

## King of Desert (*Prosopis*) : A source of potential medicinal values in Arid Zone of India: Review

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### 1. Abstract

Medicinal plants, since times immemorial, have been used in virtually all cultures as a source of medicine. The wide spread use of herbal remedies and health-care preparations, as those described in ancient texts such as Vedas , Bible, obtained from commonly used traditional herbs and medicinal plants have been traced to occurrence of natural products with medicinal properties. Medicines from these plants are in great demand in developing world of primary health care, not because they are cheap but they are culturally acceptable. In recent decades *Prosopis* has become one of the most important tree genera in many tropical and subtropical regions of world. *Prosopis cineraria*, locally known as “Khejri”, has an important place in economy of Indian desert.

“Khejri” is the lifeline of desert. It yields excellent firewood and produces high-quality charcoal. Pods are a popular vegetable in human diet. The bark yields edible gums, is used locally in leather tanning. The flowers are valuable in honey production. Its plantation is used for sand dune stabilization, remediation of famine land and as shelterbelts. (Arya.etal, 1986;Gupta.R, 1988;Gupta.etal, 1998; Felker, 1998;Puri.etal, 2002).

Besides, all these uses of *Prosopis cineraria*, it is used as folk medicine for various ailments. The flowers are mixed with sugar and administered to prevent miscarriage. It works like an antidiabetic agent, if its flowers are used with its twig. The ashes are rubbed over the skin to remove hair. The bark, considered antihelminthic, antimicrobial (Rajvanshi, S. and Garg, V. 2007) refrigerant and tonic is used for treatment of asthma, bronchitis, dysentery, leucoderma, leprosy muscle tremors, piles, and wandering of mind. Leaf smoke is used to cure eye infection (ICFRE, 1993), but the fruit is said to be indigestible, including biliousness and destroys nails and hair. Its dry pods (“khokra”) help in preventing protein calorie malnutrition and iron calcium deficiency in blood. (Shalini, 1997; Toky, 1998; Meena and Sharma, 2000; Chandra, 2001;Bhatt 2003).

**Keywords:** *Prosopis*, *Khejri*, Folk medicine, Antidiabetic, Antihelminth, Antimicrobial.

### 2. Introduction

Traditional and folklore medicines bequeathed from generation to generation are rich in domestic recipes and communal practice. Encompassing concepts and methods for protection and restoration of health, traditional medicine has served as a fount of alternative medicine, new pharmaceuticals and health care products. The best-known examples of traditional medicines,

differing in concept and protocol, are well-developed systems such as unani and ayurvedic medicine that have been widely used to conserve human health in India (Hoareau and Dasilva; 1999). It seems that people are turning towards alternative medicines, which they wish to be less harmful and with fewer side effects than synthetic drugs. The world health organization (WHO) estimated that 80% of developing world relies on traditional medicines and of this 85% use plants or their extract as the active substances.

Medicinal plants are the oldest known health-care product of the nature. Their importance is still growing, although it varies depending on the ethnological, medical and historical background of each country. India is endowed with a rich wealth of medicinal plants. These plants have made a good contribution to the development of ancient India materia medica. One of the earliest treatises on Indian medicines, the Charak Samhita (1000B.C), records the use of over 340 drugs of vegetable origin. Indian medical systems, among them the ancient science of Ayurveda, have always been aware of medicinal values of plants. To cite but one example, for at least 2500 years before the West recognized the medicinal properties of *Rauwolfia serpentina* (Sarpagandha) root, it was used by folk healers to calm violently disturbed patients. In 1940's Indian scientists isolated the active substances from *Rauwolfia* and discovered its added benefits as remedy for high blood pressure. (Malhotra.etal, 2001)

