

A Review on “Pharmacognosy and Phytochemistry of Pongamia Glabra and Syzygium Cumini”

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Date Of Submission: 01-04-2021

Date Of Acceptance: 14-04-2021

ABSTRACT: Polyherbes or natural medicine have been used to treat human and veterinary since the ancient time and the success of modern medicine largely depends on drug obtain from natural resources such as herbs, marine source etc. Phytochemicals are biologically active compounds extracts from herbs, which provide a better health for humans. Pongamia glabra [family: Leguminosae] is a medium sized glabrous tree commonly known as karanj. Extracts of pongamia glabra possess significant anti-diarrhoeal, anti-fungal, anti-plasmodial, anti-ulcerogenic, anti-inflammatory, analgesic and anti-dieabetic activities. Syzygium cumini [Family: myrtaceae] is commonly known as jamun in India. The pharmacological activites found in the fruits of syzygium cumini are anti-diabetic, antihyperlipidaemic, antioxidant, antiulcer, hepatoprotective, antiallergic, antiarthritic, antimicrobial, anti-inflammatory, antifertility, antipyretic, antiplaque, radioprotective, neuropsychopharmacological, nephroprotective and anti-diarrhoeal activity. This review paper gives an overview of pharmacognosy, phytochemistry and pharmacological activities of pongamia glabra and syzygium cumini.

Keywords: Pharmacognosy, Phytochemical, Polyherbs.

I. INTRODUCTION:

Plants produce a widevariety of compounds that can act on different systems of the body and have hightherapeutic activity. More than 2,40,000 plants are considered to be growing indifferent parts of the world. Only about 5-10 percent of them have been screenedfor chemical or biological activity. Herbal medicine cures the root cause of adisease and not merely providing symptomatic relief, as does the modernsynthetic medicine. Thus, traditional medicine not only cures but also rejuvenatesthe body’s defense system. The medicine and aromatic plants sector hastraditionally occupied an important position in

the socio-cultural, spiritual andmedicinal arena of rural and tribal lives of India .^[1]

1.1. Pharmacognosy:

Pharmacognosy, known initially as materia medica, may be defined as the study of crude drugs obtained from plants, animals and mineral kingdom and their constituents. There is a historical misinformation about who created the term pharmacognosy. According to some sources, it was C. A. Seydler, a medical student at Halle, Germany, in 1815; he wrote his doctoral thesis titled Analectica Pharmacognostica. However, recent historical research has found an earlier usage of this term. The physician J. A. Schmidt (Vienna) used that one in his Lehrbuch der materia medica in 1811, to describe the study of medicinal plants and their properties. The word pharmacognosy is derived from two Latin words pharmakon, ‘a drug,’ and gignoso, ‘to acquire knowledge of’. It means ‘knowledge or science of drugs’.^[2]

1.2. Phytochemistry:

Phytochemicals (from the Greek word phyto, meaning plant) are biologically active, naturally occurring chemical compounds found in plants, which provide health benefits for humans further than those attributed to macronutrients and micronutrients. They protect plants from disease and damage and contribute to the plant’s color, aroma and flavor. In general, the plant chemicals that protect plant cells from environmental hazards such as pollution, stress, drought, UV exposure and pathogenic attack are called as phytochemicals.^[3]

II. PONGAMIA GLABRA:

A genus Pongamia of probably 2 species sometimes included as a section Pongamia (Adans.) J. Bennet in larger genus Derris. It is recognized by its panicles of white or pink flowers and round, seeded fruit. The two species like Pongamia glabra, Pongamia velutina in tropical Asia in coastal environments, including mangal, but it is also recorded inland to altitudes of over

500m1. Pongamia is a medium size, nitrogen fixing tree native to India, Indonesia, Malaysia, and Myanmar. It has been successfully introduced to humid tropic lowland worldwide and to parts of Australia, China, New Zealand and United States. Pongamia trees are legumes so it helps in replenish soil nitrogen. The pongamia growth is estimated at more than 1 million hectares each in India and Philippines, more than 3 million hectares in Myanmar and more than 5 million hectares in Indonesia. Since Pongamia glabra(Linn.) Pierre has a vast use in the medical field and as biofuel some of its chemical and Pharmacological properties.^[4]

