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

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ABSTRACT

The paper deals with the taxonomic treatment of the genus Garcinia Linn. (including Xantochymus 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. lourieroides T. Anders., has been discovered in Assam. A new variety of G. chinonarpa Thwaites, namely var. malabarica 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.

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 88 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 Forestiere 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 (1839), Wright (1839, 1845), Planchon and Triana (1863, 1866), Lanessan (1873), 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 imports from other parts of the world. 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, Papuasia, 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 (1635-1732), who lived in India and collected plants in the eighteenth century. Although the Liinean 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 variabili-
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., Hebradenon R. Gra., 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. 190. 1805) to erect the genus Xanthochymus Roxb. However, Kaul (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 number of generic taxa like Mangostarza Gaertn., Brindonia Dupetit-Thou., etc. Similarly, the quinary arrangement of the floral parts in some species in contrast to the general binary arrangement induced Roxburgh (Ed. 2) to erect the genus Xanthochymus Roxb. However, Kaul (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 number 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, number and condition of anther thecae, mode of dehiscence, polyandry or synandry, synandrial lobes, filaments, rudimentary gynaeicum, etc. Earlier, Vesque (1893) recognized 3 subgenera (Eugarcinia Vesque, Rheediiopsis Vesque, and Xanthochymus T. Anders.) and 9 sections under Garcinia. In a subdivision of the family Gutserae, Engler (1925) has placed Garcinia under subfamily-Clusioidae; tribe Garcinieae, to which besides Garcinia belong Allanblackia Oliv., Tsimatima Jun. & Perr., Rheedia Linn., Ovataria Matsumura, Tetralathalus Ltvch., 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.


Coddampuli Adans. Fam. 2: 445. 1763.
Bialalidia Scoop. Introd. 232. 1777.
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sepal, 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, hi-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 indescent berry; rind curiosous; pulp juicy, whitish, enclosing several large seeds. Seed appressedly covered with pulp which may be mistaken for the aril, *infruct* or *coated*. Embryo a solid homogeneous mass (tigelus); 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, Malayasia 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 evergreen 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 up to 1830 m. In the forest the *Garcinia* appear as symmetrical, medium-sized, straight-stemmed trees with horizontal branches. Like the Durians, they produce their new leaves in flushes at intervals (Holttum, 1924). 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 Ming (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 *Garcinia* 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. Parthenocarpy, i.e. production of seedless fruits is also known in mangosteen (Gustafson, 1943). 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 ‘Pulp’**: In the tribe *Garciniaceae* an aril or pulp surrounds the seed. This has been named by Planck and Triana (1860) as an “Arillodium”. 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 pulp 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 pulp is detached from the pericarp and is pressed to the seeds. This view has also been advocated by Planck and Triana (1860), and has in recent times been established by enough anatomical investigations of Cordemoy (1911). It has been shown in *Rheedea 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 pulp 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 and gross characters, but an examination of the leaves 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 and 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 bisericiate 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 so characteristic of its 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 yellow-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**

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Q. Staminial bundles or lobes opposite sepals:

R. Rudimentary pistil in the male flower 8-lobed ...
R. Rudimentary pistil in the male flower not lobed:
S. Leaves 30-40 x 11 cm, oblong, obtuse to emarginate
S. Leaves 4-18 x 5-10 cm, ovate-elliptic, obtuse to shortly acuminate ...

Q. Staminial bundles or lobes opposite petals:
T. Flowers about 5 cm in diam., on rather long peduncles ...
T. Flowers about 2.5 cm in diam. ...
U. Leaves 20-25 x 8-10 cm, elliptic, acuminate ...
U. Leaves 12-15 x 4.5-7 cm, elliptic or ovate-oblong, short and obtuse-acuminate ...

C. Anthers bilocular, dehiscence by 2 vertical clefs; rudimentary pistil frequently absent; ovary 3- to plurilocular; stigma frequently lobed or radiate, rough or glandular:
V. Male flowers in terminal pedicles; female in terminal spikes ...
V. Male and female flowers solitary or in axillary and terminal fascicles:
W. Male flowers solitary to ternary:
X. Stigma minute, dot-like, smooth ...
X. Stigma tubercled or tuberculately wrinkled:
Y. Male flowers solitary or geminate, sessile ...
Y. Male flowers usually 3, pedicellate ...
W. Male flowers several, in terminal and axillary fascicles:
Z. Berry echinate ...
Z. Berry smooth:
AB. Ovary 4 to 7-locular; stamens numerous, inserted on a hemispheric-subquadrate torus ...
AB. Ovary 8 to 11-locular; stamens 12-20 or more, inserted on prominent receptacle ...

C. Anthers bilocular, thecae parallel or subparallel, dehiscence by 4 clefs; rudimentary pistil in male flowers minute or absent; ovary plurilocular; stigma lobed or radiate, rarely entire, glandular; berry often succulent:
BC. Male flowers in distinct pedunculate umbels; petals pale yellow; berry umbonate ...
BC. Male flowers in fascicles of 3-8; petals yellow flushed pink or red; berry non-umbonate ...

G. Anthers mono- or plurilocular, dehiscence transverse, circumscissile or by 2 clefs; rudimentary pistil in male flowers absent; ovary tetraxile, rarely 6-locular:
CD. Stamens in male flowers above 20:
DE. Stamens in female flowers about 12, connate in a ring ...
DE. Stamens in female flowers about 24, in 6 to 7-androus fascicles

CD. Stamens in male flowers below 20:
EF. Stigma small, verrucose; leaves lanceolate or elliptic-oblong, acuminate to cuspidate ...
EF. Stigma large, connate:
FG. Leaves linear to linear-oblong, thick, obtusely acuminate
FG. Leaves elliptic-oblong to elliptic, thinly coriaceous, abruptly and shortly caudate acuminate to subacute ...

16. G. hembronianum
17. G. cornea
18. G. affinis
19. G. speciosa
20. G. kurtii
21. G. kingii
22. G. paniculata
23. G. microstigma
24. G. lanosaefolia
25. G. lantanaea
26. G. schinoscarba
27. G. indica
28. G. cambogia
29. G. kydia
30. G. cowa
31. G. morpelta
32. G. pioria
33. G. acuminata
34. G. wightii
35. G. calitina

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, Shibpur near Calcutta.
DD—Herbarium of the Forest Research Institute and Colleges, Dehra Dun.
MII—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).

Trees, 6-12 m high. Young branches 4 to 6-gonous, pubescent, dry ones at the angles almost narrowly winged. Leaves 14-25 x 9-14 cm, ovate or oblong-ovate, often inequilateral, obscure, 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.

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

Var. andamanica

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


Herbarium specimens examined: ANDAMAN ISLANDS: without exact locality, Helfer 872; King's collector 224; Fruit's collector s.n. (CAL); Aberdeen, S. Kurz s.n. (CAL); Hobdaypur and Tusonabad, King s.n., July 12, 1890; Hill jungle, Hobdaypur, King s.n., April 25, 1891 (CAL, DD); Jarawa Khari Hill jungle, King's collector s.n., April 7, 1894; Bom-mungta, 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.: Madam-mu.


