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A Review on LepidiumSativum: An Endangered Species

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ABSTRACT

The focus of this review is to provide information on LepidiumSativum plant which is used since ancient time for various remedies, but much work is needed to prove its pharmacological evidences. Plants from this genus known to contain various active principals of therapeutic value and possesses biological activity against number of diseases.LepidiumSativum known as Garden cress belongs to Brassicaceae family, has been known centuries ago in eastern regions then spread worldwide. It is very famous in folk medicine. 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.

Keywords: Lepidiumsativum, phytochemicals, antimicrobial activities, medicinal properties.

INTRODUCTION

Lepidiumsativum famous as garden cress belongs to the family bassicaceae. Some scientists say its origin started from Ethiopia and then distributed to various parts of the world. Others say that it started from southwest Asia and then spread to Western Europe.Lepidiumsativum was famous in roman and Greek time in their banquets. It is known as garden peppercress, peppergrass, pepperwort, El rashad and town cress due to its Townes or enclosure. Lepidiumsativum main character is that it can grow in any type of climate and soilcondition and its ability to tolerate slightacidity; 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. [1,2]

Green cress seeds are used in South Asia as traditional medicine to treat bronchitis, asthma and cough. It is considered aborfacient, diuretic, expectorant, aphrodisiac, antibacterial, gastrointestinal stimulant, gastro protective, laxativeand stomadic. [3, 4].Gc seed is reported to exhibit antirheumatic andbronchodilatory potential.[5, 6]

The paste of GC seeds is applied in rheumatic joints to relieve the pain and swelling. It is also useful in hiccup, dysentery, diarrhea and skin disease caused by impurities of blood. Ethanolic extracts of Gc seed were effective intreating inflammatory bowel disease. [7, 8]

Fig 1 :Seed of LepidiumSativum

Cultivation

Lepidiumsativumcan be grown indoor or outdoor. When preparing soil, seeds should be dug and mixed with a well-balanced fertilizer, then the seed should be sowed 5-6 cm deep and 45- 60 cm apart to have a continuous crop. Leaves shouldn't stay wet for long time since the soil lodges there when water splashes on them and then it's impossibleto washout damaging the leaf. As said before its requirements are simple and broad that it tolerates changes, it can grow in moist soil and semi shade or even without shade at all. However, in summer it's preferred to be covered with some shade to prevent heat from running straight to seed. Also, irrigation is required since they're lightly rooted seeding which can dry up in few days. It's true that the crop can be collected all over the year, but the best crop is obtained in the winter season. So, seeds are sown in the plains from September to February on the hills. After 4-6 days of sowing the seed begins to sprout. In 2-3 weeks after sowing plants are ready for cutting. By that time its color is about yellow. In order to get a continuous supply of leaves farmers sow cress seeds in series at intervals of 8 days. [9]

The taxonomic classification [10]

Kingdom: Planate
Division:Magnoliophyta
Class:Magnoliopsida
Order: Brassicales

Family:Brassicaceae
Genus: Lepidiumsativum

Vernacular names of Garden Cress Plant in India:

Aadalu: Telugu**Candriki:** Assamese
Chand Shura : Sanskrit **Chandasura:** Oriya
Chansur: Hindi **Common Cress:** English
Halim: Urdu**Halim:** Bengali
Holan: Punjabi**Haliv:** Marathi
Alian: Kashmiri **Aseliyo:** Gujrati

Daily use:
Garden cress leaves are consumed raw in salads, also cooked with vegetable curriesand used as garnish. Cautions should be taken with storing raw collected cress, with any sign of slime, witting or discoloration it should be avoided. Until they're needed for use, the leaves should be left on stem. [1]

Chemical Composition and Utilization:

Garden cress is found to contain significant amounts of iron, calcuium and folic acid inaddition to vitamin A and C. It contains higher amount of protein 25% glutamic acid 19.3%, Leucine (8.21+-0.01%), Methionin (0.97+-0.02%). The major fatty acid is linolenic acid 30.2% with low amount of erucic acid 3.9% is also present . The major secondary compounds of this plant are glucosinolates. It yields on steam distillation 0.115% of a colorless volatile oil (cress oil) with a characteristic pungent odor. Cress oil contains variable properties of Benzylisoticocyante and Benzyl cyanide, with a peculiar disagreeable odor that is used in soap making. Also it is found to contain glucotropoeoline,4-methoxyglucobrassicin, sinapine, sinapic acid, calmodulin, sinapoyglucose, ester of caffeic, pcoumaric, ferulic, quinic acids, protein, minerals, and vitamins.

