



A REVIEW ON PONGAMIA PINNATA (L.): TRADITIONAL USES, PHYTOCHEMISTRY AND PHARMACOLOGICAL PROPERTIES

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ABSTRACT

Pongamia pinnata also known as karanja and Indian beech. This tree belongs to the family leguminosae and its sub family papillonaceae. *Pongamia Pinnata* has been documented in a number of traditional medicinal systems for the cure of various disease of human begin.

To study phytochemical and pharmacognostic and quantitative evaluation of leaves. by recent study provides pharmacognostic ,phytochemical and quantitative evaluation of *pogmia pinnata* of leaves and flower . macroscopic study showed was elliptic with smooth margin ,short petiole ,alternate imparipinnate , hairless , acuminate at apex, rounded to apex ,rounded to cuneate at base and slightly thickened .microscopic study releaved collated ,closed vascular bundles ,trichomes , paracytic stomata ,xylem vessels and prismatic calcium oxalate crystal .qualitative analysis showed the presence of phenol ,flavonoids tannis ,saponins alkaloids ,fixed oil and fat ,amino acid ,steroids ,anthraquinones, cardiac glycosides ,proteins, tri-terpenoids, reducing sugar . The seeds of the *Pongamia Pinnata* contain about 30 to 40 % of oil which is thick, reddish brown in color .The isolated phenylated flavonoids have two modified ring derivatives i.e. ponga flavanol and tunicatachalcone obtained from the stem bark .chemical consituent of *pogmia pinnata* is Oleic acid occurred in highest amount (44.24%), stearic (29.64%) and palmitic (18.58%) acids were the next in quantity. Hiragonic and octadecatrienoic acids were present in trace amounts (0.88%).

Pongamia Pinnata has been documented in a number of traditional medicinal systems for the cure of various disease of human begin . Incorporation of *Pongamia* plant parts is very common in Ayurvedha and Siddha Indian medicine practices. *Pongamia pinnata* exhibits many pharmacological attributes. First, anti-Plasmodial characteristics make *P. pinnata* important to treat malaria caused by *Plasmodium falciparum*. Next, the leaves of the Pongam tree exhibit anti-inflammatory qualities as well as anti-diarrheal activity; also, the leaf extracts are antioxidants. *Pongamia* prevents ulcers by protecting damage from aspirin. It may also provide diabetic patients with a safer anti-hyperglycemic drug. The roots of *Pongamia pinnata* are good for cleaning teeth, strengthening gums and gonorrhoea. Oleic acid occurred in highest amount (44.24%), stearic (29.64%) and palmitic (18.58%) acids were the next in quantity. Hiragonic and octadecatrienoic acids were present in trace amounts (0.88%). Oleic acid occurred in highest amount (44.24%), stearic (29.64%) and palmitic (18.58%) acids were the next in quantity. Hiragonic and octadecatrienoic acids were present in trace amounts (0.88%).

INTRODUCTION

Pongamia pinnata is also referred to as Indian beech and karanja. One of India's most well-known and brilliant plants is the pongamia pinnata, also known as the "Pongam Tree." South Indians, specifically Tamils, gave the pongamia its name, and the word "pinnata" alludes to the pinnata leaves. This tree is a member of the papillonaceae subfamily of the leguminosae family. They are also known as pongam and punk in Tamil. It is a medium-sized Indo-Malaysian area that can be found from sea level to 1200 m on alluvial and coastal environments from India to Fiji. now situated in Australia as well. Florida Hawaii India Malaysia Oceania Sey Chelley and the Philippine. generally speaking, seeds. are all said to have a high percentage of Polly unsaturated fatty acids and to range in content from 28 to 34%. Ponnam trees in March and April are purple for about a week before the birds notice her new foliage, and right when the leaves start to ripen, the trees turn a stunning glowing line green.

Due to its excellent N₂ fixation capacity and inability to be consumed by animals while grazing, Pongamia Pinnata was discovered to be among the most suitable non-edible oil plant species in Indonesia. The use of Pongamia Pinnata for the treatment of different human diseases and foods has been recorded in a number of traditional medical systems. There are alkaloids in it.

The herb has historically been used in Ayurvedic or Siddha medicine for its anti-inflammatory, anti-plasmodial, anti-nociceptive, anti-hyperglycemic, anti-lipidperoxidative, anti-diarrheal, anti-ulcer, anti-hyperammonic, and antioxidant properties. Pongamia pinnata was a plant that was grown extensively in India's coastal forests for a very long time. Some of them were also grown close to rivers and stream banks. For the therapy of whooping cough and bronchial inflammation, plant seeds ground into a powder are used as energizers and medicines to reduce fever. In addition to healing chest infections, hemorrhoids, and anemia, the seed powder is used to treat these conditions.

