Journal of Plant Sciences
2015; 3(1-1): 33-39
Published online December 26, 2014 (http://www.sciencepublishinggroup.com/j/jps)
doi: 10.11648/j.jps.s.2015030101.15
ISSN: 2331-0723 (Print); ISSN: 2331-0731 (Online)

Pharmacology, phytochemistry and therapeutic application of *Prosopis cineraria* linn: A review

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To cite this article:
Khandelwal Preeti, Sharma Ram Avatar, Agarwal Mala. Pharmacology, Phytochemistry and Therapeutic Application of *Prosopis cineraria* Linn: A Review. *Journal of Plant Sciences*. Special Issue: Medicinal Plants. Vol. 3, No. 1-1, 2015, pp. 33-39.
doi: 10.11648/j.jps.s.2015030101.15

Abstract: *Prosopis cineraria* is locally known as Khejri one of the most common tree of the Indian desert belonging to family Mimosacease. It has been reported that the plant contains anti -inflammatory, anticonvulsant, antifungal, anticancer, antidiabetic, hypolipidemic, abortifacient, antioxidant, antimicrobial and wound healing properties. This is a preferred tree for agro-forestry and is a popular renewable source of fuel, fodder, timber and vegetables needed by local hosts. *Prosopis cineraria* (L.) Druce is a deep rooted, nitrogen fixing, multipurpose tree endemic to the hot deserts of India.

Keywords: *Prosopis cineraria* L., Sangari, Thar Desert, Rajasthan

1. Introduction

The Great Indian Desert, popularly known as the Thar, includes some portion of northwest India. It constitutes almost 90% of the Indian arid zone and the state of Rajasthan alone accounts for 61.8%. Arid regions are characterized as having extremely arid climate with low and erratic rainfall, dry atmosphere and high wind velocities. In these deserts, a promising multipurpose tree species commonly found is *Prosopis cineraria*(L.) Druce. It holds an important place in the rural economy in the northwest region of Indian subcontinent [1]

Prosopis cineraria is a species of flowering tree in the pea family, Fabaceae. It is a multipurpose tree of desert in Western Rajasthan and is regarded as the backbone of rural economy. Since all the parts of the tree are useful, it is called kalptaru. It is also known as the ‘wonder tree’ and the ‘king of desert. [2, 33]

It is an important component of desert Ecosystem of India as biomass producer and as Leguminous tree it enriches desert soil, fixes atmospheric nitrogen and provides a green coverage. It contributes to ecological stability of the region and providing extensive support to human beings, livestock and the nutrient deficient soils [3, 32]

P. cineraria is well adopted to arid and semi arid conditions of the Indian desert, perhaps due to their well developed and expansive tap root system which reach up to a length of 20 m, often reaching out the ground water resources[4]

This species represents all five F viz., Forest, Fiber, Fuel, Fodder and Food. This tree is also mythological important in local communities. High value of this species recognized as a State tree of Rajasthan.[5] It also provides fruit, firewood, timber, livestock feed, vegetable, construction and fencing material, medicine, gum and shade.[6]

These Prosopis plant species provide excellent fuel wood for cooking and heating in most households and rehabilitation of degraded lands in arid and semi arid region mostly in Kenya. [7]

Pods of this plant locally called “Sangri” are considered as dry fruit of desert and are one of the main ingredients of quintessential Rajasthani dish -The Panchkuta. Pods contain 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 sangri pods .[4]

The immature and mature pods are energy rich edible and have high nutritional values. In Rajasthan, there is a common practice to harvest the green pods, which are boiled, dried and sold as vegetable either singly or in combination with other local plant products to yield Pach-kutta, a mixture of five species. Green pods locally called as sangria or hangri

and the ripened ones, called kho kha, are used as vegetables. substantial anecdotal reports indicate that the consumption of Sangri pods could ameliorate a wide range of illnesses. [8] During India's infamous Rajputana famine (1868-69), many lives were spared using the sweetish bark as a food. [4]

