

## A review of Guava (*Psidium guajava*)

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### Introduction

In the next of our series on Far Eastern plant we look at Guava or *Psidium guajava*. In folk medicine, extracts of roots, bark, and leaves are used to treat gastroenteritis, vomiting, diarrhoea, dysentery, wounds, ulcers, toothache, coughs, sore throat, inflamed gums, and a number of other conditions (Morton 1987). This plant seemed worthy of an in depth review.



**Family:** Myrtaceae

**Common names:** Common guava, yellow guava, apple guava. Bayabas, kalimbahin, tayabas, guayabas. Bisayan: Bayabas (Tagalog); Bayabas, guayabas (Ilokano) [Ticzon]. It also has the common names according to the Philippine dialects shown here: Bayabas, guayabas, tayabas, kalimbahin (Tag.); bayabas (Ilk., Bis., Ibn.); bagabas (Ig.); biabas (Sul.); bayaya (Bik.); gaiyabat, gaiyabit (If.); gayabas (Bon.) [Hernandez]. In addition, more local and dialect Phillipine names are given as: Bagabas (Ig); bayabas (Ibn., Ilk., Tag., C. Bis.), bayaua (Bik.); bayabo (Ibn.); getabas (Bon.); guyabas (Ilk.) [Quisumbing]. In Malay the local names are: Jambu burung, Jambu padang, Jambu berasu, Jambu bereksa,

Jambu buyawas, Jambu melukut, Jambu Portugal, Jambu batu, Jambu pelawas, Jambu biji, Jambu biyawas [Zakaria]. In Africa the names are: gwaabaa (Hausa); woba (Efik); ugwoba (Igbo); guafa (Yoruba) [Iwu]. In Indian dialects: *Sans*: Perala; Amratafalam; Amruta-phalam. *Hind*: Lal sufrium (red); Amrut. *Ben*: Lal peyara (red); Goachi-phal; Peyara; Pyara; Piyra. *Bom*: Perala. *Tel*: Jama; Jam-pandu; Goya-pandu. *Tam*: Koyapalam; Koyya; Goyya-pazham (Segapu). *Mal*: Palamper. *Can*: Perala-hannu. Jama-phala; Shebe-hannu. *Kon*: Paera. *Sind*: Zetton; jamphal. *Mah*: Peru; Jamba. *Guj*: Jamrukh. *Assam*: Madhuria. *Nepal*: Amuk. *Arab & Pers*: Amrud. *Punj*: Amrut. *Burm*: Malakabeng [Nadkarni and Nadkarni]. Ghana: gua, aduaba; uguawa, uguaba, gouwa, aduaba. India: mansala, amrud, peyara, perala, koyya, goyya, lal-jam, sufed-jam, tambara peru, pandhara peru, shivappu-goyya-pazham, vellai-goyya-pazham, tella-jam-pandu, erra-jam-pandu, beli-shebi-hannu, kempu-dhibe-hannu, dhop-goachi-phal, lal-goachi-phal, lal-safri-am, sufed-safri-am [Ayensu]. *Beng.*- Piyara; *Hind.*-Am [Dey]

**Description:** It is a low evergreen tree or shrub 6 to 25 feet high, with wide-spreading branches and square, downy twigs, is a native of tropical America. It is a common vegetation cover by roads and in waste places in Hawaii. Guava is a tropical and semitropical plant. It is well known in the islands for its edible fruit. It is common in the backyards. The branches are crooked, bringing opposite leaves. The flowers are

white, incurved petals, 2 or 3 in the leaf axils, they are fragrant, with four to six petals and yellow anthers. The fruit is small, 3 to 6 cm long, pear-shaped, reddish-yellow when ripe.

## Chemical composition

### The fruit

The fruits also contain vitamin C [Hernandez] vitamin A, iron, calcium and phosphorus [Iwu, Burkill]. Guavas are up to 5 times richer in vitamin C than oranges [Conway]. Manganese is also present in the plant in combination with phosphoric, oxalic and malic acids [Nadkarni & Nadkarni]. The fruit contains saponin combined with oleanolic acid. Morin-3-O- $\alpha$ -L-lyxopyranoside and morin-3-O- $\alpha$ -L-arabopyranoside and flavonoids, guaijavarin (Fig.1) and quercetin (Fig.2) [Arima and Danno].

