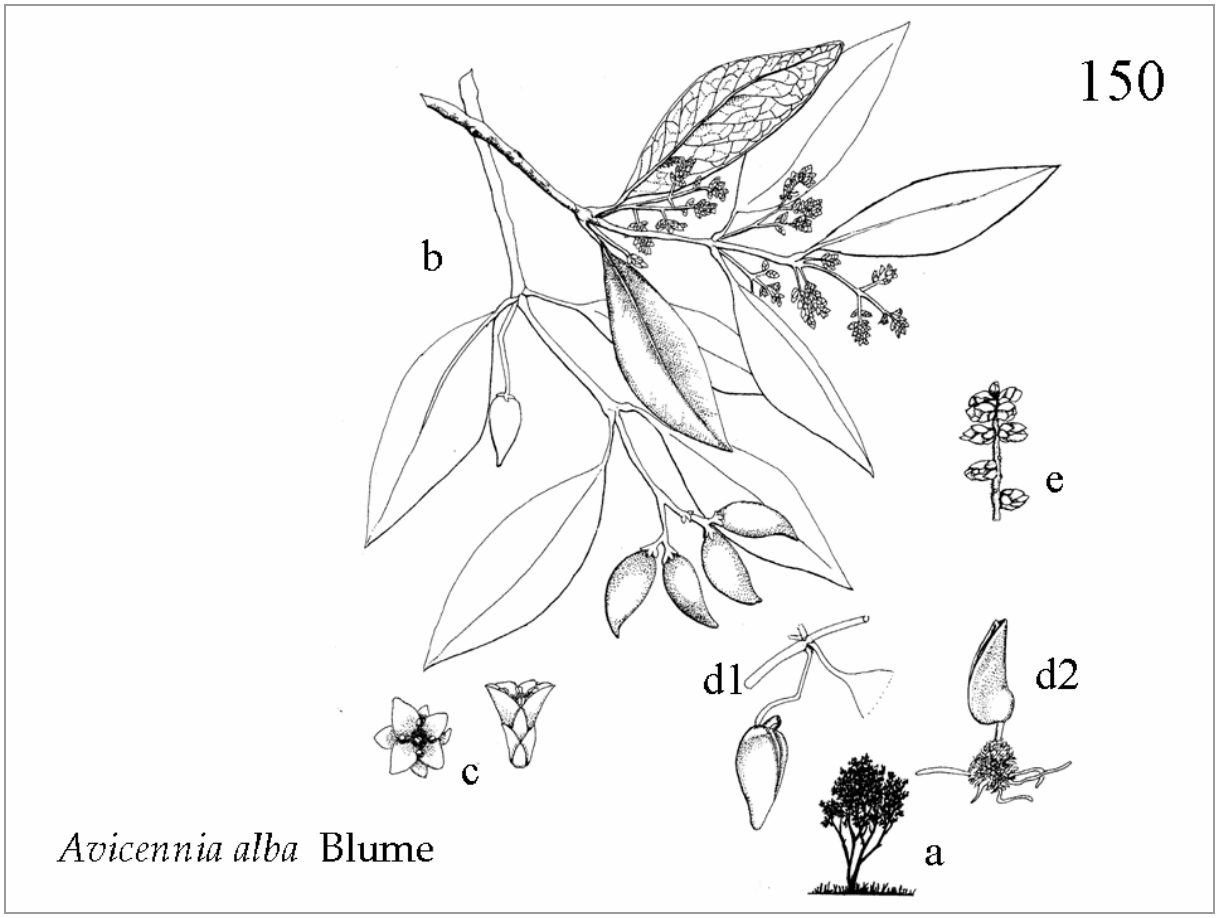

Fig. 150. *Avicennia alba* Blume. (a) Habit, (b) branch with flowers and fruit, (c) flower, seen from top and side, (d) fruit, and (e) buds.

AVICENNIACEAE

150

Avicennia alba **Blume**

Synonyms : *Avicennia marina* (Forssk.) Vierh. var. *alba* (Blume) Bakh.

Vernacular name(s) : Api-api (Mal.), Api-api, Mangi-mangi Putih, Boak, Koak (Ind.), Api-api, Kachuchis, Piapi, Pundung – *Bungalon-puti* (Phil.), Mâ'm lu'ôi dô'ng (Viet.), Kbagnsor, Mouroujsrotorb, Sman (Camb.), Samae khao (Thai)

Description : Spreading shrub or tree, up to 10 m, occasionally even 25 m, tall. It produces a complex system of horizontal roots and pneumatophores. The latter are thin, finger-like (or asparagus-like) and covered with numerous lenticels. The outer bark is greyish or brownish, and may be either warty or smooth. On older stem parts a pale, powdery mould often occurs. Trunk may attain a diameter of 50 cm at breast height. The pointed leaves are oblong or lanceolate, rarely elliptic, smooth, glossy-green above and very pale beneath, measuring up to 16 by 5 cm. The upper surface is covered with numerous sunken, glandular dots. The yellow to orange flowers measure 3-4 mm across, and occur in 10-30-flowered clusters that are 1.5-3 cm long. The lowest pair of flowers is somewhat distantly located from other flowers of the cluster. Usually only the upper half of the ovary is hairy, while the style is absent. The conical, greyish-green fruit is gradually narrowed to an extended beak-like tip, and can measure up to 4 cm. Sometimes included in the Verbenaceae.

Ecology : Pioneering species of mangrove swamps on sheltered shores, also in the more saline parts, along tidal river banks and along the seashore. It prefers the entrance of bays. Their roots reportedly aid sediment accretion and accelerate the land-building process. Flowering occurs all year round. The genus is sometimes viviparous, with fruit (partly) germinating while still on the tree. Mangrove species.

Distribution : Occurs from India to Southeast Asia, where it has been recorded in Myanmar, Cambodia, Malaysia (Peninsular, Sarawak), Singapore, Brunei, throughout Indonesia, the Philippines, Papua New Guinea and tropical Australia.

Abundance : Abundant.

Use(s) : Firewood and low quality construction timber; sap used to prevent pregnancy. Seedlings are cooked and eaten as a vegetable. Seeds are a source of resin and ointment for treating skin diseases and wounds.

Source of illustration : Based on Percival & Womersley.

Reference(s) : Heyne (1950), Backer & Bakhuizen van den Brink (1963-8), Percival & Womersley (1975), Tomlinson (1986), Aksornkoae (1993), Aragones *et al.* (1998), Marschke (2000).

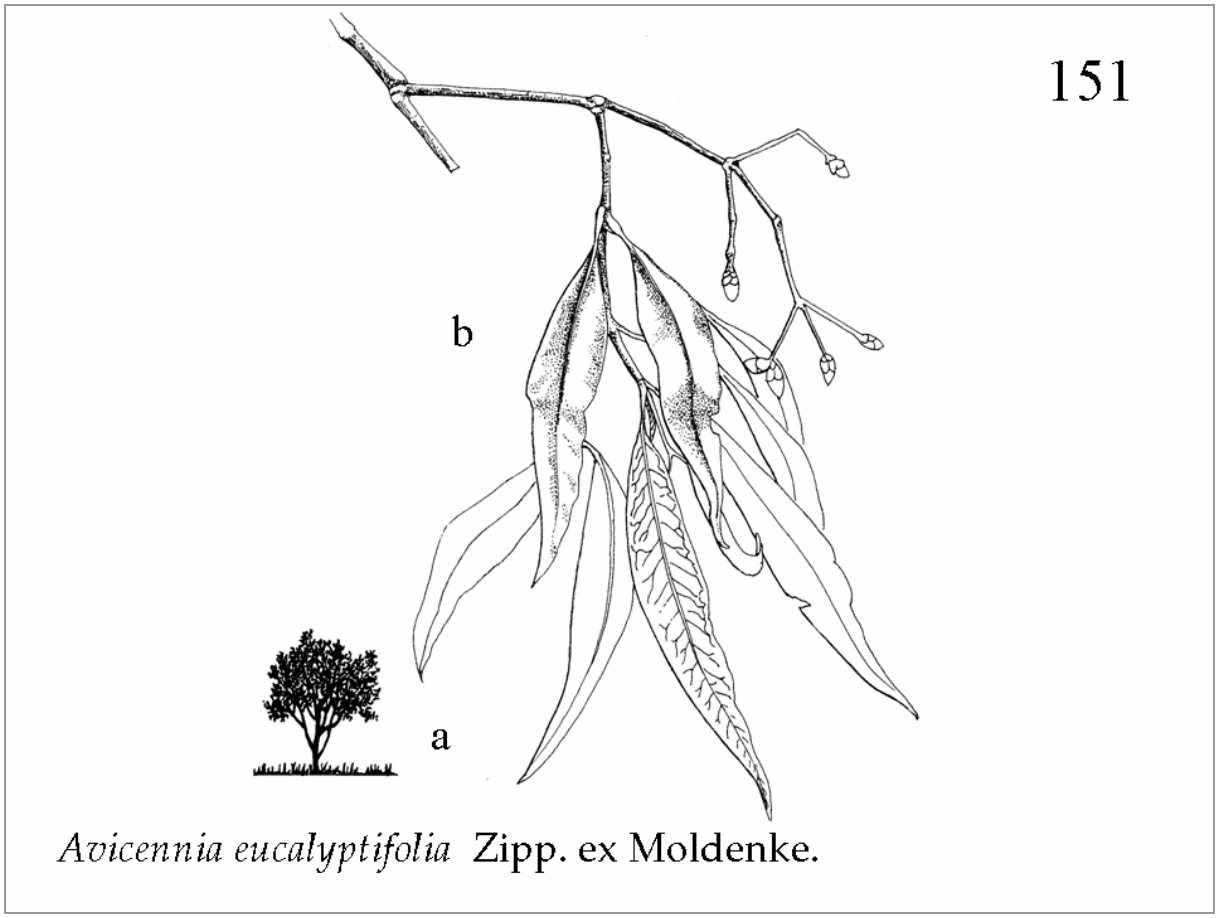

Fig. 151. *Avicennia eucalyptifolia* Zipp. ex Moldenke. (a) Habit, and (b) branchlet with fruit.

AVICENNIACEAE **151**

***Avicennia eucalyptifolia* Zipp. ex Moldenke**

Synonyms : *Avicennia eucalyptifolia* (Zipp. ex Miq) Moldenke, *Avicennia marina subsp. eucalyptifolia* (Zipp. ex Moldenke) J. Everett, *Avicennia marina* var. *eucalyptifolia* (Zip.. ex Moldenke) N.C. Duke, *Avincennia officinalis* var. *eucalyptifolia* Valet.

Vernacular name(s) : Api-api (Mal./Ind.), Api-api, Kachuchis, Piapi, Pundung – *Bungalon-sahing* (Phil.)

Description : Shrub or small tree up to 16.5 m tall and a diameter at breast height of up to 46 cm; trunk often crooked or bent. The smooth outer bark is mottled, yellowish-brown, or green, peeling off in thin flakes. The inner bark is straw-coloured to pale brown. Wood is white to straw-coloured. Leaves are pointed, lanceolate or narrow-lanceolate, measuring 4-16 cm by 1-4 cm, light to dark green or brownish-green above, greenish-yellow below. The flower cluster is enlarged at the end, and up to 2.5 cm long. Flowers are 3-4 mm in diameter, with a white, yellow or orange corolla, lobes 3-4 mm long and tube 1-2 mm long. The calyx is pale green, 2-5 mm long, covered with short hairs on the outside and smooth on the inside. The upper half of the ovary is usually hairy. Stamens are deep purple to brown. The greenish-yellow fruit has no conspicuous beak and is shorter than 3 cm. Regarded by some authors as a Papuan variety or subspecies of *Avicennia marina.* Sometimes included in the Verbenaceae.

Ecology : Occurs on off-shore (coral) islands, in the vicinity of coral reefs, and also on the landward margin/middle of mangrove swamps. As with other members of this genus, it is sometimes viviparous, with fruit (partly) germinating while still on the tree. Mangrove species.

Distribution : Recorded eastern Indonesia (Papua), the Philippines and Papua New Guinea.

Abundance : Common.

Use(s) : Used for timber and as firewood.

Source of illustration : Based on Percival & Womersley.

Reference(s) : Burkill (1935), Percival & Womersley (1975), Johnstone & Frodin (1982), Tomlinson (1986).

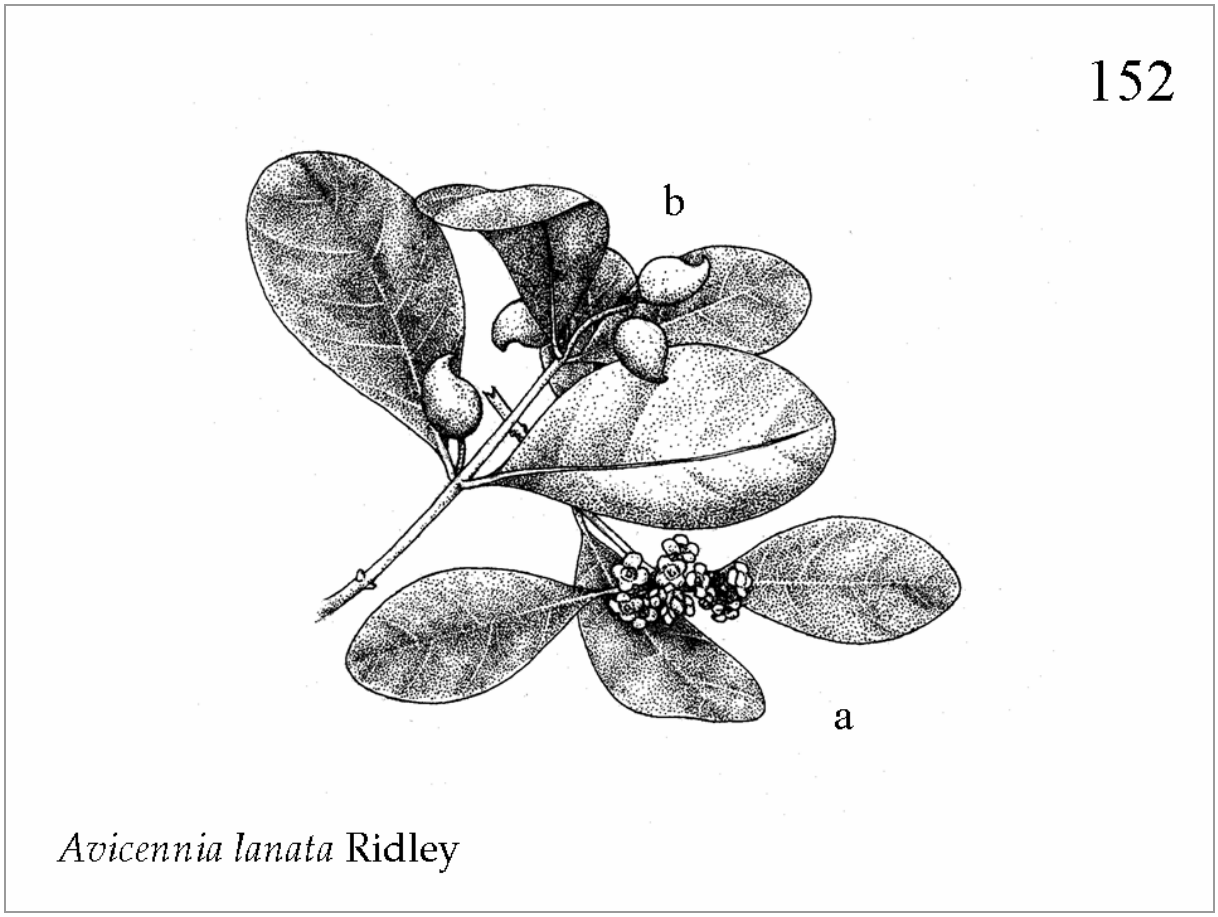

Fig. 152. *Avicennia lanata* Ridley. (a) Branchlet with flowers, and (b) branchlet with fruit.

AVICENNIACEAE

Avicennia lanata Ridley **152**

Synonyms : *Avicennia officinalis* var. *spathulata* Kuntze, *Avicennia rumphiana*

Vernacular name(s) : Api-api (Ind.), Api-api berbulu, Api-api bulu (Mal), Mâ'm quân (Viet.)

Description : Tree, up to 30 m tall and 3 m girth, but usually much smaller. Stem not buttressed but cylindrical, with a straight trunk when growing in a closed stand. Bark is dark grey and smooth. Roots have pencil-like pneumatophores emerge above ground from long shallow underground roots. Twigs are quadrangular but rounded, and when young they are covered with dense tawny coloured hairs. Leaves are simple, opposite, ovate or elliptic, sometimes a bit pointed, 10 by 6 cm, thick, entire, with non-curved edges, dark green above, covered with dense, flannel-like tawny (or yellowish-white), powdery hairs beneath. Midrib of leaf is prominent beneath, covered with hairs like the rest of the underside. Leaf stalk about 18-20 mm long, slender. Fragrant flowers clustered in three-branched heads, all parts densely covered with very fine hairs; flower stalks quadrangular; flowers small, 4-lobed, orange-yellow, fragrant. Corolla smooth inside, densely hairy outside, lobes strongly recurved. Fruit broadly ovoid, compressed, not more than about 18 mm in length, as broad as long, covered with dense woolly hairs. Woolly flat capsule containing one seed, green to yellowish brown. The vernacular name *berbulu* refers to the hairy state of the plant. Sometimes included in the Verbenaceae.

Ecology : Gregarious on the east coast of Peninsular Malaysia, where it replaces *Avicennia marina* on soils that are on the whole sandier than on the west coast. The largest of the *Avicennia* species, according to Watson (1928). The felt-like hairs on the leaves conserve water by trapping a layer of insulating air and thus reduce water loss through evaporation. Mangrove species.

Distribution : Endemic to Southeast Asia, occurring along the east coast of Peninsular Malaysia, sporadically occurring in Singapore (old records; possibly now locally extinct), western Sarawak, the Philippines (Aurora Province), Vietnam, Papua New Guinea and Indonesia (Bunaken, North Sulawesi). Probably also occurs in Thailand and western Indonesia (Kalimantan, Sumatra). Reports from Bali and Lombok are questionable.