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).


Herbarium specimens examined: ANDAMAN ISLANDS: Port Blair. Hill's rocky place, King's collector 136 (CAL); Hill jungle, Port Monat, King's collector 1277 (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. 6: 6, 1883) expressed doubt as to the identity of the Andaman and Moluccas plants, but he adopts Kurz's name for the latter.

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Stalagmitis cambogioides


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 x 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-speikes. 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. Staminal tubes 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-spike.

Type: Wight 138, Peninsular India (CAL).

Flowers: Hot season. Fruits: Cold season.


Distribution: Evergreen rain forests of Western Ghats from Konkan southwards to Kerala at low elevations and on the eastern coast from Ganjampattu southwards to Pudukottah; Ceylon. Cultivated in the Indian Botanic Garden, Calcutta (Herb. Pierre 3380).

Vernacular names: Mal.: Manjanang; Mar.: Hindly; Tam.: Kokkatt; Tel.: Pidatha; Khasi: DAGOONG WANG.

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 Fukiji, used as a mordant dyestuff in Japan.

Var. gloriosa Vesque in DC. Mon. Phan. 8: 311. 1893.

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

Type: ex Macdonnell (Ceylon): cult. in Indian Botanic Garden, Calcutta.

Flowers: March. Fruits: July - Aug.


Distribution: India, Ceylon.


This species is closely allied to G. spicata Hook. f. and is mainly distinguished by its leaves oblong; 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).


Herbarium specimens examined: PENINSULAR INDIA: Caireoppah Chat, North Kanara, W. A. Talbot 2603 (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 (DL); Bhirmashankar, Poona district, W. A. Talbot 5014 (POONA); Castle Rock, Bombay, R. K. Bhide s.n., April 16, 1909 (POONA); Shrigaoon, Bombay, J. A. Vastavada 17031, April 21, 1927 (POONA); Katlikan, N. T. Bor 11463, May 1939 (DD); Khandala, G. A. Gamit 16153, March 21, 1903 (POONA); Khandala, Santapau 62.7, 62.8, 62.9, 62.12, 3331 & 3332 (BLAT); Meroli Plateau, Khandala, Santapau 3360 & 4210 (BLAT); St. Xavier’s Villa to Elphinston slopes, Khalsa, Santapau 866, Jan. 26, 1939 (BLAT); below Elphinston Plateau, Khandala, Santapau 10985, Dec. 20, 1949 (BLAT); Elphinston slopes, Khandala, Santapau 23053, Jan. 26, 1939 (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 Rivate, Khandala, Santapau 1747, 3251, 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 2004, Feb. 26, 1920 (BLAT); nelliampatty Ghat, Anamallays (MH); Kulathurpuza, Travancore, T. F. Bourdillon 1524, April 27, 1904 (DD); Choura hill, Bhirmashankar, coll. no. 76581, April 6, 1962 (POONA); Rai Jungle, Bhirmashankar-Khed isula, coll. no. 76692 (POONA).

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

**Vernacular names:** Kan.: Holdi, Ont.: Mar.: Parsara; Bomb.: Limbott.


Medium-sized or tall, beautiful trees. Trunk straight; branches drooping, angular, glabrous, often dilated just below the axes 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, subre- pand, coriaceous, dark green, shining; midrib prominent below, lateral ribs 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 on the axes 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, convex, fleshy, unequal, spex ciliate. Petals 5, about 8 mm long, alternating with sepals, orbicular, spreading, incurved, greenish. Stamens in 5 broad bundles of 3–5 each, antepetalous, alternating with 5 fleshy glands; anthers bilocular. **Female Flowers:** like the males. Stamina less few, corianate. Ovary ovoid, acuminate, usually 5-locular; stigmatic rays 5, oblong, spreading, cuture. 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 159* (CAL); *Coorg, Wight s.n.* (MH), S. H. Howard C (CAL); *Mercara, Coorg, H. Fireman 32, June 24, 1919 (DD); *Mysore, ex Herb. Brandis* (DD); *Mahendragiri, Gajjam dist., J. S. Gamble 14692 (CAL, MH), *Fischer & Gage 9* (CAL) and V. Narayanswami 56377, Aug. 16, 1931 (MH); *Azerpar, Coimbatore dist., C. A. Barber 3841 (CAL); *Vathangi, Godavari dist., MH 12677, Feb. 5, 1916; Malabar, Konkan, etc., Stocks, Law, etc. (CAL); *Paralaal, Annamalai, C. A. Barber 3963, Nov. 6, 1901 (MH); *Iyerpar, Annamalai Hills, 1530 m, Fischer 3587, April 25, 1917 (DD); *North Kanara, W. A. Talbot 424, April 1883 (CAL); near Karwar, North Kanara, T. R. Ball 35695, April 1928 (BLAT); *Sirsi-Siddapur, North Kanara, Hallberg & McCann 34784, Oct. 1919 (BLAT); *Yellapur, Sahrahalli Khan, North Kanara. Santapau 18741, May 26, 1944 (BLAT);
Yellapur, Sahusrahalli, Dharwar, A. R. Bragansa 732, Nov. 17, 1930 (DD); Yellapur Range, Kanara, June 1935 (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. Dulcet (DD); Victoria Gardens, Bombay, no. 13815, Jan. 1917 (BLAT), R. R. Fernandez 2391, 3232, 3234 & 3236 (BLAT); Malabar Hill, Bombay, no. 13817, 1917 (BLAT); College Garden, Poona, L. D. Garade 377, June 9, 1902 (BLAT, POONA); Khandala, no. 19275, March 1899 (BLAT); Meroli Plateau, Khandala, Saniaju & McCann 1892, April 20, 1943 (BLAT). EASTERN HIMALAYAS: Munnpoo, Sikkim, Prain's collector s.n., (CAL); LOWER Assam, G. K. Waith & Newby 1884, March 31, 1911 (ASSAM); SOUTH Lushai hills, between Luichong and Demagiri, A. T. Gage 203 (CAL); Khasia, J. D. Hooker & T. Thomson s.n. (CAL); Deogarh, no. 115 (CAL); Assam, Downes s.n. (CAL); Lower Assam, G. Light 399 (DD, BENGAL); Chittagong, W. Schlich 8, Feb. 9, 1875 (DD); Chittagong, J. D. Hooker & T. Thomson s.n. (CAL); Kodaика Hill, 48 km from Chittagong, Badal Khan 421, Feb. 1880 (CAL); Burmah, Chittagong Hill Tracts, J. L. Lister s.n., March 30, 1976 (CAL); Indian Botanic Garden, Calcutta, M. B. Raisada s.n., March 3003 (DD). ORISSA: Cuttack, cultivated, H. H. Haines s.n., April 1919 (DD); Puri Division, in dense forest, H. H. Haines 4098, 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. Hennig 73, Aug. 1866 (CAL); Andamans, Prain's collector 7 (CAL); Guitar Island, Andamans, Kirat Rom 3689, Feb. 1924 (DD); Great Nicobar, K. C. Sathg 2917, March 1932 (DD).

