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CHICKOO: A WONDERFUL GIFT FROM NATURE

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ABSTRACT

Nature has blessed us with a wonderful flora and fauna, which has made our life beautiful. One of these wonders is a sapodilla fruit. Sapodilla, commonly known as Chickoo is such a fruit, which has a sweet taste that resembles a mixed flavour of brown sugar and beet root. It is liked by people of all ages. It is a most popular fruit in Asia. Sapodilla fruit has a short shelf life. Medicinal properties of Chickoo are due to chemical constituents such as polyphenols, ascorbic acid, glycoside sapotinine etc. It is an excellent nutrient useful in the management of many diseases like inflammation, pain, diarrhoea etc. It can also be used in cosmetics. Traditionally, it is used as a diuretic, expectorant and in ophthalmology.

Keywords: *Manilkara zapota*, Chickoo, Chicklets, Sapodilla.

INTRODUCTION

Nature has blessed us with a wonderful flora and fauna, which has made our life beautiful[1]. One of these wonders is a sapodilla fruit. The Sapotaceae family includes about 800 species of evergreen trees and shrubs in around 65 genera. Sapodilla, which is scientifically known as *Manilkara zapota* is one of the tropical plants belonging to this family. It is grown for many purposes such as for its fruits, timber and latex. The fruit sapodilla is commonly known as chickoo or sapota, which should not be confused with sapote that means soft and edible fruits. It possesses tremendous nutritional value. Sapodilla is regarded as natural energy booster as it contains fructose and sucrose. It has resemblance to pear because of this it was also called as *Manilkara achras, Achras zapota or Nispero achras*, (a derivative of the Greek word achras for the Pear tree). Now it is cultivated throughout India, though it is native of Mexico and Central America. The plant contains several phytochemical constituents like saponin, myricetin-3-O-α-L-rhamnoside, ascorbic acid, β-carotene, which have medicinal benefits. Moreover; various parts of the plant are used as home remedies to cure health problems.

HISTORY

Sapodilla is a tropical fruit. It is believed to be native to Yucatan and possibly other nearby parts of southern Mexico, as well as northern Belize and north-eastern Guatemala. It is believed that sapodilla was cultivated throughout tropical America, West Indies and southern part of Florida mainland, where it is a tall tree found in forests. Early in colonial times, it was carried to Philippines by the Spanish and later was adopted everywhere in the Old World tropics. From the Philippines, it spread throughout Southeast Asia as a popular fruit tree, where it is not only consumed but also exported. It reached Sri Lanka in 1802. Sapodilla was introduced to India in 1898. Various species of sapodilla are now cultivated in Africa, India, East Indies, Philippines, Malaysia, Thailand, the tropical and sub-tropical regions of America and in almost all tropical countries worldwide.

CULTIVATION

Sapodilla plant is usually grown in tropical areas, but can also be grown in semi-tropical areas in green-house. It can be grown up to 1200 m. above sea level. Being a tropical fruit, it needs warm (10-38^0 C) and humid climate (70% relative humidity) for growth. Alluvial, sandy loam, red laterite and medium black soil having good drainage system, with acidic to neutral pH, provide best environment for sapodilla. For good yield, fertilizers containing 6-8% nitrogen, 2-4% phosphoric acid and 6-8% potash every 2-3 months and increasing gradually to 250g per plant are used in the initial years. In the later years, 2 to 3 applications per year prove to be sufficient. Very little pruning is required for the plant. Plant should be protected from frost. Indian cultivars of sapodilla are summarized in Table 1.

Propagation

The sapodilla is most commonly propagated by seed and grafting. Seeds germinate readily but growth is slow and it takes 5 to 8 years. Seeds can remain viable for several years. Vegetative propagation should be used to obtain

uniform planting material and avoid the initial slow growth of seedling trees.

Harvesting

It is difficult to tell whether sapodilla fruit is mature or not by just watching it, but the colour- change of fruit from yellow to brown is one of the parameters of its maturity. Harvesting immature fruits can cause underdeveloped sweetness and flavour. For this, scurf of the fruit is rubbed to check if it loosens readily or if it separates easily without leaking of latex or wait till one fruit drops naturally and after that fruits of the same size can be picked. Fruit picked by above parameters, still can be hard though it is fully mature and must be kept at room temperature for a few days to soften.