Abundance : Locally common to very common, but with a restricted range.

Use(s) : Firewood and building material. The seeds are boiled and eaten, in some places, they are sold in markets as vegetables. The fragrant flowers produce nectar and are pollinated by insects; produces some of the best honey. This fast growing mangrove tree is among the few used in replanting mangroves to protect coastlines (the others are *Sonneratia* and *Rhizophora*). It is rarely used to make charcoal and is used as firewood only to smoke fish or rubber.

Source of illustration : Re-drawn from live specimen.

Reference(s) : Watson (1928), Kochummen (1978b), Tomlinson (1986), Hong & San (1993), Davie *et al.* (1996), Wilkie (1996), www.arcbc.org.ph/arcbcweb/wetlands/singapore/sgp_man.htm.

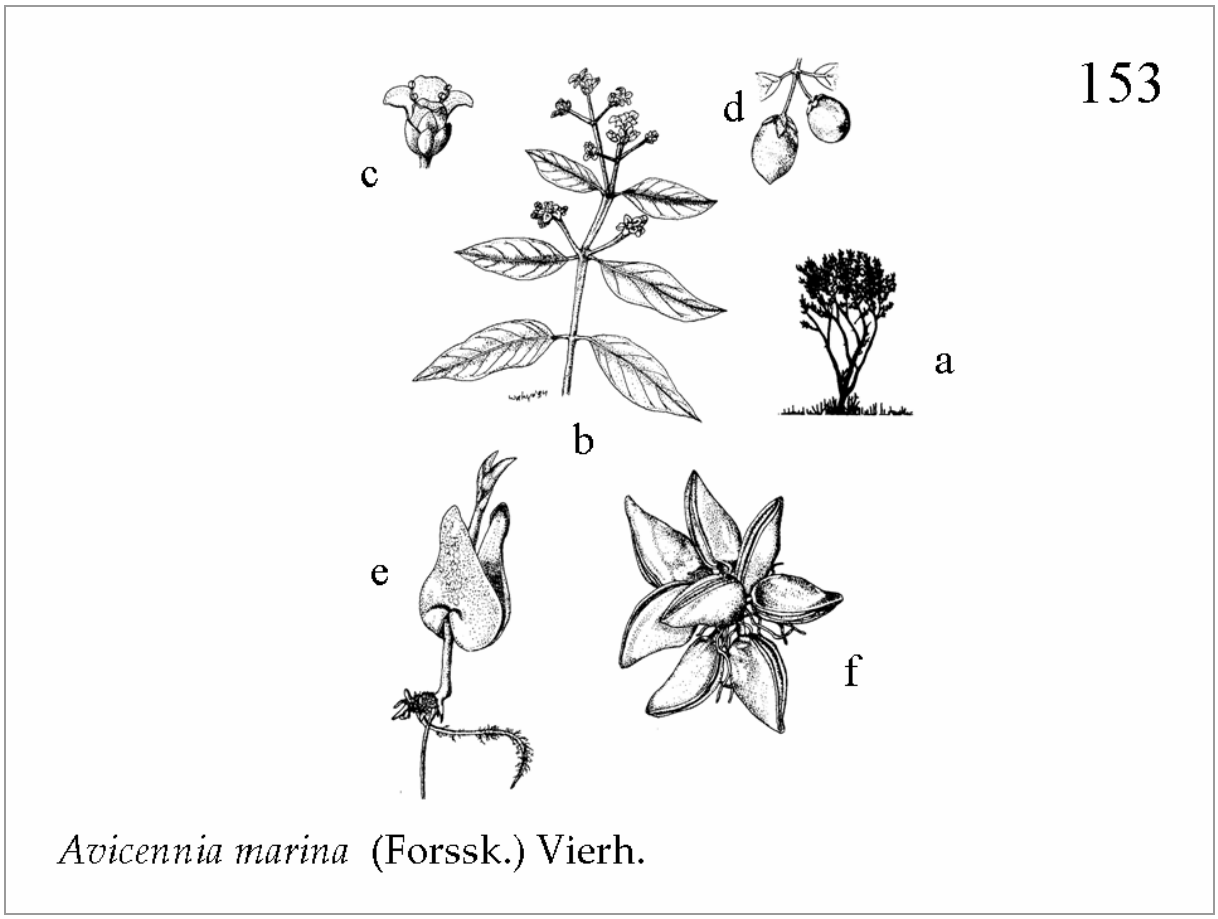

Fig. 153. *Avicennia marina* (Forssk.) Vierh. (a) Habit, (b) branchlet with flowers, (c) flower, (d) fruit, (e) germinating fruit, and (f) cluster of fruit tangled together (regularly found like this washed up along the shoreline).

AVICENNIACEAE

153

***Avicennia marina* (Forssk.) Vierh.**

Synonyms : *Avicennia intermedia* Griff., *Avicennia marina* var. *acutissima* Stapf & Moldenke, *Avicennia marina* var. *anomala* Moldenke, *Avicennia marina* var. *australiasica* (Walp.) J. Everett, *Avicennia marina* var. *intermedia* (Griff.) Bakh., *Avicennia marina* var. *marina, Avicennia marina* var. *resinifera* (Forst.) Bakh., *Avicennia marina* var. *rumphiana* (Hall. f.) Bakh., *Avicennia marina* var. *typica* Bakhuizen, *Avicennia mindanaense* Elmer, *Avicennia officinalis* L., *Sceura marina* Forssk.

Vernacular name(s) : Api-api puteh (Mal.), Api-api Putih, Api-api Abang (Ind.), Api-api, Buñgalon, Buñgalu, Kalapini, Kalapini-mañgitit, Kalapini-maputi, Lulasi, Kuyapi, Liñgog, Mabaran, Miapi, Piapi, Piksik, Pipisig, Pipisik, Sagarai – *Buñgalon* (Phil.), Mâ'm ô'i (Viet.), Samae, Samae thale (Thai.), Kbagn, Mouroujsrotorb, Sporng (Camb.)

Description : Erect or spreading shrub or tree, usually up to 10 m, occasionally even 30 m. It has a complex system of horizontal roots and pencil-like (or asparagus-like), thin, erect pneumatophores with numerous lenticels. The smooth bark is green-grey mottled and peeling in patches. The young twigs, leaf stalks, midrib, the lower surface of the leaves and the upper surface of the expanding leaves are yellow, but not hairy. The elliptic-oblong or oblong-obovate leaves with a round tip have a pale green lower surface and measure up to 9 x 4.5 cm. The upper surface is covered with numerous, sunken, glandular dots. The terminal flower clusters have 2-12 flowers. The lowest pair of flowers is sometimes distant from the others. The regular, (dark) orange flowers are small (5-8 mm), waxy, have a strong odour not unlike that of rotten fruit, and abundant nectar. The corolla has four equal lobes. The ovary has a short style and a median ring of hairs that do not obscure the stigma. The fleshy, greyish-green, never yellowish fruit measures about 2 cm across and is round or heart-shaped. At the top it is rounded or at most has a short-beaked tip, with persistent leaflets at the base of the stalk and a persistent calyx. Sometimes included in the Verbenaceae.

Ecology : Pioneer on sheltered shores, capable of colonising many tidal habitats, even very saline ones. It is one of the most common members of the intertidal flora. Roots reportedly aid accretion of sediment and accelerate land-building processes. It may also form single-species stands. Flowering occurs all year round. As with other members of this genus, it is sometimes viviparous, with fruit (partly) germinating while still on the tree. The fruit opens when ripe via the upper suture (seam), either after absorption of water, or due to consumption by ants. Mangrove species.

Distribution : Wide ranging pantropical and subtropical species, found in mangroves of Africa, Asia, South America, Australia and Polynesia. Occurs throughout Southeast Asia.

Abundance : Abundant.

Use(s) : Leaves are used to treat burns. Bark resin is used as a contraceptive. The fruit is edible. Wood produces a good-quality pulp for paper production, as the hollocellulose content is almost 70%, while lignin and pentosan contents are low. Leaves used for fodder.

Source of illustration : Percival & Womersley (1975), Tomlinson (1986), Wightman (1989).

Reference(s) : Burkill (1935), Heyne (1950), Backer & Bakhuizen van den Brink (1963-8), Percival & Womersley (1975), Tomlinson (1986), Wightman (1989), Aksornkoae (1993), Aragones *et al.* (1998), Marschke (2000).

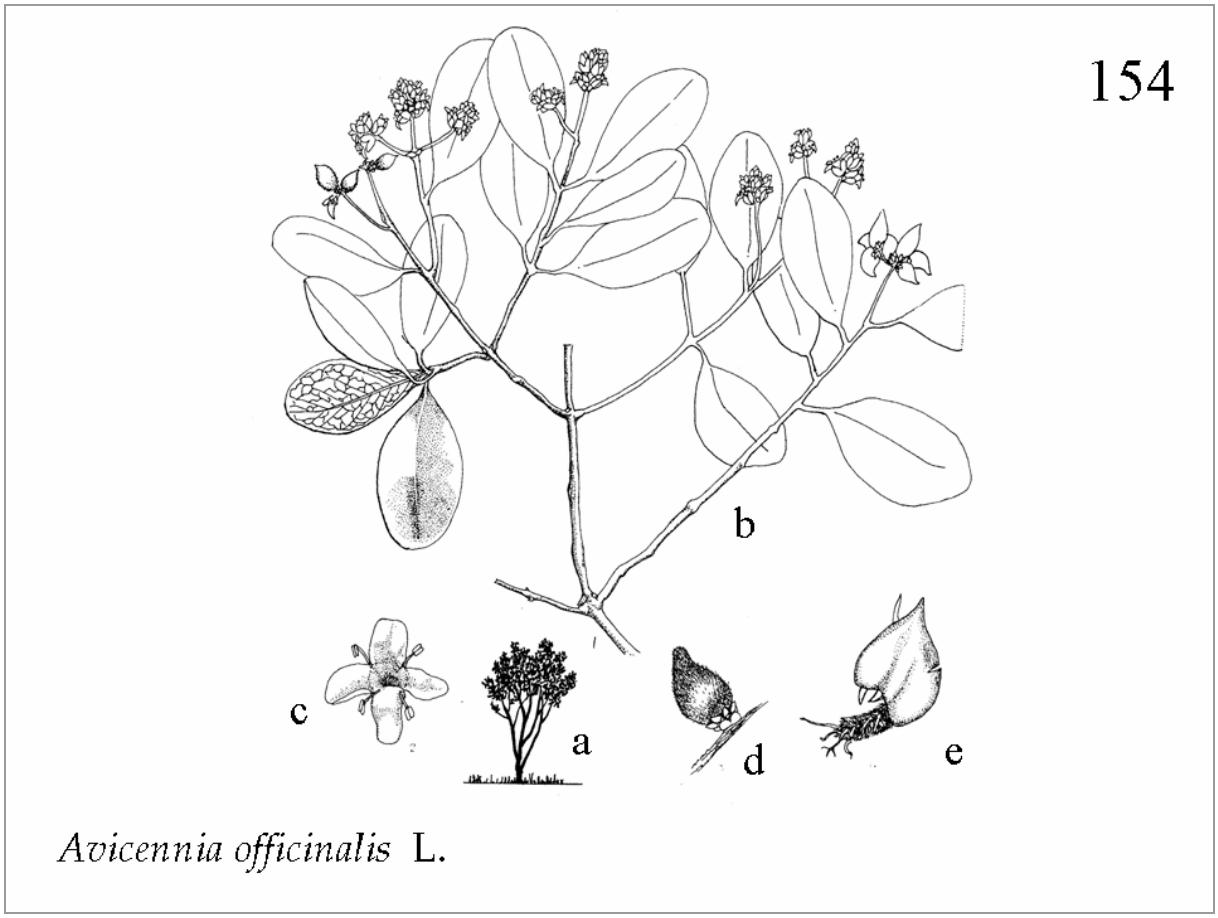

Fig. 154. *Avicennia officinalis* L. (a) Habit, (b) branchlet with flowers and fruit, (c) flower, (d) fruit, and (e) germinating fruit.

AVICENNIACEAE

154

Avicennia officinalis **L.**

Synonyms : *Avicennia tomentosa* Willd.

Vernacular name(s) : Api-api (Mal.), Api-api Daun Lebar, Api-api Ludat (Ind.), Thame (Myan.), Mâ'm den (Viet.), Samae, Samae dam (Thai.), Kbagnkmao, Spong (Camb.)

Description : Tree, usually up to 12 m, occasionally up to 22.5 m tall. Unlike other species of the genus often develops stilt roots; it always has pneumatophores that are thin, finger-like (or asparagus-like) and covered with numerous lenticels. The smooth, outer bark is yellowish-green to brownish-grey and also has lenticels. Leaves have a rounded top, and are obovate, oblong-obovate or elliptic-oblong. They gradually narrow into the leaf stalk, are dark green above and yellowish-green or bluish-grey beneath, measuring up to 12.5 by 6 cm. The upper surface is covered with numerous, sunken, glandular dots. The flower heads are rather short, 1-1.5 by 0.5 cm, more or less round, and with 2-12 flowers. The lowest pair is often distant from the other flowers. Leaflets surrounding the base of the flower stalk are black-tipped and have a fringed margin. The flowers themselves are large, 10-15 mm across. rancid-smelling, orange-yellow, and covered with short, soft hairs on both surfaces. The tips of the petals unfold in an irregular way and blacken somewhat with age. Stamens are longer than the corolla. The ovary is entirely covered with short, dense hairs, except the tip of the well-developed style. Fruit is densely covered with short hairs, measures about 3 cm, and is broadly ovate with a short beak. Sometimes included in the Verbenaceae.

Ecology : Occurs on the landward margins of mangrove swamps, especially along tidal river banks and river mouths. Flowering occurs all year round. Near sea level, but recorded to levels of 50 m asl. in Papua. Mangrove species.

Distribution : Occurs from East Pakistan, southern India, Tanasserim (Myanmar), Andaman Islands, and Sri Lanka through coasts of Vietnam, Thailand, and Peninsular Malaysia to the Philippines, Sumatra, Madura, Java, Borneo, Celebes, Sunda Islands, Molucca Islands, and New Guinea; south in Australia to New South Wales. Found throughout Southeast Asia, but not (yet) reported from Brunei.

Abundance : Common.

Use(s) : Fruits edible. Wood used as fuel. Resin in bark used as contraceptive.

Source of illustration : Drawn from herbarium material, Herbarium Bogoriense.

Reference(s) : Burkill (1935), Heyne (1950), Backer & Bakhuizen van den Brink (1963-8), Percival & Womersley (1975), Tomlinson (1986), Wightman (1989), Said (1990), Aksornkoae (1993), Marschke (2000)
http://www.rbgkew.org.uk/herbarium/brunei/bclhome.htm
http://www.hort.purdue.edu/newcrop/duke_energy/Avicennia_officinalis.html.

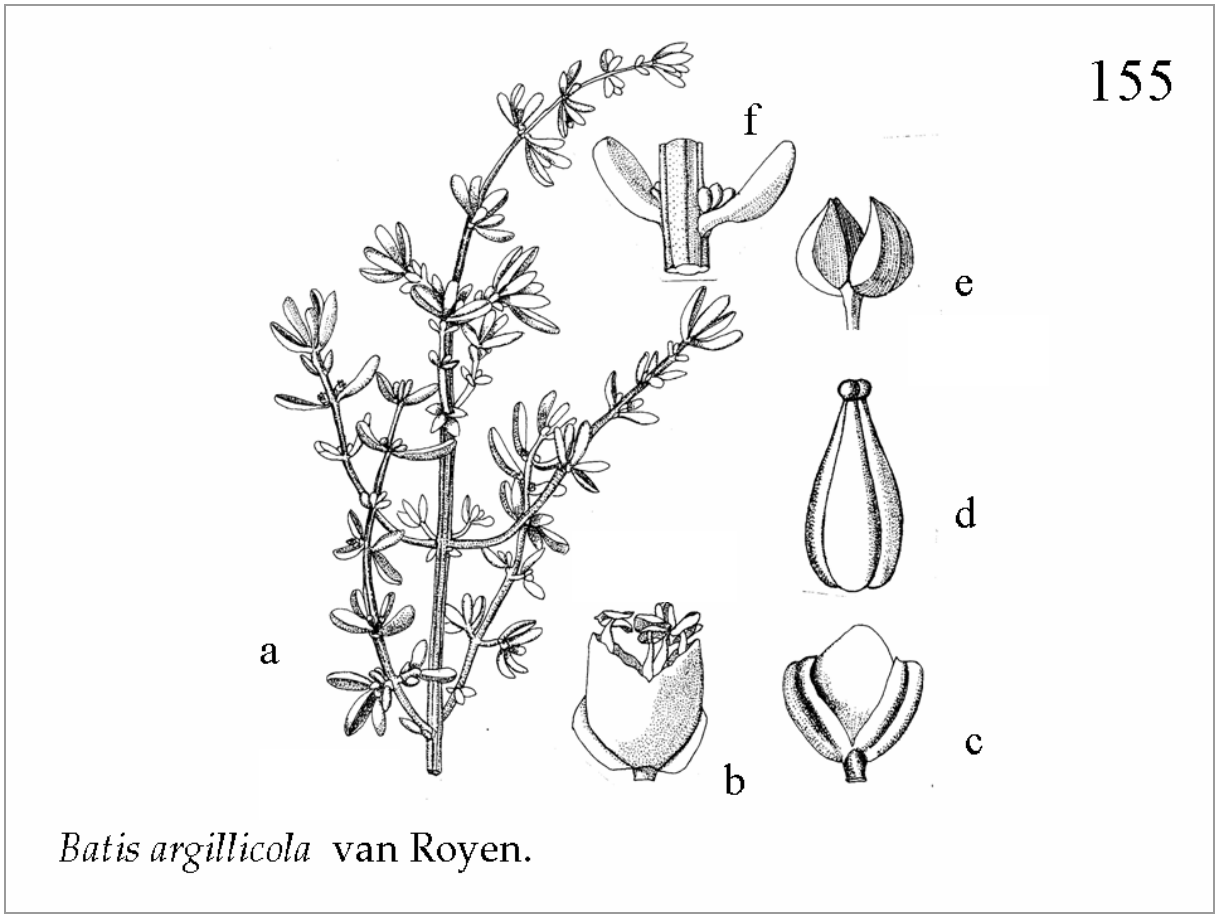

Fig. 155. *Batis argillicola* van Royen. (a) Flowering stem, (b) male flower still enclosed by two bracts, (c) juvenile male flower, (d) female flower, (e) two immature fruits and (f) leaves with flower buds.