The curative properties of such drugs are due to the presence of complex chemical substances of varied composition (present as secondary plant metabolite) in one or more parts of these plants. According to their composition, these plant metabolites are grouped as alkaloids, glycosides, corticosteroids, essential oils etc. The alkaloids forms the largest group which includes morphine and codein (poppy), strychnine and brucine (nux vomica), quinine (cinchona), ergotamine (ergot), hypocyamine (belladonna), scopolamine (datura), emetine (ipecac), cocaine (Coco), ephedrine (ephedra), reserpine (rauwolfia), caffeine (tea dust), aconite (aconite), vasicine (vasaca), santonin (aremisia), lobelin (lobelia) and a large number of others. Glycoside form another important group represented by digoxin (foxglove), stropanthin (strophanthus), glycyrrhizin (liquorice), barbolin (aloe), sennocide (senna) etc. corticosteroids have come into prominence recently and diosgenin (dioscorea), solasodin (solanum.spp.) etc. now command a large world demand. Some essential oils such as those of valerian Kutch and peppermint also possess medicating properties and are used in pharmaceutical industry (Jewer.etal, 1976).

### 3. Review

Herbal medicine is defined as “the art and science of restoring a sufferer to health by the use of plant remedies”(Angell.etal, 1998). Herbal remedies consist of proportion of a plant (e.g. leaves, root, stem) as opposed to specific chemicals isolated and extracted in the laboratory. Herbal remedies are unpurified plant extract containing several constituents, which often work together synergistically (Hill.etal, 1978).

Each herb contains hundreds of active compounds many of which act “synergistically”. It means that all of these compounds somehow combine to produce greater effect than each has alone, and that the body extracts the compounds it needs and discards the others. One possible reason that scientific studies sometimes fail to confirm a herb's traditional use in healing is that the studies often focus only on the isolated compound, not on the whole plant. Each herb should be thoroughly studied in terms of their biological contents, the medical activities of each of their components, and the collective effect of the herb in use as whole. It is this concomitant effect that makes the herb work in situations where western medicines failed to yield satisfactory results (Hoareau and Dasilva, 1999).

Popularity of herbal remedies began to decline with the rise of conventional medicine. The later decades of 20<sup>th</sup> century have seen a larger resurgence in the use of herbal remedies, to the point

where such remedies are now regarded as mainstream. Many drugs commonly used today are of herbal origin (chow.etal, 1999).

*Prosopis cineraria* (L.Druce) is the most important plant species in arid zone of India. It is referred to as the golden tree of Indian deserts, as it plays a vital role in conserving the ecosystem of arid and semi-arid areas. Since, all parts of tree are useful, it is called as “Kalptaru”. It is also known as “King of Desert” and “Wonder tree”. *P.cineraria* is extremely drought tolerant and evergreen tree belongs to family leguminoseae and subfamily mimosoideae.

Locally, this tree is known as Sami or Samri (Gujrati), jand (Punjabi), Jandi (Haryanvi) and Khejri in Rajasthani. It's synonym is *Prosopis spicigera* (Burkat, 1976;Bandari, 1978;Muthana & Arora, 1983;FFN, 1991).

#### 4.Medicinal values

Medicinal values of *Prosopis* have been mentioned in our ancient literatures such as Arthaveda, Rammayan, and Panjal Mahabharta etc. Kirtikar & Basu (1935) reported that *Prosopis* species are known to posses medicinal values. Traditionally, all most all parts of *Prosopis* species are used by local populations in curing various diseases (Kirtikar & Basu, 1975; Shalini, 1997; Toky, 1998;Chandra, 2001). There are three main groups of ailments are treated with leaf and bark extract: mouth and throat infections including ulcers and bronchitis; internal diseases including general pains, parasites and urinary diseases; and skin disorders, which includes dermatitis and parasitic infections (Pasiiecznik, 1999). Earlier, in 1993, ICFRE reported that in Asia, medicinal uses for native species, includes flower for prevention of miscarriage, bark extract for treatment of leprosy, dysentery, bronchitis, asthma, leucoderma, tremors and rheumatism. Leaf smoke is used to cure eye infections and extracts are recommended against snakebite and scorpion sting (Pimental, 1960;Celis, 1995).

