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Review Paper

Phytochemical And Pharmacological Profile of Prosopis Spicigera: A Review

Pratiksha Rathod*, Ashwin Manjrekar, Amar Deshpande, Jagdish Baheti

Kamla Nehru College of Pharmacy, Butibori, Nagpur, Maharashtra - 441108.

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ABSTRACT

In the Indian desert, Prosopis spicigera Linn., commonly referred to as Khejri, is a common medicinal plant that is used to cure a variety of illnesses, including leukoderma, leprosy, asthma, and dyspepsia. With possible pharmacological effects such as anti-inflammatory, anticonvulsant, antifungal, anticancer, antidiabetic, hypolipidemic, abortifacient, antioxidant, and wound-healing qualities, it contains phytoconstituents such as tannins, steroids, flavone derivatives, and alkaloids. Khejri is the colloquial name for Prosopis spicigera Linn. in the Indian desert. The plant is also known as Janti/Long tree in Rajasthan, Kandi in Sind, Jand in Punjab, Sami in Gujarati Marathi, and Khejri in Hindi and Sanskrit. The herb is also used in traditional medical systems.

INTRODUCTION

A small to moderately sized plant, Prosopis spicigera Linn. is classified as part of the Fabaceae (Leguminosae) family. It is also frequently referred to as Prosopis spicigera (L.), or simply "Sami." There are over 45 species of prickly trees and shrubs in the genus Prosopis. North West India is where Prosopis spicigera and other species first appeared. Tribal people use this xerophytic, draught-resistant tree for timber and fodder. Sugars, alkaloids, fatty acids, flavonones, and tannins are all present in the plant. Cattle, goats, and camels consume the leaves and pods, while the fruit is consumed in arid regions. Leprosy, dysentery, bronchitis, asthma, leucoderma, cancer, and scorpion bite are among the conditions that the bark is used to treat. Prosopis spicigera Linn is also known as Prosopis cineraria. [1,2].

***Corresponding Author:** Pratiksha Rathod
Address: *Kamla Nehru College of Pharmacy, Butibori, Nagpur, Maharashtra - 441108.*
Email ✉: rathodpratiksha79@gmal.com
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Fig no. 1 Prosopis spicigera

Taxonomical Classification and Vernacular Names [3]

Table no.: 1

Sr.no.	Taxonomical Classification	
1.	Kingdom	Plantae
2.	Division	Phanerogamic
3.	Subdivision	Angiospermae
4.	Class	Dicotyledonae
5.	Subclass	Polypetalous
6.	Order	Fabales
7.	Family	Fabaceae
8.	Subfamily	Mimosaceae, Caesalpinioideae
9.	Genus	Prosopis

Table no.: 2

Sr. no.	Vernacular Names	
1.	Sanskrit	Sami
2.	Hindi	Shami, Jhand
3.	English	Mesquite
4.	Gujarati	Khijado
5.	Marathi	Shemi
6.	Telugu	Jambi
7.	Panjabi	Jhand
8.	Sindhi	Kandi
9.	Rajasthani	khejari

Phytoconstituent of plant

Table no.: 3

Sr.no.	Part of plant	Phytoconstituent	Reference
1.	Leaves	Cholesterol, sitosterol and stigmasterol, actacosanol, hentriacontane, methyl docosanoate, Diisopropyl-10, 11-dihydroxyicosane-1,20-dioate, Tricosan-1-ol, and 7,24-Tirucalladien-3-one	[4,5]
2.	Seed	Prosogerin E, Gallic acid, patuletin, patulitrin, luteolin, and rutin. unsaturated fatty acids, with linoleic and oleic acids	[6,7]
3.	Flower	Patuletin glycoside patulitrin, sitosterol, spicigerine, Flavone derivatives Prosogerin A and Prosogerin B.	[8,9]
4.	Dried pod	3-benzyl-2-hydroxy-urs-12-en-28-oic acid, maslinic acid 3-glucoside, linoleic acid, prosphylline, 5,5′-oxybis- 1,3-benzendiol, 3,4,5, trihydroxycinnamic acid 2-hydroxy ethyl ester and 5,3′,4′-trihydroxyflavanone 7-glycoside	[10,11]
5.	Whole plant	Contains methyl heptacosanoate, heneicosanoic acid, 4-hydroxy benzoic acid, methyl 4-hydroxycinnamate, methyl 2-methoxy-5-hydroxycinnamate and *O*-Coumaroylglycrol	[12,13]
6.	Bark	Phenol, terpenoids, flavonoids, saponins, alkaloids, steroids, amino acids and proteins,	[14]

