PROSOPIS CINERARIA (L.) DRUCE: A BOON PLANT OF DESERT- AN OVERVIEW

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Abstract

Prosopis cineraria (L.) Druce is a deep rooted, nitrogen fixing, multipurpose tree endemic to the hot deserts of India. The tree is known locally as Jandi or Khejri (India), Jand (Pakistan), and Ghaf (Arabic). Its synonym is *P. spicigera*. These trees are the essential component of the agroforestry land use system in these parts of India. It belongs to the family Leguminosae and subfamily Mimosoideae. The leaves are good fodder for camels, goats and donkeys. The pods are used as a vegetable. Sangri - green pods – are boiled and dried. The flowers are useful for honey production. Khejri is also used for soil improvement and sand dune stabilization. The wood is ideal for domestic heating. The bark of the tree has abortifacient and laxative properties. Khejri is reputed for the treatment of asthma and worm. The present review is therefore, an effort to give a detailed survey of the literature on its botanical details, phytochemical reports, pharmacological reports and therapeutic importance.

Keywords: *Prosopis cineraria*, Khejri, Botanical details, Phytochemical reports, Pharmacological reports, Therapeutic importance.

Introduction

The Great Indian Desert, popularly known as the Thar, includes some portion of northwest India. In constitutes almost 90% of the Indian arid zone and the state of Rajasthan alone accounts for 61.8%. Arid regions are characterized as having extremely arid climate with low and erratic rainfall, dry atmosphere and high wind velocities.[1] In these deserts, a promising multipurpose tree species commonly found is *Prosopis cineraria* (L.) Druce. The tree, locally called as Jandi or Khejri is a boon to the people due to its myriad virtues. It holds an important place in the rural economy in the northwest region of Indian subcontinent.[2] The genus *Prosopis* belongs to the family Leguminosae, subfamily Mimosaceae and comprises about 44 species distributed mainly in dry regions of Southwest Asia, Africa and, predominantly America from western

North America to Patagonia. The commonly used term "mesquite" includes all leguminous trees of genus Prosopis.[3] *Prosopis cineraria* tree grows in dry and arid regions of Arabia and in regions of India mainly Rajasthan, Haryana, Punjab, Gujarat, Western Uttar Pradesh and drier parts of Deccan and extends as far as South in Tuticorin. In this region also it is confined only to comparatively drier areas where the normal annual rainfall is less than 500 mm. In the most important areas of *Prosopis cineraria* distribution, the climate is dry to arid and rainfall shows considerable variation 100 to 600 mm annually with long dry season. In areas of its natural distribution, the climate is characterized by extremes of temperature. Summers are very hot and winters are severe with frost during December-January. The maximum shade temperature varies from about 40 to 46 °C, the absolute minimum temperature from 9 to 16 °C. The tree grows on a variety of soils. It is seen at its best on alluvial soils consisting of various mixtures of sand and clay. It is common on moderately saline soils; it quickly dries out where the soil is very saline. The rural communities encourage the growth of Khejri in their agricultural fields, pastures and village community lands. Through experience, farmers have realized its usefulness and learnt that it does not adversely affect crop yields; instead, it improves grain yield and storage biomass production.[4]

Tree characteristics

Prosopis cineraria is a small moderate sized evergreen thorny tree, with slender branches armed with conical thorns and with light bluish-green foliage. The leaflets are dark green with thin casting of light shade. It coppices profusely. The tree is evergreen or nearly so. It produces new flush leaves before summer. The flowers are small in size and yellow or creamy white in colour; appear from March to May after the new flush of leaves. The pods are formed soon thereafter and grow rapidly in size attaining full size in about two months time. Historically *Prosopis cineraria* has played a significant role in the rural economy in the northwest arid region of Indian sub-continent. This tree is a legume and it improves soil fertility. It is an important constituent of the vegetation system. It is well adapted to the arid conditions and stands well to the adverse vagaries of climate and browsing by animals. It is drought resistant and tolerates dry and arid condition to such an extent that it is described as an aridity-loving tree. It is about the only indigenous tree species, which has withstood well the rigorous and exacting conditions of the Rajasthan desert. Very deep roots help in securing firm footing and in obtaining

moisture supplies from deep soil layers. Taproot penetration up to 35 m depth has been reported. The tree is able to withstand the hottest winds and the driest season, and remains alive when other plants would succumb. The tee is frost resistant. Because of its economic value, the tree is left standing in the arable land and the farmers regulate its population by adapting suitable agroforestry management. It is a very useful tree, possessing great vitality and rapid growth in its natural zone and considerable power of reproduction from coppice shoots.[5]