The ashes of bark are rubbed over the skin to remove hair. Fresh Leaves juice mixed with lemon juice is used for dyspepsia; extract of crushed pods is used for earache, toothache, pain relief from fractured bones.[9]The whole plant is used in the Indigenous System of Medicine as a folk remedy for various ailments like leprosy, dysentery, bronchitis, asthma, leucoderma, piles, muscular tremor and wandering of the mind. It is also known to possess anthelmintic, antibacterial, antifungal, antiviral and anticancer activities. Leaf paste of P. cineraria is applied on boils and blisters, including mouth ulcers in livestock and leaf infusion on open sores on the skin. The smoke of the leaves is considered to be a good remedy for ailments of the eye [10, 11].The bark is prescribed for scorpion stings. *Prosopis cineraria* flower is pounded mixed with sugar and used during pregnancy as safeguard against miscarriage .The smoke of the leaves is good for eye troubles .The pod is considered astringent in Punjab. Bark of the tree is used in the treatment of asthma, bronchitis, dysentery, leucoderma, leprosy, muscle tremors and piles .The plant is recommended for the treatment of snakebite.[12]

Leaves are good fodder for camels, goats and donkeys. The flowers are useful for honey production. Khejri is also used for soil improvement and sand dune stabilization. The wood is ideal for domestic heating. The bark of the tree has abortifacient and laxative properties. Khejri is reputed for the treatment of asthma and worm. [13]

The plant material is one of the herbal remedies for snake bite and scorpion sting [6]. The wood ash may be used as source of potash and the ashes are rubbed over the skin to remove hair. It is used by native healers to manage multiple ailments including gastrointestinal, respiratory, and cardiovascular disorders. [14]

The chemical constituents isolated include spicigerine from the whole plant; and steroids, namely, campesterol, cholesterol, sitosterol, stigma sterol, alcohols, namely, octacosanol and triacontan-1-ol; and alkane, all isolated from the leaves [11].

1.1. Distribution

It is native to arid portions of Western and the Indian subcontinent, including Afghanistan, Iran, India, Oman, Pakistan, Saudi Arabia, the United Arab Emirates, and Yemen. It is an established introduced species in parts of Southeast Asia, including Indonesia. [15]. In India it founds in the various parts of Rajasthan, Gujarat, Haryana, Uttar Pradesh and Tamilnadu[12]

1.2. Taxonomic Classification

Kingdom planate
Order fables
Family fabaceae
Genus prosopis
Species cineraria

1.3. Vernacular Names

Arabic- ghaf
Bengali- shami
Gujarati- khijado, sumri, semru, Sami, kamra
Hindi -janti, banni, jand, chonksa, sangri, shami, chaunkra, khejiri
Sanskrit- jhind, jhand
Tamil - perumbay, vanni, jambu
Trade name -Jand, kandi, khejri
Urdu - jandi, thand, kandi [16].

1.4. Botanical Description

Evergreen or nearly so, it forms an open crown and has thick, rough gray bark with deep fissures.[13]Its branches are slender, glabrous and armed with somewhat compressed, straight and scattered prickles of 3-4 cm length. Flower is in the form of axillary spikes with the length of 7-11 cm, either solitary or in terminal panicles. Flower posses yellow corolla, attracting large number of insects including large number of *Apis florea* and numerous other wild bees in the month of December and April. [17]

It has bipinnately compound leaves, alternate in arrangement. The leaflets are 15–18 pairs, and shaped oblong with an entire margin, apiculate apex, obtuse base, glabrous surface, reticulate venation, petiolate, and the petiole is 0.5–4 cm long. The average leaf size is 2.5 cm (length) and 1 cm (breadth). Fresh leaves are green in colour, and are odorless with a bitter taste [12]

