

TAXONOMIC STUDIES ON INDIAN GUTTIFERAE III. THE GENUS *GARCINIA* LINN. s.l.

J. K. MAHESHWARI

Botanical Survey of India, C. N. H., Sibpur, Howrah*

A B S T R A C T

The paper deals with the taxonomic treatment of the genus *Garcinia* Linn. (including *Xanthochymus* Roxb.) as occurring in India. The study was undertaken with a view to enumerate the wild types of Indian *Garcinias* that produce the 'gummi-gutt' or gamboge of commerce and which may be utilized in the improvement of the fruit of mangosteen (*G. mangostana* Linn.). Thirty five species are recognized in the area, of which thirty one species occur wild ; the rest are introduced into cultivation. Ten species are restricted to the Andaman and Nicobar Islands. One Burmese species, *G. loniceroides* T. Anders., has been discovered in Assam. A new variety of *G. echinocarpa* Thwaites, namely var. *monticola* Mahesh., is reported from southern India. These are described in detail and their synonymy, distribution, uses, vernacular names, etc. are ascertained. A key to the species is presented.

G. eugeniaefolia Wall. ex T. Anders., is incorporated in *G. brevirostris* Scheff. *G. ovalifolia* Hook.f. var. *macrantha* T. Anders. (syn. *G. malabarica* Talb., non Desr.) is raised to specific rank as *G. talbotii* Raiz. ex Santapau. *G. affinis* Wall. ex Pierre, *G. pictoria* Roxb., and *G. acuminata* Planch. & Triana, are treated as distinct species. T. Anderson (1874) in the Flora of British India has united *G. kydia* Roxb. with *G. cowa* Roxb. It is concluded here that these species should be kept separate. The details are discussed in this paper.

INTRODUCTION

According to T. Anderson (1874), who is responsible for the treatment of Guttiferae in Hooker's Flora of British India, 17 specific and 4 infraspecific taxa of *Garcinia* were known from India and East Pakistan. Subsequently, J. Vesque in De Candolle's *Monographiae Phanerogamarum* reported 28 species and 8 varieties from this area. One of the most notable works on this family is the account of *Garcinia* by Pierre (1882-1883) in *Flore Forestière de la Cochinchine*. This work describes several new species from Cochinchina and Malaysia. Among other authors who have contributed most to our knowledge of the genus are Choisy (1824, 1851), Roxburgh (1832), Wight (1839, 1840), Planchon and Triana (1860, 1861), Lanessan (1872, 1876) and Engler (1888, 1908, 1925). In the present study 35 species are recognized from India. Of these, 31 species are found wild in the Indian region; the rest are importations and cultivated in gardens.

The main bulk of the material cited here is housed in the Central National Herbarium, Sibpur, near Calcutta. Living plants were examined in the Indian Botanic Garden, Sibpur. Specimens were also received on loan from the Blatter Herbarium, St. Xavier's College, Bombay; Herbarium of the Forest Research Institute, Dehra Dun; and from the Regional Herbaria of the Botanical Survey of India at Shillong, Coimbatore and Poona.

Grateful thanks are extended to the authorities of these herbaria for their cooperation in the matter. The author is indebted to Rev. Dr. H. Santapau, Director, Botanical Survey of India, for reading through the manuscript, offering valuable suggestions and rendering the latin diagnosis of a new

taxon, and to Dr. S. K. Mukerjee, Keeper, Central National Herbarium, for interest in this study.

The material from the European herbaria† is cited here on the authority of J. Vesque (1893).

The genus *Garcinia* is badly in need of revision on a world-basis. A large number of new species has recently been discovered in Philippines, Papuasias, Tropical Africa, New Guinea, Borneo and Malaya. Yet many more are to be found in Oceania, New Guinea, Madagascar, Africa, East Asia, New Caledonia, Philippine Islands, Micronesia and other parts of Malaysia. Until the monograph of the genus is written, it may be useful to present these observations on Indian *Garcinias*. Further, the biological and growth aspects of the genus are yet to be tackled. The embryological, histological and cytological features of the infrageneric taxa are likely to provide characters of great taxonomic significance. The gamboge or 'gummi-gutt' of a number of wild species merits phytochemical examination. Its principal use is in miniature paintings and water-colours.

The genus *Garcinia* was erected by Carl Linné in honour of the French botanist and traveller, Laurent Garcin (1635-1752), who lived in India and collected plants in the eighteenth century. Although the Linnean concept of *Garcinia* is in accordance with the present currently accepted delimitation, something can be said in regard to the splitting of this heterogeneous genus. Thus, as regards *Garcinia* sens. ampl., there is remarkable variability.

* Present Address : Department of Botany, University of Delhi.

† The citation of various herbaria of the world in the text for purpose of the location of types and specimens, is abbreviated according to Lanjouw and Stafleu's *Index Herbariorum* Part I (3rd ed. 1956).

lity of the male flowers, particularly the shape and number of anther thecae, mode of dehiscence, structure of synandrium, number and condition of stamens, and nature of connective. This heterogeneity in the male organization of the flower led earlier authors to split the Linnean genus into a number of generic taxa like *Mangostana* Gaertn., *Cambogia* Linn., *Hebradendron* R. Grah., *Oxycarpus* Lour., etc. Similarly, the quinary arrangement of the floral parts in some species in contrast to the general binary arrangement induced Roxburgh (Pl. Corom. 2: 51. t. 196. 1805) to erect the genus *Xanthochymus* Roxb. However, Kurz (1874) has shown that *Xanthochymus* Roxb. cannot be kept distinct from *Garcinia* Linn., for both tetramerous and pentamerous flowers occur in the type species *X. pictorius* Roxb. In view of the fact that these variations are restricted to the male flowers and do not generally extend to the female flowers and the fruit, I, following Wight (1840), Pierre (1882-1883), Vesque (1893) and Engler (1925) consider that the genus may be divided into sections in accordance with the relative value of several structural variations mentioned above. It may be noted that in *Garcinia*, in widely different parts of its distribution, species occur which show an unusual high amount of convergent characters and resemble each other in a somewhat deceptive manner. Its generic morphological pattern acts as a stratum on which, actually, many species-groups (or sections) represent parallel segregations or homologous series.

Pierre (1882-1883) subdivided the genus *Garcinia* Linn. into 37 sections. These were later reduced to 33 sections by Engler (1925), who subdivided the genus on the basis of anther thecae, their mode of dehiscence, polyandry or synandry, synandrial lobes, filaments, rudimentary gynaeceum, etc. Earlier, Vesque (1893) recognized 3 subgenera (*Eugarcinia* Vesque, *Rheediopsis* Vesque, and *Xanthochymus* T. Anders.) and 9 sections under *Garcinia*. In a subdivision of the family Guttiferae, Engler (1925) has placed *Garcinia* under subfamily *Clusioidae*; tribe *Garcinieae*, to which besides *Garcinia* belong *Allanblackia* Oliv., *Tsimatima* Jun. & Perr., *Rheedia* Linn., *Owataria* Matsumura, *Tetrathalamus* Ltbch., *Tripetalum* K. Schum., and *Pentaphalangium* Warbg. The tribe *Garcinieae* is characterized by a very short style with a sessile, peltate or lobed stigma; loculi of the ovary with always one ovule; fruit an indehiscent berry; embryo symmetrical, undivided, cotyledons absent or minute.

Garcinia Linn. Sp. Pl. 443. 1753; Desr. in Lamk. Encyc. Méth. 3: 699. 1789; Lour. Fl. Cochinch. 1: 14. 1790; DC. Prod. 1: 560. 1824; Cambess. in Mém. Mus. Hist. Nat. (Paris) 16: 425. 1828; G. Don, Gen. Syst. 1: 619. 1831; Wt. & Arn. Prod. 1: 100. 1834; Miquel, Fl. Ind. Bat. 1: 506.

1859. Benth. & Hook. f. Gen. Pl. 1: 174. 1862; Drury, Ind. Fl. 1: 139. 1864; Oliver, Fl. Trop. Africa 1: 164. 1868; T. Anderson in Hook. f. Fl. Brit. Ind. 1: 259. 1874; Vesque in DC. Mon. Phan. 8: 251. 1893. Brühl & King in Ann. R. Bot. Gdn. Calc. 5: 139. 1896; Cooke, Fl. Pres. Bomb. 1: 76. 1901; Gamble, Man. Ind. Timb. 49. 1902 & Fl. Madras 71. 1915; Prain, Beng. Pl. 246. 1903. Pitard in Lecomte, Fl. Gén. Indo-Chine 1: 295. 1907; Brandis, Ind. Trees 49. 1907; Talbot, For. Fl. Bomb. Pres. & Sind 1: 89. 1909; Haines, Bot. Bih. & Or. 2: 53. 1921; Ridley, Fl. Malay Penins. 1: 167. 1922; Parkinson, For. Fl. Andam. Islds. 88. 1923; Engler in Nat. Pfam. (ed. 2) 21: 211. 1925; Benthall, Trees Calc. 29. 1946; Bailey, Man. Cult. Pl. rev. ed. 675. 1949.

Coddampuli Adans. Fam. 2: 445. 1763.

Biwaldia Scop. Introd. 232. 1777.

Stalagmitis Murr. in Comm. Götting. 9: 173. 1789.

Oxycarpus Lour. Fl. Cochinch. 647. 1790.

Mangostana Gaertn. Fruct. 2: 105. t. 105. 1790.

Brindomia Dupetit-Thou. in Dict. Sci. Nat. 5: 339. 1804.

Xanthochymus Roxb. Pl. Corom. 2: 51. t. 196. 1805.

Hebradendron R. Grah. in Hook. Comp. Bot. Mag. 2: 199. t. 27. 1836.

Discostigma Hassk. in Flora 25 (2), Beibl. 33. 1842.

Terpnophyllum Thw. in Hook. Kew Jour. 6: 70. t. 2 C. 1854.

Dactylanthera Welw. in Annaes Conselh. Ultramar. 560. 1858.

Rhinostigma Miquel, Fl. Ind. Bat. Suppl. 495. 1860.

Clusianthemum Vieill. in Bull. Soc. Linn. Normand. 9: 387. 1865.

Evergreen glabrous trees and shrubs, sometimes undershrubs (e.g. *G. buchneri*). Wood moderately hard or hard, close-grained, yellowish-white, red or grey. Exudate often yellow, resinous. Branches usually opposite, horizontal or pendulous. Leaves opposite or rarely ternate, simple, entire, coriaceous or submembranous, very rarely stipulate, more or less lanceolate or oblong. Hairs often absent or simply unicellular. Crystals in mesophyll echinate or rarely in simple fascicles. Glands in mesophyll canaliform, rarely ellipsoid or spherical. Stomata neither prominent nor immersed, often absent above, accessory cells often broad. Mesophyll bifacial, rarely beyond 15 layers. Cuticle thick in xerophytic species.

Flowers polygamo-dioecious or pseudo-hermaphrodite, the female or pseudo-hermaphrodite always in lesser number, axillary or terminal, solitary or in cymes, fascicled or paniculate, small or medium-sized, hypogynous, usually hetero-chlamydeous, tetra- or pentamerous. Sepals 4, decussate or 5, imbricate, rarely 2. Petals 4, alternate with the

sepals, imbricate, seldom 5. *Male Flowers*: stamens indefinite, rarely few (4 in *G. tetrandra*), free or united at the base in one to five bundles or in an entire or 4 to 5-lobed mass, usually surrounding a rudimentary pistil. Anthers various, erect or peltate, dehiscing by longitudinal slits, pores or circumscissile, sessile or on short thick filaments, bilocular, rarely tetra- and plurilocular. Rudimentary pistil absent or variously formed. *Female Flowers*: staminodes minute, various, free or united. Ovary superior, bi- to multilocular; ovule solitary, ana- or hemianatropous, erect or lateral; stigma sessile or subsessile, broadly peltate, entire, radiately lobed or furrowed, smooth or tuberculate. Fruit an indehiscent berry; rind coriaceous; pulp juicy, whitish, enclosing several large seeds. Seed appressedly covered with pulp which may be mistaken for the aril, oblong or ovoid. Embryo a solid homogeneous mass (tigellus); cotyledons absent or minute.

Type Species: *Garcinia mangostana* Linn. Sp. Pl. 443. 1753.

Distribution: This large genus of 435 species is confined to the tropics of the Old World; a large part is known from Tropical Asia, Africa and Polynesia. It appears to have two main centres of development, Malaysia with 225 species, and Tropical Africa with 115 species. The African species are predominantly endemic. 22 species, indigenous to India, are found in southern and eastern India; none of them extending to Western Himalayas and very few even to north-east Himalayas.

Ecological and Biological Notes: The species of *Garcinia* are generally at home in the evergreen and semi-evergreen forests of the tropical everwet zone, or in areas with a relatively mild monsoon climate. They are usually found below an altitude of 1000 m, though some species may occur upto 1830 m. In the forest the *Garcinias* appear as symmetrical, medium-sized, straight-stemmed trees with horizontal branches. Like the Durians, they produce their new leaves in flushes at intervals (Holtum, 1954). The flowers of most wild species appear to be nocturnal, opening at sunset and exhaling a powerful and rather overpowering odour suggestive of a highly seasoned gravy (Corner). The distribution of sexes in *Garcinia* merits careful study. The flowers may be either monoecious or dioecious. However, in *G. mangostana* Linn., Roxburgh (Fl. Ind. 2: 619. 1832) and King (in J. Asiat. Soc. Beng. 59: 156. 1890) described male flowers, the occurrence of which is doubtful. Pierre (1882) has examined more than 1500 plants of *G. mangostana* Linn., without finding a single male flower. But he adds that several species produce

male flowers while young and female flowers at a later age.

The *Garcinias* are one of the slowest growing trees known in the tropics. They are also very slow in coming into bearing. Hume (1947) reports that in mangosteen (*G. mangostana* Linn.), the fruiting may begin in 8 or 9 years after planting, but that more frequently it is 10 to 20 years. Parthenocarp, i.e. production of seedless fruits is also known in mangosteen (Gustafson, 1942). Mangosteen fruits generally contain 1 or 2 'seeds' but fertilization does not take place and growth is from primitive adventitious embryos or hypocotyl-tubercles. According to Hume and Cobin (1946), swellings occur on opposite ends of the 'seed' and the shoot comes from one and the root from the other. The primary root soon aborts and is replaced by an adventitious root from the hypocotyl after germination.

The mode of dispersal is much the same throughout the genus, which is primarily adapted for distribution by arboreal mammals. According to Ridley (1930), monkeys devour the soft fruits of various species of *Garcinia* and pass out the indigestible seeds. He describes how a Chinese in Singapore on one occasion died from a block in the intestines from a vast amount of the seeds of the mangosteen which he had been in the habit of swallowing with the pulp. The occurrence of drift fruits of mangosteen on the shores of islands where it is not cultivated is, according to Ridley, due to their being thrown overboard from ships coming from the Malayan region. However, it should be noted that in mangosteen, the soft seeds have a very short period of vitality and would be at once destroyed by sea-water.

Morphological Nature of the 'Aril' or 'Pulpa': In the tribe Garcinieae an aril or pulpa surrounds the seed. This has been named by Planchon and Triana (1860) as an "Arillodien". It has an agreeable taste and is usually eaten as in *Garcinia mangostana* Linn., and *Tsimatima pervillei* Jum. & Perr. Roxburgh (1832) expressed the view that this pulpa has developed in *Garcinia* from the pericarpial wall and septum of the ovarian locule, and in the course of time as the ripening progresses, the pulpa is detached from the pericarp and is pressed to the seeds. This view has also been advocated by Planchon and Triana (1860) and has in recent times been established by enough anatomical investigations of Cordemoy (1911). It has been shown in *Rheedia calcicola* Jum. & Perr., and *Tsimatima pervillei* Jum. & Perr. that the aril arises from an hypodermal meristematic layer situated within the pericarp. A detailed account of the development of the pulpa of *Garcinia mangostana* Linn. has been quoted by Sprecher (1919),

Evaluation of Taxonomic Characters: The search for good key characters which can be used for the rapid separation of species, is in *Garcinia* a matter of prime importance. The species are often obscure and frequently difficult to classify even when complete material is available. Frequently two species will closely simulate each other in all superficial and gross characters, but an examination of the flowers will show them to belong to quite different sections of the genus. The leaves, except in a very few instances (e.g. in the separation of infraspecific taxa) do not afford good diagnostic characters and when it does, is usually accompanied by other characters which are more to be relied upon. However, their venation pattern reveals certain differences which are diagnostic. These differences consist in the number and distance of lateral nerves, their inarching near the edge to form an inframarginal nerve, whether they are prominent or indistinct, oblique or horizontal veins, etc. The anatomical and histological features of the leaves

yield useful characters in the delimitation of sections under the genus. These may be cited as the presence or absence of hypodermis, presence of simple unicellular hairs or absence of hairs, nature of foliar crystals, uniseriate or biseriate mesophyll, shape and size of stomata and stomatal pores, internal glands, etc. (Vesque, 1889, 1893). The colour and quantity of juice exuded from the bark is sometimes of use in separating species. The role of xylotomy or wood anatomy in the identification of infrageneric taxa was recently emphasized by Engler (1925). According to the data presented by Pierre (1882), the wood is predominantly white to yellowish in the species of the section *Xanthochymus* Pierre; pale yellowish-brown in the section *Mangostana* Pierre; yellowish to brownish, reddish-brown or white in the section *Discostigma* Pierre; and yellow in the section *Hebradendron* Pierre. One can, thereby, from a comparative anatomical investigation, build up a complete system of organization within the genus.

KEY TO THE INDIAN SPECIES OF *GARCINIA*

- A. Sepals and petals 5, rarely petals 4 :
 - B. Rudimentary pistil in male flowers fungiform, base narrow, apex capitate ... 1. *G. andamanica*
 - B. Rudimentary pistil in male flowers absent or if occurring non-fungiform :
 - C. Ovary 3 to 4-locular ; branches of the tree twiggy, not thick :
 - D. Leaves obtuse, often emarginate; flowers about 10 mm in diam. ... 2. *G. spicata*
 - D. Leaves obtuse ; flowers larger, 18-27 mm in diam. ; anthers 8-12 in a fascicle ... 3. *G. talbotii*
 - C. Ovary 5-locular, rarely 2 to 4-locular ; branches of the tree somewhat thick, compressed, 4 to 6-gonous or on drying winged :
 - E. Pedicels about 2.5 cm long ; sepal tips ciliate ; petals expanded ; berry rather large, about 6.5 cm in diam. ... 4. *G. xanthochymus*
 - E. Pedicels about 1 cm long ; sepal tips not ciliate ; petals almost closed ; berry about 2 cm in diam. ... 5. *G. dulcis*
- A. Sepals and petals 4 :
 - F. Flowers fasciculate ; stamens free ; ovary bilocular ; cultivated ... 6. *G. livingstonei*
 - F. Flowers fasciculate, paniculate or solitary ; stamens mono- to polyadelphous ; ovary bi- to multilocular :
 - G. Anthers bilocular, dehiscence longitudinal, poriform or by two short clefts ; rudimentary pistil in male flowers various, often fungiform ; ovary bi- to plurilocular ; stigma smooth or rough, entire or lobed :
 - H. Ovary bilocular :
 - I. Leaves stipulate ... 7. *G. stipulata*
 - I. Leaves exstipulate :
 - J. Stamens of the male flower in an annular mass round the pistillode :
 - K. Male and female flowers in bracteate 3-flowered cymes ; stamens numerous ... 8. *G. anomala*
 - K. Male flowers in fascicles of 3, 6 or 9 ; stamens about 16 ; female flowers solitary or geminate ... 9. *G. imberti*
 - J. Stamens of the male flower in 4 distinct bundles ... 10. *G. merguensis*
 - H. Ovary 3- to plurilocular :
 - L. Stamens of the male flower in an annular, columnar or globular mass :
 - M. Stigma entire ; male flowers in terminal fascicles of few-flowered cymes ... 11. *G. atroviridis*
 - M. Stigma 8 to 12-radiate ; male flowers in terminal trichotomous panicles ... 12. *G. pedunculata*
 - L. Stamens of the male flower in 4 bundles or in a 4-lobed mass :
 - N. Stigma entire :
 - O. Staminodes in the female flower present, free ; female flowers solitary or geminate ... 13. *G. travancorica*
 - O. Staminodes in the female flower absent ; female flowers in 4 to 10-flowered umbellate cymes ... 14. *G. brevirostris*
 - N. Stigma divided into rays or 4 to 8-lobed :
 - P. Berry large, about 7 cm in diam., on a short peduncle ; stigma 5 to 8-lobed ... 15. *G. mangostana*
 - P. Berry small, about 3 cm in diam. ; stigma peltate ; radiate or lobed :

- Q. Staminal bundles or lobes opposite sepals :
 R. Rudimentary pistil in the male flower 8-lobed ... 16. *G. hombroniana*
 R. Rudimentary pistil in the male flower not lobed :
 S. Leaves 30-40 × 11 cm, oblong, obtuse to emarginate ... 17. *G. cornea*
 S. Leaves 4-18 × 3-10 cm, ovate-elliptic, obtuse to shortly acuminate ... 18. *G. affinis*
- Q. Staminal bundles or lobes opposite petals :
 T. Flowers about 5 cm in diam., on rather long peduncles ... 19. *G. speciosa*
 T. Flowers about 2.5 cm in diam. :
 U. Leaves 20-25 × 8-10 cm, elliptic, acuminate ... 20. *G. kurzii*
 U. Leaves 12-15 × 4.5-7 cm, elliptic or ovate-oblong, short and obtuse-acuminate ... 21. *G. kingii*
- G. Anthers bilocular, dehiscence by 2 vertical clefts ; rudimentary pistil frequently absent ; ovary 3-to plurilocular ; stigma frequently lobed or radiate, rough or glandular :
 V. Male flowers in terminal panicles ; female in terminal spikes ... 22. *G. paniculata*
 V. Male and female flowers solitary or in axillary and terminal fascicles :
 W. Male flowers solitary to ternary :
 X. Stigma minute, dot-like, smooth ... 23. *G. microstigma*
 X. Stigma tubercled or tuberculately wrinkled :
 Y. Male flowers solitary or geminate, sessile ... 24. *G. lanceaefolia*
 Y. Male flowers usually 3, pedicellate ... 25. *G. loniceroides*
 W. Male flowers several, in terminal and axillary fascicles :
 Z. Berry echinate ... 26. *G. echinocarpa*
 Z. Berry smooth :
 AB. Ovary 4 to 7-locular ; stamens numerous, inserted on a hemispheric-subquadrate torus ... 27. *G. indica*
 AB. Ovary 8 to 11-locular ; stamens 12-20 or more, inserted on prominent receptacle ... 28. *G. cambogia*
- G. Anthers bilocular, thecae parallel or subparallel, dehiscence by 4 clefts ; rudimentary pistil in male flowers minute or absent ; ovary plurilocular ; stigma lobed or radiate, rarely entire, glandular ; berry often furrowed :
 BC. Male flowers in distinct pedunculate umbels ; petals pale yellow ; berry umbonate ... 29. *G. kydia*
 BC. Male flowers in fascicles of 3-8 ; petals yellow flushed pink or red ; berry non-umbonate ... 30. *G. cowa*
- G. Anthers mono-or plurilocular, dehiscence transverse, circumscissile or by 2 clefts ; rudimentary pistil in male flowers absent ; ovary tetralocular, rarely 6-locular :
 CD. Stamens in male flowers above 20 :
 DE. Staminodes in female flowers about 12, connate in a ring ... 31. *G. morella*
 DE. Staminodes in female flowers about 24, in 6 to 7-androus fascicles ... 32. *G. pictoria*
 CD. Stamens in male flowers below 20 :
 EF. Stigma small, verrucose ; leaves lanceolate or elliptic-oblong, acuminate to cuspidate ... 33. *G. acuminata*
 EF. Stigma large, coronate :
 FG. Leaves linear to linear-oblong, thick, obtusely acuminate ... 34. *G. wightii*
 FG. Leaves elliptic-oblong to elliptic, thinly coriaceous, abruptly and shortly caudate acuminate to subacute ... 35. *G. calycina*

The more important diagnostic characters in the delimitation of species are undoubtedly those of the inflorescence, number of sepals and petals, stamens of male flowers, staminodes of female flowers, pistillodes of male flowers, stigma and fruit. Of these, the organization of the male flowers affords by far the best specific characters. Generally speaking, the *Garcinias* are dioecious and, therefore, in collecting specimens care should be taken to procure both the sexes.