Botanical details

Prosopis cineraria (L.) Druce (family Leguminosae, subfamily Mimosoideae) is a small thorny, irregularly branched tree, 5-10 in high. Evergreen or nearly so, it forms an open crown and has thick, rough gray bark with deep fissures.

Leaves are alternate, bipinnately compound with 1-3 pairs of pinnae. Each pinna has 7-14 pairs of leaflets, 4- 15 mm long and 2- 4 mm broad. The thorns are straight with a conical base and distributed sparsely along the length of the stem. They first become visible when the seedlings are 6-8 weeks old. In this respect, *P. cineraria* differs from the thorny New World species of *Prosopis* (e.g., *P. juliflora*) which have thorns in pairs at the nodes but thornless internodes.

The 0.6 cm yellow-green flowers are borne on 5-23 cm spike-like racemes. Up to 25 dull brown seeds, 0.3- 0.8 cm long, are contained in each of the light yellow pods, which are long (8-19 cm), narrow (0.4-0.7 cm), and cylindrical. As with other *Prosopis*, rooting can be very deep; the tap root of *P. cineraria* may penetrate vertically up to 20 m or more.[6]

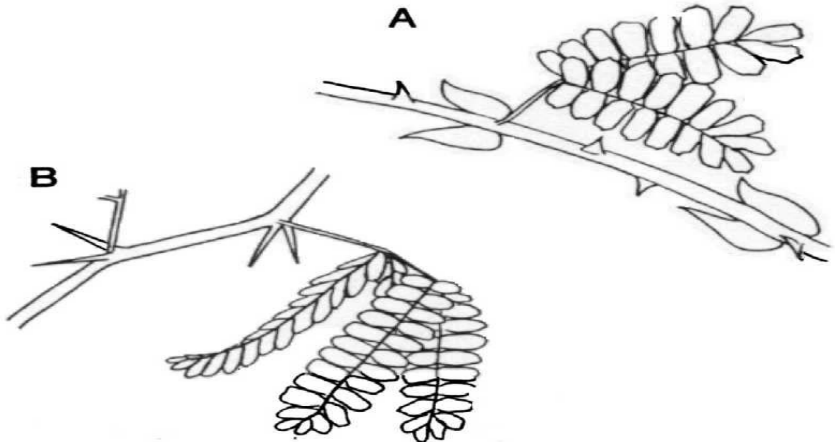


Fig 1. Young branches of (A) *P. cineraria* and (B) *P. juliflora*, showing the diff. position of thorns.

***Prosopis cineraria* (L.) Druce - A State tree of Rajasthan**

Taxonomical classification

Kingdom: Plantae – Plants

Subkingdom: Tracheobionta – Vascular plants

Superdivision: Spermatophyta – Seed plants

Division: Magnoliophyta – Flowering plants

Class : Magnoliopsida – Dicotyledons

Subclass: Rosidae

Order: Fabales

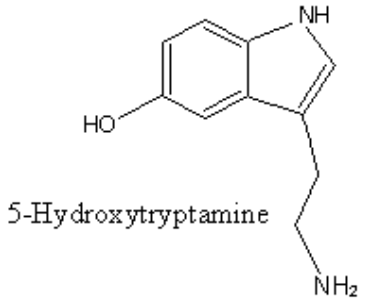
Genus: Prosopis L. – mesquite

Family: Fabaceae – Pea family

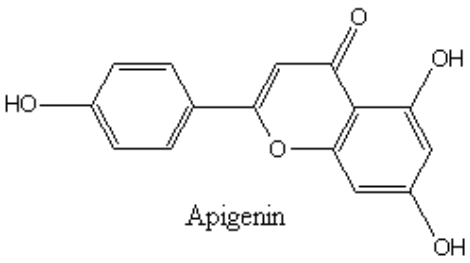
Species: *Prosopis cineraria* (L.) Druce – khejri

