



A REVIEW ON *Prosopis cineraria* AS AN IMPORTANT PLANT OF ARID REGIONS OF INDIA

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ABSTRACT

Prosopis cineraria belongs to family Leguminosae, commonly known as Khejri, Khijdo, Shami, Jandi. Leaves and pods are extensively used as fodder for cattle, camels and goats. The plant is also have been used in indigenous system of folk medicine as folk remedy for various ailments 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. Plant is previously reported to have major phytochemical compounds like fatty acids, carbohydrates, protein, saponines tannins, alkaloids and glucoside. Plant possesses pharmacological activities which includes Analgesic activity, Antitumor activity, Anticonvulsant activity, Anthyperlipidemic activity, Antipyretic activity and Antimicrobial activity.

KEY WORDS: *Prosopis cineraria*, Phytochemicals, Pharmacological activities.

INTRODUCTION

Prosopis cineraria is a small to moderate size (5 to 10meter 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.

Khejri is the only the tree that grows well despite all the environmental conditions of a desert. All the parts of the tree are usefull so it is referred to as Kalptaru. It is also referred to as the 'wonder tree' and therefore as the 'king of desert' (Bari *et al.*, 2007; Gupta & Prakash 1975; Kaul *et al.*, 1967; Burdak *et al.*, 1982). Frequent surveys made in the year 2010 in Jodhpur, Nagpur, Sikar, Churu, and Jhunjhunu by Arid Forest Research Institute, Jodhpur, revealed that the percentage mortality of khejri tree ranged from 18.08 to

22.67 % with an average mortality of 20.93 % in these districts (Ahmed *et al.* 2010; Haldhar *et al.*, 2012).

Prosopis cineraria (L.) Druce is a deep rooted, nitrogen fixing, and endemic to the hot deserts of India. (Dobhal *et al.*, 2018)

New leaves appear before or simultaneously with the fall of the old leaves in summer. Small and yellow flowers appear from March to May after the new flush of leaves and thereafter pods are formed soon and grow rapidly in size. From June to August is the ripening time of pods. Growth of new foliage, flowering and fruiting occurs during the driest months March-June. The plant is also having antifungal, anthelmintic, antibacterial, anticancer, antiviral activities too. Leaf paste of *Prosopis cineraria* is applied on boils and blisters, including mouth ulcers in livestock. The smoke



of the leaves is considered good for eye troubles. (Tarachand *et al.*, 2012)

Prosopis cineraria is capable of growing when irrigated with 50% seawater. This tree also forms open woodlands on black cotton soils and will grow on dry stony alkaline land where the pH may reach 9.8. (Harris *et al.*, 2017). The conservation of khejri trees is a religious tenet of Rajasthan's Bishnoi community. They started Chipko Movement in 1731 for saving khejri tree from cutting. (Rahman *et al.*, 2005)

The gum of the tree is nutritive and good in taste and is employed by pregnant woman at the time of delivery. A paste of flowers beside twig conjointly act as anti-diabetic agents, once administered orally. (Dobhal *et al.*, 2018)

Morphological characters

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.

Stem is erect, branched, solid, woody and strong having diameter about 13-16 cm. Young twigs are purplish green in color. Spines (0.3 to 0.6 cm long) and galls are present on the stem. It is also having annular rings in the woody portion. The stem tissue is often rich in tannin sacs and gum passages.

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

Leaves Compound, bipinnate, stipulate, stipules modified into spines, Alternate, petiolate. Leaflets are ovate, Apex is mucronate, base is unequal, and margin is entire and reticulate venation. Size of leaf is 1-1.5 cm. long and 0.4-0.6 cm. broad.

Inflorescence is Racemose Spike.

Flowers are regular, bisexual, bracteate, complete, zygomorphic, pentamerous hypogynous. The flowers are small in size and yellowish in colour, appear from March to May after the new flush of leaves.

Calyx: Sepals are 5, lobed, gamosepalous, valvate and yellowish in color.

Corolla: Petals are 5, gamopetalous, valvate and yellowish in color

Androecium: Stamens are free and 10 in number. Amongst 10 filaments 5 filaments are long and 5 filaments are short. Anthers are two celled and dorsifixed.

