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Short communication

Essential oil composition of *Teucrium scordium* L.

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Composition of the essential oil obtained from dried flowering aerial parts of *Teucrium scordium* L. (*Labiatae*) was analyzed by GC and GC/MS. Fifty-six components were identified in the essential oil of *T. scordium*. The major constituents of the oil were β-caryophyllene (22.8%), (*E*)-β-farnesene (10.4%), caryophyllene oxide (8.6%), 1,8-cineole (6.1%) and β-eudesmol (5.1%).

Keywords: Teucrium scordium (*Labiatae*), essential oil, β-caryophyllene, (*E*)-β-farnesene, caryophyllene oxide

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The genus *Teucrium* (*Labiatae*) comprises 12 species, which are widely distributed in Iran (1, 2). *T. scordium* has anti-inflammatory, antipyretic, antiseptic, astringent, diaphoretic, diuretic, laxative, stimulant, tonic, emmenagogue, vermifuge and vulnerary activities (3). Unproven uses of this herb include the treatment of festering and inflamed wounds, bronchial ailments, diarrhea, fever, hemorrhoids, and intestinal parasites (4). In herbal medicine, it has already been used as tonic and for treatment of lung tuberculosis, jaundice and hemorrhoids and in external use for healing of wounds (5). Diterpenes, flavonoids, saponnins, tannins and volatile oil have been found in *T. scordium* (4–6). 6-Acetylteucjaponin B was recently isolated from *T. scordium* (7). A literature survey has shown that there is no report on the volatile constituents of *T. scordium*. The medicinal properties attributed to *Teucrium scordium* prompted us to investigate the chemical constituents of the oil of *T. scordium* for the first time.

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EXPERIMENTAL

Plant material

Flowering aerial parts of *T. scordium* were collected in June 2005 from the suburb of Babolsar, Mazandaran province, North Iran, and identified by the Department of Botany, Research Center of Natural Resources of Mazandaran (Iran). A voucher specimen (herbarium No. 195) was deposited at the Herbarium of the Department of Botany, Research Center of Natural Resources of Mazandaran.

Isolation of the essential oil

The dried flowering aerial parts were subjected to hydrodistillation using a Clevenger-type apparatus for 4 h. After separation, the oil was submitted to gas chromatographic analysis.

Gas chromatography (GC)

Gas chromatographic analysis was carried out on a Perkin-Elmer 8500 gas chromatograph with FID detector and a DB-5 capillary column (30 m × 0.25 mm, film thickness 0.25 μm) (USA). The operating conditions were as follows: carrier gas helium with a flow rate of 2 mL min^{-1}, split ratio 1:30. The oven temperature was programmed 4 min isothermal at 60 °C and then 60–220 °C at 4 °C min^{-1}, injector and detector temperatures were set at 240 °C.

Gas chromatography/mass spectrometry (GC/MS)

GC/MS was carried out on a Hewlett Packard 6890 instrument programmed as follows: a DB-5 capillary column (30 m × 0.25 mm, film thickness 0.25 μm) (USA), 60 °C for 5 min and then up to 220 °C at 4 °C min^{-1}. The carrier gas was helium at a flow rate of 2 mL min^{-1}, split ratio 1:40; ionization energy 70 eV, scan time 1 s, acquisition mass range *m/z* 40–400.

Identification of components

The oil components were identified by their retention time, retention indices relative to C_9–C_{28} *n*-alkanes, computer matching with the WILEY275.L library and by comparison of their mass spectra with those of authentic samples or with data already available in the literature (8, 9). The concentration of the identified compounds was computed from the GC peak area without any correction factor.