The different herbaria consulted are cited in

the following pages as :

- ASSAM—Regional Herbarium of the Botanical Survey of India, Shillong (Formerly Forest Herbarium, Assam).
 BLAT—Blatter Herbarium, St. Xavier's College, Bombay.
 CAL—Central National Herbarium, Sibpur near Calcutta.
 DD—Herbarium of the Forest Research Institute and Colleges, Dehra Dun.
 MH—Regional Herbarium of the Botanical Survey of India, Coimbatore (Formerly Madras Herbarium, Coimbatore).
 POONA—Regional Herbarium of the Botanical Survey of India, Poona (Formerly Agricultural College Herbarium, Poona).

Garcinia andamanica King, in J. Asiat. Soc. Beng. 59: 170. t. 160. 1890; Vesque in DC. Mon. Phan. 8: 328, 1893; Brühl & King in Ann. R. Bot. Gardn. Calc. 5(2): 141. 1896; Brandis, Ind. Trees 49. 1907; Parkinson, For. Fl. Andaman Islands 89. 1923.

Trees, 6-12 m high. Young branches 4 to 6-gonous, pubescent, dry ones at the angles almost narrowly winged. Leaves 14-25 × 9-14 cm, ovate or oblong-ovate, often inequilateral, obtuse, base rotundate or subcordate, margin irregularly repand, glabrous on both sides, shining, coriaceous; midrib robust, less prominent above, conspicuous below, laterals 14-16 pairs, rather prominent, apices with margin nearly parallel.

Male Flowers: white, about 8 m in diam., in dense axillary fascicles from short wart-like branches. Sepals 5, ovate, rotundate, imbricate, coriaceous, pubescent externally. Petals 5, larger than the sepals, rotundate, clawed, imbricate, glabrous. Stamens indefinite, in 5 thick fleshy bundles opposite the petals; anthers minute, subglobular, introrse. Disc of 5 broad corrugated glands much shorter than the bundles of stamens and alternating with them. Rudimentary pistil absent or fungiform. Berry globular or oval, 2.5-4 × 2-3 cm, smooth, bright yellow, shortly apiculate, the 5-lobed stigma persistent.

Var. andamanica

Syntypes: Helfer 872; Kurz s.n.; King's collector 224, Andaman Islands (CAL).

Flowers: Jan.-April. **Fruits:** Feb.-July.

Herbarium specimens examined: ANDAMAN ISLANDS: without exact locality, Helfer 872; King's collector 224; Prain's collector s.n. (CAL); Aberdeen, S. Kurz s.n. (CAL); Hobdaypur and Tusonabad, King s.n., July 12, 1890 (CAL); Hill jungle, Hobdaypur, King s.n., April 25, 1891 (CAL, DD); Jarawa Khari Hill jungle, King's collector s.n., April 7, 1894 (CAL); Bom-mung-ta, Parkinson, 559, May 1915 (CAL); Havelock Bld., Parkinson 1066, March 1, 1916 (CAL, DD); Tong Island, Parkinson 1019, Feb. 19, 1916 (DD).

Distribution: Evergreen forests of Andaman Islands, especially in damp places or near streams.

Vernacular names: And.: Madaw-mu.

Var. pubescens King in J. Asiat. Soc. Beng. 59: 170. 1890.

Trees, 6-9 m high. Trunk 60-100 cm in circumference. Young bark blackish. Leaves broadly oblong to oblong-ovate, tapering at base, pubescent beneath, glossy green; lateral nerves about 1 cm apart; petiole 2.5 cm or more in length. Flowers in lateral dense fascicles on leafless branches. Young berry whitish-green. (Plate I, 1).

Type: King's collector 136, Andaman Islands (CAL).

Flowers: April. **Fruits:** April-July.

Herbarium specimens examined: ANDAMAN

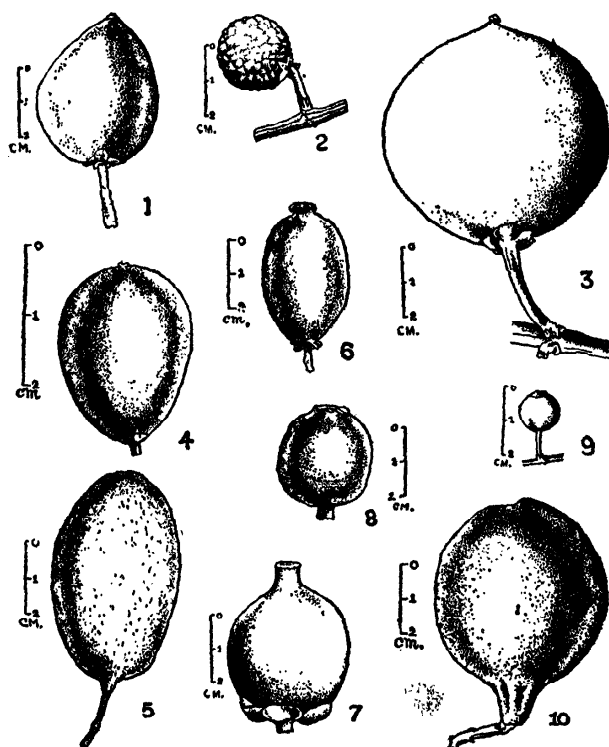


PLATE I: Figs. 1-10. Fruits of *Garcinia*

- | | |
|---|---------------------------|
| 1. <i>G. andamanica</i> v. <i>pubescens</i> | 6. <i>G. stipulata</i> |
| 2. <i>G. spicata</i> v. <i>glomerata</i> | 7. <i>G. anomala</i> |
| 3. <i>G. xanthochymus</i> | 8. <i>G. imberti</i> |
| 4. <i>G. dulcis</i> | 9. <i>G. merguensis</i> |
| 5. <i>G. livingstonei</i> | 10. <i>G. atroviridis</i> |

ISLANDS: Port Blair, Hill's rocky place, King's collector 136 (CAL); Hill jungle, Port Monat, King s.n. (CAL); without exact locality, King's collector 1277 (DD).

Distribution: Andaman Islands, Burma.

Notes: This species is referred in the Flora of British India (1: 269, 1874) under *G. xanthochymus*, as occurring in Helfer's Herbarium and resembling *G. xanthochymus*, except in having pubescent branches. It was wrongly considered by Kurz (For. Fl. Brit. Burma 1: 92. 1877) to be identical with *xanthochymus dulcis* Roxb., a native of the Moluccas, cultivated in the Indian Botanic Garden, Calcutta. It does not agree with specimens still in cultivation there, nor with Roxburgh's description. Pierre (Fl. For. Coch.-Chine 6: 6. 1883) expressed doubt as to the identity of the Andaman and Molucca plants, but he adopts Kurz's name for the latter.

G. spicata (Wt. & Arn.) Hook. f. in J. Linn. Soc. 14: 486. 1875; Pierre, Fl. For. Coch.-Chine 4. 1883; Vesque, loc. cit. 309; Cooke, Fl. Pres. Bomb. 1: 78. 1901; Gamble, Man. Ind. Timb. 50. 1902; et Fl. Madras 74. 1915; Brandis, Ind. Trees 49. 1907; Talbot, For. Fl. Bomb. Pres. 1: 95. 1909; Engler in Nat. Pfam. (ed. 2) 21: 218. 1925; Fl. Assam 1: 110. 1934; Wealth of India 4: 107. 1956; Santapau in Rec. Bot. Surv. Ind.

(ed. 2) 16: 14. 1960. *Stalagmitis cambogioides* Murr. Comm. Götting. 9: 173. 1789. p.p. non Blanco. *Xanthochymus ovalifolius* Roxb. [Hort. Beng. 42. 1814. nom. nud. et] Fl. Ind. 2: 632. 1832; Drury, Ind. Fl. 1: 142. 1864. *Stalagmitis ovalifolia* G. Don, Gen. Syst. 1: 621. 1831. *Xanthochymus spicatus* Wt. & Arn. Prod. 1: 102. 1834. *Stalagmitis spicata* Walp. Rep. 1: 396. 1842. *Garcinia ovalifolia* (Roxb.) Hook. f. Fl. Brit. Ind. 1: 269. 1874, non Oliver (1868).

Medium-sized trees, 6-12 m high. Bark thick, smooth, olive-green or brownish. Branches often 6-ribbed. Wood yellowish-white, smooth, hard, heavy. Leaves 9-22 × 4-8 cm, ovate, elliptic-oblong or lanceolate or suborbicular, rotundate or often emarginate, rarely acute, base rotundate, margin repand, coriaceous, shining; midrib strong, prominent below, laterals slender, about 18, prominent on both sides, slightly curved, obliquely parallel, transverse veins laxly reticulate; petiole about 1 cm long, robust, often pubescent.

Male Flowers: about 10 mm in diam., pedicellate, in axillary leafy fascicles or pseudo-spikes. Sepals 4 or 5, orbicular, coriaceous, ciliolate, half as large as the petals. Petals 5, obovate, membranous, concave. Stamens in 5 long-clawed spathulate fascicles, opposite petals; anthers didymous; filaments short, free. **Female Flowers:** often more and usually on much longer pedicels than the males. Staminodes 5, small with weak anthers. Ovary globose, 3 to 4-locular; style short; stigma 5-lobed to the middle. Berry broadly oblong, size of a walnut, smooth, dark green, 1 to 3-seeded.

A most variable species both as to the shape of the leaves and length of the peduncles and pedicels.

Var. *spicata*

Leaves obtuse. Male flowers in small elongate pseudo-spikes.

Type: Wight 138, Peninsular India (CAL).

Flowers: Hot season. **Fruits:** Cold season.

Herbarium specimens examined: PENINSULAR INDIA: without exact locality, *Herb. Wight* 138 (CAL); Moolipalium, *Wallich* 4838 (CAL); *Marikanam*, South Arcot, C. A. Barber 8321, June 3, 1907 (MH); Karian Shola, Annamalais, Coimbatore Dist., V. Narayanswamy 5444, March 19, 1931 (MH). BENGAL: Indian Botanic Garden, Cultivated, R. G. Cooper 4409, April 17, 1909 (CAL), ex *Herb. Brandis* (DD), Hort. Bot. Calc. no. 230, April 17, 1834 (DD). ASSAM: Garampani, Sibsagar Dist., U. N. Kanjilal 3036 (ASSAM).

Distribution: Evergreen rain forests of Western Ghats from Konkan southwards to Kerala at low elevations and on the eastern coast from Ganjam southwards to Pudukottah; Ceylon. Cultivated in the Indian Botanic Garden, Calcutta (*Herb. Pierre* 3386).

Vernacular names: Mal.: *Manja-nangu*; Mar.;

Haldi; Tam.: *Kokattai*; Tel.: *Pidatha*; Khasi: *Dingso kwang*.

Uses: The wood is a strong timber useful for general construction purposes, also suitable for wattle and daub buildings. The fruit is eaten and the pulp of young ones affords a chrome-yellow pigment. The bark is reported to contain the colouring matter Fukuji, used as a mordant dyestuff in Japan.

Var. *glomerata* Vesque in DC. Mon. Phan. 8: 311. 1893.

Leaves obtuse. Male flowers in axillary leafy fascicles, 7-9 mm broad. (Plate I, 2).

Type: ex *Macdowall* (Ceylon); cult. in Indian Botanic Garden, Calcutta.

Flowers: March. **Fruits:** July-Aug.

Herbarium specimens examined: PENINSULAR INDIA: without exact locality, *Herb. R. Wight* s.n. (MH); Gooindlapalem, Nellore Dist., J. S. Gamble 12819, July 1883 (MH); Sriharikota, Nellore Dist., March 1901 (MH), J. S. Gamble 12669, Aug. 1883 (DD); Sriharikota Range, Nellore, South Division, Madras, No. B, April 28, 1952 (DD).

Distribution: India, Ceylon.

G. *talbotii* Raizada ex Santapau in Rec. Bot. Surv. India (ed. 2) 16: 14. 1960. *Xanthochymus ovalifolius* Graham, Cat. Pl. Bomb. 26. 1839. non Roxb. *Garcinia ovalifolia* var. *macrantha* T. Anderson in Hook. f. Fl. Brit. Ind. 1: 269. 1874. *G. malabarica* Talbot in Jour. Bomb. Nat. Hist. Soc. 11: 234. t. 1. 1897 et For. Fl. Bomb. Pres. 1: 96. 1909. Gamble, Fl. Madras 74. 1915, non Desr. (1789). *G. spicata* var. *macrantha* Cooke, Fl. Pres. Bomb. 1: 79. 1901.

This species is closely allied to *G. spicata* Hook. f. and is mainly distinguished by its leaves obtuse; male flowers large, 18-27 mm in diam. and anthers 8-12 in a bundle. It is easily confused with *G. xanthochymus* Hook. f., from which it can be distinguished by the number of stigmatic lobes, *G. talbotii*: 3, *G. xanthochymus*: 5-6. From the leaves alone it is not possible to distinguish these two trees.

Medium-sized trees, 6-15 m tall. Exudate turning into a brownish sticky mass. Leaves dark green, shining. Flower buds in axillary umbels, often seen on old wood. Male flowers creamy-white, white to greenish-yellow. Berries about 5 cm in diam., abounding in yellow latex.

Type: W. A. Talbot 3713, Gairsoppah Ghat, North Kanara (CAL).

Flowers: Nov.-March. **Fruits:** Feb.-May.

Herbarium specimens examined: PENINSULAR INDIA: Gairsoppah Ghat, North Kanara, W. A. Talbot 2693 (CAL, POONA), W. A. Talbot 3713 (CAL); Diggi, North Kanara, W. A. Talbot s.n., May 9, 1888 (POONA); Devimane, North Kanara, Hallberg & McCann 34583, Oct. 1919

(BLAT); Guddhehalli Hill, Karwar, North Kanara, T. R. Bell 7811 & 7844 (BLAT); Holesurangi, Kanara, No. 10488 & 10488 B, March 1940 (DD); Bhimashankar, Poona district, W. A. Talbot 5014 (POONA); Castle Rock, Bombay, R. K. Bhide s.n., April 16, 1909 (POONA); Shirgaon, Bombay, J. A. Vasavada 17031, April 21, 1957 (POONA); Katlikan, N. L. Bor 11463, May 1939 (DD); Khandala, G. A. Gammie 16163, March 21, 1903 (POONA); Khandala, Santapau 62.7, 62.8, 62.9, 62.12, 3331 & 3332 (BLAT); Meroli Plateau, Khandala, Santapau 3560 & 4210 (BLAT); St. Xavier's Villa to Elphinstone slopes, Khandala, Santapau 866, Jan. 26, 1959 (BLAT); below Elphinstone Plateau, Khandala, Santapau 10585, Dec. 20, 1949 (BLAT); Elphinstone slopes, Khandala, Santapau 23053, Jan. 26, 1959 (BLAT); Coona River, Khandala, Santapau 28438, Oct. 1918 (BLAT); Tiger's Leap jungle, Khandala, without collector's name, 27647, Oct. 1918 (BLAT); St. Xavier's Ravine, Khandala, Santapau 1747, 3251, 3252, 15422 & 15423 (BLAT); Lake View, Matheran, Puri 9895, Jan. 29, 1957 (POONA); Matheran, T. Cooke s.n., March 1891 (BLAT); Matheran, Bombay, N. A. Irani 2485, 2486, 2620, 2745 & 2791 (BLAT); Picnic Spot, Matheran, N. A. Irani 2994, Feb. 26, 1959 (BLAT); Nelliampatty Ghat, Anamallays (MH); Kulathurpuzha, Travancore, T. F. Bourdillon 1524, April 27, 1904 (DD); Choura hill, Bhimashankar, coll. no. 76581, April 6, 1962 (POONA); Rai Jungle, Bhimashankar-Khed taluka, coll. no. 76642 (POONA).

Distribution: Evergreen forests of Western Ghats from North Kanara southwards.

Vernacular names: Kan.: *Haldi*, Ont; Mar.: *Pansara*; Bomb.: *Limboti*.

G. xanthochymus Hook. f. ex T. Anderson in Fl. Brit. Ind. 1: 269. 1874; Kurz in J. Asiatic Soc. Beng. 43: 88. 1874 et For. Fl. Brit. Burma 1: 93. 1877; Pierre, loc. cit. 3. t. 71 A; King in J. Asiatic Soc. Beng. 59: 168. 1890; Vesque, loc. cit. 315; Cooke, Fl. Pres. Bomb. 1: 78. 1901; Gamble, Man. Ind. Timb. 50. 1902; Prain, Beng. Pl. 1: 247. 1903; Brandis, Ind. Trees 49. 1907; Talbot, For. Fl. Bomb. Pres. 1: 94. 1909; Rama Rao, Fl. Pl. Trav. 30. 1914; Haines, Bot. Bih. & Or. 2: 53. 1921; Parkinson, For. Fl. Andaman Islands 89. 1923; Craib, Fl. Siam. Enum. 1: 118. 1931; Fl. Assam 1: 104. 1934; Burkill, Dict. Econ. Prod. Mal. Penins. 1: 1056. 1935; Gagnepain, Fl. Gén. Indo-Chine Suppl. 3: 257. 1943; Sinclair in Bull. Bot. Soc. Beng. 9: 87. 1955; MacMillan, Trop. Pl. & Gard. (ed. 5) 258. 1956; Wealth of India 4: 108. 1956; Santapau in Rec. Bot. Surv. Ind. 16 (ed. 2): 14. 1960. *Xanthochymus pictorius* Roxb. Pl. Cor. 2: 51. t. 196. 1805 et Fl. Ind. 2: 633. 1832, non *Garcinia pictoria* Roxb. *Xanthochymus tinctorius* DC. Prod. 1:

562. 1824. sphalm. pro "*X. pictorius* Roxb.". Wt. & Arn. Prod. 102. 1834; Choisy, Guttif. Ind. 32. 1851; Planchon & Triana in Ann. Sci. nat. sér. 4 (Bot.) Paris 14: 304. 1860. *Stalagmitis pictoria* G. Don, Gen. Syst. 1: 620. 1831. *Garcinia tinctoria* Dunn in Gamble, Fl. Madr. 74. 1915 et Kew Bull. 1916: 64. 1916.

Medium-sized or tall, beautiful trees. Trunk straight; branches drooping, angular, glabrous, often dilated just below the axils of leaves. Bark blackish or dark grey, exfoliating in small round scales; cut milky, turning yellow on exposure. Wood yellowish-brown to dark greyish-brown, very hard, moderately heavy. Leaves greatly variable in form and size, 12-35 × 4-10 cm, glabrous, opposite, linear-oblong or oblong-lanceolate, acute and acuminate, base cuneate, margin thick, subrepand, coriaceous, dark green, shining; midrib prominent below, laterals irregular, subparallel, arched, anastomosing at the apex; petiole 1-2.5 cm long, rugose.

Male Flowers: white, about 1.5 cm in diam., in 4 to 10-flowered fascicles, axillary or from the axils of fallen leaves; pedicels thickened, about 2.5 cm long. Sepals 5, rarely 4 and then often the fifth sepal disarranged and scale-like, orbicular, concave, fleshy, unequal, apex ciliate. Petals 5, about 8 mm long, alternating with sepals, orbicular, spreading, incurved, greenish. Stamens in 5 broad bundles of 3-5 each, antipetalous, alternating with 5 fleshy glands; anthers bilocular. **Female Flowers:** like the males. Staminodes few, complanate. Ovary ovoid, acuminate, usually 5-locular; stigmatic rays 5, oblong, spreading, entire. Berry rather large, about 6.5 cm in diam., subglobose, pointed, dark yellow, with plenty of yellow gum. Seeds 1-4, oblong, embedded in a yellow aril-like pulp. (Plate 1, 3).

Type: Roxburgh, Circars (Herb. Martius, BR).

Flowers: Feb.-May. **Fruits:** Nov.-Feb.

