



TRADITIONAL USES, PHYTOCHEMISTRY, PHARMACOLOGICAL PROPERTIES OF PLANT *ALHAGI MAURORUM* (MEDIK.): A REVIEW

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ABSTRACT

Traditionally number of plants are documented which holding medicinal activities. One such plant species of legume *Alhagi maurorum* family fabaceae commonly known, as camelthorn, camelthorn-bush, Caspian manna, and Persian manna. This shrub is native to the region extending from the Mediterranean to Russia, but has been introduced to many other areas of the world and has therapeutic potential against many diseases such as Asthma, rheumatism, chest pain, cough, fever. Existence of *Alhagi maurorum* in India, it is distributed in Rajasthan, Delhi, Gujarat, Maharashtra and Punjab. There are several reports on medicinal value of roots, aerial parts, leaves of *A. maurorum*. Therefore, the present review aims to

provide updated information on the phytochemistry and pharmacological properties of different parts of *A. maurorum*, in order to open new perspectives for pharmacological research.

KEYWORDS: phytochemistry, pharmacological activity, traditional uses, *Alhagi maurorum*.

INTRODUCTION

Herbal medicine, also called botanical medicine or phytomedicine, refers to using a plant's seeds, berries, roots, leaves, bark, or flowers for medicinal purposes used for the manufacturing of many drugs to treat the symptoms of wide range of problems.^[1] The bioactive extract should be standardized on the basis of active compounds. Currently 80% of

the world population depends on plant derived medicine for the first line of primary health care for human alleviation because it has no side effects.^[2] Now a days there is a growing focus on the importance of medicinal plants in the traditional health care system viz, Ayurveda, Unani, Homeopathy in solving health care problems. The active principles may be carbohydrates, glycosides, tannins, lipids, alkaloids etc. These active principles are manufactured chemically to produce the synthetic drugs.^[3]

Alhagi maurorum

The perennial plant grows from a massive rhizome system which may extend over six feet into the ground. New shoots can appear over 20 feet from the parent plant. Above the ground, the plant rarely reaches four feet in height. It is a heavily branched, gray-green thicket with long spines along the branches. It bears small, bright pink to maroon pea flowers and small legume pods, which are brown or reddish and constricted between the seeds. The seeds are mottled brown beans.



Botanical description

Plant shrub are Small erect, armed with sharp, long spines. Leaves are Simple coriaceous 6-9 × 4-5 mm, obovate, oblong, obtuse, apiculate, Flowers 5-8 on a spine, Calyx Glabrous. Corolla Red, longer than calyx, Ovary Glabrous, Seeds Reniform, blackish brown, polished, Pods 28-30 mm long falcate constricted between Seeds glabrous.^[4]

Synonyms

Synonyms of *Alhagi maurorum* include *Alhagi camelorum*. *Alhagi pseudalhagi* and *Hedysarum alhagi* L.

Common Name

Sanskrit : Bhatuashak
English : Persian Manna Plant
Gujrati and Hindi : Javaso, Bharbharra
Kannada : Turuchana gida, Javasa, Neladangara, Ballidurabi, Duralabha Venkatithura,
Malayalam : Valiya Kotithuva Dhamasa

Parts used

Leaves, stem, flower, seeds, roots, whole plant

Taxonomy^[5]

Kingdom : Plantae
Phylum : Spermatophyte
Subphylum : Angiospermae
Class : Dicotyledonae
Order : Fabales
Family : Fabaceae
Genus : *Alhagi*
Species : *Alhagi maurorum*

Phytochemistry

The plant extraction with benzene yield 24-alkyl sterols, the plant also yielded two new flavanone glycosides alhagitin and alhagidin. Their structures were established as naringenin 5-methyl ether 4'-glucoside and hesperitin 7-galactosyl(1-2) [rhamnosyl (1-6)] glucoside, respectively.

The stem yielded seven β -phenethylamines and one tetrahydroisoquinoline alkaloid. Choline and traces of betaine were also obtained from the stem. The root also has essentially the same alkaloids as the stem but in poorer amount.^[6]

Pharmacognosy

New natural compound for the enlargement of the ureter were isolated by Mohammad S., *et al.* (2014).^[7]

Chemical and phytochemical investigation of the ethanol extract of the roots of *Alhagi maurorum* led to the isolation of a new aliphatic ester, which was named glyceryl-n-tetracosan-17-ol-1-oate on the basis of spectral data analysis and chemical reactions. This compound, in pure form, was found to enlarge the ureter.

