

PHARMACOLOGICAL REVIEW ON *SPONDIAS PINNATA*: THE INDIAN HOG PLUM

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ABSTRACT

Spondias pinnata is commonly known as Wild mango or Indian hog plum. It is a fruit of an indigenous medicinal plant. This article briefly reviews the classification, common names, cultivation and morphology, botany, general information, constituents, and medicinal uses. This is an attempt to compile and document information on different aspects of *Spondias pinnata* and highlight the need for research and development.

INTRODUCTION

Spondias pinnata is a fruit of an indigenous medicinal plant belongs to the family Anacardiaceae, the cashew family. Anacardiaceae, the sumac family of flowering plants in the order Sapindales, with about 70 genera and 650 species of ever green or deciduous trees, shrubs, and woody vines. It is native to tropical and subtropical areas of the world, but a few species occur in temperate regions. Members of the family have resin ducts in the bark, leaves usually composed of leaflets in various arrangements, flowers often with only male or female parts, and usually fleshy fruits.

Spondias pinnata distributes around 20 countries all over the world and normally in India, Sri Lanka and South East Asian countries. In India it is commonly seen the deciduous to semi evergreen forests of the Western Ghats¹

Spondias pinnata is a glabrous tree upto 10.5 m high with straight trunk and smooth ash coloured bark having pleasant aromatic smell. In Ayurveda, the unripe fruits are believed to destroy "vata", enrich the blood and cures rheumatism. Leaves are glossy, green in color and having a lovely foliage. Green leaf buds are sour in taste and smells similar to the fruit. Stalked compound leaflets of this plant are having 30-40cm long leaflets oppositely arranged on it. The leaves and bark are aromatic, astringent and useful in preventing vomiting, dysentery and diarrhea. The plant is reported to have anti-tubercular properties. The tribes of Orissa use the paste of the bark orally for treating diarrhea in children. The paste is also used in adults for promoting diuresis in the adults. Flowers of this wild mango are very

small in size and come around a long stalk in a group. Small flowers are mainly white in color and stalkless. Fruits are rounded, ovate, elliptic in shape. Pulp of the fruit is sour in taste. It is being cultivated commercially in our country for both local and international market¹.

Used in treatment of obesity, hemorrhagic disease, antivomit, dyspepsia, gonorrhoea, severe cough, aphrodisiac, leprosy, diabetes, diuretic, eye inflammation, Antithirst, antioxidant, antimicrobial, thrombolytic agent, purgative^{2,4}. Fruit is astringent, sour, thermogenic, appetizer and aphrodisiac and is good for rheumatism and sore throat. In Ayurveda, the unripe fruits are believed to destroy "vata", enrich the blood and cures rheumatism. Fruits are very nutritious and rich in vitamin A, minerals and iron content. The bark is useful in dysentery and diarrhea and is also prevent vomiting. The leaves are astringent, aromatic and acidic. The root is considered useful in regulating menstruation. The plant is reported to have antitubercular properties³. Synonyms are *Mangifera pinnata* L.f ; *Spondias mangifera* wild ; *Spondias paniculata* roxb ; *Spondias amara* Lam species.

CLASSIFICATION

Taxonomic hierarchy of the investigated plant:

Kingdom	Plantae
Subkingdom	Tracheobionta
Superdivision	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Sapindales
Family	Anacardiaceae
Genus	<i>Spondias</i> L.

Species *Spondias pinnata* (L.f.)
Kurz

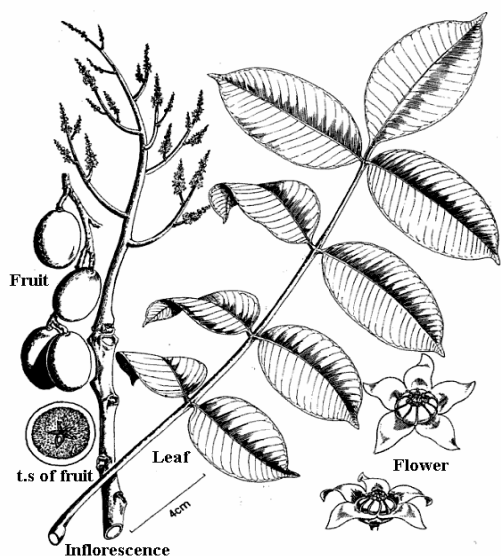
Common names:

Bengali	Amra, Piala, Pial Tribal
Thoura (Mogh);	Ambi-thong (Garo)
English	Wild Mango, Hog-plum
Hindi	Ambara, Amra, Bhringi-phal, Pashu-haritaki
Sanskrit	Aamraata
Manipuri	Eikhoi
Telugu	Adavimamidi
Nepali	Amaro
Malayalam	Ambazham, Ambalam,
Mambuli	
Tamil	Pulicha kaai

Botanical features:

Category: Ornamental tree

Diagnostic characters: Deciduous trees with a pleasant smell. Bark is smooth. Sap white, rapidly turning black. Leaves compound with the leaflets base often asymmetric. Inflorescence axillary, flowers white to cream, polygamous. Fruit a drupe with a large stone.



