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Review Article

Ethnopharmacology of *Lepidium Sativum* Linn (Brassicaceae): A Review

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ABSTRACT

Lepidium sativum (Garden cress, Brassicaceae) is a fast-growing, edible herb that is botanically related to watercress and mustard, sharing their peppery, tangy flavor and aroma. In traditional system of Indian medicine various parts of plant have been used to treat various human ailments such as diarrhea, dysentery, leprosy, skin and eye diseases, leucorrhoea, scurvy, liver diseases, renal diseases, dyspepsia, asthma, cough, cold and seminal weakness, also it is considered as bitter, diuretic, tonic, abortifacient, aphrodisiac, thermogenic, galactagogue, emmenagogue, depurative, ophthalmic, also used to treat tenesmus, secondary syphilis. *Lepidium sativum* mainly contains alkaloids, saponins, anthracene glycosides, carbohydrates, proteins, amino acids, flavonoids, sterols as chief phytochemical constituents. Glutamic acid is the most abundant amino acid; leucine and methionine are the highest and the lowest essential amino acids respectively. Its extracts have been found to possess various pharmacologicalivities. A comprehensive review of its ethno-medical uses, chemical constituents and pharmacological profile as a medicinal plant. Mainly focused on its Anti-inflammatory, antipyretic, analgesic and coagulant, antihypertensive, diuretic anti-diabetic, hepatoprotective, anti-ashthamatic, prokinetic, laxative, hypercholesterolemic, fracture healing, chemo-protective and anti-oxidant activity for better evaluation in various therapeutic applications.

Keywords: *Lepidium sativum,* Garden cress, Brassicaceae, medicinal plants, pharmacological profile of *Lepidium sativum*, chemical constituents of *Lepidium sativum.*

Introduction

Lepidium sativum (Garden cress) is an annual herb, belonging to Brassicaceae family. It is a fast-growing, edible plant botanically related to watercress and mustard and sharing their peppery, tangy flavor and aroma. Seeds, leaves and roots are economically important, however, the crop is mainly cultivated for seeds. In some regions garden cress is known as garden pepper cress, pepper grass or pepperwort. It is also known as Asalio or chandrasur in India and it is an important medicinal crop in India. Garden cress is a perennial plant, and an important green vegetable consumed by human beings, most typically as a garnish or as a leaf vegetable **[1]**.

Its common names includes Candriki , Assamese , Halim (Sanskrit); Chand Shura, Halim (Bengali); Common Cress (English); Aseriya, Aseliyo (Gujrati); Chansur (Hindi); Allibija, Kapila (Kannada); Alian (Kashmiri); Asali (Malayalam); Ahaliva, Haliv (Marathi); Chandasara, Chandasura (Oriya); Holan, Taratej (Punjabi); Allivirai (Tamil); Adityalu, Aadalu (Telugu); Halim (Urdu) **[2]**.

Properties and Ayurvedic Medicinal uses [2].

Rasa: Katu, Tikta

Guna: Laghu, Ruksa, Tiksna

Virya: Usna

Vipaka: Katu

Karma: Balapustivivardhana, Vataslesmahrt.

Botanical description

Parts used

Various parts of the plant namely; seeds, leaves and roots have been used in treating various human ailments **[3].**

Morphology

It is a small, evergreen, glabrous and semi-parasitic tree with slender branches, attaining a height up to 18 m with dark grey or nearly black or reddish and rough bark. Sapwood is unscented and white but heartwood is scented and yellowish-brown or dark-brown. Leaves are opposite, ovate or ovate-lanceolate, glabrous, 1.5-8.0 to 1.5-3.0 cm or larger and thin. The flowers are brownish purple, violet or straw-coloured unscented and are borne in terminal and axillary paniculate cymes. Drupes, the fruits are globose, 1.2 cm across, and purple black with hard ribbed endocarp. Seeds are small, oval-shaped, pointed and triangular at one end, smooth, about 2-3 mm long, 1-1.5 mm wide, reddish brown, a furrow present on both surfaces extending up to two thirds downward, a slight wing like extension present on both the edges of seed, when soaked in water seed coat swells and gets covered with a transparent, colorless mucilage, taste, mucilaginous **[2,3]**.

Microscopic

The powder of the seeds were creamish yellow in colour, microscopy of the seeds powder shows uniform thick walls, oily endosperm, number of reddish-brown fragments of seed coats and reddish coloring matter [2].

Traditional uses

Lepidium sativum have been widely used to treat a number of ailments in traditional system of medicine throughout India.