The seeds are antihelmintic, bitter, acrid, haematinic and carminative. They are useful in inflammation, chronic fevers, anaemia and hemorrhoids. The oil is antihelmintic, styptic and recommended for ophthalmia, leprosy, ulcers, herpes and lumbago. Its oil is a source of biodiesel.^[5]

Extract of the plant possesses significant anti-diarrhoeal, anti-fungal, anti-plasmodial, anti-ulcerogenic, antiinflammatorcy, anti-noniceptive, anti-hyperglycaemics, anti-lipoxidative, anti-hyperammonic, anti-oxidant and analgesic activities.^[6]

The anti-inflammatory activity of the test compound was determined by mice paw edema inhibition method. The analgesic activity was determined by both acetic acid induced writhing and tail immersion methods.^[7]

2.1. Taxonomical classification:

- Kingdom - Plantae
- Subkingdom – Tracheobionta
- Super division - Spermatophyta
- Division - Magnoliophyta
- Class – Magnoliopsida
- Subclass - Rosidae
- Family - Fabaceae
- Genus - Pongamia
- Species –glabra

2.2. Botanical Description of Pongamia glabra:

A medium sized semi evergreen glabrous tree with a short bole and spreading crown upto 18 m or more in height . P. glabra is a fast-growing tree which reaches 40 feet in height and spread, forming a broad, spreading canopy casting moderate shade.

- **Root:** Taproot is thick and long, lateral roots are numerous and well developed.
- **Leaf:** very often mottled with dark brown dots, specks, lines or streak; leaves compound, leaflets 5-7 ovate, acuminate or elliptic; fruits

thick, woody, smooth, compressed, with a short curved beak. Alternate, odd pinnately compound, 2 to 4 inches, evergreen, hairless.

- **Flower:** Flowers lilac or pinkish white, Lavender, fragrant, in axillary racemes 2-4 together, short-stalked, pea shaped, 15-18mm long
- **Pods :** 3-6cm long and 2-3cm wide, smooth, brown, thick-walled, hard, indehiscent, 1-2 seeded.
- **Seed:** Compressed ovoid or elliptical, bean-like, 10-15cm long, dark brown, oily. Seeds 1 or 2 per pod, reniform to nearly round, smooth or wrinkled, testa reddish brown leathery.
- **Bark:** Thin gray to grayish brown and yellow on the inside.^[8]

2.3. Traditional Uses:

- The seed-oil of Pongamia glabra possesses medicinal properties and used in itches, abscess and other skin diseases.
- Flowers are prescribed for glycosuria and as a remedy for diabetes.
- The bark is used internally for bleeding piles, beriberi and diabetes and anti- hepato-protective activity as an antimicrobial.
- Karanja seed is used as a medicinal plant, particularly with the Ayurvedic and Sidda medicine systems of India. Crude seed extraction completely inhibit the growth of herpes simplex virus type 1 and type 2 in Vero cells and also possesses hypoglycemic, anti-oxidative, anti-ulcerogenic, anti- inflammatory and analgesic properties.
- Different parts of the plant have been used in traditional medicines for bronchitis, whooping cough, rheumatic and to quench dipsia in diabetes.
- The leaves are hot, digestive, laxative, anti-helminthic and cure piles,wounds and other inflammations. A hot infusion of leaves is used as a medicated bath for relieving rheumatic pains and for cleaning ulcers in gonorrhoea and scrofulous enlargement.^[9]

2.4. Pharmacological activities of pongamia glabra:

- ❖ **Anti-inflammatory Activity:** It has been reported that 70% ethanolic extract of P. glabra leaves has potent anti-inflammatory activity against different phases (acute, subacute and chronic) of inflammation without side effect on gastric mucosa. They also observed significant anti-pyretic action of the extract against Brewerís yeast-induced pyrexia.