Herbarium specimens examined: PENINSULAR INDIA: without exact locality, Wight 139 (CAL); Coorg, Wight s.n., (MH), S. H. Howard C (CAL); Mercara, Coorg, H. Tireman 32, June 24, 1919 (DD); Mysore, ex Herb. Brandis (DD); Mahendragiri, Ganjam dist., J. S. Gamble 14060 (CAL, MH), Fischer & Gage 9 (CAL) and V. Narayanswami 5657, Aug. 16, 1931 (MH); Azerpadi, Coimbatore dist., C. A. Barber 3841 (CAL); Vathangi, Godavari dist., MH 12677, Feb. 5, 1916; Malabar, Konkan, etc., Stocks, Law, etc. (CAL); Paralai, Annamalai, C. A. Barber 3963, Nov. 6, 1901 (MH); Iyerpadi, Annamalais Hills, 1250 m. Fischer 3387, April 25, 1917 (DD); North Kanara, W. A. Talbot 424, April 1883 (CAL); near Karwar, North Kanara, T. R. Bell 3969, April 1928 (BLAT); Sirsi-Siddhapur, North Kanara, Hallberg & McCann 34784, Oct. 1919 (BLAT); Yellapur, Sahrahalli Khan, North Kanara, Santapau 18741, May 26, 1954 (BLAT);

Yellapur, Sahusrahalli, Dharwar, A. R. Braganza 732, Nov. 17, 1950 (DD); Yellapur Range, Kanara, June 1955 (DD); Sonda, N. Kanara dist., W. A. Talbot 3656, May 6, 1896 (POONA); Sirsy, Bombay, W. A. Talbot s.n., April 1, 1886 (POONA); Bombay, ex Herb. Dalzell (DD); Victoria Gardens, Bombay, no. 13815, Jan. 1917 (BLAT), R. R. Fernandez 2391, 3383, 3384 & 3386 (BLAT); Malabar Hill, Bombay, no. 13817, April 1917 (BLAT); College Garden, Poona, L. D. Garade 377, June 9, 1902 (BLAT, POONA); Khandala, no. 18273, May 1899 (BLAT); Meroli Plateau, Khandala, Santapau & McCann 1892, April 20, 1943 (BLAT). EASTERN HIMALAYAS: Mungpoo, Sikkim, Prain's collector s.n., (CAL); Junction of Ryang and Rungyo, Sikkim, G. King s.n., Dec. 20, 1877 (CAL); Sikkim, J. D. Hooker s.n., G. King 2571 (CAL); Siok, Sikkim, T. Anderson s.n. (CAL); Kurseong, Sikkim, Rihu & Rhomboo 4984, March 31, 1911 (CAL). ASSAM: South Lushai hills, between Luichong and Demagiri, A. T. Gage 205 (CAL); Khasia, J. D. Hooker & T. Thomson s.n. (CAL); Deogaon, no. 115 (CAL); Upper Assam, G. Mann 589 (DD). BENGAL: Chittagong, W. Schlich 8, Feb. 9, 1875 (DD); Chittagong, J. D. Hooker & T. Thomson s.n. (CAL); Kodala Hill, 48 km from Chittagong, Badul Khan 421, Feb. 1886 (CAL); Burkul, Chittagong Hill Tracts, J. L. Lister s.n., March 30, 1876 (CAL); Indian Botanic Garden, Calcutta, M. B. Raizada s.n., March 1939 (DD). ORISSA: Cuttack, cultivated, H. H. Haines s.n., April 1919 (DD); Puri Division, in dense forest, H. H. Haines 4008, April 23, 1917 (DD). ANDAMAN & NICOBAR ISLANDS: Pa-Jig-Baratang, Andamans, C. E. Parkinson 352, Feb. 19, 1915 (CAL); Near Port Blair, Andamans, King's collector 205, July 24, 1884 (CAL); Near Mt. Harriet, Port Blair, King's collector 242, April 6, 1884 (CAL); South Andamans, S. Kurz s.n. (CAL); R. L. Heinig 73, Aug. 1896 (CAL); Andamans, Prain's collector 7 (CAL); Guitar Island, Andamans, Kirat Ram 3689, Feb. 1934 (DD); Great Nicobars, K. C. Sahni 22917, March 1952 (DD).

Distribution: Considered to be a native of India and Burma; widely distributed in the lower hill forests of Eastern Himalayas, Orissa, Bombay, Madras, Mysore, Coorg, Kerala, Andaman and Nicobar Islands, Chittagong Hills, Burma, Yunnan, Thailand and Malay Peninsula. Cultivated in gardens as an ornamental tree.

Vernacular names: Hind.: *Dampel*, *Tamal*; Ass.: *Tepor*, *Tepol-tenga*; Beng.: *Chalata*, *Tamal*; Guj.: *Karamala*, *Ota*; Kan.: *Devagarige*, *Gansangi*, *Deavkai*, *Janagi*; Kon.: *Dhanambe*; Mal.: *Anavaya*; Mar.: *Jharambi*, *Ota*; Oriya: *Cheoro*, *Sitambu*, *Chiuri*; Tam.: *Kulavi*, *Malaiappachai*, *Mukki*, *Tamalam*; Tel.: *Ivarumidi*, *Tamalamu*; Garo: *Aruak*; Khasi: *Deing-soh-ryn-san*, *Dieng-*

soh-khyllung; Mikir: *Thesampreng*; Sylh.: *Dephah*.

Uses: The acidic fruits are used in India for making sherbets, medicaments and made into preserves and jams. The gumresins from the fruit and stem make a pretty good water-colour. The seeds germinate readily and seedlings, when 4 years old, are useful as rootstock for grafting and inarching mangosteen.

Notes: This species is known in some flora under the name of *Xanthochymus tinctorius* Roxb. published in DC. (Prod. 1: 562. 1824), but it is obvious from the citation given by De Candolle that *X. tinctorius* was a misprint for *X. pictorius* Roxb. (Pl. Corom. 2: 51. t. 196. 1805 et Fl. Ind. 2: 633. 1832, non *Garcinia pictoria* Roxb.), a fact also recognized by Wight and Walker-Arnott (Prod. Fl. Penins. Ind. Or. 102. 1834). This being the case, *Garcinia xanthochymus* Hook. f. is the correct name for the species under *Garcinia*; *G. pictoria* being already preoccupied. *G. tinctoria* published by W. F. Wight (in U.S. Dept. Agric. Bur. Pl. Industry Bull. 137: 50. 1909) and later independently by Dunn (in Gamble, Fl. Madras 74. 1915 et Kew Bull. 1916: 64. 1916), therefore, cannot be considered as a new combination of *X. tinctorius*.

G. dulcis (Roxb.) Kurz in J. Asiat. Soc. Beng. 43: 88. 1874, p.p. et For. Fl. Brit. Burma 1: 92. 1877, p.p.; King in J. Asiat. Soc. Beng. 59: 169. 1890; Vesque, loc. cit. 312. Backer, Fl. Bat. 1: 85. 1907; Merrill in Philip. J. Sci. (Bot.) 3: 362. 1908 et Enum. Philip. Pl. 3: 84. 1923; Ridley, Fl. Mal. Penins. 1: 179. 1922; Engler in Nat. Pfam. (ed. 2) 21: 219. 1925; Burkill, Dict. Econ. Prod. Mal. Penins. 1: 1049. 1935; Wealth of India 4: 101. 1956. *Xanthochymus dulcis* Roxb. Hort. Beng. 42. 1814, nom. nud. & Fl. Ind. 2: 631. 1832. *Garcinia elliptica* Choisy in DC. Prod. 1: 461. 1824, non Wall. *Xanthochymus javanensis* Blume, Bijdr. 1: 216. 1825. *Stalagmitis dulcis* Cambess. in Mém. Mus. Hist. Nat. (Paris) 16: 426. 1828. G. Don, Gen Syst. 1: 620. 1831; Miquel, Fl. Ind. Bat. 1: 508. 1859. *S. cambogioides* Blanco, Fl. Filip. (ed. 2) 301. 1845, (ed. 3) 2: 195. 1878, non Murr. *Garcinia ovalifolia* Vidal, Rev. Pl. Vasc. Filip. 53. 1886, non Hook. f.

Trees. Young branches tetragonous, grooved, keeled. Bark smooth, shining, olive-coloured. Leaves opposite, 11-25 × 3-14 cm, ovate, elliptic or elliptic-oblong, obtuse, often obtusely or acutely acuminate, base obtuse or rotundate, rarely subcordate, chartaceous or papyraceous; midrib prominent below, often prominent above, laterals about 20, irregularly parallel, arcuate, prominently anastomosing at the apex into the submarginal nerve; short-petioled.

Male Flowers: in axillary leafy fascicles (5-12), about 1.5 cm in diam., pedicel 1 cm long, bracteoles inserted at swollen pulvinus. Sepals 5, rarely 4 or 6, outer smaller than inner. Petals 5, rarely 4, alternating with sepals, ovate, obtuse, about 1 cm long, flabellately veined, almost closed. Staminal bundles 5, rarely 4; anthers didymous, linear, about 5 mm long. Rudimentary pistil often absent, rarely cylindrical, short. **Female Flowers:** staminodes few, distributed in 5 fascicles, free or connate below the middle. Ovary ovoid-subglobose, 5-locular with one ovule in each attached to the middle of the axis; style contracted, short, thick, stigmatic rays 5, entire, margin rotundate; stigma coronate. Berry about 3×2 cm, fleshy, bright yellow when ripe, ellipsoid, smooth, unilocular, base contracted, apex short and obtusely acuminate. Seeds 1-5, oblong; aril edible, dark coloured, with pleasant taste. (Plate 1, 4).

Type: ex Molucca Islands; cult. in Indian Botanic Garden, Calcutta.

Flowers: March-July. **Fruits:** May-Nov.

Herbarium specimens examined: BENGAL: Indian Botanic Garden, Calcutta, cult., ex Herb. Brandis (DD).

Distribution: In primary forests from Malay Peninsula and Archipelago to South Andaman Islands and Moluccas at low and medium altitudes. Cultivated throughout Malaysia and introduced in the Indian Botanic Garden, Calcutta.

Uses: The fruit contains citric acid and is suitable for jams and preserves. The seeds are medicinal and used externally. The bark is used for dyeing mats.

G. livingstonei T. Anderson in J. Linn. Soc. 9: 263. 1867; Oliver, Fl. Trop. Africa 1: 165. 1868; Pierre, loc. cit. 1; Vesque, loc. cit. 337; Engler in Bot. Jahrb. 40: 556. 1908 et Nat. Pfam. (ed. 2) 21: 215. 1925; Burkill, Dict. Econ. Prod. Mal. Penins. 1: 1051. 1935; Hutchinson & Dalzell, Fl. W. Trop. Africa. (rev. ed.) 1: 294. 1954; Wealth of India 4: 103. 1956, non Welw.

Trees. Branches robust, terete. Bark grey, rugose. Leaves often ternate, verticillate, 6-10 × 3-4.5 cm, obovate or elliptic, rotundate or shortly apiculate, base acute or cuneate, chartaceous, margin entire or subrepand or often at the base of the leaf revolute; midrib prominent below, above hardly prominent, laterals slender, 10-16, irregularly and openly parallel, veins oblique, laxly reticulate, prominent on both sides.

Flowers: white, in short axillary fascicles. Sepals 4, orbicular, concave, equal, 2×2 mm, many-nerved, coriaceous, persistent. Petals 4 or 5, three times longer than sepals, orbicular, concave, many-nerved, slender. Stamens about 24 (in male flowers) below the central mass, in female flowers below annular disc, 1 or 2-seriate, filaments free.

Ovary (in female flowers) bilocular, stigma convex, hardly lobed, nearly sessile, coronate. (Plate I, 5).

Type: ex Kirk (Zambesi, Africa); cult. in Indian Botanic Garden, Calcutta.

Flowers: March.

Herbarium specimens examined: BOMBAY [MAHARASHTRA]: Victoria Gardens, Bombay, R. R. Fernandez 2735, 2736, 2880 & 2886, Sept. 1956 (BLAT); College Garden, Poona, L. D. Garade s.n., April 12, 1903 (POONA). BENGAL: Indian Botanic Garden, Calcutta, P. M. Debbarman 11328, Feb. 11, 1915 (CAL), M. B. Raizada s.n., April 1935 & Feb. 1940 (DD).

Distribution: Tropical Africa; introduced into India and Indonesia from Tropical East Africa and grown in botanical gardens (Herb. Pierre 4147).

Uses: The plant is a promising rootstock for mangosteen. The fruits are edible, and their fleshy pericarp and pulp are used in preparing a fermented beverage.

G. stipulata T. Anderson in Hook. f. Fl. Brit. India 1: 267. 1874; Pierre, loc. cit. 9. t. 79 K; Vesque, loc. cit. 365, excl. syn.; Gamble, Man. Ind. Timb. 52. 1902; Brandis, Ind. Trees 50. 1907; Engler in Nat. Pfam. (ed. 2) 21: 225. 1925.

Trees, about 20 m high with slender branches. Bark light, smooth, brown. Wood light orange-yellow, moderately hard. Leaves 15-30×4-9 cm, elliptic-oblong or lanceolate, stipulate, acuminate, base obtuse or acute, thickly coriaceous, dark green above, pale green beneath; midrib and lateral nerves prominent, the latter alternate, distant, incurved, veins obliquely transverse, simple, furcate or laxly reticulate; petiole about 2 cm long, sulcate above; stipules small, triangular.

Male Flowers: creamy-yellow, in 4 to 6-flowered axillary cymes; pedicels about 12 mm long, stout, 2-bracteolate near base; bracts scale-like. Sepals 4, orbicular, concave. Petals 4, twice as long as sepals, obliquely ovate, acute. Stamens numerous, in an annular mass; anthers 2-locular; filaments short; pollen grains adorned with minute spines, 5-6 equatorial pores present. Rudimentary pistil fungiform; stigma peltate, convex, minutely tubercled. **Female Flowers:** axillary, solitary or paired, shortly pedicellate. Sepals persistent in fruit. Berry 40×8-15 mm, oblong, smooth, shortly acuminate, bilocular, two-seeded; stigma orbicular, tuberculate, margin revolute. Seeds 22 × 8 mm, oblong, flattened, testa strongly nerved. (Plate I, 6).

Type: Hooker f. & Thomson 17, Sikkim (CAL).

Flowers: Aug.-Nov. **Fruits:** Nov.-May.

Herbarium specimens examined: E. HIMALAYA: Sikkim, G. King 4933, Aug. 28, 1877 (CAL), S. Kurz s.n. (CAL), Dungbu 4943, Oct. 2, 1877 (CAL), J. D. Hooker 17 (CAL); Simenbong

to Richy, Sikkim, *T. Anderson* 792, Sept. 30, 1862 (CAL); Lepong, Sikkim, *T. Anderson* 789 (CAL); Kalimpong, *J. S. Gamble* 7500, Dec. 9, 1879 (CAL, DD); Mungpoo, 1066 m., *G. A. Gammie* s.n., Aug. 24, 1884 (POONA), no. 1018, April 12, 1909 (CAL); Darjeeling, *J. S. Gamble* 9670, 9760, Aug. 1881 (CAL, DD); Pomong, Darjeeling, *C. B. Clarke* 8803, Aug. 23, 1869 (CAL); Ryang, Sikkim Himalaya, 457 m., *G. King* s.n., Oct. 20, 1879 (DD). ASSAM: Mowpoot, Khasia, *C. B. Clarke* 14609 B, Nov. 14, 1871 (CAL); Above Upper Rotung, Abor, *I. H. Burkill* 38198, March 3, 1912 (CAL); South slope of Bapu, Abor, *I. H. Burkill* 36917, March 7, 1912 (CAL); Near the Dibong, Abor, *I. H. Burkill* 36124, Jan. 19, 1912 (CAL); Watershed of Egav and Serpo, Abor, *I. H. Burkill* 36209 (CAL); Piri Mountain, Abor Hills, 2360 m., *N. L. Bor* 2461A, Nov. 1934 (DD); Foruputa, Duphla Hills, *J. L. Lister* 187, Jan. 19, 1875 (CAL); Kolab, Naga Hills, Cachar, *J. C. Prazer* 27, May 14, 1889. N.E.F.A.: Aka Hills to Sisni Camp, Sela sub-agency, Kameng F.D., *G. K. Deka* 27, Nov. 13, 1951 (ASSAM); Boha Hill, Kameng F. D., *G. Panigrahi* 15350, May 10, 1958 (ASSAM).

Distribution: Moist subtropical forests of Bhutan, Eastern Himalayas and N.E.F.A., ascending to 1525 m. Common in the valleys of the Teesta and its affluents.

Uses: The fruits are eaten by Lepchas.

G. anomala Planch. & Triana in Ann. Sci. nat. sér. 4. 14: 329. 1860; Lanessan, loc. cit. 30; *T. Anderson* in Hook. f. loc. cit. 266; *Kurz* in J. Asiat. Soc. Beng. 43: 87. 1874 et For. Fl. Brit. Burma 89. 1877; *Pierre*, loc. cit. 10. t. 79 L; *Vesque*, loc. cit. 369; *Brandis*, Ind. Trees 50; *Engler* in Nat. Pfam. (ed. 2) 21: 223. 1925; Fl. Assam 1: 109. 1934. *G. monosperma* Berg et Schmidt, Offiz. Gew. 4: t. 33 d. 1863.

Small, erect, evergreen trees with subverticillate robust branches. Bark brown or grey, rough, thin; cut yellowish. Leaves 10-20 × 3.5-8.5 cm, elliptic or oblong-lanceolate, shortly acuminate, base obtuse or rotundate, margin repand, coriaceous, dark green; midrib prominent below, lateral nerves slender, 15-25, prominent on both sides, obliquely parallel, veins oblique, transverse or laxly reticulate; petiolate.

Male and Female Flowers in bracteate, 3-flowered, shortly pedunculate cymes; in the axils of upper leaves; yellowish; bracts two, foliar, about 8 mm long; pedicels short, stout, 2-bracteolate at base, bracteoles about 2 mm long. **Male Flowers:** about 12 mm in diam., buds globose. Sepals 4, decussate, concave, orbicular. Petals 4, yellowish-white, obliquely oblong, suberect, somewhat concave, margin fimbriate. Stamens numerous, in an annular mass round the pistillode; anthers bilocular, horse-shoe shaped, dehiscence vertical, introrse below, extrorse

above; filaments short, free, thick, compressed. Rudimentary pistil short, thick, columnar or slightly obconic; stigma conical, rugose, coronate. **Female Flowers:** smaller than the males. Sepals persistent. Petals deciduous, whitish-green. Stamens many, filaments united in an annular ring at the base of ovary. Ovary bilocular, oblong, apex slightly attenuated, locule uniovulate; stigma disciform, coronate, persistent, margin reflexed, many-striate, irregularly lobulate. Berry ellipsoid, pruiniform, about 42 × 35 mm, smooth, olivaceous, 1-2-seeded. Seeds 8 × 6 mm (Plate I, 7).

Syntypes: *Griffith*, Kew distrib. no. 848, East Bengal (CAL); *Hooker* f. & *Thomson* 14, Khasia, Assam (CAL).

Flowers: Nov.; April-May. **Fruits:** Nov.-Feb.

Herbarium specimens examined: E. HIMALAYAS: Jaldaha, Chumbi Valley, *G. L. Searight* 185, Dec. 1904 (CAL); Chamorchi, Chumbi, *G. L. Searight* 173, April 1905 (CAL, DD). ASSAM: South Lushai, *W. J. H. Wenger* 4, April 26, 1924 (CAL); Pynursla Gorge forest, *S. R. Sharma* 18220, Nov. 4, 1938 (ASSAM), *R. K. De* 19300, April 29, 1940 (ASSAM), *K. Biswas* 4051, Nov. 4, 1938 (CAL); Sohrarim, Khasi hills, *U. N. Kanjilal* 2582, Sept. 16, 1913 (CAL, DD), *U. N. Kanjilal* 415 P, April 20, 1914 and 6226, Nov. 18, 1915 (ASSAM); Surareen, Khasia, *C. B. Clarke* 40417 A & 45180 D (CAL); Serrarim forest, *P. C. Kanjilal* 9419, Sept. 20, 1931 (ASSAM); Jaintia hills, *G. Mann* s.n. (CAL); Jowai, Jaintia hills, *G. Mann* 857, May 1878 (ASSAM, DD), *C. B. Clarke* 42547 D, Dec. 14, 1885 (CAL) and *U. N. Kanjilal* 768 P, Feb. 9, 1915 (ASSAM); Chennapoongei, *G. Gallatly* 334, June 1878 (CAL); Khasia, *J. D. Hooker* & *T. Thomson* 14 (CAL); Dumpep, *P. C. Kanjilal* 10213, May 29, 1932 (ASSAM); Below Lynkawit, *U. N. Kanjilal* 6189, Nov. 11, 1915 (ASSAM, DD); Loharband, Cachar, *R. N. De* 16499, March 18, 1938 (ASSAM); Mamloo forests, *P. C. Kanjilal* 9577, Sept. 13, 1931 (ASSAM); Jowai to Jorain, *G. K. Deka* 17183, Nov. 6, 1938 (ASSAM); Mausmai, *P. C. Kanjilal* 10111, May 18, 1932 (ASSAM); Jarain, Khasi hills, *U. N. Kanjilal* 2717, Oct. 17, 1913 (ASSAM, DD); Khasi hills, *G. Mann* 27 & 313 (DD); Khasi hills, ex herb. *S. Kurz* 27 (CAL); without exact locality, *G. Mann* s.n., Aug. 1892 (CAL); *King's collector* s.n., May 1893 (CAL, DD); Naga hills, *N. L. Bor* 2718 (DD). EAST BENGAL: without exact locality, Herb. *Griffith* 848 (CAL, DD).

Distribution: Hill forests of Garo, Naga, Khasi and Jaintia, in North-East India and Martaban, east of Tounghoo from 900-1800 m.

Vernacular names: Garo: *Thechu*; Khasia: *Diengsoh-kwang*, *Soh-lain-khlaw*; Manipur: *Hai-bung*; Synt.: *Diengsoh-lang-sain*.

G. imberti Bourd. in Jour. Bomb. Nat. Hist. Soc. 12: 349. t. 1. 1899, *Gamble*, Man. Ind.

Timb. 57. 1902 et Fl. Madras 74. 1915; Rama Rao, Fl. Pl. Trav. 31. 1914.

Medium-sized, evergreen trees, 9-12 m high. Trunk about 30 cm in diam. Bark brown and white, smooth, about 6 mm thick; cut sweet-scented. Wood yellowish-grey, very hard; pores medium to small, scanty, evenly distributed; medullary rays indistinct; annual rings not visible. Leaves opposite, 4-8 × 1.5-3 cm, elliptic or lanceolate, acuminate, base narrowed, entire, dark green; petiole 3 mm long.

Male Flowers: terminal fascicles of 3, 6 or 9 at the ends of branchlets, yellow, about 5 mm in diam., succulent, sessile. Sepals and petals 4 each, much imbricated. Stamens in a central globose mass, about 16. **Female Flowers:** solitary or geminate, yellow, succulent, sessile. Sepals and petals as in the male. Staminalodes about 16 in a ring surrounding the ovary. Ovary bilocular; ovules solitary in each locule; stigma broad, sessile, convex. Berry about 2.5 × 2.5 cm. Seeds 1-2, enclosed in a leathery covering. (Plate I, 8).

Type locality: S. Travancore.

Flowers: April-May. **Fruits:** Aug.-Sept.

Distribution: Fairly common in the evergreen forests of South Travancore above 900 m, but very local.

Vernacular names: Tam.: *Mania-kanji*.