BATIDACEAE

155

***Batis argillicola* van Royen**

Synonyms : Unknown.

Vernacular name(s) : Saltwort (E), Haha (Ind.), Ahake (PNG)

Description : Small, succulent and smooth shrub, up to 70 cm tall, with thick, woody roots, a woody base and fibrous, grey bark. Leaves are linear to rounded/egg-shaped, 4-15 mm long. This species has both male and female flowers on the same individual plant. Flowers and fruits are solitary, occurring in the axils of leaves or at the end of branches. It has leaflets surrounding the base of the flower stalk. The small leaflets partially enveloping male flowers consist of two membranous, fused parts. The female flower mainly consists of a naked ovary. The fruit is a 9-11 by 4-5 mm berry, which when ripe opens into two compartments. Seeds are oblong, measuring 5-5.5 by 1.2 mm.

Ecology : Occurs on saline, clayey plains that are rarely flooded by seawater, and on the landward margins of mangroves. Usually either solitarily on landward margins of mangroves, or gregariously on mudflats and in tidal marshes. It is also found on sandy banks of small creeks, in open connection with the sea but out of reach of normal high tide. Flowering occurs from August to October, and fruiting from December to January (in Australia). The flower is probably pollinated by insects, and the fruit is well adapted to water dispersal. Differences have been reported between material from Papua and from Australia in leaf, stamen and flower cluster characters. This genus consists of two species that display a remarkably discontinuous distribution. *Batis maritima* is confined to Hawaii, the Galapagos islands and the America's, where it is found on saline clayey plains, regularly inundated by tides. Distribution of *Batis argillicola* is still insufficiently known. In 1994, *Batis argillicola* was reported to be expanding along the coast near Wasur National Park in Papua (pers. comm. Kristyo Budi Asmoro). This expansion was apparently occurring at the expense of *Rhizophora*, with even large seedlings of the latter dying off, perhaps due to allelopathy. Batidaceae is a small family – related to Amarantaceae and Chenopodiaceae – with only one genus and two disjunctive, restricted range species. Mangrove associate species.

Distribution : Eastern Indonesia (southern Papua, near Merauke), Papua New Guinea and tropical Australia (Queensland).

Abundance : Locally common.

Use(s) : Locally used in salads.

Source of illustration : Based on van Royen (1957), Wightman (1989).

Reference(s) : van Royen (1957), Wightman (1989), Heywood (1993).

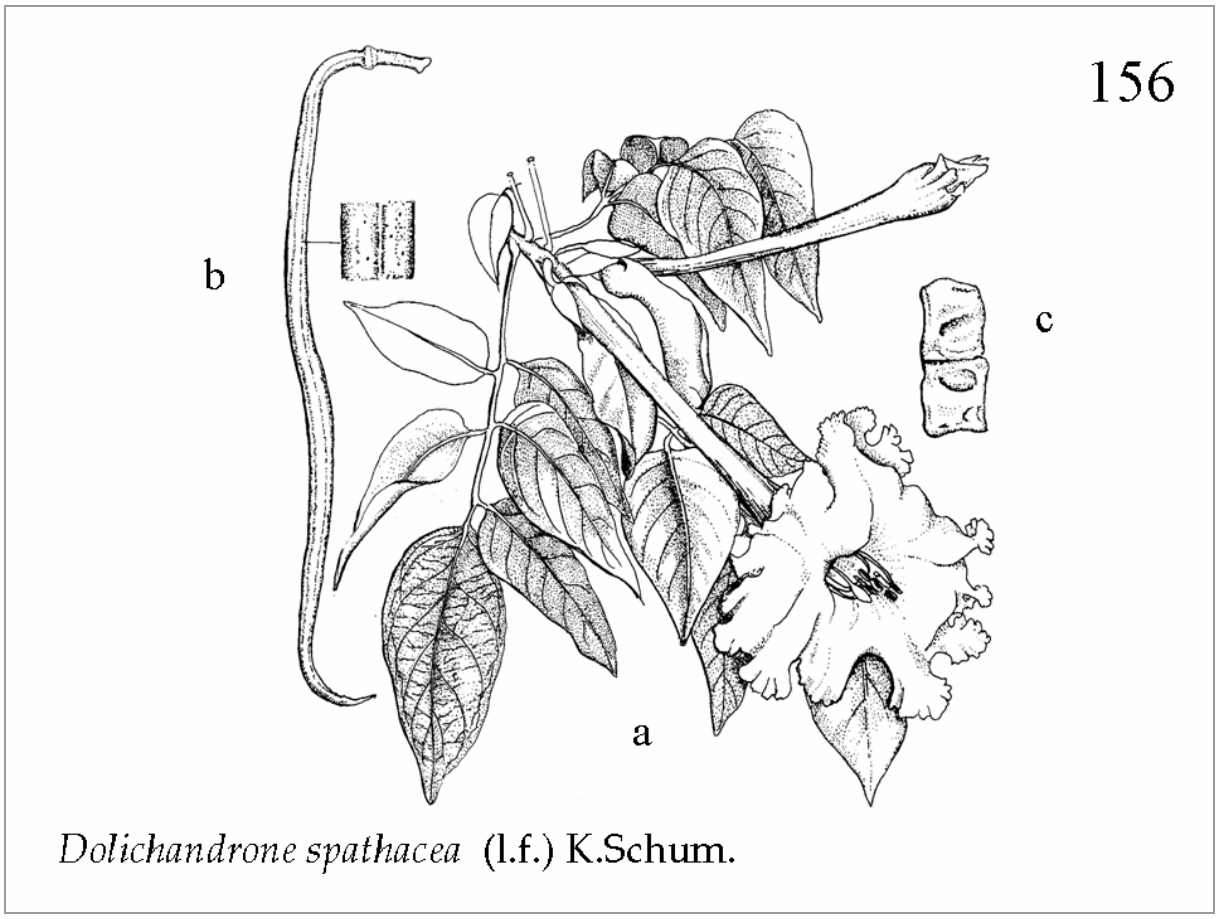

Fig. 156. *Dolichandrone spathacea* (l.f.) K.Schum. (a) Branch with two flowers, (b) fruit, and (c) two seeds (of the many enclosed in the fruit).

BIGNONIACEAE

156

***Dolichandrone spathacea* (l.f.) K.Schum.**

Synonyms : *Bignonia javanica* Thunb., *Bignonia longiflora* Willd. ex DC., *Bignonia longissima* Lour., *Bignonia spathacea* L., *Dolichandrone longissima* K. Sch., *Dolichandrone rheedii* Seem/, *Lignum equinum* Rumph. *Pongelia longiflora* Rafin., *Spathodea diepenhorstii* Miq., *Spathodea longiflora* Vent. Choix., *Spathodea loureiriana* DC., *Spathodea luzonica* Blanco, *Spathodea rheedii* Spreng.

Vernacular name(s) : Poko kulo, Tuj (Mal.), Kayu Jaran, Ki Jaran, Tuwe-ej, Kudo-kudo Uwi, Kuda-kuda, Ki Arak, Jarang, Jaran Pelok, Jaranan, Kajeng Kapal, Kaju Pelok, Kapal, Kayu Jiharan, Kayu Jaran Binek, Kelaju, Tuw, Fojet, Kaju Pelumping, Sangi, Tomana, Kayu Kuda, Kati-kati (Ind.), Pata, Stanghas, Tañgas, Tanhas, Twei, Tiwi, Tua - *Tui* (Phil.), Latiu (PNG), Khale thale (Thai), Quao nu'óc (Viet.)

Description : Evergreen, smooth tree, 5-20 m with a trunk that is cylindrical, short, often crooked, and usually measures no more than about 30 cm diameter at breast height. Bark is grey to dark brown and somewhat fissured in older trees. Young parts are often red and somewhat sticky. There are usually 3-4 pairs of leaflets on a leaf, which measures 15-35 cm. Leaflets are thin, ovate-oblong to lanceolate, unequal-sided and long-tipped, 6-16 by 3-7 cm, with hairy domatia (hollows for ants/insects) underneath. Flowers are large, conspicuous, trumpet-shaped, white to greenish-white or yellow. The flower clusters bear 2-8 fragrant flowers that open one at a time. The greenish-white calyx measures 3-6 cm across, is leathery, beaked and has many glands. The large, trumpet-shaped corolla is 12-18 cm long and 7-12 cm in diameter. The five lobes, 2.5-3 cm, are broad, frilled around the edge and have large glands. The long, horn-like fruit measures 25-70 by 2-3 cm and has hard, leathery partitions. The dark grey seeds are very numerous, rectangular, arranged in many rows, each measuring 12-18 by 6-8 mm, including the thick, corky wings.

Ecology : Confined to the landward margin of mangroves, banks of tidal rivers and estuaries, and beach vegetation. Flowering occurs all year round. At times the tree is nearly leafless. In Central and East Java it fruits in the dry season (June-August). The very fragrant flowers open at dusk and drop before sunrise. They are apparently pollinated by hawkmoths, which are equipped with very long tongues. Self pollination occurs. The corky seeds float readily and are dispersed by seawater. In this respect it is strange that this species is not found in Australia and Polynesia. Mangrove associate species.

Distribution : From the coast of Malabar (India) throughout tropical Southeast Asia to the west-Pacific and the Solomon Islands. Not recorded in Australia and Polynesia.

Abundance : Common.

Use(s) : Of little use other than firewood. The wood is not durable, but light and easy to work, usually for making small household utensils. Requires rapid drying to prevent blue stain. Sometimes the wood is used for floats of fishing nets in East Java. In Madura it is used for making traditional *wayang orang* masks. Tea brewed from the leaves is used to treat mouth infections.

Source of illustration : Based on Percival & Womersley (1975) and Tomlinson (1986).

Reference(s) : Backer & Bakhuizen van den Brink (1963-8), Percival & Womersley (1975), van Steenis (1977), Tomlinson (1986), Aksornkoae (1993), Aragones *et al.* (1998).

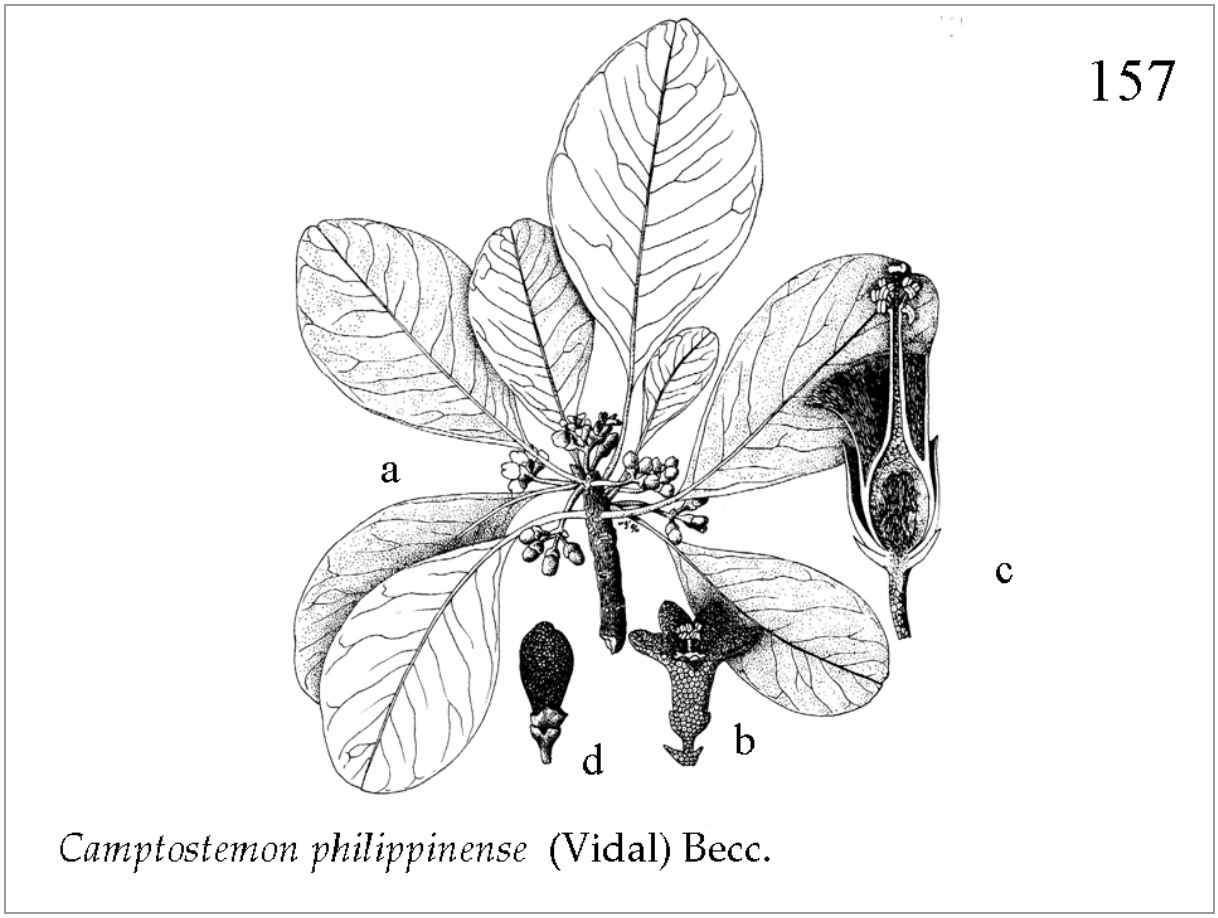

Fig. 157. *Camptostemon philippinense* (Vidal) Becc. (a) Branchlet with flowers and fruit, (b) flower, (c) cross-section of flower, and (d) fruit.

BOMBACACEAE

157

***Camptostemon philippinense* (Vidal) Becc.**

Synonyms : *Cumingia philippinensis* Vidal, *Neesia altissima* (non Bl.) F.Vill.

Vernacular name(s) : Baluno, Buñgalon, Dandulit, Lapa-lapa, Libatong-puti, Nigi-puti – *Gapas-gapas* (Phil.)

Description : Soft-wooded, evergreen shrub or tree, usually 6-10 m, occasionally up to 30 m, with a grey bark that has longitudinal fissures and a fluted stem base. The roots spread along the surface of the soil, and may bear knobbly pneumatophores. Twigs have round leaf scars. The leaves, 6-9 by 2-4 cm, are elliptic lanceolate, scaly on both sides, have a rounded point and a narrow base. The flower clusters are crowded and occur in leaf and stem axils, on short (1-2 mm) stalks. The calyx is bell-shaped, with irregular limbs, 2-5 lobes. The corolla is scaly, covered with short hairs, white, with 5 petals and 5 stamens that are united at the base; flowers are about 5-6 mm across. The round fruit is a small, pear-shaped capsule, 1-1.5 cm long, scaly, and has a persistent calyx and epicalyx. The fruit contains two (occasionally 3 or 4) 9 mm-long, densely woolly seeds. Differs from *Camptostemon schultzii* by the presence of small, scurfy scales on both sides of the leaves, which are absent in *Camptostemon schultzii.* The two species are said by Bakhuizen van den Brink to differ in leaf shape (elliptic in *Camptostemon schultzii,* obovate-oblong to lanceolate in *Camptostemon philippinense*), but they both have a similar range in leaf size. According to Tomlinson (1986), bark of this species is scaly and without fissures.

Ecology : The species is usually observed on the inner edges of the mangrove forest, often reaching the margins and bordering the tidal streams. True mangrove species.

Distribution : Southeast Asian species, found in the Philippines and Indonesia (Borneo and Sulawesi). Geographic range does not overlap with that of *Camptostemon schultzii.*

Abundance : Uncommon to locally common.

Use(s) : The wood is moderately soft but fairly strong; seasons well with negligible checking and warping. It is easy to work and fairly durable for interior work, though not lasting when exposed to the weather. Has potential for pulp and paper production, owing to the high holocellulose and low lignin content. Used for household utensils, carvings and inlays.

Source of illustration : Based on Bakhuizen van den Brink (1924).

Reference(s) : Bakhuizen van den Brink (1924), Tomlinson (1986), Aragones *et al.* (1998).

