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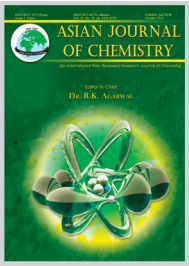

Chemical Composition of Essential Oil of *Tripleurospermum parviflorum* (Willd.) Pobed (Asteraceae) from Turkey

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The chemical composition of essential oil of *Tripleurospermum parviflorum* (Asteraceae) from Turkey was analyzed by gas chromatography and gas chromatography-mass spectrometry system. The yield of the oil is 0.3 mL/100 g. The essential oil composition of *T. parviflorum* was studied and 38 components representing 89.4 % of the total oil were identified. The main components of *T. parviflorum* were β-farnesene (18.4 %), β-sesquiphellandrene (10.1 %), carvacrol methyl ether (7.9 %) and benzene acetaldehyde (7.2 %). The chemical distribution of essential oil compounds of *Tripleurospermum parviflorum* was discussed as potential uses of this species as natural product.

Key Words: *Tripleurospermum*, Asteraceae, Essential oil, β-farnesene, β-sesquiphellandrene.

INTRODUCTION

Numerous members of tribe Anthemideae (Asteraceae) are important ornamental crops, as well as medicinal and aromatic plants. Many of these plants produce essential oils used in folk and modern medicine as well as in the cosmetic and pharmaceutical industries[1]. Asteraceae is one of the largest plant families and many genera and species have worldwide distribution comprising many useful plants, so it has been the subject of chemotaxonomical studies[2]. Anthemideae is a medium-sized tribe in the Asteraceae family[3], comprising 111 genera with *ca*. 1800 species[4] distributed worldwide (extratropical) but with main concentrations in Central Asia, Mediterranean region and Southern Africa[4]. A critical and taxonomically difficult group, *Tripleurospermum* Sch. Bip. is a small genus of *ca*. 38 species and comprises plants often included in the genus *Matricaria* L.[5] There has been some disagreement about the limits of the two genera[6] some do not separate *Tripleurospermum* from *Matricaria*, although the former has one adaxial and two lateral seed ribs and the latter has four or five adaxial seed ribs[7]. It belongs to subtribe *Matricariinae*, which is the largest in the Anthemideae in terms of the number of genera[8].

Tripleurospermum is represented with 26 taxa in the Flora of Turkey[9]. Later, *T. subnivale* Pobed. was recorded for the Flora of Turkey[10] and then the species described *T. ziganaense*[11], brought the total number of *Tripleurospermum* in Turkey to 28 taxa. The species grow in open places, fields and rocky or saline soil and on roadsides, mainly in the Eastern Anatolian region of Turkey. Given the close similarity between its species, ripe achenes are generally necessary for their identification[9]. Anthemideae is one of the most well investigated tribes of the Asteraceae; essential oils, secondary metabolites and medicinally important compounds, have been isolated from species such as *Achillea*[12], *Artemisia*[13], *Tanacetum*[14] and *Gundelia*[15].

Some *Tripleurospermum* species are used as medical purposes, like *T. maritimum* (L.) J. Koch, which is claimed to repel fleas, beetles and other insects[16] or *T. decipiens* Fisch. & Mey. in which saponines with a possible pharmacological application (invasive) have been found[17]. Species from the genus *Tripleurospermum*, include several phenolic compounds, primarily the flavonoids apigenin, quercetin, patuletin and luteolin and their glucosides. According to recent studies, essential oils of this species exhibit antiinflammatory[18], antispasmodic, antiseptic[19,20], antifungal[21], antiulcer[22] and antioxidant[23] activities. The essential oils of aromatic plant that have insecticidal properties can be considered as alternative[24]. Between them there are volatiles with high insecticidal efficiency and low persistence. Most of the active compounds of essential oils are specific to particular insect groups[25] and not to mammals and being many of them also not dangerous to humans[26]. This paper reports the chemical composition of the essential oil of *T. parviflorum* collected in the Eastern Anatolian region of Turkey. The aim of the present study is to

provide chemical data that might be helpful in potential usefulness of this species.

