Potential Role of Spondias pinnata in Food and Pharmacological Applications

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Abstract

In this modernized world, there are many unhighlighted discoveries from nature which solves numerous problems with extensive benefits. One such potential natural source is *Spondias pinnata*, which has broader applications in many fields. The review activity deals with is the significant role of *Spondias pinnata* as a source for many applications. It also focuses on the different medicinal properties of *Spondias pinnata*, which is being answerable to various ill conditions. The description of history, morphology, cultivation and harvesting of the plant are detailed for knowing the importance of different parts of the plant. *Spondias pinnata* is structurally elucidated into phytoconstituents, which show different pharmacological properties. It also has commercial advantages in the food industry, as it serves a broad range of edible purposes. It has some important which have medicinal properties and are used in the formulation of drugs.

Keywords

Phytoconstituents, Pharmacology, Anthelmintic, Anti-cancer, Hepatoprotective.

Introduction

- Synonym: *Mangifera pinnata* L.f.; *Spondias mangifera* Willd.
- Family: Anacardiaceae
- Genus: Spondias
- Species: pinnata

Vernacular names

The *Spondias pinnata* can be called by different vernacular names, named by different localities. Some of the local names are listed in the table below-
Table 1. List of names of *Spondias pinnata* in different localities.

<table>
<thead>
<tr>
<th>Language</th>
<th>Local Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>Indian hog-plum</td>
</tr>
<tr>
<td>Hindi</td>
<td>Amara</td>
</tr>
<tr>
<td>Bengali</td>
<td>Amra</td>
</tr>
<tr>
<td>Assamese</td>
<td>Amora</td>
</tr>
<tr>
<td>Sanskrit</td>
<td>Amrataka</td>
</tr>
<tr>
<td>Tamil</td>
<td>Pulicha kaai</td>
</tr>
<tr>
<td>Telugu</td>
<td>Avimamadi</td>
</tr>
<tr>
<td>Oriya</td>
<td>Ambula</td>
</tr>
<tr>
<td>Tulu</td>
<td>Ambade</td>
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</tbody>
</table>

Geological source: This plant is widely spread all over India and also grow in the countries like China, Burma, Sri Lanka, Thailand, and Malaysia. The fruits obtained from this plant at the immature stage are famous for preparing pickles. Majority of the plant parts like flowers, fruits and leaves are considered as eatables. The plant parts such as roots, bark, leaves and fruits are known for various applications [1].

**Botanical descriptions:**

*Spondias pinnata* is a deciduous variety of tree. The trunk and bark are smooth in texture, whereas branchlets are rounded and smooth. Its altitude is about 27 meters.

**Leaf characteristics of *Spondias pinnata***-

- They are composite, imparipinnate, alternative, and grouped at branch ends.
- The leaf length of *Spondias pinnata* is approximately 18 to 50 cm large.
- Petioles are of 5 to 15 cm lengthy.
- The leaf has 4 to 5 pairs of leaflets, which are single-ended
- Petiolule size of the leaf is 1 cm.
- The lamina portion of the leaflet covers approximately at a range of 6 to 14 x 5 to 7 cm.
- The leaflet of the plant is ovate-oblong to elliptic-oblong. It has a papery, flat surface covering on both sides, which have denticulate borders [2].
Flower Characteristics:

- The flowers of *Spondias pinnata* are white coloured with triangular sepals.
- These are polygamous, which possess ambisexual characters and have paniculate inflorescence [2].

Fruit Characteristics:

- The fruit of *Spondias pinnata* is a drupe type, which is ellipsoid to elliptic-ovoid in shape.
- The color of the fruit is in between yellow to green, which is at 1.5-5 x 1-3.5 cm size range.
- The fruit is fleshy with pulp which gives pleasant aromatic aroma. The fruit holds about 1 to 3 seeds, which a hard body covered by a fibrous surface with ridges on it. It is commercially used as a flavor in many food varieties [2].

The description of *Spondias pinnata* is shown in below given figures [1, 3].

**Fig. 1. Images of a) Spondias pinnata tree; b) leaves**

**Fig. 2. Image of Spondias pinnata fruits**

Cultivation Details

The cultivation activity of *Spondias pinnata* is performed in various locations all over India. Some of the areas such as Maharashtra, Andhra Pradesh, Kerala, Andaman and Nicobar Islands, West Bengal, Western Peninsula forests and sub-Himalayan ranges are the regions which harvest this crop regularly. The fruit is extensively consumed by humans, which is being considered as a vegetable by some people. The tribes of Orissa use this fruit as a medicinal agent.
Plant propagation is performed through seed cutting. During the ripening stage, the fruit is found to be almost watery, odour-free and acid taste. The fibrous pulp is very acidic, even at the fully ripened stage. The fruits appear fleshy in yellow to orange color, which has ellipsoid shape drupe. The size is nearly in the range of 27 to 50mm lengthy and 25 to 35mm wide. The obtained seeds are enclosed by a capsule having intertwined fibers. It succeeds in the hot, tropical region in lowlands and while it prefers well-drained soil in partially shady conditions [3, 4].

