

A REVIEW ON PONGAMIA PINNATA OF CLASSICAL USES, CHEMICAL CONSTITUENTS AND CURATIVE PROPERTIES

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ABSTRACT

The ancient system of medicines like Ayurveda and Unani consists of a huge number of plant and their parts with various medicinal and pharmacological significance. The *Pongamia pinnata*, it is generally known as ‘Karanj’. It has also known as Karanja (Hindi), Indian Beech (English), Sager Goti (Marathi), and Pongam (Tamil). The *Pongamia pinnata* has been acknowledged in several traditional medical systems for the treatment of a variety of human ailments. Flavonoids and fixed oil constitute the majority of the phytoconstituents found in them. The seed oil is used for ulcers, rheumatism, and scabies. Leaves are used against *Micrococcus*

infections like diarrhoea, plasmodial (*P. falciparum*), gonorrhoea, and leprosy. Bleeding piles are treated with bark. The *Pongamia pinnata* plant is utilized for anti-inflammatory, anti-viral purposes, anti-nociceptive, anti-hyperglycaemic, anti-lipid oxidative, and anti-oxidant in traditional systems of medicines such as Ayurveda and Unani.

KEYWORDS: Karanj, *Pongamia pinnata*, Chemical constituents, Curative properties.

INTRODUCTION

On a worldwide scale, traditional medicines play a vital role in the treatment of health issues. Both in contemporary and traditional medicine, medicinal herbs continue to deliver essential therapeutic ingredients. *Pongamia pinnata* (Linn.) Pierre is a medium-sized glabrous tree known in Hindi as Karanja, English as Indian Beech, Marathi as Sager Goti, and Tamil as Pongam.^[1] *Pongamia pinnata* [Synonyms: *Derris indica* (Lam.) Bennett, *Millettia novoguineensis* Kane and Hat, *Pongamia glabra* Vent., *Pongamia pinnata* Merr] belonging to the family Fabaceae (Papilionaceae).^[2] During the months of March and April, the 'Pongam Tree'

appears to be painted in red for about a week as the buds turn into wilting, new leaves, and just as the leaves begin to mature, the tree becomes a beautiful shining lime green colour. The 'Pongam Tree' is becoming one of India's most admired city trees, being grown in a significant number of gardens and along endless highways. It grows wild in coastal forests around India, as well as alongside streams and rivers. The 'Pongam Tree' is a fast-growing medium-sized tree. The bark is tough and greyish brown in colour. In this tree, fresh leaves emerge and flowers blossom in large numbers practically simultaneously. They stay partially concealed among the leaves. The flowers are around 1.3cm long and cluster at the ends of the long stalks. These stems emerge from the leaf's top angle. The blooms are on a short stalk. They have a calyx that is cup-shaped and is loose and brown in colour. There are five white petals that are outlined in pink or violet. The leaves range in length from 15 to 30 cm, with each leaflet having a short stem.^[3]



Fig. 1. Flower and Leaf of *P. pinnata*.



Fig. 2: Seeds of *P. pinnata*.

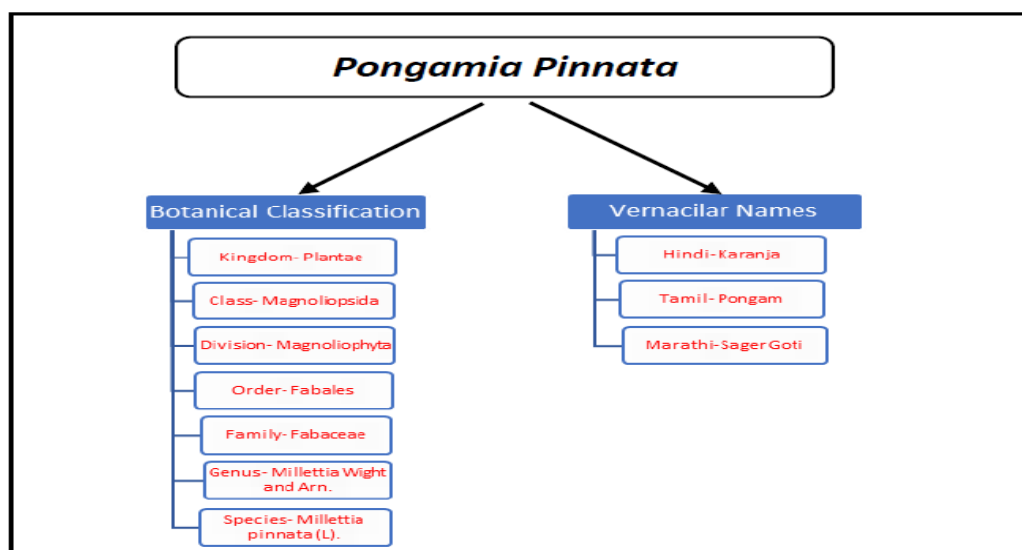


Fig. 3: Botanical Classification and Vernacular names of *pongamia pinnata*.