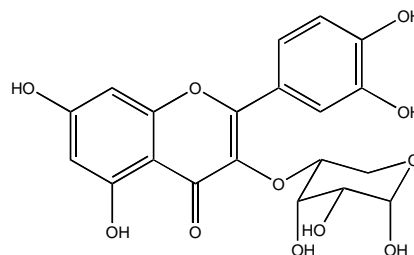
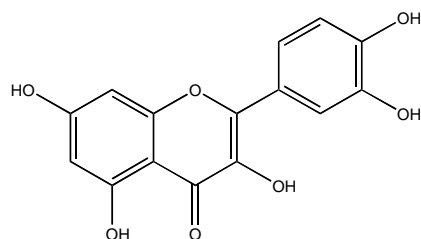


Fig.2. Guaijavarin

Fig.1. Quercetin



The essential oil and headspace of fresh white-flesh guava fruits. In the headspace, the major constituents were: hexanal (65.9%),  $\gamma$ -butyrolactone (7.6%), (E)-2-hexenal (7.4%), (E,E)-2,4-hexadienal (2.2%), (Z)-3-hexenal (2%), (Z)-2-hexenal (1%), (Z)-3-hexenyl acetate (1.3%) and phenol (1.6%), while  $\beta$ -caryophyllene (24.1%), nerolidol (17.3%),

3-phenylpropyl acetate (5.3%) and caryophyllene oxide (5.1%) were the major volatile constituents present in the hydrodistilled essential oil [Paniandy *et al*]. The occurrence of pentane-2-thiol was found in the fruits [Bassols and Demole].

In the pink fruit, the commercial essence was characterized to present a volatile profile rich in components with low molecular weight, especially alcohols, esters, and aldehydes, whereas in the fresh fruit puree terpenic hydrocarbons and 3-hydroxy-2-butanone were the most abundant components. New components were described for the first time as active aromatic constituents in pink guava fruit (3-penten-2-ol and 2-butenyl acetate). Principal differences between the aroma of the commercial guava essence and the fresh fruit puree could be related to acetic acid, 3-hydroxy-2-butanone, 3-methyl-1-butanol, 2,3-butanediol, 3-methylbutanoic acid, (Z)-3-hexen-1-ol, 6-methyl-5-hepten-2-one, limonene, octanol, ethyl octanoate, 3-phenylpropanol, cinnamyl alcohol,  $\alpha$ -copaene, and an unknown component. (E)-2-Hexenal seems to be more significant to the aroma of the commercial essence than of the fresh fruit puree.

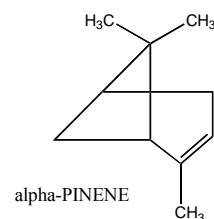
### The fruit skin

Ascorbic acid—mainly in the skin, secondly in the firm flesh, and little in the central pulp—varies from 56 to 600 mg. and may range to 350-450 mg in nearly ripe fruit. It can decline to 50- 100 mg. Canning or other heat processing destroys about 50% of the ascorbic acid. The strong odour of the fruit is attributed to carbonyl compounds.

### The leaves

The leaves contain essential oil with the main components being  $\alpha$ -pinene,  $\beta$ -pinene, limonene, menthol, terpenyl acetate, isopropyl alcohol, longicyclene, caryophyllene,  $\beta$ -bisabolene, caryophyllene oxide,  $\beta$ -copanene, farnesene, humulene, selinene, cardinene and curcumene [Zakaria]. The essential oil from the leaves has been shown to contain, nerolidiol,  $\beta$ -sitosterol, ursolic, crategolic, and guayavolic acids have also been identified [Iwu].

