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RESEARCH ARTICLE

Essential Oil Composition of *Onosma isaurica* Boiss. & Heldr. and *Onosma bulbotrichum* DC. from Tokat, Turkey

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Abstract
The genus *Onosm*a L. (Boraginaceae) is represented in Turkey by 105 species (110 taxa), 53 of them and 1 variety are endemic for Turkey. Some species of *Onosma* are used as herbs, traditional medicine such as against burns, wounds and ailments. Hydrodistilled essential oils of the aerial parts of *Onosma isaurica* Boiss. & Heldr. and *Onosma bulbotrichum* DC. were analyzed by GC and GC-MS systems, simultaneously. The essential oil of *O. isaurica* contained hexahydrofarnesyl acetone (20.3%), phytol (19.0%), farnesyl acetone (8.1%) and neophytadiene isomer I/tetradecanal (7.0%) as main constituents. The oil of *O. bulbotrichum* was characterized by the occurrence of hexahydrofarnesyl acetone (11.6%), farnesyl acetone (9.9%), hexadecanal (8.8%) *E*-geranyl acetone (7.4%) and neophytadiene isomer I (7.3%) as major components.

Keywords: *Onosma isaurica, Onosma bulbotrichum*, volatile components

Introduction

The genus *Onosm*a L. (Boraginaceae) is represented in Turkey by 105 species (110 taxa), 53 of them and one variety are endemic for Turkey (Riedl, 1978; Güner et al., 2012; Binzet, 2016). In traditional medicine, some species of *Onosma* are used as herbs, against burns, wounds and ailments (Khajuria and Jain, 1993; Özgen et al., 2003). *Onosma* species are known as 'emzik otu' in Turkey (Baytop, 1997).

A literature survey has revealed that studies on the essential oil of *Onosma* species are limited. Roots of *O. isaurica* Boiss. & Heldr. were investigated in terms of *in vivo* anti-inflammatory and antinociceptive activities. (Tosun et al., 2008). In another recent study, tyrosinase inhibitory, antioxidant activities and total phenol contents were evaluated (Zengin et al., 2019). Aerial parts of *O. isaurica* are reportedly used against bronchitis as infusion (Melikoğlu et al., 2015). *Hemmati et al.* (2018) prepared a cream from the roots of *O. bulbotrichum* DC., which was used in the treatment of second degree burns.

To the best of our knowledge, this is the first report on determination and comparison of the essential oils of *O. isaurica* Boiss. & Heldr. and *O. bulbotrichum* DC. by GC and GC/MS.

Material and Methods

Plant material

O. isaurica and *O. bulbotrichum* were collected in June, 2017 in Tokat, Turkey. Voucher specimens are kept at the Herbarium of Faculty of Pharmacy of Anadolu University, Turkey (ESSE NO:15443, ESSE NO:15444, resp.).

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Isolation of essential oil

Aerial parts of the plants were hydrodistilled for 3 h using a Clevenger-type apparatus. The essential oils were stored at 4°C in the dark until analysed. Oils yields of the samples were less than 0.1%.

Analysis of the essential oils

The oils were analysed by capillary GC-FID and GC/MS using an Agilent GC-MSD system, simultaneously.

GC-MS conditions

The oils were analysed by capillary GC/MS using an Agilent GC-MSD system (Agilent Technologies Inc., Santa Clara, CA). HP-Innowax FSC column (Hewlett-Packard-HP, U.S.A.) (60 m × 0.25 mm i.d., with 0.25 µm film thickness) was used for separation of components in the oil and helium as a carrier gas (0.8 mL/min). The GC oven temperature was kept at 60°C for 10 min and programmed to 220°C at a rate of 4°C/min, and kept constant at 220°C for 10 min and then programmed to 240°C at a rate of 1°C/min., at splitless mode. The injector temperature was set at 250°C. Mass spectra were taken at 70 eV with the mass range *m/z* 35-450.

GC conditions

The GC analysis were done with Agilent 6890N GC system fitted with a FID detector set at a temperature of 300°C. To obtain the same elution order with GC/MS, simultaneous auto-injection was done on a duplicate of the same column applying the same operational conditions. Relative percentage amounts (%) of the separated compounds were calculated from FID chromatograms.

Identification of compounds

Identification of essential oil components was performed by comparison of their mass spectra with those in the Baser Library of Essential Oil Constituents, Wiley GC/MS Library, Adams Library, MassFinder Library and confirmed by comparison of their retention indices (McLafferty and Stauffer, 1989; Adams, 2007; Hochmuth, 2008). A homologous series of *n*-alkanes were used as the reference points in calculation of relative retention indices (RRI) (Curvers et al., 1985). The relative percentages of the separated compounds were calculated from FID chromatograms. The analysis results are expressed as mean percentage as listed in Table 1.