**Edible Uses**

- The leaves are employed as flavoring agents.
- When fruits are green during the unripe stage, they have soar flavor which is used in combination with stews.
- These are also consumed as vegetables.
- It is also made into pickles and curries to give an astringent taste.
- It can be used in the preparation of chutneys, and jams [4].

**Medicinal uses**

The young shoot of *Spondias pinnata* is consumed as a vegetable. The fruit of this plant is the chief source of vitamin C. The fruits and roots are used as a remedy to satisfy the thirst. The bark has been utilized for its property of improving diuresis. The trunk barks are used as antiseptic, astringent, antiscorbutic, refrigerant, tonic, anti-dysenteric, anti-diarrheal and anti-emetic properties. Its bark is also used in the medication of dysentery and stomach aches. A paste or lotion of the bark extracts relieves sprain and strain when applied on the skin, and also worked for rheumatism of joints and muscle. The parts like Fruits, leaves, and bark are utilized in producing antiscorbutic activity. The plant roots in earlier days were employed for controlling the menstrual cycles. They also have potential in producing an anti-tubercular action [5].

From the guidance of Ayurvedic Pharmacopoeia, stem bark is utilized for treating hemorrhagic diseases. The leaves of this plant are acidic in nature, which give fragrance and also produce astringent and flavoring activity. The juice extract of this plant can clear ear pain and also produce antitumor, antipyretic, antispasmodic and anti-histamine actions against the causitive agents. The fruits are applied in treating bilious dyspepsia, while the juice of bark of *S. pinnata* and *Syzgium cumini* (Linn) are directed as a medication for dysentery [4].

**Other Uses**

The wood of *S. pinnata* is delicate in texture and simply gets destroyed when exposed outside. It is used in making cases for packing, floats, matches and non-ornamental plywood, and is also used for making canoes traditionally. It is also used for making moldings, drawers, pulp, matchboxes, boxes, crates, carvings. The obtained wood also helps to produce fuel, which is of low quality [4].
Phytoconstituents

Table 2. Phytoconstituents obtained from plant parts [6]

<table>
<thead>
<tr>
<th>Phytoconstituent</th>
<th>Chemical Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flavonoids</td>
<td>![Flavonoids structure]</td>
</tr>
<tr>
<td>Tannins</td>
<td>![Tannins structure]</td>
</tr>
<tr>
<td>Saponins</td>
<td>![Saponins structure]</td>
</tr>
<tr>
<td>Terpenoids</td>
<td>![Terpenoids structure]</td>
</tr>
</tbody>
</table>
Table 3. Phytoconstituents obtained from Essential oils [6]

<table>
<thead>
<tr>
<th>Phytoconstituent</th>
<th>Chemical Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboxylic acids</td>
<td><img src="image" alt="Chemical Structure" /></td>
</tr>
<tr>
<td>Esters</td>
<td><img src="image" alt="Chemical Structure" /></td>
</tr>
<tr>
<td>Alcohols</td>
<td><img src="image" alt="Chemical Structure" /></td>
</tr>
<tr>
<td>Aromatic hydrocarbons</td>
<td><img src="image" alt="Chemical Structures" /></td>
</tr>
</tbody>
</table>
Table 4. Phytoconstituents obtained from aerial parts of plant. [6]

<table>
<thead>
<tr>
<th>Phytoconstituent</th>
<th>Chemical Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>24-methylene cycloartenone</td>
<td><img src="image1" alt="Chemical Structure" /></td>
</tr>
<tr>
<td>ß–sitosterol</td>
<td><img src="image2" alt="Chemical Structure" /></td>
</tr>
<tr>
<td>Stigmast-4-en-3-one</td>
<td><img src="image3" alt="Chemical Structure" /></td>
</tr>
<tr>
<td>Daucosterol</td>
<td><img src="image4" alt="Chemical Structure" /></td>
</tr>
<tr>
<td>Lignoceric acid</td>
<td><img src="image5" alt="Chemical Structure" /></td>
</tr>
</tbody>
</table>
Table 5. Phytoconstituents obtained from fruits. [6]