- ❖ **Anti-plasmodial Activity:** It has been reported that *P. glabra* is one of the plant, which shows anti-plasmodial activity against *Plasmodium falciparum*. Chopade, et al.: *Pongamia glabra*: Phytochemical constituents, traditional uses and pharmacological properties | April-June 2008 | International Journal of Green Pharmacy 74
- ❖ **Antioxidant and Anti-hyperammonemic Activity:** It has been observed that effect of *P. glabra* leaf extract on circulatory lipid peroxidation and antioxidant status was evaluated in ammonium chloride-induced hyperammonium rats. It enhanced lipid peroxidation in the circulation of ammonium chloride-treated rats was accompanied by a significant decrease in the levels of vitamin A, vitamin C, vitamin E-reduced glutathione, glutathione peroxidase, superoxide dismutase and catalase. It showed that PPET modulates these changes by reversing the oxidant-antioxidant imbalance during ammonium chloride-induced hyperammonemia and this could be due to its anti-hyperammonemic effect by means of detoxifying excess ammonia, urea and creatinine and antioxidant property.
- ❖ **Anti-diarrhoeal Activity:** It has been evaluated that anti-microbial effect of crude decoction of dried leaves of *P. glabra* and also evaluated its effect on production and action of enterotoxins (*Cholera* toxin, *Escherichia coli* labile toxin and *E. coli* stable toxin) and adherence of enteropathogenic *E. coli* and invasion of enteroinvasive *E. coli* and *Shigella flexneri* to epithelial cells. The decoction had no anti-bacterial, anti-giardial, and anti-rotaviral activities, but reduced production of cholera toxin and bacterial invasion to epithelial cells. The observed result indicated that decoction of *P. glabra* has selective anti-diarrhoeal action with efficacy against cholera and enteroinvasive bacterial strains causing bloody diarrhoeal episode.
- ❖ **Anti-ulcer Activity:** It has been reported that methanolic extract of *P. glabra* roots showed significant protection against aspirin and 4 h PL, but not against ethanol-induced ulceration. It showed tendency to decrease acetic acid-induced ulcer after 10-day treatment. Ulcer protective effect of PPRM was due to augmentation of mucosal defensive factors such as mucin secretion, life span of mucosal cells, mucosal cell glycoproteins, cell proliferation and prevention of lipid per

oxidation rather than on the offensive acid-pepsin secretion.

- ❖ **Anti-hyperglycaemic and Anti-lipidperoxidative Activity:** It has been reported that oral administration of ethanolic extract of *P. glabra* flower shows significant anti-hyperglycaemic and anti-lipidperoxidative effect and enhancement in antioxidant defense system in alloxan-induced diabetic rats. These results suggested that the treatment of *P. glabra* extract could be used as a safe alternative anti-hyperglycaemic drug for diabetic patients.^[10]

III. SYZYCIUM CUMINI :

Syzygium is the largest genus of Myrtaceae with an estimated 1,200 species in the world. *Syzygium* was placed in the sixteenth in rank among 57 largest genera of flowering plants or possibly higher, within the top ten according to, on the basis that many novel species are yet to be discovered and many validly described species await transfer to *Syzygium*. This is a paleotropical genus with a wide range of occurrence mainly in Southern and South-eastern Asia, Southern China, Australia, Malesia and New Caledonia. Some species occur in East Africa, Madagascar, the Mascarenes, South Western Pacific islands, Taiwan and Southern Japan. The centre of diversity is in Malesia but its basic evolutionary diversity is in the Melanesian-Australian region.^[11]

3.1. Taxonomical classification of *syzygium cumini*:

- Kingdom : Plantae
- Unranked : Angiosperms
- Unranked : Eudicots
- Unranked : Rosids
- Order : Myrtales
- Family : Myrtaceae
- Genus : *Syzygium*
- Species : *Cumini*
- Binomial name : *Syzygium cumini* (L) Skeels.