Classical uses

Pongamia pinnata has been used to treat tumours, piles, skin problems, and ulcers as a crude medicine. The root can be used to cure gonorrhoea, clean gums, teeth, and ulcers, as well as treat vaginal and skin problems. The seed oil is used for a variety of ailments, including ulcers, rheumatism, leucoderma, and scabies.^[4] Various components of the plant have been used in traditional medicine to treat bronchitis, whooping cough, rheumatic joints, and dipsia in diabetic patients. A medicinal wash made from the leaves is used to relieve rheumatic pain and clean ulcers in gonorrhoea and scrofulous enlargement. Karanja seed is utilised as a medicinal herb in India, notably in the Ayurvedic and Siddha medical systems. *Micrococcus* is inhibited by the leaves.^[5] In the central nervous system, watery fractions of stem howl contain qualities that promote calm or induce sleep, as well as anti-fever capabilities. Abdominal tumours, female genital system disorders, leprosy, malignancies, masses, ulcers, and wind blowing upward in the abdomen are all treated with fruits. Dehydrated flowers in leftovers are blended with other ingredients and administered as a decoction to alleviate thirst in diabetes. High blood sugar, indigestion, and bleeding piles are all symptoms of this herb.^[6]

Chemical constituents

Flavonoid derivatives (flavones, flavans, and chalcones) were isolated from *Pongamia pinnata* phytochemical research. A sesquiterpene, diterpene, triterpenes, steroids, amino acid derivatives, disaccharide, fatty acids, and esters were found in this species.^[4] Demethoxykanugin, gamatay, glabrin, glabrosaponin, kanjone, kaempferol, karangin, kanugin, quercitin, pinnatin, neoglabrin, pongamol, pongapin, b-sitosterol, saponin, and tannin are some of the alkaloids found in *Pongamia pinnata*.^[7] Seeds have yielded karangin, pongagalabrone, pongapin, pinnatin, and kanjone. Flavones and chalcone derivatives such as Pongone, Galbone, Pongalbol, and Pongagallone A and B are found in the plant's leaves and stem. *Pongamia pinnata* stems were used to isolate and characterise five flavonoids known as pongamones A-E. *Pongamia pinnata* fruits include three novel furnoflavanoid glucosides, pongamosides A-C, as well as pongamoside D, a new flavanol glucoside.^[8] Further research into the flavonoid contents of *P. pinnata* from Japan resulted in the extraction of 18 flavonoid compounds from its root bark, including nine novel ones called pongamones III-XI. (2S)-3',4'-dimethoxy was found to be the novel structure. The structures were determined to be (2S)-3',4'-dimethoxy-6'',6''-dimethylpyrano[2'',3'':7,8]- flavanone (III), (2S)-6,3',4'-trimethoxy-6' '6' ' - dimethylpyrano [2'',3''7,8]- β avanone (IV), (2S)-7-methoxy6-O-γ,γ-dimethylallyl-3',4'-methylenedioxyβ avanone (V), 2'- hydroxy-3,4,5'-trimethoxy-6'',6''-

dimethylpyrano[2''3'':4'3'] chalcone (VI), 2',4'-dimethoxy-3,4-methylene dioxydihydrochalcone (VII), 2',5', β -trimethoxy-3,4-methylenedioxy-6'',6''-dimethylpyrano[2'',3'':4',3'] dihydrochalcone (VIII), 2, β -dimethoxy-3,4-methylenedioxy-furano[2'',3'':4',3']-dihydrochalcone (IX), β hydroxy-2',4',6'-trimethoxy-3,4-methylenedioxychalcone (X) and 3-methoxy-furano-[2'',3'':7,6] flavone (XI), by spectrum analysis and synthesis, respectively.^[2]

Formulations

1. Ointment cream for sun protective activity

It is reported that Ellagic acid (polyphenol) and Karanjin (flavonoid) is liable for the ointment activity of pomegranate and *P. pinnata* severally. Ellagic acid was used as a regular marker for pomegranate and Karanjin was a regular marker for *P. pinnata*. The developed ointment cream has shown sensible Photoprotective activity. The RF values of standards were zero.23 for Ellagic acid and zero.6 for Karanjin.^[9]