Cold infusions of seeds are used to relieve hiccough. The seeds are used in chronic enlargement of liver and spleen and also used as carminative adjunct to purgatives. The bruised seeds, mixed with lime juice are used as local application for the relief of inflammatory and rheumatic pains. The seed are bitter, themogenic, depurative, rubefacient, galactagogue, emmenagogue, tonic, aphrodisiac and diuretic. They are useful as poultices for spraines, and in leprosy, skin diseases, dysentery, diarrhea, splenomegal and asthma. **[4]**. The leaves are mild stimulant and diuretic, useful in scorbutic diseases and in liver complaints **[5]**. The roots are bitter, acrid and are useful in treatment of secondary syphilis and tenesmus and used as a condiment **[6]**.

An ayurvedic compound formulation in capsule form containing *Lepidium sativum* as one of the ingredients along with *Aegle marmelos* and *Plantago ovata* was tried on cases of 16 years old chronic constipation and irregular bowel movements with diarrhea from 1-6 months were found to be cured. The recovery was assessed with the disappearance of the symptoms like intermittent and incomplete evacuation, intermittent diarrhea etc. in most of the cases. The response was good in 90% cases and patient preference was very high [7].

Seeds boiled with milk are administered to cause abortion. A powder of seeds mixed with fine sugar is a nice remedy for indigestion, diarrhea and dysentery. A preparation made of seeds, butter and sugar is a common household remedy useful as a restorative in general debility. Another invigorating and nutritious tonic to relieve flatulence and to increase the secretion of milk among lying-in (recently delivered) women is prepared by boiling the seeds in milk so as to form a thin soft mass and adding to it sufficient sugar or jaggery to make it a confection; this is useful also in seminar debility, leucorrhoea, in cases of lumbago or any other pains about the loins through rheumatism **[8]**.

Chemical constituents

Seeds of the plant mainly contains Alkaloids such as lepidine, glucotropaeolin, N,N'-dibenzyl urea, N,N'-dibenzylthiourea, sinapic acid and its choline ester (sinapin); also contains carotene, cellulose, calcium, phosphorus, iron, thiamine, riboflavin, niacin, uric acid. Seed oil known to contain palmitic, stearic, oleic, linoleic, arachidic, behenic, lignoceric acids, benzyl isothiocyanate, benzyl cyanide, sterol and sitosterol. The leaf contains proteins, fat, carbohydrates, minerals – calcium and phosphorus, trace elements such as iron, nickel, cobalt and iodine, also contains various vitamins such as vitamin A, thiamine, riboflavin, niacin and ascorbic acid. The aerial parts of the plant contain stigmast-5-en-3β, 27-diol-27-benzoate as one of the key chemical constituent. The plant also contains glucotropoeolin, 4-methoxyglucobrassicin, sinapine, sinapic acid, calmodulin, sinapoyglucose, esters of caffeic, p-coumaric, ferulic, quinic acids, protein, minerals, vitamins, 5-4'-dihydroxy-7,8,3',5-tetramethoxyflavone, 5-3'-dihydroxy-7,8,4'-trimethoxyflavone, 5-3'-dihydroxy-6,7,4'-trimethoxyflavone **[7]**.

Phytochemistry

Isolation and fractionation of the glucosinolate contents of *Lepidium sativum* seeds reveled the isolation and identification of glucotropaeolin and 2-phenyl ethyl glucosinolate while the study of the glucosinolate contents of the fresh herb revealed the presence of 2-ethyl butyl glucosinolate, methyl glucosinolate, butyl glucosinolate and glucotropaeolin **[9]**.

Five new dimeric imidazole alkaloids lepidine B, C, D, E and F in addition to the known imidazole alkaloid lepidine and two new monomeric imidazole alkaloids semiledinoside A and B were isolated and structure elucidated on the basis of spectroscopic evidence **[10]**.

A new steryl ester isolated from the aerial parts of *Lepidium sativum* has been identified as Stigmast-5en-β27-diol-27-benzoate, on the basis of spectral data analyzed **[11]**.

A lectin has been isolated from the extracts of *Lepidium sativum* by affinity chromatography on human immunoglobulin-sepharose **[12]**.

Mucilage was isolated by precipitation with addition of 95% Ethanol and mucilage was evaluated for its physiochemical characteristics. Chemical tests shows the presence of carbohydrate and uronic acid which are general constituent of mucilage while absence of tannins, chloride and sulphate **[13]**.

Ethnopharmacology

Anti-inflammtory, antipyretic, analgesic and coagulant activities

The ethanolic extract of *Lipidum sativum* seeds has been studied for anti-inflammatory, antipyretic, analgesic and its coagulant activities. And also toxicity tests showed that the administration of the extract in single doses of 0.5 to 3 g/kg,p.o. did not produce any adverse effects or mortality in mice; In contrast, the animals received ethanolic extract in drinking water (100mg/kg) for 3 months showed no symptoms of toxicity except a statistically insignificant higher mortality rate. These findings suggest that the seeds of *Lepidium sativum* possess significant anti-inflammatory, ant-pyretic, analgesic and Coagulant activities **[14]**.