Height: Deciduous tree up to 27 m tall.

Girth: Usually 2.5 m

Trunk & bark: Bole straight, bark pale grey, smooth with rounded knobs.

Branches and branchlets or twigs: Twigs terete, hairy.

Exudates: Exudate white turning to black.

Leaves: Leaves compound, imparipinnate, alternate and spiral, leaflets elliptic, and apex acuminate, base acute, often asymmetrical, with distinct marginal vein, margin entire. Midrib flat above, secondary veins obtuse, widely parallel, tertiary veins reticulate. Stipules are absent. Leaves are 30-40 cm long, compound with 5-11 opposite leaflets. Leaflets are stalked, ovate-oblong to elliptic-oblong, 7-12 cm long, 4-5 cm wide, papery. Leaf base is wedge-shaped to rounded, often oblique, margin toothed or entire, with a tapering tip.

Inflorescences or flowers: Polygamous tiny white to cream flowers are borne in panicles at the end of branches, 25-35 cm long. Flowers are stalkless, white. Sepals are triangular, about 0.5 mm. Petals are ovate-oblong, about 2.5 x 1.5 mm, pointed.

Fruits: Fruit is ellipsoid to elliptic-ovoid, yellowish orange at maturity, 3.5-5 x 2.5-3.5 cm. Inner part of endocarp is woody and grooved, outer part is fibrous. Ripen fruits have pleasant fragrance.

Propagation: By seeds.

Seeds: Usually stony. Mature fruit is usually with 2 or 3 seeds.

Flowering time: May-July.

Fruiting time: November-December.

Stem: Soft Wooded

Roots: Deep roots, Tap roots².

*SPONDIAS PINNATA FLOWER**SPONDIAS PINNATA BARK**SPONDIAS PINNATA LEAFLET**SPONDIAS PINNATA LEAF**SPONDIAS PINNATA FRUIT**SPONDIAS PINNATA SEED***CONSTITUENTS**

Presence of alkaloids, carbohydrates, flavonoids, triterpenoids, steroids, tannins, resins and saponin. Essential oil from the pulp yielded carboxylic acids and esters, alcohols, aromatic hydrocarbons. Aerial parts contains 24-methylene cycloartenone, stigmast-4-en-3-one, β -sitosterol, glycoside of β -sitosterol and lignoceric acid. Fruits contains water soluble polysaccharides, composed of mainly L-arabinose, D-galactose and galacturonic acid, β -amyrin and oleanolic acid, glycine, cystine, serine, alanine and leucine^{2,3}.

MEDICINAL USES**• Diuretic and Laxative activity**

The diuretic and laxative activity of different extracts of the barks of *Spondias pinnata* (Linn. f) Kurz were studied in Wistar albino rats. Furosemide and agar-agar were used as reference standards respectively for activity comparison. The chloroform and methanol extracts produced significant diuretic and laxative activity. On the other hand, the petroleum ether extract did not reveal significant activity. Urinary levels of sodium, potassium and chloride were estimated⁵.

• Antioxidant and free radical scavenging activity

A 70% methanol extract of *Spondias pinnata* stem bark was studied in vitro for total antioxidant activity, for scavenging of hydroxyl radicals, superoxide anions, nitric oxide, hydrogen peroxide, peroxy nitrite, singlet oxygen and hypochlorous acid, and for iron chelating capacity, reducing power, and phenolic and flavonoid contents. The extract showed total antioxidant activity with a trolox equivalent antioxidant concentration value of 0.78 +/- 0.02. The IC50 values for scavenging of free radicals were 112.18 +/- 3.27 microg/ml, 13.46 +/- 0.66 microg/ml and 24.48 +/- 2.31 microg/ml for hydroxyl, superoxide and nitric oxide, respectively. The IC50 for hydrogen peroxide scavenging was 44.74 +/- 25.61 mg/ml. For the peroxy nitrite, singlet oxygen and hypochlorous acid scavenging activities the IC50 values were 716.32 +/- 32.25 microg/ml, 58.07 +/- 5.36 microg/ml and 127.99 +/- 6.26 microg/ml, respectively. The extract was found to be a potent iron chelator with IC50 = 66.54 +/- 0.84 microg/ml. The reducing power was increased with increasing amounts of extract. The plant extract (100 mg) yielded 91.47 +/- 0.004 mg/ml gallic acid-equivalent phenolic content and 350.5 +/- 0.004 mg/ml quercetin-equivalent flavonoid content⁶.