3.2. Ayurvedic properties

- Rasa - Kasaya , Madhura ,Amla.
- Virya - Sita
- Guna - Laghu, Ruksa.
- Vipala - Madhura , Katu.
- Karma – Vatala, Pittahara, Kaphahara, Vistambhi, Grahi

3.3. Distribution and Habitat: The original home of *Syzygium cumini* is India or the East Indies. It is found in Thailand, Philippines, Madagascar and some other countries. The plant has been successfully introduced into

many other tropical countries such as the West Indies, East and West Africa and some sub tropical regions including Florida, California, Algeria and Israel.^[12]

3.4. Traditional and Medicinal uses:

Entire plant of *Syzygium cumini* such as seed, fruit, leaves, flower, bark used in folk medicine. Charaka used seeds, leaves and fruits in decoctions for diarrhoea and the bark as an astringent. Sushruta prescribed the fruit internally in obesity, in vaginal discharges and menstrual disorders, cold infusion in intrinsic haemorrhage. The bark is astringent, its juice is given (56-112 ml) doses in chronic diarrhoea, dysentery, menorrhagia. Decoction of the bark is an efficacious mouth-wash and gargle for treating spongy gums, stomatitis, relaxed throat and other diseases of mouth. Bark also used for inflammation of skin. The bark is used in dyeing and tanning and for colouring fishnets. According to Ayurveda, its bark is acrid, sweet, digestive, astringent to the bowels, anthelmintic and in good for sore throat, bronchitis , asthma , thirst, biliousness, dysentery, blood impurities and to cure ulcers. The juice of Jambu, Amra and Amalaka leaves mixed with goat milk and honey prescribed in diarrhoea with blood. Leaf juice is taken orally to treat diabetes. The juice is taken mixed with milk every morning. Fresh leaf juice is taken orally for stomach pain. A syrup prepared from the juice of the ripe fruit is a very pleasant drink. Syrup or vinegar prepared from the ripe fruit is useful in spleen enlargement and efficient astringent in chronic diarrhoea. 10 Hot water extract of dried fruits is used for stomach ulcers, reduce acidity and for diabetes. The ethanolic extract of *Syzygium cumini* seeds decreased blood sugar level in alloxan induced diabetic rats.²⁸ Seed powdered in combination with mango kernels were administered with card to overcome problems of diarrhoea and dysentery, enlargement of spleen and seed also having antibacterial activity.^[13]

3.5. Pharmacological activities : *Syzygium cumini* having pharmacological activity like antidiarrhoeal, antioxidant, gastroprotective, antiallergic, astringent, analgesic, anti-inflammatory, antiplatelet, antimicrobial but the most important activity is anti-diabetic.

- **Antioxidant activity :** Various parts of Jamun have been shown to exert antioxidant activity, as indicated by free radical scavenging assays. Moreover, the Jamun leaf and seed extracts have shown a concentration-dependent

increase in the scavenging activity of nitric oxide (NO) free radicals.⁴⁰ The aqueous extract of Jamun fruit skin has been found to scavenge hydroxyl (OH), superoxide (O₂⁻) and DPPH free radicals.

- **Antibacterial and antifungal activity :** Essential oils extracted from the Jamun leaves have been reported to exert antibacterial properties against *Basillus sphaericus*, *Basillus sphaericus*, *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Samonella typhimurium*.²⁶ The hydroalcoholic extract of Jamun leaves was found to be active against *Candida krusei* and antibiotic-resistant bacterial species of *P. aeruginosa*, *Klebsiella pneumoniae* and *S. aureus* in addition to *Enterococcus faecalis*, *E. coli*, *Kocuria rhizophila*, *Neisseria gonorrhoeae*, *P. aeruginosa*, and *Shigella flexneri*. The diethyl ether, methanol and aqueous extracts of Jamun fruit inhibited the growth of *Bacillus cereus*, *Staphylococcus epidermidis*, *Micrococcus luteus* and *Salmonella typhi*, respectively. The ethanol extract of Jamun leaf has been reported to be active against the *Vibrio cholerae* serogroups Ogawa and Inaba.
- **Anti-inflammatory activity:** Jamun has been reported to act as an anti-inflammatory agent, reducing both acute and chronic inflammation . The chloroform seed extract has been reported to inhibit carrageenan (acute), kaolin-carrageenan-induced paw edema in the rats and to also suppress protein exudates, leakage of dye in peritoneal inflammation, and leukocyte migration. Similarly, the aqueous seed extract was found to exert an anti-inflammatory effect against human neutrophils.

