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Essential Oil Composition of *Stachys antalyensis* Y. Ayasligil and P.H. Davis Described Endemic Species from Turkey

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The essential oil obtained from the aerial parts of Turkish endemic *Stachys antalyensis* Y.Ayasligil and P.H. Davis (Lamiaceae) has been studied. Plant material of *S. antalyensis* was collected from the locality: C3 Çandir (Isparta), Yazili Canyon Nature Park in Turkey. Aerial parts of plants were dried in shadow than the leaves and flowers were separated from the stems. The essential oil was extracted from the leaves and flowers by hydro distillation method. The average content of essential oil was obtained as 0.2 %. The water-distilled essential oil from dried leaves and flowers of this species was analyzed by GC-MS. A total of 19 components, representing 94.5 % of the oil, were characterized. The major component of essential oil was bicyclogermacrene as 29.4 %. The other important compounds were identified such as β-caryophyllene, spathulenol, β-pinene, viridiferol and elemol.

Key Words: *Stachys antalyensis*, Lamiaceae, Essential oil composition, Turkey, Bicyclogermacrene, β-Caryophyllene.

INTRODUCTION

Stachys L. is a large genus comprising over 300 species worldwide and is widely spread throughout Northern Europe and the Mediterranean[1,2]. Seventy two Turkish species of *Stachys* (Lamiaceae) were described by Bhattacharjee[3], nine of them are new species. *Stachys antalyensis* Y. Ayasligil and P.H. Davis, *S. chasmosericea* Y. Ayasligil and P.H. Davis, *S. choruhensis* Kit Tan and Sorger, *S. tundjeliensis* Kit Tan and Sorger[4], *S. anamurensis*[5], *S. sivasica* Kit Tan and Yildiz, *S. baytopiorum* Kit Tan and Yildiz, *S. willemsei* Kit Tan and Hedge[6] and S. cydni Kotschy ex Gemici and Leblebici[7].

The aim of the present study is to investigate the chemical profile of the aerial parts of *S. antalyensis*, which were collected from Turkey. *S. antalyensis*, is a saxatile perennial plant, has 15-40 cm height, ascending-erect stem and whitish flowers. It is endemic to Anatolia, where it grows in Antalya and Isparta province only. This plant prefers conglomerate rocks which consist of cliffs and walls.

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EXPERIMENTAL

The flowering aerial parts of *S. antalyensis* Y. Ayasligil and P.H. Davis were collected in Turkey, C3 Çandir, Yazili Canyon Nature Park, on conglomerate rocks, about 300 m above the sea level at the end of May 2008. A voucher specimen is deposited at ISPO (Herbarium of the Forest Botany Department of Süleyman Demirel University) as Fakir 3925. The aerial parts were dried in the shade at room temperature.

Isolation of the essential oil: Dried aerial parts of the plants (200 g) were ground and submitted to hydrodistillation for 3 h using a Clevenger-type apparatus. The yield of oil was 0.2 %.

GC and GC/MS analysis: GC/MS analysis of the oil was performed using a Hewlett Packard 5973 mass selective detector connected to a Hewlett Packard 6890 series gas chromatograph, using a HP-5MS capillary column (30 m × 0.25 mm i.d., film thickness 0.25 μm). The column temperature was kept at 60 ºC for 5 min and programmed to 220 ºC at a rate of 5 ºC/min. The carrier gas was helium at flow rate of 1 mL/min and MS were taken at 70 eV. The conditions for GC equipped with a flame ionization detector (FID) were the same as for GC/MS.

Identification of components: Retention indices of the oil components were calculated by using retention times of *n*-alkanes that were injected after the oil sample at the same chromatographic conditions. The oil compounds were identified by comparison of their mass spectra with the Wiley library or with data already available in the literature[8-10]. Relative percentage amounts were calculated from the total chromatogram by the computer.

RESULTS AND DISCUSSION

In spite of the large size of genus *Stachys* in Turkey, the composition of the volatile compounds is known in only a small number of species. Few studies refer to the composition of the essential oil within the members of the present study: *S. recta* L. and *S. balansae*[11], *S. athorecalyx*[12], *S. iberica* subsp. stenostachya[13], *S. aleurites*[14], *S. pinardii*, *S. cretica* subsp. mersinaea, *S. aleurites*[15] and *S. laetivirens*[16].

S. antalyensis yielded 0.2 % (w/w, on dry basis) essential oil. This value is comparable with those reported for *S. aleurites* (0.1 %), *S. athorecalyx* (0.1 %), *S. iberica* subsp. *stenostachya* (0.1 %), *S. pinardii* (0.1 %) and *S. cretica* subsp. *mersinaea* (0.02 %)[12-15].

Nineteen components were identified in the essential oil of *S. antalyensis* and listed in Table-1. As can be seen from the Table-1, about 94.5 % of the oil was detected.

Table-1 indicates that the essential oil of *S. antalyensis* contains four monoterpene hydrocarbons (10.8 %), an oxygenated monoterpene (0.8 %), a monoterpene ester (0.9 %), nine sesquiterpene hydrocarbons (55.8 %), an oxygenated sesquiterpene (2.2 %) and three sesquiterpene alcohols (24.0 %).