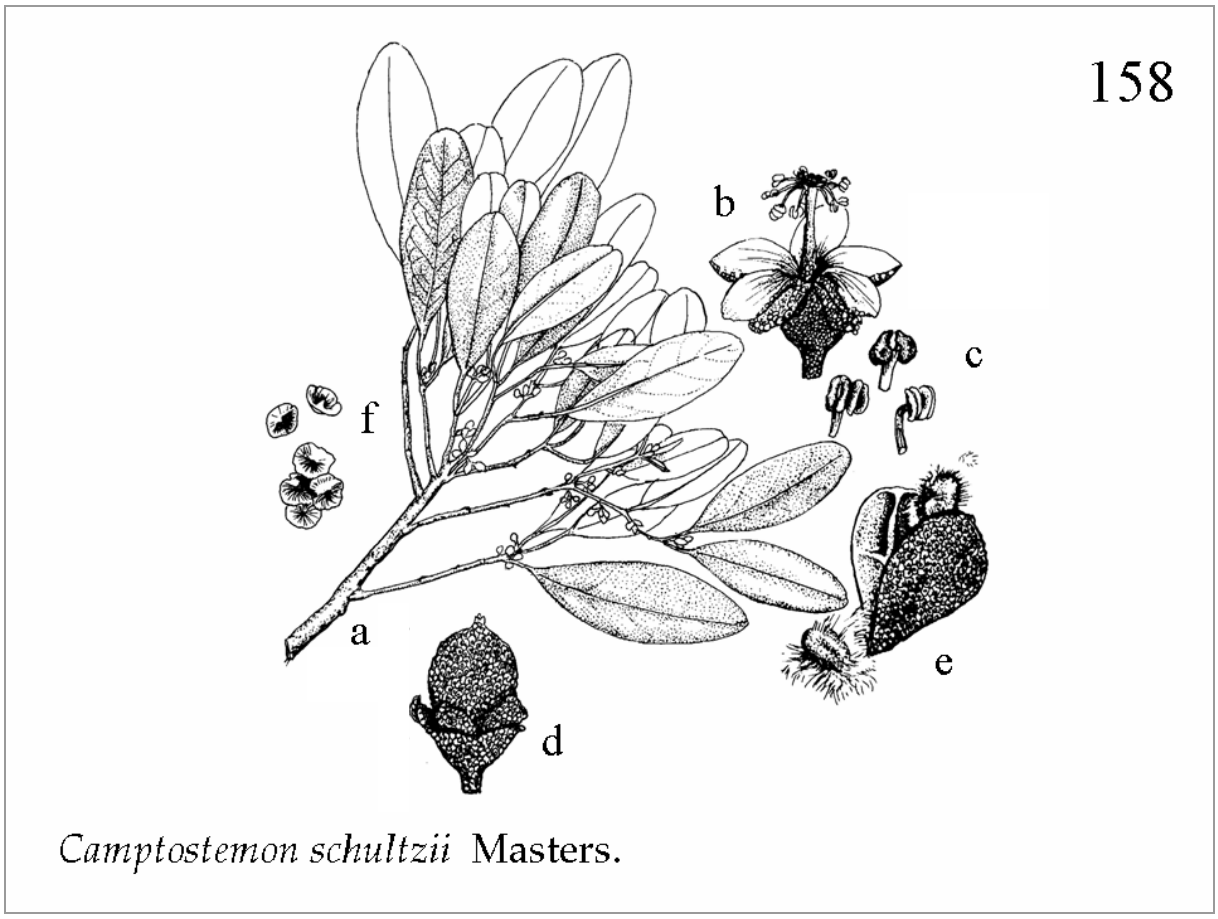

Fig. 158. *Camptostemon schultzii* Masters. (a) Branchlet with buds, (b) flower, with (c) extra stamens drawn separately, (d) fruit, (e) fruit with woolly seeds emerging, and (e) detail of scales on leaf.

BOMBACEAE **158**

***Camptostemon schultzii* Masters**

Synonyms : *Camptostemon aruense* Becc.

Vernacular name(s) : Unknown.

Description : Soft-wooded, evergreen shrub or tree, occasionally to 30(-33) m and with a stem diameter of up to 60 cm. It has pale yellow or brownish inner bark, and dark greyish-brown bark with longitudinal fissures and lenticels, and a fluted base of the trunk. The roots run along the surface of the soil and may bear knobbly pneumatophores. Twigs have rounded scars left by the leaf stalks. Leaves occur in tufts at the end of the branches, spirally arranged, and are elliptic-lanceolate, 6-16 by 2-5 cm, scaly below, smooth above, with a rounded point and a narrow base. Leaf stalk is 2-3 cm long. The flower clusters – usually in groups of 3-6 flowers each – occur in leaf- and branch axils, on 4-8(-15) mm long individual stalks. The corolla is scaly, 5-petalled and covered with short hairs; petals are white, with greyish scales on the outside, 3 by 5 mm. The calyx is 6 mm long, and the epicalyx 2-3 mm. Flowers have 20 anthers, each with two thecae (containing pollen). The fruit is a round capsule, 1 cm long, scaly, with a persistent, scaly calyx and outer calyx. The fruit contains two densely woolly, 9 mm-long seeds. According to Tomlinson (1986), bark is scaly and without fissures.

Ecology : The species is more characteristic of open rocky shores than of estuarine mangroves, and commonly described as occurring on sandy beaches within the tidal range. It is probably pollinated both by insects and wind. Flowers occur from June to October, with mature fruit appearing between October and February (in Australia). Fruits are capable of medium range water dispersal, while the woolly seeds are capable of both water and wind dispersal. Mangrove species.

Distribution : Recorded from Indonesia (Borneo, the Molluccas), Papua New Guinea and northern Australia. Geographic range does not overlap with that of *Camptostemon philippinense.* .

Abundance : Relatively common.

Use(s) : Sulphate-paper pulps with good strength properties can be produced from the wood.

Source of illustration : Based on Percival & Womersley (1975) and Tomlinson (1986).

Reference(s) : Bakhuizen van den Brink (1924), Percival & Womersley (1975), Tomlinson (1986), Wightman (1989).

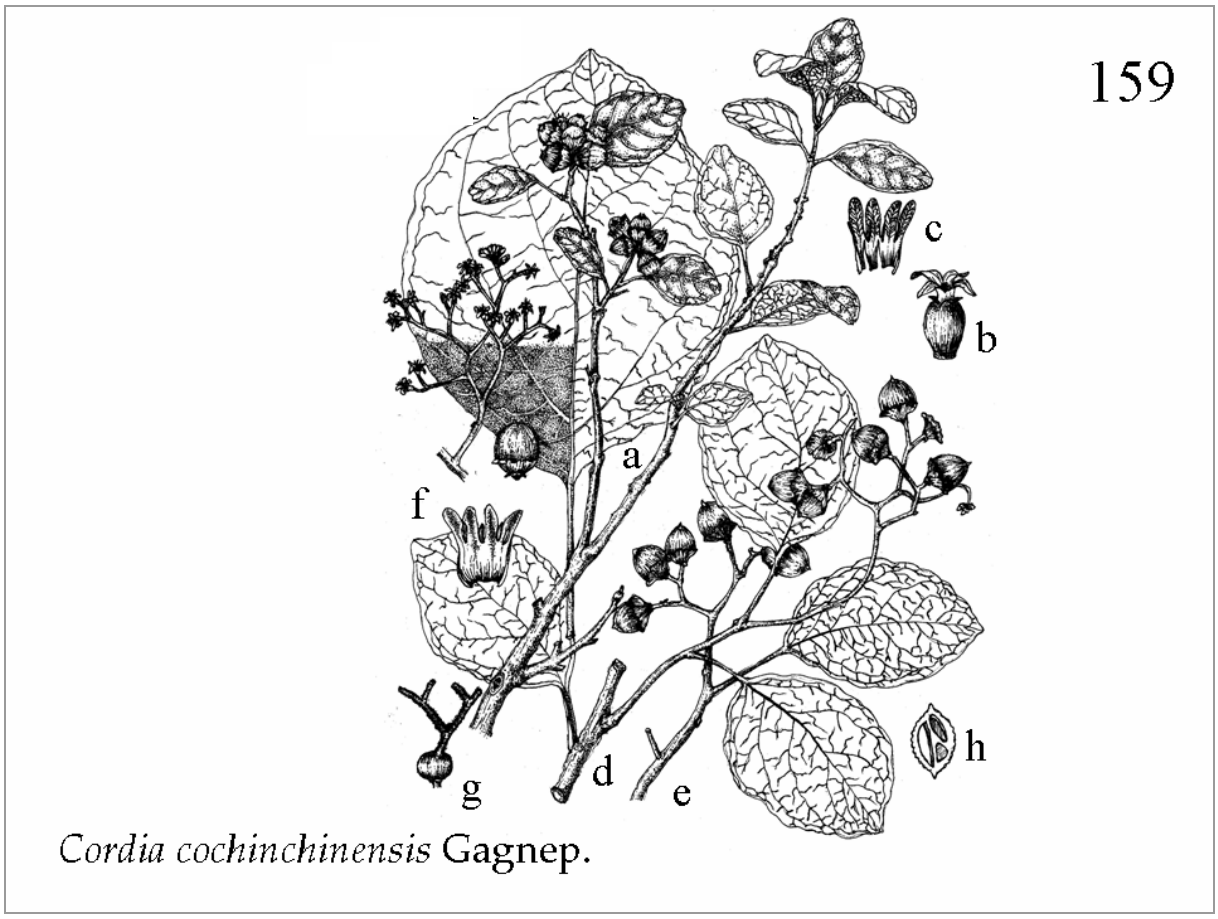

Fig. 159. *Cordia cochinchinensis* Gagnep. (a) Fruiting branch, (b) flower, (c) opened corolla showing stamens, *Cordia dichotoma* (d, e) fruiting branch, (f) opened corolla, (g) pistil, and (h) cross-section of fruit.

BORAGINACEAE **159**

***Cordia cochinchinensis* Gagnep.**

Synonyms : *Cordia premnifolia* Ridl.,

Vernacular name(s) :Dyerehatt (Camb.), Tân môc lang (Viet.)

Description : Small tree, 2-4(-12) m, or sometimes a scrambling shrub. Even young branches are woody, at first dark reddish brown, later pale yellowish to greyish brown, without hairs. Leaf stalks are 1.5-2(-4) cm long. Leaves simple, alternate, crowded towards the ends of branches. There are two types of leaves: those far from the ends of branches are broader, 9-12 cm by 6-9 cm, 5 nerves on each side; those near the tips of branches are 5-11 cm by 2.5-5.5 cm, about 8 nerves on each side. Nerves forming a dense network on the underside; a few hairs along the primary nerves, otherwise smooth. Flowering branchlets are dichotomously branched, each flower cluster with 2-5 bisexual flowers, terminal, rarely lateral on short branches. Calyx 3 mm long and wide, immediately after flowering; 8-10 mm long and 10-15 mm wide in fruit; 4-5 lobes. Corolla elongate, white, cream or greenish, 15 mm long, tube 8 mm, straight, often broadening towards the base; 4 lobes, ovate-lanceolate, 3 mm long and recurved; 4 stamens. Fruit an ovoid berry, up to 30 mm long and 22 mm diameter (more usually 8-10 mm diameter), tapering towards the tip, and surrounded by the persistent calyx. Recorded by Ng (1989) as a synonym of *Cordia dichotoma* Forster f., but according to Riedl (1997) the two differ in at least the following: fruit size (20-30 mm long in *Cordia cochinchinensis*, and up to 15 mm long in *Cordia dichotoma*) and calyx (smooth and bell-shaped in *Cordia cochinchinensis*, often hairy and cup-shaped in *Cordia dichotoma*).

Ecology : Occurs in woods along beaches, on arid, sandy hills, and landward margins of mangroves. Fruiting has been recorded in southern China as occurring in August-December. Mangrove associate species.

Distribution : Occurs in southern China (Hainan) and Southeast Asia, where it has been recorded in Cambodia, Vietnam, Thailand and Peninsular Malaysia.

Abundance : Little information available, and possibly uncommon.

Use(s) : Edible fruit (Cambodia). Gummy resin occasionally used as glue (Malaysia).

Source of illustration : Flora of China

Reference(s) : Ng (1989), Riedl (1997), Nguyen *et al.* (2000), Marschke (2000), Maung (2003).

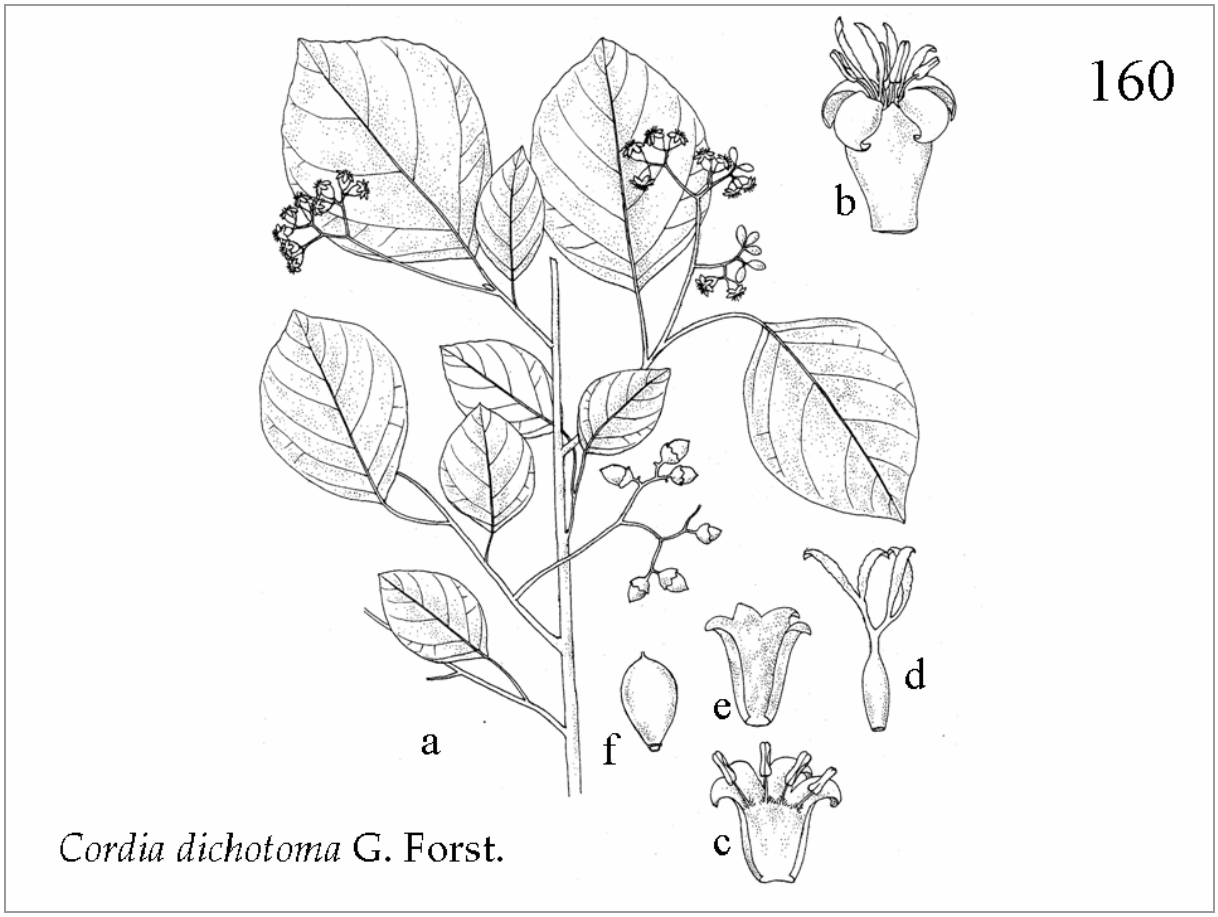

Fig. 160. *Cordia dichotoma* G. Forst. (a) Fruiting and flowering branch, (b) flower, (c) opened flower showing the stamens, (d) pistil, (e) opened corolla, and (f) fruit.

BORAGINACEAE

160

***Cordia dichotoma* G. Forst.**

Synonyms : *Arbor glutinosa* Rumphius, *Cordia blancoi* Vid., *Cordia griffithii* C.B. Clarke, *Cordia myxa* auct. non. L., *Cordia obliqua* auct. non. Willd., *Cordia suaveolens* Bl., *Cordia suaveolens* Vidal, *Cordia subdentata* Miq., *Varronia sinensis* Loureiro.

Vernacular name(s) : Cordia tree (E), Nona burung, Petekat, Sekendal, Sekendai (Mal.), Anuanga, Cena, Kanonang, Kendal, Knadate, Lantolo, Mampapu, Manonang, Nonang, Nunang, Onunang, Temampapu, Teo-teo, Tomatangtang, Toteo (Ind.)

Description : Tree or shrub, 6-20(-27) m tall, trunk up to 60 cm diameter at breast height, crown conical, cylindrical, later rounded, the branches drooping at the ends. Younger branches grey, greyish brown to brownish, smooth; bark shallowly fissured. Leaves simple, spirally arranged, variable in shape from ovate, to ovate-lanceolate, broadly ovate, or rarely almost round, 2-11 by 1.2-10 cm, leaf edge entire, papery to slightly leathery, base rounded, tip pointed, (3-)4-5(-6) secondary nerves on each side, prominent below, mostly whitish; leaf stalk 1-4.5(-5) cm, slender or robust. Leaves of saplings are strongly toothed along the edge. Flower clusters consist of branching corymbs, 4-11 cm long, forking repeatedly (hence 'dichotoma') located at the ends of branches on slender lateral branches, with a variable number of flowers (10-many). Flowers male or bisexual. Calyx cup-shaped, expanded in fruit from a narrow base, 3-5 mm long; 3-4 mm wide in flower, 6-10 mm wide in fruit; with short, dense hairs in flower, later smooth; calyx lobes recurved, shortly triangular. Corolla cylindrical, bell-shaped, white, cream or green, 5-6(-8) mm long, tube 3 mm, expanded parts of petal 5 mm diameter, lobes (4-)5(-6), oblong, recurved, 2 by 1 mm. Stamens long and projecting beyond the corolla. Fruit an egg-shaped drupe, smooth, shiny, white, pale green, pink, orange or yellow; containing a sticky, slimy pulp, about 10(-15) mm long, 8(-10) mm diameter, containing a single-seeded stone. Very variable in shape and size, especially of vegetative features. Ng (1989) incorrectly lists *Cordia premnifolia* as a synonym.

Ecology : Mainly at low altitudes from sea level upwards to about 500m altitude. Also occurs on inward (dry) side of mangroves, coastal hills below 100m, inland forests along rivers, and on limestone. Open woods on slopes, mountain streamsides. In southern China, flowering from February to April, and fruiting from June to August. Trees may be so full of fruit that the branches droop under the weight. Mangrove associate species.

Distribution : Wide ranging, from India, Pakistan to south China and Japan, through Southeast Asia to Australia, New Caledonia and western Polynesia. In Southeast Asia it has been recorded from Myanmar, Vietnam, Cambodia, Thailand, Malaysia (Peninsular), Singapore, the Philippines, Indonesia (Borneo, Sumatra, Java, Sulawesi, L.Sundas, Moluccas), E. Timor and PNG.

Abundance : Sporadic, but locally common.

Use(s) : Fruit contains a sticky gum and is used as glue (e.g. paper, kites). Planted in villages in Malaysia. The seeds contain oil, the fruit is used for medicine, and the wood is used for house construction and farm tools (e.g. ploughs, Bali). Bark used as rope, for treating headaches and fevers.

Source of illustration : Riedl (1997), http://www.efloras.org/florataxon.aspx?flora_id=2&taxon_id=200018953

Reference(s) : Heyne, (1950), Corner (1988), Ng (1989), Riedl (1997), Flora of China: http://www.efloras.org/florataxon.aspx?flora_id=2&taxon_id=200018953.

