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Shami plant: A wonder tree: Review on Ethnomedicinal claim of *Prosopis cineraria*

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Abstract
Prosopis cineraria belong to family Leguminosae, commonly known as Khejri, Khijdo, Shami, Jandi. Leaves and pods are extensively used as fodder for cattle, camels and goats. *Prosopis cineraria* is also the national tree of Telangana, Rajasthan, and Western Uttar Pradesh in India. In Rajasthan, it is known as Khejri, and in Western Uttar Pradesh as Chhonkara. It is also known as the "wonder tree," making it the "lord of the desert." Locally known as "Sangari," the pods are fresh green vegetables that Rajasthani people enjoy together with its dry fruits. The plant is also have been used in indigenous system of folk medicine as folk remedy for various aliments like leprosy, dysentery, bronchitis, asthma, leucoderma, piles, muscular tremors and wandering of the mind. Plant parts like Leaves, pods, flowers, stem and seeds are having different metabolites. It is also a good source of vitamins for people who live in desert areas. The Prosopis species that are used for medicinal reasons most frequently are *Prosopis Africana*, *Prosopis alba*, *Prosopis cineraria*, *Prosopis farcta*, *Prosopis glandulosa*, *Prosopis juliflora*, *Prosopis nigra*, *Prosopis ruscifolia*, and *Prosopis spicigera*. It mainly contains tannins (gallic acid), alkaloids (spicigerine, prosophylline), Flavone derivatives (prosogerin A, B, C, D and E) and quercetin are widely used as anti-oxidant, anti-microbial, anti-bacterial, anti-convulsant, nootropic and antidepressant activity.

Keywords: *Prosopis cineraria*, phytochemicals, pharmacological activities

1. Introduction
Prosopis cineraria is a small to moderate size (5 to 10 meter height) grows in dry and arid regions of Arabia and in some regions of Indian states, which are Rajasthan, Haryana, Punjab, Gujarat, Western Uttar Pradesh and in dry areas of Deccan [1]. Khejari is the golden tree of Indian deserts, plays a vital role in preserving the ecosystem of arid and semi-arid areas. Since all the parts of the tree are useful, it is called kalpatru. It is also known as the 'wonder tree' and the 'king of desert' [2-4]. It has thick, rough grey bark with deep fissures. Roots are very deep; the tap root of *Prosopis cineraria* may penetrate vertically up to 20 m or more. The leaves form good fodder for camels, goats and donkeys. The pods are used as a vegetable [5]. It has bipinnately compound leaves, alternate in arrangement. The leaflets are 15-18 pairs, and shaped oblong with an entire margin, apiculate apex, obtuse base, glabrous surface, reticulate venation, petiolate, and the petiole is 0.5-4 cm long. The average leaf size is 2.5 cm (length) and 1 cm (breadth). Fresh leaves are green in colour, and are odorless with a bitter taste [6]. In the summer, fresh leaves emerge before or at the same time as the old ones. Little yellow flowers bloom after the new flush of leaves appears in March through May [7]. There is immense need of potential medicinal plants in current pharmaceutical industry. Shami is one of the auspicious trees mentioned in ancient scriptures of Ayurveda [8]. It is used traditionally for treatment of various ailments like leprosy, muscular tremors, dysentery, asthma, leukoderma, bronchitis, dyspepsia, rheumatism, gastrointestinal, respiratory, cardiovascular disorders, piles and earache etc. [9].

About 45 species of thorny trees and shrubs belong to the Prosopis genus, which is a component of the Fabaceae / Leguminosae family. Members of this genus can be found both in tropical & subtropical areas of world. The Prosopis genus has historically been used to treat lots of ailments, including respiratory disbalances, calluses, conjunctivitis, diabetes, diarrhoea, the common viral, milk production, liver infections, malaria, sinus inflammatory processes, aches, painful process, rheumatoid arthritis, ringworm, skin inflammations, spasms, stomach pain, and the removal of bladder and pancreatic stones [10-12].