Some works have been carried out to find out chemical composition of this plant and to isolate chemicals of medicinal values. Burkat (1976), reported that the heartwood contains sugar, five flavonones, fatty acids and tannins. Fresh leaves (ZMB) contains 15.35 CP, 17.5% CF, 10.0% ash, 3.2% EE, 54%NFE, 2.65% Ca, and 0.25% P (Gohl, 1981). Wealth of India reports leaves contains 2.9%N, 0.4% P<sub>2</sub>O<sub>5</sub>, 1.4% K<sub>2</sub>O and 2.8% CaO. The flavones glycoside patulitrin has been isolated from the flowers (C.S.I.R, 1948-1976). The leaves of many species of *prosopis* contain many different free amino acids and flavonoids with alkaloids and diketones isolated as active ingredients (Carmen, 1974). The concentration of alkaloid varies between species and with in population but is 0.4 – 3.6% of leaf dry weight. Concentrations were significantly higher in younger than in older leaves (Cates & Rhodes, 1977). A novel variant on the piperidine-3-ol alkaloid reported is spicigerine (Jewers.etal, 1976). Moreover, Newwinger (1996), has studied medicinal properties of two piperidine alkaloid extracted from *prosopis* species and found that prosopine is a weak excitant of nervous system while prosopinine has a weak sedative effect but also has local anaesthetic effect three times stronger than cocaine.

About ten years back, Mazzuca and Balzaretta (2003), have analyzed seed lipid content of four varieties of *Prosopis*. The seed lipid contain a relative large proportions of unsaturated fatty acids with linolic and oleic acids being predominant. They have also identified stigmasta-1, 3,5-triene, stigmasta-4-6-dien and 3-ene in *Prosopis alpataco*.

Nutrition plays key role in keeping blood healthy which in turn maintains an individual health. Tokyo (1999), reported the presence of 8-13% proteins, 40-55% carbohydrates, 8- 15% sugars, 9-12% crude fiber in pods of *P.cineraria*. He suggested that dry pods (“Kokra”) can be used in protein-calorie malnutrition and flowers are used as tonic for blood purifier. On the other hand nutrient content of *Prosopis africana* seeds have been studied by Barminas.etal (1998). They have reported that these seeds contain 20.54,5.67 and 6-51g/100g of proteins, ash and fiber respectively. Hence, these seeds could be used as a protein supplement for low-protein foods for

animals, particularly during dry seasons, also the seeds could serve as a good source of carbohydrate concentrate for all classes of livestock. Furthermore, the seeds can be used to supplement the daily energy intake of consumers of their food products since they have calorie values above the range 2500 to 3000 kcal/kg needed by humans. This study also suggests that *Prosopis africana* seed could contribute partially to the overall daily dietary intake of elements such as iron & zinc and vitamin A and C.

Reports have been emerging out to show hypoglycemic and antihyperglycemic activities of *prosopis* species. In an extensive ethnobotanical survey (130 informants) of medicinal plants of Israel, 16 species were found to be used for hypoglycemic treatment, *Prosopis fraxta* was one of these plants. (Yaniv.etal, 1987).

Okide and Ezuguva (1998), evaluated the hypoglycemic effects of gum from *Prosopis africana* seed on normoglycemic and hypoglycemic rats. The antidiabetic activity was evaluated using alloxan (80 mg/kg body weight intraperitoneally) induced hyperglycemic rats. The potency of gum was compared with that of tolbutamide, with doses of 200,400 and 800mg/kg body weight of the gum in diabetic rats, the blood sugar determination showed reduction in the ratio of 1.19,1.07 and 1.06 respectively. With respect to the control, tolbutamide, in normal rats, with the same doses of gum per body weight, there was reduction in ratio of 0.35,0.36 and 0.55 respectively. This showed that the gum has a blood sugar lowering effect, though more significantly on diabetic rats.