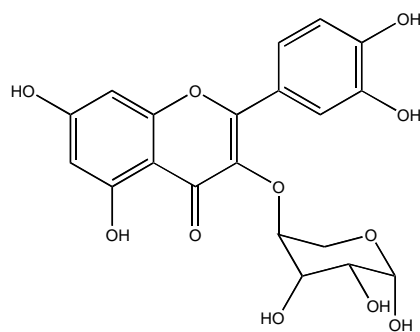
Fig.3. Pinene



The leaves contain fixed oil 6%, and volatile oil 0.365% [Burkill] 3.15% resin, 8.5% tannin, and a number of other fixed substances.

The essential oil contains eugenol [confirmed Nadkarni & Nadkarni], mallic acid and tannin from 8-15%. The fruit contains 'glykosen' 4.14% - 4.3%, saccharose 1.62% - 3.4%, protein 0.3%, etc.; and the ash yields 75% of CaCO<sub>3</sub>. Leaves contain resin, fat, cellulose, tannin, volatile oil, chlorophyll and mineral salts [Nadkarni and Nadkarni]. In addition, the leaves contain an essential oil rich in cineol, and four triterpenic acids as well as three flavonoids; quercetin, its 3-L-4-4-arabinofuranoside (Fig.4.) (avicularin) and its 3-L-4-pyranoside with strong antibacterial action [Oliver-Bever].

Fig.4. Avicularin



The constituents of essential oils from the leaves of *Psidium guajava* Linn were analyzed by GC-MS qualitatively and quantitatively. Sixty compounds of the essential oils were identified at rate 90.56%. The major components were caryophyllene (18.81%), copaene (11.80%), [1aR-(1a  $\alpha$ -, 4a  $\alpha$ -, 7  $\alpha$ -, 7a  $\beta$ -, 7b  $\alpha$ -)]-decahydro-1,1,7-trimethyl-4-methylene-1H-cycloprop[e] azulene(10.27%),

eucalyptol(7.36%) [Li *et al*]

Guajavolide (2  $\alpha$ -,3  $\beta$ -,6  $\beta$ -,23-tetrahydroxyurs-12-en-28,20  $\beta$ -olide; 1) and guavenoic acid (2  $\alpha$ -,3  $\beta$ -,6  $\beta$ -,23-tetrahydroxyurs-12,20(30)-dien-28-oic acid; 2) along with one known triterpene oleanolic acid (3) were isolated from the fresh leaves of *Psidium guajava* [Begum *et al*].

### The bark

The bark contains 12-30% of tannin and one source says it contains tannin 27.4%, or polyphenols [Burkill], resin and crystals of calcium oxalate [Nadkarni and Nadkarni].

### The roots

The roots are also rich in tannin [Quisumbing]. The plant also contains leukocyanidins, sterols, and gallic acid in the roots [Iwu]. There is a high percentage of carbohydrates and salts. Root, stem-bark and leaves contain a large percentage of tannic acid.

### ***The seeds***

The seeds which are very small but abundant in the fruit and have been reported to contain 14% oil on dry weight, with 15% proteins and 13% starch [Burkill]. Ten phenolic and flavonoid compounds including one new acylated flavonol glycoside were isolated. The structures of the new compound quercetin-3-O- $\beta$ -D-(2''-O-galloyl glucoside)-4'-O-vinylpropionate and of the known compounds were elucidated [Michael *et al*].

### ***The plant in general***

Also present amritoside [Conway] which is a glycoside (gentiobioside) of ellagic acid. Another biologically interesting compound in the plant is guajaverin, a glycoside (arabinopyroside) of quercetin. The leaves also contain essential oils and triterpenoids [Wyk *et al*].

### ***The twigs***

Twigs contain calcium (0.30-1.00%), magnesium (0.06-0.30%), phosphorous (0.10-0.38%), potassium (0.21-0.39%), and sodium (0.03-0.20%). The concentration of fluoride ranged from 0.02 to 0.11 ppm, copper (0.02-0.14 ppm), iron (2.86-5.14 ppm), zinc (0.31-0.57 ppm), manganese (0.00-0.26 ppm), and lead (0.00-0.11 ppm) [Okwu and Ekeke].