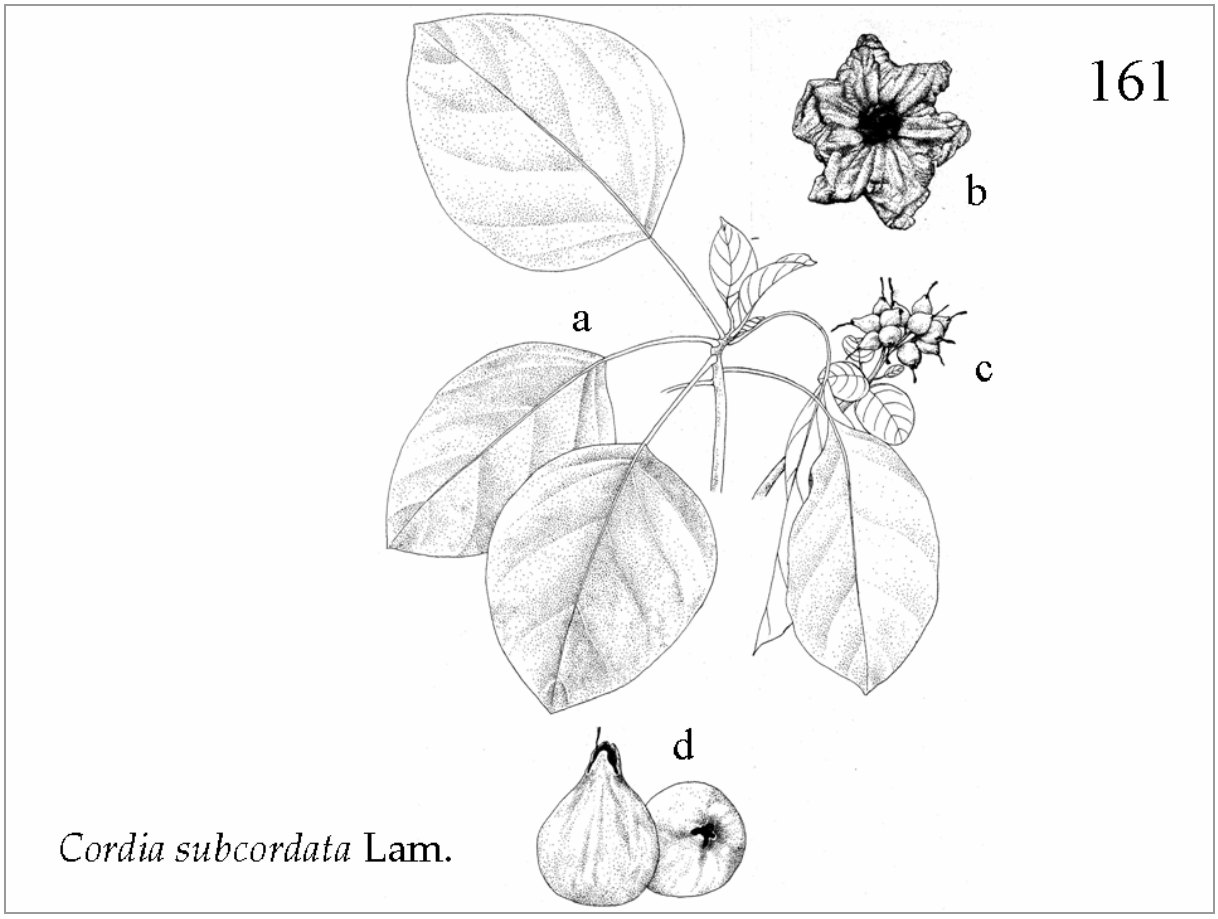

Fig. 161. *Cordia subcordata* Lam. (a) Terminal branch, (b) flower, (c) cluster of fruit, and (d) two fruits.

BORAGINACEAE

161

***Cordia subcordata* Lam.**

Synonyms : *Cordia banalo* Blanco, *Cordia moluccana* Roxb., *Cordia rumphii* Blume, *Novella nigra* Rumph.

Vernacular name(s) : Sea trumpet (E), Salimolé, Klimasada, Murmasada, Purnamasada, Bara laut, Kena, Ama, Nonwai tasi, Fala, Fana (Ind.), Balu, Alagot-ot (Phil.)

Description : Small tree, 2-6(-15) m tall, with a dense, round crown, bark brown or grey, shallowly and irregularly fissured and flaky. Usually low, with crooked branches emerging just above the ground. Branches grey to light brown, inner bark whitish, wood orange. Leaves are simple, alternate, thinly leathery, with a 2-8 cm long leaf stalk, blade ovate to elliptic, 5-15 by 8-20 cm, sometimes with a few small teeth along the edges, base usually rounded or heart-shaped, tip blunt or rounded, rarely pointed, with 4-5(-6) pairs of primary nerves on each side, upper side with shortly flattened hairs; on the underside a fine net-like pattern is discernible. Flowers are located at the end of branchlets, arranged in clusters of 6-20 flowers, each on a short 3-6 mm long stalk. Calyx cylindrical, 8-13(10-20) mm long, 4-8 mm wide, smooth or with a few short rigid hairs, and 3 short, triangular lobes that remain and eventually envelop the fruit. The corolla is large and trumpet-shaped, 3.5-5 cm long, clear orange or pinkish orange, the rounded lobes (5-)6-7 spreading out 2-3.5(-4.5) cm across; throat max. about 4 cm wide. Fruit an egg-shaped to nearly round nut, 20-30 mm long, 15-25 mm diameter, completely and tightly enclosed by the enlarged, thin-walled calyx; green, ripening yellow, with 4 cells embedded in a hard stone of irregular outline, the surface depressions being filled with tissue that is succulent when ripe, but turns corky as the fruit dries. Usually only 2(-3) cells develop and bear one seed each. Similar in habit to *Thespesia* and *Hernandra*, but the flower and fruit are unmistakeable.

Ecology : Strand flora tree. Sandy or gravely beaches, sandy, open woodland, beach forests and landward edges of mangroves. The corky, buoyant fruits are adapted for dispersal by ocean currents. Flowering has been recorded in June (southern China). Mangrove associate species.

Distribution : From the east coast of Africa (Tanzania) and the Indian Ocean (Madagascar, Comoros) through India to Southeast Asia, southern China (Hainan) and the Pacific Islands (Hawaii). In Southeast Asia is has been recorded in Cambodia, Vietnam, Thailand, the Philippines, Malaysia, Indonesia (Borneo, Java, Sulawesi, Lesser Sundas, Moluccas, Papua), East Timor and Papua New Guinea.

Abundance : Locally common.

Use(s) : Wood is highly decorative, tough and used for making rifle butts in the Moluccas; also used for house construction (highly durable, although small), and for medicinal purposes. Leaves used to treat stings and bites of fish.

Source of illustration : Ng (1989)

Reference(s) : Heyne (1950), Corner (1988), Ng (1989), Riedl (1997), Missouri Botanical Garden TROPICOS database (http://mobot.mobot.org), Flora of China (online).

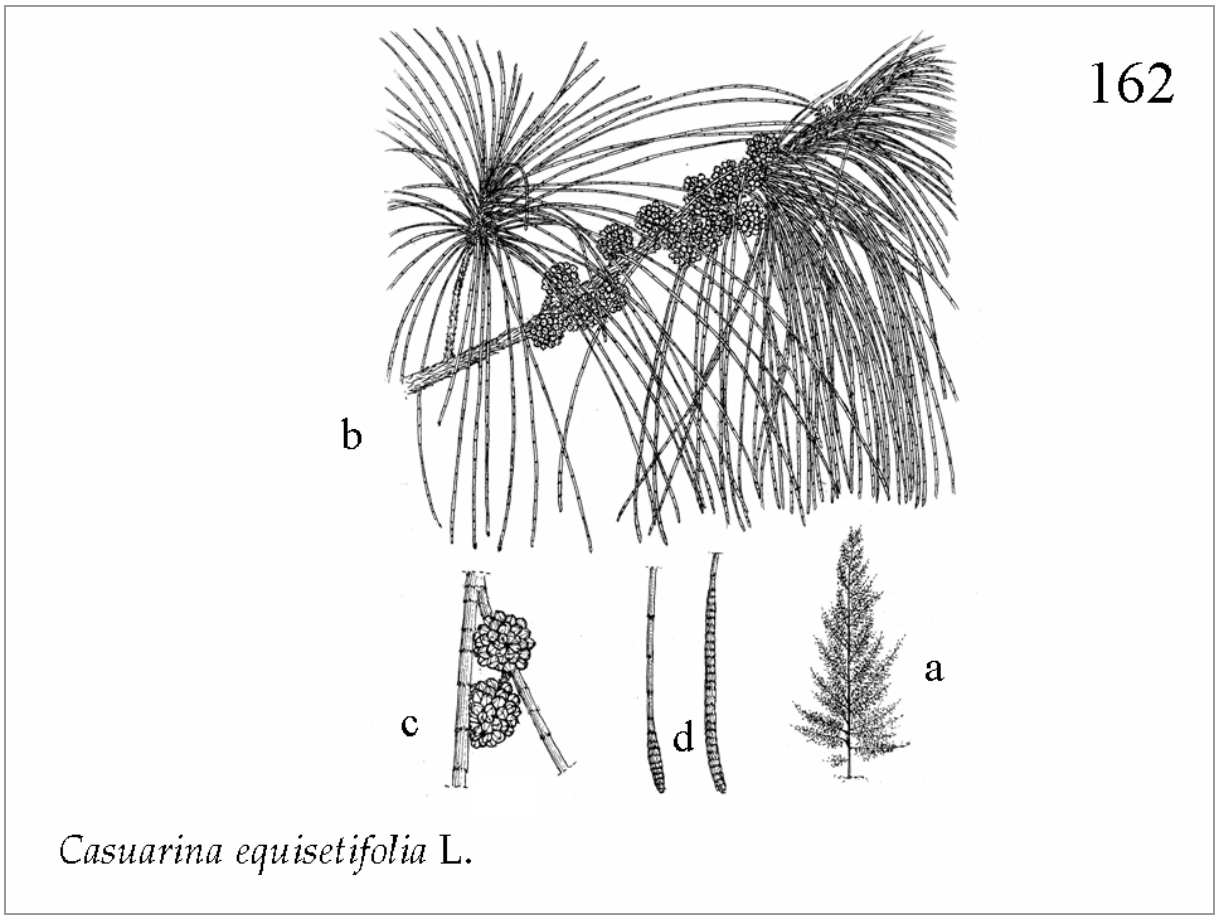

Fig. 162. *Casuarina equisetifolia* L. (a) Habit, (b) branch with female cones, (c) detail of female cone, and (d) male flower spikes.

CASUARINACEAE

162

***Casuarina equisetifolia* L.**

Synonyms : *Casuarina equisetifolia* J.R. & G. Forst., *Casuarina equisetifolia* subsp. *equisetifolia, Casuarina equisetifolia* subsp. *incana* (Benth.) L.A.S. Johnson, *Casuarina equisetifolia* var. *equisetifolia, Casuarina equisetifolia* var. *incana* Benth., *Casuarina equisetifolia* var. *microcarpa* F. Muell., *Casuarina litorea* L. ex Fosberg & Sachet, *Casuarina muricata* Roxb.

Vernacular name(s) : Horsetail, Coast She-oak, Australian oak, Whistling pine (E), Agoho (Phil.), Aru, Ru, Waru (Mal), Aru, Ru, Waru – *Cemara laut* (Ind.), Phi lao, Ho dâu (Viet.), Son thale (Thai.)

Description : Large tree, up to 50 metres tall and with a girth of up to 300 cm. Bark is brown, ridged and fissured, flaky in oblong pieces. Leaves reduced to tiny, pointed scales arranged in whorls of 6-10 (mostly 7-8) at the joints of the twigs; beginning with 2, then 4 leaf scales at the basal nodes of each needle twig. Greenish, needle-like young twigs give the tree the appearance of a conifer because of the absence of conspicuous (broad) leaves. Flowers unisexual, male and female flowers on separate trees; male flowers borne on 1.4-3 cm long terminal spikes on short, lateral branches; female flowers borne in dense, spherical cone-like heads on the twigs, and can be recognised by the reddish styles. Fruiting cones are cylindrical, woody, up to 1.8 by 1.5 cm, first green, then brownish. Bracts are persistent on the cone, opening up on maturity, releasing the small nuts. Four *Casuarina* species are native to lowland Southeast Asia, but only *Casuarina equisetifolia* occurs in coastal habitats. It can further be distinguished from the other species by its combination of mostly unbranched needle twigs (*Casuarina rumphiana* and *Casuarina sumatrana* are branched), that are very narrow (0.5 mm wide, while *Casuarina glauca's* needle twigs are 1-1.5 mm wide).

Ecology : Common on sandy coasts and low dunes, but also in sandy mangrove areas, in narrow belts on beach swales. Also commonly planted in inland areas. The species is very light demanding, and seedlings suffer if over-watered or kept under shade for too long. Growth is rapid. The roots have root nodules containing nitrogen-fixing bacteria. Needle-twigs have taken over photosynthesis from the greatly reduced and vestigial leaves. Flowers are wind-pollinated. Wide distribution owed to the ease with which cones are transported by the sea. Capable of flowering year- round and can produce tremendous numbers of small, winged seeds which are dispersed by wind. Mangrove associate species.

Distribution : Naturally occurring from the Bay of Bengal to the Pacific Islands and northeastern Australia; found throughout Southeast Asia. Introduced to many countries: arriving in India by 1868, 1900 in Florida, and before that in East and South Africa. It has been introduced to southern China, Yemen, Mauritius, the Seychelles, Hawaii, Caribbean islands and West Africa.

Abundance : Common along sandy coasts; rarely occurring in mangroves.

Use(s) : The timber is very heavy and hard, making excellent firewood and charcoal, but is otherwise lowly regarded, although timber is occasionally used as beams. Young trees may be trimmed to form a hedge, and they can reportedly be propagated by cuttings. All species of *Casuarina* are of outstanding ornamental value because of their plume like foliage of needle-twigs. Bark yields a good resin useful for tanning.

Source of illustration : Corner (1988)

Reference(s) : Khan & Huq (1972), Ng (1978), Afriastini (1988), Corner (1988).

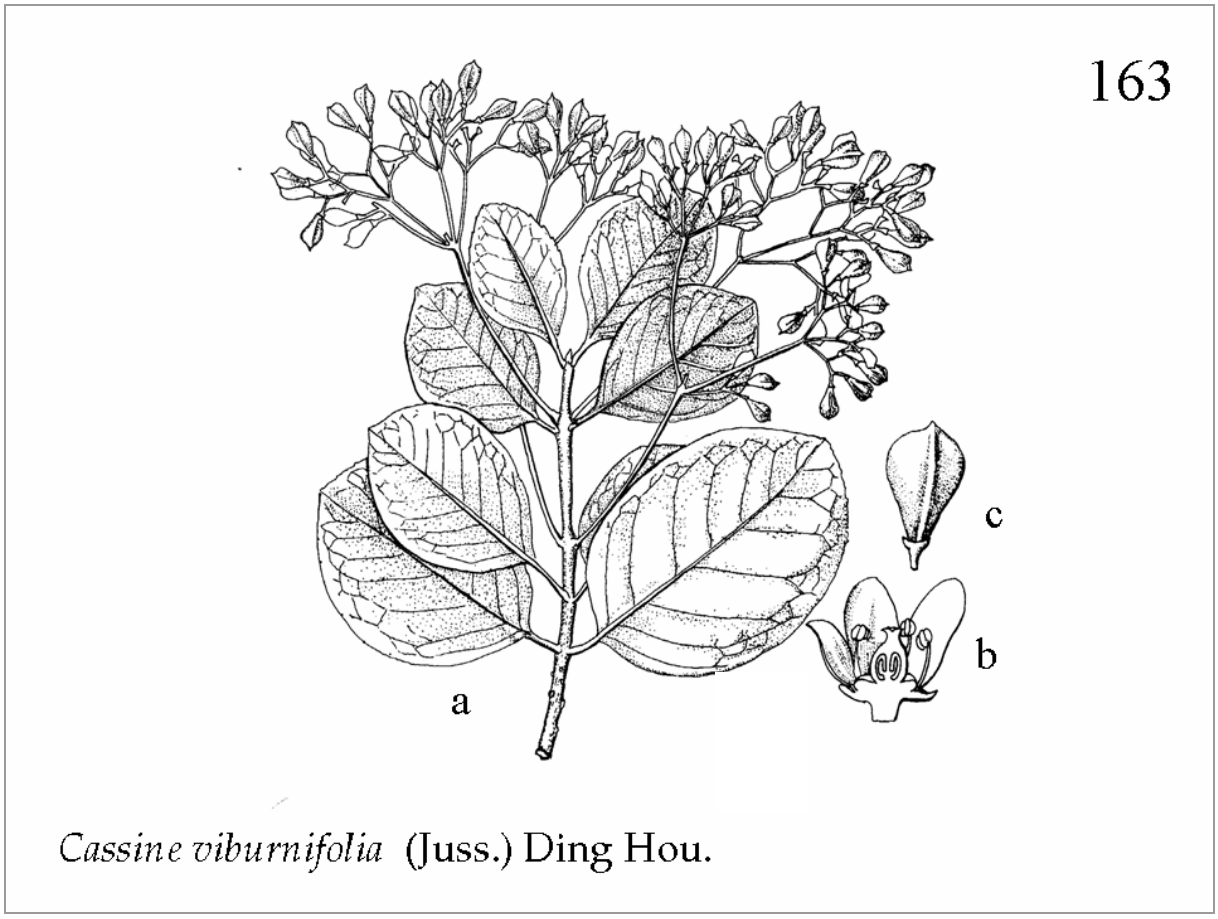

Fig. 163. *Cassine viburnifolia* (Juss.) Ding Hou. (a) Branchlet with fruit, (b) cross-section of flower, and (c) fruit.