Preclinical studies using animal models have shown that the ethanol extract of Jamun stem bark exhibits anti-inflammatory activity, as demonstrated in carrageenan (acute), kaolin-carrageenan (sub-acute) and formaldehyde (sub-acute)-induced paw edema, as well as cotton pellet granuloma (chronic) rat models. The methanol and ethyl acetate seed extracts have shown an anti-inflammatory response in carrageenan-induced rat paw edema. The methanol extracts of Jamun leaves have also been shown to reduce acute and chronic inflammation in carrageenan, histamine and serotonin-induced rat paw edema and cotton pellet-induced rat granuloma studies. In another study, essential oils from the Jamun leaf inhibited

the migration of rat eosinophils, indicating that Jamun leaf possesses anti-inflammatory activity.

- **Antiallergic activity:** The antiallergic effect of aqueous leaf extract of Jamun has been investigated in mice that had been injected with the mast-cell degranulator C48/80 or with ovalbumin (OVA) to induce anaphylaxis edema. Treatments at various doses of Jamun extract was found to reduce the edema; no significant difference was found between the different doses used. The treatment of rats with C48/80 released histamine in peritoneal mast cells, whereas pretreatment with Jamun leaf extract (1 µg/mL) inhibited this allergic reaction in the mast cells. Administration of OVA to BALBc mice induced substantial accumulation of leukocytes, mononuclear cells and eosinophils in the pleural cavity, whereas pretreatment of these mice with Jamun leaf extract at 1 h before the OVA administration significantly suppressed the accumulation of eosinophils in the pleural cavity, indicating its anti-inflammatory action. Moreover, study of the antiallergic effects of aqueous, methanol and methanol fraction of the aqueous extract of Jamun roots revealed that these extracts suppressed clonidine-induced catalepsy in mice by inhibiting the release of histamine triggered by mast cell degranulation. Finally, the administration of different root extracts of Jamun was shown to suppress milk-induced eosinophilia in mice.
- **Hepatoprotective activity** Administration of aqueous leaf extract of Jamun to albino rats for 7 days prior to carbon tetrachloride treatment has been found to be hepatoprotective, as indicated by the alleviation of enhanced levels of aspartate aminotransferase and alanine aminotransferase compared to control rats treated with carbon tetrachloride alone. The fruit extract of Jamun has also been reported to protect rat hepatocytes against carbon tetrachloride-induced toxicity *in vitro*. Similarly, the administration of ethanol extract of Jamun fruit pulp for 8 consecutive days prior to paracetamol treatment has been shown to protect rats against paracetamol-induced hepatotoxicity. The Jamun fruit extract has also been found to reduce bile duct ligation-induced damage to hepatocytes, hepatic fibrosis and macrophage infiltration by reducing lipid peroxidation and mRNA expression of intracellular adhesion molecule (Icam-1) and Chemokine (C-X-C motif) ligand

2 (Cxcl2 genes). The fruit pulp extract of Jamun was also shown to reduce NO production by suppressing iNOS transcription, as well as transcriptional activation of NF-κB.⁶⁸ The aqueous seed extract has been found to protect against liver damage in streptozotocin-induced diabetic rats. In addition, rats administered with seed extract for 14 days prior to carbon tetrachloride administration were protected against the carbon tetrachloride-induced hepatotoxicity. The findings from all of the above studies indicate the hepatoprotective potential of Jamun.

