wjpmr, 2020,6(6), 135-138

SJIF Impact Factor: 5.922

WORLD JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.wjpmr.com

Review Article

ISSN 2455-3301

WJPMR

THERAPEUTIC USES OF KHEJRI (*PROSOPIS CINERARIA*): A REVIEW ARTICLE

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Article Received on 03/04/2020 **Article Revised on 24/04/2020** **Article Accepted on 14/05/2020**

ABSTRACT

Prosopis cineraria (L.) Druce. (Family Leguminosae, subfamily Mimosoideae), is locally known as Ghaf. The plant effects socially, ethnologically, traditionally and remedially in the life of the people. The proposition is to summarize the current studies on up-to-date and comprehensive information, highlighting bioactive potential of the plant. The review aimed to revise the information available regarding the therapeutic activities published in scientific journals and to provide a comprehensive tabulated data in such a way that it is useful for academic researcher. A through scientific search of *P. cineraria* (L.) was carried out on phytochemical constituent's viz. leaf, stem, pod, bark, and their pharmacological data and safety. The review is helpful in utilizing abridged scientific knowledge of the *P. cineraria* (L.), identifying gaps in, and future possibilities to work with.

KEYWORDS: Ghaf; *Prosopis cineraria* (L.); Traditional usage; Therapeutic potential.

INTRODUCTION

The *Prosopis cineraria* (L.) Druce occurs in most of the world's hot arid and semi-arid regions as native or introduced species. The Great Indian Desert, popularly known as the Thar, the arid regions is characterized by the extremely arid climate with low and erratic rainfall, dry atmosphere and high wind velocities. *P.* cineraria (L.)**.** Its population is centered on the of India and Pakistan, but smaller populations occur in Iran, Afghanistan, and the Arabian Peninsula, *P. cineraria* (L.) is an important native species to the Northeastern United Arab Emirates (UAE), locally known as Ghaf and is among few trees growing in the arid deserts of the UAE and constitute a major ecological feature and is beneficial for the growth and development of other species**.** The climate of the UAE is characterized by high temperatures, high humidity, and low rainfall Bedouin traditional lifestyle in UAE has been very much associated with the *Prosopis* trees and their products. The rapid growth and modernization of infrastructure have led to noticeable changes in the Emirati way of life. As the country rapidly modernizing and due to rapid change in socioeconomic conditions of the country, the dependency of Bedouins become less and less on the plant. Less number of people get benefit by the plant as was practiced earlier. Therefore, the plant has been badly neglected for scientific studies. The negligence is reflected from the fact that almost no scientific work has been carried out on the plants especially from the medicinal and nutritional potential point of view.

Literature search showed that much of the work related to the exploration of medicinal properties of the plant has been carried out in Indian and Afghanistan desert conditions. The plant is yet to be explored in other environmental conditions for its therapeutic/medicinal properties. In our laboratory, investigation has been undertaken to evaluate pharmacological and safety studies, financed by Ajman University, to confirm the allied traditional uses of the plant and its therapeutic potential.

Species

The genus *Prosopis* as described by Burkart consists of 44 species. They have been introduced globally and have become invasive in many places, as native or introduced species.

Distribution

P. cineraria (L.) mainly distributed in the deserts of India, Pakistan, Afghanistan, Iran, and the Arabian Peninsula. In the Arabian Peninsula, *P. cineraria* (L.) exists mostly in the UAE and Oman, *Prosopis* has been reported to occur in 129 countries globally and many more countries are climatically suitable**.**

Traditional Uses of The Plant

Prosopis sp. is known as "Golden tree", has been used for a variety of traditional uses for more than 5000 years in their native ranges. The tree is worshiped customarily and nearly all the parts of the plants are used traditionally

by indigenous people for curing various ailments**.** The use of paste, gum, and smoke from leaves and pods has been reported as anticancer, antidiabetic, anti-inflammatory, and antimicrobial purposes. Fresh Leaves juice mixed with lemon juice issued for dyspepsia; extract of crushed pods is used for earache, toothache. The leaf paste applied on boils and blisters; leaf infusion on open sores on the skin. The stem bark has folkloric repute to possess anti-inflammatory, ant rheumatic, tonic, and vermifuge properties is reported to be used in the treatment of anxiety, asthma, bronchitis, dyspepsia, fever, dysentery, leprosy, piles, and tremors, asthma, bronchitis, dysentery, leukoderma, leprosy, muscle tremors and piles. The bark is used as a remedy for rheumatism, cough, common cold asthma and scorpion stings, and also against miscarriage. The ashes of bark are rubbed over the skin to remove hair. The flowers are used as an antidiabetic agent. The flowers are mixed with sugar and administered to prevent miscarriage. The smoke of the leaves is considered a good remedy for ailments of the eye. The immature and mature pods are energy rich edible and have high nutritional values for as a human diet in the various regions.

