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RESEARCH ARTICLE

Chemical Composition of *Bunium elegans* (Fenzl) Freyn var. *elegans* Essential Oil

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Abstract

The genus *Bunium* (Apiaceae) comprises about 50 species spreading in Asia, Europe and North Africa. It is encountered in almost every region of Turkey, especially in the Mediterranean, Southeast Anatolia and East Anatolia regions. It has various biological activities related to digestive and urinary tract disorders. In traditional medicine, it has been used in chronic stomach diseases, colitis, jaundice, chronic cholangitis, swelling and kidney stones. In this study, it was aimed to clarify the chemical profile of essential oil obtained from *Bunium elegans* (Fenzl) Freyn var. *elegans* and to determine its main compounds. Aerial parts of *B. elegans* were collected from Kayseri, Turkey and hydrodistillated for 3 h by Clevenger-type apparatus to obtain the essential oil. Chemical composition of the essential oil was analyzed by Gas chromatography (GC), Gas chromatography and Mass spectrometry (GC-MS), simultaneously. Caryophyllene oxide (28.7%), myristicin (7.4%), caryophyllenol II (4.1%) and hexadecanoic acid (3.7%) were found as major components for *B. elegans* essential oil. To the best of our knowledge, this is the first report on the chemical constituents of *B. elegans* from Turkey.

Keywords: Apiaceae*, Bunium elegans* (Fenzl) Freyn var. *elegans,* essential oil, chemical composition.

Introduction

The genus *Bunium* (Apiaceae) comprises about 50 species of geophytes with tuberiform storage roots, distributed in the arid and subarid SW and central Asia, Europe, and North Africa (Degtjareva et al., 2009; Baser & Kırımer, 2014). In Turkey, there are 15 known species, including the endemics *B. fallax, B. nudum* and *B. pinnatifolium* (Bani et al., 2012). The center of diversity of *Bunium* is in the Mediterranean region. It is spread in almost every part of Turkey, especially in the Southeastern Anatolia and Eastern Anatolia regions. *Bunium elegans* (Fenzl) Freyn known as "Zireh" is a wild plant distributed in different parts of Iran, Anatolia and Iraq. *Bunium* sp. contained mostly monoterpenes and phenylpropanoids, such as *α*-pinene, *p*-cymene, limonene, *γ*-terpinene, cuminaldehyde, cuminyl alcohol, myristicin, and dillapiole. The essential oil of *B. cylindricum* from Pakistan, on the other hand, consisted mostly of myristicin, limonene, elemicin, dillapiole, and *β*-selinene. The essential oil of the *Bunium* sp. is used as a carminative and antiseptic (Foroumadi et al., 2002). In traditional medicine, it has been used in chronic stomach diseases, colitis, jaundice, chronic cholangitis, swelling and kidney stones.

In this study, it is aimed to clarify the chemical profile of essential oil obtained from *Bunium elegans* (Fenzl) Freyn var. *elegans* and to determine its main compounds.

Materials and Method

Material

Aerial parts of *B. elegans* were collected from Kayseri, Turkey and hydrodistilled for 3 h by a Clevenger-type apparatus to obtain the essential oil. The yield of the essential oil was calculated as 0.04%.

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Method

Gas chromatography and gas chromatography-mass spectrometry (GC and GC-MS) analysis

The essential oils were analysed by GC using a Hewlett Packard 6890 system (SEM Ltd, Istanbul, Turkey) and an HP Innowax fused silica capillary column (FSC) (60 m x 0.25 mm Ø, with 0.25 µm film thickness) was used with nitrogen at 1 mL/min. Initial oven temperature was 60 °C for 10 min, and increased at 4 °C/min to 220°C, then kept constant at 220 °C for 10 min and increased at 1 °C/min to 240 °C. Injector temperature was set at 250 °C. Percentage compositions of the individual components were obtained from electronic integration using flame ionization detection (FID, 250 °C) (Demirci et al., 2008). Relative percentages of the separated compounds were calculated from FID chromatograms as given in Table 1. GC-MS analysis was performed with a Hewlett-Packard GCD, system (SEM Ltd, Istanbul, Turkey) and Innowax FSC column (60 m x 0.25 mm, 0.25 µm film thickness) was used with Helium. GC oven temperature conditions were as described above, split flow was adjusted at 50 mL/min, the injector temperature was at 250 °C. Mass spectra were recorded at 70 eV. Mass range was from m/z 35 to 425 as previously reported (Demirci et al., 2008). Identification of the essential oil components were carried out by comparison of their relative retention times with those of authentic samples or by comparison of their relative retention index (RRI) to series of n-alkanes. Computer matching against commercial (Wiley GC-MS Library, MassFinder Software 4.0) (McLafferty & Stauffer, 1989; Hochmuth, 2008), and in-house "Başer Library of Essential Oil Constituents" built up by genuine compounds and components of known oils, as well as MS literature data (Joulain & König, 1998) was used for the identification according to previous publications (Demirci et al., 2008).