In 2004,Adikwu.etal have compared antidiabetic properties of *Prosopis* gum alone and in combination with metformin in a bioadhesive form. The glucose lowering effect was found to be synergistic in later case, where as gum showed moderate antidiabetic properties, when used alone.In addition many other medicinal plants belong to other families have also been reported to produce antidiabetic effect in alloxan-induced diabetic mice and rat.

Now-a-days, scientists are trying to search out immunostimulant and immunomodulatory properties of medicinal plants. Studies of Merzabani.etal (1979), Ahmad & sultana (1989) have shown significant activity of plant extract against lung carcinoma and other carcinoma respectively.Dhyani.etal (2002), have purified and partially characterized an allergic proteins from *P.juliflora*.It shows positive reactivity (>85%) to hypersensitive patient's sera and can be used for immunotherapy.

Bhupleunum, an herbal compound, is thought to produce an immunomodulating effect by inducing the secretion of granulocyte-macrophage colony- stimulating fraction in a dose-dependent fashion (Chow.etal,2001). Moreover, an immunomodulating action of septilin was also observed by Daswani.etal (2002). They reported that septilin exhibit dual effect on the immune system of mice and rat, with lower doses it acts as an immunostimulant and higher doses showed predominantly suppressive effect.Many species of *Prosopis* have been reported to show antibacterial and antifungal activities in animal system. (Felger, 1977; Ahmad and khan, 1986; Ahmad and Sultana, 1989;Rajvanshi.S and Garg.V,2007).

Salvat.etal (2004) screened thirty-nine native plant species including *Prosopis kuntzei* and *prosopis ruscifolia* for antimicrobial activity and reported that the *P.kuntzei* was able to reduce the number of viable counts because of presence of some bactericidal components. Earlier, in 1999, Ahmed.etal studied the antibacterial therapeutic efficiency of juliflorine, julifloricine and a benzene insoluble alkaloid fraction of *Prosopis juliflora*. The study demonstrated that juliflorine and benzene insoluble alkaloidal fraction were more effective in *Staphylococcal* skin infection than julifloricine. Similarly *Prosopis juliflora* was also reported with or without low mean anti-giardiasis activity (Ponce.etal, 1994). On the other hand, oil extracted from *Prosopis cineraria* was found to be ineffective, when it was screened for antifungal activity (Rai.etal, 1999). Moreover, trypanocidal property of *Prosopis africana* has been evaluated by Atwodi (2002).

There are large number of medicinal plants posses mild or potent estrogenic activity when assessed in male and female mice (Homady.etal, 2000) and immature rats (Qureshi and Dixit, 1980). Owing

to their estrogenic characteristic, these extracts may affect the physiology of reproductive organs (Homady.etal, 2000).

*Prosopis* with reproductive medicinal attributes has been mentioned in traditional and folklore medicines (Chandra.D, 2001; Shalini, 1997) but evidences to show the effects of *Prosopis* plant extract on animals reproductive systems have not been available in literature. Although, it has been reported that piperidine alkaloid from *prosopis* plants is capable of causing congenital defects in the fetus (Knight and Walter, 1994). *Cassia fistula*, a mimosoide, shows some antifertility effects in female rats (Yadav and Jain, 1999). They reported that oral administration of aqueous extract of seeds of *Cassia fistula* to mated female rats from day 1-5 of pregnancy at the doses of 100 and 200 mg/kg body weight resulted in 57.145% and 71.43% prevention of pregnancy, respectively, whereas 100% pregnancy inhibition has been noted at 500 mg/kg of body weight.

However, it should be stated in all fairness that our knowledge of genetic and physiological make-up of most of the medicinal plants are poor and we know still less about the synthetic pathway leading to the formation of active constituents for which these crops are valued. Further research is needed to find disease specific medicinal and nutritive values that do not produce any side effects.