1.1 *Prosopis cineraria*

1.1.1 Botanical name: *Prosopis cineraria* (L.) Druce

1.1.2 Family: Leguminosae (Fabaceae)

The Bishnoi community of Rajasthan adheres to the religious principle of protecting khejri trees. They founded the Chipko Movement when 363 Bishnoi gave their lives in 1730 to stop the chopping of the khejri tree. Ancient literature alluded to *Prosopis cineraria* as an important herbal plant. The Leguminosae tribe, subfamily, and global genus Prosopis all contain the species Cineraria (L) Druce, also referred to as Khejri [13].

The trees not only boost the growth and productivity of companion plants, but also provide fuel, fodder, food, small timber, medicines, gum and tannin.

There are various common names for the plant. In Hindi and Sanskrit it is known as Khejri and in Rajasthan known as Janti/Loong tree. In Punjab it is known by the name of Jand and in Gujarat is known as Sami, Sumri. Tamil and Jammi and Vanni in Telugu. In Sind it is known as Kandi [14]. It is also known as "wonder tree" and "king of desert" as all the parts of tree are useful.

Fig 1: *Prosopis cineraria*

1.1.3 Mythological Origin of *Prosopis cineraria*

This tree Figure 1, also has a mythological importance in local communities. This tree is a highly-revered tree of Hindu religion and is worshipped during the tenth day celebrations of Dussehra festival. During this time people distribute leaves of this tree to their elders to get their blessings and to relatives and friends to share mutual love and respect and to forget past bitterness. Because of its auspiciousness, this tree has been given synonyms like Lakshmi, Shiva, Sita etc., It is believed that if worshipped this tree cleanses sins and helps to defeat enemies. Lord Rama worshipped this plant before going to battle with Ravana. In Maha Bharath also pandavas hid their arms under this three. Now people worship the tree as follows, O Shami, Lord Rama has worshipped you. I now embark upon my journey to victory. May you make it pleasant and free from obstacles!

1.1.3 Geographical Distribution

- **Worldwide:** Its native range includes Yemen, Afghanistan, Bahrain, Iran, India, Oman, Pakistan, Saudi Arabia, and other desert regions of Western Asia and the Indian Subcontinent [2].
- **India:** The plant grows in dry and arid regions of India mainly Rajasthan, Haryana, Punjab, Gujarat, Western Uttar Pradesh and drier parts of Deccan.
- **Karnataka:** Chitradurga, Bagalkot, Raichur, Gulbarga, Bidar.

1.1.5 Vernacular Names

- **Bengali**-Shami
- **Gujarati**-Khijado, Sumri, Semru, Sami, Kamra
- **Hindi**-Janti, Banni, Jand, Sangri, Shami, Chaunkra, Khejiri
- **Sanskrit**-Jhind, jhand
- **Urdu**-Jandi, Thand, Kan.

1.1.6 Taxonomy

- **Kingdom:**-Plantae
- **Sub Kingdom:**-Phanerogames
- **Division:**-Angiosperms
- **Class:**-Dicotyledons
- **Sub-class:**-Polypetalae
- **Series:**-Calyciflorae
- **Order:**-Rosales
- **Family:**-Leguminosae (Fabaceae)
- **Genus:**-Prosopis
- **Species:**-Cinerari**.**

1.1.7 Morphological Characters: Shown in Figure 2 to Figure 6

- **Root system** of *Prosopis cineraria* is long and well developed. Growth above the ground is slow but below the ground the roots penetrate deeper for ground water. Taproot penetration up to 35 m depth has been reported.
- **Leaves:** Compound, bipinnate, stipulate, stipules modified into spines, Alternate, petiolate. Leaflets are ovate, Apex is mucronate, base is unequal, margin is entire and reticulate venation. Size of leaf is 1-1.5 cm. long and 0.4-0.6 cm. broad.
- **Seeds:** Seeds are distant, longitudinal, ovate, 6 mm long, the tegument with open horse-shoe fissural line on faces, 10-15 in a pod, brown [15].
- **Flowers** -are regular, bisexual, bracteate, complete, zygomorphic, pentamerous hypogenous. The flowers are small in size and yellowish in colour, appear from March to May after the new flush of leaves.
- **Fruit (Pods):** The pods consist of three parts, mesocarp (56% of the pod) that grind to produce flour, endocarp (35%) that discard as waste alongside seeds (9%). Pods are yellow to reddish brown, Fleshy pods are sickle shape, dry pods are cylindrical shape and slightly curved; 10-20 cm long and 0.5-0.8 cm thick, 10-15 seeded pod.
- **Root:** Root is a taproot more than 3 m long.
- **Bark**-Thick, hard and dark brown in color. Liver-warts and lichens are located on the surface of bark.