Gynoecium: Monocarpellary superior ovary, Uni-locular, Marginal placentation. Style is filiform. Stigma is capitate.

Fruit is Legume (pod). Fleshy pods are sickle shape which are 10 to 20 cm long and contain sweetish mucilaginous pulp. Pods are mature in May-June.

Seeds are non-endospermic and dark brown in color packed in brown pulp. Seeds are ovoid in shape. 10 to 25 seeds are present in 1 fruit.

Plant botanical name: *Prosopis cineraria* (L.) Druce

Botanical family: Leguminosae, subfamily Mimosoideae

Classification: (According to Bentham & Hooker)

Kingdom: Plantae

Sub kingdom: Phanerogams

Division: Angiosperms

Class: Dicotyledons

Sub-class: Polypetalae

Series: Calyciflorae

Order: Rosales

Family: Leguminosae (Fabaceae)

Genus: *Prosopis*

Species: *cineraria*



Leaves



Habitat



Pods



Stem Bark

Vernacular names:

Sami (Sanskrit), Mesquite (English), Shami, Jhand (Hindi), Khijado (Gujarati), Shemi (Marathi), Jambi (Telugu), Jhand (Punjabi), Candy (Sindhi), Khejari (Rajasthani).

Geographical sources: India, Pakistan, Afghanistan, Iran, and Arabia

Chemical constituents: It contains sugars, five flavones, fatty acids, tannins and alkaloids

Pods (seeds): The major chemical compounds seen are 18% protein, 2% fat, 26% crude fiber, 56% total carbohydrates, and Ash 4%, Ca 414, P 400, Zn 4, Fe 19 and Mn 4 mg per 100 gm., High level of vitamin C 523 mg/100 gm., 0.99% Amino acids, 3.5% of fatty oil containing oleic acid and linoleic acids (80%), Non-glycosidic polyphenolics, Gallic acid, Patuletin, Luteolin, Prosogerin – E (6, 7-dihydroxy-3', 4', 5'-trimethoxyflavone), Glycosidic polyphenolics, Patulitrin, Rutin.

Leaves: The major chemical compounds seen are 11.9 % Crude Protein, 2.9% Ether extract, 17.5% Crude fiber, 43.5% Nitrogen free extract, 0.4% Phosphorus, 2.1% Calcium, 8.1% Ash.

Flowers: flavone glycoside, Patulitrin 3, 5, 6, 3, 4-pentamethoxy-7-hydroxy flavone

Stem bark: Glucose, Rhamnose, Sucrose, Starch, Vitamin K, n-octacosyl acetate & Long chain aliphatic acid

Also, this plant contains phytochemicals like 5-hydroxytryptamine, apigenin, isorhamnetin-3-diglucoside, l- arabinose, quercetin, tannin and tryptamine by researchers

Alkaloids like Spicigerine (Bhardwaj *et al.* 1979), Dasycarpidan-1-methanol, acetate (ester), 3-Butylindolizidine, Prosophylline (Aneela *et al.* 2014) are previously found in *Prosopis cineraria*.

Flavonoids like Prosogerin A, Prosogerin B, Prosogerin C, Prosogerin D, Prosogerin E found in plant. (Bhardwaj *et al.* 1978; 1980; 1981)

Steroids like Cholesterol (Malik & Kalidhar 2007), 7, 24-Tirucalladien-3-one, Campesterol, Stigma sterol, β -Sitosteryl, Stigmasta-4, 6-dien-3-one (Bhardwaj *et al.* 1981) are found in this plant by researchers.

Fatty acids and Derivatives of *Prosopis cineraria* which is (Z)-13-Docosenamide, 9-Hexadecenoic acid, (Aneela *et al.*, 2014), Palmitic acid, Stearic acid, Oleic acid, Linoleic acid (Ukani *et al.*, 2000), Heneicosanoic acid, Methyl heptacosanoate (Khan *et al.*, 2006) has been found from different plant parts.

Terpenoids that are Phytol, Squalene, Rhodopin, Rhodoxanthin (Aneela *et al.*, 2014), 3 -Benzyl-2-



hydroxy-urs-12-en-28-oic (Gangal *et al.*, 2009) is previously found from this plant.