**Distribution:** Considered to be a native of India and Burma; widely distributed in the lower hill forests of the 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:** Hindi: Dampel, Tamol; Ass.: Tepor, TepoLenga; Beng.: Chalata, Tamal; Guj.: Karamala, Ota; Kan.: Devagarie, Ganangi, Deukai, Janjai; Kon.: Dhamamb; Mal.: Anavaya; Mar.: Jhumari, Ota; Oriya: Cheo, Sitambu, Chiuri; Tam.: Kulavi, Malaiappachal, Mukki, Tamolam; Tel.: Ivarumidi, Tamalam; Garo: Aruwak; Khasi: Deingsoh-ryun-sam, Dieng-soh-khyllung; Mikir: Thesampreng; Sylh.: Debal.

**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 mango-steen.

**Notes:** This species is known in some floral under the name of Xanthochymus tinctorius Roxb. published in DC. (Prod. 1: 362, 1844), but it is obvious from the citation given by De Candolle that X. tinctorius was a misprint for X. pictoria Roxb. (Pl. Corom. 2: 51, t. 196, 1805 et F1. Ind. 2: 633, 1832, non Garcia pictoria Roxb.), a fact also recognized by Wight and Walker-Arnott (Prod. Fl. Penins. Ind. Or. 102, 1834). This being the case, Garcia xanthochymus Hook. f. is the correct name for the species under Garcia; G. pictoria being already preoccupied. G. tinctorius 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. 1913 et Kew Bull. 1916: 64, 1919), therefore, cannot be considered as a new combination of X. tinctorius.


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 abruptly 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, tiliellately veined, almost closed. Staminial 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 coronae. 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.


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.


Trees. Branches robust, terete. Bark grey, rugose. Leaves often ternate, verticillate, 6-10 × 3.5-4.5 cm, obovate or elliptic, rotundate or shortly apiculate, base acute or cuneate. Chartaceous. margin entire or subcordate 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, laxy 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 sepal, 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, coronae. (Plate I, 5).

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

Flowers: March.


Distribution: Tropical Africa; introduced into India and Indouesia from Tropical East Africa and grown in botanical gardens (Herb. Pierre ft 1147).

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.


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, fucrate or laxy reticulate; petiole about 2 cm long, sulcate above; stipules small, triangular.

Male Flowers: cream-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 fimbiform; 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, marginal revolute. Seeds 22 × 8 mm, oblong, flattened, testa strongly nervet (Plate I, 6).

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


Herbarium specimens examined: E. HIMAYA: Sikkim. G. King 4933. Aug. 28. 1877 (CAL), S. Kurz s.n. (CAL), Dungby 4943. Oct. 2, 1877 (CAL), J. D. Hooker 17 (CAL); Simenborg
to Richy, Sikkim, T. Anderson 792, Sept. 30, 1862 (CAL); Leloung, Sikkim, T. Anderson 789 (CAL); Kalimpong, J. S. Gamble 2750, Dec. 9, 1879 (CAL, DD); Mungpoo, 1066 m., C. A. Gammie s.n., Aug. 24, 1884 (POONA), no. 1018, April 12, 1909 (CAL); Darjeeling, J. S. Gamble 8670, 9760, Aug. 18(1), DD); Pomong, Darjeeling, C. B. Clarke 8803, Aug. 23, 1809 (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. Burkhill 38198, March 3, 1912 (CAL); South slope of Bulap, Abor, I. H. Burkhill 36917, March 7, 1912 (CAL); Near the Dibong, Abor, I. H. Burkhill 36124, Jan. 19, 1912 (CAL); Watershed of Egav and Serpo, Abor, I. H. Burkhill 36209 (CAL); Piri Mountain, Abor Hills, 3260 m., N. L. Bor 2461A, Nov. 1934 (DD); Foruputa, Duphala Hills, J. L. Lister 187, Jan. 19, 1875 (CAL); Kolab, Naga Hills, Cachar, J. C. Fraser 27, May 14, 1880. N.E.F.A.: Aka Hills to Sisin Camp, Sela subagency, Kameng F.D., G. K. Deka 27, Nov. 13, 1951 (ASSAM); Boha Hill, Kameng F.D., G. Panigrah 15350, May 10, 1958 (ASSAM).


Uses: The fruits are eaten by Lepchas.


Small, erect, evergreen trees with subverticillate robust branches. Bark brown or grey, rough, thin; cut yellowish. Leaves 10-20 x 3.5-8 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 axis of upper leaves: yellowish; bracts two, foliar, about 8 mm long; pedicels short, stout, 2-bracteate at base, bracteoles about 2 mm long. Male Flowers: about 12 mm in diam., buds globose. Sepals 4, deciduous, concave, orbicular. Petals 4, yellowish-white, obliquely oblong, subulate, 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. Staminodes 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-ristrate, irregularly lobulate. Berry ellipsoid, pruiniform, about 42 x 35 mm, smooth, olivaceous, 1-seeded. Seeds 8 x 6 mm (Plate I, 7).

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

Flowers: Nov.; April-May. Fruits: Nov.-Feb. Herbarium specimens examined: E. Hima-LAYAS: Jaldahal, Chulm Valley, G. L. Searight 185, Dec. 1904 (CAL); Chamorchi, Chumbi, G. L. Searight 173. April 1905 (CAL, DD). ASSAM: South Jumahai, W. L. H. Weng 4, April 26, 1924 (CAL); Pynursla Gorge forest, S. R. Sharma 18230, Nov. 4, 1938 (ASSAM), R. K. De 1930, April 29, 1940 (ASSAM), K. Biswas 4051, Nov. 4, 1938 (CAL); Sohrarimi, Khasis, 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); Serram 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); Chemnabongei, G. Gallatly 334, June 1878 (CAL); Khasia, J. D. Hooker & T. Thomson 14 (CAL); Dumpec, 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); Jawal to Jorain, G. K. Deka 17183, Nov. 6, 1938 (ASSAM, DD); Maumai, P. C. Kanjilal 10111, May 18, 1932 (ASSAM); Jarain, Khasis, U. N. Kanjilal 2717, Oct. 17, 1913 (ASSAM, DD); Khazi hills, G. Mann 27 & 313 (DD); Khasis, 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. I. Bor 2718 (DD), EAST BENGAL: without exact locality. Herb. Griffith 848 (CAL, DD).

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

Vernacular names: Garo: Thechu; Khasia: Diengs Loung, So-sain-bi-shue; Manipur: Huing; Sint.: Diengsou-lang-sain.

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; porous medium to small, scanty, evenly distributed; medullary rays indistinct; annual rings not visible. Leaves opposite, 4-8 x 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. Stamnodes about 16 in a ring surrounding the ovary. Ovary bilocular; ovules solitary in each locule; stigma broad, sessile, convex. Berry about 2.5 x 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.