1.5. Nutritional Analysis

In the present study, potential benefits were shown by nutritional attributes of Sangri pods . Moisture content and dry matter analysis reporting during nutritional analysis is very important because it directly affects the nutritional content of Sangri pods. The moisture content was quite low (8.55±0.341%) which may be advantageous in view of the sample's shelf life. Sangri pods were found to be rich in carbohydrates (51.01±1.179%). There was an appreciable amount of protein (28.42±0.56%) making it as a good source of protein, while fiber content are also good. There is evidence that the dietary fiber has a number of beneficial effects related to its indigestibility in the small intestine[5]Sangri pods has very low amount of fat (2.30±0.328) which makes it ideal diet for overweight people.[5]

2. Pharmacological Activities

2.1. Antibacterial Activity

Antimicrobial potential was evaluated by using Agar well diffusion method on different extracts of dried unripe pods of

Prosopis cineraria . Methanolic extract shows significant results on all pathogens whereas no activity was recorded by petroleum ether extract. Among the tested four gram negative bacteria,(*E.coli*, *P.aeruginosa* and *S.typhi* , *K.pneumoniae*)*K.pneumoniae* was more susceptible to methanol, chloroform and aqueous extracts. Maximum zone of inhibition was observed against *K.pneumoniae* in methanolic extract, Aqueous and chloroform extract of the unripe pods of *Prosopis cineraria* did not showed any activity against *E.coli*, *P.aeruginosa* and *S.typhi*. [18]

The antibacterial activity of the various extracts of the stem bark of *Prosopis cineraria* (Linn.) Druce 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 µg/ml concentration on comparison with the standard ciprofloxacin. The obtained activity may be due to the presence of flavonoids and tannins [19]

2.2. Antimicrobial Activity

For screening of Antimicrobial activity of ethyl ether and alcoholic extracts of leaves of *Prosopis cineraria* three micro-organisms *Staphylococcus aureus* (Gram positive), *Escherichia coli* (Gram negative) and *Candida albican*s (Fungal pathogen) were used.

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) extracts of leaves of *Prosopis cineraria*, showed positive reactions against all the three test organisms. [20]

2.3. Antihyperglycemic 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 by 27.3%, comparable to that of standard glibencl 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 and hence indicating anti-diabetic and antioxidant efficacy of the extract.[21]

2.4. Analgesic Activity

Aqueous extract of leaves were evaluated for analgesic activity by using acetic acid induced writhing test model. The Analgesic activity exhibited at a dose of 200 mg/Kg B.W. of 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.[22] Analgesic activity of ethanolic extract of root was evaluated by using tail immersion and hot plate method at doses of 200 and 300 mg/Kg B.W orally. The former dose showed a significant analgesic activity as compared to control.[12]

2.5. Anticonvulsant Activity

Anticonvulsant activity of the methanolic extract of *Prosopis Cineraria* (Linn) Druce stem barks was evaluated against maximal electro shock (MES) and Pentylenetetrazole (PTZ) induced convulsions in mice. The extract suppressed hind limb tonic extensions (HLTE) induced by MES and also exhibited Protector Effect in PTZ Induced Seizures in a dose dependent manner.

Methanolic extract of *Prosopis Cineraria* at doses of 200 and 400 mg/kg and Phenytoin (25 mg/kg) have shown significant reduction in duration of convulsions. It was effective against MES induced seizures, Drugs protecting against tonic-clonic seizures induced by PTZ are considered useful in controlling myoclonic and absence seizures in humans.[23]

2.6. Hypolipidemic and Antiatherosclerotic Efficacy along with Non-Toxic Nature

Hypo-lipidemic and anti-atherosclerotic effects of *Prosopis cineraria* bark extract is evaluated in hyper-lipidemic rabbits. The rabbits were made to induce exogenously hyper-lipidemic through orally administration of high fat diet and cholesterol powder (500mg/Kg body weight per day in 5 ml of coconut oil orally for 15 days). The induced hyper-lipidemic rabbits were treated comparatively by bark extract of *Prosopis cineraria* and standard drug. The administration of *Prosopis cineraria* bark extract in 70% ethanol significantly reduced serum total cholesterol , LDL-C , triglyceride , VLDL-C and also ischemic indices (Total cholesterol/LDL-C and LDL-C/HDL-C).