Results and Discussion

The chemical composition of the essential oil *B. elegans* was characterized by GC and GC-MS analyses. The results are shown in Table 1. Caryophyllene oxide (28.7%), myristicin (7.4%), caryophyllenol II (4.1%) and hexadecanoic acid (3.7%) were determined as major components. Twenty-nine components were identified, representing 76.7% of the sample.

Table 1. Volatile components of *B. elegans* essential oil

RRI	Component	%
1296	Octanal	0.6
1497	*α*-Copaene	tr
1553	Linalool	0.8
1590	Bornyl acetate	0.5
1594	*trans*-*β*-Bergamotene	0.5
1600	*β*-Elemene	tr
1612	*β*-Caryophyllene	3.0
1687	*α*-Humulene	0.5
1693	*β*-Acoradiene	1.5
1704	*γ*-Muurolene	tr
1726	Germacrene D	2.5
1742	*β*-Selinene	1.6
1744	*α*-Selinene	4.0
1773	*δ*-Cadinene	tr

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Table 1. Volatile components of *B. elegans* essential oil (cont.)

1786	*ar*-Curcumene	tr
1945	1,5-epoxide-Salvial 4(14)-en	0.7
1958	(*E*)-*β*-Ionone	tr
2001	Isocaryophyllene oxide	3.0
2008	Caryophyllene oxide	28.7
2037	Salvial 4(14)-en-1-ol	2.9
2071	Humulen epoxide II	2.6
2144	Spathulenol	2.6
2179	*nor*-Copaanone	1.1
2255	*α*-Cadinol	1.0
2278	Torilenol	1.7
2296	Myristicin	7.4
2392	Caryophyllenol-II	4.1
2900	Nonacosane	1.7
2931	Hexadecanoic acid	3.7
	Total	**76.7**

[a]RRI: Relative retention indices calculated against *n*-alkanes; [b]%: calculated from FID data; tr, identification based on the retention times (tR) of genuine standard compounds on the HP Innowax column

In a recent work, Jassbi et al. (2005) identified germacrene D and *β*-caryophyllene as main components for *B. elegans* oil. Essential oils of *B. elegans* and *B. carioides* contain mainly the sesquiterpene hydrocarbons germacrene-D and *β*-caryophyllene, which amounted to 24.1 % and 38 % for *B. elegans* and 22.1 % and 26.6 % for *B. caroides,* respectively. The oil of *B. caroides* contained *α*-pinene (4.1%) and (*Z*)-*β*-ocimene (5.9 %) as major constituents. Previously, Shahsavari et al. (2008) found caryophyllene (27.8%), *γ*-terpinene (15.1%) and cuminyl acetate (14.6%) as major components for *B. persicum* essential oil. In another work, Baser et al. (1997) found *p*-mentha-1,3-dien-7-al (28.9%), *γ*-terpinene (25.7%), *β*–pinene (15.6%), cuminaldehyde (11.7%) and *p*-mentha-1,4-dien-7-al (5.1%) as major components of this cumin-smelling *B. persicum* fruits.

According to the Bousetla et al. (2014) essential oil obtained from ground fruits of *B. incrassatum* afforded 28 components (81.4%) including caryophyllene oxide (31.0%), (*Z*)-*β*-farnesene (8.7%), *β*-caryophyllene (7.2%), and germacrene B (5.8%) as major components. Essential oil from fruit-bearing branches of *B. incrassatum* contained 40 constituents (85.2%) including caryophyllene oxide (26.8%), nonacosane (11.6%), germacrene B (7.7%), *β*-caryophyllene (5.8%), (*Z*)-*β*-farnesene (5.1%), caryophyllenol II (4.8%), and spathulenol (2.5%) as principal constituents. It yielded 24 constituents (75.4%) including nonacosane (44.7%), spathulenol (5.3%), eudesm-4(15),7-dien-1*β*-ol (4.4%), caryophyllenol II (4.1%), (*Z*)-*β*-farnesene (2.3%), germacrene B (1.2%), and *β*-caryophyllene (1.0%) as the principal constituents of thickened branches of *B. incrassatum* essential oil.

To the best of our knowledge, this is the first report on the volatile chemical constituents of *B. elegans* collected from Turkey.

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