Results and Discussion

Twenty-seven compounds constituting about 93.9 % of the essential oil of *O. isaurica* and twenty-six compounds constituting 87.2 % of the oil of *O. bulbotrichum* were characterized.

The oil of *O. isaurica* comprised oxygenated monoterpenes, diterpenes and other hydrocarbons. It contained hexahydrofarnesyl acetone (20.3%), phytol (19.0%), farnesyl acetone (8.1%) and neophytadiene isomer I/tetradecanal (7.0%) as main constituents. The essential oil of *O. bulbotrichum* was characterized by the occurrence of hexahydrofarnesyl acetone (11.6%), farnesyl acetone (9.9%), hexadecanal (8.8%) *E*-geranyl acetone (7.4%) and neophytadiene isomer I (7.3%) as major components.

In a previous study, main component of the essential oil of *O. sieheana* was found as *p*-cymene, while *O. microcarpum* was reported to contain thymol, carvacrol and *n*-heptane as major components (Morteza-Semnani et al., 2006; Binzet et al., 2019). *Onosma echioides* L. var. *columnae* Lacaita was characterized by the occurrence of hexadecanoic acid and phytol as major components in flower oils, while phytol and hexahydrofarnesyl acetone were the main components in the leaf oils (Maggi et al., 2009).

To the best of our knowledge, this is the first report on the GC-FID and GC/MS determination of the essential oil compositions of *O. isaurica* and *O. bulbotrichum*.

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Table 1. Volatile components of *O. isaurica* (Oi) and *O. bulbotrichum* (Ob)

RRI	Compounds	Oi	Ob	IM
1200	Dodecane	tr	-	MS
1300	Tridecane	1.0	-	MS
1400	Tetradecane	0.9	-	t_R, MS
1400	Nonanal	-	3.1	MS
1444	Dimethyl tetradecane	0.5	-	MS
1500	Pentadecane	1.3	-	t_R
1506	Decanal	-	4.0	MS
1594	*trans*-β-Bergamotene	-	0.5	MS
1600	Hexadecane	0.6	0.4	MS
1621	Hexyl hexanoate	0.7	-	MS
1655	(*E*)-2-Decenal	-	0.5	MS
1655	1-Hexadecene	0.4	-	MS
1661	Safranal	0.3	-	MS
1700	Heptadecane	-	0.6	t_R, MS
1722	Dodecanal	2.2	5.7	t_R, MS
1765	(*E*)-2-Undecenal	-	1.0	MS
1830	Tridecanal	-	2.1	MS
1868	(*E*)-Geranyl acetone	0.9	7.4	t_R, MS
1882	1-Isobutyl-4-isopropyl-2,2-dimethyl succinate	-	0.6	MS
1933	Neophytadiene isomer I	7.0	-	MS
1933	Tetradecanal		7.3	MS
1958	(*E*)-β-Ionone	-	3.6	MS
1992	Neophytadiene	0.4	-	MS
2041	Pentadecanal	-	1.6	MS
2050	(*E*)-Nerolidol	-	1.0	t_R, MS
2131	Hexahydrofarnesyl acetone	20.3	11.6	t_R, MS
2135	Hexadecanal	5.0	8.8	MS
2179	3,4-Dimethyl-5-pentylidene-2 (5H)-furanone	0.8	1.1	t_R, MS
2200	3,4-Dimethyl-5-pentyl-5H-furan-2-one	0.7	1.2	MS
2239	Carvacrol	-	2.6	t_R, MS
2300	Tricosane	2.1	3.2	t_R, MS
2369	(2*E*, 6*E*)-Farnesol	-	1.5	t_R, MS
2384	Farnesyl acetone	8.1	9.9	MS
2400	Tetracosane	0.7	-	t_R, MS
2500	Pentacosane	6.2	2.0	MS
2551	Geranyl linalool	1.1	-	t_R
2622	Phytol	19.0	3.5	MS
2700	Heptacosane	6.1	2.4	MS
2900	Nonacosane	2.8	-	MS
2939	1-Docosene	4.8	-	MS
	Total	93.9	87.2	

RRI: Relative retention indices experimentally calculated against *n*-alkanes; % calculated from FID data; IM: Identification Method: t_R: Identification based on comparison with co-injected with standards on a HP Innowax column; MS: identified on the basis of computer matching of the mass spectra. Oi: *O. isaurica;* Ob: *O. bulbotrichum*

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