Biological & Pharmacological activities

Antibacterial activity: Three microorganisms were used to test the antibacterial activity of ethanol ether and alcoholic leaf extracts: Candida albicans (fungal pathogen), Escherichia coli (gram-negative), and Staphylococcus aureus

(gram-positive). Nutrient broth (10% peptone, 0.5% labanco, and 0.5% NaCl, pH adjusted to 7.5) and liquid medium (1% peptone, 4% glucose, pH adjusted to 5.8) were the growth media utilized for Staphylococcus aureus and Escherichia coli. For comparison, paper discs with known concentrations of common antibiotics, such as mycostatin, penicillin, and chloramphenicol, were utilized. Alcoholic leaf extracts (50 percent ethanol) and ethyl ether both exhibited favourable responses against each of the three test species. The methanolic and aqueous extracts of the stem bark of Prosopis spicigera exhibited moderate antibacterial activity with all the tested strains of microorganisms at a 250 µg/ml concentration in comparison with the standard ciprofloxacin. The obtained activity may be due to the presence of flavonoids and tannins. [15]

Antihyperglycemic and Antihyperlipidemic Activity: When administered to STZ-induced diabetic rats at a dose of 750 mg/kg, a hydroalcoholic extract of Prosopis spicigera resulted in a statistically significant reduction in blood glucose levels when compared to the normal control. After 12 weeks of chronic administration of Prosopis spicigera aqueous extract, diabetic rats' serum insulin levels significantly increased. This suggests that the fractions may likely activate the remaining β-cells of the islets of Langerhans and return them to their normal state, a process known as an insulinogenic effect. It's possible that the diabetes control group's decreased body weight was caused by an increase in muscle glucose absorption, which stops tissue loss. [16]

Antidepressant and Skeletal Muscle Relaxant Activity: Using the forced swimming and tail suspension tests, the Prosopis spicigera aqueous leaf extract demonstrated strong antidepressant-like effects and skeletal muscle relaxant activities. It has long been used to treat a variety of CNS conditions. The Forced Swim Test (FST) was used to assess the antidepressant effect. Leaf extract's antidepressant properties in comparison to imipramine's (15 mg/kg). At concentrations of 200 mg/kg, the leaf extract dramatically shortened the FST immobility period. Rota-rod testing is performed to determine the skeletal muscle relaxant activity. The examination was performed to assess how well medications affect motor coordination. [17]

Antitumor Activities: The Ehrlich ascites carcinoma tumor model was used to test the anticancer activity of hydroalcoholic extracts of leaves and bark. Survival time, peritoneal cells, lipid peroxidation, haematological investigations, solid tumor mass, and in vitro cytotoxicity were used to assess the activity. At 200 and 400 mg/kg, both extracts exhibited significant anticancer activity [18]. The preventive effect of the methanolic leaf extract against experimental liver cancers generated in male Wistar rats by N-nitrosodiethylamine (DEN, 200 mg/kg) was assessed. DEN administration raised liver weight and mitochondrial lipid peroxidation (LPO) levels, which were subsequently found to be reduced by extract administration (200 and 400 mg/kg) in a dose-dependent manner. When compared to rats with liver tumors, the extract also raised the levels of non-enzymatic antioxidants, including reduced glutathione (GSH) and mitochondrial enzymatic antioxidants like glutathione peroxidase (GPx), catalase (CAT), and superoxide dismutase (SOD). According to the study, MPC may increase the mitochondrial antioxidant defense system and modify liver weight and mitochondrial lipid peroxidation levels to increase its protective effects.[19]

Analgesic and Antipyretic Activities: Using a Soxhlet apparatus, petroleum ether, ethyl acetate, and ethanol extracts of stem bark were made. At 300 mg/kg B.W., ethanolic extract significantly reduces pain in experimental rats using the Eddy's shot plate technique. At the same dosage, petroleum ether extract had a strong antipyretic

effect in a model of hyperpyrexia caused by Brewer's yeast. [20] Using the tail immersion and hot plate methods, the analgesic efficacy of an ethanolic extract of the root was assessed at oral doses of 200 and 300 mg/kg B.W. When compared to the control, the former dose had a notable analgesic effect.[21] The analgesic properties of a leaf aqueous extract were assessed utilizing the acetic acid-induced writhing test model. When Swiss albino mice were given a dose of 200 mg/kg B.W., they demonstrated substantial analgesic activity in comparison to the control. Additionally, employing a Brewer's yeast-induced hyperpyrexia model, the extract demonstrated a strong antipyretic effect at the same dose.[22]