Garden cress leaves have the following composition:

Protein 5.8%, Fats 1.0%, Carbohydrate 87% Mineral matter 2.2%,Calcium 0.36%, Phosphorous 0.11 %, Trace Elements Iron 20.6mg/ 100 gm, Nickel 40ug/Kg, Cobalt 12ug/ Kg and Iodine 1.6 ug/Kg. Vitamin A, thiamine, riboflavin, niacin and ascorbic acid have also estimated. The plant seeds contains mainly Alkaloids.

Uses of LepidiumSativum[9]

S.NO	PLANT PART	USE	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 hours for cough and asexpectorant
2	Leaves	Diuretic	The leaves are boiled With water and decoction to be taken three times a day
3	Roots	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.

Table 1: Uses of LepidiumSativum

Medicinal propertities of LepidiumSativum:

Antidiabetic and hypocholesterolemic Activity of Gc seeds

The aqueous Gc seed extract caused a potent inhibition of renal glucose reabsorption which in turn reduced blood sugar which explained that the renal effect is at least one mechanism explaining the observed hypoglycemic activity of Gc seed extract in normal and diabetic rats [11].

The hypoglycemic activity of total alkaloids from Gc seed on alloxan induced diabetic rats. Diabetic rats were fed with total alkaloid (50,150 and 250 mg/kg of body weight) for continuous 21 days. At the dose level of 250mg/kg, there was significant ($p< 0.001$) reduction in the blood glucose, cholesterol, triglyceride, and urea level in diabetic rats. Authors reported that total alkaloid from Gc seed at the dose level of 250mg/kg body weight showed potent hypoglycemic activity [12].

The effect of Gc seed aqueous extract on lipid profiles and blood glucose levels of hypercholesterolemic and alloxan induced diabetic albino rats. Gc seed extract (20mg/kg) was orally administered for four weeks to hypercholesterolemic and diabetic rats and they reported better lipid profile and reduction in blood glucose level in both the cases [13].

Antidiarrheal, antispasmodic, prokinetic and laxative activity of Gc seeds:

Theantidiarreal activity of methanolic extract of Gc Seeds. The antidiarrheal activity was studied using three experimentally induced diarrhea models i.e. Castor oil induced diarrhea;Prostaglandin E2 (PG-E2) induced enteropooling in rats and charcoal meal test in mice. The methanolic extracts of Gc seeds showed significant reduction in the weight of faeces in dose dependent manner in castor oil induced diarrhea. In PG-E2 induced diarrhea significant inhibition of PG-E2 induced intestinal secretions was observed.There was decrease in propulsion of charcoal meal in charcoal meal test, indicating its antimotility activity. Authors concluded that methanolic extract of Gc seeds possess significant antidiarrheal activity due to their inhibitory effectboth on gastrointestinal propulsion and fluid secretion. [14]

The laxative property carried out charcoal meal *gastrointestinal* tract transit test and laxative activity test in BALB/c mice and also carried out *in vitro* experiments in isolated tissues of mouse, guinea-pig and rabbit to evaluate the prokinetic and laxative activities of aqueous-methanolic extract of Gc seed. Authors reported prokineticand laxative effects of Gc seed in mice, which are partially mediated through a cholinergic pathway. The *in vitro*spasmodic effect of the Gc seed extract is also mediated through a similar mechanism with species and tissueselectivity. [15]

Fracture Healing Ability of Gc seeds

The fracture healing ability of Gc seeds in adult New Zealand White rabbits. The midshaft of the left femur were exposed in the surgery and subperiosteal transverse fractures were induced. The test animals had 6 g of *Gc*seeds in their food daily. After 6 and 12 weeks postoperatively left femurs of rabbits (control and test) were X-rayed. Results showed that the callus formations in the test rabbits fed with Gc seeds with the induced fractures, there was significant increase in the healing of fractures compared to the control group. This indicates that Gc seeds played a major

role in promoting and accelerating callus formation in fractures. They concluded that Gc seeds have a marked effect on fracture healing in rabbits. [16]