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


Small trees. 15-20 m high or shrub. Branches brachiate, subterete, tetragonous-compressed. Bark greyish-brown. Leaves 5-12 x 2.5-5 cm, lanceolate, elliptic or ovate with a long obtuse or notched tip, base acute, margin narrowly subepended, 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 5, deciduous, 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, dilated, bilocular, apex with introrse rim, shortly obliquely dehiscence; pollen 3-pored. Rudimentary pistil variable, often fimbriate. **Female Flowers**: solitary or in pairs. Pedicels 12-25 mm long. Stamnodes few, opposite petals, scale-like, margin obtuse-dentate. Ovary shallowly obconic, bilocular, 1-ovulèd; stigma thick, convex; ovule semianatropous; micropyle inferior. berry ellipsoid, 12 x 9 mm, fleshy; stigma disciform, 3-4 mm broad, sessile, coronate. Seed solitary, subreniform. (Plate I, 9).

**Type**: Griffith, Mangri (Herb. Griffith no. 57 K).

**Flowers**: December.


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


Medium-sized, graceful trees, 12-18 m high. Branches robust, terete, yellowish-grey when dry. Bark black. Leaves 12-25 x 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 x 9.5 mm, orbicular or transversely oblong, inner pair 16 x 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 theilscence longitudinal; filaments slender, nearly as long as the anthers, inserted in whorls on a thin annular fleshy receptacle. Rudimentary style cylindrical. **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, subcylindrical. 10-locular; stigma thick, fleshy, very convex, pilate, deep red, the edges undulate. Berry globular, 8-10 cm in diam., yellowish-green, base slightly 9-sulcate, crowned by the sessile, concave, tibbed stigma, with firm-textured outer rind and rather thin, translucent pulp surrounding the seeds. Edible. (Plate I, 10).

Type: Griffith, Kew distr. 862, Tahong, 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 dying of silk. A decoction of leaves and roots is used in the treatment of earaches. The sour fruit rind is used in curries.


Diocicious trees, about 20 m high. Bark spongy. Wood yellow. Leaves 12-40 x 5-14 cm, oblone 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 2.4-4.5 cm long.

Flowers: terminal, pedunculate, bracteate. Male Flowers: in terminal trichotomous, 8-12-flowered panicles, large, pale green; pedicels 6-17 cm long, stout, erect. Sepals 4, orbiculate, concave, fleshy, margin scarious, outer pair 9-10 x 12 mm, inner pair 9 x 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, bicocular, intorse. Rudimentary pistil a bluish glaucescent borne in the fleshy receptacle of the stamens. Female Flowers: solitary, terminal, larger than the male; pedicel articulate at base, thick, tetragonal, about 3 cm long. Staminodes 20-30, in 4 fascicles, connate below. Ovary globose; stigmatic rays 9-12, spreading; Berry 8 to 12-locular, large, weighing 0.9 kg each saffron-yellow, round, smooth, exceedingly acid. Seeds 8-10, large, reniform, aril succulent. (Plate II, 11).

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


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: Ron-thekera; Sylh.: Thakor; Khasi: Soh-lintran, Dieng-soh-danei; Lushai: Thaipomhien; Mik.: Ampri-arong; Miri & Abor: Tabing-asin.
Uses: It is one of the largest fruiting 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 succedaneous for lemons or limes, to put into various messes, where salt meat, etc. is employed.


Tall, slender trees. Branches obtusely 4angled, shining. Wood yellowish-brown; sapwood pale yellow, hard, heavy. Leaves 8-10 x 1.5-2.5 cm, linear-oblong to subspathulate, sometimes broader upwards, roundate or obtuse, base acute, margin revolute, coriaceous, dark green above, paler 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, de-cussate, 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. Pistilode columnar, with a circular peltate stigma. Female Flowers: solitary in the terminal axis; sepals and petals as in the male. Staminodes few (3), free; filaments complanate, linear, in 2 to 3 chotomous branches; another 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 x 15 mm, shining testa brown. (Plate II. 12).

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


Herbarium specimens examined: KERALA: Travancore hills, R. H. Beddome s.n. (MH); Tinnevelly hills, (MH 2992); Kalivayalpil, Tinnevelly, C. A. Barber 3051, June 1, 1901 (MH); Kalivayalpil to Hamilton's Bungalow, Travancore, C. A. Barber 3071, June 2, 1901 (MH); Travancore and Tinnevelly, (MH 2097); M. K. Vagal, Travancore, T. F. Bourdilllon 327, 328, Oct. 2, 1894 (CAL, MH).

Distribution: Mountain forests of Travancore and Tinnevelly 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.


Small trees. Dark grey-brown. Young branches tetragonous. Wood hard, yellow. Leaves 6.8 x 3.5-3.5 cm, broadly elliptic-lanceolate, acute or acuminate, base obtuse or acute, margin entire or narrowly subapand, subcoriaceous, upper surface shining, lower dull, pale, opaque; midrib prominent on both sides, nerves indistinct on either surface; petiole about 5 mm long.

Male Flowers: short, dense, minutely bractate, 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 stigmas large, hemispheric. Female Flowers: 4-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. Staminodes 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).


Type (G. \textit{Eugenioides}): \textit{Wallich} 4873, Penang (CAL).

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

Uses: The timber is used in house-building.

G. \textit{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,

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 15-15.6-12 cm. elliptic-oblong, acute or shortly acuminate, thickly coriaceous, at first purpurascant, shining on both surfaces; base acute, obtuse or rotundate; veins subhorizontal, numerous, intertwining with a double intramarginal nerve, rather prominent beneath when dry; petiole 2-2.5 cm long.

Male Flowers: about 4 cm in diameter, 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, rounded, concave. Petals 4, larger than the sepals, ovate, fleshy, yellowish-red within, greenish-red outside. Stamens numerous, inserted on 4 thick, regular, lacunar lobes below rudimentary pistil; filaments short; anthers ovate-oblong, recurved, deliquence longitudinal. Rudimentary pistil (disc) fleshy, red, as long as the stamens, apex conical.

**Hermaphrodite Flowers:** about 5 cm in diameter, solitary or in pairs at the apices of branchlets; pedicels 18-20 x 3-5 mm, stout, woody. Sepals 4, deciduous, outer shorter than inner, 20 x 20 mm, orbicular, concave, persistent. Petals 4, purpureous, larger than sepals, 25-30 x 25-30 mm, orbicular, 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 diameter, dark purplish-brown, smooth, surrounded by sepals at base, apex crowned by stigma; pericarp thick, spongy, abounding 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.


**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, Inda-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 1750 m, and near Courtallam in Timucelli 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, habituation, and in cultivation.

**Vernacular names:** Hind., Beng., Mar., Mal. & Tam.: Manguita, Mangustin; 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.

Trees with rather stout, 4-angular branches, yellowish when dry. Leaves 8.5-13 x 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 x 3-4 mm, inner ovate-oblong, 7 10 x 5 mm. Petals ovate-oblanceolate, 10 x 10 mm, concave, base thick, margin membranous. Stamens numerous; anthers broad-oblong, dehiscing vertically, inserted on a fleshy, slightly 4-lobed annulus; filaments united. Rudimentary pistil flat, 5-lobed, slightly protruding above the staminal mass. **Female Flowers**: solitary, terminal, with sepals and petals like the males. Staminodes 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 maillulate; pericarp rather thin, subcrustaceous; sepals persistent. Seeds about 6, oblong, 25 mm long, with soft juicy arillus. (Plate II, 19).