CELASTRACEAE 163

***Cassine viburnifolia* (Juss.) Ding Hou**

Synonyms : *Aegiphila viburnifolia* Juss., *Euonymus cochinchinensis* Merr., *Euonymus viburnifolius* Merr., *Elaeodendron subrotundum* King., *Elaeodendron viburnifolium* Merr.

Vernacular name(s) : Barak Laut, Barat Barat, Landing-landing, Mempenai, Meta Pelandok, Rambai Laut (Ind.), Pungsu (Bru.), Jojo saffranhout (Phil.)

Description : A small tree or shrub, up to 10 m tall, with a smooth, grey bark. The short-stalked leaves are obovate, 4-10 by 2-6 cm, with a light green, shiny under surface and a slightly notched leaf edge that initially has glands in each notch. The long-stalked flower clusters are up to 11 cm across, and occur in axils of leaves and/or branches, mainly towards the ends of the branches. Each cluster has four or more white 4-merous flowers that measure 2-3 mm across; calyx and corolla are free. The somewhat corky, yellow berry is 1-seeded, narrowed at the base, and about 1 cm long; the style remains prominent at the tip of the fruit.

Ecology : Occurs in wet, coastal communities, including mangroves and along tidal rivers. According to Aragones *et al.* (1998) it occurs almost exclusively on the borders of mangrove forests. The fruit is adapted to water dispersal. Mangrove associate species.

Distribution : From Thailand and the Andaman Islands through Peninsular Malaysia, Singapore and Brunei to Indonesia (northern Sumatra, Kalimantan, Sulawesi) and the Philippines.

Abundance : Uncommon to rare.

Use(s) : The husk of the fruit is said to be used to stupefy fish. Firewood.

Source of illustration : Ding Hou (1962).

Reference(s) : Ding Hou (1962), Tomlinson (1986), Aragones *et al.* (1998).

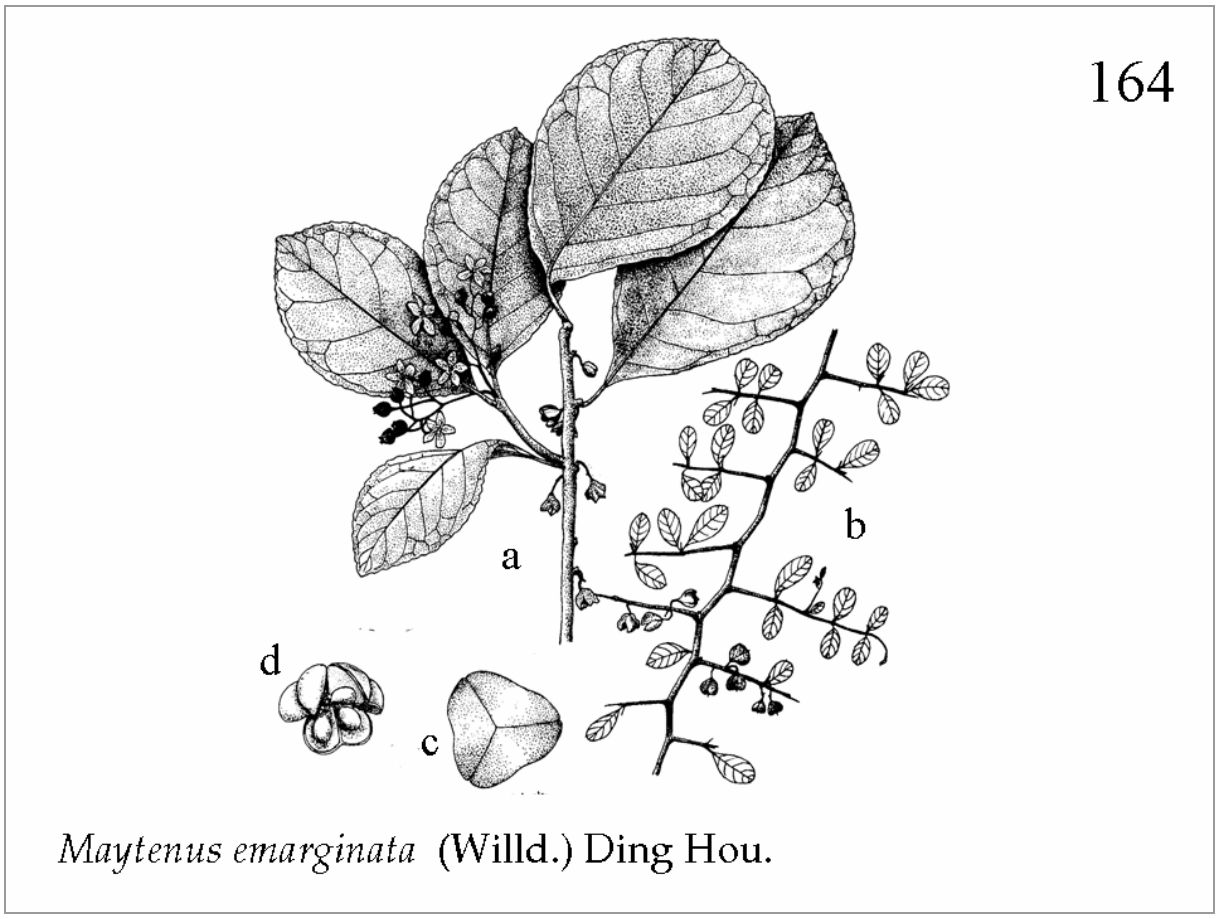

Fig. 164. *Maytenus emarginata* (Willd.) Ding Hou. (a) Branchlet with flowers, (b) branchlet with fruit, showing spines, (c) opened fruit, and (d) closed fruit.

CELASTRACEAE

164

***Maytenus emarginata* (Willd.) Ding Hou**

Synonyms : *Catha montana* G.Don., *Celastrus emarginatus* Willd., *Celastrus montanus* Roth., *Celastrus semiarillata* Turcz., *Cupania spinosa* Blanco., *Elaeodendron horizontale Turcz., Gymnosporia ambigua* Vidal., *Gymnosporia emarginata* Thw., *Gymnosporia inermis* Merr. & Perry., *Gymnosporia montana* Benth., *Gymnosporia spinosa* (Blanco) Merr. & Rolfe.

Vernacular name(s) : Unknown.

Description : Rigid, often spiny, erect shrub, up to 4 m tall. Its short shoots and/or axillary shoots terminate in a spine or are unarmed. The young parts sometimes have short, soft hairs. The papery to leathery leaves are usually obovate to almost spoon-like in shape, sometimes elliptic to elliptic-oblong, very rarely nearly round, and measure 2.5-14.5 by 1-9 cm. They often grow in bundles on short side-shoots. The leaf margin may be either distinctly wrinkled or entire. The flower clusters occur in axils and measure up to 3.5 cm across, and are either simple or occur in groups in the leaf axils. Flower clusters are sometimes crowded at the top of the short, axillary shoots. Each cluster has 2-7 flowers that are pale green and whitish along the margins, or are entirely white. The calyx lobes are sometimes sparsely bordered with fine hairs, 0.5 mm long. Petals measure 2-3.5 by 1-1.5 mm. The disk and ovary are green at first, later turning purple. The 3-valved fruits are broadly round, 10-12 by 8-9 mm. The 1-4 red, ellipsoid, leathery seeds are 2.5-3.5 by 2-3 mm, and bear a white, fleshy aril at the base, 2-2.5 mm long. The species is very variable, especially in its vegetative characters, probably due to variable environmental conditions. This accounts for the many synonyms.

Ecology : Occurs in dry thickets at low altitudes, in coastal areas directly behind beaches, or on the landward side of mangroves. Flowering occurs throughout the year. Mangrove associate species.

Distribution : From Sri Lanka throughout Southeast Asia to tropical Australia. In Southeast Asia recorded from the Malay Peninsula, the Philippines, Indonesia (throughout Java, Southeast Sulawesi, the Moluccas and Papua) and Papua New Guinea.

Abundance : Probably common.

Use(s) : Unknown.

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

Reference(s) : Ding Hou (1962), Backer & Bakhuizen van den Brink (1963-8).

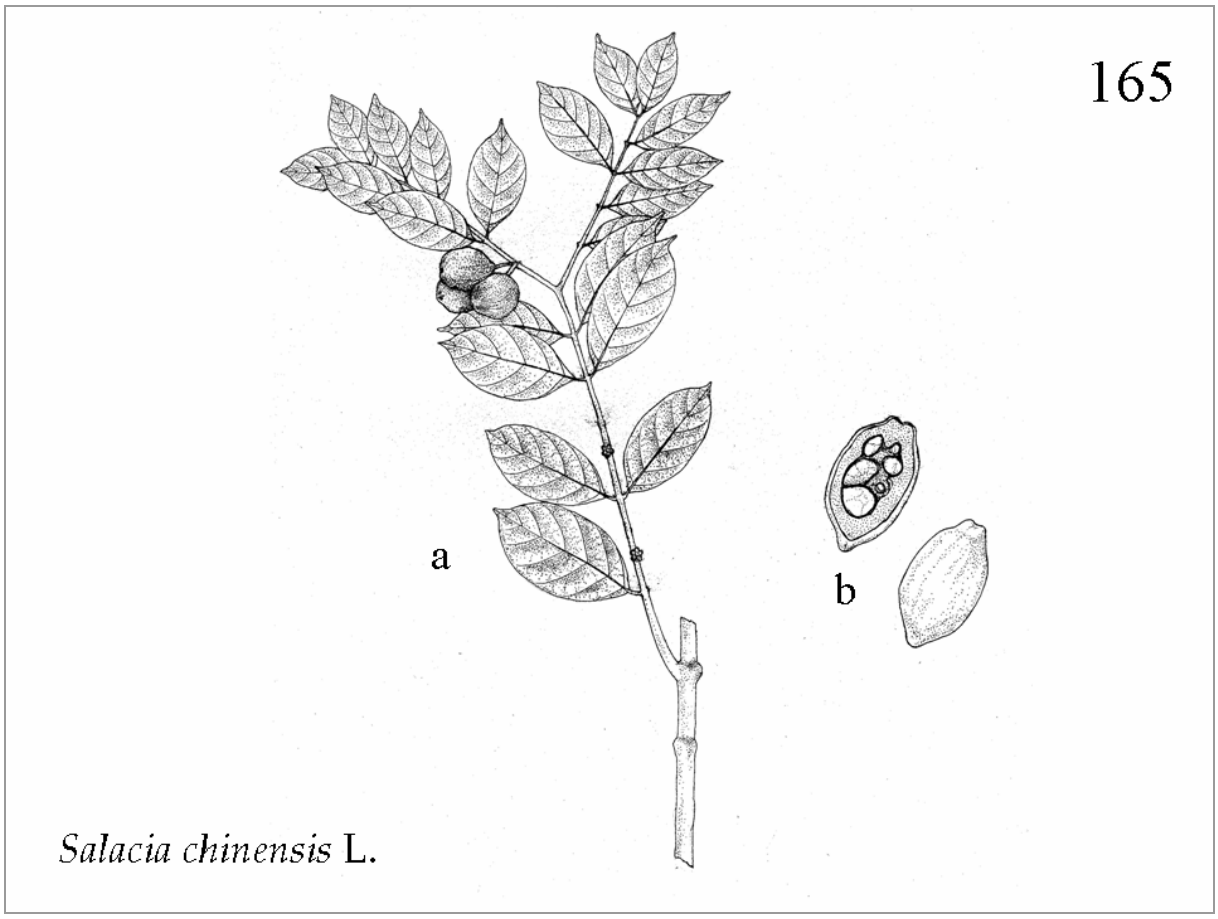

Fig. 165. *Salacia chinensis* L. (a) Fruiting and flowering branchlet, and (b) fruit.

CELASTRACEAE

165

***Salacia chinensis* L.**

Synonyms : *Comocladia serrata* Blanco, *Salacia kraemeri* (*non* Loes.) Kanehira, *Salacia latifolia* Wall., *Salacia littoralis* Back., *Salacia naumanni* Engl., *Salacia patens* Decne., *Salacia prinoides* D.C., *Salacia socia* Craib., *Tonsella chinensis* (L.) Spreng., *Tonsella prinoides* Willd.

Vernacular name(s) : Akan pelanduk, daun puyu (Ind.)

Description : Scandent shrub or liana (3-10 metres long), rarely a small tree. Leaflets at the base of the leaf stalk are triangular or kidney-shaped, <0.5 mm long. Leaves simple, opposite, ovate to broadly elliptic or obovate-oblong, 4-17 by 1.75-9.5 cm; tip pointed, and edge entire; 4-10 pairs of veins. Flowers yellowish or yellowish-green, numbering few to many, occurring in bundles on axillary twigs. Calyx lobes triangular, 0.5-0.7 mm long; petals broadly elliptic, ovate, obovate or rounded, 3-4 by 2.5-4 mm, blunt, with reddish-brown pigment in the tissue of the central part. Fruit round, sometimes broadly elliptic, 1.5-2 cm diameter, red to orange-red when ripe, usually containing one (to several) seeds. Seeds are round, 1-1.5 cm diameter.

Ecology : In coastal forests, sandy rivers banks, lowland rain forest up to 450 m asl. Also occasionally occurring in sandy mangrove forests. Mangrove associate species.

Distribution : From western India and Sri Lanka, to Hainan (PR China), Papua New Guinea, northern Australia and Fiji. Recorded throughout Southeast Asia, including Myanmar, Thailand, Peninsular Malaysia, Cambodia, Vietnam, Singapore, Philippines, Brunei, Indonesia (Sumatra, Kalimantan, Java, Lesser Sundas, Moluccas, Papua), East Timor and Papua New Guinea.

Abundance : Widely distributed but scattered; on the whole relatively common.

Use(s) : Fruit is edible and reportedly sweet. Stems used for binding material (esp. fencing), and leaves are boiled to a paste and used to treat skin disorders. Used in traditional herbal medicine, and has been found to contain a host of active compounds (roots found to contain di-ketones, fatty matter, rubber, dulcitol, etc…), including ingredients for treating diabetics. Anti-diabetic properties have been confirmed by clinical trials. Also used to treat venereal diseases. Fruit used as food in northern Australia and Papua.

Source of illustration : British Museum; from an album of 40 water colour drawings of plants made by Chinese artists at Bencoolen (Bengkulu), Sumatra, for Sir Stamford Raffles.

Reference(s) : Heyne (1950), Ding Hou (1964), Anon. (2001), Yoshikawa *et al.* (2003), Hardwick (2004), database Netherlands National Herbarium (http://www.nationaalherbarium.nl/virtual/).

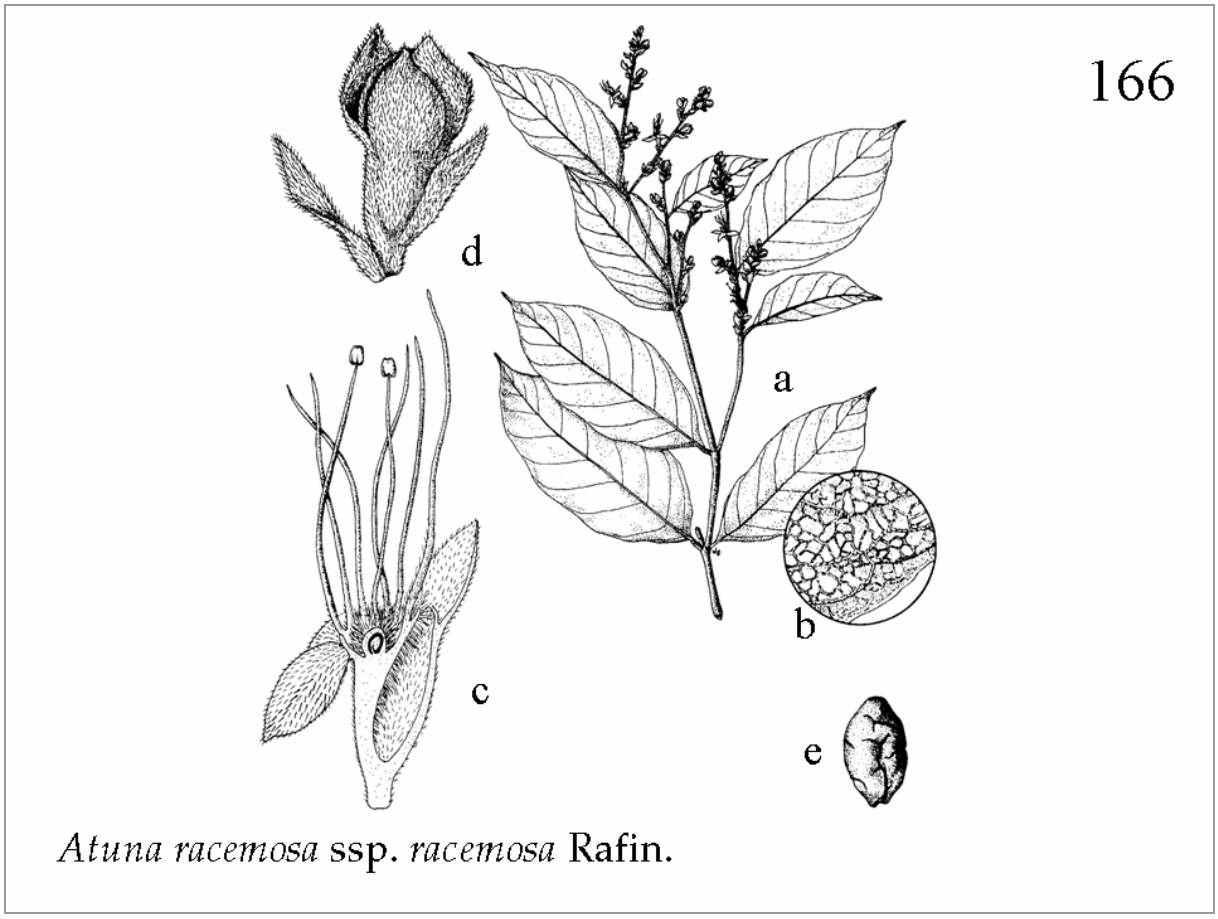

Fig. 166. *Atuna racemosa* ssp. *racemosa* Rafin. (a) Branchlet with flowers, with (b) detail of leaf lower surface (inset) (c) cross-section of flower, (d) flower bud, and (e) fruit.