The fracture healing ability of ethanolic extract of Gc seeds in internally fixed rats using femoral osteotomy model. Test group was administered (400mg/kg body weight) Gc seed ethanolic extract for 8 weeks. At 2nd, 4th and 8th weeks X- Ray photographs were taken for control and test groups. After fourth week, X-ray photographs of test groups showed significantly larger callus formation and more disposing of osseous material as compared to control group. After eight weeks, X-Ray photographs indicated that the fractured bone of test group animals was completely joined whereas fractured bone was not joined in control group. The study revealed that the ethanolic extract of Gc seeds has significant fracture healing ability [17].

Antihypertensive, hepatoprotective, diuretic, nephrocurative and nephroprtective Activity:

The antihypertensive and diuretic effects of the aqueous extract of Gc seed were studied both in normotensive and spontaneously hypertensive rats were studied by the oral administration of aqueous Gc seed extract for 3 weeks exhibited antihypertensive and diuretic activities [18].

The diuretic effect of aqueous and methanolic extracts of the Gc seeds in adult male Wistar rats Extracts were administered orally to experimental rats at doses of 50 and 100mg/kg body weight. Both the extracts of Gc seeds showed a dose-dependent increase in urine excretion. The excretion of sodium was increased by both the extracts and potassium excretion was increased only by the aqueous extract at a dose of 100 mg/kg. The methanolic extract had the additional advantage of a potassium-conserving effect. Aqueous and methanolic extracts of Gc seeds showed notable diuretic effect which is comparable to that produced by the reference diuretic hydrochlorothiazide [19].

Anti cancer activity of Gc seeds:

The cytotoxic effect of Gc seed aqueous extract on human breast cancer cells using human breast cancer cell line MCF-7 (Michigan Cancer Foundation–7), an epithelial invasive breast ducal carcinoma cell line, which is estrogen and progesterone receptor positive by trypan blue dye exclusion and sulforhodamine B assays compared to its effect on normal human skin fibroblasts (HSF). The results revealed that Gc seed extract had a significant cytotoxic effect on MCF-7 cells. It caused significant time and dose dependant decrease in cancer cell viability. The effect of Gc extract on cancers is generally attributed to the constituent isothiocyanates, specifically benzyl isothiocyanate, presence of which in Gc seed extract was also confirmed by authors using HPLC. The study provides strong evidence that Gc seedaquoues extract has ability to inhibit the growth of breast cancer cells [20].

The potential of aqueous extract of Gc seeds to induce apoptosis and necrosis in human breast cancer cells. The potential of Gc seed extract to induce apoptosis and necrosis in the human breast cancer cell line MCF-7, compared to HFS, was determined. Apoptosis was induced incells, more in MCF-7, when they were treated with 25% and 50% extract, while necrosis was observed mainly afterexposure to elevated extract concentrations (75%). DNA fragmentation resulted for both cells, in a time and dosedependentmanner. Authors reported that Gc seed extract was equally, and in some experiments more, effective against MCF-7 cells compared to HFS cells and the highest (75%) dose of extract was cytotoxic for both MCF-7 and HFS cells in most assays [21].

Bronchoprotective Activity:

The efficacy and safety of Gc seeds in patients (15-80 years old) having mild to moderate bronchial asthma. Patients were given finely powdered dried seeds at a dose of 1g thrice a day with water for 4 weeks. The bronchial asthma patients showed statistically significant improvement in various parameters of pulmonary functions after 4 weeks of Gc seed powder administration. Also, significant improvement was observed in clinical symptoms and severity of asthmatic attacks. None of the patient showed any adverse effect with Gc seeds. The results suggest the usefulness of Gc seeds in patients with bronchial asthma [22].

The bronchodilator activities of Gc seed crude extract which indicates its medicinal use in the hyperactive airways disorders, such as cough and asthma [23].