### **Medicinal use:**



**Action (various):** Stem, bark and root-bark are astringent. Unripe fruit is indigestible, causes vomiting and feverishness. Bark is astringent, febrifuge, antiseptic. Fruit is laxative, leaves are astringent [Nadkarni and Nadkarni]. Locally, decoction of the leaves is applied with much benefit to the *prolapsus ani* of children; [Nadkarni and Nadkarni].

Indians also employ it for sore throats, vomiting, stomach upsets and for vertigo [Raintree].

**Antibacterial activity:** The extract also showed *in vitro* antimicrobial activity against *Escherichia coli*, *Salmonella typhi*, *Staphylococcus aureus*, *Proteus mirabilis*, and *Shigella dysenteria* [Iwu]. Another paper showed the effectiveness of the leaf extract against *Staphylococcus aureus* [Gnan and Demello]. It was shown to be antibacterial in another study and in addition to *Staphylococcus aureus* was also useful against *Streptococcus* spp [Pranee]. The leaves are rich in tannin, and have antiseptic properties [Hernandez].

A strong antimicrobial action of guava leaves on Gram-positive and Gram-negative organisms has been reported (*Sarcina lutea* and *Staphylococcus aureus*) and also noted action on *Mycobacterium phlei*. The flavone derivatives isolated were reported to inhibit the growth of *Staph. aureus* in a dilution of 1:10,000 [Oliver-Bever].

The bark was also shown to exhibit antibacterial effects [Ali *et al*], it might well be that this activity could be attributed to the tannins present [Lutete *et al*]. The effectiveness of Guava as an antimicrobial was confirmed by [Abdelrahim *et al*]. Four antibacterial compounds were isolated from leaves of guava (*P. guajava*), two new flavonoid glycosides, morin-3-O- $\alpha$ -L-lyxopyranoside and morin-3-O- $\alpha$ -L-arabopyranoside, and two known flavonoids, guajavarin and quercetin [Arima and Danno].

*Psidium guajava* leaf and bark tincture was subjected to *in vitro* sensitivity tests by serial dilution at concentration ranging from 5% to 15% against six test dermatophytes viz. *Trichophyton tonsurans*, *T. rubrum*, *Trichosporon beigelii*, *Microsporum fulvum*, *M. gypseum* and *Candida albicans*. Bark tincture exhibited higher efficacy in controlling the mycelial growth of dermatophytes than the leaf tincture. The tincture showed fungicidal property in different concentrations but exhibited only fungistatic property in case of *C. albicans*. [Dutta *et al*]. Another paper showed good effect with the methanolic extract [Rabe and Staden].

A leaf extract enters into a Nigerian remedy for skin infections, and examination has shown a positive action on Gram-positive microbial organisms, but no action on Gram-negative organisms, nor any antifungal action. Three antibacterial substances have been detected in the leaves which are derivatives of quercetine. As in the bark polyphenols and many other substances are present [Burkill].

### **Anti-diarrhoeal**

A leaf infusion is taken in Ghana and Nigeria for stomach complaints e.g. constipation, and in Adamawa with "red" potash for dysentery; a decoction is taken in Senegal to combat diarrhoea and dysentery; the shoots and roots may also be used, while in neighbouring The Gambia the leaves are chewed for queezy tummy, a treatment that is said to work very well. A leaf infusion is drunk in Hawaii and Trinidad, and in Indonesia for medical purposes. [Burkill]. The ripe fruit is mildly laxative. The unripe fruit is astringent, anti-diarrhoeic, and has medicinal use [Burkill]. The ripe fruit is a good aperient, and should be eaten with the skin, for without it, costiveness results. The unripe fruit is said to indigestible, causing vomiting and feverishness, but it is sometimes employed for diarrhoea. [Conway].

In Peruvian herbal medicine systems today the plant is employed for diarrhoea, gastroenteritis, intestinal worms, gastric disorders and vomiting [Raintree].

The leaves of the guava tree in decoction are recommended for gastroenteritis, chronic diarrhoea, etc., the young leaves and shoots are used for dysentery and diarrhoea. [Ticzon].