CHRYSOBALANACEAE

166

***Atuna racemosa ssp. racemosa* Rafin.**

Synonyms: *Atuna alba* Rumph., *Atuna elata* (King.) Kosterm.., *Atuna scabra* (Hassk.) Kosterm., *Cyclandophora elata* (King.) Kosterm., *Cyclandrophora glaberrimima* Hassk., *Cyclandrophora scabra* (Hassk.) Kosterm., *Ferolia glaberrima* (Hassk.) O. Ktze., *Ferolia scabra* (Hassk.) O. Ktze., *Parinarium amboinense* Teijsm. & Binn., *Parinarium curranii, Parinarium elatum* King., *Parinarium glaberimmum* Hassk., *Parinarium hahlii* Warb., *Parinarium lanceolatum* Teijsm., *Parinarium laurinum* A. Gray., *Parinarium macrophyllum* T. & B., *Parinarium margarata* A. Gray, *Parinarium mindanaense* Perk., *Parinarium scabrum* Hassk., *Parinarium warburgii* Perk. *ex* Merr., *Petrocarya glaberrima* (Hassk.) Miers., *Petrocarya scabra* (Hassk.) Miers..

Vernacular name(s): Jangon, Membatu (Mal.), Kisokka, Belibu, Senumpol, Lomo (Ind.), Aluma, Botabon, Butabul, Getabon, Botga, Tabon-tabon (Phil.), Asikua, Asista, Saki, Bata-bata, Latita (PNG).

Description: Large trees, up to 45 m tall, often with a fluted trunk. Young branches are smooth. Leaves are leathery, alternate, broadly ovate, elliptic, oblong or even lanceolate, measuring 10-25 cm (occasionally 35 cm) by 3.5-11 cm, smooth on both surfaces when mature and with a long, pointed tip. Primary leaf veins occur in 10-13 pairs. Leaf stalks are thick and 3-7 mm long. Leaflets at the base of the leaf stalk do not easily detach, are stiff and up to 20 mm long. Flowers occur in clusters in the axils. The main flower stalk is 5-15 cm long, while secondary stalks are covered with soft hairs. Leaflets at the base of the flower stalk are ovate and up to 8 mm long. Individual flower stalks are 0.5-1 mm long, and the whole flower measures 10-17mm. Calyx lobes are 4-7 mm long and densely hairy on both sides. Petals are up to 10 mm long, and either bluish or white. Stamens number 15-20 and are pale blue. The ovary is densely hairy, while the stigma is small. Fruit is ellipsoid to round, up to 7.5 cm in diameter, with a brittle texture on the outside.

Ecology: Usually occurs in well-drained lowland forest or hill forest up to 600 m, but it also occurs in freshwater swamp forest, brackish water swamps and mangroves. Note: the closely related species *Atuna racemosa* ssp. *excelsa* (Jack.) Prance occurs in well drained lowland forests: leaves of this species are much smaller, being only 4.5-12 cm long. Mangrove associate species.

Distribution: A wide-ranging species found from Southeast Asia to the Pacific. In Southeast Asia it has been recorded from Thailand, Malay Peninsula, Singapore, the Philippines, Brunei, Indonesia (Sumatra, Kalimantan, Sulawesi, Ambon, Ternate, Ceram and Papua) and Papua New Guinea.

Abundance: Probably relatively common.

Use(s): The fruit is grated and widely used in the Pacific Islands for producing a putty for caulking canoes. Timber is used for domestic construction, but is not of good quality. Seeds are grated and mixed with fish, ginger, lime and other spices as a snack. Paste made from seeds is applied to stop wood rot. Seeds contain 31% oil.

Source of illustration : Based on Prance (1989).

Reference(s): Heyne (1950), Prance (1989).

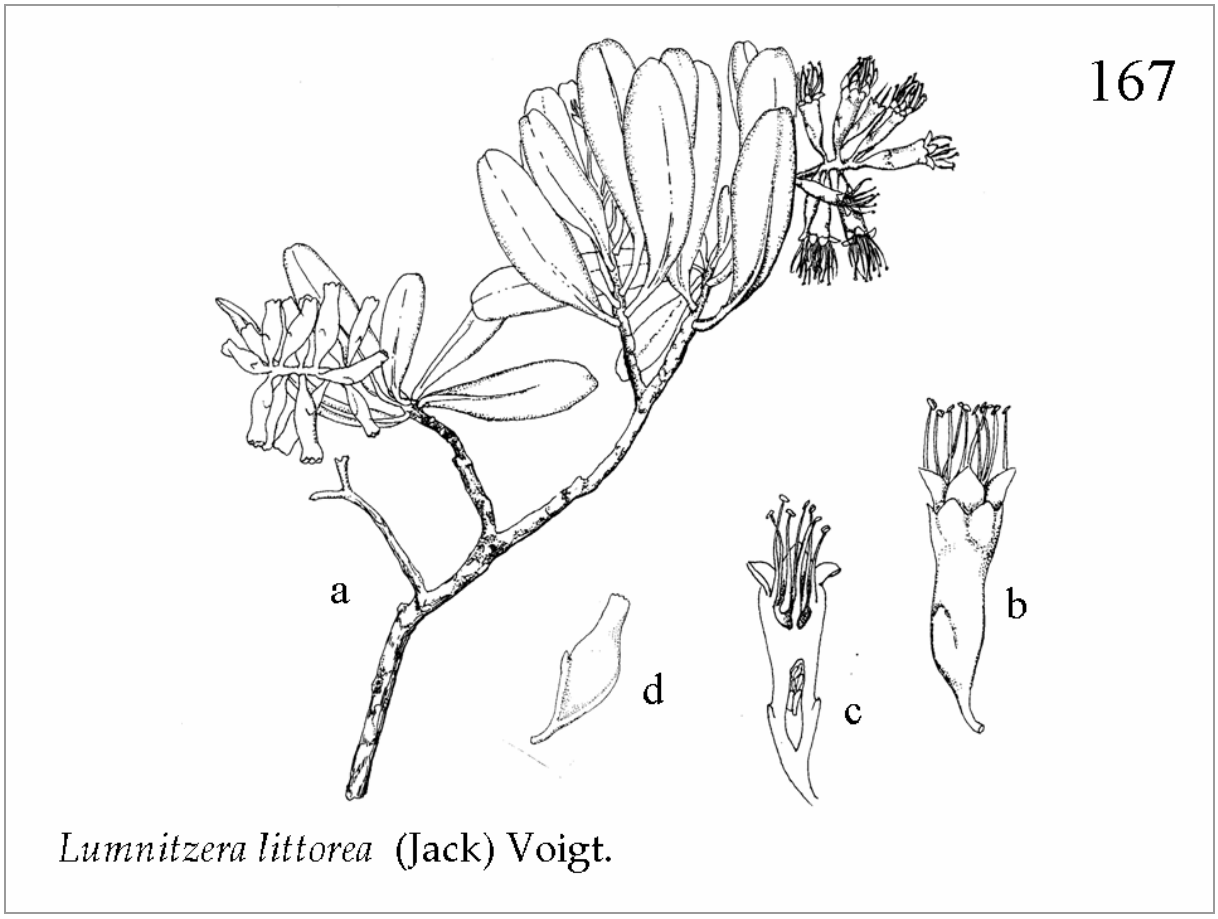

Fig. 167. *Lumnitzera littorea* (Jack) Voigt. (a) Branchlet with flowers (right) and fruit (left), (b) flower, (c) cross-section of flower, and (d) fruit.

COMBRETACEAE

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***Lumnitzera littorea* (Jack) Voigt.**

Synonyms : *Laguncularia purpurea* Gaud., *Lumnitzera coccinea* W. & A., *Lumnitzera purpurea* Presl., *Petaloma coccinea* Blanco, *Problastes cuneifolia, Pyrrhanthus littoreus* Jack.

Vernacular name(s) : Teruntum (-Merah) (Mal.) Api-api Uding, Sesop, Sesak, Geriting, Randai, Riang Laut, Taruntung, Duduk Agung, Duduk Gedeh, Welompelong, Posi-posi, Ma Gorago (Ind.), Agnaa, Aguia Anilai, Bakting, Banting, Bating, Bulokbulok, Dalunu-babae, Dulok-dulok, Kalapini, Karifurong, Kulasi, Libato, Libatu-pula, Linas, Magalolo, Maoro, Panting-panting, Papasil, Sagasa, Salasa, Santing, Supsupun, Talau – *Tabau* (Phil.), Cóc dó (Viet.), Faad daeng, Fat (Thai.), Krognyep krohom, Krognyep-pka-krohom (Camb.)

Description : A spreading, evergreen tree, up to 25 m tall, but usually smaller, with slender, knee-shaped pneumatophores and dark brown, longitudinally fissured bark, and a trunk with a diameter at breast height of up to 50 cm. The slightly fleshy, leathery leaves are narrowly obovate-elliptic, measuring 2-8 by 1-2.5 cm, and are usually crowded towards the end of the twigs. The leaf stalk is up to 5 mm long. The bisexual, red flowers occur in a terminal cluster, are strongly scented, abounding in nectar. The flower stalk is up to 3 mm long, and stamens are twice as long as the petals. The persistent calyx tube is slightly compressed, 8-12 mm long, bearing two 1 mm-long ovate leaflets at the base. Calyx lobes are broadly ovate, 1 mm long. The elliptic, smooth corolla lobes measure 4-6 by 1.5-2 mm. The ellipsoidal, somewhat corky fruit is slightly compressed and ribbed, measuring 9-20 by 4-5 mm.

Ecology : Prefers a soft, muddy substrate at the landward margin of mangroves, where tidal inundation is rare. It also occurs along waterways that have a permanent and strong input of freshwater. Flowering occurs all year round. Nectar production, flower colour, morphology and location suggest bird pollination. The corky, buoyant fruit is well suited to water dispersal. Though occurring throughout Malaysia and Indonesia, *Lumnitzera littorea* and *Lumnitzera racemosa* practically exclude each other in habitat and have never been collected in exactly the same stand. The exact cause of this different ecological behaviour is not yet known. Mangrove species.

Distribution : From East Africa through tropical Asia; throughout Southeast Asia to northern Australia and Polynesia. In Southeast Asia recorded in Myanmar, Cambodia, Thailand, Vietnam, Malaysia, Singapore, the Philippines, East Timor, Brunei, Indonesia and Papua New Guinea. In Indonesia, apparently absent or very rare on the coasts of the Java Sea.

Abundance : Locally abundant, and occasionally occurring gregariously.

Use(s) : The timber is valued for its extreme durability. The wood is reportedly free from decay after 50 years submersion in salt water, especially when the bark is not removed; uased for bridges, wharves, cart axles, flooring and sleepers. A rose-like scent and its attractive appearance enhance its suitability as a cabinet timber. However, large-sized timber is rare.

Source of illustration : Based on Percival & Womersley (1975).

Reference(s) : Exell (1954), Backer & Bakhuizen van den Brink (1963-8), Wightman (1989), Aksornkoae (1993), Aragones *et al.* (1998), Ng & Sivasothi (1999), Marschke (2000).

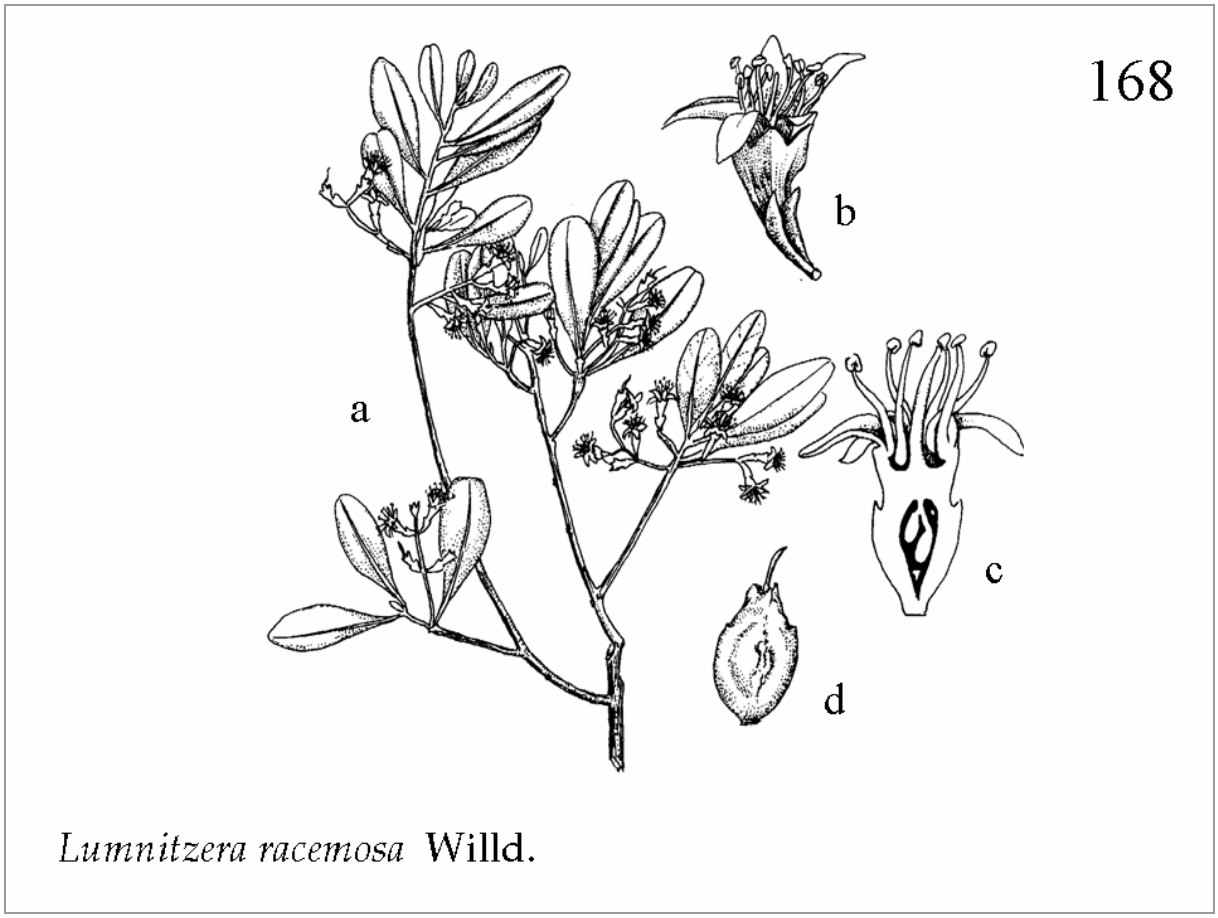

Fig. 168. *Lumnitzera racemosa* Willd. (a) Flowering branchlet, (b) flower, (c) cross-section of flower, and (d) fruit.

COMBRETACEAE

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***Lumnitzera racemosa* Willd.**

Synonyms : *Languncularia rosea* Gaud., *Lumnitzera racemosa* var. *lutea* Gaud., *Lumnitzera racemosa* var. *pubescens* Koord. & Vahl., *Lumnitzera racemosa* var. *racemosa* Willd., *Lumnitzera rosea* Presl., *Petaloma alba* Blanco

Vernacular name(s) : Api-api Balah, Duduk Laki-laki, Api-api Jambu, Teruntum, Adu-adu, Duduk, Knias (Ind.), Agnaya, Kulasi, Solasi, Tabao – *Kulasi* (Phil.), Cóc trâ'ng (Viet.), Faad khao, Fat (Thai.), Krognyep sor, Krognyep-pkasor (Camb.)

Description : Evergreen shrub or small tree, up to 8(-9) m tall, with a reddish-brown, longitudinally fissured rough bark, and without pneumatophores. Young branchlets are reddish or grey, sometimes slightly hairy at first, later smooth. The slightly fleshy, leathery leaves are narrowly obovate, 2-10 by 1-2.5 cm, and have a small notch at the tip. Leaves are crowded towards the ends of twigs and have a leaf stalk of up to 10 mm. The bisexual, stalkless white flowers occur in a clusters located in the axils, 2-7 cm long. Flowers are weakly scented, but abound in nectar and have five petals. The persistent calyx tube is strongly compressed, 6-8 mm long, and bears two broadly-ovate, 1.5 mm-long leaflets at the base. The occasionally gland-tipped calyx lobes are broadly ovate and 1 mm long. The elliptic corolla lobes measure 4 by 2 mm. Stamens 10, and are as long as, or extend slightly beyond the petals. The ellipsoidal, fibrous and woody fruit is distinctly compressed, measuring 10-12 by 3-4 mm. Though occurring throughout Malaysia and Indonesia, *Lumnitzera littorea* and *Lumnitzera racemosa* practically exclude each other in habitat and have never been collected in exactly the same mangrove stand. The exact cause of this different ecological behaviour is not yet known. Gland-tipped calyx lobes are to be found in Papua, Papua New Guinea and the Philippines.

Ecology : Occurs on the landward fringe of many mangrove vegetations, usually prefering sandy portions. A substrate of consolidated mud is preferred. It also occurs along waterways with a distinct freshwater influence. The white, slightly scented and nectar-rich flowers are pollinated by insects. The fibrous fruit is adapted to water dispersal. Mangrove species.

Distribution : From eastern tropical Africa and Madagascar, through South Asia to Malaysia, throughout Southeast Asia, to southern China, northern Australia and Polynesia. In Southeast Asia it is almost absent from shores facing the Indian Ocean.

Abundance : Rather common.

Use(s) : The timber is hard and durable, and therefore is suitable for many construction purposes such bridges, ship building, furniture and so on. The dimensions are even smaller than in *Lumnitzera littorea*, so large timber is scarce. The bark is sometimes used for tanning purposes. Good firewood.

Source of illustration : Based on Exell (1954) and Wightman (1989).

Reference(s) : Exell (1954), Backer & Bakhuizen van den Brink (1963-8), Wickens (1973), Wightman (1989), Aksornkoae (1993), Aragones *et al.* (1998), Marschke (2000).