TABLE-1
COMPOSITION OF THE ESSENTIAL OIL OF
Stachys antalyensis Y. Ayasligil and P.H. DAVIS

Constituent	Retention indices calculated against *n*-alkanes	Percentages calculated from FID data
α-Pinene	946	1.3
β-Pinene	978	8.6
Limonene	1027	0.4
1,8-Cineole	1031	0.8
γ-Terpinene	1059	0.5
Bicycloelemene	1336	2.0
α-Terpinyl acetate	1351	0.9
β-Elemene	1388	0.8
β-Caryophyllene	1418	15.1
α-Humulene	1452	3.4
allo-Aromadandrene	1458	1.0
Germacrene-D	1480	0.9
α-Zingiberene	1489	1.7
Bicyclogermacrene	1494	29.4
β-Himachalene	1497	1.5
Elemol	1547	6.3
Spathulenol	1577	10.7
Caryophyllene oxide	1581	2.2
Viridiferol	1592	7.0
Monoterpene hydrocarbon		10.8
Oxygenated monoterpene		0.8
Monoterpene ester		0.9
Sesquiterpene hydrocarbon		55.8
Oxygenated sesquiterpene		2.2
Sesquiterpene alcohol		24.0

The detected monoterpene hydrocarbon constituents were α-pinene (1.3 %), β-pinene (8.6 %), limonene (0.4 %) and γ-terpinene (0.5 %). The oxygenated monoterpene constituent was 1,8-cineole (0.8 %); the monoterpene ester constituent was α-terpinyl acetate (0.9 %). The sesquiterpene hydrocarbon constituents were bicycloelemene (2.0 %), β-elemene (0.8 %), β-caryophyllene (15.1 %), alloaromadandrene (1.0 %), α-humulene (3.4 %), β-himachalene (1.5 %), germacrene-D (0.9 %), α-zingiberene (1.7 %) and bicyclogermacrene (29.4 %). The oxygenated sesquiterpene constituent was caryophyllene oxide (2.2 %). The sesquiterpene alcohol constituents were elemol (6.3 %), viridiferol (7.0 %) and spathulenol (10.7 %). The major compounds of *S. antalyensis* essential oil were bicyclogermacrene (29.4 %), β-caryophyllene (15.1 %), spathulenol (10.7 %), β-pinene (8.6 %), viridiferol (7.0 %) and elemol (6.3 %).

The major constituent in *S. antalyensis* essential oil was bicyclogermacrene (29.4 %), while oct-1-en-3-ol (33.80 %), β-pinene (24.10 %), β-caryophyllene (29.34 %), oct-1-en-3-ol (18.70 %), non-acasene (23.10 %), linalyl acetate (42.16 %), α-curcumene (34.10 %) and cedrandiol (25.26 %) were found to be major compounds for *S. recta*, *S. balansae, S. aleurites, S. athorecalyx, S. laetivirens, S. iberica* subsp. *stenostachya*, *S. cretica* subsp. *mersinaea* and *S. pinardii*, respectively[11-16].

REFERENCES

1. D.J. Mabberly, The Plant Book, A Portable Dictionary of the Vascular Plants, Cambridge University Press, Cambridge, edn. 2, p. 678 (1997).
2. P. Maria, N.K. Kotsos and S. Mitakou, *Biochem. System. Ecol.*, **35**, 381 (2007).
3. R. Bhattacharjee, in ed.: P.H. Davis, Flora of Turkey and the East Aegean Islands, Edinburgh University Press, Edinburgh, pp. 199-262 (1982).
4. P.H. Davis, R. Mill and T. Kit, Flora of Turkey and East Aegean Islands, Edinburgh University Press, Edinburgh, Vol. 10 (1988).
5. H. Sümbül, *Turk. J. Bot.*, **14**, 55 (1990).
6. B. Yildiz and K. Tan, Thirteen New Species from Turkey, Notes Royal Botanic Garden Edinb., Vol. 45, pp. 439-451 (1988).
7. Y. Gemici and E. Leblebici, *Turk. J. Bot.*, **22**, 359 (1998).
8. R.P. Adams, Identification of Essential Oil Components by Gas Chromatography and Mass Spectroscopy, Allured Publishing Co., Carol Stream, IL (1995).
9. H. Van den Dool and P.D. Kratz, *J. Chromatogr.*, **11**, 463 (1963).
10. A. Bisio, G. Ciarallo, G. Romussi, N. Fontana, N. Mascolo, R. Capasso and D. Biscardi, *Phytother. Res.*, **12**, S117 (1998).
11. A. Çakir, ME. Duru, M. Harmandar, S. Izumi and T. Hirata, *Flav. Fragr. J.*, **12**, 215 (1997).
12. M.E. Duru, A. Cakir, M. Harmandar, S. Izumi and T. Hirata, *Flav. Fragr. J.*, **14**, 12 (1999).
13. A. Kaya, B. Demirci and K.H.C. Baser, Chemistry of Natural Compounds, Vol. 37, No. 4 (2001).
14. G. Flamini, PL. Cioni, I. Morelli, S. Çelik, RS. Göktürk and O. Ünal, *Biochem. System. Ecol.*, **33**, 61 (2005).
15. G. Özkan, R.S. Göktürk, O. Ünal and S. Çelik, Chemistry of Natural Compounds, Vol. 42, No. 2 (2006).
16. H. Duman, M. Kartal, L. Altun, B. Demirci and K.H.C. Baser, *Flav. Fragr. J.*, **20**, 48 (2005).

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