Oleanane glycosides from the roots of *Alhagi maurorum* were isolated by Arafa H., *et al.* (2012).^[8]

Three new oleanane-type triterpene glycosides (1–3), along with four known compounds (4–7) glycosides, were isolated from the roots of *Alhagi maurorum*. The antiproliferative activity of the isolated compounds was evaluated against a small panel of cancer cell lines including human breast cancer (MCF-7), human lung adenocarcinoma (A549), human prostate cancer (PC-3) and human leukemia (U937) cell lines. None of the tested compounds, in a range of concentrations between 1 and 50 μM , caused a significant reduction of the cell number.

Antioxidant flavonoids from *Alhagi maurorum* were extracted by Ahmad S., *et al.* (2010).^[9]

A new flavonoid, isorhamnetin-3-O-[- α -l-rhamnopyranosyl-(1 \rightarrow 3)]- β -d-glucopyranoside (1), along with two known flavonoids 3'-O-methylrobof (2) and quercetin 3-O- β -d-glucopyranoside (3), was isolated from *Alhagi maurorum*. Their structures were established with the help of mass spectrometry, 1D and 2D NMR spectroscopy, and in comparison with the literature data.

***Alhagi maurorum*: A convenient source of lupeol reported by Laghari A.H, *et al.* (2011).**^[10]

Lupeol, a bioactive triterpenoid, has been isolated from the root barks of *Alhagi maurorum* for the first time in considerable quantity via an easy extraction and isolation process. In this study, a new and versatile LC–MS method has also been developed by optimizing various parameters for the rapid determination of lupeol in plant extract. The anti-inflammatory property of *Alhagi maurorum* can be correlated to this compound. The superiority of *Alhagi maurorum* over other plant sources of lupeol is due to its wild nature and ability to grow throughout the year.

Pharmacological activities

Enlargement of the ureter

New natural compound for the enlargement of the ureter were isolated by Mohammad S., *et al.* (2014).^[11] Chemical and phytochemical investigation of the ethanol extract of the roots of *Alhagi maurorum* led to the isolation of a new aliphatic ester, which was named glyceryl-n-tetracosan-17-ol-1-oate on the basis of spectral data analysis and chemical reactions. This compound, in pure form, was found to enlarge the ureter.

Antioxidative

comparison of biological activity of phenolic fraction from roots of *Alhagi maurorum* with properties of commercial phenolic extracts and resveratrol were evaluated by Olas B., *et al.* (2015).^[12] The effect of phenolic fraction from roots of *Alhagi maurorum* on oxidative protein/lipid damages (determined by such parameters as levels of protein thiol groups and the concentration of thiobarbituric acid reactive species – TBARS) in human blood platelets and human plasma after treatment with hydrogen peroxide – H₂O₂ (which is the strong biologic oxidant and inflammatory mediator) was studied in vitro. Tested fraction from *A. maurorum* has more effective antioxidative activity and antiplatelet properties than aronia extract or other commercial extract, however differences between their actions are not statistically significant.

Hepatoprotective

Phytochemical Screening and Hepatoprotective Effect of *Alhagi maurorum* Boiss (Leguminosae) Against Paracetamol-Induced Hepatotoxicity in Rabbits were evaluated by Rehman JU., *et al.* (2015).^[13] Aqueous-ethanol extract of *Alhagi maurorum* at doses of 250 mg/kg and 500 mg/kg body weight, p.o., was administered for 7 days in paracetamol (2 gm/kg, s.c.) intoxicated rabbits and compared with silymarine (50 mg/kg, p.o.) treated rabbits. The extract, at dose of 250 and 500 mg/kg. exhibited significant effects.

Anticancer Activity

In vitro Anticancer Activity of *Ocimum Basilicum*, *Alhagi maurorum*, *Calendula Officinalis* and their Parasite *Cuscuta Campestris* were evaluated by Mandana B., *et al.* (2014).^[14] The cytotoxic activity of the pure compounds was performed by MTT assay against breast cancer cell lines (MCF-7 and MDA-MB-231) and normal breast cell line (MCF 10A). The induction of apoptosis was measured by the expression levels of p53, bcl-2, bax and caspase-3 genes using quantitative Real Time PCR. Three active fractions were detected

by nuclear magnetic resonance as lutein, lupeol and eugenol, respectively, in *C. officinalis*, *Alhagi maurorum* and *O. basilicum*. These compounds and their epoxidized forms were also detected in their parasite *C. campestris*.