TAXONOMICAL CLASSIFICATION

KINGDOM	Plantae
SUBKINGDOM	Tracheobionta
SUPER DIVISION	Spermatophyta
DIVISION	Magnoliophyta
CLASS	Magnoliophyta
SUB CLASS	Rosidae
ORDER	Fabales
FAMILY	Fabaceae
GENUS	Pongamia
SPECIES	Milietia pinnata

VERNACULAR NAMES OF PONGAMIA PINNATA LINN.

- Hindi, Marathi and Gujarati – Karanj, Karanja
- Sanskrit- Ghrtakarauja, Karanjaka, Naktahva, Naktamala
- English- Indian beech
- Telugu- Pungu, Gaanuga
- Tamil- Ponga, Pongam
- Malayalam- Pungu, Punnu
- Oriya- Koranjo
- Punjabi- Sukhehein, Karanj, Paphri
- Assam- Karchuw
- Bengali- Dahara karanja, karanja, nataranja
- Kannada- Honge, Hulagilu
- Urdu- Karanj

MORPHOLOGY

- **STEM:** The 50 cm in diameter, straight or crooked stem is covered in grey to greyish brown bark. It has a large number of secondary lateral roots and a deep, dense taproot.



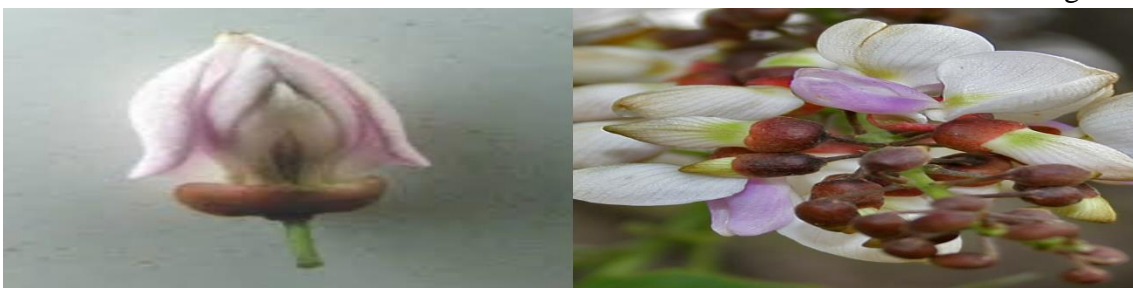
- **BRANCHES:** Branches are smooth and have light scarring on their stipules. A wide hemispherical crown of dark green leaves is emerging from them as they expand.



- **LEAVES:** Pinkish-red in hue, alternate, and pinnately compound. Young leaves are glossy and black; as they mature, they turn green. The leaves are single terminal on thin stems and have pairs of five to seven glabrous leaflets each. The leaflets are ovate-elliptic, 4-6 cm wide, and pointed at the apex. They measure 5-10 cm long.



- **BLOSSOMS:** Lavender blossoms range in size from 15 to 18 mm, are finely pubescent, and are typically white or pink in colour. A typical papilionaceous, highly fragrant flower is present in the inflorescence, which is a raceme



- **Fruits:** Pongamia pinnata produces a lot of elliptical, firm, woody, and 3-6-seeded fruits with indehiscent pods. Seeds are found in 1-2 pods.



- Seeds: These dark brown, bean-like seeds are 1.2–2.0 centimetre wide, 1.5–2.5 cm long, and oily. They have 30–40% oil content. Only after several months have passed since the plant has dropped its seeds do the pod shells begin to decompose.



CHEMICAL CONSTITUENTS

Most of the Chemical Constituents of the Pongamia Pinnata Plant are present in the seeds of the plant. This oil is also referred to as Pongamol, Hongay oil, and Pongam oil. It also includes both saturated and neutral fatty acids in addition to the oil. There are more polyunsaturated fatty acids, for example. The leaves and stem of the shrub The spores of the plant contain the majority of the chemical components that make up the Pongamia Pinnata plant. Pongone, Pongalbol, Pongagallone A, and Pongagallone B are all present in the oil that makes up 30 to 40% of the Pongamia Pinnata seeds.