Chemo protective effects

Pretreatement of roots with Lepidium sativum juice (0.8ml) and its metabolized constituents such as glucotropaeolin (GT), benzylisothiocynate (70mg/kg) for three cosecutative days caused a significant reduction in quinoline induced DNA damage in colon and liver cells in range of 75-92% **[15]**.

Anti-diabetic property

The blood glucose levels were normalized in 2 weeks after daily repeated oral administration of aqueous *Lepidium sativum* extract (20mg/kg)($p<0.001$).Blood glucose levels were significantly reduced in normal rats after both acute ($p<0.01$) and chronic treatment ($p<0.001$).No changes were observed in basal plasma insulin concentrations after treatment either in normal or STZ diabetic rats indicating that the underlying mechanism of this pharmacological activity seems to be independent of insulin secretion **[16]**.

Antihypertensive and diuretic activity

The volume of urine was significantly increased in two doses of aqueous and methanol extracts compare to control group. Potassium and sodium excretion was increased when treated with aqueous extract at 100mg/kg, p.o. Potassium conserving effect was observed in methanolic extract **[17]**. The antihypertensive and diuretic effects were observed in both normotensive and spontaneously hypertensive rats. Another study by mohamed maghrani *et al*. revealed that, oral administration of aqueous extract of *Lepidium sativum* at 20mg/kg produced a significant increase of urinary excretion of sodium, potassium and chlorides in normotensive as well as spontaneously hypertensive rats **[18].**

Fracture healing property

Lepidium sativum seeds mixed with normal diet and feeded to the rabbits after the surgery where as no seeds were given to the control group. X rays of induced fractures were taken at a regular interval postoperatively to assess the healing of the fractures. *Lepidium sativium* seeds had a marked influence on fracture healing in rabbits **[19]**.

Hepatoprotective activity and Pesticidal activity

Acute toxicity studies of Pet. Ether and alcoholic extract of aerial parts of the plant showed the alcoholic extract is safer than that of Pet. Ether extract and both the extracts has a hepatoprotecttive activity in the liver at the concentration of 50µg/ml. The different extracts of the seeds and herbs of *Lepidium sativum* showed a potent effect against the white fly (Bemisa tabaci). The total glucosinolate and in particular glucotropaeolin showed significant activity against the pest, which gave a highest moratlity percentage on the adult stage **[9]**.

Antidiarrheal activity

A study carriedout by manohar co-workers **[20]** reported antidiarrheal effect of alcoholic and aqueous extract of *Lepidium sativum* seeds in three animal models (Castor oil induced diarrhea in rats, Prostaglandin induced enteropooling in rats and charcoal meal test in mice) of diarrhea; Furthermore, the aqueous extract was found to be more potent than alcoholic extract.

Anti-oxidant activity

Ethanolic extract of *Lipidum sativum* seeds showed a potential nephrocurative, nephroprotectivity and invivo antioxidant potential at 200mg/kg and 400mg/kg against Cisplatin(5mg/kg, i.p) induced nephrotoxicity. The enzyme estimation in Kidney tissue found that increased in malondialdehyde, superoxidedimutase, catalase and reduced glutathione level **[21]**.

Hypercholesterolemic activity

Protective effect of *Lepidium sativum* L. seeds powder and extract was studied for its hypercholesterolemic effect on rats **[22]**.

Prokinetic and laxative activities

The aqueous methanolic extract of *Lepidium sativum* L. seeds at 30 and 100mg/kg showed atropine sensitive prokinetic and laxative activities in mice which were partially sensitive to atropine. In isolated gut preparations of mouse and guinea pig at a dose of 0.1mg/ml caused concentration dependent stimulatory effects both in jejunum and ileum, which was blocked the presence of atropine **[23]**.

Nephroprotective activity

Clinical studies In the treatment of Bronchial asthma

Lepidium sativum seed powder was given at a dose of 1g thrice a day orally to 30 patients of either sex in the range of 15-80 years with mild to moderate bronchial asthma without any concurrent medication. The respiratory functions were assessed using a spirometer prior to and after 4 weeks of treatment with the drug showed statically significant improvement in various parameters of pulmonary functions in asthmatic attacks. Adverse effects were not observed in any patients **[24]**.

Conflicts of Interest: Authors declares no conflicts of interest.