Phytochemical reports

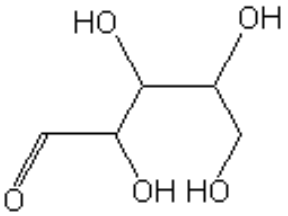
Prosopis has been found to contain 5-hydroxytryptamine, apigenin, isorhamnetin-3-diglucoside, l- arabinose, quercetin, tannin and tryptamine.[7-10]



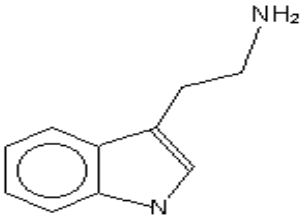
5-Hydroxytryptamine



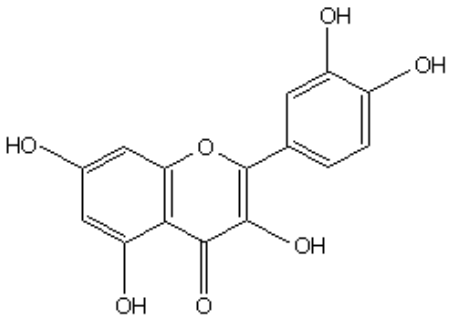
Apigenin



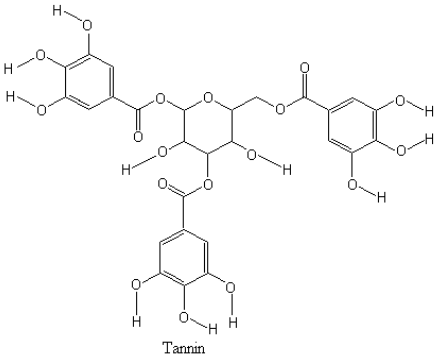
L-Arabinose



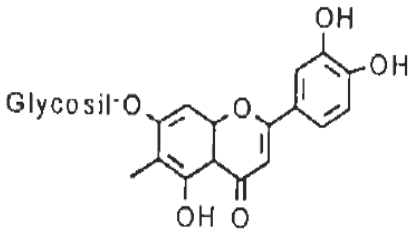
Tryptamine



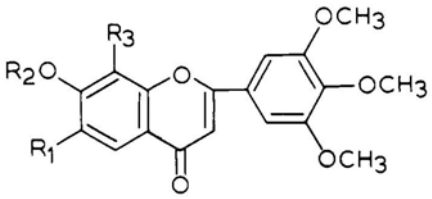
Quercetin



In 1964 R.C. Sharma *et al.* reported the isolation of a flavone glycoside Patulitrin 3, 5, 6, 3, 4- pentamethoxy-7-hydroxy flavone from flowers of *Prosopis cineraria*. The fruits of *Prosopis juliflora* D.C. (leguminosae) were found to contain the same compound. Iches and co-workers in 1973 found that patulitrin showed significant activity against the Lewis lung carcinoma in vivo.



Patulitrin



R_1 = OH; R_2, R_3= H

Prosogerin –E

Seeds contain non-glycosidic polyphenolics, gallic acid, patuletin, luteolin, and a new compound named prosogerin –E (6, 7-dihydroxy-3', 4', 5'-trimethoxyflavone).other compounds are glycosidic polyphenolics, patulitrin, and rutin. Seeds also contain fixed oils (4.5%), fatty acid such as palmitic acid, stearic acid, oleic acid & linoleic acid, Sterols like Campstool, Stigmasterol, β- Sitosterol,

Stimasta– 5, 24(28)-dien-3 β-ol, Stimasta-1,3,5-triene, Stimasta-4,6-dien-3-one etc.[11] Amino acids isolated from leaves and pods are Aspartic acid, Glutamic acid, Serine, Glycine, Histidine, Threonine, Arginine, Alanine, Proline, Tyrosine, Valine, Methionine, Cysteine, Isoleucine, Leucine, Phenylalanine and Lysine.[12]

