

## A review of Mangosteen (*Garcinia mangostana*) Linn.

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Dweck Data

**Latin name:** *Garcinia mangostana*

**Family:** Guttiferae.

**Common names:** Mangosteen (the English derived from olden Malay, *manggusta* or *manggistanl*). In Portuguese it is called mangostao (Feijao) [Burkill]. Sinhalese: Mangus; Tamil: Sulambali; Hindi: Mangustan [Jayaweera]. *Manggis* (Sul.), *mangostan* (Tag.) [Quisumbing]. German: Maogostane; Hind & Ben: Mangustan; Bom., Guj., and Mah.: Mangostin, Mengut, Mangastin, Mangustan; Burm: Mengkop, Mengut. Mimbu, Young-zalai; Mal.: Mangusta; Malay: Mangusta; Kon.: Tavir; French: Mangostan [Dey; Nadkarnis & Nadkarnis]. Mangostan (Tagalog, Samar-Leyte Bisaya, Bikol, Hiligaynon, Cebu Bisaya, Manobo); Mangosta (Iloko); Kadiis; Kanabla (Cebu Bisaya); Manggis (Tausug, Sulu) Mangosteen (Chabakano). The fruit is often called the ‘Queen of Fruits’.

**Description:** The plant was an import from Indonesia [Abbiw]. It is a tree 7-8 m high with dense heavy profusely branched crown, known only from cultivation in SE Asia and subsequently taken by man to other parts of the tropics. A constantly humid climate is required.

The leaves are leathery. The timber is dark-brown, rather hard and heavy and the inner bark yellowish. The petioles are short and thick. The flowers are 5 centimeters in diameter, 4-parted, bisexual, and borne singly or in pairs at the ends of the branchlets. The seeds are large, flattened- and embedded in snowy-white or pinkish delicious pulp, which is botanically called the aril. Dried fruits are shipped from Singapore to Calcutta and to China for medicinal use.



*“The white delicate pulp which surrounds the seeds has been aptly likened by Sir E. Tennent to “perfumed snow”. The tree has been successfully grown and the fruit ripened at Courtallum, but it requires great care, and the fruit never acquires the size and flavour it has in its native country.— (Pers Obs )” [Drury].*

Captain Cook, in 1770, found it at Batavia and says *“it is about the size of a crab apple and of a deep red wine-colour, on the top of it are the figures of five or six small triangles found in a circle and at the bottom several hollow, green leaves, which are remains of the blossom. When they are to be eaten, the star, or rather flesh, must be taken off, under which are found six or seven*

white kernels placed in a circular order and the pulp with which these are enveloped is the fruit, than which nothing can be more delicious: it is a happy mixture of the tart and the sweet, which is no less wholesome than pleasant.” [Hedrick].

The fruit is the mangosteen, rated one of the most delectable of the tropics and pulp gives the fruit its reputation as one of the finest and most delicious of fruits. Good fruits may attain 6-7 cm in diameter and contain 5-7 seed surrounded by a white, sweet and succulent flesh [Burkill; Quisumbing]. The fruit is a rounded berry 5 to 7 centimeters in diameter, smooth, and dark purple. The rind is firm, spongy, thick, and full of yellow, resinous juice.



**Distribution:** Central Provinces, Peradeniya. Indigenous to Malaya and cultivated in the west coast of India and Ceylon. It is a common fruit tree in most village gardens in Ceylon, both in the mid and wet low-country [Jayaweera]. Mangostan is usually found planted in parts of Mindanao and in the Sulu Archipelago, and occasionally in other regions, ranging at least as far as Sorsogon. It was purposely introduced into the Philippines from Malaya [Quisumbing]. It is a native of the Straights, Settlements and Singapore.

Escape to British Burma, Malayan Peninsular (Malay Archipelago) and the Madras Presidency [Nadkarni and Nadkarni].