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

**Flowers**: Feb.


**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 Malay. 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, stout branches and 8-lobed stigma.


Lofty trees, 9-12 m high. Bark blackish. Wood heavy, very hard. Leaves 30-40 x 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, orbicular, concave. Petals shorter than sepals, orbicular or suboblong, concave, thick. Stamens in four phalanges free at apex, alternating the petals. Rudimentary pistil central. top globose. Berry 26 x 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, 10).

**Type locality**: Ambon Islands.

**Distribution**: Native of the East Indies in the high mountains of Ambon; 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.


Small trees, 6-10 m high. Branchlets robust, tetragonal-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 x 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 x 7-12 mm, all concae suborbicular or inner obovate. Petals somewhat longer than sepals, 13-15 x 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, bicellular. **Female Flowers**: solitary at the apex of branchlets or paired; pedicels about 5 mm long. Staminodes 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 PACIS-

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

**Vernacular names** : Garo : Thekahhaki; Khias : Dieng-soh-kwang-rir.

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


Evergreen trees, 12-18 m high. Trunk straight, erect, about 150 cm in girth. Bark thin, greyish-black. Young branches cinnamomeous, slightly teregentinous. 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 5-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 4, short, thick, diverging, ovate 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 the male. Ovary subglobose; stigma large, convex, margin 6 ± 8-lobed. Uripe 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 arborescent 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.


**Shrubs**. Young bark green. Leaves 20-25 x 8-10 cm, elliptic, acuminate, base obtuse or acute, margin entire or subcrenated, 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 tetragonal, 9-10x2-3 mm. Sepals orbicular, concave, recurved after anthesis, thick, many-nerved, outer ones 13-15,5 mm, inner 13-15 x 12 mm. Petals suborbicular, 15-18 x 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 recurved, 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, 1901.
S. Kurz s.n. (CAL, DD); Hope Town, King's collector s.n., Jan. 13, 1884 (CAL); East Coast, S. Andamans, R. L. Heing s.n., March 1889 (CAL).

NICOBAR ISLANDS: Katchall, Modsha Lapoo, S. Kurz s.n. (CAL); Hill's Rocky Place, Havell, 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 Veesee 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 x 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 aruncate, submarginal nerves elicited, 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 ovate-oblong, obtuse, 13-15 x 10-11 mm, indistinctly flabellately veined. Androecium below cupuliform rudimentary, staminal margin 4-lobed, lobes opposite petals, somewhat involuted at the apex; anthers oblong, numerous, apex recurved, theca parallel. Rudimentary stamen base columnar; stigma nearly smooth, somewhat convex.

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

**Distribution:** Andaman islands.


Boehmerioideae. 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 x 4-7 cm, opposite, decussate, oblong-lanceolate or oblate, 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, bractiate 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 cuculate; filaments short. **Female Flowers:** fewer in number, forming short terminal spicate racemes, similar to the males. Stamina absent. Ovary subglobose, pentagonal, pentacular; 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 Indiann Botanic Garden, Calcutta.

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

**Herbarium specimens examined:** NEPAL: without exact locality, Wallich s.n. (CAL). BENG.: Indian Botanic Garden cult (CAL)


**Distribution:** Foot-hills of Eastern Himalayas, Bhutan, Assam, Khasi and Jaintia hills, East Pakistan, ascending to 915 m; ordinarily cultivated.
Vernacular names: Assam: Sochop-tenga; Sylh.: Bubi cowa; Garo: Thisu; Khasi: Dieng-soh-jadu, Dieng-soh-longkor, Dieng-soh-longkydow; Lushai: Bombalheth; Tipp.: Bombs.

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


Shrubs, 1-2 m high. Young branches obscurely 4-angled. Bark dark coloured. Leaves 10-11 x 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 a to 3-flowered, axillary cymes, about 8 mm in diam., bracteolate; pedicels 6 mm long; buds globose. Sepals 4, 5.5 x 6 mm, outer pair ovate-acute, fleshy, keeled, longer than the inner obovate-orbicular, very concave pair. Petals 4, (in bud) 3 x 3 mm, obovate-orbicular, fleshy, concave, about the same size as the inner sepals. Stamens 20-35, inserted on a single convex receptacle; anthers bicolateral, 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; sepal persistent at the base. Seeds 2 or more. (Plate III, 20).

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


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.


Plate 111: Figs. 20-33. Fruits of Garcinia

20. G. microstigma 27. G. hydia
22. G. lanceaeifolia v. oxyphilia 29. G. cowa
23. G. ochinocarpa v. monticola 30. G. marila
24. G. indica 31. G. paniculata
25. G. cambogia v. concarpa 32. G. acuminata
26. G. cambogia v. popilla 33. G. nighiti


Evergreen, small trees. Bark rugose, black. Leaves 8-10 cm x 15-25 mm, narrowly lanceolate, cuspidate or acuminate, base attenuated, margin connate, subcoriaceous, dark green; lateral veins 7-9, distinct, 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, inrostrate.

**Female Flowers:** terminal or solitary axillary; pedicels equally long as the flowers, thick, based 2-bracteate. Sepals 4, ovate, carnose, margin membranous. Petals 4, much narrower, carnose. Staminodes in four bundles of 4-8 each, connate at the base in a ring, irregular, opposite the sepals; anthers ovate. Ovary glbose, contracted to the apex; stigmatic rays 6-10, irregularly or regularly 2-seriate tubercululate. Berry about 25 mm in diameter, orange-yellow, obovoid, not grooved, 6 to 8 seeds; stigma persistent, nearly sessile, coriaceous.

**Var. lanceofolia**

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 obovoid or turbinate, yellow, edulis. (Plate III, 24).

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

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

**Herbarium specimens examined:** ASSAM: Sibsagar. S. C. Pest 207 (CAL); Amgori, Sibsagar, Khasi hills, G. Mann s.n., Jan. 1888 (CAL); Gauri- sagar, Sibsagar Dist., U. N. Kanjilal 3556, March 6, 1914 (ASSAM); Raja Baree, Herb. G. Watt 11152, April 18, 1895 (CAL); Nungklau, Khasia; C. B. Clarke 44024 A, May 26, 1895 (CAL); Khasia, Kew distrib. no. 890 (CAL); Outer Tharism hills below Cheerrung, Schllich 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-thekera; Garo: Thiisuru; Kach.: Shushu-thaise; Khasi: Dieng- soh-fadu; Kuki: Kengrapel, Toiteng; Lushai: Pele; Mik.: Prangsu, Prangso-aron; Synt.: Digoswo-swi.

**Uses:** The leaves are subacid and reported to be eaten in Assam by Mikias 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 tubercululate. Flower-bearing branches 0.5-1.5 mm thick. (Plate III, 22).