<table>
<thead>
<tr>
<th>Phytoconstituent</th>
<th>Chemical Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>L-arabinose</td>
<td><img src="image1" alt="Chemical structure" /></td>
</tr>
<tr>
<td>Galacturonic acid</td>
<td><img src="image2" alt="Chemical structure" /></td>
</tr>
<tr>
<td>Oleanolic acid</td>
<td><img src="image3" alt="Chemical structure" /></td>
</tr>
<tr>
<td>D-galactose</td>
<td><img src="image4" alt="Chemical structure" /></td>
</tr>
<tr>
<td>Serine</td>
<td><img src="image5" alt="Chemical structure" /></td>
</tr>
</tbody>
</table>
Pharmacological activities

Anthelmintic activity

The ethanol and acetone extracts obtained from *S. pinnata* bark consists of glycosides. These extracts were subjected to Indian earthworms, *Pheritima Posthuma* at different concentrations. The functionality was compared with the standard drug piperazine citrate. From the results, it was observed that the extracts had produced comparative anthelmintic activity through the glycosides present in them [7, 8].

Anti-cancer activity

From a recent study, the *Spondias pinnata* has reported for anti-cancer activity. The methanolic extract of *Spondias pinnata* bark was tested for its anti-cancer activity. From the report, an increased death rate of adenocarcinoma cells in human lungs, and the human breast has observed. From the analytical reports and microscopic studies, the extract had confirmed for significant anticancer activity in the human body [8, 9].

Ulcer-protective activity

From the findings, it is reported that *Spondias pinnata* extract showed a desirable effect on indomethacin-induced ulcer effect was reported and evaluated. About 90% of methanolic extract has inhibited the ulcer-causing effect of indomethacin. It has demonstrated an antiulcer impact and antioxidant effect. When the extract was administrated through the oral route at varying doses, an inhibition rate was observed against the ulcer-causing agents [9].

Anti-microbial activity

The antimicrobial activity is evaluated through in-vitro analysis by employing the methanolic, and aqueous extract of *Spondias pinnata* against different strains of *E. coli, Salmonella typhimurium* and *Vibrio cholerae*. The
methanolic extract was reported to exhibit good antibacterial efficacy, in comparison to moderate results of aqueous extract. The test can be applicable to gram-positive as well as gram-negative bacteria [10]. From the reports, the trial had achieved good results for most gram-positive bacteria; for the case of gram-negative, the results were insignificant. It was also observed that the extract materials are heat stable during the activity [10] [11-13].

**Anti-oxidant activity**

From the study, it has observed that *Spondias pinnata* confirmed a more effective scavenging activity than Vitamin C. From the results, it is reasoned that 70% of the methanolic extract can deliver the anti-oxidative effect by the phenolic and flavonoid groups, which are present as constituents [14]. Their activity can also be recognized through scavenging effect produced on the free radical by the extract [15-17].

**Thrombolytic activity**

The thrombolytic action of the *Spondias pinnata* is noticed by exocarp of the fruit. The thrombolytic activity was performed on the blood samples of different healthy people, where streptokinase is used as a standard. From the reports, considerable results were noticed in showing a thrombolytic property in the blood samples [18-20].

**Hepatoprotective activity**

The hepatoprotective activity was achieved through the methanolic and ethyl acetate extracts of stem heartwood of *S. pinnata*. They had conducted a test against carbon tetrachloride given rats. Then its effect is equated between groups who were cured and were not by involving different biochemical markers [21].

The hepatoprotective action was noticed during the histopathological analysis of the liver segments in carbon tetrachloride infused rats. The liver was held to regular cellular shape in the rats when administered with the plant extracts of ethyl acetate and methanol [22].

**Cytotoxic activity**

Preliminary cytotoxic action was checked by Brine shrimp lethality test in the fruit of *Spondias pinnata*. An in-vivo analysis was performed using the ethanolic extract, which was practiced on *Artemia salina*. Vincristine sulphate was utilized as a standard in the test. Cytotoxicity shown by the ethanolic crude extract was observed to be noticeable; as the LC50 results were found to be in the acceptable range [1].

**Conclusion**

*Spondias pinnata* is a potent natural source, which is has been reviewed for its significant medicinal values and food advantages. This review also gives information about different ethno-medicinal properties and pharmacological features of the plant. The plant has been accepted medicinally in inducing various activities against the disease-causing agents and even in regulating the physiological role in the body. On the other side, it has gained many commercial advantages by having involvement in a variety of food preparations. The review content has also included a few reports of research studies for achieving the conformity of its role in pharmacological activities.
The details of the phytochemistry of this plant help in isolation of different phytochemical constituents from different parts of the plant, which have specific pharmacological action. Furthermore, thorough research is being driven by the investigations in order to figure out a few more significant properties of this plant.

References