The Tikuna Indians of South America decoct the leaves or bark of guava as a cure for diarrhoea. An infusion or decoction made from the leaves and/or bark has been used by many tribes for diarrhoea and dysentery throughout the Amazon [Raintree]. The roots are astringent and in India and Ghana are used for childhood diarrhoea (root bark); diarrhoea (roots with water); dysentery (roots with water) [Ayensu]. The bark and leaves are astringent, vulnerary, and when decocted can be used for diarrhoea.

A tisane of the bark (and of the leaves) is taken in Congo against diarrhoea [Burkill].

Internally the bark is used in the chronic diarrhoea of children and sometimes adults. The root bark has been recommended for chronic diarrhoea. In a decoction of half ounce in 6oz water, boiled down to 3 oz and given in teaspoonful doses; and also recommended as a local application in prolapsus and of children.

Guava leaves are commonly used in South Africa as a remedy for diarrhoea [Wyk *et al*].

Modern proof of the traditional use can be found in modern studies. The methanolic extract of *P. guajava* (leaves) showed significant inhibitory activities against the growths of 2 isolates of *Salmonella*, *Shigella* spp. (*Shigella flexneri*, *Shigella virchow* and *Shigella dysenteriae*) and 2 isolates of the enteropathogenic *Escherichia coli*. The results have confirmed the effectiveness of this Zulu medicinal plant as an antidiarrhoeal agent. [Lin *et al*]. Guava sprout extracts (*P. guajava*) by 50% diluted ethanol showed the most effective inhibition of *E. coli*, while those in 50% acetone were less effective. It is concluded that guava sprout extracts constitute a feasible treatment option for diarrhoea caused by *E. coli* or by *S. aureus*-produced toxins, due to their quick therapeutic action, easy availability in tropical countries and low cost. [Vieira *et al*]. A further paper proving the anti-diarrhoeal activity has been seen [Lutterodt] and since the extract was effective against *Staphylococcus aureus* (present in wounds) would also be an excellent treatment for infections. In a further paper the author suggested that the effect of guava might be caused by the inhibition of the increased watery secretions that occur commonly in all acute diarrhoeal diseases and cholera [Lutterodt; 1992]. The guava always seems to come out well in screening studies to further confirm its value in this area. [Tona *et al*; Lozoya *et al*]. It has been proposed that the quercetin present can inhibit the intestinal movement and reduce capillary permeability in the abdominal cavity and this may explain the antidiarrhoeal mechanism of *Psidium guajava* extract [Zhang *et al*].

In India and Ghana the green fruit and leaf decoction is considered astringent and used for diarrhoea and dysentery. The ripe fruit is considered laxative in India [Ayensu]. In Costa Rica, a decoction of the flower buds is considered an effective remedy for diarrhoea. [Ayensu]. In child cases, the treatment with guava has good curative effect on infantile rotaviral enteritis [Wei *et al*]. A weak infusion of the leaves and tender branches is dispensed for diarrhoea. In Malayan traditional medicine it is used to cure stomach ache and the remedy is to drink water boiled with the leaves and shoots. It also helps to stop purging or griping often associated with this condition [Zakaria].

**Anti-inflammatory effect:** The anti-inflammatory and analgesic activities of 70% ethanolic extract of *Psidium guajava* was investigated in rats using the carrageenin-induced hind paw oedema model. Extracts which exhibited antiinflammatory activity were screened for analgesic activity using the Randall-Selitto method in rats. The extracts were administered at a dose of 300 mg/kg, p.o. Aspirin (300 mg/kg, p.o.) was employed as the reference drug. *Psidium guajava* leaves, showed significant anti-inflammatory activity with percentage inhibitions of 58.27%. [Muruganandan *et al*]

The essential oil has also been proven to have anti-inflammatory effect. The essential oil, steam-distilled from leaves of *P. guajava* leaves, was given orally rats to study its effects on the exudative and proliferative phases of the inflammatory reaction (carrageenan-induced paw oedema and cotton pellet-induced granuloma models). The essential oil (0.8 mg/kg) significantly reduced oedema formation induced by carrageenan. The essential oil (0.4 and 0.8 mg/kg) significantly reduced granuloma formation induced by cotton pellets. [Kavimani *et al*]. Another paper confirmed the anti-inflammatory activity and also showed significant antipyretic activity and potent anti-arthritic activity in rats [Sen *et al*]. In Peru it is said to be good for oedema [Raintree].

