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Full Length Research Paper

Composition of the essential oil of *Teucrium parviflorum* L. (Lamiaceae) from Turkey

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The essential oil of the aerial parts of *Teucrium parviflorum* L. (Lamiaceae) from Turkey was analyzed by GC and GC/MS system. The oil was obtained by hydrodistillation with clevenger apparatus. Thirty three components, representing (80.7%) of the oils, were characterized. The main components were β-caryophyllene (18.6%), germacrene D (9.2%), caryophyllene oxide (8.8%) and bicyclogermacrene (6%). The results were discussed with the genus pattern in means of medicinal purpose and natural products.

Key words: *Teucrium parviflorum*, lamiaceae, essential oil, β-caryophyllene, germacrene D.

INTRODUCTION

The genus *Teucrium* L. is represented by 27 species in Turkey (Ekim, 1982). Two new species have been mentioned by Duman in the second supplement to the flora of Turkey (Duman, 2000) and the total number has reached 30 species by adding the new records (Dönmez, 2006). *Teucrium* is a large genus of the Labiatae, from the subfamily Ajugoideae (Harley et al., 2004). The cosmopolitan genus *Teucrium* comprises approximately 100 species, which occur in the Mediterranean region (Boulos, 2002). It is also widely distributed in Europe, Asia, America and Australia, but the Mediterranean area represents the major area of distribution for the genus, comprised about 96% of all species in the genus (Navarro and El, 2000).

Representatives of *Teucrium* genus have been used for more than 2000 years as medicinal herbs (Grieve, 1996; Ulubelen et al., 2000; Bedir et al., 2003). Previous studies demonstrated therapeutic potentials of some *Teucrium* species such as antibacterial (Monthana et al., 2009), antipyretic (Autore et al., 1984), anti-inflammatory (Barrachina et al., 1995), antioxidant (Yazdanparast and Ardestani, 2009), antiulcer (Fernandez et al., 1997), anti-allergic (Kim et al., 2009) activities. The genus *Teucrium* is one of the richest sources of diterpenes, with a neoclerodane skeleton: more than 220 diterpenes have been described up to now, and many of these are particularly interesting because of their ecological role as antifeedants against different species of insects and for their role in the medicinal properties of the plants (Piozzi et al., 2005). Monoterpenes, sesquiterpenes, diterpenes, sterols, saponins, iridoids, flavonoids, polyphenolic compounds, fatty acids, alkaloids and essential oils have been isolated from the plants of this genus (Glasby, 1991; Perez-Alonso et al., 1993; Kamel and Sandra, 1994; Piozzi et al., 1998; Eikani et al., 1999; Bagci et al., 2004) like in some genus in same family (Bagci and Baser, 2005; Kocak and Bagci, 2011). The extracts of *T. parviflorum* showed strong antioxidant activity and effective antioxidant assay. The results have indicated that *T. parviflorum* is a potential source of natural antioxidant (Turkoglu et al., 2010). It is aimed that to evaluate the composition of the essential oils obtained from the aerial parts of *T. parviflorum* growing wild in Turkey in means of medicinal purpose, natural products and renewable resources with the genus patterns.

EXPERİMENTAL

Plant material

T. parviflorum specimens were collected from natural habitats in Hankendi- Turkey in 2009 (Yazgin- 1025). Voucher specimens are kept at the Firat University Herbarium (FUH).

Isolation of the essential oils

Air-dried aerial parts of the plant materials (100 g) were subjected to hydrodistillation using a Clevenger-type apparatus for 3 h.

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Table 1. Essentail oil constituents of *Teucrium parviflorum* L.

No	Compounds	RRI	Percentage
1	α-pinene	1023	4.4
2	Sabinene	1052	0.7
3	β-pinene	1057	2.8
4	Limonene	1096	0.5
5	α-terpinolene	1137	0.2
6	Linalool L	1148	0.4
7	Nonanal	1151	0.1
8	α-campholenal	1167	0.1
9	*Trans*-isolimonene	1215	0.7
10	α-Terpinolene	1336	0.8
11	α–copaene	1360	0.4
12	β-Bourbonene	1366	0.6
13	β–elemene	1370	0.4
14	β-caryophyllene	1394	18.6
15	α-cis-Bergamotene	1402	0.2
16	α- Guaiene	1403	0.5
17	β-Farnesene	1416	3.7
18	α-Humulene	1418	1.9
19	Aromadendrene	1421	0.3
20	α-Amorphene	1432	0.2
21	Germacrene- D	1437	9.2
22	Bicyclogermacrene	1446	**6.0**
23	Azulene	1448	1.2
24	β-bisabolene	1452	2.8
25	Δ-cadinene	1459	4.5
27	α-bisabolene	1472	4.4
28	Spathulenol	1496	2.8
29	Caryophyllene oxide	1499	8.8
30	β-calacorene	1544	1.3
31	α-bisabolol	1555	1.5
32	Naphthalene	1561	0.4
33	Mintsulfide	1583	0.3
	Total		80.7

