

TAXONOMIC STUDIES ON INDIAN GUTTIFERAE

I. THE GENUS *CALOPHYLLUM* L.

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ABSTRACT

This revision of the genus *Calophyllum* L. is precursory to the treatment of the family of Guttiferae as occurring in India. No particular attention was paid of late years to this important timber plant in India. It was, therefore, thought necessary to undertake taxonomic their studies on the genus.

Nine species occur in India, of which three are restricted to the Andaman and Nicobar Islands. The rest occur in Southern and Eastern India. These are described in detail and their synonymy, distribution, uses, vernacular names, etc. are ascertained.

The nomenclature of plants have been adjusted to the latest findings in botanical literature, and aims to be completely in accordance with the 1956 edition of the International Code of Botanical Nomenclature. For one species of *Calophyllum*, viz., *C. apetalum* Willd. (Syn. *C. wightianum* Wall. ex Pl. et Tr.), Wallich 4847 (in Herb. Calc.) is selected as the neotype of the species. This is done in accordance with the provisions of Article 7 of 1956 edition of the Code.

The present treatment of the genus differs in some respects regarding the circumscription of species, from that of T. Anderson (1874) in the Flora of British India. T. Anderson has united *C. amoenum* Wall. with *C. retusum* Wall., and *C. elatum* Bedd. with *C. tomentosum* Wight. However, a careful study leads me to conclude that these species should be kept separate and of these only *C. amoenum* Wall., and *C. elatum* Bedd. occur in India. The details are discussed in this paper.

Introduction

This revision of the genus *Calophyllum* L. is precursory to the treatment of the family of Guttiferae as occurring in India. The Guttiferae of India has been studied by Choisy (1851); this was followed by a fuller and more exhaustive treatment of the family on a world-basis by Planchon et Triana (1861-1862), and by Vesque (1893). Engler (1925) has summarised the family in light of previous works, besides adding some useful and vital information. Although, these classics will, for many years to come, form the basis of subsequent works, there is still room for modest compilations and revisions which will meet the needs of those who are interested in the flora of a restricted area. Worthy to mention here is the revision of the genus *Calophyllum* L., as occurring in Malaysia, by Henderson et Wyatt-Smith (1956). No particular attention was paid of late years to this genus in India. Further, the Indian *Calophyllums* are well known in the timber circles under the trade name "Poon" and they form a valuable range of structural timbers of the first class. Being strong for their weight, they are worthy of the notice of engineers and architects. It was, therefore, thought necessary to undertake taxonomic studies on this important guttiferan genus, belonging to the Old World tropics. Also, the pursuit of cytological and embryological studies on the genus would furnish an advantageous subject for workers interested in tropical botany.

The name *Calophyllum* is derived from the Greek word *Kalon*, beautiful, and *Phyllon*, a leaf, alluding to

the elegantly veined leaves. It was founded by Carl Linnaeus in the Genera Plantarum (ed. 1), 154, in 1737. In the pre-Linnean days, the genus has masqueraded under the names *Calaba*, *Inophyllum*, *Kalophyllodendron* etc. Although, Linnaeus (in Species Plantarum (ed. 1), 513, 1753) had accepted the name *Calophyllum* for this group of plants, they (or a section of them) were also known in post-Linnean botany as *Balsamaria* Lour., *Apoterium* Blume, *Lamprophyllum* Miers., etc. However, the genus *Calophyllum* Linn. is now well-defined and unanimously adopted. In a subdivision of the family Guttiferae, Engler (1925) has placed *Calophyllum* under subfamily—*Calophylloideae*; tribe—*Calophylleae*, to which besides *Calophyllum* belong *Mesua*, *Mammea*, *Ochrocarpus*, *Nouhouysia*, *Poeciloneuron* and *Kayea*. The tribe *Calophylleae* is characterized by embryo consisting of thick, fleshy cotyledons and very short radicle.

Vesque (1893) has established four sections of the genus *Calophyllum*, viz., (1) *Hypodermata*, (2) *Microphyllum*, (3) *Apetalum* (syn. *Apoterium* Blume), and (4) *Inophyllum*. However, Engler (1925) had doubted the validity of such a subdivision of the genus, partly because no sharp boundary exists between the sections *Microphyllum* and *Inophyllum*. Further, there is transition between the sections *Apetalum* and *Inophyllum*.

CALOPHYLLUM L., Sp. Pl. (ed. 1) 513, 1753; Jussieu, Gen. Pl. 258, 1789; Willd., Sp. Pl., 2: 1159, 1800; Choisy, DC. Prodr., 1: 562, 1824; et Guttif. Ind. in Mém. Soc. Phys. Hist. Nat. Genève, 12: 40,

1851; Cambess., Mém. Mus. Hist. Nat. Paris, **16**: 427, 1828; Wight et Arn., Prodr. Fl. Penins. Ind. Or., **1**: 102, 1834; Wight, Illustr. Ind. Bot. **1**: 127, 1840; Voigt, Hort. suburb. calc., **87**, 1845; Planchon et Triana, Mém. Guttif. in Ann. Sci. Nat. sér. 4, **15**: 247, 1861; Bentham et Hooker, Gen. Pl., **1**: 175, 1862; Drury, Ind. Fl., **1**: 143, 1864; T. Anderson, in Hook.f. Fl. Brit. Ind., **1**: 271, 1874; Kurz, For. Fl. Burma, **1**: 94, 1877; King, Jour. As. Soc., Beng., **59**: 172, 1891; Vesque, in DC. Mon. Phan., **8**: 529, 1893; Cooke, Fl. Bomb., **1**: 80, 1901; Brandis, Ind. Trees, **53**, 1907; Talbot, Fr. Fl. Bomb., **1**: 98, 1909; Pitard., in Lecomte, Fl. Gén. Indo-Chine, **1**: 316, 1910; Gamble, Fl. Mad., **1**: 75, 1915; Ridley, Fl. Mal. Penins., **1**: 181, 1922; Lauterbach, in Engler, Bot. Jahrb., **58**: 8, 1923; Engler, in Nat. Pflanzenfam., 2 Aufl. **21**: 192, 1925; Benthall, Trees Calc., **32**, 1946; Wealth of Ind., **2**: 17, 1950; Henderson et Wyatt-Smith, Gard. Bull., **15**: 285, 1956.

Augia Lour. Fl. Cochinch., 337, 1790.

Balsamaria Lour. loc. cit. 469.

Apoterium Blume, Bijdr., **1**: 218, 1825.

Lamprophyllum Miers, Trans. L. Soc., **21**: 249, t. 26, 1855.