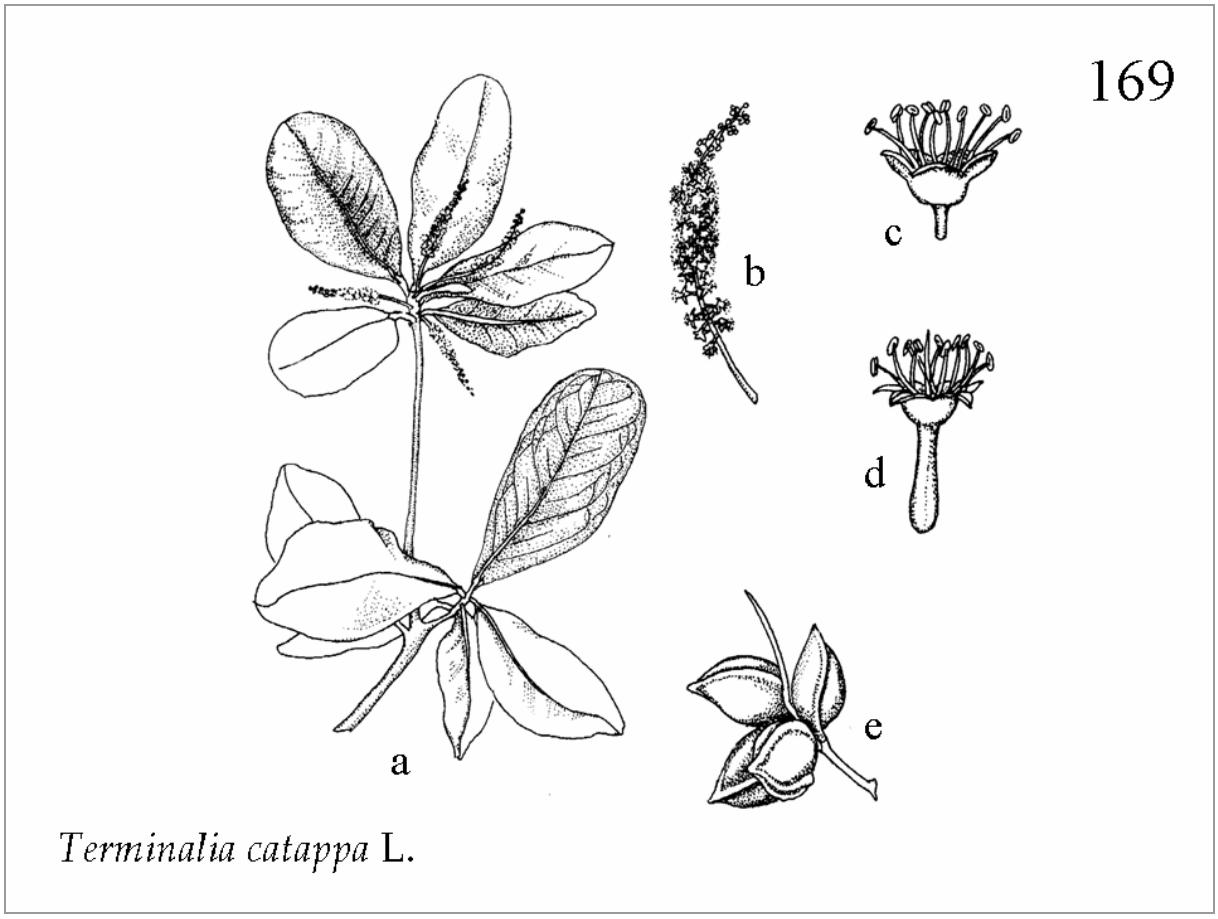

Fig. 169. *Terminalia catappa* L. (a) Branchlet with cluster of flowers, (b) raceme of flowers, (c, d) flowers, and (e) group of fruits.

COMBRETACEAE

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***Terminalia catappa* L.**

Synonyms : *Myrobalanus catappa* Kuntze, *Terminalia catappa* var. *chlorocarpa* Hassk., *Terminalia catappa* var. *macrocarpa* Kassk., *Terminalia catappa* var. *rhodocarpa* Hassk., *Terminalia latifolia* Blanco, *Terminalia mauritiana (non* Lamk.) Blanco, *Terminalia moluccana* Lamk.

Vernacular name(s) : Indian or Singapore Almond (E), Ketapang (Mal.), Beowa, Kilaula, Ketapas, Klihi, Lisa, Wewa, Sabrise, Sarisei, Talisei, Dumpajang, Luumpoyang, Sadina, Sarisa, Sirisal, Lisa, Tasi, Klis, Tiliho – *Ketapang* (Ind.), Talisai, Almendras, Almendro (Phil.), Kalis, Kris, Runge (PNG), Hu kwang (Thai.)

Description : Medium-sized to tall tree, 10-35 m tall. Deciduous, leaves shed twice a year (in Java, Indonesia), turning (orange-)reddish before dropping, giving the tree a colourful appearance. Young branchlets are thickened and densely covered with hairs that are later shed. The crown of the tree is horizontally layered, a phenomenon which is particularly conspicuous in younger trees. Leaves are spirally arranged, typically oval-obovate, 8-25 by 5-14 cm. Leaves usually with 6-9 pairs of widely-spaced veins, and with a gland located on either side of the base of the midrib. Flowers are white or pale green, stemless, and occur in 8-16 cm-long clusters located in the axils. The majority of the flowers are male, either without, or with a very short style. Calyx lobes are smooth inside. The stalk of the flower cluster is covered with soft hairs. Fruit is 2-angular, somewhat flattened, 5-7 cm by 4-5.5 cm, hard, green, and later turning dark red.

Ecology : Occurs on sandy or rocky beaches and on the landward margin of mangroves. Usually below 100 m asl, but may occur up to 800 m asl. – often planted in gardens as an ornamental or shade tree. Dispersal of fruit occurs via fruit eating bats, monkeys and by water. Trees shed their leaves all at once, usually twice a year (in Java, January or February and July or August), with leaves colouring vivid (orange-)red. Mangrove associate species.

Distribution : Occurs from tropical Asia through Southeast Asia to northern Australia and Polynesia. In Southeast Asia it occurs throughout, but is rather rare on Sumatra and Borneo.

Abundance : Common, often dominating the beach vegetation.

Use(s) : Often planted as a shade-tree. The timber is reddish and of good quality, being used for house- and boat building and planks. The kernel of the fruit is edible and contains a colourless, fatty oil similar to almond oil. Tannin of the bark used as an astringent to treat dysentery, and for tanning leather. Leaves are applied to treat rheumatic joints.

Source of illustration : Excell (1954).

References : Excell (1954), Backer & Bakhuizen van den Brink (1963-8), Sastrapradja *et al.* (1980), Afriastini (1988).

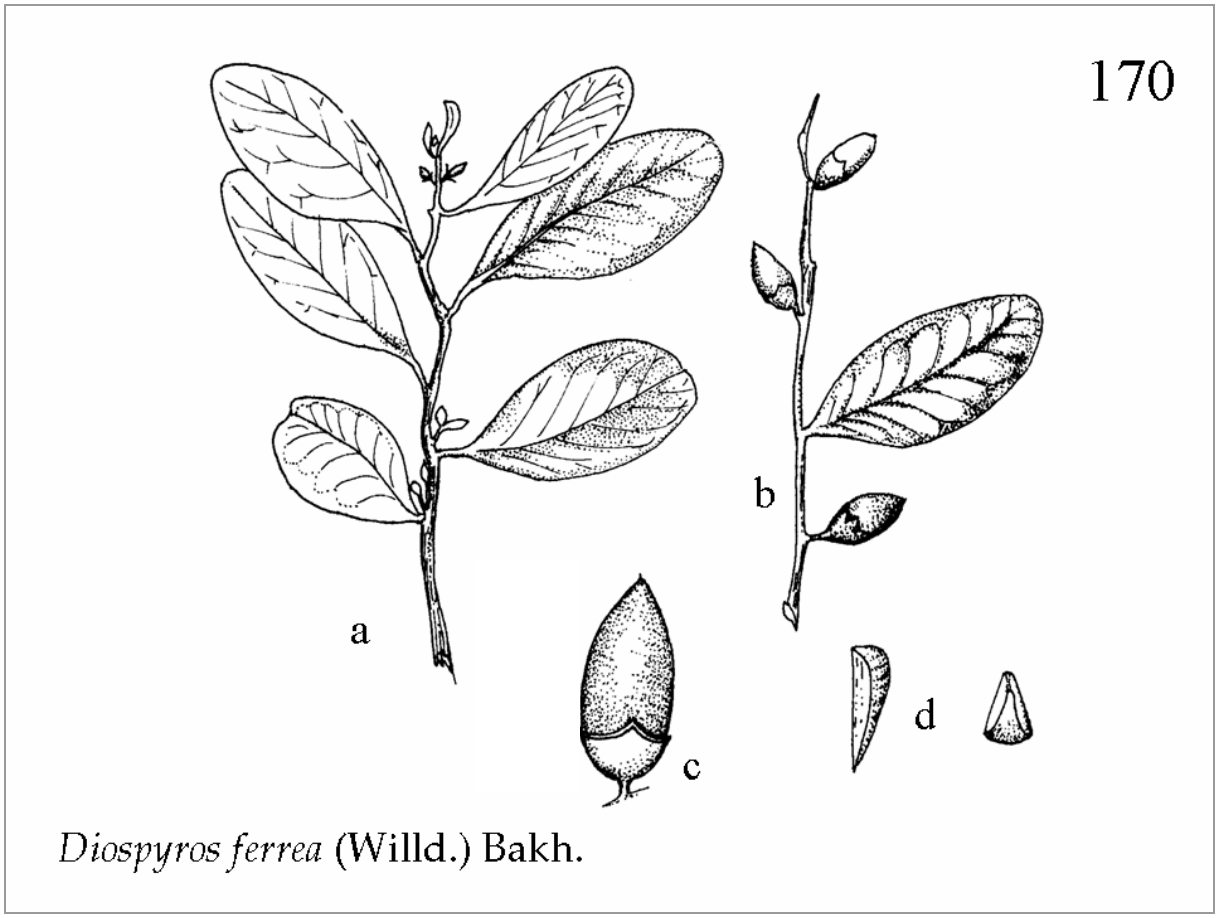

Fig. 170. *Diospyros ferrea* (Willd.) Bakh. (a) Branch with buds, (b) fruiting branch, (c) fruit, and (d) seed, seen from side and end.

EBENACEAE

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***Diospyros ferrea* (Willd.) Bakh.**

Synonyms : *Diospyros abyssinica* (Hiern.) F.White, *Diospyros ferrea* var. *buxifolia* (Rottb.) Bakh., *Diospyros ferrea* var. *littorea*, *Diospyros ferrea* var. *guineensis* (Schumach. & Tonn.) Bakh., *Diospyros ferrea* var. *reticulata*, *Diospyros ferrea* var. *madagascarensis* (A.DC.) Bakh., *Diospyros littorea* (R.Br.) Kostermans, *Ebenus buxifolius* (Rottb.) Kuntze, *Ebenus parvifolius* Rumphius, *Ehretia ferrea* Willd., *Ferreola guineensis* Schumach. & Tonn., *Maba buxifolia* (Rottb.) Juss., *Maba buxifolia* Pers., *Maba ebenus* Spreng., *Maba ferrea* (Willd.) Aubév., *Maba guineensis* (Schumach. & Thonn.) A.DC., *Maba madagascarensis* A.DC., *Maba smeathmannii* A.DC., *Pisonia buxifolia* Rottb.

Vernacular name(s) : Sea ebony, Philippine ebony (E), Sechirik laut (Mal.), Batulinao (Phil.), Lambit thale (Thai)

Description : Small tree, up to 15(-25) m tall, occasionally multi-stemmed and procumbent, with a mottled charcoal grey to black, smooth to scaly bark, (rarely) with finger-like pneumatophores. Trunk up to 60 cm diameter; branches greyish, covered with hairs. The plant is dioecious, with male and female flowers occurring on different individual trees. Leaves are narrowly elliptic to oblong-elliptic, with a somewhat dull upper surface and an inconspicuous net-like venation, measuring 6-25(-45) mm by 36-65(-95) mm. The leaf tip is blunt, sometimes notched, while the leaf stalk is very short (4-5 mm) or absent. Flowers are white or pale yellow. Male flowers are borne in clusters located in the axils, usually in groups of (1-)3. The calyx is 3-lobed, 4 mm long and loosely attached to the 6 mm long, also 3-lobed corolla, which is covered with dense, soft hairs. The female flowers are without stalk and solitary, occurring in axils, and resemble the male flowers. The orange-red to purple (when ripe) berry is oval-elliptic, 8-10 (15) mm across, and occurs solitary; may be either covered with short hairs or smooth. The calyx-cup is still present on the fruit, as its lobes surround the berry, but are not attached to it. The (1-)3-5(-6) dark brown to almost black, wrinkled seeds are semi-circular and wedge-shaped, 3.5 by 8 mm. Often recorded in mangroves under the synonym *D. littorea.*

Ecology : Occurs on the landward margin of mangroves. It is a coloniser of sandy and muddy substrates, but also occurs in monsoon vine forests, evergreen broadleaved forests, and in coastal, non-mangrove vegetation. From 0-500 m asl. In Australia, flowering occurs from October to December, while fruit may be found throughout the year, peaking in November to May. In southern China fruiting occurs in September. Flowers are pollinated by insects, but relatively few flowers mature into fruit. Reportedly common on rocky and sandy sea coasts, in the *Terminalia* (beach) zone, in mangroves, and on limestone hills. Mangrove associate species.

Distribution : Occurs from West Africa through India to Taiwan, Japan, Australia and Polynesia. In Southeast Asia recorded in Myanmar, Thailand, Cambodia, Vietnam, the Philippines, Malaysia (Peninsular), Indonesia (throughout, except Borneo) and Papua New Guinea.

Abundance : Widespread and common along coasts, rarer inland.

Use(s) : Wood can be very dark, and is used for furniture, handles of knives and so on, but may cause skin irritation during processing. Wood may be ground to a fine paste and used to treat an upset stomach. In the Philippines it is regarded as an ornamental and cultivated for sale (in bonsai form) to Taiwan. In Taiwan, wood is used for walking sticks & ornamental carvings.

Source of illustration : Based on Wightman (1989).

Reference(s) : Heyne (1950), Ng (1978), Tomlinson (1986), Corner (1988), Wightman (1989), Aksornkoae (1993), Yao (2000), Flora of China vol.15 p.234.

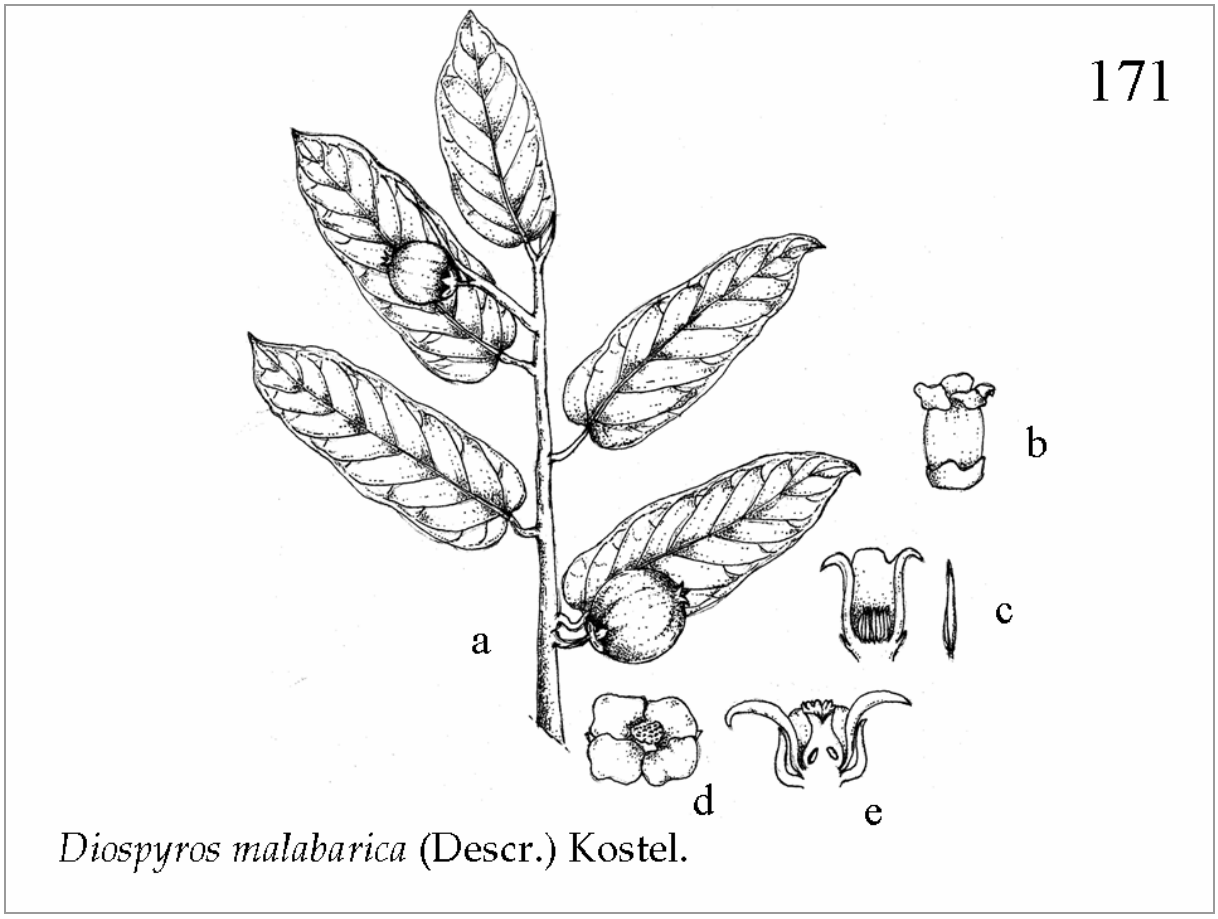

Fig. 171. *Diospyros malabarica* (Descr.) Kostel. (a) Fruiting branch, (b) male flower, (c) longitudinal section of male flower showing stamens, and individual stamen, (d) female flower, and (e) longitudinal section of female flower showing stigma and embryo.