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Constituents of the volatile oils of two teucrium species from Turkey

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ABSTRACT

In this study, chemotaxonomical relationships between two species (Teucrium polium subsp. polium and T. multicaule) belongs to the genus Teucrium were investigated. The chemical composition of the essential oils of dried aerial parts of two Teucrium species were analyzed by GC and GC-MS. The essential oils of two Teucrium species were studied and eighty components, in all, were identified representing (90.8%) and (82.4%) of the oils respectively. The oil of Teucrium polium L. subsp. polium is characterized by the monoterpene □-pinene (10.2%) and the sesquiterpene germacrene D (10.1%), while that of Teucrium multicaule had a higher contents of sesquiterpene caryophyllene oxide (31.1%). The main components of monoterpenes (α- , β-pinene), the sesquiterpenes germacrene D, caryophyllene oxide make the studied taxon in terms of medicinal aim, cosmetic and natural yield.

1. Introduction

The Lamiaceae family, which contains the Teucrium genus, contains 224 genera and represented by about 5600 species, rich and important families of Angiosperms it is one. The gene center is located in the Mediterranean region but spread of almost every region of the world, along with it is a cosmopolitan family (1). According to the Flora of Turkey this genus represented with twenty seven species and eight of them are endemic (2). The basic sectional arrangement of this genus compared to other member of Labiatae family is that flower completely lack of the upper lip of corolla and inflorescence types with varying characteristics (3). Some species, namely Teucrium polium L. subsp. polium and T. multicaule are widely distributed in steppe, arid, and rocky slopes regions (2).

Teucrium polium L. subsp. polium is one of the native perennial species distributed in all of the Turkey. It is a very polymorphous and suffruticose perennial plant, 10–40 cm high and gives off a very pleasant aromatic odor. The leaves are oblong to narrowly obovate or linear, obtuse, crenate to the base or middle, flat or revolute margined, usually tomentose. The flowers have a whitish corolla, in a globular inflorescence and appear from June to August. (2). This plant is a therapeutic plant and its vernacular names is 'Acıyavşan' in Turkey (4). T. polium L. subsp. polium has been used for traditional medicine in the Mediterranean region and Middle East due to its its abdominal pain, gastrointestinal disorders, inflammations, antispasmodic and cholagogic properties (5,6).

Teucrium multicaule is a strongly suffriticose perennial. Stems 12-40 cm., many, erect or ascending, pubescent. Leaves are entire or tripartite, sessile, segments linear with revolute

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margins. The flowers have a pale lilac-pink corolla in a laxly racemose inflorescence and flowering time is between April to June. These species especially grows between 0.5–1.6 km altitudes, on steppe, shrubby lands, and fallow areas (2). This medicinal plant is called 'Haptutan' in Turkish language (4).

Recently it is made several chemosystemic studies on Teucrium members (7).Essential oil yield and composition ratios were showed its changes according to the growing place of the plant (8). In addition, the essential oil contained of the plant varies qualitatively and quantitatively were shown in different phenological stages (vegetative, flowering and fruiting) of the plant (9).

According to literature variety diversity in the oil composition of the genus Teucrium has been studied (10-28). The objective of this study was to investigate the essential oil composition of two Teucrium species reported in Flora of Turkey and to supply contributions to the food quality, renewable resources and chemotaxonomy of this plant in Turkey.

2. Materials and Methods

2.1. Plant Source

Teucrium polium subsp. polium and Teucrium multicaule specimens were gathered from wild field during fruiting season in Elazığ in 2011, Hayta-1802 and 1889. The plant materials were identified by a plant taxonomist, Şükrü HAYTA, in Department of Environmental Engineering, Bitlis Eren University, Turkey.

2.2. Isolation of the essential oils

Essential oils were obtained 100 g plant samples taken from each localite hydrodistillation method using a clevenger-type apparatus.

2.3. Gas Chromatography / Mass Spectrometry (GC-MS) Analysis

The essential oils of Teucrium polium subsp. polium and Teucrium multicaule of chemical analyzes were performed with a Hewlett Packard system, HP-Agilent 5973 N GC-FID, and GC-MS (Gas ChromatographyChemical Spectrometry) 6890 GC System. A DB-5 MS column (30m × 0.25 µm with an inner diameter of 0.25 mm) was used. Helium was used as carrier gas. Analyses conditions were utilized according to (29).

3. Results and Discussion

The essential oil yields of Teucrium polium subsp. polium and T. multicaule were found as 0.7 and 0.5 % v/w, respectively. The result of analysis of essential oils are presented in Table-1. Overall, 69 compounds which accounted for 90.8 % in T. polium subsp. polium and 24 constituents, which accounted for 82.4 % of the total compositions of each oil are determined in T. multicaule. The oils were complex mixtures of non-terpenes, monoterpenes and sesquiterpenes: Totally, 80 components were identified in both essential oil in the study. While results of this study compared with previous results that documenting the main constituents of the oils of Teucrium species were characterized by a higher content of sesquiterpenes (13; 25-27). By this way the predominance of sesquiterpenes in this Teucrium species is an expected result. In the essential oil analysis of the T. multicaule in our achievements showed similarities with the study of Polat et al. (24); they reported that, the main constituents of this plant oil (total 56 compounds) were as germacrene D, caryophyllene oxide, spathulenol, -caryophyllene, like in our samples with different quantity.

