

PROSOPIS CINERARIA: A GIFT OF NATURE FOR PHARMACY

Ashish Kumar Pareek*, Dr. Shiv Garg, Manoj Kumar, Sardar mal yadav

Department of Pharmaceutics –Maharishi Arvind College of Pharmacy

Ambabari, Jaipur (Rajasthan)

M-Pharma(pharmaceutics)

E-mail:pareekashishjpr@gmail.com

Mob no.-8104493021

Abstract

Prosopis cineraria is commonly known as Khejri, It is a Leguminous multipurpose tree. The tree prosopis have climatic adaptation so it can easily survive in a broad range of climatic variation. It is very useful tree and famous specially in desert area due to its spreadability and importance. It is also known as “Golden tree” or “Wonder tree” of the desert. Prosopis cineraria stem bark is useful in the treatment of Rheumatism, Cough, Common cold, Anthelmintic disorder, dysentery, Bronchitis, Asthma, Leucoderma, piles and Tremors of the muscles. The Prosopis cineraria plays an important role in the socio-economic development of the farmers. The wood of the prosopis is the main part of the tree that have economic importance it is used for fuel, firewood and charcoal. Flowers of the prosopis are used for skin disease, as a blood purifier and producing a cooling effect. Prosopis provides safeguard in pregnancy by preventing miscarriage in pregnancy. Dry pods of the prosopis is known as sangri and it is the main part of some rajasthani dishes and also have a broader range of pharmaceutical application like in pain, High cholesterol level, Diabetes, Anaemia, Kidney & Liver disorders. The leaf of the tree is known as loom and they have high nutrient content like Carbohydrate, Protein, Fat, Minerals and Vitamins. The Leaf of the Prosopis is used in mouth ulcer and eye trouble, the leaf of prosopis have Antibacterial, Antihyperglycemic, Antihyperlipidemic, and Antioxidant activity. The following Article covers all pharmaceutical property of Prosopis cineraria with chemical constituents.

Key words: King of desert, Sangri, Loom, Nutrient etc.

Introduction

Prosopis cineraria is the botanical name of the khejri. Khejri is the state tree of the Rajasthan. The importance of khejri is increased due to the socio economic development of the India specially thar desert in the Rajasthan. Khejri is the tree of medium size and can withstand at a temperature upto 48^oc. Khejri is also known as “Kalpatru” which means “the king of desert” due to its food, feed and medicinal value. Khejri is worshipped by a number of community. Prosopis cineraria is cultivated in a number of countries in all over the world but it is specially cultivated in western and southern Asia including Afganistan, Iran, India, Oman, Saudi Arabia and Pakistan. The crude extracts of prosopis cineraria shows positive results in supporting of health benefits and in prevention of wide range of illness includes protein and mineral deficiency. Prosopis is extensively planted as fast growing and drought tolerant fuel and fodder tree but in a large number of countries it spreads readily without control as invasive weed. The wood of Prosopis is an excellent source of fuel, and Firewood and charcoal are the important part to provide an economic value to the poor farmers. State branches of the tree are used for fence posts, and poles in construction of homes and shelters. Sawn timber of prosopis is used for making furniture and flooring. Honey produced from the prosopis have highest quality with long and abundant flowering. The gum obtained from the bark is similar to the gum Arabic with high quantity. Leaves of the prosopis are collected by the farmers and used as a source of compost on the agricultural field. The leaves of the prosopis have some fungicidal and insecticidal activity. Bark of the prosopis used as a source of tannin, dye and fibres so it is used for the preparation of medicines mostly for stomach, skin and eye problem. Prosopis is a nitrogen fixing tree, so it improves fertility and physical characteristic of the soil^{1,2,3}.

Synonym	Prosopis spicigera, prosopis spicata
Common name	Ghaf,Kandi,Jand,Khejri,Shemi,Shami,Khejado,jambi,
Habit	Tree of dry condition, found in sandy plains and grows abundantly on the dry,arid and exposed habitat like wasteland,cultivated lands,road sides and surrounding plains of hills.
Distribution	The most common occurrence of the prosopis is the dry places of the world it most commonly found at western rajasthan,delhi,Punjab and Gujarat state of the india.
Description	It is a tree and the length of the tree is upto 7 m with straight bole to height of 2m and a round crown resulting from a lopping for fodder.
Variation	Studies describes that it varies from different species in the growth rate,pod size and range wide seed collection.
Biology	It is a evergreen tree and the tree starts flowering and fruiting at an early age.New leaves appear when the old leaves fall in the summer.The small yellow flowers appear in the month of march to may.The pods are ripened in the month of june to august ^{4,5} .