2. Deliquescent gel for Bactericidal and Wound healing properties

Synthesis of AgNPs was achieved by inexperienced technique exploitation methanolic seed extract of *P. pinnata*, and also the ready AgNPs were characterised for inhibitor potential and medication activity against unhealthful microorganisms. Further, the AgNPs were loaded during a deliquescent gel and tested for wound healing activity against a marketed formulation. Methanolic seed extract showed smart medication activity against *S. aureus*, *B. subtilis* and *E. coli* as reportable within the literature for AgNPs, silver and silver ions. The anti-inflammatory properties of the AgNPs promote wound healing by reducing protein unleash and decreasing leucocyte and mastocyte infiltration. All elements of *P. pinnata* are wide utilized in ancient medication to treat a broad spectrum of diseases and wounds.^[10]

3. Herbal gel for antipsoriatic activity

Pongamia pinnata hydroalcoholic leaf extract was first submitted to phytochemical screening and phytoconstituent identification. Using Carbopol 934 as a gelling agent, herbal gel containing *Pongamia pinnata* extracts was synthesized. The mouse model for psoriasis caused by imiquimod indicated strong anti-psoriatic efficacy.^[11]

Curative properties

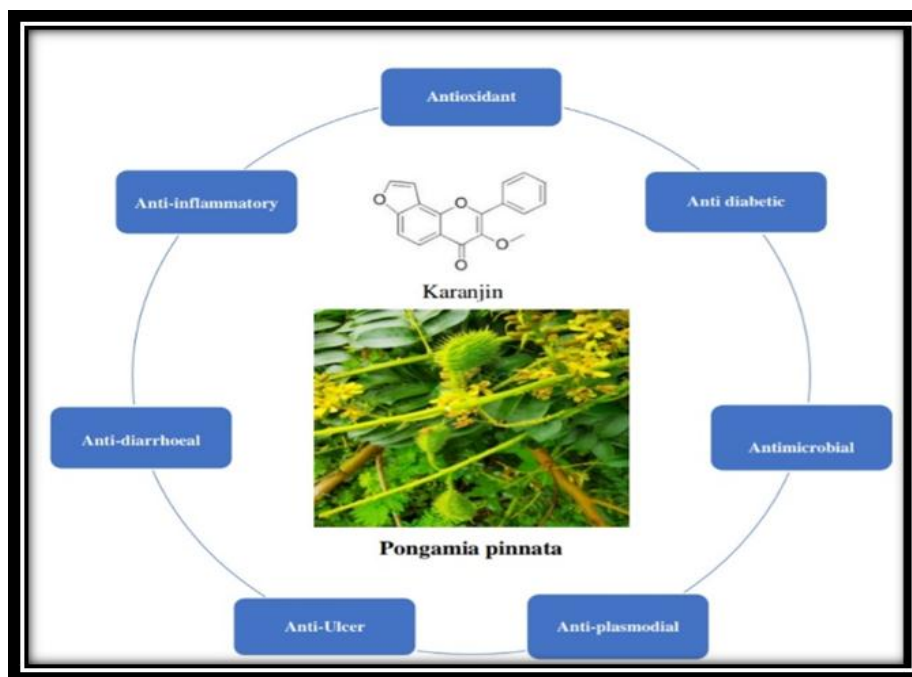


Fig. 4: Curative properties of pongamia pinnata.

1. Antioxidant activity

By assessing the amount of oxidative damage as well as antioxidant status during ammonium chloride-induced hyperammonaemia, the preventive function of *Pongamia pinnata* leaf extract was investigated.^[12] The chemical contents of this plant may be linked to its antioxidant properties. Several chemicals present in this species have been shown to have antioxidant properties. In many trials, four flavones, a chalcone, two triterpenes, and an aromatic carboxylic acid showed considerable antioxidant activity.^[13] As indicated by the normalisation of lipid peroxidation and antioxidant enzyme (i.e., catalase, peroxidase, and superoxide dismutase) levels, a marker molecule of this species prevented oxidative stress^[14]. The effect of *Pongamia* leaf extract on circulatory lipid peroxidation was evaluated in ammonium chloride – induced hyper ammonium rats. Increased lipid peroxidation in the circulatory ammonium chloride – treated rats was accounted for by a significant decrease in the levels of vitamin-C, vitamin-E reduced glutathione peroxidase, superoxide dismutase, catalase. PPEt regulates chloride-induced hyperammonemia by rectifying the oxidant–antioxidant imbalance, which might be related to its antihyperammonemia impact via detoxification of excess ammonia, urea, and creatinine, as well as its antioxidant function.^[15]