- **FLAVONOIDS**

Pongamia pinnata is rich in flavonoids, such as quercetin, karanjin, and pongamol. These substances have anti-inflammatory, anti-cancer, and antioxidant effects..

- **ALKALOIDS**

Kanjone, kanugin, and pongapin are just a few of the compounds found in Pongamia pinnata. These substances have demonstrated antimicrobial and anti-inflammatory properties.

- **FATTY ACID**

Oleic, linoleic, and palmitic acids are among the many fatty acids found in significant concentrations in Pongamia pinnata seeds. These fatty acids are helpful in skin care items because of their moisturising and emollient qualities.

- **TANNINS**

Pongamia pinnata includes tannins, which are also known as astringent and antioxidants. They have anti-inflammatory and wound-healing properties and are frequently used in conventional treatment.

• **TERPENOIDS**

Terpenoids: *Pongamia pinnata* includes a number of terpenoids, such as lupeol and betulinic acid. The anti-inflammatory and anti-cancer effects of these substances.

• **STEROIDS**

Sterols: *Pongamia pinnata* includes stigmasterol and -sitosterol among its many sterols. It has been demonstrated that these substances have anti-inflammatory and cholesterol-lowering properties.

CULTIVATION AND COLLECTION

To aid in germination, *Pongamia pinnata* seeds should be soaked in water for a few days prior to sowing. The seeds can be planted directly in the ground or in containers, and until they are established, the young seedlings need to be shielded from direct sunshine and kept well-watered.

Pongamia pinnata can grow in a variety of climates, from tropical to subtropical, and favours well-drained soil. It is a resilient tree that can withstand heat, drought, and saline spray.

The *Pongamia pinnata* tree's seeds are typically collected after they have matured and dropped to the ground. After being cleaned, they are usually sun-dried before being used for a variety of uses. The oil that is taken from the seeds has a number of uses, including the production of soap and biofuel.

To guarantee the long-term viability of the species and its ecological benefits, *Pongamia pinnata* cultivation and collection should be done in a sustainable and responsible way. This may entail following ethical farming procedures and taking precautions to preserve the tree's native habitat and the wildlife that depends on it

- It frequently grows along the sides of rivers, canals, roads, and open fields. From tropical dry to subtropical dry zones, it is extensively cultivated. Around the nation, seed harvesting typically occurs periodically, most frequently in May and June.
- In the spring, seeds are collected, weighing between 1.1 and 1.8 grammes each. Depending on the circumstances, the yield per tree can vary from 9 kg to more than 50 kg, with an average of 1500–1700 seeds per kg.
- The seeds are removed after they have been dried in the sun for a couple of days during harvest. The fruit is pounded while being harvested, and the seed Pods are then dried in the light for 2 to 3 days.
- Indian oil seed plant cultivation Different countries are searching for different vegetable oils as alternatives to diesel fuel depending on the climate and soil conditions. The variety of the genera has been preserved. Through the most popular, conventional, and cost-effective technique, storage seed (Hong and Ellis) (1996). Planting between 60 X 60 Cm³ pits is suitable. Rows should be spaced 5 metres apart, and plants should be 4 metres apart.

MEDICINAL PROPERTY

• **Anti-inflammatory property:-** In rodents with severe, subacute, and ongoing inflammation, the authors showed that a 70% ethanol fraction of *P. pinnata* leaves has anti-inflammatory properties. These findings imply that the *P. pinnata* leaf portion has potent anti-inflammatory activity without ulcerative activity, indicating that it may be used to treat a variety of inflammatory diseases.²² The anti-inflammatory effectiveness of the watery portion of *P. pinnata* stem bark in acute and chronic inflammation sculpts was examined using albino rats. Oral administration of *Pongamia pinnata* stem bark (PPSB) (400, 800 mg/kg) demonstrated strong anti-inflammatory action in both severe carrageenin-induced rear mitt edoema and chronic (cotton pellet granuloma) inflammation forms. The PPSB is an effective anti-inflammatory drug that is not ulcerogenic.²³