Antibacterial and Antifungal activities

In vitro antibacterial and antifungal activity of different solvent extracted samples of *Alhagi maurorum* were evaluated by Bakht J., *et al.* (2014).^[15] Antimicrobial potential of sample were determined against bacterial strains (gram positive and gram negative) and fungal specie using diffusion susceptibility assay. The most resistant bacterial strain was *P. aeruginosa*, which showed resistance to most of extracts while the most susceptible bacterial specie was *K. pneumonia*, the growth was inhibited by all extracts.

Antimicrobial and cytotoxic activities

Antimicrobial and cytotoxic activities of methanol extract of *Alhagi maurorum* were evaluated by Ghassan M., *et al.* (2013).^[16] Methanol extracts of *Alhagi maurorum* from the aerial part were screened for total phenolic and flavonoids contents, antioxidant, antimicrobial and cytotoxic activities. The total phenolic and total flavonoids contents were assessed by Folin–Ciocalteu and aluminum nitrate methods, respectively.

Antioxidant activity

Free phenolic acids and antioxidant capacity of methanolic extracts obtained from leaves and flowers of camel thorn (*Alhagi maurorum*) were evaluated by Laghari AH., *et al.*(2012).^[17] The present study comprises the determination of some phenolic acids from the leaves and flowers of *Alhagi maurorum* by HPLC-DAD, confirmed by LC-MS-APCI. The antioxidant properties and measurements of the total phenolic contents of the extracts were assessed by 1,1-diphenyl-2-picrylhydrazyl (DPPH) free radical scavenging and Folin-Ciocalteu methods, respectively. It was found that the leaf extract had higher antioxidant potential (83.5%) than the flower extract (72.3%). The antioxidant properties and total phenolic contents of the leaves were higher than those of the flowers.

Anti-inflammatory, antinociceptive and antipyretic activities

Anti-inflammatory, antinociceptive and antipyretic effects of some desert plants, *Alhagi maurorum* Medic., *Conyzadiscoscoridis* (L.) Desf., *Convolvulus fatmensis* G. Kunze., *Diplotaxisacris* (Forssk) Boiss and *Origanum syriacum* L. were evaluated for their phytochemical contents by Amani S., *et al.* (2011).^[18] Their antioxidant, anti-inflammatory,

antinociceptive and antipyretic activities were evaluated in lab animals at doses of 250, 500 and 1000 mg/kg. The antioxidant activity was estimated using DPPH free radical scavenging activity method for the alcoholic extracts of the investigated plants at different concentrations (2, 4, 6, 8 and 10 mg/ml). The anti-inflammatory activity was estimated using carrageenan-induced rat paw edema method and the activities were compared to that of diclofenac sodium (30 mg/kg). The antinociceptive activity was estimated peripherally and centrally using the writhing and the hot plate tests, respectively. The antipyretic activity was estimated using Brewer's yeast-induced hyperpyrexia in rats and the activities were compared to that of diclofenac sodium.

Anti-inflammatory and anti-ulcer activities

Anti-inflammatory and anti-ulcer activity of the extract from *Alhagi maurorum* (camelthorn) were evaluated by Shaker E., *et al.* (2010).^[19] *Alhagi maurorum* (camelthorn) is considered a medicinal plant with its prospective potent flavonoids. GC-MS spectrum has found three flavone structures (2-phenyl-1,4-benzopyrone derivatives) with rate more than 50% in the ethanolic plant extract. In rat experiment, ethanolic *Alhagi maurorum* extract (oral daily 100 mg/kg body weight) and ranitidine the standard ulcer drug (oral daily 100 mg/kg body weight) were treated rats to protect against administration of aspirin ASP (oral 200 mg/kg body weight) for two times through the 10 days. Some rats were sacrificed after first and second aspirin administrations and the rest were sacrificed in the end of the experiment. Gastro fluid volume has been decreased in ASP group, and acid output was decreased for plant extract followed by ranitidine. Ranitidine and plant extract protect liver enzymes, oxidation status (MDA and GSH), fucosidase tumor marker and risk lipid ratio.