The *Prosopis cineraria* bark extract significantly prevented the atherogenic changes in aorta. Toxicity profile parameters were also under normal ranges[24]

2.7. Adsorption Potentialities

Leaves, stems and their ashes of *Prosopis cineraria* have been explored for their surface sorption abilities towards Methyl Orange Dye using simulated waters. Various physicochemical parameters such as pH, time of equilibration and sorbent concentrations are optimized for evoking the sorption potentialities of the plant materials for the maximum extraction of the Methyl Orange Dye from waters.[25]

2.8. Anti Helminitic Activity

Anti helminitic activity of different extracts of prosopis

cineraria (Linn) druce stem bark was evaluated against Indian earthworm. Various concentrations of the extracts were bio-assayed for determination of time of paralysis (p) and time of death (d) of the worm. The different solvent extracts of Prosopis cineraria stem bark exhibit anti helmintic activity in a dose dependent manner. The methanolic extract at dose of160 mg/ml caused paralysis in 25 min and death in 62 min against *Phretima posthuma* as compared to the standard drug piperazine citrate (10 mg/ml) showed the same at 23 min and 61 min respectively. . This study confirmed the use of plant stem barks as an anti helmintic agent.[26]

2.9. Antioxidant Activity

To evaluate antioxidant activity of different solvent fractions obtained from the leaves of *Prosopis cineraria*. Scavenging ability of the extracts for radicals like DPPH, ABTS, hydroxyl, superoxide, nitric oxide and hydrogen peroxide were performed to determine the potential of the extracts.

This suggests that the plant leaves extract which contain compounds that are capable of donating hydrogen to a free radical in order to remove odd electron which is responsible for radical's reactivity. Among six extracts ethyl acetate and methanolic extracts show maximum scavenging activity followed by chloroform and aqueous extracts.[16]

2.10. Apoptotic Activity

Methanolic extract of *Prosopis cineraria* leaves was evaluated in breast cancer cell line MCF -7 and non cancerous cell line HBL 100. Various staining techniques like Giemsa, ethidium bromide, Propidium iodide and Hoechst were performed both in cancerous cell line MCF-7 and noncancerous cell line HBL 100. Than plant extract caused a steep increase in apoptotic ratio in cancer cell line and not in HBL 100.

This study showed that *Prosopis cineraria* leaves inhibit the proliferation of MCF-7 breast cancer cells with the involvement of apoptosis or programmed cell death. *Prosopis cineraria* worked as a promising chemotherapeutic agent in cancer treatment. [27]

2.11. Antihyperglycemic and Antihyperlipidemic

The present results indicated significant decrease in body weight and raise in blood glucose levels in diabetic rats and they became normal when treated with the plant extract. This suggests that the plant *Prosopis cineraria* has protective role in reducing glucose levels as well as in increasing body weight. Administration of the hydro alcoholic extract of *Prosopis cineraria* of dose 750 mg/kg caused statistically highly significant decrease in the blood glucose levels of STZ induced diabetic rats as compared to the normal control. Chronic administration of the aqueous extract of *Prosopis cineraria* PC for 12 weeks in diabetic rats caused significant increase in the serum insulin levels of all groups, indicating that these fractions may probably activate the surviving β-cells of the islets of Langerhans and revert them to the normal state i.e. an insulinogenic effect. The decrease in body weight observed in the diabetic control group in our study may be attributed to due to increase in muscle glucose uptake which results in preventing tissue loss.[28]

2.12. Antidepressant and Skeletal Muscle Relaxant Activity

The aqueous leaves extract of *P. cineraria* possess significant antidepressant like effect and skeletal muscle relaxant activity. It is used traditionally for the treatment of various CNS disorders. . The forced swimming and tail suspension tests were done to study these activities.