Evergreen trees. Bole usually without buttresses. Bark usually smooth with diamond or boat-shaped, lenticellate fissures (characteristic of the genus) in immature trees and longitudinally fissured, frequently with coarse, anastomosing ridges in mature trees, grey or yellowish-brown in colour. Inner bark pink or reddish, laminated with colourless, yellow or milky-white, varnish-like exudate. Resin ducts present. Buds puberulous with minute, rusty hairs. Young twigs generally quadrangular. Leaves opposite, simple, entire, glossy, often coriaceous, exstipulate; lateral nerves numerous, slender, close together and parallel, usually at right angles to the midrib; petiole present.

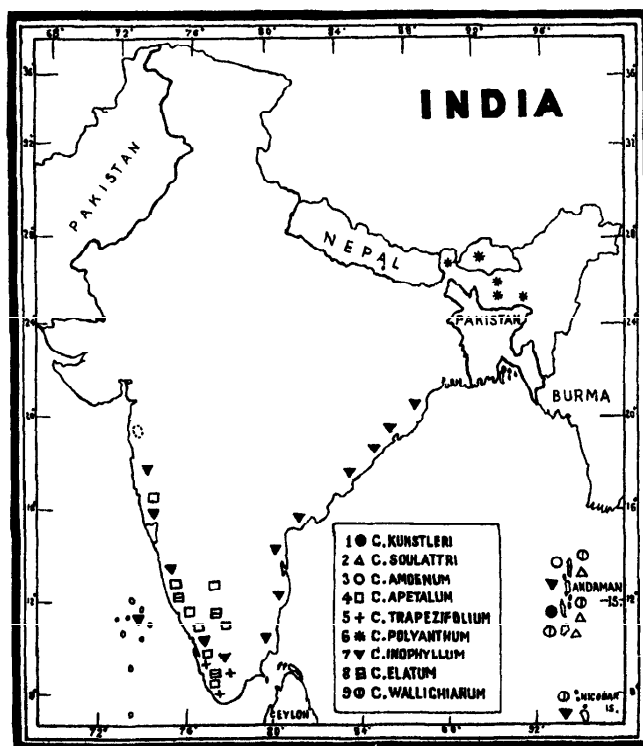
Inflorescence often copiously produced, axillary or terminal, paniculate or racemose, sometimes fascicled. Flowers hermaphrodite or polygamous (male and hermaphrodite), pretty, small or medium-sized, hypogynous, usually homochlamydeous, pedicellate. Perianth leaves 4 or 8 (sometimes more or less), tile-like. Sepals 2 or 4, decussate. Petals 2—4 or more or absent, resembling the sepals. Stamens numerous; filaments slender, free or slightly connate at the base, often flexuous; anthers erect, ovate or oblong, bilocular, dehiscing longitudinally. Ovary superior, unilocular; ovule solitary, anatropous; style slender, rather long; stigma peltate. Fruit an indehiscent drupe; sarcocarp thin, membranous; mesocarp dry, subspongy; endocarp (putamen) crustaceous. Seed single, erect, globose or egg-shaped, non-endospermic. Embryo plano-convex; hypocotyl short; cotyledons large, thick and fleshy.

The woods of all the Indian species of *Calophyllum* are similar in appearance, and are commercially classed under POON. Many of the species yield timber of economic value. The wood is of a pale reddish-brown colour with characteristic darker streaks showing upon all tangentially or radially cut surfaces. When this bold

grain effect is in evidence, poon woods can be classed as ornamental. In other respects they are excellent strong constructional timbers and as good long lengths are usually available, they are useful woods for many purposes where other timbers are ruled out on the score of having short marketable boles. In the days of wooden vessels, fine spars for the ship building trade were obtained from some species of *Calophyllum* and hence the common name "poonspars" was given to these plants. The woods, in general, are hard and strong, ranging on the average a little below teak in strength. They are all moderately durable and in dry positions will last a number of years. The chief source of supply of poon-wood is in South India from the Western Ghat Forests and Coorg. *Lalchuni* (*C. soulattri* Burm. f.), *C. wallichianum* Pl. et Tr. and *C. kunstleri* King, on the other hand, are available only from the Andaman and Nicobar Islands in limited quantities, while N. Bengal and Assam can supply a small quantity of poon (*C. polyanthum* Wall. ex Choisy).

TYPE SPECIES: *Calophyllum inophyllum*
Linn., Sp. Pl. (ed. 1), 513, 1753.

Distribution: This large genus of 188 species is distributed mostly in Tropical Asia, with some American species. Their chief centre of development is Malaysia, where as many as 106 species occur in the tropical forests. Nine species occur in India, of which three are restricted to the Andaman and Nicobar Islands. The rest occur in Southern and Eastern India.



Distribution map of *Calophyllum* in India.

Ecology: The species occur in nearly all habitats up to an elevation of 1828.8 m., but the commonest habitat appears to be low-lying forests.

Diagnostic Characters: The genus *Calophyllum* is at once distinguished by its close and parallel venation of the leaves. This venation at first sight appears very much the same in all species, but a closer examination reveals several differences which are diagnostic. These differences consist in the number of veins per mm., whether they are prominent or indistinct, oblique or horizontal etc. There is also great similarity in the flowers of the various species, the main differences being in size, presence or absence of petals, and the presence or absence, or nature of the tomentum. However, the discrimination of the species is by no means easy; indeed

the characters that mark them out as members of the same family, equally serve to render difficult their distinction from each other.

In all the species, the parts whether we choose to call them sepals or petals, are petaloid. I have, therefore, following Wight (1840), preferred to group them under the intermediate term perianth leaves. However, in the description I have used the general practice regarding the outer four floral leaves as sepals and anything within them as petals.

The more important diagnostic characters in the delimitation of species are undoubtedly those of the inflorescence, fruit, vegetative buds, bole and bark characters, colour of exudate and shape, size, texture and venation of leaf.

CONSPECTUS SPECIERUM.

KEY TO THE INDIAN SPECIES OF *CALOPHYLLUM*.

- A. Perianth leaves 4 (K_2 , C_2 or K_4 , C_0):
 - B. Flowers in axillary fascicles 1. *C. kunstleri*.
 - B. Flowers in axillary racemes:
 - C. Leaves $10-25 \times 4-7$ cm. 2. *C. soulattri*.
 - C. Leaves $2.5-10 \times 1-4$ cm.:
 - D. Leaf apex obtuse or produced in a short, obtuse acumen 3. *C. amoenum*.
 - D. Leaf apex often emarginate, sometimes rounded 4. *C. apetalum*.
- A. Perianth leaves 8 (K_4 , C_4):
 - E. Racemes equalling or 2 to 3-times longer than leaves:
 - F. Leaves below 5.5×5.5 cm., ovate, rhomboid or trapezoid 5. *C. trapezifolium*.
 - F. Leaves $10-15 \times 3-4$ cm., oblong-lanceolate, acuminate 6. *C. polyanthum*.
 - E. Racemes shorter (usually half as long) than the leaves:
 - G. Leaf apex rounded or emarginate 7. *C. inophyllum*.
 - G. Leaf apex acute or obtusely acuminate:
 - H. Racemes usually paniculate, many-flowered; fruit obliquely ovoid; leaves elliptic to oblong-lanceolate 8. *C. elatum*.
 - H. Racemes simple, few-flowered; fruit globose; leaves narrowly elliptic-oblong 9. *C. wallichianum*.