Another modern study confirms many of the traditional uses. The methanol extract of guava leaves was found to inhibit paw oedema induced by carrageenan in rats, and pain induced by acetic acid in mice, and it exhibited an antipyretic effect in mice. The oral administration of the extract reduced intestinal transit time and prevented castor oil-induced diarrhoea in mice [Olajide *et al*]

**Antispasmodic:** This plant is among the aromatic antispasmodics; a decoction of the young leaves and shoots is prescribed in the West Indies for febrifuge and antispasmodic baths. In India and Ghana the stem and twigs are considered astringent (bark as well). In the West Indies it is used as a febrifuge, antispasmodic bath (decoction of shoots and young leaves) [Ayensu]. They are recommended for swollen legs. The young leaves and shoots are used for The leaves of the guava tree in decoction. It has been used for spasms, fevers, worms, diabetes [Ticzon].

**CNS activity:** The leaves of the guava tree in decoction is used for spasms, epilepsy and even for cerebral affections [Ticzon]. The cerebral aspects of the plant may be seen in the CNS depressant activity due to the presence of caryophyllene-oxide and  $\beta$ -selinene that has been seen for the plant [Meckes *et al*] extracts exhibited mostly dose-dependent antinociceptive effects in chemical and thermal tests of analgesia. The extracts also produced dose-dependent prolongation of pentobarbitone-induced sleeping time [Shaheen *et al*]. In India the leaf infusion is used for cerebral infections [Ayensu]. The tincture has been employed by rubbing it into the spine of children suffering from convulsions. It has also been used as a tonic in psychiatry [Zakaria]. A CNS-depressant activity was exhibited by the extract which potentiated the phenobarbitone sleeping time in mice. [Olajide *et al*]. An extract is used for epilepsy and chorea (any of several degenerative nervous disorders characterized by spasmodic movements of the body and limbs) [Quisumbing].

**Conjunctivitis:** Flowers are also used as a poultice for conjunctivitis [Ayensu]. This use is reflected by that in the Amazon, where the flowers are also mashed and applied to painful eye conditions such as sun strain, conjunctivitis or eye injuries [Raintree].

**Coughs:** Boiled with lemon grass (*Cymbopogon citratus*) to make a decoction that is drunk for coughs. A decoction is also taken in Senegal for tracheobronchitis [Burkill]. The leaves are also used for cough [Wyk *et al*] a use also followed in Peru [Raintree].

**Diabetes:** The leaves are also used for several other ailments including diabetes. The leaf infusions are used in the Cape for diabetes [Wyk *et al*]. Water in which the fruit is soaked is good for thirst in diabetes [Conway].

**Food uses:** The fruit is sweet and is eaten raw or cooked. It makes good jam and is universally known for its jelly [Burkill]. The fruit is rich in vitamin C, and is eaten raw, candied, or made into jellies and jams [Hernandez]. The fruits are edible and the juice is used as a refreshing drink [Iwu]. Eating the fruit may well have longer term cardioprotective effects as a result of the antioxidant and free radical protection the plant was proved to offer [Yamashiro *et al*]. The fruit is also a source of antioxidant dietary fibre [Jimenez-Escrig *et al*]. Guava powder containing 2,500-3,000 mg ascorbic acid was commonly added to military rations in World War II.

**Gout:** Fruits are recommended for gout. [Conway].

**Haemostatic:** Said to stem the flow of blood. [Ayensu]

**Kidney problems:** The young leaves and shoots are used for inflammation of the kidney and kidney problems [Ticzon]. In India the leaf decoction used for nephritis (an inflammation of the kidney) [Ayensu].

