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Review Article

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# Pithecellobium dulce (Roxb.) Benth: A Nutritionally Rich, Ecologically Resilient, and Therapeutically Promising Anukta Dravya

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Pithecellobium dulce (Roxb.) Benth, commonly known as Manila tamarind or Jangle Jalebi, is a resilient, multipurpose tree. Known for its twisted, sweet pods and high adaptability to poor soil and saline conditions, it is valued for both its ecological and medicinal properties. Traditionally used in various cultures for treating ailments like diarrhoea etc, the plant exhibits a broad range of therapeutic effects, including anti-diabetic, antimicrobial, antiulcer, anthelmintic, CNS depressant, and anti-venom activities. Its different parts - leaves, bark, seeds, and pulp are rich in nutrients, essential elements, and bioactive compounds like flavonoids and tannins. As such, there is no reference found in classical Ayurvedic texts of P. dulce, and it is classified as an Anukta Dravya. Scientific studies support its pharmacological potential, making it a promising drug for future research in herbal medicine, pharmaceuticals, and environmental sustainability. This article highlights the botanical, nutritional, pharmacological, and traditional significance of P. dulce, underlining the need for further exploration and validation to integrate it into mainstream therapeutic applications.

**Keywords:** Pithecellobium dulce, Anukta Dravya, Nutritional value, Therapeutic properties

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# Introduction

The name *Pithecellobium dulce* (Roxb.) Benth is derived from its sweet, spirally twisted pods, which resemble a monkey's earring. Its generic name, Pithecellobium, is derived from the Greek words 'pithecos' and 'ellobium', which mean 'monkey' and 'earring', respectively. The species name "dulce" is a feminine word in Latin, meaning "sweet" in allusion to the edible pulp of the pod. *Pithecellobium dulce* (Roxb.) Benth is a tree native to Mesoamerica and the Aztecs. It is also known by its local name "Quamachil" - a hardy tree that grows even in waste and denuded lands, pure sandy soil, and on the sea coast with its roots in brackish or salt water. It can withstand shade and is resistant to drought. It reproduces easily by seeds or cuttings. Quamachil is mostly grown in India for hedges and for fuel. Commonly, it is known as Manila tamarind or Jangle jalebi in India, because of the resemblance of the fruits to the Indian sweet "Jalebi", the plant is also given the name "Jangle Jalebi". Its fruits are eaten locally for their high nutritional value.**[1]**

The knowledge about medicinally useful plants in the early age was scientifically documented and organized in systematic *Ayurvedic Samhita, Nighantus*, and other texts. Codified information regarding plants of folklore origin is not documented in the classical texts of *Ayurveda*. Multiple exotic plants exist in India that are not referred to in either classical literature of *Ayurveda* and are commonly referred to as *Anukta Dravya* in *Ayurveda*. In *Ayurveda, P. dulce* is considered an *Anukta Dravya* because no reference is found in any classical *Ayurveda* texts like *Samhitas, Nighnatus*. This article highlights the botanical, nutritional, pharmacological, and traditional significance of *P. dulce*, underlining the need for further exploration and validation to integrate it into mainstream therapeutic applications.

Different vernacular names and taxonomical classification have been listed in Tables no 1,2, respectively. Whole plant parts of *P. dulce,* like Bark, leaves, seeds, flowers, pulp, and root, are being used medicinally.

**Synonyms:** There are many synonyms of the *P. dulce*, which are listed below**[2]**

- Acacia obliquifolia M.Martens & Galeotti
- Albizia dulcis (Roxb.) F.Muell.
- Feuilleea dulcis (Roxb.) Kuntze
- Inga camatchili Perr.
- Inga dulcis (Roxb.) Wild.
- Inga javana DC.
- Inga leucantha C. Presl
- Inga pungens Humb. & Bonpl. ex Willd.
- Mimosa dulcis Roxb.
- Mimosa edulis Poir.
- Mimosa pungens Poir.
- Mimosa unguis-cati Blanco
- Pithecellobium littorale Reco