Effective storage

Mostly sapodillas are picked un-ripe. At normal summer temperature and relative humidity (RH), the hard and immature sapodillas ripen within 9 - 10 days and rot in two weeks but extremely low temperature seriously retards the ripening of the fruit and damages its quality. Low relative humidity causes the fruit to wrinkle and shrivel up and extreme humidity causes sogginess. Sapodillas can be stored for long under proper conditions. Harvested fruits can be stored for 2 to 3 weeks at 12 to 16 °C with 85 to 90% RH. The fruits can also be stored with 5% CO_2 for 18 days at normal temperature. Fully matured/ripe fruits can be kept at a temperature of 1.67^{0}C for as long as six weeks.

GEOGRAPHICAL DISTRIBUTION

Cultivation of sapodilla is done in the warm and humid areas of the world. It is indigenous to southern Mexico, Yucatan Peninsula, Central America and South America. It is very popular in Asian countries like Phillipines, Sri Lanka,Thailand, Malaysia and India. In India, sapodilla is grown in several states including Chennai, Andhra Pradesh, Maharashtra and Gujarat. Indian names of chickoo and international synonyms are depicted in Table 2 & 3.

BOTANICAL DESCRIPTION

Habit: The sapodilla tree is an attractive upright, slow-growing, evergreen tree, which has extensive root system. Tree may develop a dense and rounded crown with age, which can be sometimes open or irregular in shape, but at young stage it is distinctly pyramidal in shape. Sapodilla tree is very rich in white, gummy latex called chickle. In the tropics, height of the tree can reach up to 100 feet, but grafted cultivars are relatively shorter. Botanical classification of sapodilla is described in Table 4.

Leaves: The leaves are 3 to 4-1/2 inches long and 1 to 1-1/2 inches wide. They are green, glossy, alternate and spirally clustered at the tip of forked twigs. Stomata are more on upper part.

Flowers: Sapodilla flowers are small (8-12 mm), inconspicuous and bell-like, approximately 3/8 inch in diameter with three (brown) outer and three inner sepals. They enclose a pale green to white tubular corolla and six stamens and the stigma extends beyond the corolla. They are borne on slender stalks in the axil of the leaves. There are several flushes of flowers throughout the year.

Fruits: The sapodilla fruit is round or egg-shaped, 2 - 4 inches in diameter. The skin is brown and scruffy when ripe. The flesh, which varies from yellow to shades of brown, has smooth or a granular texture. The raw fruit has a high latex content and a bit of latex remains even in the ripe fruit. The raw fruit skin is rough and leathery and it becomes smooth on ripening. Unripe fruit has high amounts of tannin, which can pucker mouth. The flavour of ripe fruit is deliciously sweet and pleasant. It ranges from a pear flavour to crunchy brown sugar.

PHYTOCONSTITUENTS OF SAPODILLA

The plant contains several phytochemical constituents belonging to categories such as alkaloids, carbohydrates[2], glycosides, tannins, triterpenes and flavonoids etc (Table 5). It also contains amino acids[2], proteins, ascorbic acid, phenols, carotenoids and minerals like iron, copper, zinc, calcium and potassium. Vitamins are also present in substantial quantity (Table 6), which make Chickoo a useful cosmetic. The concentration of constituents varies in leaves, fruits, latex seeds and bark. Major constituents isolated from fruits of *M. zapota* are polyphenols.

PHARMACOLOGICAL ACTIONS

Antibacterial activity: Antimicrobial activity of the root extract of *Manilkara zapota* is reported against both *Staphylococcus aureus* gram (+) positive and *Escherichia coli* gram (-) negative[3]. Whereas, the extract of bark and leaves possess bacteriostatic activity against *Bacillus subtilis, Bacillus megaterium, Bacillus cereus, Sarcina lutea, Escherichia coli, Salmonella typhi ,Shigella dysenteriae, Shigella sonnei, Shigella shiga*[4]. The antibacterial activity is probably due to presence of tannins, glycosides, alkaloids, saponins, carboxylic acids in plant. Thus, *Manilkara zapota* possess broad spectrum antibacterial activity.