**Malaria:** The leaves are used as an ingredient in the preparation of fever "teas". They are also used as part of the pot herb used in steam treatment for malaria. Indeed, the main ethnotherapeutic use in Africa is said to be for malaria. *Psidium guajava* stem-bark extract contained anthraquinones, flavonoids, seccoirridoids and terpenoids and was found to be effective for the treatment and/or prophylaxis of malaria in KwaZulu-Natal province of South Africa. The *in vitro* antiplasmodial assay was carried out using a chloroquine-sensitive strain of malarial parasite [Nundkumar *et al*]

**Oral Care:** In the lagoon area of coastal Ivory Coast young twigs serve as chew-sticks [Burkill]. In southern Nigeria the twigs are used as chew sticks and the presence of bioactive compounds comprised of saponins, tannins, flavonoids, and alkaloids is responsible for their effectiveness. Chewing sticks when used without toothpaste are very efficient, effective, and reliable for cleaning teeth. The teeth of chewing sticks users are usually strong, clean, fresh, and devoid of dental plaques and carries [Okwu and Ekeke].

In South America: The tender leaves are chewed for bleeding gums and bad breath, and it is said to prevent hangovers (if chewed before drinking). Indians throughout the Amazon gargle a leaf decoction for mouth sores, bleeding gums. In Brazil guava is considered an astringent and diuretic and is used for the same conditions as in Peru. A decoction is also recommended as a gargle for sore throats, laryngitis and swelling of the mouth [Raintree Tropical Data Base].

Chewing sticks when used without toothpaste are very efficient, effective, and reliable in cleaning the teeth of many people in Southern Nigeria. The teeth of the users of chewing sticks are usually strong, clean, fresh, and devoid of dental plaques and carries. These results indicate the basis for the preventive and protection of the teeth against caries and plaques by the samples used.



In Ghana and in Nigeria the leaves are chewed to relieve toothache. [Burkill]. A decoction of the root-bark is recommended as a mouthwash for swollen gums and a decoction of the leaves makes an efficacious gargle for swollen gum and ulceration of the mouth [Nadkarni and Nadkarni] and also for bleeding gums [Conway].

It is used in the Amazon to regulate menstrual periods. or use it as a douche for vaginal discharge and to tighten and tone vaginal walls after childbirth. [Raintree]

**Parturient:** A combined decoction of leaves and bark is given to expel the placenta after childbirth.

**Pharmacological effects and studies:** The aqueous alcohol extract has been shown to exhibit sedative activity [Iwu].

Ellagic acid is a known intestinal astringent and haemostatic which explains the therapeutic value of the plant against diarrhoea and dysentery. The tannins are generally of value because of their vasoconstricting effects and their ability to form a protective layer on the skin and various mucosa. These effects, together with proven antibacterial and antifungal activity, result in effective treatment of both internal and external infections. Quercetin (and its glycosides) undoubtedly also contribute to the efficacy of the medicine, because it is a known antioxidant with anticarcinogenic, anti-HIV and antibiotic effects. Hypoglycaemic effects have been documented [Wyk *et al*].

**Rheumatism:** Pulped leaves are made up into a suppository in Congo for treating piles [Burkill]. The pounded leaves in India are used for rheumatism [Ayensu; Quisumbing]

**Skin use:** The benefits are many and the plant can provide astringency, wound healing and skin damage repair properties that follow from the ethnopharmaceutical traditions of the plant. The antimicrobial properties of the plant may also be of benefit in certain product applications.

In Mexico the leaves are said to be a remedy for itches. The leaves of the guava tree in decoction is used as a wash for ulcers and especially where an astringent remedy is needed [Ticzon].



In the Amazon, a decoction of the bark and/or leaves or a flower infusion is used topically for wounds, ulcers and skin sores [Raintree].

In addition the antioxidant activity will provide a caring environment for the skin. A method of detection for guava is described in the literature [Masuda *et al*]

The use of the flowers may be applicable in eye products for their soothing effect.

A solvent extraction of the *Psidium guajava* leaves had an antiallergic activity. The study was performed in single-blind challenge test of *Psidium guajava* cream in 46 atopic dermatitis patients. Improvement of clinical symptoms (activity of eczema, pruritus, sleep disturbance, etc) and various inflammatory markers were evaluated to examine the effect of the 0.45% *Psidium* cream after 4-8 weeks. The result revealed that acute clinical symptoms were improved. *Psidium* cream may be a valuable adjunctive therapy in the management of atopic dermatitis [Suzuki *et al*].