1. *Calophyllum kunstleri* King, J. Asiat. Soc. Beng., 59: 174, 1891; Vesque, DC. Mon. Phan., 8: 607, 1893; Ridley, Fl. Mal. Penins., 1: 182, 1922; Merrill, Enum. Philipp. Pl., 3: 79, 1923; Henderson et Wyatt-Smith, Gard. Bull., 15: 320, 1956.

C. apetalum Blanco, Fl. Filip. (ed. 2) 429, 1845; et (ed. 3) 415, 1879, (non Willd., 1811).

C. pulcherrimum F. Vill., Novis. App. 17, 1880, (non Wall., 1828).

A tree without buttresses, 12.19-18.29 m. high. Bark fawn and brown, or fuscous-brown, smooth, horizontal furrows present. Exudate yellowish-brown, watery, jelly-like. Buds, young twigs, petioles and lower parts of rachis of inflorescence ferruginous-tomentose. Terminal buds narrow, pointed; extra-axillary buds present. Leaves variable in size, $5.5-16 \times 1.5-6$ cm., narrowly elliptic or oblong-elliptic, sometimes lanceolate, subcoriaceous to coriaceous, upper surface usually polished when dry; apex \pm acuminate; base tapering; venation usually very oblique, close, rather obscure; petiole short, ca 1 cm. long.

Inflorescence axillary, short, umbelliform or fascicled; peduncle very short, tomentose, with four, narrow, tomentose bracts at its apex. Flowers white or light yellow, apetalous, on slender, glabrous pedicels. Sepals 4, the two outer ones oblong, reflexed in open flower; inner ones oblong or obovate. Fruit globular, ca 1-1.5 cm. in diam., reddish-brown when dry, coarsely wrinkled; pericarp thick, crustaceous.

Flowers: Nov.-Dec. Fruits: March.

Herbarium specimens examined: North Bay-Hill jungle, S. Andamans, King's collector s.n., Dec. 5, 1891; Namunaghar-Hill jungle, S. Andamans, King's collector s.n., Sept. 10, 1892; Cadelegunj, S. Andamans, Oct. 24, 1891; Larut, Perak, King's collector 5328, 5374, 5459 (SYNTYPES! in Herb. Calc.).

Distribution: Widely distributed in low land forests of Malaya, Philippines, Andaman Islands, Perak, Penang and Pahang.

Notes: This species is reported on the authority of Dr. G. King, who collected it from South Andamans, and so far, this is the only record of its occurrence in

India. It is distinct in its pointed leaves, with usually very oblique venation, and in the short, umbelliform inflorescences with hairy bracts.

2. *C. soulattri* Burm. f., Fl. Ind., 2: 121, 1768; Merrill, Enum. Philip. Pl., 3: 81, 1923; Wealth of Ind., 2: 20, 1950; Henderson et Wyatt-Smith, Gard. Bull., 15: 319, 1956.

C. spectabile Willd., Ges. Natürl. Fr. Berl. Mag., 5: 80, 1811; Choisy, DC. Prodr., 1: 562, 1824; et Guttif. Ind. in Mém. Soc. Phys. Hist. Nat. Genève, 12: 43, 1851, p.p.; Wight, Illustr., 1: 128, 1840; Planchon et Triana, loc. cit., 266, 1861; T. Anderson, in Hook.f., loc. cit., 1: 271, 1874; Kurz, For. Fl. Burma, 1: 94, 1877; Gamble, Ind. Timb., 25, 1881; Pierre, Fl. Coch.-Chine, 7: t. 107, 1885; King, J. Asiat. Soc. Beng., 59: 175, 1891; Vesque in DC. Mon. Phan., 8: 583, 1893; Brandis, Ind. Trees, 55, 1907; Pitard, in Lecomte, Fl. Gén. Indo-Chine, 1: 323, 1910; Ridley, Fl. Mal. Penins., 1: 185, 1922.

C. tetrapetalum Roxb., Fl. Ind., 2: 608, 1832, (non Wall., 1828).

C. Moonii Wight, Icon., t. 111, 1839; et Illustr., 1: 129, 1840; Voigt, Hort. suburb. calc., 87, 1845; Planchon et Triana, loc. cit., 269, 1861; Beddome, Pl. Sylv. Gen., 22, 1869.

C. cymosum Miq., Fl. Ind. Bat. Suppl., 1: 497, 1860.

C. Diepenhorstii Miq., loc. cit.

C. hibbardii Elm., Leaf. Philip. Bot., 2: 503, 1908.

Apoterium soulattri Blume, Bijdr., 1: 218, 1825.

A tall tree, without buttresses, 21.34-24.38 m. high and ca 2.13 m. in girth. Bark greyish to brownish, smooth but with tubercled lenticels, inner bark light pink-brown. Exudate creamy-white, watery but soon becoming sticky on exposure, copious. Wood pale reddish-white to pale reddish-brown, moderately heavy (sp. gr. ca 0.84). Terminal buds narrow, pointed, coarsely ferruginous-tomentose, ca 1 cm. long. Leaves very variable in size, 10-25 × 4-7 cm., ovate to ovate-oblong, sometimes elliptic-oblong but nearly always broadest just above the base, coriaceous, glabrous, dull, acute at the base; venation fine, raised, closed but not sharply clear cut; petiole 1.5-2 cm. long, canaliculate.

Inflorescence axillary, umbelliform, shortly pedunculate or subsessile. Flowers ca 12-15 mm. in diam., apetalous, on slender, ca 2 cm. long pedicels. Sepals 4, glabrous, obovate-orbicular, unequal, in two whorls. Fruit globose, 10 × 8 mm., mucronate with persistent style base, smooth; pericarp thick.

Flowers: Aug.-Dec. Fruits: Feb.-March.

Herbarium specimens examined: Wallich 6842 (without precise locality); Portsmouth, S. Andamans, S. Kurz s.n.; Middlepatis, Middle Andamans, S. Kurz s.n.; Dr. King's collector (without precise locality); Claudius Range, Middle Andamans, C. E. Parkinson 1173; Port Blair, Andamans, C. E. Parkinson 696; Anikhet-Hill jungle, S. Andamans, King s.n.; Dhaki-Khari-Hill

jungle, S. Andamans, King s.n., April 8, 1893; Andamans (without precise locality), Prain's collector 32, October 1900; Andamans (without precise locality), Prain's collector 33, June, 1900; Kamorta, Nicobar Islands, S. Kurz s.n.