G. merguensis Wight, Icon. t. 116. 1839 et Illustr. 1: 124. 1840; Kurz in J. Asiat. Soc. Beng. 43: 87. 1874; T. Anderson in Hook. f. loc. cit. 267; Hook. in J. Linn. Soc. (Bot.) 14: 485. 1875; Pierre, loc. cit. 6. t. 68, 69, 91 D; King in J. Asiat. Soc. Beng. 59: 150. 1890; Vesque, loc. cit. 341; Brandis, Ind. Trees 50; Pitard in Lecomte, Fl. Gén. Indo-Chine 1: 299. 1907; Ridley, Fl. Mal. Penins. 1: 169. 1922; Engler in Nat. Pfam. (ed. 2) 21: 223. 1925; Craib, Fl. Siam. Enum. 1: 116. 1931; Burkill, Dict. Econ. Prod. Mal. Penins. 1: 1055. 1935; Gagnepain, Fl. Gén. Indo-Chine Suppl. 3: 258. 1943. *Discostigma merguense* Planchon & Triana in Ann. Sci. nat. sér. 4. 14: 363. 1860.

Small trees, 15-20 m high or shrub. Branches brachiate, subterete, tetragonous-compressed. Bark greyish-brown. Leaves 5-12 × 2.5-5 cm, lanceolate, elliptic or ovate with a long obtuse or notched tip, base acute, margin narrowly subrepand, thinly coriaceous; midrib prominent on both sides, laterals minute, irregular, parallel, arcuate, ending in a stout intramarginal nerve; petiole 5-10 mm long.

Male Flowers: numerous, about 1 cm in diam., in short axillary cymes nearly tripartite at base, lateral branches 1-flowered, 2-bracteolate at base, median 3-flowered, often in false contracted umbels; pedicels 2-10 mm long, tetragonal. Sepals 4, decussate, outer bract-like, inner larger,

concave, thin. Petals 4, 5-6 mm long, ovate, obtuse, concave, imbricate, alternate with sepals. Stamens many, in 4 distinct bundles, opposite petals, each bearing a head of anthers on short filaments; anthers small, didymous, bilocular, apex with introrse rim, shortly obliquely dehiscent; pollen 3-pored. Rudimentary pistil variable, often fungiform. **Female Flowers:** solitary or in pairs, pedicels 12-25 mm long. Staminalodes few, opposite petals, scale-like, margin obtuse-dentate. Ovary shallowly obconic, bilocular, 1-ovuled; stigma thick, convex; ovule semianatropous; micropyle inferior. Berry ellipsoid, 12 × 8-9 mm, fleshy; stigma disciform, 3-4 mm broad, sessile, coronate. Seed solitary, subreniform. (Plate I, 9).

Type: Griffith, Mergui (Herb. Griffith no. 97, K).

Flowers: December.

Herbarium specimens examined: EAST PAKISTAN: Longai Reserve, Sylhet, U. N. Kanjilal 4942, Dec. 27, 1914 (DD).

Distribution: In dense forests of Andaman Islands, Sylhet, Burma, Penang, Cambodia, Cochin-China, Thailand, Malacca and Malay Peninsula.

G. atroviridis Griff. ex T. Anderson in Hook. f. Fl. Brit. Ind. 1: 266. 1874; Pierre, loc. cit. 24. t. 80 C; King in J. Asiat. Soc. Beng. 59: 159. 1890; Vesque, loc. cit. 414; Brandis, Ind. Trees 50. Ridley, Fl. Mal. Penins. 1: 173. 1922; Engler in Nat. Pfam. (ed. 2) 21: 220. 1925; Craib, Fl. Siam. Enum. 1: 114. 1931; Fl. Assam 1: 109. 1935; Burkill, Dict. Econ. Prod. Mal. Penins. 1: 1047. 1935; Wealth of India 4: 99. 1956.

Medium-sized, graceful trees, 12-18 m high. Branches robust, terete, yellowish-grey when dry. Bark black. Leaves 12-25 × 5-7.5 cm, oblong-lanceolate, very shortly acuminate, base cuneate, contracted into a marginated petiole, coriaceous, shining; lateral nerves about 40, spreading, straight, indistinct when fresh but rather distinct when dry, anastomosing near the edge with a fine intramarginal nerve; petiole 15-20 mm long.

Male Flowers: about 30 mm in diam., in terminal clusters of few-flowered cymes; pedicels unequal, 7-20 mm long. Sepals 4, fleshy, concave, outer pair 15 × 9.5 mm, orbicular or transversely oblong, inner pair 16 × 11 mm, broadly oblong or orbicular, fleshy with thin edges, streaked with red inside. Petals 4, blood-red, orbicular-obovate, concave, fleshy, larger than the sepals, apex recurved. Stamens numerous, forming with large convex rudimentary stigma a globose mass; anthers narrowly oblong, bilocular, introrse, the dehiscence longitudinal; filaments slender, nearly as long as the anthers, inserted in whorls on a thin annular fleshy receptacle. Rudimentary style cylindric. **Female Flowers:** solitary terminal,

rarely geminate, pedicel 10-16 mm long. Sepals and petals as in the male but the petals smaller. Staminodes small, attached to a thin fleshy wavy annulus which surrounds the ovary. Ovary oblong, smooth, subcylindric, 12 to 16-locular; stigma thick, fleshy, very convex, pileate, deep red, the edges undulate. Berry globular, 8-10 cm in diam., yellowish-green, base slightly 9-sulcate, crowned by the sessile, concave, ribbed stigma, with firm-textured outer rind and rather thin, translucent pulp surrounding the seeds, edible. (Plate I, 10).

Type: Griffith, Kew distrib. 862, Tabong, Upper Assam (K).

Distribution: From north-east districts of Assam to Burma, Thailand, Malay Peninsula and Malacca.

Uses: The fruit is used as a fixative with alum in the dyeing of silk. A decoction from leaves and roots is used in the treatment of earaches. The sour fruit rind is used in curries.

G. pedunculata Roxb. [Hort. Beng. 42. 1814, nom. nud. et] Fl. Ind. 2: 625. 1832; G. Don, Gen. Syst. 1: 620. 1831; Wight, Icon. tt. 114-115. 1839 et Illustr. 1: 125. 1840; Voigt, Hort. Suburb. Calc. 86. 1845; Choisy, Guttif. Ind. 35. 1851; Drury, Useful Pl. Ind. 228. 1858 et Ind. Fl. 1: 140. 1864; Planchon & Triana, loc. cit. 347; Lanessan, Mém. Garcin. 42. 1872; T. Anderson in Hook. f. loc. cit. 264; Pierre, loc. cit. 24. t. 79 M. 1883; Vesque, loc. cit. 374; Prain, Beng. Pl. 1: 247. 1903; Brandis, Ind. Trees 49; Engler in Nat. Pfam. (ed. 2) 21: 220. 1925; Fl. Assam 1: 107. 1934; Wealth of India 4: 107. 1956; Sealy in Kew Bull. 1956: 341. 1956.

Diocious trees, about 20 m high. Bark spongy. Wood yellow. Leaves 12-40 × 5-14 cm, oblong and obovate-oblong, acute or obtuse, base cuneate, long attenuated in petiole, membranous, margin undulate-revolute; midrib conspicuous, prominent below, lateral veins 10-30, 8-15 mm distant, regular, obliquely parallel, tips inarched and anastomosing, prominent below; petiole 2-4.5 cm long.

Flowers: terminal, pedunculate, bracteate. *Male Flowers*: in terminal trichotomous, 8-12-flowered panicles, large, pale green; pedicels 6-7 cm long, stout, erect. Sepals 4, orbiculate, concave, fleshy, margin scarious, outer pair 9-10 × 12 mm, inner pair 9 × 6 mm. Petals 4, obovate-oblong, narrower, as long as sepals. Stamens inserted at base of the receptacle, in a quadrangular, truncate, shortly stipitate mass; anthers tetragonal, bilocular, introrse. Rudimentary pistil an abortive gland immersed in the fleshy receptacle of the stamens. *Female Flowers*: solitary, terminal, larger than the male; pedicel articulate at base, thick, tetragonous, about 3 cm long. Staminodes 20-30, in 4 fascicles, connate below. Ovary globose; stigmatic rays 8-12, spreading. Berry 8 to 12-locular, large,

weighing 0.9 kg each saffron-yellow, round, smooth, exceedingly acidic. Seeds 8-10, large, reniform, aril succulent. (Plate II, 11).

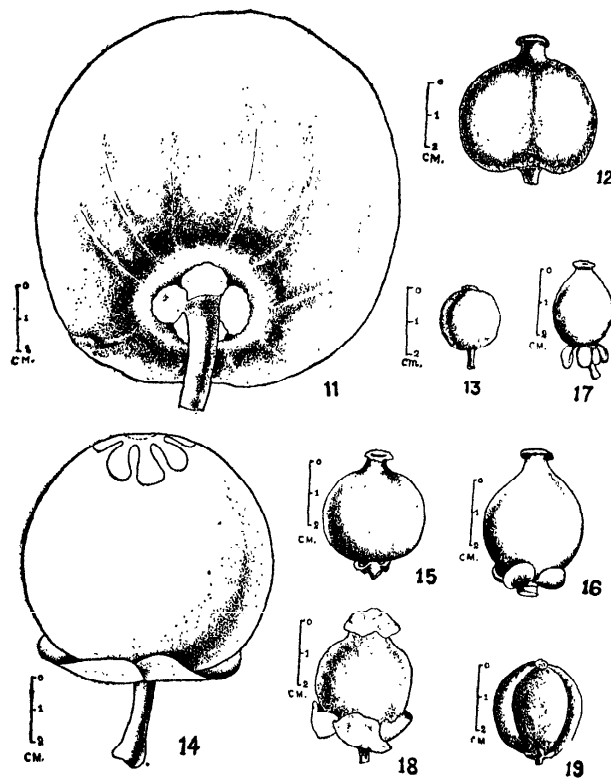


PLATE II: Figs. 11-19. Fruits of *Garcinia*

- | | |
|----------------------------|--------------------------|
| 11. <i>G. pedunculata</i> | 16. <i>G. cornea</i> |
| 12. <i>G. travancorica</i> | 17. <i>G. affinis</i> |
| 13. <i>G. brevirostris</i> | 18. <i>G. speciosa</i> |
| 14. <i>G. mangostana</i> | 19. <i>G. paniculata</i> |
| 15. <i>G. hombroniana</i> | |

Type: Wallich 4860, Goalpara. Bengal (CAL, proposed here as Neotype).

Flowers: Sept.-Apr. *Fruits*: Dec.-June.

Herbarium specimens examined: BENGAL: Goalpara, Wallich 4860 (CAL). ASSAM: Upper Assam, G. Mann 41 (CAL); Harjuli, Duphla hills, J. L. Lister 112, Dec. 23, 1874 (CAL); Sibsaigar, March 1879 (CAL); Naga hills, H. Collett 192, March 1, 1882 (CAL); Parasuram Road Teju, N.E.F.A., R. N. De 18023, Feb. 3, 1939 (ASSAM); Darrang-Panbari Camp, Batasipur, G. M. Nath s.n., Nov. 1952 (DD); Panbari, Darrang dist., G. M. Nath s.n., May 1952 (DD). EAST PAKISTAN: Karimganj; Sylhet dist., Dinanath Paul 22090, March 8, 1947 (ASSAM).

Distribution: Forests of north-east Bengal; sporadic in Upper Assam and N.E.F.A. up to an altitude of 915 m and in Manipur. It is cultivated in Sylhet for its pleasant acid fruits.

Vernacular names: Hind. & Beng.: Tikul, Tikur; Assam: Bor-thekeera; Sylh.: Thaikor; Khasi: Soh-lyntraw, Dieng-soh-danei; Lushai: Thaipomlien; Mik.: Ampri-arong; Miri & Abor: Tabing-asing.

Uses: It is one of the largest fruited species of the genus and is worth trying as a stock for mangosteen. The acid fruit is eaten raw or cooked and used as a fixative or as a mordant for saffron dye. The timber is said to be useful, after seasoning, for planks, beams and building purposes. The fleshy part of the fruit which covers the seeds and their juicy envelope or aril, is in large quantity of a firm texture and of a very sharp, pleasant, acid taste. It is used in curries and for acidulating water. If cut into slices and dried, it retains its quantities for years and might be most advantageously employed during long sea-voyages, as a succedaneum for lemons or limes, to put into various messes, where salt meat, etc. is employed.

G. travancorica Beddome, Fl. Sylv. t. 173. 1869; T. Anderson in Hook. f. loc. cit. 268; Pierre, loc. cit. 8. t. 90 D; Vesque, loc. cit. 384; Gamble, Man. Ind. Timb. 52. 1902 et Fl. Madras 74. 1915; Brandis, Ind. Trees 49; Rama Rao, Fl. Pl. Trav. 30. 1914; Engler in Nat. Pfam. (ed. 2) 21: 224. 1925.

Tall, slender trees. Branches obtusely 4-angled, shining. Wood yellowish-brown; sapwood pale yellow, hard, heavy. Leaves 8-10 × 1.5-2.5 cm, linear-oblong to subspathulate, sometimes broader upwards, rotundate or obtuse, base acute, margin revolute, coriaceous, dark green above, pale beneath; midrib stout, prominent below, lateral nerves slender, numerous, horizontal.

Male Flowers: trichotomous, short, few-flowered, terminal and subterminal cymes, about 1 cm in diam.; pedicels very short, thickened. Sepals 4, decussate, orbicular, concave, two outer ones much smaller than the inner pair. Petals 4, about twice as long as sepals, shortly clawed, rounded. Stamens numerous, in four multifid polyandrous masses; anthers bilocular, versatile, linear-oblong, longitudinally bivalvular; filaments short. Pistillode columnar, with a circular peltate stigma. **Female Flowers:** solitary or twin in the terminal axils; sepals and petals as in the male. Staminalodes few (5), free; filaments complanate, linear, in 2 to 3-chotomous branches; anther loculi often divaricate, oblong. Ovary subglobose or pyriform, 4-locular, half concealed by the large convex stigma. Berry oblong to subglobose, as large as a walnut, contracted into a short, thick style with a broad imbricate stigma. Seeds few, large, 25 × 15 mm, shining testa brown. (Plate II, 12).

Type: Beddome s.n., Travancore & Tinnevely (in herb. DC., G).

Flowers: Sept.-Oct. **Fruits:** Feb.-May.

Herbarium specimens examined: KERALA: Travancore hills, R. H. Beddome s.n. (MH); Tinnevely hills, (MH 2992); Kalivayalpil, Tinnevely, C. A. Barber 3051, June 1, 1901 (MH); Kalivayalpil to Hamington's Bungalow, Travancore, C. A. Barber 3071, June 2, 1901 (MH); Travancore and Tinnevely,

(MH 2997); M. K. Vagal, Travancore, T. F. Bourdillon 327, 328, Oct. 2, 1894 (CAL, MH).

Distribution: Mountain forests of Travancore and Tinnevely in southern India; cultivated in the botanic garden at Bangalore.

Uses: The tree yields as yellow gamboge, the uses of which are not yet known.

G. brevirostris Scheff. in Tijdschr. Nederl. Ind. 31: 353. 1870 et Flora 53: 241. 1870; Pierre, loc. cit. 5. t. 91 C. 1883; Vesque, loc. cit. 362; Merrill, Enum. Philipp. Pl. 3: 83. 1923; Burkill, Dict. Econ. Prod. Mal. Penins. 1: 1048. 1935. *G. eugeniaefolia* Wall. [Cat. 4873. 1831, nom. nud.] ex T. Anderson in Hook. f. Fl. Brit. Ind. 1: 268. 1874; Pierre, loc. cit. 6. t. 91 E, F; King in J. Asiat. Soc. Beng. 59: 150. 1890; Vesque, loc. cit. 343; Ridley, Fl. Mal. Penins. 1: 169. 1922. *G. gitinensis* Elm. Leaf. Philip. Bot. 3: 1053. 1911. *Discostigma rostratum* Planchon & Triana in Ann. Sci. nat. sér. 4. 14: 362. 1860, pro parte.

Small trees. Bark grey-brown. Young branches tetragonous. Wood hard, yellow. Leaves 6-8 × 2.5-3.5 cm, broadly elliptic-lanceolate, acute or acuminate, base obtuse or acute, margin entire or narrowly subrepand, subcoriaceous, upper surface shining, lower dull, pale, opaque; midrib prominent on both sides, nerves indistinct on either surface; petiole about 8 mm long.

Male Flowers: short, dense, minutely bracteate, axillary or terminal cymes, pedicels about 5 mm long. Sepals 4, orbicular, the outer pair small, the inner pair as large as the petals. Petals 4, orbicular, thin, with a circular thickened coloured fleshy spot near the base. Staminal bundles distinct, suberect; anthers numerous, very small, orbicular-oblong, bilocular, the dehiscence vertical. Stylodes slender; rudimentary stigma large, hemispheric. **Female Flowers:** 4-10-flowered, short, umbellate cymes. Sepals 4, minute, scale-like. Petals smaller, margin ciliate. Ovary short, terete; stigma broad, peltate with revolute entire margins, covering nearly the whole of the ovary. Staminalodes and disc absent. Berries in fascicles of 2-4, about 2 cm in diam., globular, smooth, brown, crowned by the papillose stigma. (Plate II, 13).

Herbarium specimens examined: BENGAL: without exact locality, J. W. Helfer 202 (CAL); near Calcutta, J. W. Helfer 279 (CAL). MALAYA: Penang, Wallich 4873 (CAL).

Type (*G. eugeniaefolia*): Wallich 4873, Penang (CAL).

Distribution: Primary forests of Singapore, Tenasserim, Penang, Malay Peninsula, Sumatra, Banca, Malacca and Andaman Islands, at low and medium altitudes.

Uses: The timber is used in house-building.

G. mangostana Linn. Sp. Pl. 443. 1753; Desr. in Lamk. Encyc. Méth. 3: 699. 1792; DC. Prod. 1: 560, 1824; Blume, Bijdr. 213. 1825; G. Don,

Gen. Syst. 1: 619. 1831; Roxb. Fl. Ind. 2: 618. 1832; Voigt, Hort. Suburb. Calc. 86. 1845; Choisy, Guttif. Ind. 33. 1851; Miquel, Fl. Ind.-Bat. 1: 506. 1859; Planchon & Triana in Ann. Sci. nat. sér. 4. 14: 325. 1860; Lanessan, Mem. Garcin. 15. 1872; T. Anderson in Hook. f. Fl. Brit. Ind. 1: 260. 1874; Kurz in J. Asiat. Soc. Beng. 43: 86. 1874 et For. Fl. Brit. Burma 1: 87. 1877; Pierre, Fl. For. Coch.-Chine t. 54. 1882; King in J. Asiat. Soc. Beng. 59: 156. 1890; Vesque in DC. Mon. Phan. 8: 386. 1893; Gamble, Man. Ind. Timb. 52. 1902 et Fl. Madras 73. 1915; Pitard in Lecomte, Fl. Gén. Indo-Chine 1: 307. 1907; Brandis, Ind. Trees 49. 1907; Backer, Fl. Bat. 1: 84. 1907; Merrill in Philip. J. Sci. (Bot.) 3: 364. 1908 et Enum. Philip. Pl. 3: 85. 1923; Rama Rao, Fl. Pl. Trav. 28. 1914; Ridley, Fl. Mal. Penins. 1: 172. 1922; Engler in Nat. Pfam. (ed. 2) 21: 223. 1925; Burkill, Dict. Econ. Prod. Mal. Penins. 1: 1052. 1935; MacMillan, Trop. Pl. & Gard. (ed. 5) 237. 1956; Wealth of India 4: 103. 1956; Sealy in Kew Bull. 1956: 341. 1956. *Mangostana garcinia* Gaertn. Fruct. 2: 105. t. 105. 1790.

Evergreen, glabrous, pyramidal trees, 20-25 m high. Bark yellow within, black outside, smooth. Wood brick-red, hard, heavy. Young branches cylindric, slightly grooved. Leaves 15-25 × 6-12 cm, elliptic-oblong, acute or shortly acuminate, thickly coriaceous, at first purpurascens, shining on both surfaces; base acute, obtuse or rotundate; veins subhorizontal, numerous, interarching with a double intramarginal nerve, rather prominent beneath when dry; petiole 2-2.5 cm long.

Male Flowers: about 4 cm in diam., showy, in terminal fascicles of 3 to 9; pedicels 1.5-2 cm long, with several, orbicular, concave, scarious bracts. Sepals 4, erect, unequal, coriaceous, rotund, concave. Petals 4, larger than the sepals, ovate, fleshy, yellowish-red within, greenish-red outside. Stamens numerous, inserted on 4, thick, receptacular lobes below rudimentary pistil; filaments short; anthers ovate-oblong, recurved, dehiscence longitudinal. Rudimentary pistil (disc) fleshy, red, as long as the stamens, apex conical.

Hermaphrodite Flowers: about 5 cm in diam., solitary or in pairs at the apices of branchlets; pedicels 18-20 × 3-5 mm, stout, woody. Sepals 4, decussate, outer shorter than inner, 20 × 20 mm, orbiculate, concave, persistent. Petals 4, purpureous, larger than sepals, 25-30 × 25-30 mm, orbiculate, concave, thick. Stamens many, one to two-seriate; filaments slender, connate below, 4-5 mm long; anthers ovate-oblong, introrse, bilocular, polliniferous, apex recurved. Ovary globular, smooth, 5-8-locular; stigma sessile, punctate, 5-8-lobed; ovules solitary, ascending, hemianatropous, raphe ventral. Fruit globose, about 7 cm in diam., dark purplish-brown, smooth, surrounded by sepals at base, apex crowned by stigma; pericarp thick, spongy, aboun-

ding in a gummy substance. Seeds up to 8, oblong, laterally compressed, with white, juicy, pleasant smelling aril. (Plate II, 14).

Flowers: March-Sept. **Fruits:** Cold season.

Herbarium specimens examined: PENINSULAR INDIA: Bevlia garden, April 1883 (MH 2921); Sengalteri, Tinnevely Dist., Sept. 26, 1916 (MH 2922); Burlia, Nilgiri Dist., cult., G. V. Narayana & S. R. Raju 85828, Sept. 10, 1928 (MH); Courtallam, Nov. 1901 (MH 2925). ASSAM: Dulong R. F., G. Panigrahi 27621 (ASSAM). ANDAMAN ISLANDS: Dover Garden, S. Andaman, G. King s.n., April 1890 (CAL).

Distribution: Native of the Molucca Islands from where it has been transplanted to Java and Malacca. The exact origin of mangosteen is unknown, but is believed to be Malay Peninsula or Malaysia. It is cultivated to a considerable extent only within a restricted area in Java and Malay Peninsula and in small orchards in Burma, Thailand, Indo-China, Ceylon and Sunda Islands. It occurs in a semi-wild state in parts of Philippines. In India its cultivation has been attempted in Bengal, Bombay and Madras, but so far it has been successfully established only in southern India on the lower slopes of Nilgiris between 365 and 1070 m, and near Courtallam in Tinnevely Dist. The total area under mangosteen does not exceed 10 hectares in India. The tree can be grown in Wynaad, Annamalai and Palnis in South India. However, among cultivated plants it is one of the most local species both in its origin, habitation, and in cultivation.