**Chemical composition:** Tannin is obtained from the bark [Abbiw]. The fruit shell contains 7-13% tannin and the seeds contain 3% oil [Burkill]. The rind of the fruit contains tannin, a resin and a bitter principle called mangostin (Fig. 1). The edible aril contains saccharose, dextrose and kerrellose [Jayaweera]. The rind contains 5.5 per cent of tannin, and a resin as well as a yellow crystalline bitter principle, mangostin ( $C_{20}H_{22}O_5$ ) or mangosim [Nadkarni & Nadkarni] isolated from the rind. It was reported that the flesh of the fruit (aril) contains saccharose 10.8%, dextrose 1%, and kerrellose 1.2%. The seeds are reported to contain vitamin C [Quisumbing]. From a methanolic extract of mangosteen leaves a new flavour compound, 2-ethyl-3-methylmaleimide N-beta-D-glucopyranoside was found [Krajewski *et al*]. The rind is rich in pectin.



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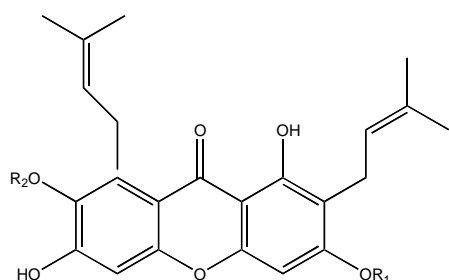


fig.1. Mangostin

Mangostin	$R_1 = H, R_2 = CH_3$
$\gamma$ -mangostin	$R_1 = H, R_2 = H$
$\beta$ -mangostin	$R_1 = H, R_2 = H$

A new xanthone with a geranyl group, named mangostinone, and 7 known xanthones ( $\alpha$ - $\beta$ - $\gamma$ -mangostins, gartanin, garcinone E, 1,5-dihydroxy-2-(3-methylbut-2-enyl)-3-methoxyxanthone and 1,7-dihydroxy-2-(3-methylbut-2-enyl)-3-methoxyxanthone), were isolated from pericarps of *G. mangostana* [Asai *et al*]. Twelve xanthones were isolated from the hexane extract of the heartwood of *Garcinia mangostana* from Myanmar [Nilar *et al*].

A new polyoxygenated xanthone, mangostanol, was isolated from fruit hulls of *G. mangostana*, along with known xanthones, alpha-mangostin, gamma-mangostin, gartanin, 8-deoxygartanin, 5,9-dihydroxy-2,2-dimethyl-8-methoxy-7-(3-methylbut-2-enyl)-2H,6H-pyrano[3,2-b]xanthen-6-one, garcinone E and 2-( $\gamma$ , $\gamma$ -dimethylallyl)-1,7-dihydroxy-3-methoxyxanthone and epicatechin [Chairungsrikerd *et al*]. Two novel xanthones also isolated from hulls of *Garcinia mangostana* [Gopalakrishnan and Balaganesan].

Three new xanthones, mangostenol (1), mangostenone A (2), and mangostenone B (3), were isolated from the green fruit hulls of *Garcinia mangostana*, along with the known xanthones, trapezifolixanthone, tovophyllin B (4), alpha- and beta-mangostins, garcinone B, mangostinone, mangostanol, and the flavonoid epicatechin [Suksamrarn *et al*; 2002].

Investigation of the constituents of *Garcinia mangostana* has led to the isolation of four new compounds: three minor xanthones, garcimangosone A, garcimangosone B, and garcimangosone C, and a benzophenone glucoside, garcimangosone D [Huang *et al*].

Mangostin is obtained by boiling the rind in water, and tannin is removed by exhausting by boiling in alcohol and evaporating ; resulting product is mangostin and resin; resin is precipitated by redissolving it in alcohol and water, and evaporating the water. It occurs in small yellow scales, tasteless neutral, insoluble in water, but readily soluble in alcohol and ether [Nadkarni & Nadkarni].