References

1. Tiwari PN, Kulmi GS. Performance of Chandrasur (*Lepidium sativum*) under different levels of nitrogen and phosphorus. J Med Arom Plant Sci 2004; 26: 479-481.
2. Anonymous. Ayurvedic Pharmacopoeia of India, Part-1,1st ed, Volume-1. New Delhi civil lines, Delhi;, The drug controller of India, Government of India, Ministry of health and family welfare development of Indian system of medicine and homeopathy;2001. Page No.26.
3. Anil kumar D. *Ayurvedic Drug Plants*, 2006, Page no. 97. Publisher: Daya Books.
4. Kirtikar KR, Basu BD. Indian Medicinal Plants. Publisher: Popular Prakashan, Allahabad, 2006, pp 174.
5. The Wealth of India, Raw Material. CSIR publication, New Delhi, 1962, Vol.6.
6. Th Uphof JC. Dictionary of Economic Plants, 1st edition, 1959, Publisher: Verlag Von J Cramer, pp. 308.
7. Billore KV, Yelne MB, Dennis TJ, Chaudhari BG. Database on Medicinal Plants used in Ayurveda, Vol.7,

2005Publisher: Central Council for Research in Ayurveda and Siddha, New Delhi, page: 52.

8. Panda H. Herbs cultivation and medicinal uses, 2000, Pg: 325. Publisher: National Institute of Industrial Research.
9. Radwan HM, El-Missiry MM, Al-said WM, Ismail AS, Abdel Shafeek KA, Seif-El-Nasr MM. Investigation of the Glucosinolates of *Lepidium sativum* Growing in Egypt and their Biological activity. Res J Med Sci 2007*;* 2(2):127-132.
10. Ulrich HM, Heidrun G, Meinhart HZ. Seven Imidazole alkaloids from *Lepidium sativum.* Phytochem 1998; 49 (6): 1791-1795.
11. Hasseb Mughal HM, Ali M, Iqbal M, Srivastasa PS. A steryl ester from *Lepidium sativum.* Phytochem 1999 ; 50 (8) : 1721-1725.
12. Ziska P, Kindt A, Franz H. Isolation and characterization of a lectin from garden cress (*Lepidium sativum). Acta Histachemica* 1982 ; 71 (1) : 29-33.
13. Divekar Varsha B, Kalaskar Mohan.G, Chougule P, Redasani VK, Baheti DG. Isolation and characterization of Mucilage from *Lepidium sativum* seeds. *International Journal of Pharm. Research and Development-online 2010;* 2 (1); 1-5.
14. Al-yahya MA, Mossa JS, Ageel AM, Rafatullah S. Pharmacological and safety Evalution studies on Lepidium sativum L .seeds. Phytomed 1994 ;1 :155-159.
15. Fekadu K, Sylvie R, Mariauhl WH, Hong MQ, Christoph H, Rolf SH, Siegfried K. Chemoprotective effects of garden cress (*Lepidium sativum* L.) and colonic preneoplastic 2-amino-3-methyl-imidazole (4,5-f) quinoline (IQ)- induced genotoxic effects and colonic preneoplastic lesions. *Carcinogeneis 2002;* 23(7) :1155-1161.
16. Eddoaks M, Maghrani M, Zeggwagh NA, Michel JB. Study of the hypoglycemic activity of *Lepidium sativum L.* aqueous extract in normal and diabetic rats. J Ethnopharmacol 2005; 97: 391-395.
17. Umang P, Mukul K, Undale ,Ashok B. Evaluation of Diuretic activity of Aqueous and Methanolic Extracts of *Lepidium sativum* Garden Cress (Cruciferae) in Rats. Trop J Pharma Res 2009; 8(3): 215-219.
18. Mohamed M, Naoufel A, Jean BM, Mohamed E. Antihypertensive effects of *Lepidium sativum* L. in spontaneously hypertensive rats. J Ethanophamacol *2003;* 100: 193-197.
19. Abdullah H, Abdullah J. The Effects of *Lepidium sativum* Seeds on Fracture-Induced Healing in Rabbits. Med Gen Med 2007; 9(2): 23 -29.
20. Manohar D, Shylaja H, Viswanatha GL, Rajesh S. Antidiarrheal activity of methanolic extracts of Lepidium sativum in rodent. J Nat Remidies 2009; 9 (2): 197-201.
21. Yogesh chand Y, Srivastav DN, Seth AK, Vipin S, Balaraman R, Tejas KG. Invivo antioxidant potential of *Lepidium sativum* L. seeds in albino rats using cisplatin induced nephrotoxicity. Inter J Phytomed 2010; 2: 292-298.
22. Wafeka A, Al H. Protective Effect of *Lepidium sativum L.* Seeds Powder and Extract on Hypercholesterolemic Rats. J American Sci 2010; 6(11): 873-879.
23. Najeeb UR, Malik HM, Khalid MA, Anwarul HG. Prokinetic and laxative activities of *Lepidium sativum* seed extract with species and tissue selective gut stimulatory actions. J Ethanopharmacol 2011; 134: 878-883.

24. Archana NP, Anita AM. A Study on Clinical Efficacy of *Lepidium sativum* Seeds in Treatment of Bronchial Asthma. Iran J Pharmacol Ther 2006; 5(1): 55-59.

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