Antifungal activity: Five fungal strains (*Aspergillus flavus, Aspergillus fumigatus, Candida albicans, Vasianfactum, and Fusarium*) were used to test antifungal activity. Stem bark extract showed antifungal activity against *Aspergillus flavus*, *Fusarium* and *Vasianfactum*[4]. The antifungal activity is probably due to the presence of terpenoids, flavonoids and glycosides.

Antitumor activity: Antitumor activity of *Manilkara zapota* stem bark against Ehrlich ascites carcinoma (EAC) in Swiss albino mice is reported. Sapodilla remarkably increased the RBC count and haemoglobin content bur reduced the WBC count in mice. The average life span of animals consuming sapodilla was increased[5]. This

anticarcinogenic property of *Manilkara zapota* was probably due to the presence of saponin.

Anti-inflammatory and antipyretic activity: Anti-inflammatory and anti-pyretic activity of *Manilkara zapota* leaves was found in albino wistar rats. Inflammation is associated with histamine or serotonin release in first phase and formation and release of prostaglandin in the second phase. Anti-inflammatory activity of *Manilkara zapota* may be due to inhibition of release of histamine and serotonin. Inhibition of biosynthesis of prostaglandins by inhibiting cyclooxygenase pathway may also contribute for both anti-inflammatory and anti-pyretic activities. Anti-inflammatory and anti-pyretic activities of the leaves of the plant could be attributed to the active constituents like lupeol acetate, oleanolic acid; apigenin-7-O-α-L-rhamnoside and myricetin-3-O-α-L-rhamnoside present in the *Manilkara zapota* leaves [6, 7].

Analgesic activity: Availability of alkaloids, polyphenols and flavonoids in sapodilla plant as chemical constituents contribute for its potent analgesic activity. Mechanism of analgesic activity appears to be related to desensitization of nociceptors and non-selective inhibition of cyclooxegenase pathway[8]. It can be used as both central and pheripheral analgesic[9].

Hepatoprotective effect: Hepatoprotective activity of *Manilkara zapota* is based on its strong antioxidant activity due to the presence of flavonoids, carotenoids and ascorbic acid in sapodilla[10,11].

Hypocholesterolemic effect: Compounds identified as lupeol acetate, oleanolic acid, apigenin-7-O-α-L-rhamnoside, myricetin-3-O-α-L-rhamnoside and caffeic acid from the petroleum ether and ethyl acetate fractions of the alcoholic extract of the leaves of *Manilkara zapota* exhibited the hypocholesterolemic effect[12].

Hypoglycaemic activity: Hypoglycemic activity of aqueous and ethanolic extracts of *Manilkara zapota* seeds in streptozotocin induced diabetic rats is shown. The presence of phytochemical constituents like saponin, sapotin, achrassaponin and the bitter principle sapotinine in *Manilkara zapota* seed have antidiabetic effect. The ethanolic extract of *Manilkara zapota* having dose 4oo mg/kg was found to be toxic in rats whereas, aqueous extract and lower dose of ethanolic extract was found to be safe[13].

Antidiarrhoeal activity: *Manilkara zapota* leaves showed moderate antidiarrhoeal properties in castor oil and magnesium sulphate induced diarrhoea in albino mice. The antidiarrhoeal activity of the extract may be due to the increase of the re-absorption of electrolytes and water from gastrointestinal tract or inhibition of prostaglandin biosynthesis. Antidiarrhoel effect may be seen due to the presence of flavonoids, and saponins[14].

Tyrosinase and elastase inhibitor effect: Tyrosinase and elastase inhibitory effect has been seen in methanolic extract of *Manilkara zapota*, which may be due to the presence of myricitrin or myricetin-3-O-α-L-rhamonoside. Tyrosinase (Phenol oxidase) is a key enzyme that catalyzes melanin synthesis in plants, microorganisms and mammalian cells. Tyrosinase inhibitors have been tested in cosmetics and pharmaceuticals (alkaptonuria) as a way of preventing over production of melanin in epidermal layers. Elastase inhibitory activity can work as an anti-ageing agent[15].