Fig 2: Leaves

Fig 3: Seeds

Fig 4: Flowers

Fig 5: Stem/ Bark

Fig 6: Pods

1.1.8 Mythological Origin of *Prosopis cineraria*

This tree Fig.1, also has a mythological importance in local communities. This tree is a highly-revered tree of Hindu religion and is worshipped during the tenth day celebrations of Dussehra festival. During this time people distribute leaves of this tree to their elders to get their blessings and to relatives and friends to share mutual love and respect and to forget past bitterness. Because of its auspiciousness, this tree has been given synonyms like Lakshmi, Shiva, Sita etc., it is believed that if worshipped this tree cleanses sins and helps to defeat enemies. Lord Rama worshipped this plant before going to battle with Ravana. In Maha Bharath also pandavas hid their arms under this three. Now people worship the tree as follows, O Shami, Lord Rama has worshipped you. I now embark upon my journey to victory. May you make it pleasant and free from obstacles!

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- **Sub-class-**Polypetalae
- **Series-**Calyciflorae
- **Order-**Rosales
- **Family-**Leguminosae (Fabaceae)
- **Genus-**Prosopis

1.1.12 Morphological Characters: Shown in Figure 2 to Figure 6

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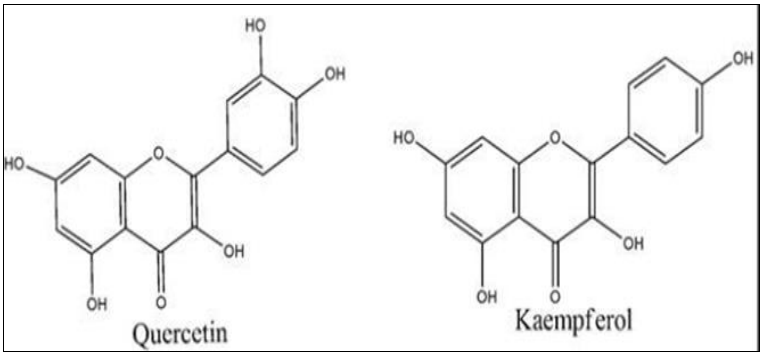
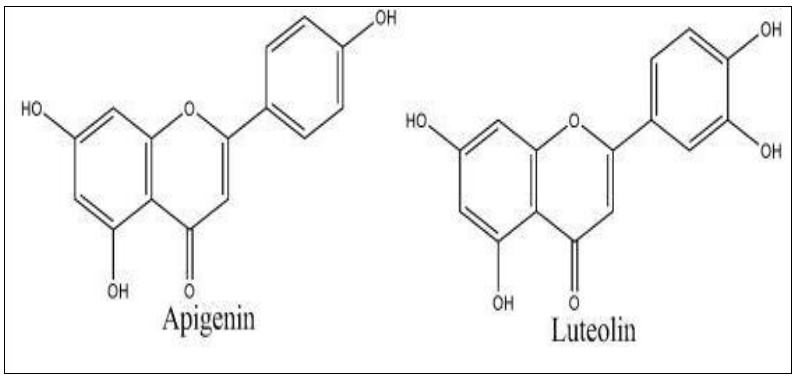
- **Bark-** thick, hard and dark brown in color. Liver-warts and lichens are located on the surface of bark.