**Type:** ex Herb. W. F. Hooker and Jemini, Assam (K, DD).

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

**Herbarium specimens examined:** ASSAM: without exact locality, Jenkins s.n. (DD); Sibsagar, S. Pest 83 (CAL); Amgori, Sibsagar, Khasia hills, G. Mann s.n., July 1862 (CAL); Bokajan Rca, 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); Chattuck, G. A. Garnnie 513, April 9, 1894 (CAL); Baldijan, Rangapahar, Naga hills dist., G. K. Deka 20091, May 2, 1946 (ASSAM); Nartiang. K. & J. hills dist., S. R. Sharma 1655, Nov. 27, 1937 (ASSAM); Khonsnong. K. & J. hills dist., U. N. Kanjilal 713 P, Feb. 5, 1915 (ASSAM); Jokai Res., Lakhipur Dist., U. N. Kanjilal 4865, 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 Lakhipur districts of Assam; cultivated in villages for the fruit.

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


Shrubs or small trees. Branches slender, decusate, horizontal, young ones reddish-purple. Old bark dark grey. Leaves 5-10×1.5-2 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 diameter. 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 sesal 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); Kingba, Naga hills, A. Meebold 7399, Dec. 1907 (CAL).

**Distribution:** Assam, Burma.


**Var. monticola** var. nov.
follis coriaceis, obovatis vel oblongis, retusis vel obtusi. Var. nova est planta monticola, indigena ad altit. 915 - 1830 m.

Typus, *Thuwates* 335, lectus in Provincia centrali Ceylonensi et positus in herbario calcuttense (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**: Thuwates 335. Central Province, Ceylon (CAL).

Trees, about 15 m high. Branchlets quadrature, compressed. Wood dark red, hard, heavy. Leaves 8 - 15 x 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, suboblong. Stamens 12 - 40, on a short tetragonal stalk; anthers bilocular, linear-oblong, laterally introrse, vertically dehiscent, subseссѐl; 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 x 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); Tinnevelly 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); Chinnumjie, 1666 m, Travancore. T. F. Bourdillon 953. April 8, 1898 (DD); Kannikatti, Tinnevelly Dist., D. Hooper & M. S. Ramaswami 39428, Feb., 21, 1913 (CAL), 8. nom., March 19, 1917 (MH 2931).

**Distribution**: Moist evergreen forests of southern Travancore, Tinnevelly 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 dropical affections and also as vermifuge.


Slender trees with drooping branches, up to 8 m high. Young branches suberete, irregularly striate, about 2.5 mm thick. Bark light brown, rather shining, very thin, smooth. Wood greyish-white, hard. Leaves 6.5 - 11 x 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 - 19), prominent on both sides; petiole 3 - 10 mm long. slender.

**Male Flowers**: small, 4 - 8 in axillary and terminal fascicles; pedicels 6 mm long. Sepals 4. yel-
lowish-orange to pinkish-orange, coriaceous, ovato-rotundate. Base narrow. outer ones 2-4.5 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 equaling stamens. Female Flowers: solitary, terminal; pedicels 3 mm long, thick. Sepals and petals in 2 unequal, 4, in a fruit.


Distribution: endemic to the tropical rain forests of Western Ghats from Konkan southwards in Mysore, Coorg, Wynnaad, and in Goa, Mahé, 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; Gujarati: Kakan; Kannada: Murgala; Malayalam: Amsol, Bhirand, Katamb; Kokam; Katamb; Ram; Tam: Malgoli; English: Wild mango, Red mango, Kokam butter tree, Mangosteen oil tree, Brindonina 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 blacksheets for melting iron. It is used in Konkan chity 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 spermacetin. The wood is well suited for paper pulp.


Small or medium-sized, erect, trees with drooping or horizontal branches. Bark grey, rugose. Wood grey, shining, hard, smooth. Leaves 7.15 x 2-6 cm, oblong, elliptic or lanceolate, acute to obtuse, long 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 fascicules; pedicels 7-15 mm long, thickened towards the tip, often reflexed. Sepals 4, coriaceous ovate or obovate. Staminodes 2-6, oblong 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. *Hermaproditic 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, corona 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 fascicules. Ovary 8 to 10-sulcate. Stigmatic rays 8-10, linear, cuneate, tuberculate. Berry pome-shaped, yellow or red, costa prominent, furrows narrow.

**Type**: Rheedee (Malabar).

**Flowers**: 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 386, March 5, 1890 (POONA); Kumpata, North Kanara dist., W. A. Talbot s.n., June 1, 1901 (POONA); Arball, 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, Dhawar, A. R. Brganza 410, March 15, 1950 (DD); Sile Valley, Madras, no. 388, Sept. 1938 (DD); Colatoorpolay, MH 10 (CAL); Tha Shola, Nilgiris Dist., J. S. Gamble 20711, May 1889 (CAL, POONA); Chiunar-Coimbatore-Travancore Frontier, C.E.C. Fischer 3431, May 14, 1912 (CAL); Coog, R. H. Beddome s.n., 1889 (MH); Annamalay, 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 up to an altitude of 1830 m; Ceylon. Cultivated in the botanic garden of Bogor (Herb. Pierre 4152) and Ceylon.

**Vernacular names**: Coog: Manthulli; Kan.: Upagi mara, Simai hunase; Mal.: Pinenga, Pinetu, Kodapuli, Kadumpuli; Mar.: Dharmambe; Tam.: Penampilu, Kodakkapuli; Tel.: Simachina; Trav.: Gorukkanpuli; Kodokapuli.

**Uses**: The 'gummi-gutt' of gamboge is used medicinally as a purgative, hydraulic and emetic, particularly in dropsy 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 ridn which is used in Travancore-Cochin and Malabar as a condiment for flavouring curries in place of tamarind or lime. The dried ridn 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.


Stamens (in male flowers) numerous, funiform; 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 rips.

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

**Herbarium specimens examined**: CEYLON: Henaragoda 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.


Stamens about 35, inserted on a short convex torus; filaments short. Rudimentary pistil absent. Berry ovoid or conical, 4-grooved along the top, funnus angular. Leaves broader than the middle or linear-oblong. (Plate III, 27.)
**Type**: ex Herb. Wight, 142, Shevagerry hills (CAL).

**Fruit**: October.

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

**Distribution**: Kanara, Hohenacker 552.


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

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

**Herbarium specimens examined**: PENINSULAR INDIA: Sisparah Ghat, Nilgiris, (MH 2973); Lambourgh Shola, 1525 m, Nilgiris dist, Madras, J. S. Gamble 11230, April 1883 (DD); Hill Grove Estate, 1325 m, Nilgiris dist, Madras, J. S. Gamble 11906, Jan. 1883 (DD); Sengaleri, Tinnevelly 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); Nilgirs, Herb. Wight 143 (CAL).

**Distribution**: Nilgiris, Wight, Hohenacker 152, Perrosel 152.


*Diococious 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, 6-15 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; pedicels 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, blunted. Anthers numerous, square, bilocular, inserted into the slightly 4-lobed fleshy mass of conjoint filaments. Rudimentary pistil absent. **Female Flowers**: solitary axillary and terminal, sessile. Sepals and petals as in the male. Stamens 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, acid juice. (Plate III, 26).