TRADITIONAL USES OF SAPODILLA

- The fruits and crushed seeds of sapodilla are used in preventing oedema due to diuretic property. They also prevent formation of kidney and bladder stones.
- The latex content of sapodilla fruit is used as a material for filling tooth cavities.
- The Chickoo fruit reduces inflammation and pain in gastritis, reflux oesophagitis and bowel disorders. Paste of seeds of sapodilla is used to alleviate pain and inflammation due to stings and bites. Chickoo strengthens the intestines, boosts immunity and prevents from many bacterial infections due to presence of Vitamin C.
- It is useful in pregnancy due to its high nutritional content. It reduces weakness, nausea and dizziness and prevents anaemia.
- A decoction of the bark and fruit is used for fevers and diarrhoea. Tea made of the bark also treats dysentery. Moreover, it is also useful in constipation and piles.
- The fibre and vitamin A content of sapodilla fruit prevents colon cancer, lung cancer, and oral cavity cancers.
- A paste of the mixture of sapodilla flowers and fruits relieves as well as prevents the respiratory disorders.
- Sapodilla fruit is also a good anti-spasmodic agent.

COSMETIC VALUE OF SAPODILLA

Sapodilla, being rich in nutrients can be used as a herbal remedy for skin infections and particularly for beauty enhancement. The Vitamins E, A and C of the fruit *Manilkara zapota*, makes the skin healthy due to its moisturising effect. Presence of antioxidant like ascorbic acid, polyphenols and flavonoids help in reducing wrinkles. Warts and fungal growth on the skin is cleared away by the milky sap of the sapodilla plant. The seed oil helps in moisturizing the scalp and softening hair. It yields beneficial results in the management of curly hair. The sapodilla seed oil helps in treating hair-fall due to seborrheic dermatitis.

MISCLLANEOUS USES OF SAPODILLA

Besides having medicinal, nutritional and culinary uses, sapodilla tree has several other uses, which enhance its utility. Chickle (latex of the sapodilla tree) is a base material for chewing gum and is used as an adhesive in repairing goods in India. This gum-latex of the plant Manilkara is also used in dental surgeries and making transmission belts. Being strong and durable, the sapodilla

wood is used to prepare flooring, wooden carts, tool handles and railway crossties. Some other materials like archer's bows, furniture, banisters etc are also manufactured from the red heartwood of plant. Philippine fisherman uses bark of the sapodilla plant to stain their sails and fishing lines. Coffin is made out of timber of a species of Manilkara genera, *Manilkara kauki* in Malaya.

ADVERSE EFFECTS

When half-a-dozen seeds of sapodilla are consumed, stomach pain is experienced due to the presence of sapotine and sapotinin. Raw sapodilla fruits contains high amount of latex and tannins, which contribute to its extremely bitter taste. Mouth ulcers, prickling in the throat, and dyspnoea, especially in small children is observed upon eating of raw fruits.

STRANGE FACTS

Fruits of sapodilla do not ripe until they are picked. Chickoo is fried or stewed with lime juice or ginger in Indonesia and Malaya. The sawdust of sapodilla plant is irritating to the nostrils. Dishes containing sapodilla comprise of fresh Fruit slices, Breads, Muffins, Milkshakes, Ice creams, Sweet sauce, Pies, Jellies and Syrups. Sapodilla fruit is a favourite dish of many Birds and bees. Fruit in the form of syrup, is stored in Bahams. Wine can also be made from the sapodilla fruit. Young and leafy shoots of the sapodilla plant are eaten raw or steamed with rice after removing the sticky sap in Indonesia.

