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REVIEW ARTICLE

Chemical composition & medicinal importance of *Bunium persicum* (Boiss.)B.fedtsch. – A review

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Abstract

Bunium persicum also known as 'Black Cumin' is one of the economically and medicinally important plant species. The economic production of B.persicum is through seeds (schizocarp fruits) that are used as medicine and spices. Black cumin essential oil is used in pharmaceutical, food sweetening, soft drink, food and hygiene industries. Ripe black cumin fruits contain an essential oil rich in monoterpene aldehydes with the main components as cuminaldehyde, p-mentha-1,3-dien-7-al and p-mentha-1,4-dien-7-al; terpene hydrocarbons are the main components of fruits collected in the wild or harvested unripe (γ-terpinene, p-cymene, β-pinene, limonene).

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INTRODUCTION

Medicinal plants are the exclusive source of drugs for majority of the World's population. Bioactive compounds extracted from these plants are used as food additives, pigments, dyes, insecticides, cosmetics, perfumes and fine chemicals (Balandrin and Klocke, 1998). These compounds belong to a group collectively known as secondary metabolites which represent an important source of pharmaceuticals (Ramachandra Rao and Ravishankar, 2002).

Bunium persicum is a native of west Asia and has a limited distribution. It belongs to the family Apiaceae. The family consists of about 423 genera (Koul et al., 1979). The genus Bunium contains about 166 species, including *B. persicum*, *B. carum*, *B. bulbocastenum*, *B. copticum*, *B. flexuosum*, *B.elegans*, *B. cylendricum* and *B. chaerophyllocides* that are prevalent in Central Asia, Caucasus, Crimea, and Europe (Vasilava et al., 1985). In Kashmir it has been reported from Baramulla, Gurez, Harwan Dara, WasturwanTral,Chrarisharief, Khrew (Sofi et al.,2009).

The most distinctive feature of the Apiaceae is its inflorescence "umbel". The other distinctive feature is its fruit, shizocarp consisting of two mericarps The fruit is slender, dark brown in colour, and crescent shape. The stem is often hollow in the internodal region with secretory canals containing ethereal oils and resins (Judd et al., 2002). The plant type of 'Black Cumin' varies from dwarf (30 cm) to tall (80 cm) compact or spreading, moderately to highly branched, tuberous and perennial herb (Panwar, 2000). The leaves are freely, pinnate (2-3), finely dissected and filiform. The flowers are small, white in color with readily symmetrical small sepals, petals and stamens (each five in number), and are present in compact umbels. The bracts are linear, sometimes divided, and bracteoles are absent with asymmetrical rays. The gynoecium is bicarpelate with inferior ovary with two styles fused at the base.

P-mentha-1,4-dien-7-al (28.98%), gamma-terpinene (25.72%), beta-pinene (15.62%) and cuminaldehyde (11.71%) have been identified as the major bioactive constituents of B.persicum by Thapa et al.,(1991). The ripe fruits are used as carminative, lactagogue, diuretic, expectorant, antispasmodic, and a valuable spice for flavouring foods (Chauhan, 1999; Kala, 2003). In addition, the essential oil is reported to exhibit significant antioxidative (Shahsavari et al.,2008), antibacterial (Moghtader et.al.,2009; Talei and Mosavi, 2009) and antifungal activities (Sekine et al., 2007).

Chemical composition and economic importance of B.persicum has been reported by various workers. Some of the recent studies are:
Shahsavari et al., (2008) studied chemical constituents of the essential oils of the seed from *B.persicum* by Gas chromatography/Mass spectroscopy (GC/MS) technique. The major components were reported to be caryophyllene (27.81%), ϒ-terpene (15.19%), cuminyl acetate (14.67%). In addition, the antioxidant activity of the essential oil was evaluated in crude soyabean oil by monitoring peroxide and thiobarbituric acid values of the oil substrate. The results showed that the essential oil was able to reduce the oxidation rate of the soyabean oil in the accelerated condition at 6^{o}C(oven test).

Kayser et al., (2009) analysed fruit oils of *B.persicum* from wild type (WT), first (CY1), second year (CY2) cultivars (fourth and fifth year plants) by GC and GC/MS technique. The essential oil content of the WT (9.1% v/w) was higher than the oil content of the CY1 (6.2% v/w) and CY2 (5.1% v/w). The main constituents were reported to be ϒ-terpene (WT:44.2%, CY1:40.8%, CY2:36.8%), associated with cuminaldehyde (WT:16.9, CY1:14.1 and CY2:11.8%) and ϒ-terpene-7-al (WT:16.9, CY1:10.6, CY2:18.7%).