Distribution: Forests of north-west Sumatra, Penang, Singapore, Malacca, Pahang, Kwantan, Tenasserim, Andaman and Nicobar Islands, Great Nicobar, Ceylon, Malayan Archipelago, Cochinchina, Fiji and Society Islands.

Vernacular names: Hindi: *Lalchuni*; Andamans: *Dakar-talada*; Eng.: *Nicobar Canoe Tree*.

Uses: The timber is strong and elastic. It is used for masts and spars, and is considered eminently suitable for planking, rafters, boxes and joinery work. It has lately been used in building barracks in the Andaman Islands.

Notes: I have followed Merrill (loc. cit.), Henderson et Wyatt-Smith (loc. cit.), and others in reducing *C. spectabile* Willd. to *C. soulattri* Burm. f. The diagnostic characters are the ovate leaves and short, umbelliform inflorescences.

3. *C. amoenum* Wall. Cat. 4849, 1828, nomen; Choisy, Guttif. Ind. in Mém. Soc. Phys. Hist. Nat. Genève, 12: 41, 1851, cum descript.; Planchon et Triana, Mém. Guttif. in Ann. Sci. Nat. sér. 4, 15: 263, 1861; King, J. Asiat. Soc. Beng., 59: 176, 1891; Vesque, in DC. Mon. Phan., 8: 576, 1893; Brandis, Ind. Trees, 55, 1907. (PLATE I)

C. retusum T. Anderson, in Hook.f. Fl. Brit. Ind., 1: 272, 1874, pro parte, (non Wallich., 1828).

C. parvifolium Wall., Plant. Itin. Birm. Exsicc. 1731 (in herb. DC.).

C. retusum var. *parvifolium* Choisy, loc. cit., excl. syn. Wall. et Wight. (fide Planchon et Triana).

C. Burmanni var. *brachiatum* Wight, Illustr. Ind. Bot., 1: 129, 1840, ex descript. (fide Planchon et Triana).

An erect, leafy tree, 6.1-12.19 m. high. Branches square, compressed, minutely ferruginous. Leaves 2.5-8 × 1-3 cm., elliptic or ovate-elliptic, shining above; apex obtuse or produced in a short, obtuse acumen, rarely rotundate or retuse; midrib prominent on both sides; lateral nerves parallel, making an acute angle with the midrib; petiole 2-5 mm. long, canaliculate above, minutely velutinous.

Racemes axillary, ca 1-3 cm. long, 3 to 7-flowered; peduncle compressed, nearly articulate at the base, velutinous. Flowers small; pedicels 5-6 mm. long. Sepals 4. Petals absent. Fruit pisiform or globose, white, ca 7 mm. in diam.; epicarp membranous, fragile; mesocarp spongy.

Flowers: Dec.-Feb. Fruits: March-May.

Herbarium specimens examined: Amherst, Wallich 4849 (ISOTYPE! in Herb. Calc.); Andaman Islands (without precise locality), King 378, 451, 548.

Distribution: Andamans, Malacca, Amherst, Moulmein and Tenasserim.

Notes: T. Anderson (*loc. cit.*) has united this species with *C. retusum* Wall. However, I consider it to be a distinct species and this is also the opinion of Planchon

et Triana (*loc. cit.*), King (*loc. cit.*) and Vesque (*loc. cit.*) The differences between the two species are as follows:



PLATE I. *Calophyllum amoenum* Wall.

Fig. A. Flowering twig showing flower buds; Fig. B. Flower bud; Fig. C. Fruit.

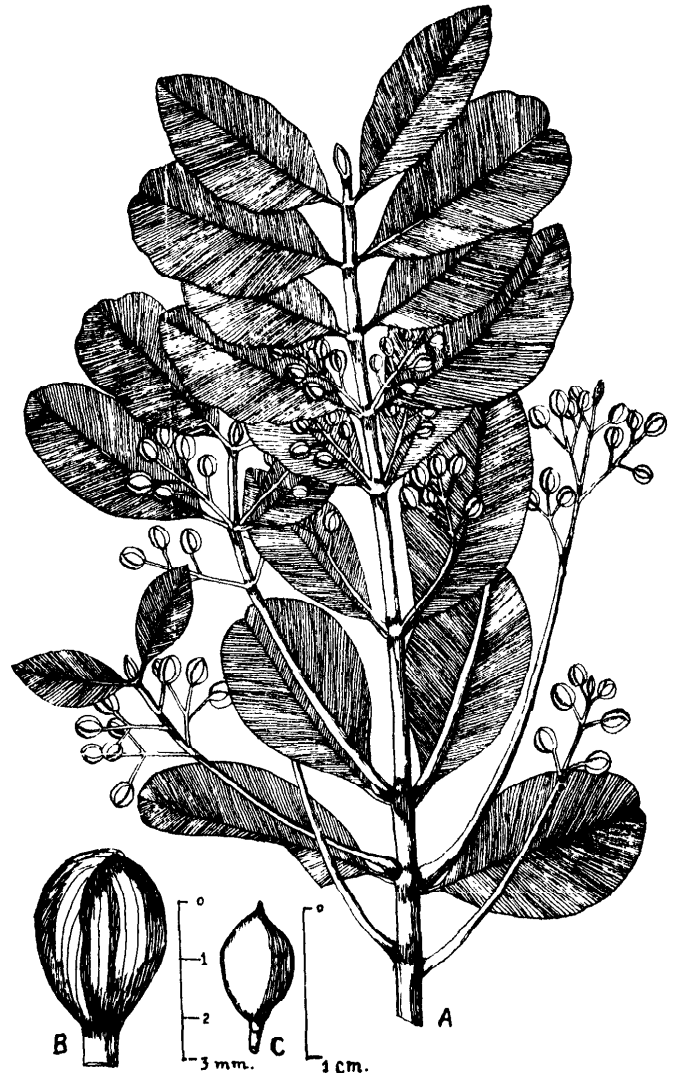


PLATE II. *Calophyllum retusum* Wall.

Fig. A. Flowering twig showing flower buds; Fig. B. Flower bud; Fig. C. Immature fruit.

<i>C. amoenum</i> Wall. (PLATE I)	<i>C. retusum</i> Wall. (PLATE II)
1. Leaves elliptic or ovate-elliptic.	1. Leaves elliptic or obovate or oblong-elliptic.
2. Lamina 2.5-8 cm. long.	2. Lamina 5-11 cm. long.
3. Leaf apex obtuse or obtuse-acuminate, rarely rotundate or retuse.	3. Leaf apex obtuse or truncate, retuse.

4. *C. apetalum* Willd., Ges. Naturf. Fr. Berl. Mag., 5: 79, 1811; Sprengel, Syst. Veg. (ed. 16), 2: 571, 1825; Wealth of Ind., 2: 17, 1950, (non Blanco, 1845).

C. spurium Choisy, DC. Prodr., 1: 563, 1824; Wight et Arn., Prod., 1: 103, 1834; Dalz. et Gibs., Bomb. Fl. 32, 1861; Drury, Ind. Fl., 1: 143, 1864.