In the Philippines the astringent, unripe fruit, the leaves, the cortex of the bark and roots – though more often the leaves only – in the form of a decoction, are used for washing ulcers and wounds [Quisumbing].

The leaves of the guava tree in decoction are traditionally used to heal wounds and cuts. [Ticzon]. The leaves are also used ulcers, boils, and wounds [Wyk *et al*]. In India it is considered astringent wounds and ulcers [Ayensu]. Locally, decoction of the leaves is employed in scurvy and for unhealthy ulcers [Nadkarni and Nadkarni]. The decocted leaves are used in Mexico for cleansing ulcers. The ground leaves make an excellent poultice [Nadkarni and Nadkarni]. Ground up with kaolin and water to a paste, they are applied in Ghana to the body as an ointment for measles [Burkill].

In Brazil guava is used in decoction externally for skin ulcers [Raintree]

**Tonic:** It is used as a restorative aid in convalescence [Conway]. It is also for cachexia (any general reduction in vitality and strength of body and mind resulting from a debilitating chronic disease) [Ayensu]. The astringency of these preparations may be masked by the addition of lime juice. From leaf buds, the Hawaiians make a medicinal tea, which has an astringent effect. Guava jelly is tonic to the heart and good for constipation [Nadkarni and Nadkarni].

**Vaginal disorders:** In Uruguay, a decoction of the leaves is used as a vaginal and uterine wash, especially in leucorrhoea where it can be infused and applied as a douche [Conway]. The leaves of the guava tree in decoction are recommended for uterine haemorrhage. The same decoction is used as a wash for vaginal and uterine problems, and especially where an astringent remedy is needed [Ticzon]. Water in which the leaves have been boiled is taken in Senegal to assist menstruation [Burkill]. In Peruvian medicine the leaves are used for vaginal discharges, menstrual pain and haemorrhages [Raintree]. In Brazil guava is considered an astringent and diuretic and is used for the same conditions as in Peru. A decoction is used externally for vaginal irritation and discharges.” [Raintree]

**Other uses:** A black dye is made from it in E. Africa for dyeing matting, silk and cotton. It is used in Gabon for tanning hides [Burkill].

**Parts used:** The whole plant, although in some areas only the leaves and stems are used [Zakaria].

**Dose:** 30 to 60 grams for 1 litre of water. 4 to 5 cups a day  
For diarrhoea: half an ounce of the bark is boiled down with six ounces of water to 3 ounces; the dose (for children) is one teaspoonful 3 or 4 times a day.

Root-bark is successfully employed in chronic infantile diarrhoea in the form of a concentrated decoction (1 in 12), or 2 oz of the bark in a pint of water boiled down to half a pint. Dose is 1 drachm or 1-2 teaspoons two or three times daily [Nadkarni and Nadkarni].

Crushed leaves are boiled in water and the infusion is either taken orally as a tea or as an enema. For severe diarrhoea, an infusion of one crushed leaf in a litre of water is used [Wyk *et al*].

The root-bark has been recommended in chronic infantile diarrhoea, in decoction of 1/2 oz. in 6 oz of water, boiled down to 3 oz., and given in teaspoonful doses [Dey].

**Safety data:** A case report of a 17-year-old student who developed contact dermatitis to *Psidium guajava* is presented. He was treating his eczema by bathing in water (50 litres) infused with a 30 g guava tea bag. Patch testing revealed allergies to various constituents of guava leaves.

The LD<sub>50</sub> of the aqueous extract was >5 g/kg, p.o. [Pranee]

The effect of *Psidium guajava* leaf extract (collected from Thailand) on the bleeding time and the 3 main mechanisms of haemostasis: vasoconstriction, platelet aggregation and blood coagulation, were investigated. The water extract did not shorten bleeding times in rats. The extract did not affect bleeding times, it stimulated vasoconstriction and platelet aggregation but it inhibited blood coagulation. The leaf extract is not recommended as a haemostatic agent. [Jaiarj *et al*]

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