**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); Bamboo Filleet, Port Blair, Andamans, King’s collector 150, March 5, 1884 (CAL); Andamans, Prain’s collector 43, April 20, 1901 (CAL); Bon-Jung-Ja Creek, Andamans, C. E. Parkinson 915, Feb. 4, 1916 (CAL); S. Andamans, R. L. Hems 734, Dec. 1896 (DD); Mr. Harriett, Andamans, C. E. Parkinson 823, Jan. 2, 1916 (DD); Wilson Island, Andamans, Kirat Ram 3745, Feb.-March 1934 (DD); BENCAL: Indian Botanic Garden, Calcutta, cult., M.B. Raizada s.n., Feb. 1954 (DD), I. K. Maheshwari 4660, March 21, 1961 (CAL).

**Distribution**: Tropical forests of Assam, Burma and East Pakistan from Chittagong, Pegu and Manipur down to Tenasserim and Andaman Islands; uncommon in South Andamans, Wimmerleygunj 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-shekera; Cach.: Hau; Caro: Tekra, Dengadota; Kamrup: Chophopa; Khasi: Dzeng-soh-longkasa; Min & Abor: Tarabasing.

**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. corva Roxb. and T. Anderson (in Fl. Brit. Ind. 1: 262, 1873) has united the two under G. corva 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:

G. kydia Roxb.
1. Branchlets more or less round.
2. Male flowers ca 20 mm in diam., in distinct pedunculate umbels.
3. Female flowers solitary terminal.
4. Petals pale yellow.
5. Berry with vertical grooves only near the apex and with curious nipping from depressed apex.

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. corva 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. corva turn orange-ochre. The leaves of the two species seem identical. He, therefore, thinks it better to make G. kydia a variety of G. corva. It seems that introgressive hybridization may take place in areas where both the species occur.


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 x 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 rows. Stamens in 4 clusters of 3-8, unequal. Berry gloular, 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 (Herr. Maritius, BR).


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); Tengali Bam Jungle, Naga hills, Prain's collector 1000/0, May 1899 (CAL); Angaur, no. 11174, April 22, 1895 (CAL); 35 km. Dalu Road, Goro hills. U. N. Kanjilal 5276, March 12, 1915 (CAL, DD); Shibagar, Jorbh, C. B. Clarke 38037 B, April 30, 1885 (CAL); Shibagar, S. E. Peal s.n., 1894 (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); Tumpidar, Cachar Dist., R. N. De 19256, April 4, 1940 (ASSAM); Mokshaol Res., U. N. Kanjilal 5467, April 5, 1915 (ASSAM, DD); Andherijuli, Kamrup Dist., U. N. Kanjilal 5467, April 13, 1915 (ASSAM); Chhaygaon Res., Kamrup Dist., U. N. Kanjilal 5427, April 5, 1915 (ASSAM); Digboi, Lakshmipur, G. K. Deka 17002, June 16, 1936 (ASSAM); Jharia Forest, K. J. Hills, G. K. Deka 190, July 5, 1940 (ASSAM); Mahadeo, K. J. & Hills, Sri Ram 10081, May 15, 1932 (ASSAM); 65 km G. S. Road, K. & J. Hills, S. R. Sharma 13257, 13279 (ASSAM); Umteswar Forests, K. & J. Hills, S. R. Sharma 12307, July 7, 1935, S. R. Sharma 13436, June 22, 1936 (ASSAM); BENGAL: Rajabhatkawa, A. H. Khan s.n., March 1931 (DD); Rajabhatkawa, Buxa Du., 152 m, A. E. Osmaston s.n., March 24, 1931 (DD); Damiapur Range, Buxa Du., April 28, 1933 (DD); Rangampura, Tipperah Hill, P. M. Debborn 547, 568, Dec. 31, 1914 (CAL). Bardin near Feni, Tip.
perah plains. P. M. Debraymann 1198, March 16,
1920 (CAL); Indian Botanic Garden, Calcutta, S.
Kurz s.n., June 2, 1834 (CAL). BIHAR & ORISSA: 
Athamall State, near river, H. H. Haines 4711, Feb.
26, 1917 (CAL); Muljiharu, 305-365 m., Haiti-
dhara Block, Athamall State, Orissa, H. F. Mooney
16d8, May 7, 1947 (DD); Singbhum. West Duars,
bank of stream, H. H. Haines 156, May 1899 (CAL).
UTTAR PRADESH: New Forest, Dehra Dun, 
cult., M. B. Rasada s.n., May 1944 (DD). EAST 
PAKISTAN: Sylhet Jungles, A. Bellcitty s.n., Oct.
29, 1904 (CAL); Longail Res., Sylhet Dist., P. C.
Kanjilal 10123, March 28, 1932 (ASSAM), P. C. Kan-
jilal 10245, June 1, 1932 (ASSAM); Kodala hill, 48 
km from Chittagong, King’s collector (Badul Khan)
235, 372 (CAL); Burdull, Chittagong hill tracts, J. L.
Lister 331, March 3, 1876 (CAL); Chittagong hill 
tracts division, V. S. Rau 3638, Aug. 28, 1935 (DD).

Distribution: Frequent in evergreen and semi-
evergreen tropical forests of Andaman Islands, all 
districts of Assam upto 1015 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.: Kaut-thekera; Kauqag; Beng.: Gaw; Daff.: 
Blaching-changme; Garo: Tehra, Rengran; Mech.: 
Khatoki; Or.: Sambara; Sylh.: Kau; Eng.: Cowa 
fruit; Cowa mangoosteen.

Uses: The tree yields an inferior sort of gam-
boge. 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 feel-
ing in the mouth. The young leaves are cooked 
eated as a vegetable. The fruit is preserved in 
sun-dried slices in Assamese households for use 
in dyeing.

G. morella Desrous in Lamk. Encyc. 3: 
707. 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 
& Trinana, loc. cit. 350; Bedd. Fl. Sylv. t. 86. 1869;
f. loc. cit. 264, excl. syn.; Pierre, loc. cit. 22. 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 
Pres. 1: 93; Rama Rao, Fl. Pl. Trav. 29. 1914;
Engler in Nat. Plam. (ed. 3) 21. 226. 1925; Fl. 
Assam 1: 107. 1934; Wealth of India 4: 105-
106. Stalagmitis cambogioidei Murr. in Comm. 
1: 621. 1831; Mangifera morella Gaertn. Fruct. 
2: 106. t. 101. 1790. Garcinia cambogi-
oides Royle, Mat. Med. (ed. 3) 339. 1832. 
Hebradendron cambogioideis Graham 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. Guttaefera 
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 x 4-8 cm, elliptic, 
ovate or obovate, thickly coriaceous, obnute to 
shortly obnute-acuminate, base acute, margin entire 
or subrempand; midrib prominent below, lateral veins 
slender, 8-12, obliquely parallel, arculate, anastom-
osing 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, plurilocu-
tate, dehiscence circumcissile; filaments short, obco-
nic. Pistillode absent. Female Flowers: larger 
than the male, solitary axillary, sessile or shortly 
pedicellate. Staminodes about 12, connate at the 
basis. Ovary glabrous, subglobose, 4-locular; stigma 
large, sessile, broadly 4-lobed, tuberculate, persist-
ent, coronate, margin dentate. Berry 20-30 mm 
broad, subglobose, smooth, 4-seeded. (Plate III, 
30).