C. wightianum Wall. Cat., 4847, 1828, nomen; Planchon et Triana, loc. cit., 256, cum descript.; Beddome, Fl. Sylvat., t. 90, 1871; T. Anderson, in Hook.f. Fl. Brit. Ind., 1: 274, 1874; Vesque, loc. cit., 569; Cooke, Fl. Bomb., 1: 81, 1901; Brandis, Ind. Trees, 54, 1907; Talbot, For. Fl. Bomb., 1: 101, 1909; Rama Rao, Fl. Pl. Trav., 32, 1914.

C. calaboides Don, Gen. Syst., 1: 622, 1831.

C. decipiens Wight, Icon., t. 106, 1839; et Illustr., 1: 128, 1840; Voigt, Hort. suburb. calc., 87, 1845; Choisy, Guttif. Ind. in Mém. Soc. Phys. Hist. Nat. Genève, 12: 42, 1851; Gamble, Fl. Mad., 1: 76, 1915.

C. calaba L. Sp. Pl., 514, 1753, pro parte.

A medium-sized tree. Bark yellowish. Wood pale reddish-white to reddish-brown with darker streaks and characteristic odour, moderately heavy (sp. gr. ca 0.64; wt. 42 lb./c.ft.). Young shoots glabrous, square. Leaves 6-10 × 2.5-4 cm., oval or obovate to oblong-obovate, chartaceous, shining on both surfaces, cuncate at base, obtuse or rounded at the apex, often emarginate; midrib fading near the apex of the leaf, prominent beneath; venation close, prominent on the lower surface, lateral veins making an acute angle with the midrib; petiole ca 6 mm. long, concave above.

Racemes axillary, few-flowered, 4-5 cm. long, shorter than the leaves, glabrous or when young slightly puberulous towards the base; peduncle about 1 cm. long. Flowers apetalous, 8-12 mm. in diam.; pedicels slender, 7-12 mm. long; bracts small, caducous, boat-shaped. Sepals 4, subequal, deflexed, ovate, prominently veined. Petals absent. Stamens numerous, many-seriate. Stigma peltate, entire. Fruit ellipsoid, 2 cm. long, smooth, apiculate, red when ripe, edible.

Talbot (*loc. cit.*) reports that the edges of the leaves are often transformed into large, hollow, irregularly shaped, winged galls. This disease is very common in the districts of North Kanara.

Flowers: Dec.-April. Fruits: March-May.

Herbarium specimens examined: Travancore, T. F. Bourdillon 76, February 4, 1894; Quilon, Peninsular India, in Herb. Wight 1357, December, 1835; Udumapora, in Coimbatore District, C. A. Barber 5763, May 4, 1903; Nilkund, North Kanara, W. A. Talbot 245; Mundomurhi, in Kerala, C. C. Calder and M. S. Ramaswami 241, August 27, 1913 and M. Rama Rao 1487, August 27, 1913; North Kanara (without precise locality), T. R. Bell 5976, May 1919; Wallich 4847 (proposed here as NEOTYPE!).

Distribution: Evergreen forests of Western Ghats from Mysore to Travancore, up to an elevation of 1000' and along the banks of rivers and streams.

Penins. Ind. Or.: Malabar (*Rheede*); Quilon (*Wight*); Cunneepooram, N.-W. Trivandrum (*Drury*); Dschamalabad, Mangalor Dist., Kanara (Hohenacker, *vide* Vesque *loc. cit.*); Honore in Kanara (*Dalzell et Gibson*); Konkan (*Stocks et Law*; *Nimmo*).

Vernacular names: Sans.: *Jothishmathi*; Mar. *Bobbi*; Kan.: *Irai*, *Kalpoon*; Tam.: *Siru-binnai*, *Cherupinnei*, *Valuluvai*; Mal.: *Cherupinna*; *Attupunna*, *Manjapurna*; Guj.: *Sarpuna*; Engl.: *Poonspar* of Travancore.

Uses: It is a strong constructional timber used for boats, oil mills, cabinet work and building purposes. The sundried seed kernels yield 45-50% of a greenish-yellow oil having a characteristic odour and a bitter

taste. The oil is used in rheumatism, leprosy and as sceptic poison. The resin from the tree is used as a vulnerary, resolute and anodyne. The fruit when ripe is eaten locally. The wood is suitable for match boxes.

Notes: According to the Rule of Priority, the earliest valid name for this plant is *C. apetalum* Willd. *loc. cit.* Willdenow, at the time he described this taxon, did not state the type of this species. Hence, in accordance with the provisions of Article 7 of 1956 edition of International Code of Botanical Nomenclature, under the circumstances, *Wallich 4847* (in Herb. Calc.) is selected as the neotype of the species.

5. *C. trapezifolium* Thwaites, Enum. Pl. Zeyl. 51, 1858; Planchon et Triana, *loc. cit.*, 282; Beddome, *loc. cit.*, 22; T. Anderson, in Hook.f. *loc. cit.*, 275; Vesque, *loc. cit.*, 563; Brandis, Ind. Trees, 54, 1907; Rama Rao, Fl. Pl. Trav., 32, 1914; Gamble, Fl. Mad., 1: 76, 1915.

A large tree. Branches glabrous. Leaves small, under 5.5 cm. long and broad, ovate, rhomboid or ovato-trapezoid, rigid, coriaceous; apex rounded, retuse or shortly acuminate; base cuneate; midrib prominent beneath, lateral veins fine, parallel, somewhat prominent on both sides; petiole 5-10 mm. long, concave above.

Racemes axillary, few-flowered, two to three times longer than the leaves, glabrous; rachis robust. Flowers ca 2 cm. in diam., petalous; pedicel ca 15 mm. long. Sepals 4, outer ones smaller than the inner. Petals 4. Ovary globose. Fruit ovoid or subglobose, ca 2 cm. in diam.

Flowers: Nov.-Dec. Fruits: May-June.

Herbarium specimens examined: Udumbansholay, Travancore, 5,000 ft., A. Meebold 13085, December, 1910; Quilon at 3,500 ft., T. F. Bourdillon 179, April 3, 1894; Hunasgiria District, Central Province, Ceylon, at 4-5,000 ft., Thwaites 2446 (ISO-HOLOTYPES! in Herb. Calc.).

Distribution: *Penins. Ind. Or.*: Evergreen forests of Travancore and Tinnevely, at an elevation of 4,000 ft., S. Kanara and Ceylon.

6. *C. polyanthum* Wall. Cat., 4844, 1828, nomen; Choisy, Guttif. Ind. in Mém. Soc. Phys. Hist. Nat. Genève, 12: 43, 1851, cum descript.; Planchon et Triana, *loc. cit.*, 278; T. Anderson, in Hook.f., *loc. cit.*, 274; Vesque, *loc. cit.*, 555; Prain, Beng. Pl., 1: 246, 1903; Brandis, Ind. Trees, 54, 1907; Kanjilal *et al.*, Fl. Assam, 1: 114, 1934; Wealth of Ind., 2: 19, 1950.