Figure 1: Fruit salad

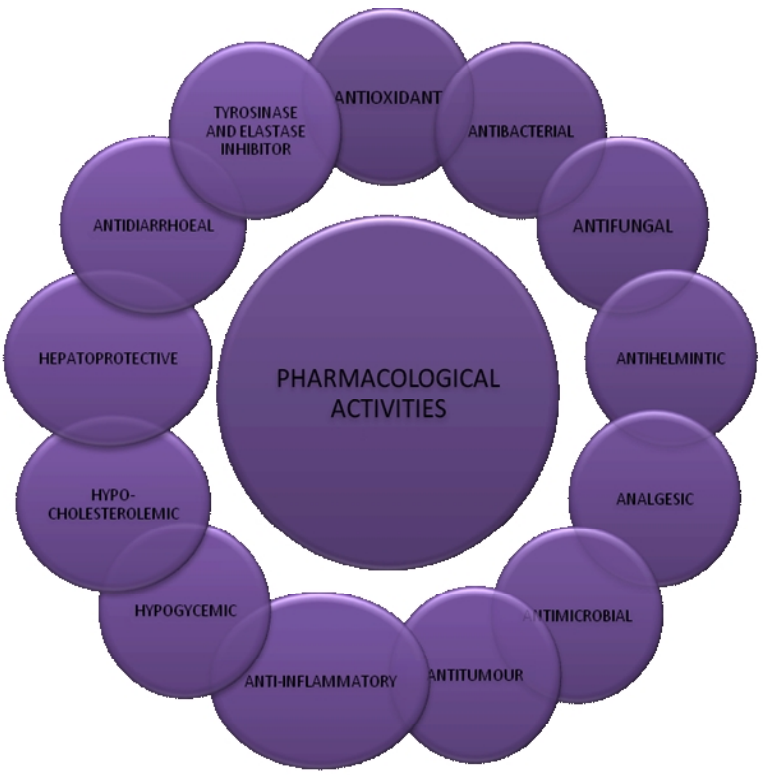

Figure 2: Pharmacological activities

Table 1: Indian cultivars of Sapodilla

Cultivars	Characteristics	State
Kalipatti	small, early, high quality	Maharashtra ,Karnataka ,Tamil Nadu
Calcutta round	large, late	Karnataka ,West Bengal ,Bihar ,Uttar Pradesh
Pillipati	small, midseason to late	Maharashtra
Bhuripatti	small, midseason	Maharashtra
Jumakhia	small, in clusters, late	Gujarat
Mohan gooti	small, midseason, not very sweet	Gujarat
Kittubarti	very small, ridged, very sweet	Andhra Pradesh
Kittubarti big	large, but of inferior quality	Andhra Pradesh
Cricket ball	very large, with crisp, granular, very sweet flesh but not distinctive in flavor	Andhra Pradesh, Maharashtra, Tamil Nadu, Karnataka
Dwarapaudi	similar, but not quite as big, sweet and very popular	Andhra Pradesh
Bangalore	large, ridged	Karnataka
Vavivalasa	oval and popular in the Circars but are only medium-sweet and bear poorly.	Andhra Pradesh
Jonnavalosa-II	medium size, ridged, with yellowish-pink flesh, sweet but not agreeable in flavour	Andhra Pradesh
Jonnavalosa round	large, ridged, with cream-colored flesh, very sweet	Andhra Pradesh
Ayyangar	large, very thick-skinned, sweet, rose-scented	Tamil Nadu

Different cultivars of sapodilla differ in shape and size.

Table 2: Indian synonyms of Sapodilla

Languages in India	Vernacular names
Hindi	Chickoo, Sapota
Malayalam, Telugu	Sapota, Sapotasima
Tamil	Simaiyiluppai
Gujarati	Chicku
Bengali	Sopeta, Sofeda
Marathi	Chikku
Oriya	Sapeta
Urdu	Cheeku

Table 3: International synonyms of Sapodilla

Country	Vernacular names
Honduras, Cuba	Zapote
Columbia, Venezuela	Nispero
Bahamas	Dilly
Jamaica	Naseberry
Brazil,Haiti	Sapoti
Phillipines	Chickoo
Hawai,Mexico,Southern California,Southern Flourida	Chickoosapote or Chickoozapote
Laotian	Lamud.
Korea	Kkom na mu
German	Breiapfel, Breiapfelbaum, Kaugummibaum , Sapote, Sapotille, Sapotillbaum.
China	Ren xin guo
France	Nèfle d'Amérique, Sapote, Sapotier, Sapotillier.
Malay	Ciku, Sawo londo (Indonesia), Sawo manila (Indonesia).
Nepal	Gudalu, Saapotaa.
Spain	Níspero, Sapote (Latin America), Zapote, Zapotillo
Thai	Lámút farang
Vietnamese	Hông xiêm, Hong xuan dinh, Xabôchê.
Japanese	Sabojira, Sapojira,Lomut
Sri Lanka	Sapathilla/Rata-mi
Guyana, Trinidad, Tobago	Sapodilla