Gas chromatographic (GC) analysis

The essential oil was analyzed using HP 6890 GC equipped with and FID detector and an HP- 5 MS column (30 m × 0.25 mm i.d., film tickness 0.25 µm) capillary column was used. The column and analysis conditions were the same as in GC-MS. The percentage composition of the essential oils was computed from GC – FID peak areas without correction factors.

Gas chromatography/mass spectrometry (GC-MS) analysis

The oils were analyzed by GC-MS, using a Hewlett Packard system. HP- Agilent 5973 N GC-MS system with 6890 GC in Plant Products and Biotechnology Res. Lab. (BUBAL) in Firat University. HP-5 MS column (30 m × 0.25 mm i.d., film tickness 0.25 µm) was used with Helium as the carrier gas. Injector temperature was 250°C, split flow was 1 ml/min. The GC oven temperature was kept at 70°C for 2 min and programmed to 150°C at a rate of 10°C/min and then kept constant at 150°C for 15 min to 240°C at a rate of 5°C/min. Alkanes were used as reference points in the calculation of relative retention indices (RRI). MS were taken at 70 eV and a mass range of 35 to 425. Component identification was carried out using spectrometric electronic libraries (WILEY, NIST). The identified constituents of the essential oils are listed in Table 1.

RESULTS AND DISCUSSION

The essential oil yields of *T. parviflorum* was found as 0.3% v/w. Overall, thirty three compounds which accounted for 80.7% in *T. parviflorum.* The hydrodistillation essential oil composition of *T. parviflorum* from Turkey and the relative amounts of the components are shown in Table 1, according to their retention indices on a HB-5

column. The results showed that the essential oils of *T. parviflorum* contains β-caryophyllene (18.6%), germacrene D (9.2%), caryophyllene oxide (8.8%) and bicyclogermacrene (6%) as major components (Table 1). The oils were characterized by a higher content of sesquiterpenes like in *T. capitatum*, *T. salviastrum* Schreber from Portugal (Cavalerio et al., 2002), *T. ramosissimum* Desf from Tunusia (Hachicha et al., 2007), *T. royleanum* Wall ex Benth from Pakistan (Saroglou et al., 2007) and *T. chamaedrys* subsp. *chamaedrys*, *T. chamaedrys* subsp. *lydium*, *T. orientale*, *T. pestalozzae* Boiss, *T. sandrasicum* O. Schwarz (Kucuk et al., 2006) and *T. chamaedrys* L. from Turkey (Bagci et al., 2010a). Qualitative and quantitative differences were reported in all of the *Teucrium* species essential oils reported and these may be due to the genetic, differing chemotypes, drying conditions, mode of distillation and/or extraction and geographic or climatic factors. Germacrene D and β-caryophyllene were the main components of the essential oils of *Teucrium chamaedrys* (Kovacevic and Lakusic, 2001; Morteza-Semnani et al., 2005; Bagci et al., 2010b).

Interestingly, this plant oil were found as similar with the *T. parviflorum* essential oil (germacrene D 9.2% and β-caryophyllene 18.6%) studied in here according to these major constituents. The chemical composition of *Teucrium polium* of essential oil contained trans-caryophyllene (11.8%), germacrene D (11.1%), β-pinene (8.7%), β-pinene (8.6%) and bicyclogermacrene (6.7%) as major components (Dogan, 2008). Although these major components of this plant oil were found as similar with our sample in different quantity and also trans-caryophyllene was not detected in *T. parviflorum* oil. It is concluded that the essential oil of *T. parviflorum* has β-caryophyllene/germacrene D type essential oil. These findings have also ecological and economic significance for utilization of the species in the medicinal, natural product and chemical industries.

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