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Composition of the essential oils of wild and cultivated *Satureja khuzistanica* Jamzad from Iran

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ABSTRACT: The essential oils of the wild and cultivated *Satureja khuzistanica* Jamzad (Lamiaceae) from Iran were isolated by hydrodistillation in yields of 0.6% and 1.2% respectively. The chemical composition of the essential oils was examined by GC and GC–MS. Twelve components of the wild plants' oil, representing 98.5% of the total oil, and 21 components of the cultivated plants' oil, representing 99.2%, were identified. The main components of the wild plants' oil were carvacrol (93.9%), eugenol (1.0%), *p*-cymene (0.8%) and thymol (0.6%). The major constituents of the cultivated plants' oil were carvacrol (80.6%), *p*-cymene (4.8%), myrcene (1.5%), γ-terpinene (2.1%) and terpinene-4-ol (2.1%). In both the wild and cultivated plants the main component of the oil was carvacrol. Copyright © 2004 John Wiley & Sons, Ltd.

KEY WORDS: *Satureja khuzistanica*; essential oil; carvacrol; *p*-cymene, eugenol, myrcene, γ-terpinene, terpinene-4-ol

Introduction

Satureja khuzistanica Jamzad (Persian name, 'marzeh khuzistani') of the family Lamiaceae is an endemic plant of Iran that is widely distributed in the southern part of Iran.[2,3] This species is close to *Satureja edmondi* Briquet but with some differences in stem, leaf and inflorescence. It is a small shrub ±30 cm high, shortly pubescent with white hairs. Floral leaves similar to the cauline leaves but smaller. Each verticill has 2–8 flowers, shortly pedunculate. It grows in limestone crevices.[2]

In the classical Iranian medical books[4,5] a few varieties of herbs are described under the names 'saatar', 'nadgh' and 'marzeh kouhi' (a montane variety of savory). These herbs are described as stomachic, sedative and analgesic, especially in toothache.[4,5] 'Nadgh' and 'marzeh kouhi' are classified as species belong to the genus *Satureja*.[4–6] On the other hand, *S. khuzistanica* is used traditionally to relief toothache among the inhabitants of Lorestan province where the both wild and cultivated samples are collected.[7]

The chemical composition of the essential oil of *S. khuzistanica* has not yet been described. Therefore, this report is the first on the chemical composition of the essential oils of wild and cultivated samples of this species.

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Experimental

Plant Material and Isolation Procedure

The aerial parts of both wild and cultivated plants from the field were collected during the flowering stage of the plant in June 2000 from Khorramabad (Lorestan province) at an altitude of 1170 m. The plant was identified by the Department of Botany of the Research Institute of Forests and Rangelands (TARI), Tehran. A voucher specimen (No. 58416) has been deposited at the Herbarium of TARI.

The aerial parts were air-dried at ambient temperature in the shade and hydrodistilled using a Clevenger-type apparatus for 5 h, giving yellow oil in 0.6% yield for the wild plant and 1.2% for the cultivated plant. The oils were dried over anhydrous sodium sulphate and stored at 4–6 °C.

Identification of the Oil Component

Analytical gas chromatography (GLC) was carried out using a Hewlett-Packard HP 6890 chromatograph with a DB5 column (methyl phenyl siloxane 30 m × 0.25 mm i.d.); with a flame ionization detector; carrier gas, helium, with a split ratio of 1:10. Oven temperature programme was 60 °C to 240 °C at a rate of 4 °C/min; injector temperature, 220 °C; detector temperature, 240 °C. GC–MS was performed (quadrupole mass spectrometer, Hewlett-Packard 6890) on a cross-linked 5% phenyl methyl siloxane column (HP-5, 30 m × 0.25 mm i.d.) with a helium as the carrier gas and a split ratio of 1:10,

Table 1. Composition of the essential oils of wild and cultivated plant of *Satureja khuzistanica*

Compounds	RRI (DB5)	Percentage in oil[a]		Methods of identification[b]
		C	W	
α-Thujene	925	0.5	—	RI–MS
α-Pinene	934	1.0	0.1	RI–MS
β-Pinene	980	0.2	—	RI–MS
Myrcene	991	1.5	—	RI–MS
α-Phellandrene	1005	0.1	—	RI–MS
Δ-3-carene	1012	0.1	—	RI–MS
α-Terpinene	1019	0.8	0.1	RI–MS
α-Terpinolene	1022	0.2	—	RI–MS
p-Cymene	1027	4.8	0.8	RI-MS
γ-Terpinene	1067	2.1	0.2	RI–MS
Linalool	1098	1.3	—	RI–MS
Terpinene-4-ol	1183	2.1	0.3	RI–MS
α-Terpineol	1196	0.6	—	RI–MS
Carvacrol methyl ether	1249	0.3	—	RI–MS
Thymol	1295	—	0.6	RI–MS
Carvacrol	1304	80.6	93.9	RI–MS
Eugenol	1362	0.7	1.0	RI–MS
β-Caryophyllene	1424	0.5	0.2	RI–MS
Geranyl acetone	1454	0.2	0.2	RI–MS
β-Bisabolene	1512	1.3	0.8	RI–MS
Caryophyllene oxide	1522	0.2	0.3	RI–MS
cis-α-Bisabolene	1547	0.1	—	RI–MS
Total		99.2	98.5	

[a] W, wild; C, cultivated. [b] RI, retention indices on a DB-5 column; MS, identification based on comparison of mass spectra.

operating at 70 eV ionization energy. The retention indices for all the components were determined according to the Van Den Doll method, using *n*-alkanes as standard.[8] Compounds were identified by comparison of their retention indices (RI, DBI-5) with those reported in the literature and by comparison of their mass spectra with the Wiley library[9] or with the published mass spectra.[10]

Results and Discussion

Table 1 shows the constituents of the essential oils of the wild and cultivated plants of *S. khuzistanica*; 12 compounds of the wild plants' oil, representing 98.5%, and 21 compounds of the cultivated plant's oil, representing 99.2%, were identified. The main constituents of the wild plants' oil were carvacrol (93.9%) eugenol (1.0%), *p*-cymene (0.8%) and thymol (0.6%). The major constituents of the cultivated plants' oil were carvacrol (80.6), *p*-cymene (4.8), myrcene (1.5%), γ-terpinene (2.1%) and terpinene-4-ol (2.1%). In both the wild and cultivated plants the main major component was carvacrol. While both types of this plant grow in the same province and even at the same altitude, their growing conditions, including the composition of the soil, are not exactly the same. This might be the main cause of difference in the composition of oils of this plant, especially the carvacrol content. The results of the study show the high content of phenolic compounds, similar to *Zataria multiflora* and other related species from Iran.[11–14] These results support the use of essential oil of *S. khuzistanica* as an antiseptic or analgesic.[15,16]

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