The antidepressant effect was evaluated using Forced swim test (FST). The antidepressant effect of leaf extract was compared to that of imipramine (15 mg/kg. p.o). The leaf extract at doses of 200 mg/kg significantly decreased the duration of immobility time in FST. For Skeletal muscle relaxant action rotarod test is used. The test is used to evaluate the activity of drugs interfering with motor coordination.[29]

3. Pharmaceutical Activity

When the boiling water extract of its 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). High antioxidant activity has also been exhibited by the methanolic extract of its pods, which also have indicated antimicrobial activity against *Candida albicans*. There is also empirical proof that P. cineraria can exhibit estrogenic activity in vitro. Although most of the biological activities showed in studies were proven in animals, there are potential benefits of P. cineraria pod extract as an antioxidant. However, the toxicity effects of the extracts need to be adverse effects when consumed, as mentioned by Bahorunet al. [30].

4. Toxicity Studies

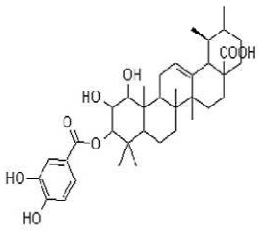
Acute Toxicity studiese50% Hydro alcoholic extract was administered to rats by oral route at dose of 50, 500, 1000,2000 mg/Kg B.W. The extracts didn’t produce Sub acute to evaluate toxicity studies Female rats were treated with 50% Hydro alcoholic extract of leaves and stem bark at a dose of 200,500,1000 mg/Kg B.W. There were no significant changes in hematological parameters such as RBC, WBC, Hb, ESR, platelets, PCV and clotting time in extract treated animals compared to the control. No mortality recorded within 24 h.

No significant changes in behavior, breathing, cutaneous effects, sensory nervous system responses.[31]

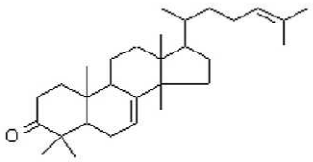
5. Phytochemistry

Flowers contain patuletin glycoside patulitrin, sitosterol, spicigerine, Flavone derivatives Prosogerin A and Prosogerin B. 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

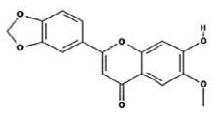
with a piperidine alkaloid spicigerine Seeds contain Prosogerin C, Prosogerin D, Prosogerin E,Gallic acid, patuletin, patulitrin, luteolin, and rutin.[9]



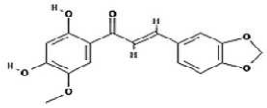
3-benzyl-2-hydroxy-urs-12 en-28-oic acid



