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AN OVERVIEW ON PHYTOCONSTITUENTS AND UTILIZATION OF LEPIDIUM SATIVUM LINN (GARDEN CRESS)

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ABSTRACT

Garden Cress, sometimes referred to as garden cress to distinguish it from similar plants also referred to as cress from old Germanic cresso which means sharp, spicy, is rather fast growing, edible herb. Garden cress is known for its pungent odor due to the several volatile oils and used to treat various condition; respiratory disorders, muscle pain, inflammation, bone fractures in the past. Leaves, seeds, Arial parts extracts found to have alkaloids, flavonoids, glycosides, polyketides, vitamins, minerals, proteins, fats, carbohydrates which give the plant it's hepatoprotective, antihypertensive, diuretics, fracture healing, respiratory disorder healing, antimicrobial, milk production, anti-inflammation, antioxidant, laxative, chemoprotective and many other therapeutic applications. It is very famous in folk medicine. Synonyms 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. The current review discussed the phytoconstituents and utilization of Lepidium sativum.

KEYWORDS: Lepidium sativum, Phytoconstituents, utilization activities, medicinal properties.

INTRODUCTION

Herbal medicines are in nice demand within the developed additionally as developing countries for primary aid due to their wide biological and medicinal activities, higher safety margins, and lesser prices. 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. Lepidium sativum main character is that it can grow in any type of climate and soil condition and its ability to tolerate slight acidity; it can be grown like white mustard. It's an annual plant of a height of 50 cm that can grow easily using less irrigation, equipment's facilities, and in comparatively weak soil without having special technical knowledge. Its growth increases rapidly without extensive addition of fertilizers, so weed cannot develop. The pods of L. sativum are obovate, rotundate, elliptic, irregular at apex emarginated, and winged. It can be developed at all the elevations, throughout the year; however, the most effective herb is obtained within the winter season. The leaves of the plant utilized in salads, cooked with other vegetables and used to decorate food. Leaves have diuretic and stimulant action . Halon seeds are brownish red in color and oval in shape.

Taxonomy

Botanical name: *Lepidium sativum* Linn

Kingdom: Plantae,

Subkingdom: Viridiplantae,

Infrakingdom: Streptophyta,

Superdivision: Embryophyta,

Division: Tracheophyta,

Class: Magnoliopsida,

Order: Brassicales,

Family: Brassicaceae,

Genus: Lepidium,

Species: *Lepidium sativum*

Local names

Common name	The *Lepidium sativum* plant and fruit is known as
Assamese	Candriki
Bengali	Halim
English	Common Cress
Gujrati	Aseliyo
Hindi	Chansur
Kashmiri	Alian
Kannada	Allibija

Malayalam	Asali
Marathi	Haliv
Oriya	Chandasura
Punjab	Holan
Sanskrit	Chand Shura
Tamil	Allivirai
Telugu	Aadalu
Urdu	Halim (Doke 2014).

Plant description

Lepidium sativum Linn. (Brassicaceae) 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, colourless mucilage, taste, mucilaginous.

Geographical distribution

Garden Cress plant is native to Egypt and South west Asia. It is cultivated in India, North America and parts of Europe. The plant is cultivated as culinary vegetable all over Asia.

Traditional uses

The seeds of Lepidium sativum were used as an aperient, diuretic, tonic, demulcent, carminative, galatogogue, emmenagogue, to cure throat diseases, uterine tumour, nasal polyps and breast cancer. Seeds were supplemented in the diet of lactating women to increase the milk secretion during the postnatal period. Seeds also applied as a poultice to pains, hurts, sprains, in the treatment of bacterial and fungal infections.[13-16] The seeds were also used for the treatment of fracture healing in Saudi traditional medicine.[17] In Unani system of medicine, seeds and leaves were used as diuretics, aperient and aphrodisiac, and were recommended in inflammation, bronchitis, rheumatism and muscular pain.[18] In Turkish folk

medicine, Lepidium sativum was used as to enhance digestion, as carminative and appetizer.[19] The plant was eaten and seed oil was used in treating dysentery, diarrhea and migraine.[20]