Characteristic of Prosopis cineraria stem bark

The stem bark of the prosopis cineraria is very important some important macroscopic and microscopic characters are described here.

MACROSCOPIC CHARACTER OF PROSOPIS CINERARIA	
Colour	Externally Brownish white or Brownish green in colour
Texture	Rough, Ridged and Fissured
Taste	Slightly Pungent
Odour	Aromatic odour
Shape	Shallow Curved
Thickness	2mm to 5mm
MICROSCOPIC CHARACTER OF PROSOPIS CINERARIA	
Periderm	Periderm consist of outer cortical tissue and it includes a few layers of outer layer of phellem and inner narrow zone of phelloderm.
Collapsed 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 fibres are gelatinous type.Gelatinous fibre have thick outer cellulose wall and inner unligified mucilage.
Crystal distribution	Calcium oxalate crystals are present in the collapsed phloem zone.the crystals are prismatic type.

Chemical constituents of the prosopis cineraria

Prosopis cineraria have a number of chemical constituents that have nutritional value and also have certain action in the prevention and treatment of the disease.Various chemical constituents with their role in disease prevention are described in the following table.

Name of the plant part	Chemical constituent Present in the plant part
Flower	Patuletin Glycoside patulitrin, luteolin and rutin sitosterol, spicigerine, Flavone derivatives Prosogerin A and Prosogerin B
Leaves	Steroids like campesterol, cholesterol, sitosterol, 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
Seeds	Prosogerin C, Prosogerin D, Prosogerin E, Gallic acid, patuletin, patulitrin, luteolin, and rutin
Bark	Hexacosan-25-on-1-ol, a new keto alcohol along with ombuin and a triterpenoid glycoside. vitamin K1, n-octacosyl acetate, the long chain aliphatic acid. Presence of glucose, rhamnose, sucrose and starch is also reported. ^{6,7,8,9,10}

Therapeutic Utility of the Prosopis Cineraria

Antibacterial activity

The Antibacterial activity of the prosopis is due to the presence of flavanoids and tannins. The Methanolic and Aqueous extracts of stem bark of prosopis shows moderate Antibacterial activity at 250 µg/ml. Methanolic extract shows significant action on all pathogens¹¹.

Antihyperglycemic Activity

Deepika sharma et al proposed that the prosopis have abundant activity in lowering blood sugar level. A number of studies are carried out and on the basis of the study it is concluded that decrease in body weight and increase in blood sugar level in diabetic rats became normal when treated with the plant extract of the prosopis. Prosopis extracts probably activate the surviving of the β cells of the islets of langerhans and reduce the blood sugar level by producing an insulinogenic effect. The decrease in body weight is due to increase in muscle glucose uptake which results in prevention of the tissue loss.

Antihyperlipidemic effect

The lipid changes associated with diabetes mellitus are attributed to increase flux of free fatty acids into the liver this may lead to insulin deficiency. It can cause excess fatty acid deposition in the liver and increase triglyceride level. It increases the hepatic VLDL production and overall the level of HDL (good cholesterol) decreases. Treatment with prosopis cineraria bark normalized all the lipid profile parameters. Hydroalcoholic extract of the prosopis shows dose dependent effect on the lipid profile, higher dose shows significant action over Triglyceride, cholesterol, and also increase the level of the HDL¹².

Antidepressant effect

The aqueous extract of the leaves is used traditionally for the treatment of various CNS disorder. The Phytochemical analysis of the prosopis shows the presence of saponins, Flavanoids, Glycosides, Alkaloids and phenolic compounds. M. George et al used two animal models for the study of Antidepressant action, and used forced swim test to detect the antidepressant activity. In the study aqueous extract administered to mice produced significant antidepressant effect and the efficacy is similar to antidepressant drug Imipramine.

Skeletal Muscle relaxant

M. george et al used rotarod to evaluate the skeletal muscle relaxant activity. The test is used to determine the activity of the drug interferes the motor activity. It is concluded by the study that prosopis cineraria possesses significant skeletal muscle relaxant activity and the activity is due to the presence of alkaloids, tannins, and flavanoids which are present in the leaves extract¹³.

Bronchodilator activity

Prosopis cineraria is used for the treatment of respiratory disease like asthma, cough and bronchitis. Hence Khalid hussain Janbaz et al used methanolic extract to test the bronchodilator activity on carbachol. The extract shows concentration dependent relaxant effect on both carbachol and K^+ induced contraction. The bronchodilator activity is due to the blockade of Ca^{2+} channel. Ca^{2+} Channel blocking activity is also useful in tracheal relaxant which is characterized by hyperresponsiveness of the respiratory tract.