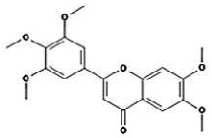
7,24-Tirucalladien-3-one



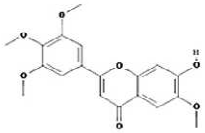
Prosogerin A



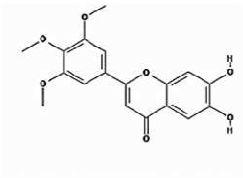
Prosogerin B



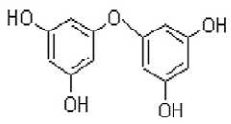
Prosogerin C



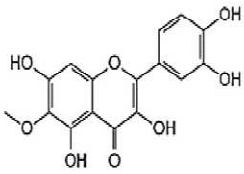
Prosogerin D



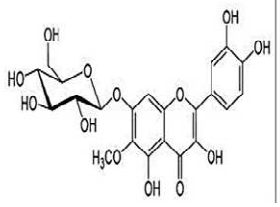
Prosogerin E



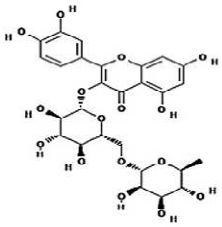
5,5'-oxybis- 1,3- benzendiol



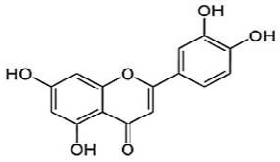
Patuletin



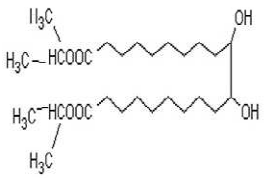
Patulitrin



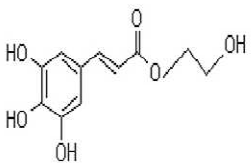
Rutin



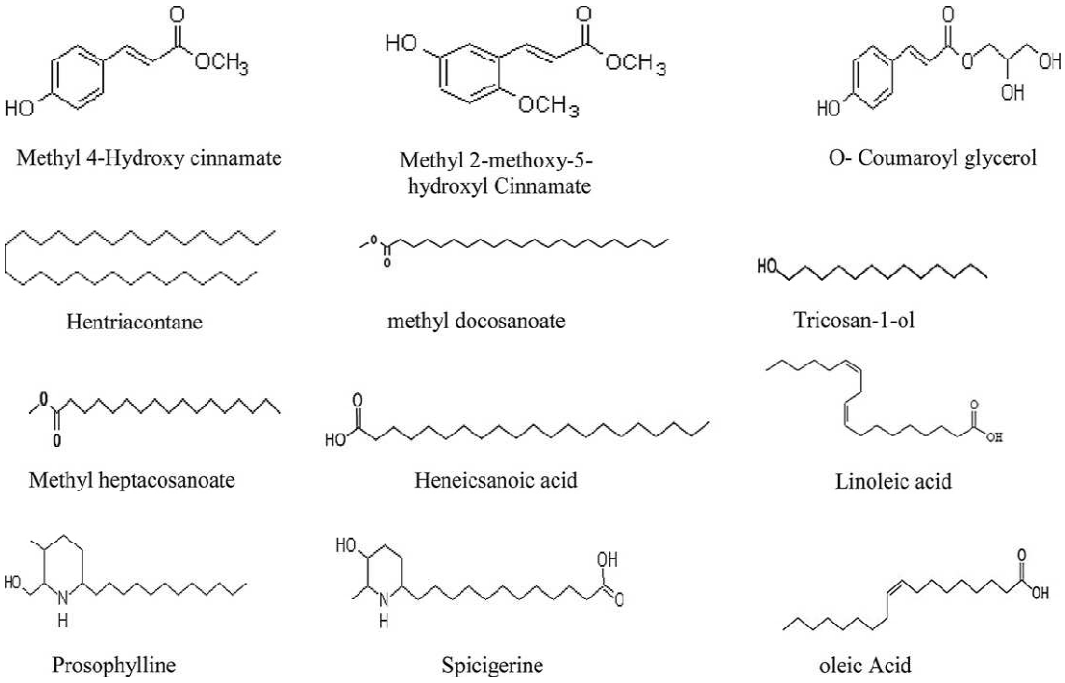
Luteolin



Diisopropyl-10,11-dihydroxyicosan-1,20-dioat



Trihydroxycinnamic acid 2- hydroxyl ethyl ester



6. Conclusion

From the above review, it can be concluded that Prosopis *cineraria* Linn. is used traditionally since many years as reported in various literatures. However, after detected of various newer compounds from the plant, several new activities were reported by the researchers and hence the plant is now gaining importance to develop some more new search for the future development by understanding the gene level study. Therefore, considering its versatile medicinal uses, there is an ample scope for future research on *Prosopis cineraria* and hence further pharmacological investigations are warranted.