Table 4: Botanical classification of Sapodilla

Kingdom	Plantae
Subkingdom	Tracheobionta
super division	Spermatophyte
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Dilleniidae
Order	Ericales
Family	Sapotaceae
Genus	Manilkara
Species	*M .zapota*

Table 5: Phytoconstituents of Chickoo

Sr.	Phytoconstituents	Plant part
1.	**Triterpenoid:** Erythrodiol[5]	Leaf
2.	**Fixed oils:** **Unsaturated oils**[12]: like oleic acid, linolenic acid and linoleic acid, lupeol acetate, oleanolic acid. **Saturated oils**: palmitic acid	Leaf
3.	**Hydrocarbons**[12]**:** n-hexane, n-triacontane, n-octacosane.	Leaf
4.	**Sterols:** β-sterol, stigmasterol[12].	Leaf
5.	**Enzyme:** polyphenol oxidase	Fruit
6.	**Alkaloids:** sapotinine, sapotin[13]	Whole plant
7.	**Phenolic compounds**[16]: D-quercitol , methyl chlorogenate, dihydromyricetin, quercitrin, myricitrin, myricetin-3-O-α-L-rhamnoside, methyl 4-O-galloylchlorogenate and 4-O-galloylchlorogenic acid, (+)-catechin, (-)-epicatechin, (+)-gallocatechin, and gallic acid, apigenin-7-O-α-L-rhamnoside, leucodelphinidin, leucocyanidin and leucopelargonidin, D-quercitol and saccharose.	Leaf, Fruit, Seed
8.	Ascorbic acid	Leaf, fruit, bark
9.	**Minerals:** Iron, copper, zinc, calcium, potassium	Fruit
10.	**Carbohydrates**[17]**:** lactose, glucose, galactose , fructose, arabinose, sucrose, and galactouronic acid	Leaf, Fruit
11.	β-carotene	Fruit
12.	**Amino acids**[17]**:** alanine ,arginine, leucine, isoleucine, hydroxyproline, lysine, aspartic acid, glutamic acid, glycine, phenylalanine, proline, serine, threonine, tyrosine, valine, methionine, β-aminobutyric acid, cystine, threonine, tyrosine, valine.	Fruit, Leaf
13.	**Saponin:** Manilkoraside[18]	Stem bark

Table 6: Nutritive value of fresh sapodilla fruit

Nutrients	Amount (per 100g)
Carbohydrates	19.9 g
Fats	0.44 g
Cholesterol	0 mg
Dietary fibres	5.3 g
Folates	14 µg
Niacin (vitamin B_3)	0.200 mg
Pantothenic acid(vitamin B_5)	0.252 mg
Pyridoxine (vitamin B_6common)	0.037 mg
Riboflavin (vitamin B_2)	0.020 mg
Thiamin (vitamine B_1)	0.058 mg
Vitamin A	60 IU
Vitamin C	14.7 mg
Sodium	12 mg
Potassium	193 mg
Calcium	21 mg
Copper	0.086 mg
Iron	0.80 mg
Magnesium	12 mg
Phosphorous	12 mg
Selenium	0.6 µg
Zinc	0.10 mg

CONCLUSION

Nature has blessed us with a wonderful flora and fauna, which has made our life beautiful. One of these wonders is a sapodilla fruit. Sapodilla, commonly known as Chickoo is such a fruit, which has a sweet taste that resembles a mixed flavour of brown sugar and beet root. It is liked by people of all ages. It is a most popular fruit in Asia. Sapodilla fruit has a short shelf life. Medicinal properties of Chickoo are due to chemical constituents such as polyphenols, ascorbic acid, glycoside sapotinine etc. It is an excellent nutrient useful in the management of many diseases like inflammation, pain, diarrhoea etc. It can also be used in cosmetics. Traditionally, it is used as a diuretic, expectorant and in ophthalmology. Sapodilla fruit is a crop of tropical region. It is consumed in various forms either as a whole fruit or in ice-creams, fruit-shakes etc. Sapodilla is regarded as a natural energy booster as it contains fructose and sucrose. Chickoo is a delicious fruit and every part of the sapodilla plant has several medicinal and cosmetic properties.

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