Galactagogue Potential:

Galactagogue properties of Gc seeds were studied in adult female virgin Norway rats. Each experimental rat was administered 1.6 mg seeds powder /gm body weight /day for fourteen days. Different parameters (gross assessment, histological examination, enzymatic histochemical study, and hormonal assay of follicle-stimulating hormone, luteinizing hormone, prolactin, estrogen and progesterone) were assessed to study the effect of Gc seeds on the mammary gland of young adult virgin rats. Authors concluded that Gc seeds are most probably a real galactagogue and might be useful in induction of lactation
[24].

Anti- inflammatory, antipyretic and analgesic activities:

The anti-inflammatory, antipyretic and analgesic activities of an ethanolic extract of Gc seeds in rats. The extract significantly inhibited carrageenan-induced pedal oedema in rats. However, only a weak inhibition of cotton pellet-induced granuloma was observed in rats fed with extract. Gc seed extract administration significantly prolonged the hot plate reaction time revealing its analgesic activity. The coagulation studies showed that the extract produced a significant increase in fibrinogen level and insignificant decrease in prothrombin time [25].

Health benefits of Gc seed oil:

In-vivo and in-vitromodulation of platelet aggregation and eicosanoids by eugenol and a-linolenic acid rich Gc seed oil in adult Wistar rats. Eugenol and Gc seed oil showed synergistic effect against platelet aggregation and thromboxane B2 levels in spleen and lung tissues of Wistar rats. [26]

Vegetable oil blends with ALA rich Gc seed oil and assessed their modulatory effect on lipid metabolism. Sunflower oil, rice bran oil, sesame oil were blended with Gc seed oil at different ratios to obtain n-6/n-3 polyunsaturated fatty acids (PUFA) ratio of 2.3-2.6. Native and Gc seed oil blended oils were fed to Wistar rats at 10% level in the diet for 60 days. Blending of vegetable oils with Gc seed oil increases ALA, decreases n-6 / n-3 PUFA ratio and beneficially modulates lipid profile in rats. [27]

Food and Food Ingredients from Gc seeds:

The dietary fiber formulation using Gc seed coat fraction. The powdered seed coat (5 kg) was blended with fresh carrot pulp (500 g), lime extract (100 g) and lecithin (100 g) and the blend was dispersed in potable water (100ml), boiled for 5 min and homogenized in a colloidal mill and the slurry was spray dried. The formulation was a free flowing smooth powder with yellowness index of 37.2. Its water holding capacity, viscosity and dietary fiber content were 23.6 ml/g, 5100mPas and 74.3% respectively. [28]

Microencapsulation of Gc seed oil using different wall materials such as sodium caseinate whey protein concentrate, blend of maltodextrin, gum arabica and skimmed milk powder was carried out using spray-drying

method. The microencapsulatedGc seed oil powder can be supplemented in food products to enhance plant based *n*-3 fatty acid [29].

Side –effects of Lepidiumsativum:

It is a substance that induces abortion, if had in excess. It containgoitrogens that prevent iodine absorption in the thyroids and hence can lead to hypothyroidism. If large quantities of garden cress are consumed, the mustard oil it contain may cause digestive difficulties in some people who are so sensitive to it. Pregnant women should avoid taking garden cress in any from because it has ability to induce uterine contractions and thereby trigger a spontaneous abortion. Also not suitable for patient suffering from hypothyroidism. [30]

Conclusion:

Lepidiumsativum, which is known as garden cress in English, belongs tobrassicaceae family. It is a native plant in south west Asia and spread to Europe
centurys ago. Lepidiumsativumwas very well known in ancient India and Saudi
Arabia and was used for treating varies condition such as bone fracture healing,
inflammation, arthritis and many others. It contains different chemicals including fatty acids, proteins,shikmicacids, vitamins,carbohydrates, calcium, phosphorus, trace elements, etc. Garden cress is used as food and a medicine source, and it is effective against varies diseases, such as hypertension, arthritis, hepatotoxicity, inflammation, diabetes, cancer, bronchitis, etc. based on all these studies, Lepidiumsativumhas proved its value and it worth further studies on its nutritional and medicinal uses.

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