References

[1] Khatri, A. Rathore, A. and Patil, U. K., "*Prosopis cineraria*(L.) Druce: A Boon Plant of Desert- An Overview" IJBAR, Vol1(5), 2010.

[2] Singh S, Naresh V and Sharma S., " Pharmacognostic Studies on the Leaves of *Prosopis cineraria*(L) Druce. Growing in South Haryana, India**,** Vol. 2(1), 2013

[3] Chaudhry P , "*Prosopis cineraria* (L) Druce: A Life Line Tree species of the Thar Desert In Danger . Journal of Biodiversity and Ecological Sciences", Vol 1(4), p289-293, 2011.

[4] Gehlot P, Bohra N.K. and Purohit D.K, " Endophytic Mycoflora of Inner Bark of *Prosopis cineraria*- a Key Stone Tree Species of Indian Desert". American-Eurasian Journal of Botany, Vol 1 (1): p1-4, 2008

[5] Rani B, Singh U, Sharma R, Gupta A, Dhawan N, Sharma A and Maheshwari R, "*Prosopis cineraria* (L.) druce: A Desert Tree to Brace Livelihood in Rajasthan". Asian J Pharmaceutical Research & Health Care,Vol5(2)p58,2013.

[6] Pareek A, Sharma D and Pareek L, "In-Vitro Micropropagation through Cotyledonary Nodal segments in *Prosopis cineraria* L." Research Journal of Pharmaceutical, Biological and Chemical Sciences,Vol3(3)309-313.

[7] Nellie M. Oduor and Joseph K. and Githiomi, " Fuel-wood Energy Properties of *Prosopis juliflora* and *Prosopis pallidagrown* in Baringo District, Kenya ,Vol. 8(21), pp. 2476-2481, 2013

[8] Malik S, Mann S, Gupta D and Gupta R , " Nutraceutical Properties of *Prosopis cineraria* (L.) Druce Pods: A Component of "Panchkuta" Journal of Pharmacognosy and Phytochemistry, Vol 2(2)

[9] Garg A and Mittal S, " Review on *Prosopis cineraria*: A potential Herb of Thar Desert Drug invention today" vol5p60-65,2013.

[10] Raj Bhansali R, " Development of Flower galls in *Prosopis cineraria* Trees of Rajasthan", The Journal of Plant Protection Sciences, 4(1) p 52-56, 2012

[11] Stellaa R, Narayanan, N. Deattu, N. R.and Nargis R., "Comparative Anatomical Features of *Prosopis cineraria*(L.) Druce and *Prosopis juliflora*(Sw.)" International J. Green pharmacy,Vol4(4) p275-280, 2010.

[12] Dharani B, Sumathi S, Sivaprabha J and Padma P.R., "In vitro antioxidant potential of *Prosopis cineraria* leaves" J. Nat. Prod. Plant Resour. Vol 1 (3) p26-32,2011.

[13] Kumar A, Yadav S K, Singh S, Pandeya S N, "Analgesic activity of ethanolic extract of roots of *Prosopis cineraria* (l.) Druce" Journal of Applied Pharmaceutical Science Vol1 (8)p 158-160,2011.

[14] Khalid H , Sajjad J, Haider, I, Muhammad Z U H, Laura De M and Vincenzo De F, "Pharmacological Evaluation of *Prosopis cineraria* (L.) Druce in Gastrointestinal, Respiratory, and Vascular Disorders" Evidence Based Complement and Alternative Med., Vol 1,p7 ,2012

[15] *Prosopis cineraria*, From Wikipedia, the free encyclopedia.

[16] Agroforestry Database 4.0 (Orwa et al.2009)

[17] Gorain M, Charan S K, Ahmed S I, "Role of insect bees in the pollination of *Prosopis cineraria* (L.) Druce (Leguminosae, Subfamily Mimosideae) in Rajasthan".Advances in Applied Science Research, Vol 3 (6) p3448-3451, 2012.