**Table 1: Names of *P. dulce* in different regions[3]**

| | |
|---|---|
| English | Quamachil, Madras Thorn, Manila Tamarind |
| Hindi | Vilayati Babul, Vilayati Imli, Jangle Jalebi |
| Bengali | Deccani Babul, Chinch |
| Gujarati | Bakhai Ambli, Goras Ambli |
| Kannada | Seeme Hunase, Kottampuli |
| Malayalam | Korukkapuli |
| Marathi | Ingraji Chinch, Vilayati Chinch |
| Odia | Seema Kaiyan |
| Tamil | Kodukkaapuli, Karkapilli, Kattuppilli, Konapuli, Korukapuli |
| Telugu | Sima Chintakay, Simachinta |

**Table 2: Taxonomical classification of *Pithecellobium dulce* (Roxb.) Benth[4]**

| | |
|---|---|
| Domain | Eukaryota |
| Kingdom | Plantae |
| Phylum | Spermatophyta |
| Subphylum | Angiospermae |
| Class | Dicotyledonae |
| Order | Fabales |
| Family | Fabaceae |
| Subfamily | Mimosoideae |
| Genus | Pithecellobium |
| Species | Dulce |

**Botanical description of *P. Dulce* (Roxb.) Benth[5,6,7]**

A small to medium-sized tree 5-18 m. high, glabrous, evergreen spiny tree with Armed, stipules or branchlets spinescent, native to tropical America, and cultivated throughout India, and the Andamans. The tree is armed with short straight stipular thorns, the pods are twisted, and the seeds are embedded in sweet whitish or reddish edible pulp (Fig. no. 1).

The part-wise characteristic features of the *P. dulce* are listed in Table No.3

**Table 3: Partwise characteristics features of the *P. dulce*:**

| | |
|---|---|
| Leaves | Bipinnate 4-8 cm long; pinnae a single pair, each pinna bearing a single pair of pale green, coriaceous, unequal-sided oblique, ovate-oblong, obtuse,1-4 cm long leaflets, often with a pair of sharp spines at the base of the leaf which ranges from 2 to 15 mm in length (Fig. no. 2 & 4) |
| Leaflets | 25-56 mm long and 9-32 mm wide, obliquely elliptic or oblong-elliptic with 4-7 pairs of pinnate veins, deep olive green above, paler grey-green below, with small glands, 0.3-0.8 mm high and 0.4-0.7 mm in diameter, at the tip of the petiole and the tip of the pinnular rachi (Fig. no. 3) |
| Flowers | white to yellow, fragrant in small globose, sessile, or short pedunculate heads about 1 cm in diameter, arranged in raceme-like or spiciform panicles 10-20 cm in length and 1.0-1.5 cm in diameter, often in the terminal compound. (Fig. no. 5 & 6) |
| Corolla & Calyx | 5 Pubescent corollas (3.0-4.5 mm long) and 5 calyces (1.5 mm long) surrounding about 50 thin stamens, which are united in a tube at the base |
| Ovary | Sessile or stalked; many ovules |
| Style | Filiform |
| Stigma | Minute capitate |
| Pods/ Fruits | Linear, curved legume pods. Pod turgid, twisted, often spiral, 10-18 cm long, about 1 cm wide, dehiscent along the lower suture, the valves turn pinkish-red when ripe, and open to reveal the seeds; pink or white edible pulp. (Fig. no. 7 & 8) |
| Seed | 6-8 shiny seeds reddish brown to black, elliptical, beanlike, and about 1 cm in length. |
| Bark | Smooth, grey with yellowish lenticels, becoming rough, furrowed, and eventually starting to peel when it matures. (Fig. no. 9) |