Phenyl propanoids: Ferulic acid, (Singh *et al.* 2013), Methyl 4-hydroxycinnamate, Methyl 2-methoxy-5-hydroxycinnamate, O-Coumaroylglycerol (Dobhal *et al.*, 2018)

Other compounds: (Liu *et al.*, 2012); (Aneela *et al.*, 2014); (Gangal *et al.*, 2009); (Soni *et al.*, 2015) has found the other chemical compounds like alcohols, esters, diketones, alkanes, heterocyclic compounds are Hentriacontane, Actacosanol, Methyl docosanoate, Diisopropyl-10,11-dihydroxyicosane-1,20-dioate, Tricosan-1-ol, Dichloronitromethane, Octamethylcyclotetrasiloxane α), 2-Methyl benzaldehyde, 2,7-Anhydro-1- heptulofuranose, 2-[(9Z)-9-Octadecene-1-yloxy]ethanol, 2-C-Methyl myoinositol, 2-Methyl-2-(3-oxobutyl)-1,3-cyclohexanedione, Diphenyldimethylsilane α), Dibutyl phthalate α), 2,2,4-Trimethyl-4-(4'-trimethylsilyloxyphenyl) chromane α), 5-Nitro-2-furaldehyde, N-[4-(Tributylstannyl)butyl]-3-tributylstannylpropionamide α), 17-Pentatriacontene, Octacosyl pentafluoropropionate, 5,5'-Oxybis-1,3-benzendiol, n-Octacosyl acetate, Methyl 5-tridecyloctadec-4-enoate, Nonacosan-8- one.

PHARMACOLOGICAL ACTIVITIES

Anti-Microbial activity

Ethyl ether and alcoholic extracts of leaves of *Prosopis cineraria* were used to check Anti-microbial activity, *Staphylococcus aureus* (Gram positive), *Escherichia coli* (Gram negative) and *Candida albicans* (Fungal pathogen) were used as pathogenic organism. The growth medium used for *Staphylococcus aureus* and *Escherichia coli* was Nutrient broth (10% peptone, 0.5% labanco and 0.5% NaCl, pH adjusted to 7.5) and for *Candida albicans* liquid medium (1% peptone, 4% glucose, pH adjusted to 5.8). Paper discs of known concentration of standard antibiotics namely chloramphenicol, penicillin and mycostatin were used for comparison. Both ethyl ether and alcoholic (50% ethanol) leaves extracts showed positive reactions against all the three test organisms (Kumar *et al.*, 2011). The antibacterial activity of the various extracts of the stem bark of *Prosopis cineraria* was evaluated by the agar well diffusion method. The methanolic and aqueous extracts of the stem bark of *Prosopis cineraria* exhibited moderate antibacterial activity with all the tested strains of microorganisms at 250 $\mu\text{g/ml}$ concentration on comparison with the standard ciprofloxacin. The obtained activity may be due to the presence of flavonoids and tannins (Velmurugan *et al.*, 2010)

Anti-tumor activity

Hydro alcoholic extracts of bark and leaves were evaluated for Antitumor activity against Ehrlich as cites carcinoma tumor model. The activity evaluated using survival time, peritoneal cells, lipid peroxidation, hematological studies, and solid tumor mass and in vitro cytotoxicity. Both the extract showed substantial antitumor activity (Velmurugan *et al.*, 2012). Methanolic extract of leaves was evaluated for protective action against induced experimental liver tumors in male Wister rats. The levels of mitochondrial lipid peroxidation and liver weight were found to be decreased by the administration of extract (200 and 400 mg/kg) in dose dependent manner. The extract also increased the levels of mitochondrial enzymatic antioxidants (Vijay *et al.*, 2013).

Analgesic and antipyretic activities

Petroleum ether, ethyl acetate and ethanol extract of stem bark were prepared by using soxhelt apparatus. Ethanoic extract showed a significant analgesic activity Eddy's hot plate model at a dose of 300 mg/Kg B. W. in experimental rats. The Petroleum ether extract of stem bark exhibited a significant antipyretic activity using Brewer's yeast induced hyperpyrexia model in experimental rats. (Sachdeva *et al.*, 2014). 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 (Joseph *et al.*, 2011).