Vernacular names: Hind., Beng., Mar., Mal. & Tam.: *Mangusta*, *Mangustan*; Eng.: *Mangosteen*.

Uses: The mangosteen is considered to be the most delicious among tropical fruits. The fruit is used mostly as a dessert and can be made into preserve. Large quantities of fruit, both fresh and dried, are reported to be imported into Calcutta from Singapore and sold in the bazaar. The rind of the fruit is astringent and used as febrifuge, in chronic diarrhoea, cystitis, gonorrhoea, gleet and tropical dysentery. It is also used in dyeing and tanning. The active principle appears to be a yellow pigment, mangostin. The pericarp is also used in the form of paste in the treatment of itch, eczema and other skin affections. The bark, young leaves and rind are used as a gargle for a sore mouth. The fruit is substituted for bael fruit. The wood is suitable for cabinet work, building purposes, rice pounders and spear handles.

G. hombroniana Pierre, Fl. For. Coch.-Chine fasc. 5: 12. t. 79 D-J. 1883; King in J. Asiat. Soc. Beng. 59: 155. 1890; Vesque, loc. cit. 395; Ridley, Fl. Mal. Penins. 1: 171. 1922. Engler in Nat. Pfam. (ed. 2) 21: 223. 1925; Craib, Fl. Siam.

Enum. 1 : 115. 1931; Burkill, Dict. Econ. Prod. Mal. Penins. 1 : 1051. 1935; Wealth of India 4 : 101. 1956.

Trees with rather stout, 4-angular branches, yellowish when dry. Leaves 8.5-13×5-7 cm. elliptic to oblong-elliptic, slightly inequilateral, subacute or very shortly and abruptly acuminate, base cuneate, slightly unequal, upper surface slightly glossy, lower rather dull; midrib prominent on both sides, lateral nerves numerous, about 32, slender, ascending, not prominent on either surface; petiole 10 mm long.

Male Flowers : about 2.5 cm in diam., terminal, in fascicles of 3-6; pedicels 5-10 mm long. Sepals thinly coriaceous, concave, outer pair orbicular. 6-8×3-4 mm, inner ovate-oblong, 7-10×5 mm. Petals ovate-orbicular, 10×10 mm, concave, base thick, margin membranous. Stamens numerous; anthers broad-oblong, dehiscent vertically, inserted on a fleshy, slightly 4-lobed annulus; filaments united. Rudimentary pistil flat, 8-lobed, slightly protruding above the staminal mass. *Female Flowers* : solitary, terminal, with sepals and petals like the males. Stamens absent. Ovary globose, 8 to 9-locular; stigma large, convex, recurved at the edge when young, when adult with 8 shallow crenations. Berry subglobose, about 30 mm in diam., not mamillate; pericarp rather thin, subcrustaceous; sepals persistent. Seeds about 6, oblong, 28 mm long, with soft juicy arillus. (Plate II, 15).

Syntypes : Griffith 857, Kew distrib. 1861-62 (K), Cuming 2296, between Singapore and Malacca, Malay Peninsula.

Flowers : Feb.

Herbarium specimens examined : NICOBAR ISLANDS : without exact locality, Jelinek 138, Exped. Novara (CAL); Kamorta, S. Kurz s.n., Feb. 1875 (CAL).

Distribution : Nicobar Islands, Thailand, Singapore, Pahang, Dingings, Penang, Perak, Malacca; chiefly on sandy and rocky coasts.

Uses : The pulp surrounding the seeds is sour and edible. It has the making of a superior fruit and crossing with mangosteen has been recommended. The roots and leaves are used for itch in Malaya. The timber is used for house building and oars.

Notes : This species, which has been established by L. Pierre comes (as his own description and figures show) very near to *G. cornea* Roxb. It differs chiefly from the latter by its broader leaves, stouter branchlets and 8-lobed stigma.

G. cornea Roxb. Fl. Ind. 2 : 629. 1832; Pierre, Fl. For. Coch.-Chine 12. 1882; Vesque, loc. cit. 397. *Lignum corneum* Rumph. Amb. 3 : 55. t. 30. 1743.

Lofty trees, 9-12 m high. Bark blackish. Wood heavy, very hard. Leaves 30-40×11 cm, oblong-

elliptic, obtuse or emarginate, base rotundate, smooth, firm, shining; midrib canaliculate above, prominent beneath; petiole 5-15 mm long, thick.

Male Flowers : solitary and umbellate, lateral and terminal, yellow, drooping; pedicels 10-15 mm long. Sepals 4, orbiculate, concave. Petals shorter than sepals, orbiculate or suboblong, concave, thick. Stamens in four phalanges free at apex, alternating the petals. Rudimentary pistil central, top globose. Berry 26×25 mm, globose, dusky-brown or smoke-coloured with resinous smell when fresh, surrounded by four sepals at base; apex contracted in a short style; stigma discoid, 7-8 mm broad, coronate. (Plate II, 16).

Type locality : Amboina Islands.

Distribution : Native of the East Indies in the high mountains of Amboina; sometimes cultivated.

Uses : The wood is used for the handles of tools and building purposes. The fruit pulp is subacid and pleasantly flavoured. It may be tried as a rootstock for mangosteen.

G. affinis Wall. ex Pierre, Fl. For. Coch.-Chine 16. t. 78 C, 79 G. 1883; Vesque, loc. cit. 410; Brandis, Ind. Trees 50; Fl. Assam 1 : 106. 1934, non Chiov. (1932). *G. cornea* Choisy, Guttif. Ind. 53. 1851; T. Anderson in Hook. f. loc. cit. 260, p.p. non Roxb. (1832).

Small trees, 6-10 m high. Branchlets robust, tetragonous-compressed, dry ones acutely angular. Bark grey, exfoliating in large roundish flakes, cut pink turning brown. Wood brown or reddish-brown, hard, heavy. Leaves 4-18×3-10 cm, ovate-elliptic, obtuse or obtuse and short acuminate, base acute or subacute, chartaceous; midrib conspicuous little above, much prominent below, laterals about 35, slender, filiform; petiole 1-2 cm long, canaliculate above, transversely striate on drying.

Male Flowers : 3-9, fascicled at the apices of branchlets, large; pedicels 9-10 mm long. Outer sepals broader than inner, 9-11×7-12 mm, all concave suborbiculate or inner obovate. Petals somewhat longer than sepals, 13-15×8-10 mm, obovate. Androphore central, thick, apex divided opposite sepals in 4 short thick phalanges, centre produced in rudimentary pistil. Anthers numerous, sessile or subsessile, bilocular. *Female Flowers* : solitary at the apex of branchlets or paired; pedicels about 5 mm long. Stamens absent. Ovary short, broad, turbinate, smooth, 4-locular; median style short and thick; stigma broad (6-7 mm), convex, hardly 5 to 7-crenate, coronate, glandular. Berry ovate-oblong, smooth, 2 to 4-seeded, purpurascens. Seeds as of mangosteen, pulp hardly of pleasant taste. (Plate II, 17).

Type : Wallich 4854, Sylhet, E. Pakistan (CAL).

Flowers : Nov.-April. *Fruits* : May-June.

Herbarium specimens examined : EAST PAKIS-

TAN : Sylhet, Wallich 4854 (Type, CAL), J. D. Hooker & T. Thomson s.p. (CAL 46201). ASSAM : Rongrengiri Reserve, Garo hills, U. N. Kanjilal 5338, March 21, 1915 (DD). BENGAL : Indian Botanic Garden, Calcutta, cultivated, Wallich 4852 C (CAL), CAL 46189-46196, 46198, S. K. Mukerjee s.n., Dec. 7, 1961 (CAL), ex King s.n., 1882 (DD), J. S. Gamble 21139, Dec. 1888 (DD), M. B. Raizada s.n., Feb. 1940 (DD); near Calcutta, J. W. Helfer (CAL 46200). PENINSULAR INDIA : Kanjirapalli, A. Meebold 12774, Dec. 1909 (CAL); Quilon, Travancore, M. Rama Rao 681, Nov. 21, 1912 (DD). BURMA : Mergui, Tenasserim, A. Meebold 14831, April 1911 (CAL); Yemukyo Yoma, Schwegyin Div., Toungoo Dist., S. Rochin 6667, May 17, 1928 (CAL).

Distribution : Tropical forests of Burma, Assam and East Pakistan; sometimes cultivated in gardens.

Vernacular names : Garo : *Thekakhaksi*; Khasi : *Dientg-soh-kwang-rit*.

Uses : It yields an inferior sort of gamboge, the uses of which are not yet known.

G. speciosa Wall. Pl. As. Rar. 3: 37. t. 258. 1832; Planchon et Triana, loc. cit. 14: 326. 1860; Kurz, Enum. Pl. Andam. Islds. 2. 1870 et in J. Asiat. Soc. Beng. 43: 86. 1874 et For. Fl. Brit. Burma 1: 88. 1877; T. Anderson in Hook. f. loc. cit. 260; Vesque, loc. cit. 402; Gamble, Man. Ind. Timb. 53. 1902; Parkinson, For. Fl. Andaman Islds. 90. 1923. Craib, Fl. Siam. Enum. 1: 117. 1931; Gagnepain, Fl. Gén. Indo-Chine Suppl. 3: 267. 1943; Sinclair in Bull. Bot. Soc. Beng. 9: 87. 1955; Wealth of India 4: 107. 1956.

Evergreen trees, 12-18 m high. Trunk straight, erect, about 150 cm in girth. Bark thin, greyish-black. Young branches cinnamomeous, slightly tetragonous. Leaves 15-35 × 5-10 cm, oblong or elliptic-oblong, narrowed at ends, leathery, shining on both surfaces, usually light cinnamomeous in colour when dry; midrib prominent below, main lateral veins ± parallel and straight, all forming an intra-marginal vein; petiole 12-25 mm long, angular.

Male Flowers : bright yellow, fragrant, in 3 to 9-flowered terminal fascicles; peduncles longer than the petioles. Sepals 4, fleshy, concave, slightly unequal, outer pair ovate, inner pair reniform. Petals 4, thick, rotundate, slightly clawed, longer than the sepals. Stamens numerous, in four, short, thick, diverging, oval masses confluent at the base; filaments short; anthers oblong with longitudinal dehiscence. Style short, thick, columnar; rudimentary stigma large, convex, with shallow, broad, blunt lobes. **Female Flowers :** solitary, terminal, on short thick pedicels. Sepals and petals longer than in the male. Ovary subglobose; stigma large, convex, margin 6 to 8-lobed. Unripe fruit

ovoid, subglobose, apiculate, the hardened stigma and the thickened sepals persistent. (Plate II, 18).

Type : Wallich 4855, Amherst, Burma (CAL).

Flowers : Jan.-April. **Fruits :** Rainy season; April.

Herbarium specimens examined : BURMA : Amherst, Wallich 4855 (CAL). ANDAMAN & NICOBAR ISLANDS : Andamans; without exact locality, Prain's collector 100, April 20, 1901 (DD), C. E. Parkinson 912 (DD); Chiriatapu, S. Andamans, C. E. Parkinson 884, 888, January 1916 (CAL, DD); Nicobars, R. L. Heinig s.n., March 1897 (CAL, DD). EAST PAKISTAN : Kodula Hill, 48 km from Chittagong, King's collector 274, Feb. 1887 (CAL).

Distribution : Tropical evergreen and semi-evergreen forests of Andaman and Nicobar Islands, Burma and East Pakistan.

Vernacular names : Andam. : *Parawa*.

Uses : The wood is hard, heavy, uniformly reddish-brown and close-grained. It is suitable for house and bridge posts. It is used for making bows in Andamans. The tree yields an inferior gamboge.

Notes : This arboreous species is very closely allied to the shrubby *G. kurzii* Pierre. Although its headquarters are Burma and Sylhet, *G. speciosa* does occur on the Andamans.

G. kurzii Pierre, Fl. For. Coch.-Chine Enum. 14. t. 78 A. 1883; King in J. Asiat. Soc. Beng. 59: 155. 1890; Vesque, loc. cit. 403; Brandis, Ind. Trees 49; Engler in Nat. Pfam. (ed. 2) 21: 223. 1925. *G. speciosa* Kurz Mss. Fl. Exsic. And. Islds., non Wall.

Shrubs. Young bark green. Leaves 20-25 × 8-10 cm, elliptic, acuminate, base obtuse or acute, margin entire or subrepand, coriaceous, glossy; midrib prominent on both sides, lateral slender, about 1 cm distant, somewhat arcuate, irregularly anastomosing at the tip in the submarginal nerve, veins laxly reticulate.

Male Flowers : pale white, solitary, terminal; pedicels tetragonous, 9-10 × 2-3 mm. Sepals orbicular, concave, recurved after anthesis, thick, many-nerved, outer ones 13 × 15.5 mm, inner 13 × 10-12 mm. Petals suborbicular, 16-18 × 20 mm, base narrow, thick, inconspicuously nerved. Stamens numerous, in 4 bundles opposite petals; anthers oblong with parallel loculi, apex recurved; filaments long. Rudimentary pistil short, apex discoid, plain or somewhat convex, 1.5 mm broad, margin repand, fimbriate.

Type : Kurz 24, Andamans (CAL).

Flowers : Jan. **Fruits :** March.

Herbarium specimens examined : ANDAMAN ISLANDS : S. Andamans, R. L. Heinig s.n. (CAL); S. Andamans, Macpherson's Straits, S. Kurz s.n. (CAL); S. Andamans, Aberdeen;

S. Kurz s.n. (CAL, DD); Hope Town, *King's collector* s.n., Jan. 13, 1884 (CAL); East Coast, S. Andamans, *R. L. Heinig* s.n., March 1889 (CAL). NICOBAR ISLANDS: Katchall, Modscha Lapoo, *S. Kurz* s.n. (CAL); Hill's Rocky Place, Haveit, *King's collector* 483 (CAL).

Distribution : Andaman and Nicobar Islands.

Notes : This species differs from *G. speciosa* Wall. chiefly in being a shrub, leaves less acuminate with longer petioles, male flowers solitary, stamens less numerous and the rudimentary stigma discoid and flat instead of convex.

G. kingii Pierre ex Vesque in DC. Mon. Phan. 8: 407. 1893; Brandis, Ind. Trees 50. 1907.

Trees. Branchlets terete, young ones quadrato-compressed, dry ones grey-ochraceous. Leaves 12-15 × 4.5-6.5 cm, elliptic or ovate-oblong, short and obtuse-acuminate, base obtuse or acute, margin narrowly repand, chartaceous; lateral nerves about 15, slender, somewhat arcuate, submarginal nerve slender, 1-1.5 mm distant.

Male Flowers : 25 mm in diam.; pedicel 15 mm long. Sepals orbiculate, about 7 mm long, subequal, concave, membranous. Petals obovate, obtuse, 13-15 × 10-11 mm, indistinctly flabellately veined. Androecium below cupuliform rudimentary pistil, margin 4-lobed, lobes opposite petals, somewhat involuted at the apex; anthers oblong, numerous, apex recurved, theca parallel. Rudimentary pistil base columnar; stigma nearly smooth, somewhat convex.

Type : *King* s.n., Andaman Islands.

Distribution : Andaman Islands.

G. paniculata Roxb. [Hort. Beng. 42. 1814, nom. nud. et] Fl. Ind. 2: 626. 1832; Wight, Icon. t. 112. 1839 et Illustr. 1: 125. 1840; Voigt, Hort. Suburb. Calc. 87. 1845; Choisy, Guttif. Ind. 35; Planchon & Triana, loc. cit. 349; Drury, Ind. Fl. 1: 140. 1864; Lanessan, loc. cit. 60; T. Anderson in Hook. f. loc. cit. 266; Kurz, For. Fl. Brit. Burma 92. 1877; Pierre, loc. cit. 25. t. 83 J. 1883; Vesque, loc. cit. 415; Gamble, Man. Ind. Timb. 53. 1902; Brandis, Ind. Trees 50. 1907; Engler in Nat. Pfam. (ed. 2) 21: 224. 1925; Fl. Assam 1: 108. 1934; Sinclair in Bull. Bot. Soc. Beng. 9: 87. 1955; Wealth of India 4: 107. 1956; Sealy in Kew Bull. 1956: 341. 1956. *G. boobicowa* Roxb. Hort. Beng. 42. 1814, nomen nudum; Choisy, Guttif. Ind. 35. 1851. *Stalagmitis paniculata* G. Don, Gen. Syst. 1: 621. 1831.

Dioecious trees, 12-18 m high, with many ascending branches. Wood moderately hard, greyish-brown. Bark grey-red, peeling off in small thin flakes. Leaves 13-20 × 4-7 cm, opposite, decussate, oblong-lanceolate or obovate, acuminate, base acute, margin repand, shining on both surfaces; midrib conspicuous, prominent below, lateral nerves 7-10, arcuate, prominent below, veins transverse, parallel.

Male Flowers : in terminal, compound, brachiate panicles, many, pure white. Sepals 4, decussate; outer ones smaller, thick. Petals 4, three times longer than sepals, ovate, concave, imbricate, alternate with sepals. Stamens numerous, imbricate in a large subglobose mass; anthers bilocular, obovate, connective cuneate; filaments short. **Female Flowers :** fewer in number, forming short terminal spicate racemes, similar to the males. Staminodes absent. Ovary subglobose, pentagonous, pentalocular; stigma sessile, convex, entire, tubercled, coronate. Berry spherical, yellow, the size of the large cherry, succulent, usually 4-locular. Seeds 3-5, reniform; aril pulpy with an agreeable odour. (Plate II, 19).

Type : ex Sylhet, E. Pakistan; cult. in Indian Botanic Garden, Calcutta.

Flowers : Nov.-Feb. **Fruits :** April-July.

Herbarium specimens examined : NEPAL : without exact locality, *Wallich* s.n. (CAL). BENGAL : Indian Botanic Garden. cult. (CAL). ASSAM : Umsaw Forest, C. S. *Purkayastha* 10938, Nov. 30, 1934 (ASSAM); S. R. *Sharma* 17926, Oct. 26, 1938 (ASSAM); K. *Biswas* 3767, Oct. 26, 1938 (CAL); Rangmachakgiri to Samphaligiri Rd., Garo hills, U. N. *Kanjilal* 5195, March 1, 1915 (ASSAM, CAL, DD); Dombu Res., Garo hills, U. N. *Kanjilal* 5373, March 26, 1915 (ASSAM, DD); Sarai Korang, Herb. G. *Watt* 11103, March 28, 1895 (CAL); Jaintia, C. B. *Clarke* 17905 B, Nov. 21, 1872 (CAL); Khasi hills, S. *Kurz* 1 (CAL); Nongpoh, Khasi hills, U. N. *Kanjilal* 3981, May 30, 1914 (ASSAM); Sri-Ram 9758, Dec. 13, 1931 (ASSAM); Syndai, Khasi hills, U. N. *Kanjilal* 2771, Oct. 19, 1913 (ASSAM); Dawki, K. & J. hills, G. K. *Deka* 12875, Nov. 1, 1935 (ASSAM); Barpani, K. & J. hills, U. N. *Kanjilal* 7106, Dec. 5, 1916 (ASSAM, DD); without exact locality, W. R. *Fischer* s.n. (CAL); *Jenkins* s.n. (CAL, DD); Khasia, J. D. *Hooker* & T. *Thomson* s.n. (CAL); Garampani, Sibsagar Dist., U. N. *Kanjilal* 3007, Nov. 20, 1913 (ASSAM); Hologapal Res., Sibsagar Dist., U. N. *Kanjilal* 7074, Dec. 20, 1910 (ASSAM); Nagajanka, Sibsagar Dist., U. N. *Kanjilal* 1656, April 23, 1911 (ASSAM); Burni Forest, Kamrup, Sri Ram 9897, Feb. 13, 1932 (ASSAM); Burdwan Reserve, Kamrup dist., U. N. *Kanjilal* 5439, April 8, 1915 (DD); Phalang, Naga hills, Manipur, A. *Meebold* 6471, Dec. 1907 (CAL). EAST PAKISTAN: Sylhet, *Wallich* 4857, 4858, 4858 B (CAL); Longai Res., Sylhet Dist., U. N. *Kanjilal* 4922, Dec. 24, 1914 (ASSAM, DD); Barkul, Chittagong Hill Tracts, J. L. *Lister* 330, March 31, 1876 (CAL); Chittagong, *Schlich* s.n., July 1875 (CAL); Hazarikhel, Chittagong Hill Tracts, V. S. *Rao* 5657, Jan. 7, 1936 (DD).

Distribution : Foot-hills of Eastern Himalayas, Bhutan, Assam, Khasi and Jaintia hills, East Pakistan, ascending to 915 m; ordinarily cultivated.

Vernacular names : Assam : *Sochopa-tenga*; Sylh. : *Bubi cowa*; Garo : *Thisru*; Khasi : *Dieng-soh-jadu*, *Dieng-soh-longkor*, *Dieng-soh-longkydaw*; Lushai : *Bombhathei*; Tipp. : *Bombs*.

Uses : The aril of the fruit, like that of mangosteen, is highly flavoured and is eaten with relish. The plant has been recommended as a suitable rootstock for mangosteen.

G. microstigma Kurz in Jour. Bot. 13 : 324. 1875 et For. Fl. Brit. Burma 1 : 91. 1877. Pierre, loc. cit. 19; King in J. Asiat. Soc. Beng. 59 : 157. 1890; Vesque, loc. cit. 434; Gamble, Man. Ind. Timb. 53. 1902; Brandis, Ind. Trees 52; Parkinson, For. Fl. Andaman Islands 90. 1923; Wealth of India 4 : 105. 1956.

Shrubs, 1-2 m high. Young branches obscurely 4-angled. Bark dark coloured. Leaves 10-11 × 3.5-6 cm, elliptic to elliptic-oblong or lanceolate, obtuse, acuminate, base cuneate, rather dull on both surfaces when dry; midrib prominent below, lateral nerves 7 to 8 pairs; petiole 12-20 mm long.

Male Flowers : solitary terminal or in 2 to 3-flowered, axillary cymes, about 8 mm in diam., bracteolate; pedicels 6 mm long; buds globose. Sepals 4, 5.5 × 6 mm, outer pair ovate-acute, fleshy, keeled, longer than the inner obovate-orbicular, very concave pair. Petals 4, (in bud) 3 × 3 mm, obovate-orbicular, fleshy, concave, about the same size as the inner sepals. Stamens 20-35, inserted on a single convex receptacle; anthers bilocular, broadly ovate, red, introrse, the dehiscence longitudinal; filaments broad, short. Rudimentary pistil absent. **Female Flowers :** solitary, on shorter pedicels than the male. Berry globose, 4-5 cm in diam., smooth, thin, reddish; stigma minute, discoid, sessile, entire; sepals persistent at the base. Seeds 2 or more. (Plate III, 20).