[18] Sharma R, Jodhawat N, Purohit S and Kaur S, "Antibacterial activity and phytochemical screening of dried pods of *Prosopis cineraria*." India, Int. J. Pharm. Sci. Rev. Res., Vol 14(1), 2012.

[19] Velmurugan V, Arunachalam G and Ravichandran V, "Antibacterial activity of stem bark of *Prosopis cineraria* (Linn.) Druce" Archives of Applied Science Research, Vol 2 (4) p 147-150, 2010.

[20] Kapoor B.B.S and Bansal R, " Antimicrobial Screening of Some Medicinal Tree Species of Nagaur District of Rajasthan" IJHM Vol 1 (4)p 10-11,2013.

[21] Sharma N, Garg V and Paul A. Antihyperglycemic, Antihyperlipidemic and Ant oxidative Potential of *Prosopis cineraria* bark. Indian J Clin Biochem. Vol20 (2) p193, 2010.

[22] Joseph L, George M, Sharma A and Gopal N., "Antipyretic and analgesic effects of the aqueous extracts of *Prosopis cineraria*"Global J Pharmacol. Vol5 (2) p73, 2011.

[23] V. Velmurugan1, G. Arunachalam and V. Ravichandran, "Anticonvulsant Activity of Methanolic Extract Anticonvulsant Activity of Methanolic Extract of *Prosopis Cineraria* (Linn) Druce Stem Barks". Vol4 (1), p 89-92, 2012.

[24] Purohit A and Ram H, "Hypolipidemic and anti-atherosclerotic effects of *Prosopis cineraria* bark extract in experimentally induced hyperlipidemic rabbits"Vol5 (3) p63-76, 2012.

[25] Shaik K. and Ravindhranath K, "Adsorption potentialities of bio-sorbents derived from *Prosopis cineraria* and *Hibiscus rosa-sinensis* in the removal of methyl orange dye from polluted waters International J. Applied Biology and Pharmaceutical Technology,Vol4(1).

[26] Velmurugan V, Arunachalam G and Ravichandram V, "Anthelmintic potential of *Prosopis cineraria* (Linn.) druce stem barks"Vol 1 (2) pp 88-91, 2011.

[27] Sumathi S., Dharani B, Sivaprabha J, Sonia R. K. and Padma P R, "Cell death induced by methanolic extract of *Prosopis cineraria* leaves in MCF-7 breast cancer cell line" Vol 2(1) pp21-26,2013.

[28] Sharma D and Singlas Y P, "Evaluation of antihyperglycemic and antihyperlipidemic activity of *Prosopis cineraria* (Linn.) in wistar rats"Vol2 (4) p 751-758, 2013.

[29] George M., Joseph L, Sharma A, V.Velmurugan, G.Arunachalam and V.Ravichandram, "Antidepressant and skeletal muscle relaxant effects of the aqueous extract of the *Prosopis cineraria*" Brazialian J. Pharmaceutical Sciences Vol48p578-581, 2012.

[30] Karim A.A. and Azlan A, "Fruit Pod Extracts as a Source of Nutraceuticals and Pharmaceuticals Molecules" vol 17p 11931-11946,2012

[31] Robertson S, Narayanan N, Ravinargis NR, " Toxicity evaluation on hydroalcoholic extract of leaf and stem bark of Prosopis cineraria". Int J Pharm and Pharma Sci. Vol4 (3) p113-118, 2012.

[32] Panwar D, Pareek K ,Bharti C S, "Unripe Pods of *Prosopis cineraria* used as a vegetable(sangri) in Shekhawati region" International Journal of Scientific & Engineering Research, Vol 5(2),2014 .

[33] Tarachand, Bhandari A, Bhupendra K. Kumawat, Sharma A and Nagar N, " Physicochemical and Preliminary phytochemicals screening of pods of *Prosopis cineraria* (L.) Druce" Der Pharmacia Sinica, Vol 3 (3)p377-381,2012.