2. Anti-inflammatory activity

It has been reported that a 70% ethanolic extract of *P. pinnata* leaves has substantial anti-inflammatory action against various stages of inflammation (acute, subacute, and chronic) with no negative effects on the stomach mucosa. They also discovered that the extract had a significant anti-pyretic effect against Brewer's yeast-induced pyrexia.^[16] In carrageenin and PGE1 induced oedema models, root extracts demonstrated considerable anti-inflammatory effect (relative to phenylbutazone). Prostaglandin inhibition, particularly by ethanolic and acetate extracts, was suggested as a possible mechanism of action. The petroleum ether extract of *Pongamia pinnata* seeds had a powerful anti-inflammatory impact in the short term, however the aqueous solution had pro-inflammatory effects. Further research found that the bradykinin-induced oedema model had the greatest anti-inflammatory impact.^[17]

3. Anti-plasmodial activity

P. pinnata has been identified as one of the plants with anti-plasmodial action against *Plasmodium falciparum*.^[18] The bark and leaf extract, which has low IC50 values of 9-43 mcg/ml and anti-plasmodial activity, has been demonstrated to have anti-malaria potential. This action might be attributable to the presence of lupeol (120), which had an IC50 of 1.5 mcg/ml and prevented *Plasmodium falciparum* merozoites from invading erythrocytes. It also showed that an IC90 of 100 mcg/ml inhibited the development of *Trypanosoma cruzi* and *Leishmania* parasites.^[19]

4. Anti-diarrhoeal activity

More than 1.31 million individuals have died as a result of diarrhoea over the world. In impoverished nations, diarrhoea is a leading cause of death and morbidity.^[20] Dehydration, caused by the loss of electrolytes in diarrheal stools, is the leading cause of mortality from diarrhoea.^[21] The antimicrobial efficacy of a crude decoction of dried *P. pinnata* leaves was assessed, as well as its effect on the production and action of enterotoxins (Cholera toxin, *Escherichia coli* labile toxin, and *E. coli* stable toxin) and the adherence of enteropathogenic *E. coli*, enteroinvasive *E. coli*, and *Shigella flexneri* to epithelial cells. The decoction inhibited cholera toxin synthesis and bacterial penetration of epithelial cells. The results showed that the decoction of *P. pinnata* had a selective anti-diarrheal effect.^[22]

5. Anti-hyperglycaemic & Anti-lipid peroxidative activity

In alloxan-induced diabetic rats, oral treatment of ethanolic extract of *P. pinnata* flower has been shown to have a significant anti-hyperglycaemic and anti-lipid peroxidative impact, as

well as an elevation in antioxidant defence system. These findings showed that *P. pinnata* extract might be utilised as a safe anti-hyperglycaemic option for diabetic patients^[15]. Oral treatment of the ethanolic extract of the flower (300mg/kg bw) exhibited considerable antihyperglycemic action, lowering blood glucose levels to a similar extent as the reference medication glibenclamide (600microgram/kg bw).^[23]

6. Antimicrobial activity

Petroleum ether and ethyl acetate were used to extract the plant elements leaves, bark, and seeds in order. Disc diffusion was used to evaluate the extracts for antibacterial activity against *Bacillus subtilis*, *S. aureus*, *E. coli*, *Pseudomonas aeruginosa*, and *C. albicans*. And the extract has a significant inhibitory zone^[24]. Wagh et al. used the Minimum Inhibitory Concentration (MIC) determination and dry-weight method to test the antifungal and antibacterial activity of different concentrations of oil obtained from *Pongamia pinnata* against *A. niger*, *A. fumigatus*, *S. aureus*, and *P. aeruginosa*. Gas chromatography (GC) and gas chromatography/mass spectrometry (GC-MS) study of oil revealed the presence of fatty acid. They proposed using the plant's fatty oil to generate antibacterial medicines derived from plants.^[25]

7. Anti-Ulcer activity

After 10-days of therapy, a methanolic extract of *P. pinnata* roots showed considerable protection against aspirin-induced mucosal damage and a potential to reduce acetic-acid-induced ulcer. With the cessation of mucosal defence factors such mucin secretion, mucosal cell life span, mucosal cell glycoproteins, cell proliferation, and lipid peroxidation prevention, the extract displayed ulcer preventive effects.^[26] The extract had a dose-dependent (12.5-50mg/kg for 5 days) ulcer-protective efficacy against stomach ulcers caused by 2h cold resistance stress when given orally.^[27]

CONCLUSION

Pongamia pinnata has been wide utilized as a therapeutic agent in ancient Ayurvedic and Unani drugs for variety of diseases. The genus *Pongamia Pinnata* plant is used for its inhibitor, anti-inflammatory drug, anti-plasmodial, anti-diarrhoeal, anti-diabetic, antimicrobial, and anti-ulcer properties, etc. This promising plant will require extensive study in the areas of characterisation and standardisation in order to create its many formulations, which might be useful to both people and animals. Genus *Pongamia Pinnata* L. may be a vital

versatile medicative plant with a varied medical specialty spectrum that will be used for the good thing about world, in keeping with a comprehensive literature review.

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