Type : S. Kurz s.n., South Andamans (CAL).

Flowers : Sept.-Feb. **Fruits :** March-May.

Herbarium specimens examined : BENGAL : Indian Botanic Garden, Calcutta, cultivated, no. 33 (DD). ANDAMAN ISLANDS : Bommung-la, Andamans, C. E. Parkinson 1000, Sept. 16, 1916 (CAL); M. Andaman, Betapav, C. E. Parkinson 1140, March 28, 1916 (CAL, DD); Mt. Harriet, S. Andamans, S. Kurz s.n., Feb. 2, 1875 (CAL); S. Andamans, S. Kurz s.n. (CAL); Baratang Island, Andamans, C. E. Parkinson 165, Dec. 1913 (DD); Rongat, Andamans, C. E. Parkinson 580, May 1915 (DD).

Distribution : Tropical forests of Andaman Islands.

Uses : The young leaves are reported to be cooked and eaten as vegetable in Burma. The fruit is edible.

G. lanceaefolia Roxb. [Hort. Beng. 42. 1814, nom. nud. et] Fl. Ind. 2 : 623. 1832; Wight, Icon. t. 103. 1839; Voigt, Hort. Suburb. Calc. 87. 1845;

Planchon & Triana, loc. cit. 341; Drury, Ind. Fl. 1 : 140. 1864; Lanessan, loc. cit. 48; T. Anderson in Hook. f. loc. cit. 263; Kurz in J. Asiat. Soc. Beng. 43 : 87. 1874 et For. Fl. Brit. Burma 1 :

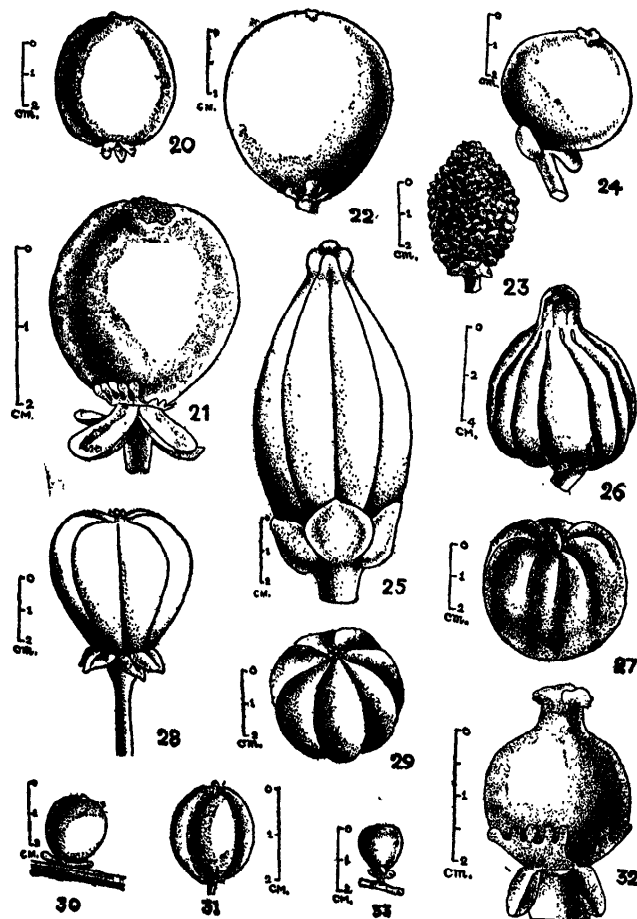


PLATE III : Figs. 20-33. Fruits of *Garcinia*

- | | |
|---|-------------------------|
| 20. <i>G. microstigma</i> | 27. <i>G. kydia</i> |
| 21. <i>G. lanceaefolia</i> v. <i>lanceaefolia</i> | 28. } <i>G. cowa</i> |
| 22. <i>G. lanceaefolia</i> v. <i>oxyphylla</i> | 29. } <i>G. morella</i> |
| 23. <i>G. echinocarpa</i> v. <i>monticola</i> | 30. <i>G. pictoria</i> |
| 24. <i>G. indica</i> | 31. <i>G. acuminata</i> |
| 25. <i>G. cambogia</i> v. <i>conicarpa</i> | 32. <i>G. wightii</i> |
| 26. <i>G. cambogia</i> v. <i>papilla</i> | 33. <i>G. wightii</i> |

91. 1877; Pierre, loc. cit. 19. t. 80 D,E et t. 81 A. 1883; Vesque, loc. cit. 429; Gamble, Man. Ind. Timb. 53. 1902; Brandis, Ind. Trees 50. 1907; Engler in Nat. Pfam. (ed. 2) 21 : 219. 1925; Fl. Assam 1 : 196. 1934; Wealth of India 4 : 103. 1956; Sealy in Kew Bull. 1956 : 341. 1956. *G. purpurea* Wall. Cat. 4862. 1831, nom. nud.; Choisy, Guttif. Ind. 36. 1851, non Roxb. *Stalagmitis lanceaefolia* G. Don, Gen. Syst. 1 : 621. 1831. Evergreen, small trees. Bark rugose, black. Leaves 8-10 cm × 15-25 mm, narrowly lanceolate, cuspidate or acuminate, base attenuated, margin repand, subcoriaceous, dark green; lateral veins 7-18, indistinct, anastomosing below the margin; petiole 5-12 mm long.

Male Flowers : solitary or geminate, terminal, dark yellow. Sepals 4, fleshy, oblong. Petals nar-

row, slightly oblique, red. Stamens 18-40, in a globose mass; anthers bilocular, nearly sessile, introrse. *Female Flowers*: terminal or solitary axillary; pedicels equally long as the flowers, thick, base 2-bracteate. Sepals 4, ovate, carnosae, margin membranous. Petals 4, much narrower, carnosae. Staminodes in four bundles of 4-8 each, connate at the base in a ring, irregular, opposite the sepals; anthers ovate. Ovary globose, contracted at the apex; stigmatic rays 6-10, irregularly or regularly 2-seriate tuberculate. Berry about 25 mm in diam., orange-yellow, obovoid, not grooved, 6 to 8-seeded; stigma persistent, nearly sessile, coronate.

Var. lanceaefolia

Leaves narrowly lanceolate. Sepals 7×6.5 mm. Petals 5×3 mm. Staminodes (in female flowers) 30-40, collected in 4 to 8-androus bundles. Flower-bearing branches about 1.5 mm thick. Berry obovate or turbinate, yellow, edible. (Plate III, 21).

Type: Wallich 4861 A, B, Sylhet, East Pakistan (CAL).

Flowers: Feb.-March. *Fruits*: June-July.

Herbarium specimens examined: ASSAM: Sibsagar, S. C. Peal 297 (CAL); Amgori, Sibsagar, Khasi hills, G. Mann s.n., Jan. 1888 (CAL); Gaurisagar, Sibsagar Dist., U. N. Kanjilal 3556, March 6, 1914 (ASSAM); Raja Baree, Herb. G. Watt 11152, April 18, 1895 (CAL); Nungklao, Khasia, C. B. Clarke 44024 A, May 26, 1886 (CAL); Khasia, Kew distrib. no. 850 (CAL); Outer Thorasim hills below Cheerung, Schlich s.n. (DD). BENGAL: Indian Botanic Garden, cult. (CAL); Wallich 4862 (CAL). EAST PAKISTAN: Sylhet, Wallich 4861 A, B (CAL).

Distribution: Common in the evergreen forests of Assam, Khasi hills, Chittagong and Sylhet up to 915 m and is often cultivated in villages for its fruits.

Vernacular names: Ass.: *Rupohi-thekeera*; Garo: *Thisuru*; Kach.: *Shushru-thai*; Khasi: *Diengsoh-jadu*; Kuki: *Kengrapel*, *Toiteng*; Lushai: *Pelte*; Mik.: *Prangsu*, *Prangso-arong*; Synt.: *Diengsoh-swit*.

Uses: The leaves are subacid and reported to be eaten in Assam by Mikirs after cooking. The ripe acid fruit is eaten with relish.

Var. oxyphylla (Pl. & Tr.) Lanessan, Mém. Garcin. 48. 1872; Vesque, loc. cit. 431. *Garcinia oxyphylla* Pl. & Tr. Mém. Guttif. loc. cit. 342. 1860; Pierre, loc. cit. 20. t. 80 K.

Leaves linear-oblong, acute at ends. Staminodes (of female flowers) 8-13, collected in 2 to 4-androus bundles. Ovary 7 to 10-locular; stigmatic rays as many, regularly 2-seriate tuberculate. Flower-bearing branches 0.5-1.5 mm thick. (Plate III, 22).

Type: ex Herb. W. Hooker and Jenkins, Assam (K, DD).

Flowers: Nov.-Feb. *Fruits*: March-May.

Herbarium specimens examined: ASSAM: without exact locality, Jenkins s.n. (DD); Sibsagar, S. Peal 83 (CAL); Amgori, Sibsagar, Khasia hills, G. Mann s.n., July 1882 (CAL); Bokajan Res., Sibsagar Dist., U. N. Kanjilal 121 M, Dec. 15, 1913 (ASSAM); Gauri Sagar, Sibsagar dist., 97.5 m, U. N. Kanjilal 3556, March 6, 1914 (DD); Dimapur, Sibsagar Dist., U. N. Kanjilal 2166, March 24, 1913 (ASSAM); Barpathar, Sibsagar Dist., U. N. Kanjilal 21 M (ASSAM), U. N. Kanjilal 1882, Nov. 9, 1912 (ASSAM); Chattuc, G. A. Gammie 513, April 9, 1894 (CAL); Balijan, Rangapahar, Naga hills dist., G. K. Dea 22091, May 2, 1946 (ASSAM); Nartiang, K. & J. hills dist., S. R. Sharma 16055, Nov. 27, 1937 (ASSAM); Khonsnong, K. & J. hills dist., U. N. Kanjilal 713 P, Feb. 5, 1915 (ASSAM); Jokai Res., Lakhimpur Dist., U. N. Kanjilal 4085, March 18, 1914 (ASSAM). BENGAL: Indian Botanic Garden, cult., introduced from Assam (CAL).

Distribution: Fairly common in evergreen forests in Sibsagar, Naga hills, Khasi hills and Lakhimpur districts of Assam; cultivated in villages for the fruit.

Vernacular names: Ass.: *Rupohi-thekeera*.

G. loniceroides T. Anderson in Hook. f. Fl. Brit. Ind. 1: 264. 1874.

Shrubs or small trees. Branches slender, decussate, horizontal, young ones reddish-purple. Old bark dark grey. Leaves $5-10 \times 1.5-2$ cm, oblong-lanceolate or oblanceolate, membranous, glaucous beneath, confined to the young shoots; veins slender, indistinct, irregularly branched and forked; petiole about 6 mm long.

Flowers very small, about 5 mm in diam. *Male Flowers*: usually 3 or more, rarely axillary; pedicels slender, about 5 mm long. Sepals and petals about 2 mm long, broad-ovate, thinly fleshy, concave. Stamens numerous, in a central sessile sub-tetragonal mass; anthers bilocular, subsessile. Rudimentary ovary absent.

Type: Griffith, Kew distrib. no. 870, Burma (K).

Flowers: Nov.-Feb.

Herbarium specimens examined: ASSAM: Nungba, Manipur, A. Meebold 6326, Nov. 1907 (CAL); Kungba, Naga hills, A. Meebold 7399, Dec. 1907 (CAL).

Distribution: Assam, Burma.

G. echinocarpa Thwaites in Hook. Kew Journ. 6: 71. 1854 et Enum. Pl. Zeyl. 1: 49. 1858; Planchon & Triana, loc. cit. 348; Lanessan, loc. cit. 33. t. 6; Pierre, loc. cit. 23. t. 80 J; T. Anderson in Hook. f. loc. cit. 264; Vesque, loc. cit. 422; Trimén, Handb. Fl. Ceylon 1: 96. 1893; Gamble, Man. Ind. Timb. 53. 1902 et Fl. Madras 73. 1915; Brandis, Ind. Trees 50. 1907; Rama Rao, Fl. Pl. Trav. 29. 1914; Wealth of India 4: 101. 1956.

Var. monticola var. nov.

Varietas monticola a varietate typica distinguenda

foliis coriaceis, obovatis vel oblongis, retusis vel obtusis. Var. nova est planta monticola, indigena ad altit. 915-1830 m.

Typus, *Thwaites* 335, lectus in Provincia centrali Ceylonensi et positus in herbario calcuttensi (CAL).

Differs from the typical form in leaves thickly coriaceous, obovate or oblong, retuse or obtuse; a montane form occurring at altit. 915-1830 m.

Type: *Thwaites* 335, Central Province, Ceylon (CAL).

Trees, about 15 m high. Branchlets quadrate, compressed. Wood dark red, hard, heavy. Leaves 8-15 × 3-7 cm, obovate or oblong, retuse or obtuse, base narrowed, thickly coriaceous, margin revolute; midrib prominent below, lateral veins about 30, obliquely parallel, prominent on both sides; petiole stout, 1.5-2 cm long.

Male Flowers: several, in sessile, axillary and terminal heads, pale yellow. Buds globose, mature ones about 5 mm broad. Sepals 4, thick, orbicular, subcordate. Petals 4, twice as long as sepals, thinner, oblong, suboblique. Stamens 12-40, on a short tetragonal stalk; anthers bilocular, linear-oblong, laterally introrse, vertically dehiscent, subsessile; filaments short. **Female Flowers:** solitary, terminal, sessile. Staminodes uniseriate, connate in a ring. Ovary covered with imbricate, fleshy scales; stigma peltate, irregularly lobed. Berry 3-4.5 × 2.5-3 cm, subglobose or ellipsoid, dark red, trilocular,

covered with broad sharp tubercles, 1 to 3-seeded. (Plate IV).

Flowers: Feb.-April. **Fruits:** Dec.-March.

Herbarium specimens examined: PENINSULAR INDIA: Travancore hills, *R. H. Beddome* s.n. (MH); Tinnevely hills, *R. H. Beddome* s.n., 1879 (MH); Travancore, *T. F. Bourdillon* s.n., April 5, 1895 (CAL); Strathmore, Travancore, *T. F. Bourdillon* 611, April 17, 1895 (MH); Chimunjie, 1066 m, Travancore, *T. F. Bourdillon* 953, April 8, 1898 (DD); Kannikatti, Tinnevely Dist., *D. Hooper & M. S. Ramaswami* 39428, Feb. 21, 1913 (CAL), s. nom., March 19, 1917 (MH 2931).

Distribution: Moist evergreen forests of southern Travancore, Tinnevely and Ceylon at altitude 915-1830 m.

Vernacular names: Mal.: *Para*; Tam.: *Madul*.

Uses: The oil from the seeds is used for illuminating purposes, but it gives an indifferent light. It can be used for soap-making and for the preparation of stearine used in candle manufacture. The wood is used for shingles in Ceylon. The leaves and bark are used in dropsical affections and also as vermifuge.

G. indica (Dupetit-Thouars) Choisy in DC. Prod. 1: 561. 1824; Planchon & Triana, loc. cit. 338; Lanessan, Mém. Garcin. 45. 1872; T. Anderson in Hook. f. loc. cit. 261; Hook. in J. Linn. Soc. (Bot.) 14: 484. 1875; Pierre, loc. cit. 18. t. 80 l. 1883; Vesque, loc. cit. 423; Cooke, Fl. Prés. Bomb. 1: 76. 1901; Gamble, Man. Ind. Timb. 54. 1902 et Fl. Madras 73. 1915; Brandis, Ind. Trees 52. 1907; Talbot, For. Fl. Bomb. Pres. 1: 90. 1909; Rama Rao, Fl. Pl. Trav. 28. 1914; Engler in Nat. Pfam. (ed. 2) 21: 219. t. 87 H-J. 1925; Wealth of India 4: 101. 1956; Santapau in Rec. Bot. Surv. Ind. (ed. 2) 16: 14. 1960. *Brindonia indica* Dupetit-Thouars in Dict. Sci. Nat. 5: 340. 1804. *Garcinia celebica* Desr. in Lamk. Encyc. 3: 700. 1789, non Rumph. *G. purpurea* Roxb. [Hort. Beng. 42. 1814, nomen et] Fl. Ind. 2: 624. 1832, cum descrip. Drury, Useful Pl. Ind. 230. 1858 et Ind. Fl. 1: 140. 1864. *Oxycarpus indica* Poir, Encyc. Suppl. 4: 257. 1816. *Stalagmitis indica* G. Don, Gen. Syst. 1: 621. 1831. *Stalagmitis purpurea* G. Don, Gen. Syst. 1: 621. 1831.

Slender trees with drooping branches, upto 8 m high. Young branches subterete, irregularly striate, about 2.5 mm thick. Bark light brown, rather shining, very thin, smooth. Wood greyish-white, hard. Leaves 6.5-11 × 1.5-4 cm, lanceolate or obovate-oblong, acute or acuminate, base contracted in petiole, membranous, shining, dark-green; midrib prominent below, lateral veins slender, few (7-18), prominent on both sides; petiole 5-10 mm long, slender.

Male Flowers: small, 4-8 in axillary and terminal fascicles; pedicels 6 mm long. Sepals 4, yellow.

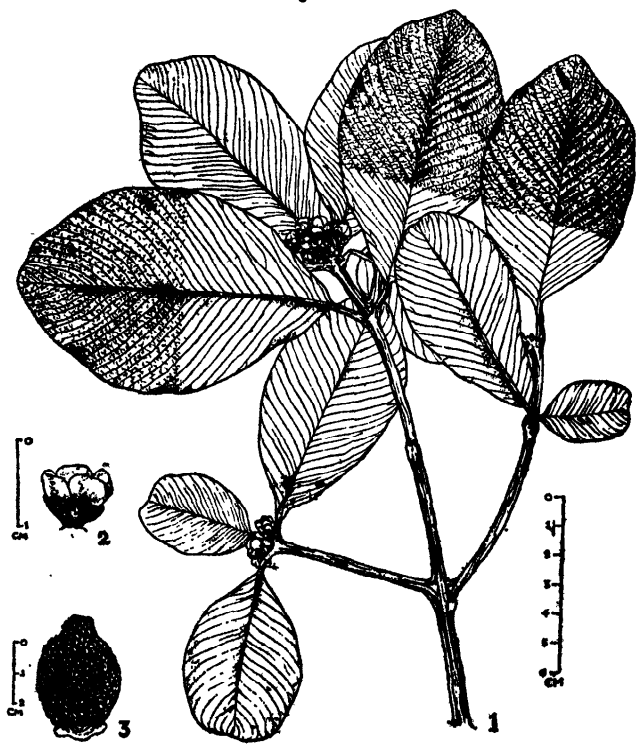


PLATE IV: *Garcinia echinocarpa* Thw. var. *monticola* Mahesh.
Figs. 1-3: 1. Flowering twig. 2. Flower. 3. Fruit
(*Thwaites* 335, type, CAL.).

lowish-orange to pinkish-orange, coriaceous, ovato-rotundate, base narrow, outer ones 3-4.5 mm long, inner ones 4.5-5 mm long. Petals thick, larger than sepals. Stamens numerous, forming a short capitate column; filaments short; anthers oblong, bilocular, truncate, loculi laterally introrse, opening longitudinally. Rudimentary pistil absent or a few equalling stamens. *Female Flowers*: solitary, terminal; pedicels 3 mm long, thick. Sepals and petals as in male flowers. Staminodes 10-18, in 4 unequal, 2 to 3-seriate phalanges alternating with petals, 1-3 mm long. Ovary 4 to 8-locular, subglobose; stigma 4 to 8-rayed, convex, coronate, rays tuberculate, often 2-seriate. Berry cherry-shaped, about 30 mm long, purple or wine-brown, surrounded by persistent calyx; pulp red. Seeds 5-8, compressed, enclosed in an acidic pulp. (Plate III, 24).

Type: Dupetit-Thouars s.n., India (PARIS).

Flowers: Nov.-March. *Fruits*: Jan.-Aug.

Herbarium specimens examined: PENINSULAR INDIA: Konkan, Ritchie 95 (CAL); Konkan, ex Herb. Talbot (POONA); North Kanara, W. A. Talbot 16 (CAL); Tinai Ghat, North Kanara, L. J. Sedgwick 3352, Dec. 1917 (CAL, BLAT); Karwar, in coastal forest, North Kanara, L. J. Sedgwick 5062, Dec. 1918 (BLAT); Arbail Ghat, North Kanara, L. J. Sedgwick 5127, 5131, Dec. 1918 (BLAT); Ambi, North Kanara dist., W. A. Talbot s.n., Jan. 1888 (POONA); Anmodi, North Kanara, W. A. Talbot s.n., Feb. 10, 1889 (POONA); Yellapur, North Kanara, W. A. Talbot s.n., March 1883 (POONA); Yellapur, Telligeri, Kanara, S. K. Jain 16504, March 12, 1957 (POONA); Yellapur, Karwar dist., L. J. Sedgwick 5855, April 1919 (BLAT); Karwar, sub-ghat forest, L. J. Sedgwick 5043, Dec. 1918 (BLAT); Mobar, near Malvan, Santapau 62.1, March 1941 (BLAT); Ghodbunder, Bombay, Santapau 17921, 17922, Jan. 23, 1954 (BLAT); Victoria Gardens, Bombay, R. R. Fernandez 3550 Jan. 17, 1957 (BLAT); Mt. Berry, Matheran, N. A. Irani 4816, 4817, Dec. 21, 1959 (BLAT), N. A. Irani 5643, Nov. 11, 1960 (BLAT); Anshi Ghat, Dharwar, A. R. Braganza 847, Dec. 4, 1950 (DD); Yellapur Range, Eastern Kanara, Bombay, May 6, 1953 (DD); Wuddel Ghat, Medmurgal, W. A. Talbot s.n., Dec. 1883 (POONA); Devimani Ghat, Bombay, B. Kulkarni s.n., Nov. 20, 1908 (POONA); Lonavla, Picchli Hill, Bombay, S. K. Jain 918, May 6, 1956 (POONA); Khandala, G. A. Gammie 16162, March 21, 1903 (POONA); Khandala, s.n., May 1899 (BLAT); Khandala, Santapau 62.3, 62.10, 62.11, 62.13, 62.14 & 3253 (BLAT); Khandala, N. A. Irani 1733, Feb. 25, 1956 (BLAT); Khandala, Y. A. Merchant 1116, June 7, 1959 (BLAT); St. Xavier's Ravine, Khandala, Santapau 1526, Jan. 23, 1943 (BLAT); Echo Point Ravine, Khandala, Santapau 2147 & 3596 (BLAT); Con. Home-Echo Point Ravine, Khandala, Santapau 1554 (2), Jan. 24, 1943 (BLAT);

Kune Plateau, Khandala, Santapau 3122, Nov. 8, 1943 (BLAT); Chandanathode, Madras State, N. L. Bor 9426, Dec. 1937 (DD). BENGAL: Indian Botanic Garden, cult., S. C. Banerji 11353, Dec. 16, 1912 (CAL), A. T. Gage s.n., Jan. 31, 1912 (CAL).