**Figure 1: Whole plant**


**Figure 2: Bipinnate leaf**

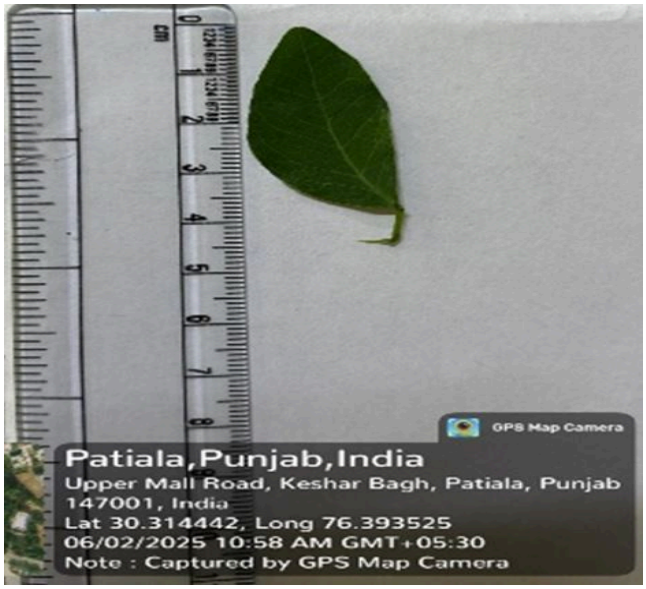


**Figure 3: Leaflet**


**Figure 4: New and Tender leaves**


**Figure 5: Matured Flower**

**Figure 6: Inflorescence**


**Figure 7: Immature Fruit**

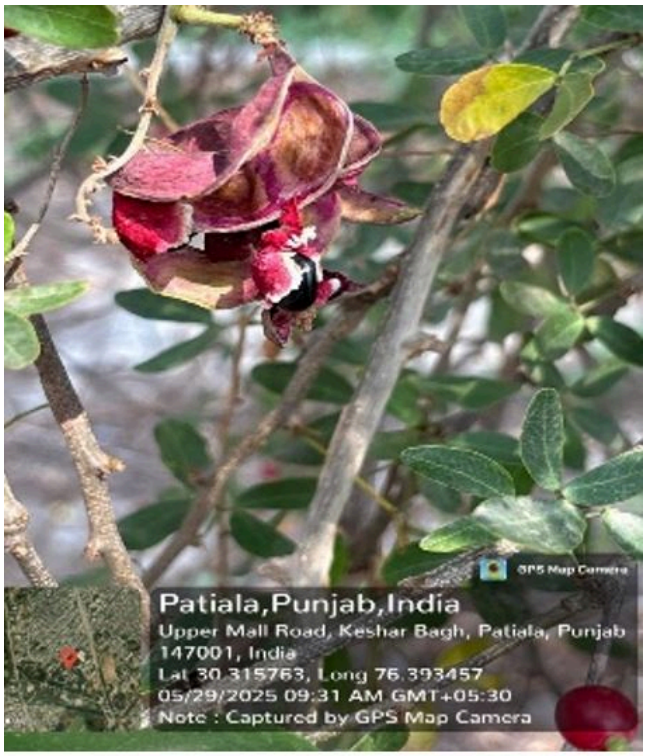


**Figure 8: Mature fruit**


**Figure 9: Bark**

**Flowering and Fruiting**

*P. dulce* typically flowers during the dry season, from December to May. The pods mature within 2 to 4 months following the flowering period, generally between March to July. As they ripen, their colour changes from green to brown or black.

**Nutritional Value of *P. Dulce*[8]**

The concentrations of various key nutrients found in *Pithecellobium dulce* (Roxb.) Benth is listed below in Table 4.

**Table 4: Nutritional Value of P. dulce**

| Key Nutrients | Concentrations |
|---|---|
| Energy | 78 Kcal |
| Protein | 3% |
| Fat | 4% |
| Carbohydrate | 18.2% |
| Ash | 6% |
| Fibre | 1.2% |
| Calcium | 13mg |
| Phosphorus | 42 mg |
| Iron | 5mg |
| Sodium | 19mg |
| Vitamin A | 15mg |
| Thiamine/B1 | 24mg |
| Riboflavin/B2 | 10mg |
| Niacin/B6 | 60mg |
| Vitamin C | 133mg |

Table 5 summarizes the concentrations (mg/kg) of essential and toxic elements, which were observed in different concentrations - Ar, Cu, Cd, Fe, K, Mg, Na, Pb, and Zn have been analyzed for *P. dulce*.