## 5. References

1. Adhikwu.MU, Yoshikawa.Y, Takada.K, 2004, Bioadhesive delivery of metformin using gum with antidiabetic potential, Department of Pharmokinetics, KoyotoPharmaceutical University, Japan.
2. Ahmad.A, Ahmad.V, Khalid.S.Mohamad, Siddiqi.S.Khan, 1986, Study of antibacterial therapeutic efficiency of juliflorine, Karachi.
3. Ahmad.A, Khan.KA, Ahmad.VK, Qazi.A, Haroon.TS, 1986, "Arzein- Forson", res. 36:17.
4. Ahmad.VH, Sultan.A, 1989, A terpenoid, diketone from the leaves of *Prosopis juliflora*, phytochemistry 28, P- 278-79.
5. Arya.HC, Shekawat.NS, Oct 1986, Clonal multiplication of tree species in Thar Desert through tissue culture, Forest ecology and management, Vol-16, Issue 1-14, P 201-8.
6. Atwodi.SE, Ameh.DA, Ibrahim.S, Andrew.JN, Zelibe.N, Orinjike.EO, Anigo.KM, Abu.EA, James.DB, Joku.GC, Sallou.A, feb2002, Indigenous knowledge system of treatment of trypanosomiasis in kaduna state of Nigeria, "Journal of Etanopharmacol", 7(2), P- 279:82.
7. Barminas.JT, Maina.HM, Ali.J, 1998, Nutrient content of *Prosopis africana* seeds plant foods for human nutrition, 52, P-325-28.
8. Bhatt.D, Jadeja.BA, Odedra.NA, Baxi.VS, 2003, Enumeration of wild plants and use of antidiabetic in Barda hills of Gujarat, " Journal of Economic and Taxonomic Botany, Vol- 27.
9. Burkart.A, 1976, A Monograph of genus *Prosopis* (Leguminous), "Journal of Ar.Arb", 57 (3/4), P- 219-249,450-525.
10. C.S.I.R (Council of Scientific and Industrial Research), 1948-1976, The Wealth of India, Vol-11, News, Delhi
11. Carman.NJ, Dossaji.SF, Mary.IJ, 1974, A population survey of amino acid in *Prosopis* species from North and South America, Biochemical Systematic and Ecology, 2: 73-74.
12. Cates.RG, Rhoades.DF, 1977, *Prosopis* leaves as a source for insect,
13. Chandra.D, 2001, Khejra, "Vanoshdi Chitravali"(Jaributti), Vol-1, P- 269-70.
14. Chow.LW, Loo.WT, Sham.JS, 2001, Hongkong, "Medicinal journal", Vol-7 (4), P- 408-13.
15. Daswani.BR, Yegnanaryan.R, 2002, Immunomodulatory activity of septilin – a polyhyderal preparation, Vol- 16(2), P-162-165.
16. Felker.P, Cannel.GH, Clar.PR, Osborn.JF, Nash.P, 1981, Screenig of *Prosopis* (Mesquite) species for biofuel production on semiarid lands.
17. FFN, 1981, Spotlight on species *P.cineraria*, farm forestry news, Vol-4, no.3