Type: Hermann, Ceylon (BM).


Herbarium specimens examined: PENINSU-
LAR INDIA: Maddermore, North Kanara, 
W. A. Talbot 376, April 1893 (CAL, POONA); 
North Kanara, W. A. Talbot s.n., Jan. 1896 (DD); 
Gairsooppah, N. Kanara dist., W. A. Talbot s.n., 
Nov. 70, 1884 (POONA), W. A. Talbot 3714, May 
15, 1856 (POONA); Souda, N. Kanara dist., W. A. 
Talbot 3632 (POONA); Falls of Gairsooppah, N. Kan-
ara dist., W. A. Talbot s.n., Nov. 900 (POONA), 
W. A. Talbot 2662, Jan. 2. 1892 (POONA); North 
Kanara, T. R. Bell 5985, May 1299 (BLAT); Jog Falls, 
North Kanara, Santapeu 1867, May 18, 1954 (BLAT); 
Tinai Ghat, North Kanara, Sedgewick 3341, Dec. 
1917 (BLAT); Devimane Ghat, North Kanara, 
Hallberg & McCann 34648, Oct. 1919 (BLAT); 
Sampkhand, North Kanara, Sedgewick & Bell 5678, 
Oct. 1919 (BLAT); Siddhapur to Jog, North Kanara, 
Hallberg & McCann 38079, Oct. 1919 (BLAT); 
Jog, Dharwar, R. P. Patil 607, May 18, 1954 (DD); 
Yellapur, Bombay, N. L. Bor 9355, April 1939 (DD); 
Siddapur Range, East Kanara division, Bombay, 
Herb. Reg. No. 119519 (DD); Matsani-Basant-
ball, Region east of Goa boundary, J. Fernandes 
1856 (BLAT, CAL); Devala, South Kanara, Wed-
dermann s.n. (MH); Attapadi hills, South Malabar, 
C. E. C. Fischer 2365, Oct. 23, 1910 (CAL); 
Chenath-
11, 1920 (CAL); Iyerpad, Coimbatore Dist., C. A. 
Barber 3831, Oct. 20, 1910 (CAL, MH); Kannikatti, 
Tinnevelly Dist., D. Hooper & M. S. Ramaswami
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3943: Feb. 21, 1913 (CAL), March 19, 1917 (MH 2593), K. C. Jacob s.n., Sept. 22, 1931 (MH); Colatoparlay, Travanore, Bourdillon 734, Jan. 23, 1896 (DD); Coorg, no. 5, Nov. 5, 1920 (DD); Udumpanpar, Annamalai, C. A. Barber 5750, May 3, 1903 (MH); Wynnaid, Brumgherries (MH 9057); Beltampany hills (MT 2941), Cinnamoun Grove to Minna, Annamalai, C. A. Barber 3874, Oct. 28, 1901 (MH). ASSAM: Tura, Caro hills, C. B. Clarke 43100, Feb. 14, 1886 (CAL); Chennat Valley, K. & J. hills, G. Gallaty 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 36724, March 5, 1912 (CAL); Bhuban hill, Cachar, U. N. Kamijil 4797. D.D., 2, 1914 (CAL). EAST BENGAL: without exact locality, Griffilh, Kew distrib. no. 847 (CAL, DD). Ceylon: Botanic Garden, Peradeniya, no. 17444, Oct. 18, 1916 (DD).

Distribution: Most forests of the plains up to 610 m and in Western Ghats from North Kanara southwards to Travancore and up to an alt. of 1975 m. Ceylon, Assam, Malaca, Singapore and eastwards to Thailand.

Vernacular names: Hindi, Beng., Mar.: Tamal; Ass.: Kuji-bhukan; Mii.: Chigiri, Durambu, Karakumolu, Pinnarul; Kan.: Harada, Devanabuli, Jarise, Arsina gurgi; Tam.: Makkhi, Solipuli; Tel.: Pasuptuur, Revachilmin: 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 by C. 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 silk fabrics. A golden-yellow ink is prepared from it for writing on black paper. The gamboge is used as a hydrargogue and drastic cathartic, anthelmintic, in constipation and in anasarca and other dropsical affections. The pigments, morellin and gutturin, 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.


Medium-sized trees, up to 18 m high. Branchlets tetragonal, thick, polished. Bark dark ferruginous incrustated with many yellow specks. Leaves to 13 cm x 5-24 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, concaev, 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, circumsiccisile. Rudimentary ovary absent. Female Flowers: solitary, sessile or shortly pedicellate, yellow. Sepals and petals as in the males. Staminaconfluent at base in a ring, disposed in 6 to 7- androous 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-reiniform. (Plate III, 31).

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


Distribution: Common in the forests of Western Ghats from Malabar to Wynnaid, Nilgiris and Mysore, ascending to 1057 m; Mergui.

Vernacular names: Tamil: 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 as a substitute for ghee.

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

Trees. Branches roundish, young ones quadrato-compressed, yellowish-brown. Leaves 11 14 x 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 sepal and crowned by the stigma. (Plate III, 32).

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

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


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

**Vernacular names:** Kuki: Korbomba; Lushai: Thokey; Sylhet: 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.


Trees. Branchlets tetragonous. Wood white, hard. Leaves 9-13 x 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, orbiculate, concave, coriaceous. Petals 4, obovate, concave, 4.5-5 x 3.5 mm. Stamens about 20, often 12-15, united in a tetragonal column and enclosing a tetragonal stylum; anthers peltate, dehiscence oblique; filaments free above. **Female Flowers:** solitary, axillary, sessile. Berry subglobose, 11-12 x 9-11 mm; stigma sessile, 4-lobed, corona. 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 Malatiur River, Travancore, Bourdillon 58 b, March 1889 (MH); Udumanparai, Annamalais, C. A. Barber 4085, Nov. 22, 1901 (MH); Mundukayam, Travancore, A. Meebold 13839, Dec. 1910 (CAL, DD); Banks of the Periyar river, Travancore, Bourdillon 1757, 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.: Attukaru, Pulimanga.

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


Shrubs, upto 4.6 m high. Young branches slender, tetragonous, pale brown when dry. Leaves 9-13 x 3-5 cm, elliptic-oblong to elliptic, abruptly and shortly ciliate-acuminate or subacute, base cuneate, thin, 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 globular; pedicels 4 mm long. Sepals and petals each 4, equal, orbiculate, 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 sepal persistent at its base and the apex crowned by the sessile stigma.

**Type locality:** Kamorta Islands.

**Distribution:** Andaman, Nicobar and Kamorta Islands.
SPECIES DUBIAE


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


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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