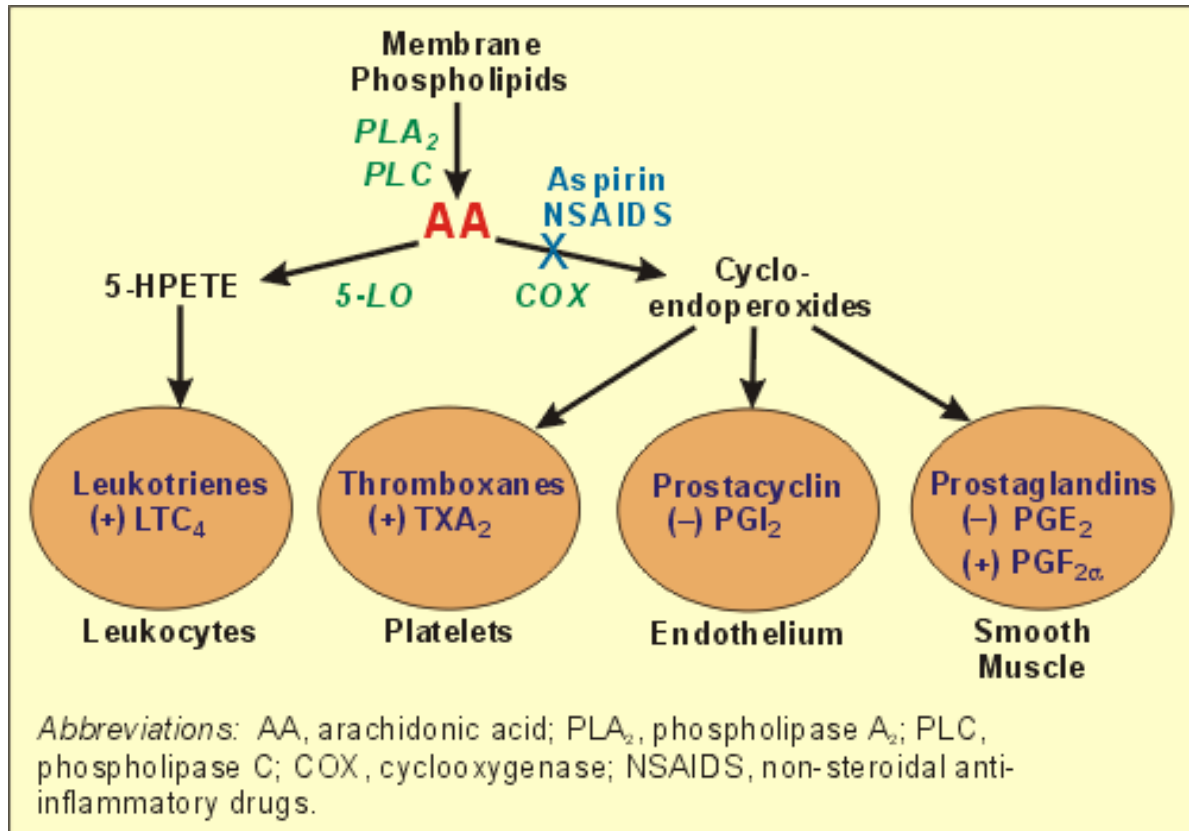
**Food use:** The round dark purple-brown fruit looks rather like a smooth small oddly coloured cricket ball. The juicy flesh of the Mangosteen is similar to that of a lychee [Bastyra and Canning]. Mangosteen is apple-shaped with dark leathery skin which ripens to a deep purple. Cooking kills the delicate flavour and texture. Low in vitamin C, eaten for flavour not vitamin content [Daily Mail]. The kernels can be ground to produce a vegetable butter [Burkill].

**Antifungal use:** The antifungal activity of several xanthones isolated from fruit hulls of *G. mangostana* (collected from Tamil Nadu, India) and some derivatives of mangostin against *Fusarium oxysporum* f.sp. *vasinfectum*, *Alternaria tenuis* [*A. alternata*] and *Drechslera oryzae* [*Cochliobolus miyabeanus*] was evaluated. The natural xanthones inhibited the growth of all the fungi. Substitution in the A and C rings modified the bioactivities of the compounds [Geetha *et al*; Gopalakrishnan *et al*].