RESULTS AND DISCUSSION

Hydrodistillation of the dried flowering aerial parts of *T. scordium* gave 0.9% (*m/m*) of light yellowish oil. As shown in Table I, fifty-six components were identified in this

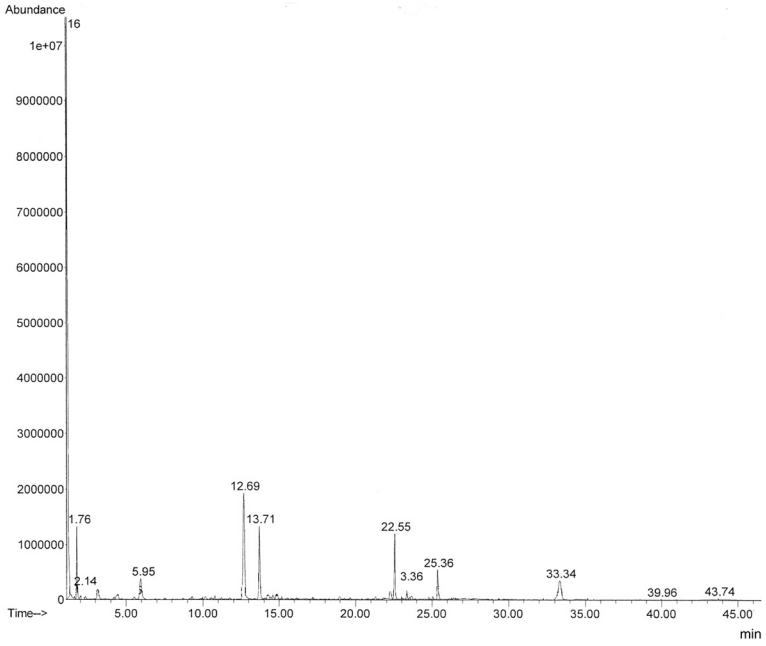

Fig. 1. Gas chromatogram of the essential oil of *Teucrium scordium* on DB-5 capillary column (30 m × 0.25 mm; film thickness 0.25 μm).

oil, accounting for 97.9% of the total oil composition. The gas chromatogram of the oil on DB-5 capillary column is shown in Fig. 1. The major constituents were *β*-caryophyllene (22.8%), (*E*)-*β*-farnesene (10.4%), caryophyllene oxide (8.6%), 1,8-cineole (6.1%) and

Table I. Composition of the essential oil of Teucrium scordium L.

No.	Component	RI[a]	GC area (%)
1	Pentanal	708	0.1
2	(*E*)-2-Hexenal	857	0.2
3	*α*-Pinene	941	3.3
4	Sabinene	977	1.1
5	1-Octen-3-one	976	0.1
6	1-Octen-3-ol	980	0.2
7	*β*-Pinene	981	3.2
8	Myrcene	993	1.2
9	*p*-Cymene	1027	0.9
10	Limonene	1031	1.9
11	1,8-Cineole	1033	6.1
12	*n*-Nonanal	1103	0.1
13	(*E*)-Tagetone	1146	0.1

No.	Component	RI[a]	GC area (%)
14	Menthofuran	1166	1.2
15	α-Terpineol	1191	1.1
16	(2*E*, 4*E*)-2,4-Decadienal	1319	0.4
17	α-Copaene	1353	1.1
18	*n*-Undecanol	1372	0.1
19	β-Cubebene	1378	1.2
20	(*E*)-β-Damascenone	1386	0.8
21	β-Bourbonene	1389	1.4
22	β-Elemene	1393	1.1
23	Sativene	1394	0.2
24	(*E*)-β-Damascone	1416	2.3
25	β-Caryophyllene	1421	22.8
26	4,8-β-Epoxy-caryophyllene	1427	0.1
27	*trans*-α-Bergamotene	1437	0.6
28	Aromadendrene	1443	1.2
29	(*Z*)-β-Farnesene	1445	1.5
30	Khusimene	1457	0.1
31	(*E*)-β-Farnesene	1459	10.4
32	(*E*)-2-Dodecenal	1468	0.1
33	Germacrene D	1486	2.6
34	(*E*)-β-Ionone	1491	1.1
35	β-Selinene	1492	2.6
36	α-Muurolene	1502	1.2
37	δ-Cadinene	1525	1.4
38	(*E*)-γ-Bisabolene	1533	0.1
39	Dodecanoic acid	1569	0.1
40	Spathulenol	1579	1.1
41	Caryophyllene oxide	1585	8.6
42	Alloaromadendrene epoxide	1642	0.7
43	Caryophylla-4(14),8(15)-diene-5-ol	1643	0.3
44	*epi*-α-Muurolol	1644	1.2
45	Cubenol	1649	1.1
46	β-Eudesmol	1652	5.1
47	α-Eudesmol	1654	1.3
48	α-Cadinol	1655	1.2
49	Selin-11-en-4α-ol	1662	1.1
50	Eudesma-4(15),7-dien-1β-ol	1690	0.1
51	*n*-Heptadecane	1702	0.1
52	Longifoliol	1717	0.1
53	(2*E*, 4*E*)-Farnesol	1727	0.3
54	14-Hydroxy-α-muurolene	1782	0.1
55	6,10,14-Trimethyl-2-pentadecanone	1845	0.1
56	Hexadecanoic acid	1984	0.1
Total			97.9