Folk medicine

Various parts of the *Lepidium sativum* plant have medical value. All the parts of the *Lepidium sativum* plant find use in the treatment of dysentery, 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. The leaves are mild stimulant and diuretic, useful in scorbutic diseases and in liver complaints. The roots are bitter, acrid and are useful in treatment of secondary syphilis and tenesmus and used as a condiment. The recovery was assessed with the disappearance of the symptoms like intermittent and incomplete evacuation, intermittent diarrhoea etc. in most of the cases.

Properties and Ayurvedic medicinal uses

Rasa: Katu, Tikta

Guna: Laghu, Ruksa, Tiksna

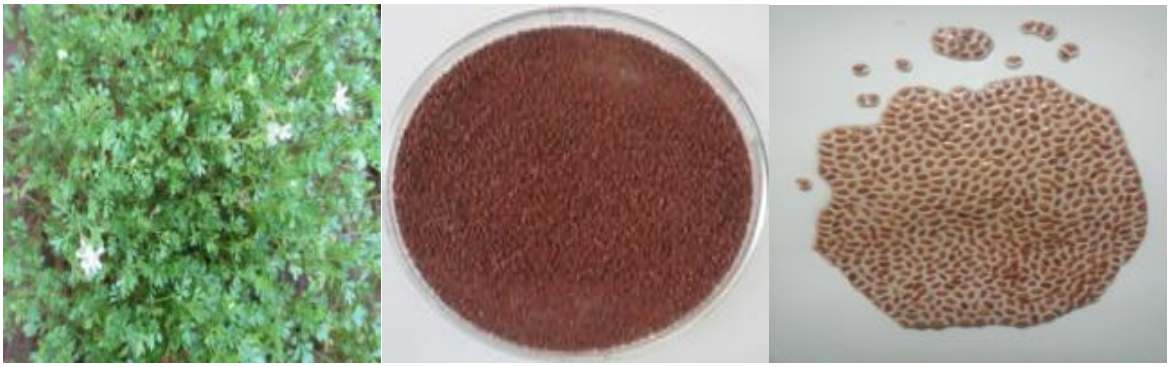
Virya: Usna

Vipaka: Katu

Karma: Balapustivivardhana, Vataslesmahrt.

Useful parts of plant

Sr. No.	Plant Parts	Uses	Method of preparation
1	Whole herb	Asthma,Cough, Expectorant, Bleeding piles	The plant was crushed and made infusion with the water and taken twice a day. (For Asthma), whole herbs paste to be taken every 4 h for cough and as expectorant.
2	Leaves	Diuretic	The leaves are boiled with water and decoction to be taken three times a day.
3	Root	Syphilis	Root powder is to be taken with luke cow's milk.
4	Seeds	Abortion	Seeds boiled with milk and taken within 45 days of conception.



***(a) Lepidium sativum* plant, (b) *Lepidium sativum* seeds, (c) *Lepidium sativum* swollen seeds**

Dosage

Seed powder 1-3 gm.

Phytoconstituents of lipidium sativum

The preliminary phytochemical analysis of Lepidium sativum showed that it contained cardiac glycoside, alkaloids, phenolic, flavonoids, cardiotonic glycosides, coumarins, glucosinolates, carbohydrates, proteins and amino-acids, mucilage, resins, saponins, sterols, tannins, volatile oils, triterpene, sinapic acid and uric acid. The complete plant contains Glucotropaeolin, 4-methoxyglucobrassicin, esters of caffeic, β-sitosterol, benzylcyanide, calmodulin, sinapoyglucose, p-coumaric, ferulic, quinic acids, protein, mineral, vitamin, 5-4'-dihydroxy7,8,3',5-tetramethoxyflavone, 5-3'-dihydroxy-7,8,4' tetramethoxyflavone, and 5-3'-dihydroxy-6,7,4'-tetramethoxyflavone. Preliminary phytochemical screening showed the presence of carbohydrates, phenolic compounds, flavonoids, alkaloids, proteins, saponins and lipids in the drug extract. The chemical study has shown that seeds and leaves have Vitamin A, thiamine, riboflavin, niacin and ascorbic acid, and secondary metabolites as sinapic acid and its choline ester (sinapine) and flavonoids. Leaves also contain sinapoylglucose, esters of caffeic, pcoumaric, ferulic, quinic acids, and the esters of flavonoids.