Bioactivity Studies

Hydro-alcoholic extract of leaves and bark showed significant antitumor activity. Experimental liver tumors in rats inhibited cell proliferation inhibited the proliferation of MCF-7 breast cancer cells reported antigenotoxic effects.

P. cineraria (L.) produce antibacterial properties. The antibacterial activity was tested against clinical isolate, the methanol extract showed better results against all pathogens in comparison to standard antibiotic drug. Aqueous and chloroform extract of the unripe pods of did not showed any activity against *E.coli, P. aeruginosa* and *S. typhi.* The ethyl ether and alcoholic extracts showed positive reactions against all *S. aureus*, *E. coli* and *Candida albicans*. The microbial activity has been reported due them to the presence of flavonoids and tannins[57].

P. cineraria (L.) has been shown protective role in reducing glucose levels as well as in increasing body weight, decreasing in the blood glucose, antihyperglycaemic activity decreasing the fasting blood glucose level in mice, and reducing the oxidative damage in the tissues of diabetic animal. Sharma and Singlas reported that *Prosopis* extracts showed insulinogenic effect; and caused significant increase in the serum insulin levels.

Analgesic Activity and Antipyretic activity

Different extracts of leaves exhibited significant analgesic activity and antipyretic activity. Petroleum ether, ethyl acetate and ethanol extracts of stem bark showed a significant analgesic activity in experimental rats. Ethanol extract exhibited analgesic activity and significant anti-pyretic activity as reported due to the presence of alkaloids, tannins, and steroids.

Methanolic extract of dried stem bark of *P. cineraria* (L.) showed improved nootropic activity in mice. Methanolic extract from the stem bark exhibited spasmolytic, bronchodilator, and vasodilator activities in isolated rabbit tracheal preparations. Methanolic extract showed significant reduction in duration of convulsions.

Phytochemical Constituents/Compounds of The Plant And Bioactivity

P. cineraria (L.) were investigated for various phytochemical constituents such as alkaloids, carbohydrates, steroids, proteins, phenols, tannins, flavonoids, glycosides, and saponins as per Indian Pharmacopoeia.

Seeds

The seeds contain protein, carbohydrates, seed protein is constituted of alanine, arginine, aspartic acid, glutamic acid, glycineserine, isoleucine-leucine, histidine, lysine, methionine, phenylalanine, proline, threonine, tyrosine, valine, and traces of tryptophan ; also contains fixed oils, 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. The seed lipids contain a relatively large proportion of unsaturated fatty acids, with linoleic and oleic acids being predominant. Seeds have been reported to contain the chemical compounds Prosogerin C, Prosogerin D, Prosogerin E, Gallic acid, patuletin, patulitrin, luteolin, and rutin; flavones from seeds.

Flowers

The isolation of a flavone glycoside Patulitrin 3, 5, 6, 3, 4-pentamethoxy-7-hydroxy flavone from flowers of *P. cineraria* (L.) has been reported. The presence of phytochemicals in *Prosopis* flowers that include Patuletin Glycoside patulitrin, luteolin and rutin sitosterol, spicigerine, and flavone derivatives Prosogerin A and Prosogerin B.

Leaves

Amino acids isolated from leaves are Aspartic acid, Glutamic acid, Serine, Glycine, Histidine, Threonine, Arginine, Alanine, Proline, Tyrosine, Valine, Methionine, Cysteine, Isoleucine, Leucine, Phenylalanine and Lysine; phenolic acid derivatives. Garg and Mittal reported that the leaves contain steroids like campesterol, cholestrol, sitosterol and stigmasterol, actacosanol, hentriacontane, methyl docosanoate, Diisopropyl-10, 11-dihydroxyicosane-1,20-dioate, Tricosan-1-ol, and 7,24-Tirucalladien-3-one along with a piperidine alkaloid spicigerine. The leaves also showed the presence of large proportion of unsaturated fatty acids, with linoleic acid and oleic acid.

Pods

Fresh, ripe pods contain calcium and phosphorus. They are rich in carbohydrates, a good source of protein, while fiber content are also good. The dry pods reported to contain copper and manganese, zinc, yielded fatty oils. Dried pods also contains 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. When the boiling water extract of the pods is fractionated using methanol and trichloro methane, it results in the isolation of compounds such as 3-benzyl-2-hydroxy-urs-12- en-28-oic acid and maslinic acid-3-glucoside (triterpernoids); linoleic acid (fatty acid); prosophylline (piperidine alkaloid); 5,5′-oxybis-1,2-benzanediol; 3,4,5-trihydroxycinnamic acid 2-hydroxyethyl ester; and 5,3′,4′-trihydroxyflavanone 7- glycoside (polyphenols). Various phytoconstituents like tannins (gallic acid), steroids (stigma sterol, campestral, sitosterol, etc.), Flavone derivatives (prosogerin A, B, C, D, and E), alkaloids (spicigerine, prosophylline), etc. have been isolated from the *Prosopis* pods. Dried unripe pods of *P. cineraria* showed the presence tannins, alkaloids, flavonoids and glycosides in the dried unripe pods.