Vasodilatory activity

Since the prosopis cineraria methanolic extract causes blockade of the Ca⁺ channel hence it also provides the vasodilatory effect. Ca⁺ channel blocking agents are used as vasodilatory agents they are most commonly prescribed in hypertension and congestive Heart failure¹⁴.

Detoxifying Activity

Sivarathri Siva Rajesh et al proposed the detoxification effect of the Aqueous, Methanol and petroleum ether extract of medicinal plant prosopis cineraria against Naja naja. The aqueous bark extract of prosopis cineraria has substantial antivenom potential. The aqueous extract with the dose of 14mg/kg have ability to neutralize the lethal activity completely. Aqueous extract not causes any type of adverse effect that are most common with other detoxifier and antidotes¹⁵.

Anticancer activity

Cancer is a class of disease in which a group of cell divides in uncontrolled manner with invasion and metastasis. The medicinal value of the plants are increased randomly in the treatment of the cancer due to antioxidant activity. The methanolic extract of the leaves of prosopis cineraria are used which shows significant radical scavenging activity. The extract inhibits cell proliferation by inducing cell death and the extent of cell proliferation¹⁶.

Analgesic activity

Arvind kumar et al proposed that the prosopis have analgesic activity. A brief experiment was done by using tail immersion test and hot plate method in rats. The ethanolic extracts at the acute dose of 200mg/kg and 300mg/kg is administered. At both the dose significant analgesic activity is reported. Analgesic activity of ethanolic extract of root of the prosopis cineraria is due to the presence of alkaloids, tannins and steroids. Alkaloids and tannins are basically present in the root of the prosopis. The plant of the prosopis may play a key role in household remedy for the treatment of pain¹⁷.

Antidiarrhoeal activity

Naik et al concluded that prosopis have antidiarrhoeal activity. Naik et al performed a study on the stem bark of prosopis cineraria. Methanolic extract of the plant is utilized to evaluate the antidiarrhoeal activity. The plant extract shows dose dependent antidiarrhoeal activity¹⁸.

Anticonvulsant activity

Methanolic extract of the prosopis cineraria shows significant reduction in duration of convulsion. The methanolic extract have good anticonvulsant activity. The methanolic extract of the prosopis shows good anticonvulsant activity against Seizure induced Maximum electro shock (MES) and Pentylene tetrazole in a dose dependent manner. Inhibition of the Maximum electro shock is observed against generalized Tonic-Clonic and cortical focal seizure¹⁹.

Antioxidant Activity

Antioxidant are the compounds that inhibits the oxidation of lipids and other molecules by inhibiting the oxidizing chain reaction. Redox property of the phenolic compounds are responsible for Antioxidant activity. It can play a major role in the adsorbing and neutralizing free radical and decomposing peroxides²⁰.

Activity against multidrug resistant bacterial and fungal strains

The extract of the prosopis shows significant activity against most of the recently investigated microbial strains. The phytoconstituents present in the plant play a major role and act like phytomedicine to act against microbes. The extract of the prosopis act like a novel antibiotic and the effect of the prosopis is similar to the broad spectrum antibiotics. The extract of the prosopis does not produce any adverse effect after administration. The various types of phytochemicals are responsible for activity against multidrug resistance²¹.

Agricultural effect of prosopis

A study is conducted on the prosopis the samples are collected from the depth of the 15 cm and analysis of N, P, K and Micronutrients like Zn, Mn, Cu and Fe are carried out. The results are concluded that 3.54% upto 15 cm and 3.86% upto 30cm increase in the moisture content in comparison to the open field. The most common reason behind of this is the deep root system of the prosopis cineraria.

Electrical conductivity and pH of the soil is decreases in the area of the prosopis in comparison to the open field. The reduction of the pH and electrical conductivity results in high organic matter. It is also observed that the prosopis increases the N, P, K and Micronutrients Zn, Mn, Cu and Fe quantity.

Thus overall it is observed that prosopis increase condition of soil, moisture retention capacity, enhance organic matter and also enhance the macro and micro nutrients²².

Importance of Prosopis cineraria

Socio economic importance of the Prosopis cineraria

Prosopis play a major role in the socio economic development of the villagers due to its virtue of increasing soil fertility ,Providing fuel ,timber and vegetables to human being.The following points describes the socio economic importance of the prosopis cineraria.