Distribution: Endemic in the tropical rain forests of Western Ghats from Konkan southwards in Mysore, Coorg, Wynaad, and in Goa, Mahe, etc. (Garcia; Sonnerat). It is often planted in the southern districts of Bombay-Maharashtra and reported to flourish well on the lower slopes of Nilgiri hills. Introduced and cultivated in France, Bourbon and Calcutta.

Vernacular names: Hindi: Kakam; Guj.: Kokan; Kan.: Murgala; Mal.: Penampuli; Mar.: Amsol, Bhirand, Katambi, Kokam, Kokambi, Ratamba; Tam.: Murgali; Eng.: Mate mangosteen, Wild mangosteen, Red mango, Kokam butter tree, Mangosteen oil tree, Brindonia tallow tree; Tomato Plant (Khandala).

Uses: The seeds yield a valuable fat known in commerce as "Kokum butter". This is used as an edible fat, an adulterant of ghee, in soap and candle manufacture, and suitable for ointments, suppositories and other pharmaceutical purposes. The acidic juice of fruit is used by blacksmiths for melting iron. It is used in Konkan chiefly in the form of Kokam prepared by drying the outer rind, soaking it repeatedly in the juice of the pulp and sun-drying. It is used as a garnish to give an acid flavour to curries and also for preparing cooling syrups during hot months. Kokam is reported to be imported into Zanzibar from India. The oil from seeds is used as a remedy in phthisis-pulmonalis, scrofulous diseases, dysentery, mucous diarrhoea, and external for excoriations, chaps, fissures of lips and as a substitute for spermaceti. The wood is well suited for paper pulp.

G. cambogia Desr. in Lamk. Encyc. 3: 701. 1792; Willd. Sp. Pl. 2: 848. 1800; Roxb. Pl. Corom. 3: 94. t. 298. 1820 et Fl. Ind. 2: 621. 1832; Choisy in DC. Prod. 1: 561. 1824; G. Don, Gen. Syst. 1: 620. 1831; Wt. & Arn. Prod. 1: 100. 1834; Thw. Enum. Pl. Zeyl. 1: 48. 1858; Miquel, Fl. Ind. Bat. 1: 507. 1859; Planchon & Triana, loc. cit. 332; Drury, Ind. Fl. 1: 139. 1864; Bedd. Fl. Sylv. t. 85. 1869-1873; Lanessan, Mém. Garcin. 36. 1872, P.P.; T. Anderson in Hook. f. loc. cit. 261; Pierre, loc. cit. 21. t. 83 H. 1883; Vesque, loc. cit. 426; Trimen, Handb. Fl. Ceylon 1: 94. 1893; Cooke, Fl. Pres. Bomb. 1: 77. 1901; Gamble, Man. Ind. Timb. 54. 1902 et Fl. Madras 73. 1915; Brandis, Ind. Trees 50. 1907; Talbot, For. Fl. Bomb. Pres. 1: 91. 1909; Rama Rao, Fl. Pl. Trav. 29. 1914; Engler in Nat. Pfam. (ed. 2) 21: 219. 1925; Wealth of India 4: 99. 1956; Sealy in Kew Bull. 1956: 341. 1956; MacMillan, Trop. Pl. & Gard. (ed. 5) 257. 1956, non F.-Vill. (1880). *Cambogia gutta* Linn. Sp. Pl. 728. 1753, p.p. *Mangos-*

tana cambogia Gaertn. Fruct. 2: 106. 1790. *Garcinia roxburghii* Wight, Illustr. 1: 125. 1840, p.p. *Coddam pulli* Rheede, Hort. Malab. Ind. 1: 41. t. 24. 1986.

Small or medium-sized, erect, trees with drooping or horizontal branches. Bark grey, rugose. Wood grey, shining, hard, smooth. Leaves 7.5 × 2.6 cm, oblong, elliptic or lanceolate, acute to obtusely short acuminate, base cuneate, contracted in petiole, shining, dark green; midrib prominent below, scarcely prominent above, lateral veins slender, prominent on both sides; petiole 5-12 mm long.

Male Flowers. in short axillary fascicles; pedicels 7-15 mm long, thickened towards the tip, often reflexed. Sepals 4, coriaceous ovate or obovate, unequal, margin membranous. Petals 4, obovate or oblong, concave, twice as long as the sepals. Stamens 12-20 or more, inserted on prominent receptacle, imbricate; filaments short; anthers bilocular, apices obtuse, locules introrse, dehiscing vertically. Rudimentary pistil minute or absent. **Hermaphrodite Flowers:** 1-3, terminal and axillary; pedicels short. Stamens 10-20; filaments unequal, all connate at the base or in unequal bundles; anthers bilocular, fertile or often a few empty. Ovary subglobose or conoid, 8 to 11-locular, 8 to 11-sulcate; stigmatic rays 8-11, coronate, spreading, free nearly to the base, margin crenate, irregular or tuberculate. Berry the size of a small apple, about 5 cm in diam., yellow or red; grooves 6-8, ending about the middle; apex flat, depressed, mamilla thick. Seeds 6-8, aril succulent.

Var. *cambogia*.

Staminodes 15-20, subequidistant, connate at the base or collected in fascicles. Ovary 8 to 10-sulcate. Stigmatic rays 8-10, linear, cuneate, tuberculate. Berry pome-shaped, yellow or red, costa prominent, furrows narrow.

Type: Rheede (Malabar).

Flowers: Jan.-Sept. **Fruits:** July-August.

Herbarium specimens examined: PENINSULAR INDIA: Nilkund Ghat, North Kanara, W. A. Talbot s.n., March 2, 1889 (POONA); Dodmune, North Kanara dist., W. A. Talbot 3586, March 5, 1890 (POONA); Kumpta, North Kanara dist., W. A. Talbot s.n., June 1, 1901 (POONA); Arbail, N. Kanara dist., W. A. Talbot s.n., Oct. 1888 (POONA); Sonda, N. Kanara dist., W. A. Talbot 3660, May 9, 1889 (POONA); Yellapur, W. A. Talbot s.n. (POONA); Yellapur, Dharwar, A. R. Braganza 410, March 15, 1950 (DD); Silel Valley, Madras, no. 388, Sept. 1938 (DD); Colatoor-polay, MH 10 (CAL); Jhila Shola, Nilgiris Dist., J. S. Gamble 20711, May 1889 (CAL, POONA); Chiunar-Coimbatore-Travancore Frontier, C.E.C. Fischer 3431, May 14, 1912 (CAL); Coorg. R. H. Beddome s.n., 1869 (MH); Annamallays, R. H. Beddome s.n., 1871 (MH); Cochin, M. A. Lawson s.n.

1884 (MH); Travancore, M. A. Lawson s.n. (DD); Koni, Travancore, T. F. Bourdillon 1585, Jan. 2, 1905 (DD). BENGAL: Indian Botanic Garden, cult. (CAL).

Distribution: Common in the evergreen forest of Western Ghats from Konkan southwards to Travancore and in the Shola forests of Nilgiris upto an altitude of 1830 m; Ceylon. Cultivated in the botanic garden of Bogor (*Herb. Pierre* 4152) and Ceylon.

Vernacular names: Coorg: *Manthulli*; Kan.: *Upagi mara*, *Simai hunase*; Mal.: *Pinenga*, *Pineru*, *Kodapuli*, *Kadumpuli*; Mar.: *Dharambe*; Tam.: *Penampuli*, *Kodakkapuli*; Tel.: *Simachinta*; Trav.: *Gorakkapulli*; *Kodokapuli*.

Uses: The 'gummi-gutt' of gamboge is used medicinally as a purgative, hydragogue and emetic, particularly in dropsies and worm cases. The principal use of gamboge is as a pigment in miniature-paintings and water-colours. The fruits are very acidic and eaten raw or pickled. They are valued for their dried rind which is used in Travancore-Cochin and Malabar as a condiment for flavouring curries in place of tamarind or lime. The dried rind is also used for polishing gold and silver and as a substitute for acetic and formic acids in the coagulation of rubber latex. The seeds yield an oil used in medicine. The gum makes a good varnish. The wood is suitable for match boxes, splints and posts.

Var. *zeylanica* (Roxb.) Vesque in DC. Mon. Phan. 8: 427. 1893. *Garcinia zeylanica* Roxb. Fl. Ind. 2: 621. 1832; Wt. & Arn. Prod. 101; Planchon & Triana, loc. cit. 337; Lanessan, loc. cit. 408; Pierre, loc. cit. 22. t. 83.

Stamens (in male flowers) numerous, fungiform; in pseudohermaphrodite flowers 6-8, i.e. as many as ovarian loculi. Rudimentary pistil often large. Berry orange-coloured, smaller in weight and form than the typical one, smooth, with long, slightly torulose ribs.

Type: ex Thwaites (Ceylon); cult. in Missionaries Garden at Tranquebar, India.

Herbarium specimen examined: CEYLON: Henaratgoda Garden, Ceylon, March 5, 1923 (DD).

Distribution: Ceylon. It was introduced into the botanic garden at Tranquebar near Tanjore where the tree grows freely and acquires a medium size.

Uses: It yields an inferior sort of gamboge.

Var. *conicarpa* (Wight) T. Anderson in Hook. f. Fl. Brit. Ind. 1: 262. 1874; Vesque, loc. cit. 428. *Garcinia conicarpa* Wight, Icon. t. 121. 1839 et Illustr. 1: 125. 1840; Planchon & Triana, loc. cit. 347; Lanessan, loc. cit. 53; Pierre, loc. cit. 21.

Stamens about 35, inserted on a short convex torus; filaments short. Rudimentary pistil absent. Berry ovoid or conical, 4-grooved to the top, furrows angular. Leaves broader beyond the middle or linear-oblong. (Plate III, 25).

Type: ex Herb. Wight, 142, Shevagherry hills (CAL).

Fruit: October.

Herbarium specimens examined: PENINSULAR INDIA without exact locality, Herb. Wight 142 (CAL); Between Olliar and Thorakadavuar, Coimbatore, C. A. Barber 3701, Oct. 10, 1901 (MH).

Distribution: Kanara, Hohenacker 552.

Var. papilla (Wight) T. Anderson in Hook. f. Fl. Brit. Ind. 1: 262. 1874; Vesque, loc. cit. 428; Trimmen, loc. cit. 94. *Garcinia papilla* Wight, Icon. t. 960. 1839; Drury, Ind. Fl. 1: 141. 1864; Pierre, loc. cit. 21. t. 83 D. *Garcinia kydia* Wt. & Arn. Prod. 101. 1834, non Roxb. *Garcinia roxburghii* Wight, Illustr. 1: 125. 1840, p.p.

Stamens (in male flowers) about 25, united in a globose androphore. Rudimentary pistil absent. Ovary 6 to 8-locular; style short, thick; stigma 6 to 8-rayed. Berry ovate-oblong, 4 to 8-grooved to the top, with a terminal mamilla. Seeds subtriangular, testa slender. Leaves elliptic. Flowers orange-red (Plate III, 26).

Type: Wight, Conoor and Sisparah jungles, Nilgiris (K).

Flowers: Feb.-May. *Fruits*: Jan.

Herbarium specimens examined: PENINSULAR INDIA: Sisparah Ghat, Nilgiris, (MH 2975); Lambourk Shola, 1525 m, Nilgiris dist., Madras, J. S. Gamble 11339, April 1883 (DD); Hill Grove Estate, 1525 m, Nilgiris dist. Madras, J. S. Gamble 11906, Jan. 1883 (DD); Sengalteri, Tinnevely dist., Sept. 26, 1916 (MH); Devicolam, Travancore, A. Meebold 13533, Dec. 1909 (CAL); Travancore, M.A. Lawson s.n. (CAL); Konal-Arsources, Annaimalai Hills, C.E.C. Fischer 3350, April 8, 1912 (CAL); Nilgiris, Herb. Wight 143 (CAL).

Distribution: Nilgiris, Wight, Hohenacker 152, Perrotet 152.

G. kydia Roxb. Fl. Ind. 2: 623. 1832; Wt. & Arn. Prod. 1: 101. 1834; Planchon & Triana, loc. cit. 347; Lanessan, Mém. Garcin. 59. 1872, p.p.; Kurz in J. Asiat. Soc. Beng. 43: 87. 1874; Pierre, loc. cit. 29; King in J. Asiat. Soc. Beng. 59: 164. 1890; Parkinson, For. Fl. Andaman Islands 90. 1923; Fl. Assam 1: 105. 1934; Sealy in Kew Bull. 1956: 341. 1956. *G. kydiana* Roxb. [Hort. Beng. 42. 1814, nom. nud.]; Wight, Icon. t. 113. 1839; Voigt, Hort. Suburb. Calc. 86. 1845. *G. umbellifera* Wall. Cat. 4864. 1831, nomen. *G. wallichii* Choisy in Mém. Soc. Phys. Genev. 12: 417. 1851, p.p. *G. cowa* T. Anderson in Hook. f. Fl. Brit. Ind. 1: 262. 1874, p.p.; Wealth of India 4: 100. 1956, p.p.

Dioecious trees, 7.5-13 m high; branchlets dark-coloured when dry, not angled. Bark blackish-brown, rough, cracked; cut brown, exuding a yellow milk which hardens into an inferior kind of gamboge.

Wood white turning yellowish, rather heavy, coarsely fibrous, very perishable. Leaves opposite, 8-15 x 2-4 cm, ovate-oblong to lanceolate, acuminate, base acute, both surfaces shining, thinly coriaceous; nerves thin but distinct when dry; petiole 8-12 mm long.

Male Flowers: about 2 cm in diam., in small axillary or terminal pedunculate umbels of 3-5 or solitary; peduncles of the umbels 10-15 mm long; pedicels thick, glabrous, clavate, about 6 mm long. Sepals 4, yellow, equal, ovate, obtuse, fleshy. Petals 4, pale yellow, twice as large as the sepals, broadly ovate, blunt. Anthers numerous, square, bilocular, inserted into the slightly 4-lobed fleshy mass of conjoined filaments. Rudimentary pistil absent. *Female Flowers*: solitary axillary and terminal, sessile. Sepals and petals as in the male. Stamminodes 4, small, 3 or 4-fid, alternate with the petals, the branches gland-tipped. Ovary globular, sessile, 6 to 8-lobed; stigma subsessile, with 6-8 spreading glandular rays. Berry 2.5-4 cm in diam., dark purple-brown, smooth, globular, depressed, with 6-8 deep vertical grooves near the apex, and with a nipple-like protuberance from the depressed apex on which is inserted the persistent stigma. Seeds 6-8, oblong, about 20 mm long; the aril soft, acidic juicy. (Plate III, 27).

Type: ex Kyd (Andaman Islands); cult. in Indian Botanic Garden, Calcutta.

Flowers: Dec.-May. *Fruits*: May-Aug.

Herbarium specimens examined: ANDAMAN ISLANDS: North Corbus' Cove, Hill jungle, S. Andamans, King's collector s.n. (CAL); Bamboa Filleet, Port Blair, Andamans, King's collector 150, March 5, 1884 (CAL); Andamans, Prain's collector 28, April 20, 1901 (CAL); Bom-Jung-Ja Creek, Andamans, C. E. Parkinson 919, Feb. 4, 1916 (CAL, DD); S. Andamans, R. L. Heinig 734, Dec. 1896 (DD); Mt. Harriett, Andamans, C. E. Parkinson 837, Jan. 2, 1916 (DD); Wilson Island, Andamans, Kirat Ram 3745, Feb.-March 1934 (DD). BEN-GAL: Indian Botanic Garden, Calcutta, cult., M.B. Raizada s.n., Feb. 1954 (DD), J. K. Maheshwari 4660, March 21, 1961 (CAL).

Distribution: Tropical forests of Assam, Burma and East Pakistan from Chittagong, Pegu and Martaban down to Tenasserim and Andaman Islands; often cultivated for its fruit. Uncommon in South Andamans, Wimberleygunj and Mt. Harriett. It was discovered by Col. Kyd in the Andaman Islands and introduced into the Indian Botanic Garden, Calcutta in 1794, where when about 10 years old, it began to blossom in February and the fruit to ripen in July.

Vernacular names: Ass.: Kuji-thekera; Cach.: Hau; Garo: Tekra, Denga-doti; Kamrup: Chopchopa; Khasi: Dieng-soh-longhsan; Miri & Abor: Tarak-asing.

Uses: The tree yields an inferior gamboge. The acid fruit is considered as a specific for dysentery and

also for external application in obstinate cases of headache.

Notes: This elegant tree is closely allied to *G. cowa* Roxb. and T. Anderson (in Fl. Brit. Ind. 1 : 262. 1872) has united the two under *G. cowa* Roxb. However, I consider it to be a distinct species and this is also the opinion of Planchon et Triana, King and Parkinson. The differences between the two species are as follows :

<i>G. kydia</i> Roxb.	<i>G. cowa</i> Roxb.
1. Branchlets more or less round.	1. Branchlets 4-angular.
2. Male flowers ca 20 mm in diam., in distinct pedunculate umbels.	2. Male flowers 10-13 mm in diam., in fascicles of 3-8.
3. Female flowers solitary terminal.	3. Female flowers terminal, in fascicles of 3-5.
4. Petals pale yellow.	4. Petals yellow flushed pink or red.
5. Berry with vertical grooves only near the apex and with curious nipping from depressed apex.	5. Berry with 4-8 vertical grooves from base to apex and non-mamillate.

Recently Corner (in Gardns. Bull. Str. Settl. 10 : 36-38. 1939) examined living material of these species in Malaya and found that although the differences pertaining to the flowers hold, but those of the fruit do not hold. The fruit of *G. cowa* Roxb. in Malaya may be umbonate or not, with grooves proceeding from base to apex or at the apex only, and with the stigma sunken or not. On the other hand, the fruits of *G. kydia* Roxb. in Singapore ripen orange-red and are slightly ribbed, not grooved, while those of *G. cowa* turn orange-ochre. The leaves of the two species seem identical. He, therefore, thinks it better to make *G. kydia* a variety of *G. cowa*. It seems that introgressive hybridization may take place in areas where both the species occur.

***G. cowa* Roxb. ex DC. Prod. 1 : 561. 1824; Roxb. Fl. Ind. 2 : 622. 1832; Wt. & Arn. Prod. 1 : 101. 1834; Choisy, Guttif. Ind. 34. 1851; Planchon & Triana, loc. cit. 186; Lanessan, loc. cit. 54 T. Anderson in Hook. f. loc. cit. 262, p.p.; Kurz in J. Asiat. Soc. Beng. 43 : 87. 1874 et For. Fl. Brit. Burma 1 : 90. 1877; Pierre, loc. cit. 28. t. 82 D-H. 1883; King in J. Asiat. Soc. Beng. 59 : 163. 1890; Vesque, loc. cit. 449, p.p.; Haines, Bot. Bih. & Or. 2 : 53. 1921; Parkinson, For. Fl. Andam. Islands 89. 1923; Engler in Nat. Pfam. (ed. 2) 21 : 226. 1925; Craib, Fl. Siam. Enum. 1 : 114. 1931; Fl. Assam 1 : 105. 1934; Gagnepain, Fl. Gén. Indo-Chine Suppl. 3 : 261. 1943, p.p. excl. syn.; Sealy in Kew Bull. 1956 : 341. 1956; Wealth of India 4 : 100. 1956, p.p., non Vidal (1883). *Oxyccarpus gangetica* Buch.-Ham. in Mem. Wern. Soc. 5 : 344. 1824. *Stalagmitis cowa* G. Don, Gen. Syst. 1 : 621. 1831. *Garcinia lanceaefolia* Wall. Cat. 4861 C. 1831, non Roxb. *G. roxburghii* Wight, Icon. t. 104. 1839 et Illustr. 1 : 125. 1840, p.p. Kurz, For. Fl. Brit. Burma 1 : 90. 1877.**

Erect, evergreen, medium-sized, dioecious trees, 9-18 m high. Young branches slender, not angled.

Bark brown-greyish outside, nearly smooth, inside red, soon turning reddish-brown. Leaves 8-13 × 2.5-5 cm, broadly lanceolate, acute at ends, the apex sometimes acuminate, both surfaces rather dull when dry; veins slender, numerous, rather straight oblique, inarching with an intramarginal vein; petiole 8-13 mm long.

Flowers rather small, yellow. **Male Flowers:** about 1 cm in diam., axillary or terminal, in fascicles of 3-8; pedicels about 6 mm long. Sepals broadly ovate, fleshy, yellow. Petals twice as long as sepals, oblong. Stamens numerous on a convex fleshy receptacle; anthers bilocular, 4-cornered, oblong, on very short filaments. Rudimentary pistil absent. **Female Flowers:** about 1.5 cm in diam., terminal, in fascicles of 2-3-5, pedicellate. Ovary subglobose, 6 to 8-locular; stigma sessile, flat, deeply divided into 6-8, papillose, wedge-shaped rays. Staminodes in 4 clusters of 3-8, unequal. Berry globular, depressed, non-mamillate, with 4-8 vertical grooves, smooth, yellow, 2-4 cm in diam.; pericarp thin. Seeds 13-20 mm long, oblong, with a soft aril. (Plate III, 28, 29).

Type: Roxburgh, Chittagong, East Pakistan (Herb. Martius, BR).

Flowers: Jan.-May. **Fruits:** May-Aug.