- **Gastroprotective** Tannins extracted from the stem bark of Jamun protect against gastric ulcers in Sprague-Dawley rats induced by oral administration of HCl/ethanol, as indicated by alleviated gastric mucosal damage, reduced free radicals and reduced ulceration of the gastric mucosa.⁷⁰ In addition, the ethanol extract of Jamun seeds has been reported to reduce indomethacin- and ethanol-induced peptic ulcers and acid-pepsin output in the streptozotocin-induced diabetic rats
- **Cardioprotective activity** Cardiovascular disorders represent the number one killer disease in the world, and the different extracts of Jamun have been investigated in diverse preclinical models for their
- **Cardioprotective activity** :Methanol extract of Jamun seeds administered orally at 500 mg/kg daily for 30 days to isoproterenol-treated rats was able to protect against myocardial damage. The ethanol extract of Jamun seed powder administered to Wistar rats for subsequent 15 days at 1 hour before doxorubicin treatment, in a similar fashion, protected cardiac tissues against the doxorubicin-induced cardiotoxicity.
- **Antidiabetic activity** : Diabetes afflicts a large number of the world's population, and Indians are especially prone to it. Despite the fact that this ailment was uncommon in ancient times, Ayurveda pharmacopeia mentions the antidiabetic effect of Jamun, whereby its seed powder is reported to control high blood sugar levels. In the Western world, Jamun has been applied as a treatment to control blood sugar levels for more than 130 years now; however, clinical studies have shown mixed results. While some patients responded well, others did not respond to the treatment at all. The antidiabetic activity of Jamun has also been

investigated in several preclinical animal models, which have demonstrated hypoglycemic effects for the different parts of Jamun .^[14]

IV. DISCUSSION:

The extensive literature survey revealed that *Pongamia glabra* is an important medicinal plant with diverse pharmacological and phytochemical spectrum. The plant shows the presence of many chemical constituents like alkaloids, tannins, steroids, glycosides, demethoxy-kanugin, glabrin, kanugin, karangin, flavonoids and fixed oils which are responsible for varied pharmacological and medicinal properties like Anti-inflammatory activity, Anti-pyretic action, Anti-microbial activity, Anti-diarrhoeal action, Anti-viral activity, Anti-hepato-protective activity, Anti-filarial activity, Dyspepsia, Gonorrhoea, Leprosy, Anti-hyperglycemic activity, Antilipidperoxidative activity, Anti-hyperammonemic activity, Antioxidant activity and Bleeding piles. Furthermore, it also represents a milestone in the field of bio fuel industry as one of the most important bio fuel crop. However, evaluation needs to be carried out on *Pongamia glabra* in order to explore the concealed areas and their practical clinical applications, which can be used for the welfare of the mankind.

The effect of *Syzygium cumini* and its phytochemicals should also be investigated for its anti-diabetic activity and chemopreventive effects in other models of carcinogens, that includes chemical, radiation and viral carcinogenesis models. Mechanistic studies responsible for the chemopreventive and radioprotective effects are also lacking and need to be studied in detail. Based on these facts this review high-lights the role of *Syzygium cumini* seeds in various treatments and recommend that further phytochemical and clinical research should be done on this traditional medicinal plant for the discovery of safer drugs. Studies should also be on understanding which of the phytochemicals are responsible for the observed beneficial effects. Although most of the studies of *Syzygium cumini* as antidiabetic agent with its possible mechanism of action and delaying complications of diabetes such as cataract, neuropathy have been conducted but detailed research on isolation of bioactives through clinical trials followed by standardisation is seriously required to know potential of plant. Most of the pharmacological work was carried out on seeds of

Syzygium cumini but the pharmacological potential of other parts also required to be explore.

V. CONCLUSION:

In recent years of scientific investigations, attention has been drawn to the health promoting activity of plant foods and its active components. Many herbal remedies have been recommended in various medical treatises for the cure of different diseases. *Pongamia glabra* is a multipurpose tree with immense medicinal and economic value. The *Pongamia glabra* is a source of many market formulations due to its various proved Pharmacological actions and of enormous isolated Phytoconstituents. It is a reliable bio fuel and interest must be focused on further development of *Pongamia glabra* as a potent biofuel and many more studies should be done in pharmacognostical part.

Indian literatures like Ayurveda have already mentioned herbal remediation for a number of human ailments. *Syzygium cumini* also having various pharmacological activity such as antidiarrhoeal, astringent, digestive, antibacterial, antioxidant, antiviral but most important activity is antidiabetic. Most pharmacological works on diabetes were carried out with seeds but the pharmacological potential of the other parts of the plant is required to explore in detail. There are several studies have been carried out as an antidiabetic agent with its possible mechanism of action and delaying complications of diabetes such as cataract, neuropathy but detailed research on isolation of bioactives through clinical trials followed by standardization is seriously required to know potential of plant.

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