A medium-sized to large, evergreen tree. Bark grey or brown, exfoliating in oblong flakes. Wood pale reddish-white to light reddish-brown, light (sp. gr. ca 0.51). Twigs tetragonous, compressed. Leaves 10-15 × 3-4 cm., oblong-lanceolate, acuminate, coriaceous, shining on both surfaces, margins waved; apex obtuse or acute to acuminate; base acute or cuneate, narrowed into the margined petiole; midrib prominent beneath, lateral

veins distinct on both surfaces; petiole *ca* 1 cm. long, concave above.

Racemes terminal and axillary, as long as leaves and the upper ones forming a terminal panicle. Flowers white, *ca* 1 cm. in diam., polygamous, tetramerous, petalous; pedicel 4-10 mm. long. Sepals 4, outer ones sub-orbicular, very small; inner twice as long, petaloid. Petals 4, longer than the inner sepals, obovate, reflexed, concave. Fruit the size of a small plum, subglobose or ovoid, blunt or shortly acuminate (as in Bhootan specimens), *ca* 2.5 cm. long. Seed egg-shaped, brown.

Flowers: Jan.-April. Fruits: May-June.

Herbarium specimens examined: Kasalong River (West), Chittagong, E. Pakistan, *J. L. Lister* 36; Upper Rungtung, Assam, *I. H. Burkill* 38199 (in Herb. R.E.P.); Serpo Valley, Assam, *Burkill* 36839; Khasia, Assam, *Griffith* 879; Khasia, Assam, *J. D. Hooker* et *T. Thomson s.n.*; Khasi Hills, *G. Mann s.n.*; Assam (without precise locality), *W. R. Fisher s.n.*; Chumbi Valley, E. Himalaya, *G. L. Searight* 174; Mungpoo, Sikkim Himalaya, *Dr. Prain's collector* and *J. L. Lister s.n.*; Kurseong, at 5,000 ft., Bhootan Himalaya, *Dwg Pro s.n.*, June 7, 1877; Sylhet (without precise locality), *Wallich* 4844 (ISOTYPE! in Herb. Calc.).

Distribution: *Ind. Or.*: Forests of Chittagong, N. and E. Bengal, Cachar, Garo Hills, Sikkim, Khasia and Jaintia Hills, Abor, Assam, and Martban, up to an elevation of 5,000 ft.

Vernacular names: Beng.: *Kandeb*; Assam: *Dieng-la-kuru*; Nep.: *Kironli*; Lepcha: *Sunglyer*; Cach.: *Telo*.

Uses: The timber is hard, durable, strong and elastic. It is useful for house posts, beams, rafters, dug outs, masts, spars and helms.

7. *C. inophyllum* L., Sp. Pl., 513, 1753; Burm. f., Fl. Ind., 2: 120, 1768; DC., Prodr., 1: 562, 1824; Blume, Bijdr., 1: 217, 1825; Roxb., Fl. Ind., 2: 606, 1832; Wight et Arn., Prodr., 1: 103, 1834; Wight, Icon., t. 77, 1839 et Illustr., 1: 128, 1840; Voigt, Hort. suburb. calc., 87, 1845; Choisy, loc. cit., 42; Thwaites, Enum. Pl. Zeyl., 51, 1858; Planchon et Triana, loc. cit. 282; Dalz. et Gibs., Bomb. Fl., 31, 1861; Drury, Ind. Fl., 1: 143, 1864; Beddome, loc. cit., 22; T. Anderson, in Hook. f. loc. cit., 273; Kurz, For. Fl. Burm., 1: 95, 1877; Gamble, Ind. Timb., 25, 1881; King, J. Asiat. Soc. Beng., 59: 178, 1891; Vesque, loc. cit., 544; Cooke, Fl. Bomb., 1: 80, 1901; Brandis, Ind. Trees, 54, 1907; Talbot, For. Fl. Bomb., 1: 99, 1909; Pitard, in Lecomte, Fl. Gén. Indo-Chine, 1: 324, 1910; Rama Rao, Fl. Pl. Trav., 31, 1914; Gamble, Fl. Mad., 1: 76, 1915; Haines, Bot. Bih. & Orissa, 2: 54, 1921; Ridley, Fl. Mal. Penins., 1: 186, 1922; Merrill, Enum. Philip. Pl., 3: 79, 1923; Lauterbach, in Engler, Bot. Jahrb., 58: 9, 1923; Benthall, Trees Calc., 33, 1946; Wealth of Ind., 2: 18, 1950; Henderson et Wyatt-Smith, Gard. Bull., 15: 314, 1956.

C. Bintagor Roxb., Hort. Beng., 41, 1814, nomen, et Fl. Ind., 2: 607, 1832, cum descript.

C. Blumei Wight, Illustr. Ind. Bot., 1: 128, 1840; Voigt, loc. cit., 87.

Balsamaria Inophyllum Lour., Fl. Cochinch., 2: 470, 1790.

A large or medium-sized, handsome, spreading tree, usually up to 20 m. high and girth of 1.5 m., without buttresses. Bark pale grey and fawn, smooth, with wide, boatshaped fissures. Exudate milky. Wood reddish-white to reddish-brown, moderately heavy. Twigs glabrous; young ones tetragonous, compressed. Terminal buds nearly triangular, finely rusty-tomentose, 5-10 mm. long. Leaves variable in size, 10-20 × 5-9 cm., broadly elliptic-oblong or obovate, often broadest a little above the middle, thinly coriaceous; apex rounded or widely and shallowly emarginate; midrib prominent below; venation distinct, close, raised and clear cut on both surfaces; petiole short, 1-1.5 cm. long.

Racemes axillary, lax, few-flowered, shorter than the lamina and exceeding the petiole, 7-12 cm. long. Flowers marble-white, fragrant, polygamous, *ca* 2 cm. in diam. Sepals 4, reflexed, two outer ones concave; inner petaloid. Petals usually 4 (or 3-5), reflexed. Ovary pink or light purple after pollination, depressed-globose; style much longer than ovary; stigma peltate. Fruit globose, *ca* 3 × 4 cm., yellowish, pulpy, smooth, top shortly acuminate; pericarp thick.

Flowers: Feb.-June. Fruits: May-Oct.