Herbarium specimens examined: EAST HIMALAYA : Birick, Sikkim, *G. H. Cave* s.n., July 15, 1914 (CAL). ASSAM : Ranigodam, *Prain's collector* s.n., June 1898 (CAL); Tingali Bam Jungle, Naga hills, *Prain's collector* 1000/0, May 1899 (CAL); Amgori, no. 11174, April 22, 1895 (CAL); 35 km. Dalu Road, Garo hills, *U. N. Kanjilal* 5276, March 12, 1915 (CAL, DD); Sibisagar, Jorhat, *C. B. Clarke* 38037 B, April 30, 1885 (CAL); Sibisagar, *S. E. Peal* s.n., 1891 (CAL); Kalabari, Darrang, *U. N. Kanjilal* 3726, April 1, 1914 (CAL, DD); Khasi hills Herb. *S. Kurz* 248 (CAL); Khasia, *C. B. Clarke* 45150 D (CAL); 58 km Shillong-Dawki Road, *S. R. Sharma* 17124, Oct. 13, 1938 (ASSAM); Tupidhar, Cachar Dist., *R. N. De* 19258, April 4, 1940 (ASSAM); Mugakhhol Res., *U. N. Kanjilal* 5416, April 3, 1915 (ASSAM, DD); Andherijuli, Kamrup Dist., *U. N. Kanjilal* 5463, April 13, 1915 (ASSAM); Chhaygaon Res., Kamrup Dist., *U. N. Kanjilal* 5427, April 5, 1915 (ASSAM); Digboi, Lakshimpur, *G. K. Deka* 17002, June 16, 1938 (ASSAM); Jharua Forest, K. & J. Hills, *G. K. Deka* 19604, July 3, 1940 (ASSAM); Mahadeo, K. & J. Hills, *Sri Ram* 10081, May 15, 1932 (ASSAM); 65 km G. S. Road, K. & J. Hills, *S. R. Sharma* 13259, 13279 (ASSAM); Umteswar Forests, K. & J. Hills, *S. R. Sharma* 12207, July 7, 1935, *S. R. Sharma* 13436, June 22, 1936 (ASSAM). BENGAL : Rajabhatkawa, *A. H. Khan* s.n., March 1931 (DD); Rajabhatkawa, Buxa Dn., 152 m, *A. E. Osmaston* s.n., March 24, 1931 (DD); Damenpur Range, Buxa Dn., April 28, 1953 (DD); Rangam-pura, Tipperah Hill, *P. M. Debbarman* 547, 548, Dec. 31, 1914 (CAL), Bardain near Feni, Tip-

perah plains, *P. M. Debbarmann* 1198, March 16, 1920 (CAL); Indian Botanic Garden, Calcutta, *S. Kurz* s.n., June 2, 1834 (CAL). BIHAR & ORISSA: Athmallik State, near river, *H. H. Haines* 4711, Feb. 26, 1917 (CAL); Muljharau, 305-365 m., Hathidhara Block, Athmallik State, Orissa, *H. F. Mooney* 2868, May 7, 1947 (DD); Singbhum, West Duars, bank of stream, *H. H. Haines* 146, May 1899 (CAL). UTTAR PRADESH: New Forest, Dehra Dun, cult., *M. B. Raizada* s.n., May 1944 (DD). EAST PAKISTAN: Sylhet Jungles, *A. Belletty* s.n., Oct. 29, 1904 (CAL); Longai Res., Sylhet Dist., *P. C. Kanjilal* 10123, March 28, 1932 (ASSAM), *P. C. Kanjilal* 10245, June 1, 1932 (ASSAM); Kodala hill, 48 km from Chittagong, *King's collector (Badul Khan)* 325, 372 (CAL); Burkul, Chittagong hill tracts, *J. L. Lister* 331, March 3, 1876 (CAL); Chittagong hill tracts division, *V. S. Rao* 5658, Aug. 28, 1935 (DD).

Distribution: Frequent in evergreen and semi-evergreen tropical forests of Andaman Islands, all districts of Assam upto 915 m, in the Khasi hills, Bengal, Bihar and Orissa along streams, Chittagong, Burma, Yunnan and Thailand. Cultivated in the Indian Botanic Garden at Calcutta (*Herb. Pierre* 3620).

Vernacular names: Hind.: *Kataphal*, *Cowa*; Ass.: *Kau-thechera*, *Kaugach*; Beng.: *Kowa*; Daff.: *Blachung-changne*; Garo: *Tekra*, *Rengran*; Mech.: *Khatoksi*; Or.: *Sarbana*; Sylh.: *Kau*; Eng.: *Cowa fruit*; *Cowa mangosteen*.

Uses: The tree yields an inferior sort of gamboge. The acid fruit is eaten and is pleasant to the taste but is full of a yellow juice which sticks to the teeth and gives one an uncomfortable feeling in the mouth. The young leaves are cooked and eaten as a vegetable. The fruit is preserved in sun-dried slices in Assamese households for use in dysentery.

G. morella Desrouss in Lamk. Encyc. 3: 701. t. 405. f. 2. 1792; Choisy in DC. Prod. 1: 561. 1824; G. Don, Gen. Syst. 1: 620. 1831; Thwaites, Enum. Pl. Zeyl. 1: 49. 1858; Planchon & Triana, loc. cit. 350; Bedd. Fl. Sylv. t. 86. 1869; Lanessan, loc. cit. 62, p.p. T. Anderson in Hook. f. loc. cit. 264, excl. syn.; Pierre, loc. cit. 32. t. 85 A; Vesque, loc. cit. 472; Trimen, Handb. Fl. Ceylon 1: 96. 1893; Cooke, Fl. Pres. Bomb. 1: 77. 1901; Gamble, Man. Ind. Timb. 55. 1902 et Fl. Madras 73. 1915, p.p.; Talbot, For. Fl. Bomb. Pres. 1: 93; Rama Rao, Fl. Pl. Trav. 29. 1914; Engler in Nat. Pfam. (ed. 2) 21: 226. 1925; Fl. Assam 1: 107. 1934; Wealth of India 4: 105. 1956. *Stalagmitis cambogioides* Murr. in Comm. Götting. 9: 173. 1789, p.p.; G. Don, Gen. Syst. 1: 621. 1831. *Mangostana morella* Gaertn. Fruct. 2: 106. t. 101. 1790. *Garcinia cambogioides* Royle, Mat. Med. (ed. 3) 339. 1832. *Hebradendron cambogioides* Grah. in Hook. Comp. Bot. Mag. 2: 199, t. 27. 1836; Choisy,

Guttif. Ind. 39. 1851. *Garcinia gutta* Wight, Illustr. 1: 126. t. 44. 1840, excl. syn. *Guttiaefera vera* Koenig in mss.

Small to medium-sized trees, 10-17 m high. Girth 84 mm at 1.5 m from base. Bark ochraceous or brownish-grey. Wood yellow, hard, mottled. Exudate yellow. Leaves 10-15 × 4-8 cm, elliptic, ovate or obovate, thickly coriaceous, obtuse to shortly obtuse-acuminate, base acute, margin entire or subrepand; midrib prominent below, lateral veins slender, 8-12, obliquely parallel, arcuate, anastomosing below the margin.

Male Flowers: small, few (about 3), white or creamy, in axillary leafy fascicles, sessile or shortly pedicellate. Sepals 4, orbicular, concave, outer pair smaller than the inner. Petals 4, rotundate, larger than the sepals. Stamens numerous, in a central subglobose mass; anthers peltate, adnate, plurilocular, dehiscence circumscissile; filaments short, obconic. Pistillode absent. **Female Flowers:** larger than the male, solitary axillary, sessile or shortly pedicellate. Stamnodes about 12, connate at the base. Ovary glabrous, subglobose, 4-locular; stigma large, sessile, broadly 4-lobed, tuberculate, persistent, coronate, margin dentate. Berry 20-30 mm broad, subglobose, smooth, 4-seeded. (Plate III, 30).

Type: *Hermann*, Ceylon (BM).

Flowers: Nov.-May. **Fruits:** Jan.-Dec.

Herbarium specimens examined: PENINSULAR INDIA: Maddermone, North Kanara, *W. A. Talbot* 376, April 1883 (CAL, POONA); North Kanara, *W. A. Talbot* s.n., Jan. 1896 (DD); Gairsoppah, N. Kanara dist., *W. A. Talbot* s.n., Nov. 30, 1884 (POONA), *W. A. Talbot* 3714, May 15, 1896 (POONA); Sonda, N. Kanara dist., *W. A. Talbot* 3632 (POONA); Falls of Gairsoppah, N. Kanara dist., *W. A. Talbot* s.n., Nov. 1900 (POONA), *W. A. Talbot* 2662, Jan. 2. 1892 (POONA); North Kanara, *T. R. Bell* 5985, May 1929 (BLAT); Jog Falls, North Kanara, *Santapau* 18567, May 18, 1954 (BLAT); Tinai Ghat, North Kanara, *Sedgwick* 3341, Dec. 1917 (BLAT); Devimane Ghat, North Kanara, *Hallberg & McCann* 34648, Oct. 1919 (BLAT); Sampkhand, North Kanara, *Sedgwick & Bell* 6087, Oct. 1919 (BLAT); Siddhapur to Jog, North Kanara, *Hallberg & McCann* 35079, Oct. 1919 (BLAT); Jog, Dharwar, *R. P. Patil* 627, May 18, 1954 (DD); Yellapur, Bombay, *N. L. Bor* 9555, April 1939 (DD); Siddapur Range, East Kanara division, Bombay, Herb. Reg. No. 115919 (DD); Matsani-Basantbail, Region east of Goa boundary, *J. Fernandes* 1856 (BLAT, CAL); Devala, South Kanara, *Weddermann* s.n. (MH); Attapadi hills, South Malabar, *C. E. C. Fischer* 2365, Oct. 28, 1910 (CAL); Chenathnari, South Malabar, *C. E. C. Fischer* 4570, Dec. 11, 1920 (CAL); Iyerpadi, Coimbatore Dist., *C. A. Barber* 3831, Oct. 20, 1910 (CAL, MH); Kannikatti, Tinnevely Dist., *D. Hooper & M. S. Ramaswami*

39433, Feb. 21, 1913 (CAL), March 19, 1917 (MH 2959), K. C. Jacob s.n., Sept. 22, 1931 (MH); Colatooorpolay, Travancore, Bourdillon 734, Jan. 23, 1896 (DD); Coorg, no. 5, Nov. 5, 1920 (DD); Udumanparai, Annamalais, C. A. Barber 5750, May 3, 1903 (MH); Wynaad, Brumagherries (MH 2951); Bolampatty hills (MH 2947); Cinnamon Grove to Moinca, Annamalais, C. A. Barber 3874, Oct. 28, 1901 (MH). ASSAM: Tura, Garo hills, C. B. Clarke 43109, Feb. 14, 1886 (CAL); Chennat Valley, K. & J. hills, G. Gallatly 252 (CAL); Khasia, J. D. Hooker & T. Thomson s.n. (CAL); Duphla hills, J. L. Lister s.n. (CAL); Rami dam bang, Abor, I. H. Burkill 37498, Jan. 16, 1912 (CAL); Pasighat, Abor, I. H. Burkill 36754, March 5, 1912 (CAL); Bhuban hill, Cachar, U. N. Kanjilal 4797, Dec. 2, 1914 (CAL). EAST BENGAL: without exact locality, Griffith, Kew distrib. no. 847 (CAL, DD). CEYLON: Botanic Garden, Peradeniya, no. 17424, Oct. 18, 1916 (DD).

Distribution: Moist forests of the plains up to 610 m and in Western Ghats from North Kanara southwards to Travancore up to an alt. of 915 m. Ceylon, Assam, Malacca, Singapore and eastwards to Thailand.

Vernacular names: Hindi, Beng., Mar.: *Tamal*; Ass.: *Kuji-thekera*; Mal.: *Chigiri, Daramba, Karukkampuli, Pinnarpuli*; Kan.: *Hardala, Devanabuli, Jarize, Arsina gurgi*; Tam.: *Makki, Solaipuli*; Tel.: *Pasupuvarne, Revalchinmi*; Eng.: *Mysore gamboge tree, Indian gamboge tree*.

Uses: A beautiful pigment exudes from the tree. This is the indigenous source of gamboge but no effort appears to have been made to collect it on a commercial scale. The one sold in India is mostly imported from Thailand from *G. hanburyi* Hook. f. Indian gamboge is identical in composition with the Siamese gamboge and is used in place of the latter. It is esteemed as a pigment and used in preparation of water colours and golden-coloured spirit varnishes for metals and for dyeing silken fabrics. A golden-yellow ink is prepared from it for writing on black paper. The gamboge is used as a hydragogue and drastic cathartic, anthelmintic, in constipation and in anasarca and other dropsical affections. The pigments, morellin and guttiferin, extracted from several parts of the plant, possess antibacterial properties. The rind of fruit is used in tanning. The oil or 'butter' from the seeds is used in cooking and confectionery, as a substitute for ghee, in candle making and in medicine. The wood is used for cabinet work and temporary structures.

G. pictoria Roxb. [Hort. Beng. 42. 1814, nom. nud. et] Fl. Ind. 2: 627. 1832; Wight, Icon. t. 102. 1839; Choisy, Guttif. Ind. 37; Planchon & Triana, loc. cit. 355; Drury, Ind. Fl. 1: 141. 1864; Bedd. Fl. Sylv. tt. 86-87; Pierre, loc. cit. 32. t. 85 B; Vesque, loc. cit. 476; Gamble, Man. Ind. Timb.

55. 1902; Brandis, Ind. Trees 53; Sealy in Kew Bull. 1956: 341. 1956. *Hebradendron pictorium* Graham in Hook. Comp. Bot. Mag. 2: 195. t. 199. 1836.

Medium-sized trees, up to 18 m high. Branchlets tetragonous, thick, polished. Bark dark ferruginous intermixed with many yellow specks. Leaves 10-13 cm × 32-54 mm, oblong or elliptic-lanceolate, entire, apex somewhat broad and obtuse acuminate, base acute otherwise petiole decurrent; lateral nerves about 20, prominent on both sides, rarely with short interposed alternate nerves; petiole 5 mm long.

Male Flowers: sessile, aggregated in the axils of fallen leaves. Sepals 4, orbicular, 3 × 5 mm, concave, coriaceous, outer shorter than inner. Petals 4, larger and thicker than sepals. Stamens about 24, closely packed on a fleshy ± 4-sided receptacle in the centre of the flower; filaments short; anthers depressed, peltate, circumscissile. Rudimentary ovary absent. **Female Flowers:** solitary, sessile or shortly pedicellate, yellow. Sepals and petals as in the males. Staminodes confluent at base in a ring, disposed in 6 to 7-androus distinct fascicles. Ovary oblong, 4-locular, with one ovule in each attached to the axis a little above its middle; stigma sessile, 4-lobed, 4-furrowed, coronate, stigmatic lobes 11-13, glandular, rotundate, obtuse. Seeds 4, oblong-reniform. (Plate III, 31).

Type locality: Wynaad, Western Ghats (ex Roxburgh).

Flowers: February. **Fruits:** May-June.

Distribution: Common in the forests of Western Ghats from Malabar to Wynaad, Nilgiris and Mysore, ascending to 1067 m; Mergui.

Vernacular names: Tam.: *Mukki*.

Uses: An excellent pigment exudes from the tree and is quite equal to that of *G. morella* Desr. The timber is used locally for various purposes. The oil from the seeds is used locally as a lamp oil and a substitute for ghee.

Notes: The species is closely allied to *G. morella* Desr., and scarcely distinguishable except by the female flowers.

G. acuminata Planchon & Triana in Ann. Sci. nat. sér. 4, 14: 355. 1860; Pierre, loc. cit. 34, non Cheval. (1920). *G. elliptica* Wall. [Cat. 4869. 1831, nom. nud.]; Pierre, Fl. For. Coch-Chine 33. t. 86 B. 1883; Vesque, loc. cit. 478; Brandis, Ind. Trees 53; Engler in Nat. Pfam. (ed. 2) 21: 226. 1925; Craib, Fl. Siam. Enum. 1: 114. 1931; Gagnepain, Fl. Gén. Indo-Chine Suppl. 3: 265. 1943, non Choisy (1824) nec Kurz (1877). *Stalagmitis elliptica* G. Don, Gen. Syst. 1: 621. 1831. *Hebradendron ellipticum* Grah. in Hook. Comp. Bot. 2: 200. 1836. *Garcinia wallichiana* Klotzsch ex Planchon & Triana in Ann. Sci. nat. sér. 4, 14: 356. 1860.

Trees. Branches roundish, young ones quadrato-compressed, yellowish-brown. Leaves 11-14 × 3-5.5 cm, lanceolate or elliptic-oblong, acutely acuminate to cuspidate, base acute, margin repand, chartaceous, mature ones pale greenish-yellow; midrib conspicuous, prominent below, laterals slender, 10-20, slightly arcuate, obliquely parallel; petiole slender, about 1 cm long, furrowed above.

Male Flowers : solitary axillary or fasciculate, subsessile; buds globose. Sepals 4, orbiculate, outer pair much smaller than inner. Petals 4, imbricate or contorted. Stamens few (16), inserted on top of a short androphore, imbricate; filaments short, confluent in a ring. **Female Flowers** : almost sessile. Stigma small, verrucose. Berry globose or slightly elongate, seated on the persistent sepals and crowned by the stigma. (Plate III, 32).

Type : Wallich 4869, Sylhet, East Pakistan (K-W).

Flowers : Dec.-Feb. **Fruits** : Feb.-June.

Herbarium specimens examined : ASSAM : Mahadeo, K. & J. hills, S. R. Sharma 8961, Jan. 15, 1931 (ASSAM); Bhulukpung, Darrang Dist., U. N. Kanjilal 562 M, April 24, 1914 (ASSAM); Barak Res., Cachar Dist., U. N. Kanjilal 4745, Nov. 24, 1914 (ASSAM, DD); Bhubhan hill, Cachar Dist., U. N. Kanjilal 4797, Dec. 2, 1914 (ASSAM, DD); Jeypur Res., Lakhimpur Dist., U. N. Kanjilal 6975 a, Jan. 28, 1915 (ASSAM); Tippum, Lakhimpur Dist., U. N. Kanjilal 3401, Feb. 14, 1914 (ASSAM); Nangaghat, Lakhimpur Dist., U. N. Kanjilal 6975, Feb. 2, 1915 (ASSAM); Tura Forest, Garo hills, R. N. De 20505, March 26, 1941 (ASSAM). EAST PAKISTAN : Singla Res., Sylhet Dist., U. N. Kanjilal 4911, Dec. 22, 1914 (ASSAM, DD).

Distribution : Assam in districts of Khasia, Cachar, Lakhimpur, Garo hills, etc. at 610-1220 m, Sylhet, Bengal and Thailand.

Vernacular names : Kuki : *Korbomba*; Lushai : *Thoikoy*; Sylh. : *Sundar Kau*.

Uses : The gum resin is useful as a dye and medicine, but its use is not known in Assam. The seed yields a fatty oil which can be used for illuminating purposes and as a substitute for ghee.

G. wightii T. Anderson in Hook. f. Fl. Brit. Ind. 1 : 265. 1874; Pierre, loc. cit. 33. t. 86 A. 1883; Vesque, loc. cit. 473; Gamble, Man. Ind. Timb. 55. 1902 et Fl. Madras 74. 1915; Brandis, Ind. Trees 52. 1907; Rama Rao, Fl. Pl. Trav. 30. 1914; Engler in Nat. Pfam. (ed. 2) 21 : 226. 1925.

Trees. Branchlets tetragonous. Wood white, hard. Leaves 9-14 × 2-2.5 cm, linear-lanceolate, obtuse acuminate, base acute, decurrent in the petiole, coriaceous; lateral nerves 16-20, parallel, arcuate, prominent on both sides, apex anastomosing in submarginal nerve; petiole short.

Male Flowers : small, sessile, axillary or often 2-3, sometimes numerous. Sepals 4, equal, orbicu-

lar, concave, coriaceous. Petals 4, obovate, concave, 4.5-5 × 3.5 mm. Stamens about 20, often 12-15, united in a tetragonal column and enclosing a tetragonal stylodium; anthers peltate, dehiscence oblique; filaments free above. **Female Flowers** : solitary, axillary, sessile. Berry subglobose, 11-12 × 9-11 mm; stigma sessile, 4-lobed, coronate. Seeds 9.5 × 4.5 mm (Plate III, 33).

Type : Wight 145, Southern India (K).

Flowers : Nov.-Feb. **Fruits** : Feb.-March.

Herbarium specimens examined : PENINSULAR INDIA : By the banks of Maliatuv River, Travancore, Bourdillon 58 b, March 1889 (MH); Udumanparai, Annamalais, C. A. Barber 4085, Nov. 22, 1901 (MH); Mundukayam, Travancore, A. Meebold 12839, Dec. 1910 (CAL, DD); Banks of the Periyar river, Travancore, Bourdillon 1575, Dec. 10, 1895 (DD).

Distribution : Endemic in the forests of southern India; usually found near water-courses and not uncommon in the moist forests at a lower elevation.

Vernacular names : Mal. : *Attukaruka*, *Pulimara*.

Uses : The gamboge of this species is very soluble and yields a good pigment.

G. calycina Kurz in Jour. Bot. 13 : 324. 1875; Pierre, loc. cit. 33. t. 87 D; King in J. Asiat. Soc. Beng. 59 : 160. 1890; Vesque, loc. cit. 478; Gamble, Man. Ind. Timb. 55. 1902; Engler in Nat. Pfam. (ed. 2) 21 : 226. 1925.

Shrubs, upto 4.6 m. high. Young branches slender, tetragonous, pale brown when dry. Leaves 9-13 × 3-5 cm, elliptic-oblong to elliptic, abruptly and shortly caudate-acuminate or subacute, base cuneate, thinly coriaceous, upper surface shining, lower rather dull and pale; lateral nerves 8-10 pairs forming bold intramarginal arches, intermediate nerves very numerous, all slightly prominent beneath; petiole 8-12 mm long.

Male Flowers : about 4 mm in diam., axillary, solitary or in 2 to 3-flowered fascicles; buds globose; pedicels 4 mm long. Sepals and petals each 4, equal, orbicular, concave, the petals veined. Stamens under 20, in a single convex group; filaments short, uniseriate, not in fascicles; anthers elongate, plurilocular, bent like a horse-shoe over the apex of the connective and dehiscing along the convexity; loculi confluent. Rudimentary stigma absent. **Female Flowers** : larger than the male, subsessile, solitary, axillary. Sepals broadly ovate, outer pair larger than the inner. Staminodes about 12, distinct, short, square. Ovary hidden by the large, hemispheric, lacunose, deeply 4-lobed stigma. Berry (immature) ovoid-oblong, smooth, 4-locular, the sepals persistent at its base and the apex crowned by the sessile stigma.

Type locality : Kamorta Islands.

Distribution : Andaman, Nicobar and Kamorta Islands.

SPECIES DUBIAE

G. cadelliana King in J. Asiat. Soc. Beng. 59 : 154. 1890. Syn. *G. lanessanii* Pierre var. β *cadelliana* Vesque in DC. Mon. Phan. 8 : 359. 1893.

This species is at present imperfectly known and its female flowers and fruits so far are not known. Dr. King's collector, namely Kunstler collected the type material (*King's collector* 371) near Port Blair, Hill's rocky place, Andamans and thought it to be related to *G. hombroniana*. On the other hand, Vesque (loc. cit.) considered it to be a variety of *G. lanessanii* Pierre, based on available morphological and anatomical evidences.

G. jelinekii Kurz ex King in J. Asiat. Soc. Beng. 59 : 172. 1890. Vesque, loc. cit. 487.

A specimen with leaves like a *Garcinia* and detached fruit of a true *Garcinia* (Jelinek 106, Exped. Novara 169, Nicobar Island) collected by Dr. Jelinek has been thus named in the Calcutta Herbarium. The material is too imperfect to be dealt with (ex Herb. Mus. Palat. Vindob. no. 169).

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