**Antibacterial:** Extracts of *Garcinia mangostana* showed inhibitory effects against the growth of *Staph. aureus* NIHJ 209p and some of the components had activity against methicillin-resistant *Staphylococcus aureus* (MRSA). One active isolate,  $\alpha$ -mangostin, a xanthone derivative, had a minimum inhibitory concentration (MIC) of 1.57-12.5  $\mu$ g/ml. Other related xanthones were also examined to determine their anti-MRSA activity. The

strong *in-vitro* antibacterial activity of xanthone derivatives against both methicillin-resistant and methicillin-sensitive *S. aureus* suggested the compounds might find wide pharmaceutical use [Iinuma *et al*].

**Anti-inflammatory:** *G. mangostana* fruit hulls are used as an antiinflammatory agent [Chairungrilerd *et al*], astringent and to treat diarrhoea. The fruit hull of mangosteen, *Garcinia mangostana* has been used as a Thai indigenous medicine for many years. The 40%



ethanol extract of mangosteen has potent inhibitory activities of both histamine release and prostaglandin E2 synthesis [Nakatani *et al*].

**Antioxidant:** In the course of a search for natural antioxidants, the methanol extract of the fruit hulls of mangosteen (*Garcinia mangostana* L.) originating in Vietnam was found to exhibit a potent radical scavenging effect. By monitoring this radical scavenging effect, two xanthenes, alpha- and gamma-mangostins, were isolated, together with (-)-epicatechin and procyanidins A-2 and B-2, as active principles. The antioxidant activity of the two xanthenes was measured by the ferric thiocyanate method; gamma-mangostin was more active than butylhydroxyanisole and alpha-tocopherol [Yoshikawa]. A paper entitled “Antioxidant activities of some tropical fruits” [Guan, Tan Tze, Whiteman, Matthew] but source unknown also confirmed the benefits of Mangosteen as an antioxidant.

**Cosmetic uses:** The technical data and scientific studies confirm that this extract is an excellent choice for antibacterial, antifungal and anti-inflammatory effects on the skin. These are exactly the conditions encountered in acne-prone skin where soaps, creams and washes ideally suit the use of the extract.

Made into an ointment, it is applied on eczema and other skin disorders [Morton].

The traditional oral use also suggests the use of this plant in herbal toothpastes for good oral hygiene.

**Medical uses:** It is used to prepare astringent medicines for use in dysentery, enteritis, [Burkill]. The rind of the fruit, which contains resin, is used in diarrhoea and dysentery. The bark and young leaves are also used for the same purpose and for ailments of the genito-urinary tracts [Jayaweera]. In Cambodia, the bark and the rind of the fruit are used for diarrhoea and dysentery as astringents. The bark and young leaves are employed by the Macassars in diarrhoea, dysentery [Quisumbing]. The rind is also used as an astringent medicine for diarrhoea and dysentery. It has been found very useful in chronic diarrhoea in children. The value of the rind lies in the yellow resin which may act as a stimulant to the intestines.

A decoction of the powdered rind is used as an external astringent application [Quisumbing; Nadkarni and Nadkarni; Morton] as are the bark and young leaves.

The pericarp is regarded as very efficacious in curing chronic intestinal catarrh [Quisumbing] and the fleshy pericarp is a valuable astringent [Drury] and has been successfully employed in the advanced stages of dysentery and in chronic diarrhoea as well as for a strong decoction as an external astringent application in dysentery [Drury].

A decoction of the roots is drunk in dysmenorrhoea [Quisumbing].

It is used for affections of the genito-urinary tracts [Quisumbing].

It also has anti-tubercular action with  $\alpha$ - and  $\beta$ -mangostins and gartinone B which exhibited strong inhibitory effect against *Mycobacterium tuberculosis* with the minimum inhibitory concentration value of 6.25  $\mu\text{g/ml}$  [Suksamrarn].

Filipinos employ a decoction of the leaves and bark as a febrifuge and to treat thrush, diarrhoea, dysentery and urinary disorders. In Malaya, an infusion of the leaves, combined with unripe banana and a little benzoin is applied to the wound of circumcision. A root decoction is taken to regulate menstruation. A bark extract called "amibiasine", has been marketed for the treatment of amoebic dysentery [Morton].