- Pod of the Prosopis,flowers of the Caligonum Polygonides are used as dry fruit in extreme arid areas of the western rajasthan.Pods are known as “Sangri”.They are Basically brown to chocolate in colour and hang in the cluster of upto 12 from the tree.Dried pods are called as “Khokha” and used as Marwarimewa.They contain sucrose(13.16%),Protein(9-15%),and Carbohydrate(45-55%)²³.
- If the growth of the phog (Caligonum Polygonides) Is increased then the next crop yield is better means the phog directly affects the crop yield.
- When the growth of the pods is better it means there will be a good crop year.
- Prosopis cineraria provides green leaves(basically known as “Loom”) to the animals like camel, goats and sheeps.Loom provides Nutritive Fooder to the animals²⁴.

Traditional use of Prosopis

It has been used for centuries as a human diet in the rajasthan region.The dry pods of the Prosopis is known as “Marwari Mewa”.It reduces the craving of water in the summer due to this it is some times used by the farmers in lean periods.Pods of the prosopis increase milk production in milch animals.

Medicinal uses of Prosopis

A lot of pharmaceutical property are present in the prosopis and they are discussed above but apart from that the bark of the prosopis is used in rheumatism.The ash of the bark is utilized to remove the unwanted hairs from the body and the flowers of the prosopis is mixed with sugar and used by the pregnant lady to prevent the abortion and to provide the safety.

Ceremonial uses

The tree of the Prosopis is worship by a number of occasion like marriage and son born etc. A number of communities are responsible to protect the prosopis during last 40 to 50 years²⁵.

Description of the important part of Prosopis cineraria

Leaves of the Prosopis

As described above that the leaves of the Prosopis have high nutritional value and known as “Loong”.The leaf of the Prosopis also have pharmaceutical property like the leaf paste of Prosopis cineraria is also applied on boils and blisters including mouth ulcer.Leaf extract of the Prosopis shows Antibacterial, Antihyperglycemic, Antihyperlipidemic,and Antioxidant activity.The smoke of the leaves of prosopis is considered as good for eye Trouble²⁶.

Pods of Prosopis Cineraria

Pod of the prosopis is locally called as “sangri”. It is considered as dry fruit of rajasthan and important ingredient of rajasthani dish well known as “Panchkuta”.Sangri fulfill the essential requirement of the body and provide nutrients like Carbohydrate, fats minerals, protein etc. Several Dietary agencies prescribe Sangri for prevention of the chronic disease like Cancer and atherosclerosis.

Pharmaceutical importance of Sangri

Content present in Sangri	Pharmaceutical Importance of the content
Alkaloids	Alkaloids have good Anaesthetic and Spasmolytic activity.
Saponin	Saponin boost Immunity system of the body, lowering the cholesterol level in the body and also reducing the risk of intestinal cancer.
Tannins	Tannins produce Anthelmintic activity as they bound to the free protein of the GI tract of Host animal.
Zinc (Zn)	It is relevant to the nutritional aspect. Zinc supplementation in diabetes mellitus have Antioxidant effect.
Iron (Fe)	Iron is used in Anaemia, Tuberculosis and Growth disorder.
Calcium (Ca) & Phosphorus (P)	They are useful for the bone, Teeth and ligament related disorder
Magnesium (Mg)	It is important for proper functioning of every organ like Heart, Muscle and Kidney ^{27,28} .

Future Prospective

It is observed from various studies that the *Prosopis cineraria* have a number of pharmaceutical and medicinal property and according to this it is effective in the treatment of a number of chronic diseases, But a Huge research work is required. This is the tree that is effective in treatment of various disease without producing any side effect. The government of india is required to provide proper care for this tree specially in desert area and providing proper plan related to the pest control that is the most common requirement for the growth of the tree.

In the recent years the Khejri tree is declined in Thar desert. The main region behind of this are lowering of the water table, Mechanization of farm lands, and uncontrollable pest growth. About 153 pests are reported in all over the world that damage the species specially *Prosopis cineraria*. In north western India the Bugs are reported that damage the tree rapidly. *Homoeocerus variabilis* Dallas is one of the common organism that damage the tree rapidly. The incidence of growing rate of the organism is highest in December and minimum in July. The bug sucked sap from the newly leaves, branches and flowers which causes suppression of the growth of tree. The affected tree produces defective pods which are useless for any human consumption. A root borer *Acanthophorus serraticornis* attacks on its root system and *Ganoderma lucidum* that attacks further and then subsequently termites attack it very easily, resulting in partial or total decaying of tree. Insect galls are formed and Inflorescence are the common feature and that results in obstruction in setting of fruits and declination of population²⁹.

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