Antioxidant Activity: Various in vitro tests were used to assess the successive leaf extracts for antioxidant capability. According to the findings, plant leaf extract contains substances that can give a free radical hydrogen in order to eliminate the odd electron that causes the radical's reactivity. Petroleum ether had the least amount of scavenging action among the six extracts, whereas ethyl acetate and methanolic extracts had the most, followed by chloroform and aqueous extracts. [23]

Anticonvulsant Activity: Using phenytoin (25 mg/kg i.p.), the anticonvulsant properties of the methanolic extract of stem barks were investigated against maximum electrical shock (MES) and convulsions caused by pentylenetetrazole (PTZ) in mice at dosages of 200 and 400 mg/kg i.p. As expected, the extract demonstrated a protective effect on PTZ-induced seizures and inhibited hind limb tonic extensions (HLTE) brought on by MES. In both models, methanolic stem bark extract demonstrated strong anticonvulsant activity.[24].

Nootropic Activity: Rats were given methanol extract of stem bark once daily for seven days at dosages of 200, 400, and 600 mg/kg. The rats were then put through the Morris water-maze (MWM) test for the spatial reference memory (SRM) and spatial working memory (SWM) models of memory testing. Acetyl-thiocholine iodide and dithio-bis-nitrobenzoic acid reagent were also used to test the extract's inhibitory impact on acetyl cholinesterase (AChE) in certain rat brain regions (prefrontal cortex [PFC], hippocampus [HIP], and amygdala [AMY]). By reducing escape latency during SRM and increasing time spent in the target quadrant during the SWM probe trial, oral administrations of Prosopis spicigera methanol extract at all tested doses effectively enhanced both spatial reference and working memories in the MWM test. At 400 mg/kg, a ceiling effect was noted. Seven days of pretreatment markedly reduced AChE activity in the HIP, PFC, and AMY. [25]

Antihypercholesterolemic Activity: In albino male New Zealand white rabbits fed a high-fat diet, the antihypercholesterolemic effect of hydroalcoholic 70% stem bark extract at a dose of 500 mg/kg was assessed using a conventional medication, atorvastatin (0.25 mg/kg orally). Serum samples at the beginning and end were used to estimate the ischemia indices, toxicological profile, total cholesterol (TC), triglycerides (TG), LDL cholesterol, HDL cholesterol, and TC. In comparison to hypercholesterolemic control, the treatment of bark extract significantly decreased serum total cholesterol (88%), LDL-C (95%), triglycerides (59%), VLDL-C (60%), and ischemia indicators. Additionally, the extract considerably inhibited the aortic atherogenic alterations. [26,27]

Respiratory and gastrointestinal activity: The stem bark's methanolic extract was examined for its vasodilator, bronchodilator, and spasmolytic properties. The extract resulted in both spontaneous and K+ (80 mM) relaxation. caused contractions in isolated rabbit jejunum preparations at tissue bath concentrations ranging from 3 to 10 mg/mL, most likely due to Ca+ channel blockage. The Ca+ concentration response curves changing to the right in a way akin

to that of verapamil, a common Ca^{2+} channel blocker, further supported this conclusion. In isolated rabbit tracheal preparations, the extract also demonstrated a nonspecific relaxant effect on contractions generated by carbachol (1 μM) and K+ (80 mM). Similar to verapamil, the same effect was observed for contractions generated by phenylephrine (11 μM) and K^+ (80 mM) in isolated rabbit aortic preparations. These findings support the theory that blockage of Ca+2 channels may have mediated the observed bronchodilator and vasodilator actions.[28]

Antihyperglycemic and antioxidant activities: Using the Alloxan-induced Hyperglycemia Model, the antihyperglycemic effects of a 50% hydroalcoholic extract of stem bark were assessed. For 45 days, hyperglycemic mice were given extract orally once daily at a concentration of 300 mg/kg B.W. Mice's body weight reduction was considerably more controlled than that of the control group. When compared to the control group, the liver glycogen content was much higher, and the fasting blood glucose level reduced by 27.3%, which is somewhat close to the 49.3% reduction caused by conventional glibenclamide. Drug therapy also restored the content of non-enzymatic antioxidants and decreased the activity of antioxidant enzymes, which decreased oxidative damage in diabetic animals' tissues and demonstrated the extract's anti-diabetic and antioxidant properties. [29]

CONCLUSION

Prosopis spicigera is a promising medicinal plant with a wide range of pharmacological activity that has been used traditionally, according to the review above. However, the researchers discovered a number of new activities following the identification of several newer compounds from the plant, and as a result, the plant is now gaining prominence in order to produce further new searches for future development by comprehending the gene level study. Thus, there is a lot of room for more research on Prosopis spicigera Linn given its many therapeutic applications.

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