Leaf

Leaf contains protein, fat, carbohydrates, mineral, phosphorus (P), calcium (Ca), trace elements- iron, nickel, cobal, iodine, Vitamin A, thiamine, riboflavin, niacin, and ascorbic acid. N-Butanol fraction of aqueous-methanolic extract of leaves afforded three flavonol glycosides, quercetin-3-O-β-glucosyl (1 → 2) – glucopyranoside- 7-0- glucopyranoside, kaempferol-3–O– β- glucosyl (1 → 2)- glucopyranoside – 7 – O – β – glucopyransoide, and isorhamnetin – 3 – O – sophoroside -7 – O – β – D – glucopyransoide.

Seeds

Chemical constituents in seeds of the plant mainly contains alkaloids such as lepidine, glucotropaeolin (GT), N, N'-dibenzyl urea, N, N'-dibenzylthiourea, sinapic acid and its choline ester (sinapine); the bioactive flavonoids such as 5-4-dihydroxy-7, 8, 3, 5 tetramethoxyflavone, and 5-3-dihydroxy-6, 7, 4' trimethoxyflavone have been isolated. Seed contains 20–25% yellowish semi drying oil and the major fatty acid in it is alpha-linolenic acid (32–34.0%). It has a balanced amount of polyunsaturated fatty acids (46.8%) and monounsaturated fatty acids (37.6%) and also contains ordinary antioxidants, namely tocopherols and carotenoids which defend the oil from rancidity. It also contains palmetic, stearic, oleic, linolenic, arachidic, behenic, lignoceric acids, benzyl isothiocyanate, benzyl cyanide, sterol, and sitosterol. The seeds of L. sativum showed significant antibacterial activity against a number of pathogenic bacteria responsible for severe infections; this might be due to the presence of benzyl isothiocyanate. Infections caused by these bacteria, especially those with multidrug resistance, are among the most difficult ones to treat with conventional antibiotics. Glucosinolates are the major secondary metabolites of L. sativum, and the extracts have chemopreventive effects in inhibiting carcinogenesis. The seeds contain edible oil which is rich in alpha-linolenic acid with an ideal ratio of omega-3 and 6-fatty acids as well as imidazole alkaloids. Other chemical constituents like lepidine, lepidine B, C, D, E and F, semilepidinoside A and B are also present in seeds. The scavenging activity might be due to the presence of total polyphenolic compounds. These polyphenolic compounds include flavonoids, anthraquinones, anthocyanins, xanthones, and tannins. Seeds have protein about 25%, lipids about 14–24%, 33–54% of carbohydrates, and 8% of crude fiber. The carbohydrates consist of 90.0% non-starch polysaccharides and 10% of starch. The seed bran has high nutritional fiber content and also it has high water holding ability. The GC-MS spectrum of Lepidium sativum seed oil from Saudi Arabia revealed the presence of 16 components. The constituents included: β-amyrine (31.33%), 9,12,15-octadecatrienoic acid (15.97%), 9- octadecenoic acid methyl ester (11.93%), α-amyrine (9.32%), 11- eicosenoic acid (6.64%), 9,12-octadecadienoic acid methyl ester (6.03%), hexadecanoic acid (5.24%), 13-docosenoic acid (2.64%), Urs-12-en-24-oic acid,3-oxo-, methyl ester (2.52%); 9-octadecenamide (2.32%), eicosenoic acid (1.93%), methyl stearate (1.75%), phenol, 2,2-methylenebis[6-(1,1-dimethyl (0.96%), docosanoic acid, methyl ester (0.69%), butylated hydroxytoluene (0.42%) and 1s,R,7R,11R-1,3, 4, 7-tetramethyltricylo (0.31%).