Anti-Diabetic and Antioxidant Activities

50% Hydro-alcoholic extract of stem bark was evaluated for anti-hyperglycemic activity using Alloxan induced Hyperglycemia Model. Extract at a dose of 300 mg/Kg B.W. was administered to hyperglycemic mice orally once in a day for 45days. Body weight loss in mice was significantly controlled as compared to control group. Fasting blood glucose level decreased 27.3%, comparable to that of standard glibness amide which produced 49.3% reduction and liver glycogen content was significantly increased as compared to control group. Declined activity of antioxidant enzymes and concentration of non-enzymatic antioxidants were also normalized by drug treatment, thereby reducing the oxidative damage in the tissues of diabetic animals, so it's indicating Antidiabetic and Antioxidant activity of the extract (Sharma *et al.*, 2010)



Anticonvulsant activity

Methanolic extract of stem barks was studied for anticonvulsant activity against maximal electro shock (MES) and Pentylene tetrazole (PTZ) induced convulsions in mice. Methanolic extract of stem barks showed significant anticonvulsant effect in both models (Sachdeva *et al.*, 2014) & (Velmurugan *et al.*, 2012).

Ethnomedicinal uses: The importance of the healthful worth of *Prosopis cineraria* tree has been highlighted in ancient Ayurvedic literature

Bark: The Bark of *Prosopis cineraria* is cooling anthelmintic, tonic, cures infectious disease, dysentery, bronchitis, asthma, leucoderma, piles, tremors of the muscles (Kirtikar & Basu 1984). Rheumatism, cough and colds, diarrhea, worm infestations, and skin problems (Sharma *et al.*, 1993). The bark of the plant offers immediate relief to an individual bitten by a snake or a scorpion (Chopra *et al.*, 1956). It has reported that in the severe famine of rajputana in 1868-69, several lives were saved by the employment of bark as a supply to food. It was ground into flour and transformed into cakes

Leaves: leaves of the *Prosopis* have high nutritional value and known as "Loong". Leaf extract of the *Prosopis* shows Antibacterial, Ant hyperglycemic and Antioxidant activity (Pal *et al.*, 2015). Smoke of the leaves seem to be good for eye troubles. Leaf paste of is applied on boils and blisters, together with mouth ulcers in livestock and leaf infusion is employed on open sores on the skin (Nandkarni *et al.*, 2000). Leaves and fruits are used to prepare medicines for curing nervous disorders. The leaves besides the pods are eaten by camels, goats and cattle.

Flowers: it is pounded, mixed with sugar and used throughout maternity as safeguard against miscarriage Paste of flowers beside twig conjointly act as anti-diabetic agents, once administered orally. (Dobhal *et al.*, 2018)

Gum: gum of the tree is nutritive and good in taste and is employed by pregnant woman at the time of delivery and is according to be astringent, demulcent, and pectoral

Fruits: the pods are locally called "Sangari" and it is eaten by tribal peoples and also it is rich fodder for animals. It is used as a food in the desert area during scarcity. It is also rich source of vitamins for the tribal people. Maheshwari *et al* reported that Sangri pods 'flour is mixed with wheat flour to make bread (chapatti) and bakery products. One of the great dishes of Rajasthani cuisine.

CONCLUSION

Prosopis cineraria has varied phytoconstituents and possess different kinds of biological activities like Analgesic activity, Antitumor activity, Anticonvulsant activity, Anthyperlipidemic activity, Antipyretic activity and Antimicrobial activity. The plant is used medicinally since ancient times, different parts of plant is containing a lot of phytochemicals which can be utilized for the treatments of various disease, parts of plant is used by native healers to manage multiple ailments which is gastrointestinal, respiratory, and cardiovascular disorders. The stem bark has folkloric repute to possess anti-inflammatory, antirheumatic, tonic, and vermifuge properties and is used in the treatment of anxiety, asthma, bronchitis, dyspepsia, fever, dysentery, leprosy, piles, wandering of the mind, and tremors. Furthermore, it is claimed to have abortifacient and laxative properties.

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