Urease-inhibition activity

A new flavanenol with urease-inhibition activity isolated from roots of manna plant camelthorn (*Alhagi maurorum*) by Laghari A.H, *et al.* (2010).^[20] A new flavanenol (1) was isolated from ethyl acetate fraction of roots of *Alhagi maurorum* (Fabaceae). Its structure was elucidated on the basis of spectroscopic evidence using elemental analysis, IR, MS, and NMR techniques. Experiments were carried out to evaluate its urease-inhibition activity. From the observations it has been noticed that flavanenol possesses remarkable urease-inhibitory effect.

Pharmacological activity

Pharmacological activity of ethanolic extract of *Alhagi maurorum* roots were studied by Marashdah M S., *et al.* (2010).^[21] Showed the following results: (1) Administration of EE intraperitoneally into mice decreased the body temperature in a dose-dependent manner. The decreases ranged from 0.2 to 3.3°C. (2) Treatment of the frog tissue with EE blocked the action of the neurotransmitter, acetyl choline (Ach). Thus, EE seemed to act as a skeletal muscle relaxant. (3) Intraperitoneal administration of EE into the anaesthetized rats decreased heart rate by 22.5%, thus, EE seemed to be a bradycardiogenic drug. (4) The extract induced relaxations to the guinea-pig ureter and suppressed histamine-induced spasms. It seemed to possess a spasmolytic action and a ureter relaxing action that can enhance getting rid of renal stones and relieve of the accompanying pain (contraction of the ureter). (5) The extract did not possess the property of enhancing dissolution of oxalate calculi.

Antiproliferative and antioxidant activities

Antiproliferative and antioxidant properties of aerial parts of *Alhagi maurorum* Boiss (Leguminosae) were studied by Monica R., *et al.*(2009).^[22] This work is aimed to investigate the antiproliferative and antioxidant activities of *Alhagi maurorum*, a legume used as natural sweetener. Diethyl ether (DE) and petroleum ether (PE) extracts were analyzed for their chemical composition by GC–MS analysis. Both extract were further investigated for their potential cytotoxicity against a panel of human cancer cell lines by sulforhodamine B (SRB) assay.

Gastroprotective activity

Gastroprotective effect of *Alhagi maurorum* on experimental gastric ulcer in rats were evaluated by Naseri MKG, *et al.* (2007).^[23] Male Wistar rats were pretreated with the AME (150, 300 and 450mg/kg, P.O.) before induction of gastric ulcer by water immersion restraint-stress (5 h, water immersion restraint stress at (20-22°C) or ethanol (100%; 1ml/200g of B.W, P.O). Negative control animals received saline (0.5ml/100g of B.W) & positive control animals received ranitidine (60mg/kg, P.O).

Antiulcerogenic Activity

Antiulcerogenic Activity of *Alhagi maurorum* were evaluated by Awaad AS., *et al.* (2006).^[24] Six main flavonoid glycosides were isolated, for the first time, from the ethanol extract of *Alhagi maurorum* Boiss (Leguminosae). They were identified as kaempferol, chrysoeriol, isorhamnetin, chrysoeriol-7-O.-xylosoid, kaempferol-3-galactorhamnoside, and isorhamnetin

3-O.- β -D-apio-furanosyl (1-2) β -D-galactopyranoside. Their identities were established by m.p., UV, EI-mass, Fab-mass, 600 MHz ^1H and ^{13}C NMR. The total extract (300 and 400 mg/kg) and two of the isolated compounds (chrysoeriol 7-O.-xylosid and kaempferol-3-galactorhamnoside, 100 mg/kg each) showed a very promising antiulcerogenic activity with curative ratios 66.31%, 69.57%, 75.49%, and 77.93%, respectively.

CONCLUSION

The present review compiles information on an ethnopharmacologically useful plant *A. maurorum*. The *Alhagi maurorum* has been reported to possess varied medicinal properties. The Anti-inflammatory and anti-ulcer, Gastroprotective, antibacterial and antifungal, antinociceptive and antipyretic, activities of plant *Alhagi maurorum* has been studied. The plant is also mentioned for antiasthmatic and antitussive activities and shows good effect to treat asthma and cough. Furthermore, the detailed study of toxicity and pharmacological properties of extracts of *A. maurorum* is required to confirm the ethnomedicinal claims of *A. maurorum*.

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