Herbarium specimens examined: Chilka Lake, Orissa, *Dr. Prain's collector*, May 21, 1899; Tirukanmyndi, Tinnevely Dist., Peninsular India, *D. Hooper* and *M. S. Ramaswami*, February 11, 1913; Madras Presidency (without precise locality), *M. S. Ramaswami* 805; Quilon, Madras State, *A. Meebold* 12660, November, 1910; Peninsular India Orientalis, Kew Distrib. No. 137 (*Herb. Wight*); Kumtha to Sirsi Road, Herb. Coll. Sci. Poona 27/20; North Reef Island, Andamans, *Ram Prashad s.n.*, November 24, 1903; Rogolochang, Baratang Island, Andamans, *B. B. Osmaston* 8, Sept. 29, 1905; S.-W. corner of Andamans, *S. Kurz s.n.*; Western coast near Port Mouth, S. Andamans, *S. Kurz s.n.*; Little Andamans, *C. G. Rogers s.n.*, January 1903; Little Andamans, *D. Prain s.n.*; Narcondam, Port Blair, *King's collector s.n.*, March 10, 1884; S. Andamans (without precise locality), *R. L. Heinig* 65, 582, March 8, 1901; Andamans (without precise locality), *Prain's collector s.n.*, March 1889; Nicobars (without precise locality), *R. L. Heinig s.n.*; Katchall, Nicobar Islands, *S. Kurz s.n.*, February 1875; Seashores on Hill's rocky place, Haveit, Nicobar Islands, *King's collector* 490, November 5, 1884; Ganges Harbour, Great Nicobars, *C. G. Rogers s.n.*, April 16, 1903; Aucutta, Laccadive Islands, H.M.I.M. "Investigator"; Kalpeni, Laccadives, *Alcock, s.n.*, November 1, 1889.

Distribution: Seashores of India, Tropical East Africa, Malaysia, Polynesia, Burma, Ceylon, Australasia, Trop. Asia, Cochinchina, Cambodge, Tonkin, Laos, Siam; often planted.

Ind. Or.: Konkan, Salsette, Ratnagiri, Love Grove (Bombay), Orissa, N. Kanara, Andamans, Great Nico-

bar. In the N. Kanara district, it is common on the sandy coast, laterite soil just above the high water mark, often associated with *Anacardium occidentale* Linn., *Salvadora persica* Linn., *Erythrina variegata* var. *orientalis* Merr., *Pongamia pinnata* Pierre, *Ficus tomentosa* Roxb., and other littoral species (Talbot, *loc. cit.*).

Vernacular names: Hindi & Beng.: *Sultana champa*; Sans.: *Naga-champa*, *Panch-kesara*, *Punnaga*; Mar.: *Undi*, *Surangi*, *Wumakan*; Kan.: *Vuma*, *honne*; Tam.: *Pinnai*; Tel.: *Poona*; Mal.: *Pinna*; Oriya: *Poonang*; Kutch: *Udi*; Eng.: *Alexandrian Laurel*, *Dilo Oil Tree*.

Uses: The timber is used for knees for boats, railway sleepers and other crafts. The seeds yield an oil, known variously as *Wundi*, *Pinnay*, *Domba* or *Dilo Oil*, which is used in medicine, for burning and for painting wood work; recently recommended as a lubricant in place of castor. The oil is manufactured in large quantities in the districts of Kerala and Madras. It also supplies the real *Mariae Balsam* and the yellowish-green resin, *Tacamahaca*. The gum from wounded bark is a purgative and an emetic, and applied to wounds and ulcers. The leaves soaked in water are applied to inflamed eyes. The decoction of flowers is given to cure syphilis, eczema and insanity. Also cultivated as an ornamental tree.

8. *C. elatum* Beddome, *Flor. Sylvat. Gen.*, 22, t. 2, 1869; Brandis, *Ind. Trees*, 54, 1907; Gamble, *Fl. Mad.*, 1: 76, 1915; *Wealth of Ind.*, 2: 18, 1950. (PLATE III).

C. tomentosum T. Anders. in *Hook. f. Fl. Brit. Ind.*, 1: 274, 1874, pro parte; Vesque, *loc. cit.*, 552, p.p., (non Wight, 1840).

C. angustifolium Dalz. et Gibs., *Bomb. Fl.*, 32, 1861, (non Roxb., 1832).

A large, straight tree. Young shoots, buds and panicles obscurely tomentose or subglabrous. Wood reddish-white to pale reddish-brown with darker streaks, strong, elastic. Leaves 8-13 × 3-5 cm., elliptic to oblong-lanceolate, acuminate, attenuated at the base, glabrous, shining; venation very fine, equally conspicuous on both surfaces, lateral veins horizontal, nearly perpendicular with the midrib; petiole 12-20 mm. long.

Racemes and panicles axillary or terminal. Flowers 12-20 mm. in diam.; pedicels long, slender, tomentose. Sepals 4, unequal, ciliolate. Petals 4, spreading, exceeding the sepals. Fruit obliquely ovoid, pointed, smooth (*vide* Beddome).

Flowers: Jan.-March. Fruits: April-June.

Herbarium specimens examined: Annamallays, South India, Beddome 35 (TYPE!); Herb. Calc. Acc. No: 47420, 47421 (*sine loco et lectae*); North Kanara (without precise locality), W. A. Talbot 284.

Distribution: *Penins. Ind. Or.*: Tropical, wet, ever-green forests of Western Ghats and adjoining hills, from Nilgiris and Pulneys to Travancore and Tinnevely, ascending to 5,000 ft. In N. Kanara, it is practically restricted to the forests about Mulamane on the Gair-soppah Ghat and Nilkund, where it is locally common.

Vernacular names: Mar.: *Nagari*; Kan.: *Kuve*, *bobbi*; Tam.: *Katta pinnei*, *pongu*; Mal.: *Katta pinna*, *pinnapai*; Trav.: *Viri*; Bombay: *Pun*; Anam.: *Pongoo*; Eng.: *Poonspar Tree*.

Uses: It furnishes the poon spars of commerce, which are much used for ceiling boards, rafters, planking, cheap furniture, masts and spars. The timber is also used for chests, tent poles, mathematical instruments, bridges etc. Rama Rao (*op. cit.*) reports that the wood is suitable for paper pulp. The oil from seed kernels is used for illuminating purposes. In Kanara, the Public Works Department makes use of the wood in the construction of bridges, principally on the ghat roads leading to the sea coast (Talbot, *op. cit.*).

Notes: T. Anders. (*loc. cit.*) has united this species with *C. tomentosum* Wight. I am, however, of the opinion that the two species should be kept separate. The differences between them are as follows:

<i>C. elatum</i> Bedd. (PLATE III)	<i>C. tomentosum</i> Wight. (PLATE IV)
1. Young parts glabrous or obscurely tomentose.	1. Young parts rusty-tomentose.
2. Leaf venation horizontal and perpendicular with the midrib.	2. Leaf venation oblique, making an acute angle with the midrib.
3. Fruit obliquely ovoid, ca 2.5 cm. long.	3. Fruit subglobose, ovoid, ca 2 cm. long.