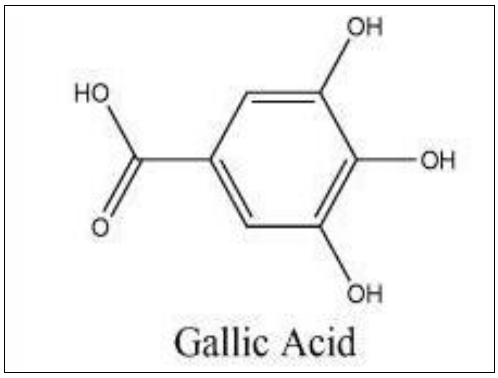


Fig 7: *Prosopis cineraria* Phytoconstituents

1.1.13 Microscopic Characters

- **Periderm:** Periderm is made up of outer cortical tissue, a limited zone of phelloderm, and a few layers of phellem on the outside.
- **Collapse Phloem:** Secondary phloem are present inside the periderm it is differentiated as outer wide zone of collapsed phloem and inner narrow zone of non-collapsed phloem. In collapsed zone sieve elements are crushed into small necrost masses. Phloem fibers are gelatinous type. Gelatinous fiber have thick outer cellulose wall and inner unlignified mucilage.
- **Crystal Distribution-**Calcium oxalate crystals are present in the collapsed phloem zone. The crystals are prismatic type [27].

Leaves

- **Epidermis:** Both the upper and lower epidermis are present, with the lower epidermis containing stomata and trichomes.
- **Trichomes:** Multicellular trichomes are present on the leaf surface, providing a protective layer.
- **Mesophyll:** The mesophyll consists of both palisade and spongy parenchyma, which are involved in photosynthesis and gas exchange.
- **Midrib:** The midrib region contains a vascular bundle enclosed by pericyclic fibers and collenchyma.
- **Vascular Bundle:** The vascular bundle comprises xylem and phloem, responsible for transporting water and nutrients.

Fruits

- **Fruit Wall:** The fruit wall is composed of epidermal cells, parenchyma cells, and fibers.
- **Epidermal Cells:** Epidermal cells of the seed with oils, as well as epidermis of the testa, can be observed.
- **Parenchyma:** Thick-walled parenchyma cells are present, providing structural support.
- **Fibers:** Fibers are also present, contributing to the fruit's rigidity.

Seeds

- **Seed Coat:** The seed coat, or testa, is composed of epidermal cells.
- **Epidermal Cells:** Epidermal cells containing oils are present on the seed surface.
- **Non-Endospermic:** The seeds are non-endospermic, meaning they lack a nutritive endosperm [28]**.**

1.1.14 Ethnomedicinal Activity of *Prosopis cineraria*-

Anti-bacterial Activity-Stem-bark extracts (aqueous and methanolic) of *Prosopis cineraria* exhibited antibacterial potential at 250 µg/ml in comparison with Ciprofloxacin (Standard at 100mg/ml) against eight bacterial strains-Streptomyces griseus, Salmonella typhi, Bacillus subtilis, Bacillus Lintus, Staphylococcus aureus, Klebsiella pneumonia, Staphylococcus albus, Escherichia coli. Significant potent action of methanolic extract of the plant has been analyzed against all pathogens. It was postulated that flavonoids and tannins contribute and render the antibacterial activity to *Prosopis cineraria*. Antimicrobial potential of different extracts of dried unripe pods of *Prosopis cineraria* was investigated by using the method Agar well diffusion. However, negligible activity was reported by petroleum ether extract [29].

Antioxidant Activity

Studies have demonstrated that extracts of *Prosopis cineraria* exhibit strong free radical scavenging activity, attributed to its high phenolic and flavonoid content. The antioxidant potential of this plant positions it as a promising candidate for preventing oxidative stress related disorders. Oxidative stress, often implicated in the pathogenesis of chronic diseases such as cardiovascular diseases, neurodegenerative disorders, and diabetes, can be mitigated through the scavenging of reactive oxygen species (ROS). The phenolic compounds in *Prosopis cineraria* interact with free radicals, neutralizing them and

preventing cellular damage. Experimental evidence has shown that methanolic and ethanolic extracts of the plant display dose-dependent antioxidant activity in assays such as DPPH (2, 2- diphenyl-1-picrylhydrazyl) and ABTS (2, 2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) radical scavenging assays. These findings underscore its potential for incorporation into antioxidant therapies and functional foods [30].

Analgesic and antipyretic activity

The Petroleum ether extract of stem bark exhibited a significant antipyretic activity using Brewer's yeast induced hyperpyrexia model in experimental rats. The ethanolic extract of root was evaluated by using tail immersion and hot plate method and showed significant results. The aqueous extract of leaves was evaluated for analgesic activity by using acetic acid induced writhing test model. The Analgesic activity exhibited in Swiss Albino mice was significant as compared to control. The extract also exhibited a significant antipyretic activity at same dose using Brewer's yeast induced hyperpyrexia model [31].