18. Gupta. GN, Singh.G, Kachwaha.GR, 1998,performance of *P.cineraria* and associated crops under varying spacing regimes in the arid zone of India, Agro forestry systems, Vol-10: P 149-157.
19. Gupta.R, 1988, Life-support species for medicinal use in India, National Bureau of Pharmaceuticals, Genetic Resource Publications.
20. Hoareau.L, Dasilva.E.J, August 1999,Medicinal plants: a reemerging health aid, electronic journal of biotechnology, volume-2
21. Homady .MM, Hussain.HH, Tarawneh.KA, Singh.JM, Gupta.DN, Wadhwa.V, Jain.GH, Shakhabehe.IA, Raheil.A, Brain.PF, 2000, Contraceptive efficiency of oral application of some medicinal plants extract used and hormonal profile of Ferijol. "Planta Medica", Vol- 3, P-268-70.
22. ICFRE (Indian Council of Forestry Research and Education), 1993, Khejri (*Prosopis cineraria*) ICFRE, Dehradun, India.
23. Jewer.K, Nirwika.MJ, Ani.F, 1976, Lipid, steroids and a piperidine alkaloid from *prosopis spicigera* leaves, "Journal of phytochemistry".
24. Kirtikar.KP, Basu.BD, 1935, Indian Medicinal plants, Vol-2, Leader press, Allahbad, 910
25. Knight.AP, Walter.RG, 7 May 1994, plant toxin in milk, Department of Biology, Fortcollins, CO, USA.
26. Mazzuca.M, Krass.W, Balzaretti.V, 2003, "Journal of Herbal Pharmacology", 2003, 3(2); 31-7.
27. Meena.SL, Sharma.HC, Gopalan.R, Nov 2003,Ethano botanical plant of Rajasthan, "Journal of Economic and Taxonomic Botany", Vol-27, no.1.
28. Merza.H.Homady, 2001,changes in testicular and perpetual gland structure of mice related to influence of Ferula hormonis extract, "The Science", Vol- 3, P- 108-112.
29. Muthana.DC, Arora.KD, Arora.GD, 1983, *Prosopis.juliflora* (swart), a fast growing tree to bloom the desert, central arid zone research institute Jodhpur, India CAZRI, monograph.no.22.
30. Newwinger.HD, 1996, Poisons and drugs, "African Ethnobotany", Chapman and Hall, London.
31. . Okide GB, Odoh.UE, CO.Ezuglulu, 1998, hypoglycemic activity of gum extract of *prosopis africana* seed, Department of pharmaceutical. P- 61-83.
32. Pasiiecznick.N, 1999, Prosopis-Pest or providence, weed or wonder tree, ETFRN News, 28/29, P-12-4.
33. Pimentel.M.DL, 1960, *P.juliflora*, (SW)(DC), In:1 "Simposio Brasileiro sobre Algarobera", Vol-1,P-330-35.
34. Ponce.M, Navano.A, Martinez, Gardilla.MN, Alvorez.CR, 1994, "Journal of Ehanopharmacol", In vitro effect against giardiac in plant extract, Lab investigation of parasitologio, 46(5), P- 343-7.
35. Puri.S, Kumar.A, Singh.S, 24 April 2002,Productivity of *Licer arientinum* (chick pea) under a prosopis cineraria agro forestry system in the arid region of India, "Journal of Arid Environment", Vol-27, Issue1, P- 85-98.
36. Qureshi.S, Dixit.VP, 1980,Effect of *gossupum* of different doses of acetate on perpetual herbaceous Linn, Root active fraction gland structure and activity in intact male mice, on female mice reproductive system of white albino rat, symposium on recent advances in experimental zoology, Biochemistry. Physiology, 85 c, P- 187-91.
37. Rai.MK, Qureshi.S, Pandey.AK, 1999, In vitro susceptibility of *opportunistic fusarium* species to essential oil, "Journal of microbiology", 42(1-2), P- 67-97.
38. Rajvanshi, S. and Garg, V. 2007,Evaluation of Antimicrobial activity of Plant *Prosopis cineraria* extract against E. coli., Biochemical and Cellular Archives. Vol.7, No. 2, pp 271-276, 2007.
39. Shalini, 1997,ed.1997, Shami, "Vedic Leguminous Plants", P- 57-8,Vol-1.
40. Toky.OP, 1999, ed.2000, Medicinal values of *Prosopis cineraria* in arid and semiarid India, Society of chemical industry. Vol-1, Issue9.

41. Yadav.R, Jain.GC, 1999, Advances in Contraception, Antifertility effect of aqueous extract of seeds of *Cassia fistula* in female rats, Vol- 15, no.4, P- 293- 301.
42. Yaniv.Z.D, Friedman.J, Palevitch.D, 1987,plants used for treatment of diabetes in Israel, "Journal of Ehanopharmacol", 19(2), P-145-51.