Bark

The bark of *Prosopis* has been reported for the presence of glucose, rhamnose, sucrose and starch by several researchers. The chloroform extract the compounds isolated from bark of *P. cinereria* (L.) reported Methyl 5-tridecyloctadec-4-enoate, nonacosan-8-one, lupeol, β-sitosterol and stigmasterol.

Bioactive Compounds and Their Activity

The Phytochemical and Ethnobotinical Database includes the report on the Phytoconstituents of *Prosopis sp.* have been reported to be allied with various bioactivities eg., 5-hydroxytryptamine (antidepressant, antibacterial), apigenin (antidermatic, antiviral, anti-inflammatory), isorhamnetin-3-diglucoside (hepatoprotective), L-arabinose (analgesic, antiallergic), quercetin (antibacterial, antidiabetic, antiviral, anti-inflammatory), tryptamine (antiamoebic, antibacterial) and Tannin from the bark (antidiarrhoic, antiviral activity).

The presence of flavonoids, glycosides and phenolic contents from *P. cineraria* (L.) extract has hypolipidemic potential against hyperlipidemia, steroids like campesterol, cholesterol, sitosterol and stigmasterol, actacosanol, hentriacontane, methyl docosanoate, diisopropyl-10, 11-dihydroxyicosane-1,20-dioate, tricosan-1-ol, 7,24-tirucalladien-3-one along with a piperidine alkaloid spicigerine. Patulitrin isolated from flowers exhibited cytotoxic active against Lewis lungs carcinoma *in vivo*. Rutin exhibited anti-inflammatory activity. Luteolin showed anticancer activity. The compounds belong to triterpenoids, fatty acid, piperidine alkaloid and polyphenols have been studied to determine their antioxidant and anti-inflammatory activities. Luteolin inhibit may inhibit skin cancer mechanisms *in vitro* and *in vivo*. Hydrocinnamic acid and coumaric derivatives have been reported to possess antioxidant properties and are believed to reduce the risk of stomach cancer by reducing the formation of carcinogenic nitrosamines.

Safety Studies of The Plant

50% Hydro alcoholic extract of the leaves and stem bark showed No mortality recorded within 24 h. No significant changes in behavior, breathing, cutaneous effects, sensory nervous system responses. The extracts did not produce significant changes in hematological parameters compared to the control. Methanolic extract of the leaves was found safe at 100mg/kg body weight. Methanolic extract LD50 was reported to be 122.47 mg/kg body weight. The leaves extract was found to be safe up to maximum dose of 2 g/Kg body weight of the rats. Hydro- alcoholic extract of the leaves and bark showed LD50 higher than 2000 mg/kg[77]. Aqueous extract of the bark was reported to be safe. Methanolic extract of the leaves showed significant decreased the viability of the cells, the Flavoneglycoside Patulitrin from the flowers exhibited cytotoxic activity.

Future Prospective

The current trend of increasing use of herbal medicines and their growing popularity all over the world, the search for drugs and dietary supplements derived from plants have accelerated in recent years. The increasing use and fast-growing market of herbal medicines and widespread use of herbal medicines is likely to increase even further throughout the world in the coming years with more and more scientific evidence of their quality, efficacy and safety coming from the researchers. The available data on *P. cineraria* (L.) can provide evidential support for the clinical development of *P. cineraria* (L.) as adjuvant therapy. We believe *P. cineraria* (L.) fulfils the criteria for its selection of the plant based on its therapeutic potential and toxicity profile, and also availability of the plant. It is observed from various studies that the *P. cineraria* (L.) have a number of pharmaceutical and medicinal properties and according to this; it is effective in the treatment of a number of chronic diseases. We hope the therapeutic potential of *P. cineraria* (L.) could be best connected, towards a possible integration into the healthcare system.

CONCLUSION

P. cineraria (L.) is well-adapted to extreme environmental conditions grows in wide geographic range. It can be concluded that *P. cineraria* (L.) is promising medicinal plant having wide ranges of pharmacological activities and used traditionally *viz*, antioxidant, antimicrobial, anti-diabetic, hypertension, hepatotoxicity, lipid lowering activity, anti-inflammatory, anticancer potential. In addition to their medicinal importance, *P. cineraria* (L.) has significant nutritional importance. The present review is aimed to

summarize the up-to-date information on the traditional uses, pharmacological activities and phytochemistry of *P. cineraria* (L.). The researchers reported numbers of new activities and hence the plant is now achieving importance place to work for further search, considering its versatile medicinal uses, there is an ample scope for future research on *P. cineraria* (L.), Despite progress in conventional chemistry and pharmacology in producing effective drugs, the plant kingdom might provide a useful source of new medicines and may be used in place of existing drugs.

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