• **Antiviral property** enhance their lipid peroxidation, antioxidant status, or blood glucose levels. The PPEt could therefore be used as a safe high blood sugar treatment choice for diabetic patients. The liquid seed extract was coarse and had antiviral properties. At concentrations of 1 and 20 mg/ml (w/v), respectively, it completely inhibited the development of HSV type-1 and type-2 and had no cytopathic effect. A crude extract of desiccated leaves had no effect on the rotavirus. Extensive and ongoing toxicological tests on Swiss albino rats showed that *P. pinnata* seed fraction offers protection.²⁴ The conflict between the White Spot Syndrome Virus of *Penaeus monodon* Fabricius and the virus of bis (2-

methyl heptyl) phthalate isolated from *P. pinnata* leaves was investigated. The effects of an ethanol fraction of *P. pinnata* flowers on lipid peroxidation and activity against elevated blood sugar levels were investigated in control and alloxan-induced diabetic rats. By mouth administering *P. pinnata* flowers with an ethanol concentration of 300 mg/kg BW, diabetic rats given alloxan had significant effects against elevated blood sugar levels, anti-lipid peroxidative effects, and antioxidant defence system enhancement effects. On the other hand, standard rats treated with *P. pinnata* leaf extract (PPEt) alone did not significantly

- **Biofuel from *Pongamia pinnata*** *P. pinnata* seed oil as a biofuel has physical characteristics that are very similar to those of regular gasoline. As opposed to conventional gasoline, biofuel has cleaner emission characteristics. It produces less poisonous burn and dust because it doesn't contain polyaromatic composites. It will be necessary for the petroleum diesel produced by Indian facilities to have a very low sulphur content (350 ppm) and a high cetane rating of at least 51. Biofuel satisfies these two important criteria and might lessen the oily of short-sulfur (0.13% to 0.16%) diesel. For petroleum diesel, the current flashpoint requirement is 350°C, which is lower than the world average of >550°C. A safety requirement, raising the flashpoint with biofuel can help.

- **Hepatoprotective property**:- PPEt's hepatoprotective properties were studied while ammonium chloride-induced hyperammonemia was present. Ammonium chloride-managed rats had significantly increased levels of bilirubin, urea, aspartate transaminase, alanine transaminase, alkaline phosphatase, lactate dehydrogenase, gamma-glutamyl transferase, thiobarbituric acid reactive substances, and haptoglobin. These amounts were lower in animals that had received PPEt. The ability of PPEt to become free of harmful substances overload urea, creatinine, and ammonia, as well as its free radical hunting properties by decreasing lipid peroxidation and the presence of common antioxidants, may be attributed to its ability to become free of harmful substances overload and provide hepatoprotection in experimental hyperammonemia.

- **Anti-diarrheal property** :-The antimicrobial effectiveness of a straightforward decoction made from dehydrated leaves of *P. pinnata* was investigated, as well as its impact on the presence of enteroinvasive *E. coli* and *Shigella flexneri* that attack epithelial cells and produce toxins that are harmful to the digestive system (cholera toxin, stable *E. coli* toxin, and labile *E. coli* toxin). *P. pinnata* was heated or boiled to produce a concentrated liquid, but this liquid lacked any antibacterial, anti-giardiasis, or anti-rotaviral characteristics. However, it did lessen the generation of cholera poison and the invasion of epithelial cells by bacteria. As a consequence, it seems ineffective against diarrhoea brought on by viruses and protozoa as well as by toxins. It turns out to be particularly effective against bacterial diarrhoea and enteroinvasive bacterial strains that produce periods of bloody diarrhoea. These results support their historical use as an anti-diarrheal medication.

- **Efficacy against lice** Research into novel anti-lice mediators for therapeutic plants was spurred on by the increasing pattern of pediculocidal drug resistance to head louse infestations. Various *P. pinnata* leaf extracts were tried on the head louse, *Pediculus humanus capitis*, during the lessons. The outcomes demonstrated that PPEt mixed with methanol extract had mild pediculocidal effects.

- **Anti-ulcer property**:-The *P. pinnata* methanol root extract has been shown to significantly guard against aspirin-induced mucosal damage after 10 days of treatment and may lessen ulcers brought on by acetic acid. When mucosal protection factors like mucin secretion, mucosal cell glycoproteins, mucosal cell life span, cell proliferation, and lipid peroxidation prevention were inhibited, the extract showed ulcer-protective benefits.

- Antimicrobial, antioxidant, and wound healing properties Wistar rodents were used to examine the antimicrobial, antioxidant, and wound-healing abilities of *P. pinnata*. *P. pinnata* has shown improved lesion reduction and tensile strength in methanol extracts of its leaves, as well as higher hexosamine and hydroxyproline content, antioxidant activity, and reasonable action against microorganisms.