**Table 5: Elemental composition[9]**

| Elements | Concentrations (mg/kg) |
|---|---|
| Arsenic | 17.6µg/kg |
| Copper | 16.25 |
| Cadmium | 3.48 |
| Iron | 1.89 |
| Lead | 0.19 |
| Magnesium | 15.06 |
| Potassium | 26.89 |
| Sodium | 10.19 |
| Zinc | 26.89 |

**Therapeutic and Biological Values of *P. Dulce*[10]**

**Hypolipidemic activity**

In an anti-hyperlipidemic activity of *Pithecellobium dulce* aqueous extract of leaves was isolated against triton-induced hyperlipidemia in rats. The dose of PD was 200µg/kg (p.o) to the triton induced hyperlipidemic rats.

*Pithecellobium dulce* has shown a significant decrease in the levels of serum cholesterol, phospholipids, triglyceride, LDL, VLDL and significant increase in the level of serum HDL. Aqueous extract fraction decreased serum level of total cholesterol, LDL and increased the serum HDL cholesterol level.

**Antitubercular Activity**

The hexane, chloroform and alcoholic extracts of the *P. dulce* leaves were studied for their antimycobacterial activity by BACTEC460TB- Radio spirometric system. The alcoholic extract at the concentration 20mg/ml showed highest activity when comparable with standard drugs like, streptomycin, isoniazid, rifampicin, ethambutol and pyrazinamide.

**Anti-Diabetic**

The methanolic crude extract of *P. dulce* seed was tested in Streptozotocin (STZ)-induced diabetic rat (albino Wistar male model), and the extract has the ability to protect the functional β-cells that produce and maintain the insulin level in the blood. This insulin treatment improves the glycogen content. In the methanolic extract-treated STZ-induced rats, the liver glycogen level was higher compared with the control group of Wistar rat, and the functional glucose metabolism could be due to better insulin secretion from β-cells, and the glucose was utilized in the oral glucose tolerance test. Thus, it could be a potential therapeutic for diabetic patients. The *P. dulce* fruit contains a cyclic polyol pinitol, and it has been reported to have anti-diabetic activity.

**Antimicrobial activity**

It was found that ZnO nanoparticles of *P. dulce* exhibited maximum (15 mm) bacterial growth inhibition against B. Subtilis, and in the case of E. coli, the zone of inhibition is found to be 17mm. The maximum zone of inhibition is shown by P. aeruginosa, Streptococcus pyogenes and S. Aureus.

**CNS Depressant**

A study evaluating the locomotor activity of aqueous and alcoholic extracts of PD in albino mice showed significant CNS depression. The potency of alcoholic and aqueous extracts of the leaf was compared with that of chlorpromazine at a dose of 100 mg/kg, the alcoholic extract exhibiting a greater effect when compared to chlorpromazine. The activity was attributed to an increase in the concentration of GABA in the brain.

**Anti-venom effect**

The tannin was extracted from *P. dulce* barks using aqueous extraction. The venom lethality was inhibited and the necrotizing activity of the venom was minimized by this crude extract.

The extract also inhibited 90% of acetylcholine esterase activity as it contains higher tannin concentration or combined hydrolyzable tannin concentration. α-cobra toxin protein was docked with four different tannin compounds using Autodock 3 and tannic acid, Digallic acid has −14.7 kcal/mol, −10.38 kcal/ mol binding energies were studied. The plant extract selectively blocks nicotinic acetylcholine receptor and non-selectively precipitate the venom protein.

**Anthelmintic activity**

Study evaluated leaf extracts of *P. dulce* in three different concentrations for anthelmintic activity against Pheretima posthuma. The aqueous extract was more potent than alcoholic extract, with activity comparable to reference drug piperazine citrate.