Lepidium sativum seed oil extracted by soxhlet and maceration was evaluate against Escherichia coli, Klebsiella pneumonia, Acinetobacter baumannii, Pseudomonas aureginosa, Staphylococcus aureus, Bacillus subtilis, Candida albicans and Aspergillus flavus. Lepidium sativum seed oil extracted by maceration was partially active against Escherichia coli at concentrations of 10 and 50 µg/ml, while the oil extracted by soxhlet showed no activity at these concentrations. At 50µg/ml both samples were partially active against Klebsiella pneumonia. The soxhlet sample also exhibited partial activity against Bacillus subtilis at a concentration of 10 and 50µg/ml, while the macerated sample was inactive at these concentrations. Both samples were inactive against Staphylococcus aureus.

Utilization of lipidium sativum

1. Antibacterial activity

L. sativum extracts are effective against various bacteria used in this study. According to the results of this study show that the methanol extract revealed prominent antibacterial activity on Staphylococcus aureus (22 mm), Bacillus cereus (16 mm), Escherichia coli (14 mm), Pseudomonas aeruginosa (14 mm), Micrococcus luteus (16 mm), and Salmonella typhi (13 mm), respectively, in terms of zone of inhibition, while the ethyl acetate extract exhibited moderate effect and the other two extracts showed weak inhibition on the growth of the organisms.

2. Antifungal activity

The antifungal potential of the methanolic extract of L. sativum seeds against the tested fungi at different concentrations. It is revealed that the methanolic extract at a concentration of 30mg/ml completely inhibited the growth of Aspergillus flavus. Toward the end of the incubation period, Rhizopus sp. showed slow and weak growth on 30 mg/ml and 60 mg/ml slant and was completely inhibited at 90 mg/ml. At a concentration of 90 mg/ml, the fungi Aspergillus fumigatus, Candida albicans, Fusarium sp., Microsporum sp., Penicillium sp., and Penicillium marneffi were completely inhibited.

3. 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.

4. 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.

5. 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.

6. Diuretic activity

A dose-dependent increased in urine excretion showed by L. sativum. With the aqueous extract, the maximum increase in urinary excretion was produced at 100 mg/kg with a value of 49.89% compared while the methanol extract (100 mg/kg) showed an increase of 41.05% grouping urine volume. The specific conductivity was increased in a dose-dependent manner in all the extract-treated groups which are an indirect measure of the ionic content of the urine. Thus, the diuretic effect of aqueous and methanol extract is indicated by an increase in both water excretion and excretion of sodium and potassium. The active principles responsible for the diuretic effects of the extracts of this plant have not yet been confirmed, but the preliminary phytochemical study of the extracts revealed the presence of polar compounds such as flavonoids and steroids.

7. Fracture healing property

The effect of L. sativum used for fracture healing in Saudi folk medicine was studied on collagen deposition and tensile strength in experimental models. L. sativum significantly increased collagen deposition at fracture position. The tensile strength of the broken tibiae also increased in the L. sativum treated group.

8. Anti-inflammatory and antiarthritic activity

For this study, the protein denaturation bioassay was selected for in vitro assessment of the anti-inflammatory property of the methanol extract of L. sativum seeds. Denaturation of tissue proteins is one of the well-documented causes of inflammatory and arthritis diseases. Production of autoantigens in certain arthritic disease conditions may be due to denaturation

of tissue proteins in vivo. L. sativum act as anti inflammatory agent that can prevent protein denaturation. Therefore, it would be worthwhile for anti-inflammatory drug development.

CONCLUSION

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. 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. These studies will be helpful to create focus toward L. sativum and may be useful in developing new formulations with more therapeutic and to provide a direction for advance research.

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