• Anticancer activity

The present study is aimed to investigate the role of 70 % methanolic extract of *S. pinnata* bark in promoting apoptosis in human lung adenocarcinoma cell line and human breast adenocarcinoma cell line. These two malignant cell lines and a normal cell line were treated with increasing concentrations of the extract and cell viability is calculated. The extract showed significant cytotoxicity to both the carcinoma cells with an IC50 value of 147.84 ± 3.74 and 149.34 ± 13.30 µg/ml, respectively, whereas, comparatively no cytotoxicity was found in normal human lung fibroblast cell line with IC50 value of 932.38 ± 84.44 µg/ml⁷.

• Antibiotic and Cytotoxic activity

Attempt was undertaken to study the antibacterial potency and cytotoxic activity of 80% ethanol extract of the fruits of *Spondias pinnata*. The antibacterial activity was performed by the disc diffusion method and cytotoxicity was observed by brine shrimp lethality bioassay. The fruit extract exhibited mild to potent antibacterial activity against some Gram-positive and Gram negative bacteria at a concentration of 500 µg/disc. Among them *Pseudomonas aeruginosa* and *Staphylococcus epidermidis* shows promising result. The ethanolic extract revealed strong cytotoxicity having LC50 of 2.12 ± 0.09 µg/ml⁸.

• Hypoglycemic activity

The various extracts of the barks of *Spondias pinnata* was evaluated for hypoglycemic activity on adult Wistar albino rats at dose levels of 300 mg/kg p.o. each using normoglycaemic, glucose loaded and alloxan induced hyperglycaemic rats. Glibenclamide was used as reference standard for activity comparison. Among the tested extracts, the methanol extract was found to produce promising results that is comparable to that of the reference standard glibenclamide⁹.

• Analgesic Activity

The ethanol extract of *Spondias pinnata* was obtained from the dried stem barks of *S. pinnata* and its analgesic properties investigated using acetic acid, formalin test and hot plate model. Ethanol extract of *S. pinnata* showed analgesic effects in a dose dependent manner in the acetic acid test and in the second phase of formalin test which were comparable to the effects observed with acetylsalicylic acid. The results of this study lead credit to the traditional uses *S. pinnata*, especially as an analgesic¹⁰.

• Antibacterial, Antidiarrheal and Ulcer-protective Activity

The extracts of *S. mangifera* were tested for castor-oil induced diarrhea, and intestinal fluid Accumulation and propulsion in rats using diphenoxylate hydrochloride and atropine as standard drug. The effect of the extracts on indomethacin-induced ulceration in rats was also evaluated. Cimetidine was used as positive control. In-vitro antibacterial activity of methanolic and aqueous extract was also evaluated against *Escherichia coli*, *Salmonella typhimurium* and *Vibrio cholera* bacteria¹¹.

• *Spondias pinnata* stem bark extract lessens iron overloaded liver toxicity due to Hemosiderosis in Swiss albino mice

The study was designed to evaluate the ameliorating effect of 70% methanol extract of *Spondias pinnata* on iron overload induced liver injury. Iron overload was induced by intraperitoneal administration of iron-dextran into mice and resulting liver damage was manifested by significant rise in serum enzyme markers and reduction in liver antioxidants. Hepatic iron, serum ferritin, lipid peroxidation, protein carbonyl and hydroxyproline contents were measured in response to the oral administration of the extract of different doses. In order to determine the efficiency as iron chelating drug, the release of iron from ferritin by the extract was further studied. Enhanced levels of antioxidant enzymes were detected in the extract treated mice. The extract produced a dose dependent inhibition of lipid peroxidation,

protein oxidation, liver fibrosis; and levels of serum enzyme markers and ferritin were also reduced dose dependently. The liver iron content was also found to be less in the extract treated group compared to control group¹².

• Anthelmintic Activity

The stem heart wood and bark of *Spondias pinnata* when tested in vitro, showed potent anthelmintic activity on the earthworm, *Pheretima posthuma*. While stem heart wood methanolic extract of *S. pinnata* was also more potent than the bark extract¹³.

CONCLUSION

Various parts of the plant *Spondias pinnata* has been widely studied in different areas for its pharmacological activities by utilizing several experimental screening models and based on the previous research works, it could be concluded that this plant has the potential to be explored as a natural medicinal source. It is alleged that the comprehensive information presented in this review on its pharmacological activities offer enticement for proper evaluation of the uses of various parts of this plant in medicine. The use of this plant as conventional drug requires further medico-chemical investigation.

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