Omidbaigi and Arvin, (2009) studied the influence of climatic conditions on the essential oil content and compositions of *B. persicum*. The essential oils of dried fruits were extracted by hydrodistillation technique and were analysed by capillary GC and GC-MS, the results showed that the essential oil content and compositions of B.persicum fruits were significantly affected by growing locations.

Mortazavi et al., (2010) made a comparative study of superheated water extraction (SWE) with two conventional volatile isolation methods including hydrodistillation and soxhlet extraction that was performed on the plant. They investigated the influence of operating conditions such as temperatures from 100 to 150^{o}C, mean particle size from 0.5 to 1.0 mm and flow rates from 2 to 4 ml/min on the extraction process.The optimum extraction efficiency for SWE was determined at 125^{o}C, 4 ml/min and 0.5mm.

Sharififar et al., (2010) studied medicinal properties of *B.persicum* by evaluating the essential oil and different extracts of the seeds of this plant for antioxidant activity by Diphenylpicrylhydrazil (DPPH) assay,β-carotene bleaching and ammonium thiocyanate methods and reported its usage as antispasmodic, carminative, antiobesity and lactogage.

Amin et al., (2011) extracted essential oil using hyrodistillation technique.Main compounds were reported to be Cuminaldehyde (23.04%), Gamma –terpene (14.48%), Trans – 3- caren-2-ol(12.51%),Acetic acid (10.90%) and 1.38-P methatriene (7.89%).

Foroumadi et al., (2011) identified the chemical composition of the essential oil obtained from the fruits by using GC and GC/MS. Among the 25 components identified in this oil the major constituents were reported to be cuminaldehyde (27.0%), ϒ-terpene (25.8%), P-cymene (12.14%), cuminyl alchohol (6.0%) and limonene (5.1%).

Khosravinia et al., (2012) compared different methods of extractions and targeted cuminaldehyde as one of the 'Black cumin' essential oil constitute. According to Gas chromatography analysis, cuminaldehyde was not detected in the supercritical fluid samples while it was present in hydrodistillation and solvent extract.

Mazidi et al., (2012) applied microwave-assisted hydrodistillation (MAHD) at three levels of microwave power (180,360 and 540 w) and the traditional hydrodistillation (HD) to obtain essential oils from the plant. Analysis of the essential oils using gas chromatography-mass spectrometry showed that ϒ-terpene (28.16-31.13% w/w), cuminaldehyde (24.85-29.20%), p-cymene (14.67-16.50%) and limonene (16.13-8.28%) were their main constituents with a similar composition both after HD and MAHD extraction.

Oroujalian et al., (2013) analysed the essential oil by hydrodistillation method and analysed their constituents by GC and GC/MS spectrometry. The antibacterial effects of the essential oils were assessed on several food-borne pathogens by microdilution technique using ELISA reader.

Rabiey et al., (2013) determined the highest concentration of essential oil (EO) without any undesirable effect on sensory properties of fillet and then examined the antimicrobial effect of this essential oil at 0.5, 0.2, and 0.4% against Listeria monocytogenes in Fish model systems for 12 days at 4^{o}C. EO of Black zira demonstrated strong

inhibitory activity against L.monocytogenes in Fish broth, but this efficacy significantly decreased in kutum and cold smoked kutum broth. EO performance significantly stimulated in broth with 4% NaCl.

Discussion

The aim of present review is to present comprehensive information about the chemical composition and medicinal importance of *Bunium persicum* (Boiss.)B.Fedtsch. Although there are 166 species of the genus Bunium, but they have not been broadly subjected to chemical characterisation as evident from perusal of the literature. Current studies have shown that the plant is a potent source of various bioactive compounds like terpenes,aldehydes which indicates that the plant is medicinally very important and shows several therapeutic effects on digestive and urinarytract disorders and is also used against diarrhea,dyspepsia,fever,flatulence,stomachache,hemmorrhoides,hiccoughs and as an antihistaminic. The essential oil is capable of suppressing the initial stage of an inflammatory response. The plant is also used for culinary purposes and for flavouring foods and beverages (Haghirossadat et al., 2010). The recent scientific data and the rich historical evidence of its medicinal uses could support further research as well as its use as an aromatic plant.

Conclusion

Bunium persicum (Boiss.)B.Fedtsch. is a medicinally important plant. The plant has tremendous medicinal usage as indicated by its chemical composition, and as such is used for the treatment of various ailments. The plant has also aromatic properties and as such is used as a spice. There is a need for further bio prospection of this important plant species, which may prove to be vital and could lead to new pharmacological products beneficial for humans.

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