The rind of partially ripe fruits yields a polyhydroxy-xanthone derivative termed mangostin, also  $\beta$ -mangostin. That of fully ripe fruits contains the xanthenes, gartinin, 8-disoxygartanin, and normangostin. A derivative of mangostin, mangostine- 6-di-*O*-glucoside, is a central nervous system depressant and causes a rise in blood pressure [Morton].

**Oral uses:** In Ghana it is said to be used for chew-sticks [Burkill] and also as a wash for aphthae of the mouth [Jayaweera]. The leaves and the bark are used as an astringent for aphthae and also as a febrifuge [Quisumbing].

It has been the subject of part of a patent application. "A composition in the form of a biodegradable gel, chip or ointment is provided, for *adjunct treatment of periodontitis, comprising: (i) an antimicrobial extract having antimicrobial or antibacterial activity against*

*periodontal pathogens, preferably from one or more of the plants Andrographis paniculata, mangosteen (Garcinia mangostana) and turmeric (Curcuma longa); and (ii) a gel base containing a mixture of glyceryl monooleate and triglyceride. The composition is biodegradable, and forms a liquid crystal structure on contacting gingival fluid, which liquid crystal structure releases active ingredients gradually, to provide a sustained release dosage form.” [U.S. Patent]*

**Other uses:** It can be used for tanning. In Malaya the shell is used to obtain a black dye [Burkill].

**Pharmacology:** It has been used for many years as a medicine for treatment of skin infection, wounds, and diarrhoea in Southeast Asia. The effect of  $\gamma$ -mangostin, a tetraoxygenated diprenylated xanthone contained in mangosteen was examined, on arachidonic acid (AA) cascade in C6 rat glioma cells. The study demonstrated that  $\gamma$ -mangostin, a xanthone derivative, directly inhibited COX activity.

### Doses

Preparations: (all of the rind): Extract, dose 3 to 10 grains; Tincture (1 in 10), dose: 1/2 to 1 drachm; Syrup (1 in 10), dose: 1/2 to 1 drachm; Decoction (1 in 10), dose: 4 ounces; Powder, dose: 10 to 60 grains and juice [Nadkarni and Nadkarni].

### Local Recipes

*Rind and pulp or entire dried fruit are employed as specific remedies in chronic diarrhoea and dysentery, usually in the form of a syrup, the drug being boiled in water, strained and the decoction evaporated to a suitable consistence and then sugar added. A decoction of the rind with a little cumin and coriander added is also useful in doses of 4 ounces twice a day with or without the addition of 5 to 10 minims of tincture of opium to each dose; sugar or syrup may also be added to it just to make it palatable. Mangosteen fruit may also be employed in powder given in doses of 10 to 15 grains in port wine, or made into a paste with a little sugar; in either form it may be unproved by the addition of aromatics, such as cardamom and cinnamon powder 5 to 10 grains to each dose. Fruit is regarded as a remedy in leucorrhoea, gonorrhoea and gleet and is stated to lessen both the irritation and the discharge of matter [confirmed Morton].*

*A compound powder consisting of Mangostin, cubebs, alum and gum acacia, each 10 grains, is a good sedative for gonorrhoea. For injection a strong astringent decoction 'is employed. Juice is used locally as a gargle in tonsillitis and as a lotion in prolapsus ani and vaginae.*

*Following compound powders are very useful remedies:*

*(1) Take of Mangosteen (the rind of the fruit) 5, Poppy seeds 4, Sugar 6, Pomegranate bark 5 and Rose petals 4 parts.; mix and make a powder; dose: 10 to 20 grains; useful in dysentery and chronic diarrhoea in children. (2) Take of Mangosteen 6, Coriander seeds 2, Chebulic myrobalans 2 & Indian sweet fennel seeds 2 parts; mix and make a powder: dose: 10 grains with sugar; useful in chronic dysentery [Nadkarni and Nadkarni].*

*“The rind or entire dried fruit are employed as remedies in chronic diarrhoea and dysentery,*

usually in the form of a syrup, the drug being boiled in water, and sugar added to the strained decoction, previously evaporated to a suitable volume. It may also be employed in powder given in port wine or made into a paste with a little sugar, and in either form may be improved by the addition of aromatics.” [Dey]

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