**Antiulcer Activity**

Peptic ulcer disease refers to pathological damage that causes ulcers in gastrointestinal tract exposed to acid-activated pepsin. There are three common forms of peptic ulcers: gastric ulcers (inside stomach), esophageal ulcers (inside esophagus) duodenal ulcers (inside duodenum). Treatment of ulcers with ranitidine, alcoholic, and aqueous extract significantly prevents number of ulcers induced by pylorus ligation. Results indicated that 66.6% gastro-protection with ranitidine, 55.56% gastro-protection with alcoholic extract of *P. dulce* at 100 mg/kg, and 61.11% with aqueous extract of *P. dulce* at a dose of 100 mg/kg as compared with ulcerated control. The antiulcer activity is probably due to presence of bioactive compounds like flavonoids- quercetin, rutin, kaempferol, naringin, and daidzein. Cell proliferation was found to be enhanced in drug-receiving animals. The total protein-bound carbohydrate to total protein ratio was found to be significantly maintained by hydroalcoholic fruit extract of *P. dulce* (HAEPD). Ulcer score was significantly minimized in HAEPD-administered animals at dose of 200 mg/kg body weight for 30 days.

**Anti-diarrheal effect**

The ethanolic extract of P. dulce showed an anti-diarrheal effect in the castor oil-induced mice. Loperamide is the standard anti-diarrheal drug used to compare the results. The phytochemicals of P. dulce have the ability to increase the latent period, delay, and decrease the frequency of defecation.

**Traditional Applications**

- In Haiti, root and bark decoctions as tea are taken orally against diarrhoea; the bark is used medicinally as a febrifuge.
- From the bark of the *dulce* tree, infusions can be prepared to combat dysentery, fever, gum ailments, toothache and haemorrhages.
- In Mexico, a decoction of leaves is used for earaches, leprosy, toothaches, and larvicide.
- The leaves have been used as a remedy for peptic ulcers, and intestinal disorders, and as a treatment to decrease seizures. The extracts of the leaves are used to treat gallbladder ailments.
- The leaves, when applied as a plaster, can allay pain of venereal sores, and taken with salt can cure indigestion. They have also been reported to possess astringent, emollient, anodyne, larv-icide, and abortifacient properties. An insulin-like principle has been reported in leaves.
- An extract from Quamachil twigs has been reported to be an effective check against the tobacco mosaic virus in India.
- The fruit pulp is taken orally to stop blood flow in case of haemoptysis.
- The seed juice is inhaled into the nostrils against chest congestion, and pulverized seeds are ingested for internal ulcers.
- The root bark may be used to cure dysentery.

**Hazardous Effect[11]**

Bark contains an irritant that can cause dermatitis and inflammation in the eye.

## Discussion

*Pithecellobium dulce* (Roxb.) Benth is a highly versatile tree recognized for its remarkable adaptability, nutritional richness, and wide range of therapeutic applications. Native to Mesoamerica and cultivated extensively across tropical regions, this species thrives in poor soils, saline conditions, and harsh climates, making it particularly valuable for ecological restoration and sustainable land use. The tree is consumed locally and holds considerable nutritional value, containing essential vitamins like Vitamin C and B-complex, along with minerals such as calcium, phosphorus, iron, and zinc.

Extracts from various parts of the plant—including leaves, bark, seeds, and fruit pulp—have demonstrated anti-diabetic, antimicrobial, antiulcer, anti-inflammatory, CNS depressant, and even antivenom properties in experimental models. The presence of bioactive compounds like flavonoids, tannins, and polyols underlies these effects. In traditional medicine, the plant has been employed to treat a variety of conditions such as diarrhea, ulcers, fever, and chest congestion, with practices observed across cultures in India, Mexico, and other countries.

Despite these promising uses, *P. dulce* remains underrepresented in classical Ayurvedic literature and is categorized as an *Anukta Dravya*, suggesting that its traditional uses, although widespread, are not canonically documented. *Pithecellobium dulce* has potential for pharmaceutical development due to its diverse bioactive compounds. Further research can validate its traditional uses and explore its role in managing lifestyle diseases. Additionally, it holds commercial value in the nutraceutical and herbal product industries.

## Conclusion

*Pithecellobium dulce* (Roxb.) Benth stands out as a highly valuable plant with multifaceted benefits ranging from nutritional richness to diverse medicinal properties. Its adaptability to extreme environmental conditions adds to its ecological significance. Although it is not mentioned in any classical Ayurvedic texts, its traditional uses and scientific validation highlight its therapeutic promise. Continued research and clinical studies could further unlock its potential in modern medicine and sustainable development.

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