- **Antihyperglycemic activity:** Prosopis have abundant activity in lowering blood sugar level. Study showed that blood sugar level increase and body weight decrease in diabetic rats become normal when treated with the plant extract of Prosopis. Thus, Prosopis extract activates the surviving of the β-cells of the islets and reduce the blood sugar level by producing an insulinogenic effect [32].
- **Anti-inflammatory Activity:** The anti-inflammatory action of *Prosopis cineraria* is one of the plant's most important pharmacological traits. It facilitates the healing of wounds. Hydroalcoholic extract fractions of *Prosopis cineraria* that are dissolved in ethyl acetate, chloroform, and butanol have anti-inflammatory effects. Rats' dorsal wounds healed faster when treated with a Page butanol fraction of a hydroalcoholic extract of *Prosopis cineraria* than they did in the control group, with an increase in the amino acid hydroxyproline concentration and a shorter time for epithelialization & inflammatory indicators in the blood [33].
- Antitumor Activity Bark and leaf hydro-alcoholic extracts were tested for antitumor efficacy using the Ehrlich ascites carcinoma tumour model. The effectiveness of the activity was assessed using *in vitro* cytotoxicity, solid tumour mass, haematological investigations, peritoneal cells, lipid peroxidation, and survival time. Both extracts exhibited substantial anticancer activity. Male Wister rats were subjected to a preventive activity test using a methanolic extract of the leaves against artificially produced liver cancers. It was discovered that the administration of extract (200 and 400 mg/kg) reduced the levels of mitochondrial lipid peroxidation and liver weight in a dose-dependent manner. Additionally, the extract raised the concentrations of mitochondrial enzymatic antioxidants [34].
- Eye diseases-conch shell that has been fumigated with ghee smeared shami leaves and breast milk-rubbed in a copper vessel applied to the eyes to relieve eye pain and itching. In order to treat eye problems, the fruits of udumbara are rubbed with breast milk in an iron vessel and fumigated using ghee-smeared shami leaves.
- Anticonvulsant activity Methanolic extract of stem barks was studied for anticonvulsant activity against maximal electro shock (MES) and Pentylenetetrazole (PTZ) induced convulsions in mice. Methanolic extract of stem barks showed significant anticonvulsant effect in both models [35-36]. Respiratory and gastrointestinal activity Methanolic extract from the stem bark was tested for spasmolytic, bronchodilator, and vasodilator activities. The observations confirmed the bronchodilator and vasodilator activities which were possibly mediated through blockade of Ca^{2+}channels [37].

2. Results

The ethnomedicinal review of *Prosopis cineraria* reveals its significant role in traditional healing systems, especially in the arid and semi-arid regions of India, Pakistan, and parts of Africa. Various plant parts including the bark, leaves, pods, flowers, and gum are traditionally used to treat a range of ailments such as gastrointestinal disorders (diarrhoea, ulcers), respiratory conditions (asthma, cough), skin infections, diabetes, fever, and inflammation. The bark and leaves are most frequently used, often prepared as decoctions, powders, or pastes. Oral administration is the most common route, followed by topical application.

Phytochemical investigations have confirmed the presence of bioactive compounds such as flavonoids, alkaloids, tannins, and saponins. These contribute to the plant's antioxidant, antimicrobial, anti-inflammatory, and antidiabetic activities, lending scientific support to many traditional claims. The widespread and culturally rooted use of *Prosopis cineraria*, combined with emerging pharmacological evidence, underscores its therapeutic potential and the need for further scientific validation through preclinical and clinical studies.

3. Conclusion

Prosopis cineraria possesses significant ethnomedicinal importance, with traditional applications in the treatment of gastrointestinal, respiratory, skin, and metabolic disorders. The consistent use of this plant across various cultures, supported by preliminary phytochemical and pharmacological studies, highlights its therapeutic potential. However, further scientific investigations, including detailed pharmacological evaluations and clinical trials, are necessary to validate these traditional claims and facilitate its integration into modern healthcare practices.

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