Pharmacological reports

An alkaloid mixture (1 mg/kg) of *Prosopis cineraria* was given to dogs caused decrease in blood pressure and immediate mortality. Extensive damage to liver, spleen, kidney, lung and heart was observed on histological examination of mice given the alkaloid mixture.[9]

Tapia A & coworkers reported the "Biologically active alkaloids and a free radical scavenger from Prosopis species" in this study The biological activity of extracts from the aerial parts of five Argentinian Prosopis species and the exudate of *P. flexuosa* were assessed for DNA binding, beta-glucosidase inhibition and free radical scavenging effect using the DPPH decoloration assay. DNA binding effect was found mainly in the basic fraction.[13]

Aqeel A & coworkers reported the "Antimicrobial activity of julifloricine isolated from *Prosopis juliflora"* Antimicrobial activity of julifloricine, an alkaloid isolated from Prosopis juliflora, was studied *in vitro* against 40 microorganisms which included 31 bacteria, two Candida species, five dermatophytic fungi and two viruses. Significant inhibitory effect was noted against Gram positive bacteria.[14]

Vaithiyanathan S & coworkers reported the "Effect of feeding graded levels of *Prosopis cineraria* leaves on rumen ciliate protozoa, nitrogen balance and microbial protein supply in lambs and kids" The investigation was carried out to assess the effect of feeding graded levels of tannin-containing *Prosopis cineraria* leaves in a complete feed mixture (CFM) on the rumen ciliate protozoa, nitrogen metabolism, microbial protein supply and wool yield (in lambs only). It is concluded from the results that Prosopis tannins could be included in the diets of lambs and kids at 23 and 45 g/kg DM, respectively to have higher microbial protein supply.[15]

Ali A. Al-jeboory and Wesal A.H. Al-husainy in 1984 reported the cardiovascular studies on *Prosopis farcta.* Alcoholic extract of leaves of this plant has shown a dual action of increase and decrease in blood pressure in vivo and increase in contraction of heart *in vitro* studies.[16]

Therapeutic importance

Prosopis cineraria flower is pounded, mixed with sugar and used during

pregnancy as safeguard against miscarriage. The wood ash which contains 31 percent of soluble potassium salts may be used as a source of potash. The bark of this plant has a sweetish taste. It is reported that during servere famine of rajputana in 1868-69, many lives were saved by the use of bark as a source of food. It was ground in to flour and made in to cakes. The bark of the tree is dry, acrid, bitter with a sharp taste; cooling anthelmintic; tonic, cures leprosy, dysentery, bronchitis, asthma, leucoderma, piles and tremors of the muscles.[17] The bark is also used for tanning. Mesquite pollen serves as a dietary source for mice. Leaf paste of *P. cineraria* is applied on boils and blisters, including mouth ulcers in livestock and leaf infusion on open sores on the skin.[18] The smoke of the leaves is good for eye troubles. The fruit is dry and hot, with a flavour, indigestible, causes biliousness, and destroys the nails and the hair. The pod is considered astringent in Punjab. Recently processing composition, nutritional evolution and utilization of mesquite (prosopis spp.) pods as a raw material for food industry had been reported. The bark is used as a remedy for rheumatism, in cough colds, asthma. The plant is recommended for the treatment of snakebite. The bark is prescribed for scorpion sting.[19]

Conclusion

Prosopis cineraria (khejri) holds an important place in the rural economy in the northwest region of Indian subcontinent. Studies by Gupta and Saxena (1978)[20] and Shankar *et al* (1976)[21] shows higher biomass and soil moisture status under the canopy of the Khejri. According to Mann & Muthana (1984),[22] this tree enhances herbaceous plants and crop yield. Singh and Lal (1969)[23] reported better growth of the plant in its vicinity due to high organic matter, total nitrogen, available Potassium and soluble Calcium. Aggarwal (1980)[24] concluded that the status of available micronutrients generally improved under *P. cineraria* plantation. The crop improving effect of tree legumes, especially khejri, is generally ascribed to the input of microbial fertilizers in the soil through nodulation (Basak and Goyal, 1975).[25]

Considering the many medicinal purpose for which it is used, there is enormous scope for future research on *Prosopis cineraria*, and further pharmacological investigation is warranted.

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