- **Cardioprotective property**:-The cardioprotective effectiveness of *P. pinnata* was examined by the writers using streptozotocin-nicotinamide in diabetic rats. The writers looked at how the petroleum ether fraction of *P. pinnata* stem howl affected diabetic rats' cardiomyopathy.

- **Antipyretic and antinociceptive activity** :-*P. pinnata*'s foliage have antinociceptive and antipyretic qualities. To test the effectiveness of a 70% ethanolic portion of *P. pinnata* leaves in various pain models, the author used rats and mice as test subjects. Rats with fever caused by Brewer's yeast were also used to evaluate *P. pinnata* leaf extract for its ability to reduce fever. It was discovered that the preparation of *P. pinnata* leaves had powerful antinociceptive and commotion-reducing properties.

- **Antibacterial property** :-*P. pinnata* leaf chloroform fraction had antibacterial activity that was above average against *E. coli*, *Pseudomonas aeruginosa* (*P. aeruginosa*), and *Staphylococcus aureus* (*S. aureus*), whereas acetone fraction had antibacterial activity that was stronger than usual against *P. aeruginosa* and *E. coli*. As compared to the standard, the petroleum ether fraction did not exhibit a significant antibacterial effect.

- **Neuroprotective activity** :- The current research discovered that an ethanol extract of the stem bark of *P. pinnata* shields rats from neurotoxicity brought on by monosodium glutamate. Neurotoxicity was brought on by administering monosodium glutamate intraperitoneally (IP) at a rate of 2 g/kg body weight (BW)/day for 7 days. *P. pinnata* stem bark ethanolic fraction (200 and 400 mg/kg) was administered orally after 1 hour of monosodium glutamate therapy. For contrast, dextromethorphan (30 mg/kg orally) was used as the standard drug. According to a study, albino rats significantly benefit from the neuroprotective effects of the ethanolic extract of *P. pinnata* plant stem bark.
- **Anticonvulsant property**:- Scientists examined the anticonvulsant potency of the petroleum ether fraction of *P. pinnata* branch growl and its components in lab animals. Using the petroleum ether portion of *P. pinnata* branch growl, it was possible to study the effects of picrotoxin, pentylenetetrazol, strychnine, maximal electroshock, and isoniazid on mice. Petroleum ether extract from the stem bark of *P. pinnata* was discovered to have a potent anticonvulsant action.
- **Anti-diabetic property**:-Giving an ethanol fraction of *P. pinnata* blossoms orally to diabetic rats induced by alloxan had significant antihyperglycemic effects, bringing blood sugar levels down to a level similar to that of the prescription drug glibenclamide (glyburide) (600 mg/kg BW). The watery portion of the flower had potent antihyperglycemic effects and significantly raised plasma insulin levels. In alloxan-induced hyperglycemic rodents, the fraction also regulated glucose-6-phosphatase and hexokinase activities.

Sr.No.	Plant part used	Activity Done
1	Roots	<ul style="list-style-type: none"> • Anti-Nociceptive activity • Anti-Helminthic activity • Vaginal infections • Skin diseases • Gonorrhea
2	Stem	<ul style="list-style-type: none"> • Anti-pyretic activity • CNS sedative
3	Bark	<ul style="list-style-type: none"> • Swelling of the spleen • Mental disorder • Bleeding piles • Beriberi • Cough and cold
4	Leaves	<ul style="list-style-type: none"> • Anti-diarrhoeal action • Anti-lice Activity • Dyspepsia • Anti-viral activity • Anti-filarial activity • Anti-microbial activity Gonorrhea • Leprosy • Anti-inflammatory activity Anti-pyretic action
5	Flowers	<ul style="list-style-type: none"> • Anti-hyperammonemic activity • Anti-oxidant activity • Bleeding pile • Anti-hyperglycemic activity • Anti-lipidperoxidative activity
6	Oil	<ul style="list-style-type: none"> • Leprosy • Ulcers • Liver pain • Piles • Rheumatism arthritis Scabies • Chronic fever • Whooping cough • Anti-fungal activity • Anti-bacterial activity • Anti helminthic
7	Fruits	<ul style="list-style-type: none"> • Female genital tract • Leprosy • Tumour

		<ul style="list-style-type: none"> • Piles • Ulcers • Anti-filarial activity • Abdominal tumors
8	Seeds	<ul style="list-style-type: none"> • Bronchitis • Whooping cough • Inflammations • Nootropic activity • Rheumatic arthritis. • Hypertension • Skin ailments • Chronic fevers • Hemorrhoids • Anemia • Pectoral diseases

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