RI – Retention indices on DB-5 capillary column.

β-eudesmol (5.1%). *T. scordium* oil comprised monoterpenoids (13 compounds, 24.3%), sesquiterpenoids (31 compounds, 71.9%) and non-terpenoids (12 compounds, 1.7%).

Caryophyllene oxide was reported as one of the main compounds of *T. polium* oil in both hydrodistillation and diethyl ether-pentane extraction methods (10). In 1990, the oils of six *Teucrium* species from the Iberian peninsula and the Balearic islands were characterized by high contents of aristolene, *β*-caryophyllene, *α*-humulene, alloaromadendrene, caryophyllene epoxide and spathulenol, confirming the close morphological relationships between these species, as other authors have previously suggested (11). Caryophyllene oxide (33.5%), linalool (17.0%) and *β*-caryophyllene (9.3%) were also identified as major compounds in the oil of *T. orientale* L. spp. *orientale* collected from the Fars province, Iran (12). We have already reported germacrene D (16.5%), (Z)-*β*-farnesene (12.2%), *β*-caryophyllene (10.5%), *α*-pinene (9.1%) and *δ*-cadinene (7.4%) as the main compounds of *T. chamaedrys* collected in the Mazandaran province, North Iran (13). *β*-Caryophyllene was reported as the most abundant component in both *T. orientale* var. *puberulens* and *T. chamaedrys* subsp. *lydium* oils – 21.7% and 19.7%, respectively (14).

According to our literature surveys, *β*-caryophyllene and caryophyllene oxide were reported as the main sesquiterpenes in many other *Teucrium* species, but in this research, in addition to *β*-caryophyllene and caryophyllene oxide, we also identified (*E*)-*β*-farnesene as the major compound. Since *β*-caryophyllene is an anti-inflammatory sesquiterpene (15), the results of this study may be used to confirm the anti-inflammatory activity of this plant.

CONCLUSIONS

Based on the above study, it may be summarized that the flowering aerial parts of *T. scordium* may be utilized for separation of the essential oil and a source of natural *β*-caryophyllene, (*E*)-*β*-farnesene and caryophyllene oxide.

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S A Ž E T A K

Sastav eteričnog ulja biljke *Teucrium scordium* L.

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Sastav eteričnog ulja iz osušenih nadzemnih dijelova biljke *Teucrium scordium* L. (*Labiatae*) u cvatu analiziran je pomoću GC i GC/MS. Identificirano je pedeset šest komponenata, a najvažniji sastojci ulja su β-kariofilen (22,8%), (*E*)-β-farnesen (10,4%), oksid kariofilen (8,6%), (1,8-cineol) (6,1%) i β-eudezmol (5,1%).

Ključne riječi: Teucrium scordium (Labiatae), sastav eteričnog ulja, β-kariofilen, (*E*)-β-farnesen, oksid kariofilena

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