The main constituents were transcaryophyllene (11.8%), germacrene D (11.1%), β-pinene (8.7%), and bicyclogermacrene (6.7%) in the essential oil of Teucrium polium subsp. polium (28). Although these main constituents of Teucrium specimens oil were found as similar with our sample in trace amount and also transcaryophyllene was not detected in our study.

In addition, the terpenoid compounds identified in this study increase their usefulness in daily life, such as medicine, cosmetics and food industry. As seen in previous studies the main components of the oils of Teucrium polium were characterized by the presence of germecrene D, α-pinene, (Z)-b-farnesene and -caryophyllene, respectively (30-34). This findings were similar with our analyses result but (Z)-b-farnesene was detected in trace amount.

The achievements of this study clearly identicate that more research should be encouraged to qualitative and quantitative differences among Teucrium species in essential oil composition. In this study, as a result of analysis of essential oils of these two species belonging to the genus Teucrium L .; It is possible to say that the chemotype of T. polium is β-pinene / germakene D while T. multicaule chemotype is caryophyllen oxide / thymol.

Table 1. Essentail oil constituents of Teucrium polium subsp. polium and Teucrium multicaule.

NO	Compounds	RRI	T. polium	T. multicaule
1	2-hexenal	964	0.1	0.6
2	Etilbenzene	969	--	0.2
3	-phellandrene	1016	0.1	--
4	-pinene	1023	**8.9**	--
5	Camphene	1034	0.1	--
6	Sabinene	1052	2.7	--
7	-pinene	1057	**10.2**	0.7

8	□□myrcene	1065	6.2	--
9	3-octanol	1070	0.1	--
10	2,4-Heptadienal	1080	--	0.3
11	Benzene, 1-methyl-2	1092	0.1	--
12	Limonene	1096	4.1	--
13	Cis-ocimene	1100	0.2	--
14	Benzenacetaldehyde	1105	--	0.3
15	1,3,6 Octatriene	1108	0.9	--
16	□□terpinene	1117	0.1	--
17	Linalool L	1148	1.9	2.6
18	Nonanal	1151	0.1	--
19	Octen-1-ol, acetate	1153	0.2	--
20	□-campholenal	1167	0.2	--
21	4-Acety-1-methylcyclohexene	1170	0.1	--
22	Nopinone	1176	0.1	--
23	Trans-pinocarveol	1178	0.6	--
24	Trans-verbenol	1181	0.6	--
25	Pinocarvone	1193	0.4	--
26	Borneol	1200	0.1	--
27	3- cyclohexen-1-ol, 4 methyl -1	1205	0.2	--
28	□-Terpineol	1214	--	**10.7**
29	Verbenone	1223	0.1	--
30	Trans-carveol	1231	0.1	--
31	Nerol	1234	0.2	--
32	Carvone	1249	0.1	--
33	□-myrcene	1252	0.2	--
34	Thymol	1285	--	**13.2**
35	Bicycloelemene	1324	0.2	--
36	Delta-elemene	1327	0.2	--
37	□-Terpinolene	1336	0.4	--
38	□-cubebene	1358	--	0.3
39	□-copaene	1360	0.2	--
40	□-Bourbonene	1366	0.4	0.2
41	□□elemene	1370	0.3	0.3
42	Trans-caryophyllene	1382	0.1	--
43	□-Gurjunene	1384	0.1	--
44	□-caryophyllene	1394	**8.2**	2.5
45	□□elemene	1400	0.4	--
46	□-cis-Bergamotene	1402	0.1	--
47	□- Guaiene	1403	--	--
48	□□Farnesene	1416	3.3	--
49	□-Humulene	1418	1.1	--
50	Aromadendrene	1421	0.2	--
51	□-Amorphene	1432	0.1	0.8
52	Germacrene- D	1437	**10.1**	1.0
53	Bicyclogermacrene	1446	5.5	1.0
54	Azulene	1448	--	--
55	□□bisabolene	1452	0.9	--
56	□□Bisabolene	1454	0.3	--
57	□- cadinene	1456	0.5	1.2
58	Delta-cadinene	1459	1.2	1.1
59	□-bisabolene	1472	--	1.4
60	Germacrene B	1485	2.2	--
61	Spathulenol	1496	1.9	**7.6**
62	Caryophyllene oxide	1499	2.7	**31.1**
63	Cedrene	1502	0.2	--
64	□-Gurjunene	1505	0.2	--
65	Azulene	1511	--	3.3
66	isospathulenol	1527	0.3	--
67	[+] Epi-bicyclosesquiphellandrene	1533	4.9	--
68	□-cadinol	1540	3.3	--
69	□-calacorene	1544	0.3	0.6
70	□-bisabolol	1555	--	--
71	Naphthalene	1561	0.5	--
72	Cryptomerione	1576	0.2	--
73	İsocaryophyllene	1580	0.1	--
74	Mintsulfide	1583	0.1	--
75	2-pentadecanone	1631	0.1	1.2
76	1,2 Benzenedicarboxylic acid	1639	0.1	0.2
77	2- Heptadecanone	1660	0.1	--
78	1,19- Eicosadiene	1670	0.1	--
79	n- Hexadecanoic acid	1692	0.1	--
80	Heneicosane	1789	0.1	--
Total	**90.8**	**82.4**		

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