9. *C. wallichianum* Planch. et Triana, *Mém. Guttif. Ann. Sci. Nat. sér. 4*, 15: 277, 1861; T. Anderson, in *Hook. f. loc. cit.*, 273, King, *J. Asiat. Soc. Beng.*, 59: 179, 1891; Vesque, *loc. cit.*, 599; Ridley, *Fl. Mal. Penins.*, 1: 187, 1922; Henderson et Wyatt-Smith, *Gard. Bull.*, 15: 303, 1956.

C. tetrapetalum Wall. *Cat.*, 4843, 1828, nomen (p.p.), (non Roxb., 1832).

A tree, up to 40 m. tall and 3 m. in girth. Bark greenish-grey, fawny-grey or grey-brown, irregularly fissured. Exudate white turning creamy-yellow on exposure. Branchlets pale yellowish, young ones square and with the buds, undersurface of young leaves and inflorescence minutely ferruginous-tomentose. Terminal buds cylindrical. Leaves 10-15 × 4-5 cm., narrowly elliptic-oblong, thinly coriaceous; upper surface shining, lower surface dull; apex shortly and obtusely acuminate; base acute; midrib prominent below, at first minutely ferruginous-tomentose, when adult glabrous; venation rather indistinct on both surfaces, almost horizontal; petiole rusty, ca 2 cm. long.

Racemes axillary and terminal, 7 to 13-flowered, less than half as long as the leaves, ferruginous-tomentose, erecto-patent. Flowers ca 12 mm. in diam., petalous; pedicels ca 1 cm. long or shorter. Sepals 4, orbicular,

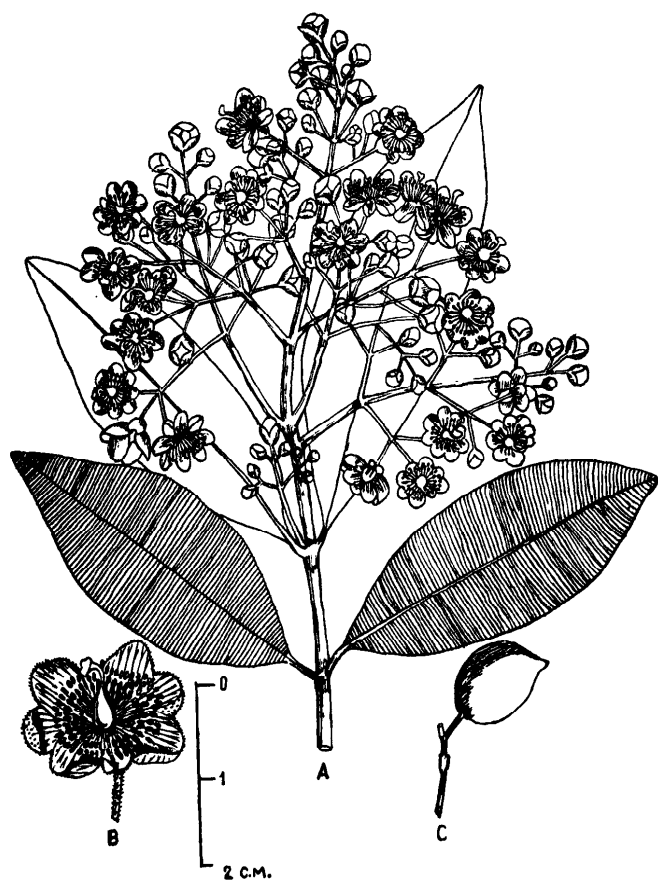
PLATE III. *Calophyllum elatum* Bedd.

Fig. A. Flowering twig showing open flowers; Fig. B. Open flower; Fig. C. Fruit.

ferruginous-tomentose on both surfaces. Petals 4 (sometimes 2-3), cuneate-oblong, glabrous inside. Fruit globose, ca 4.5×3.5 cm., wrinkled; pericarp thick.

Flowers and Fruits: March.

Herbarium specimens examined: South and Middle Andamans (without precise locality), *Kurz s.n.*; Kamorta, Nicobar Islands, *Kurz s.n.*

Distribution: Common in forests of Malacca (*Main-gay*, *Griffith*), Penang (*Curtis*), Singapore (*Wallich*, in herb. DC.), Johor, Pahang, Andaman and Nicobar Islands.

Notes: This species was founded by Planchon et Triana (loc. cit.) on a specimen mixed with *Wallich* Catalogue No. 4843 (in herb. DC.), the bulk of which is *C. spectabile* Willd. It was collected in the year 1822 under a false name *C. tetrapetalum* Roxb. This does not appear to be a common species. However, it may be readily distinguished by its yellow branches, rusty tomentum and almost cinnamoneous colour of its leaves when dry. The plant has affinities with *C. tomentosum* Wight; the latter, however, does not occur in India.

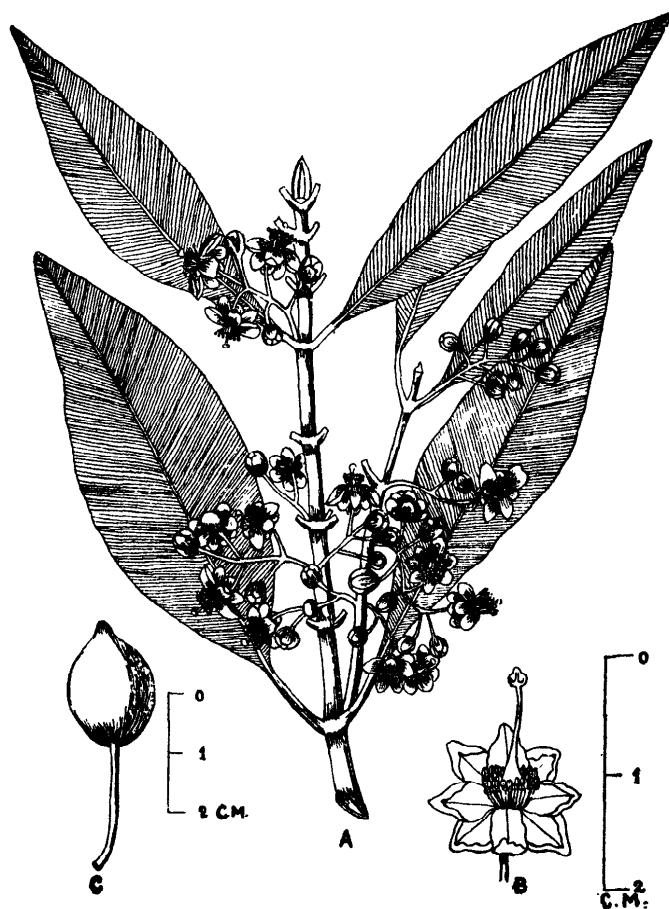
PLATE IV. *Calophyllum tomentosum* Wight

Fig. A. Flowering twig showing open flowers; Fig. B. Open flower; Fig. C. Fruit.

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