EXPERIMENTAL

Plant material: Plant samples were collected in natural habitats from Elazig-Keban-Pinarlar village steppe, Turkey, on May 2010 at an altidude of 1150-1200 m. A voucher specimen of *T. parviflorum* (FUH-10276) was kept at the Firat University Herbarium (Plant Products and Biotechnology Research Laboratory, PPRL).

Isolation of volatile oil: Air-dried aerial parts of the plant materials were subjected to hydrodistillation using a clevenger-type apparatus for 3 h to yield essential oil.

Gas chromatographic analysis: The essential oil was analyzed using HP 6890 gas chromatographic equipped with an 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 gas chromatography/mass spectrometry. The percentage composition of the essential oils was computed from GC-FID peak areas without correction factors.

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

RESULTS AND DISCUSSION

The chemical composition essential oil of dried aerial parts of *T. parviflorum* was analyzed by mass spectrometry and gas chromatography-mass spectrometry. 0.3 mL oil was obtained from 100 g plant material. The chemical compounds of the essential oil of this plant are shown in Table-1. Thirty eight components representing 89.4 % of the total oil were identified. β-Farnesene (18.4 %), β-sesquiphellandrene (10.1 %), carvacrol methyl-ether (7.9 %) and benzene acetaldehyde (7.2 %) were identified as the major components (Table-1). Among the monoterpenes, carvacrol methyl-ether (7.9 %) was determined as one of the major constituents in this plant. This compound was also reported as a major component in the essential oil of *T. disciforme* (22.46 %) from Iran[27], *T. corymbosum* (18.2 %) from Turkey[28] and in *T. disciforme* (15.6 %) from Iran[29]. Although benzene acetaldehyde (7.2 %) was detected as one of the major components in the essential oil of this species (Table-1) and in *T. disciforme* (9.3 %)[27], it was not detected in either *T. corymbosum*[28] or *T. disciforme*[29]. Dodecanoic acid is also detected in the essential oil of *T. parviflorum* studied, but in amounts less than 3 % (Table-1). It was found as the main constituent of the essential oil of *T. corymbosum* (4.5 %)[28] and in low amounts in *T. disciforme* (0.8 %)[29]. On the contrary, it was not found in other populations of *T. disciforme* in which *p*-methoxy-β-cyclopropylstyrene (18.8 %;16.6 %) were the main[27,29]. *p*-Methoxy-β-cyclopropylstyrene was also reported in the chloroform extract of flowers, stems and roots of *T. callosum*, but less than 1 %[30]. This compound was not reported in the *T. parviflorum* population studied and *T. corymbosum*[28].

TABLE-1
CHEMICAL PROFILES OF
Tripleurospermum parviflorum (WILLD.) POBED

No	Compounds	RRI	Percentage (%)
1	α-Thujene	1016	0.2
2	α-Pinene	1022	2.2
4	Sabinene	1052	0.2
5	β-Pinene	1056	3.9
6	β-Mryrcene	1064	0.4
7	α-Terpinene	1085	0.1
8	Limonene	1096	3.1
9	1,8-Cineole	1098	0.8
10	Benzene acetaldehyde	1103	**7.2**
11	γ-Terpinene	1117	0.5
12	α-Terpineol	1137	2.6
13	Linalool	1148	0.8
14	2-cyclohexen-1-ol	1166	0.1
15	Camphor	1182	2.1
16	Borneol	1189	1.9
17	Cyclohexanone	1195	0.5
18	*cis*-Isopulepone	1202	0.8
19	3-Cyclohexen-1-ol	1205	0.7
20	Carvacrol methyl ether	1246	**7.9**
21	Camphene	1259	1.7
22	α-Cubebene	1333	**4.5**
23	Eugenol	1348	3.5
24	Copaene	1360	1.2
25	β-Bourbonene	1367	0.1
26	*cis*-Jasmone	1373	1.2
27	*iso*-Caryophyllene	1380	1.4
28	β-Caryophyllene	1393	3.2
29	Aromadendrene	1420	1.1
30	α-Cadinene	1458	2.3
31	β-Sesquiphellandrene	1462	10.1
32	Spathulenol	1472	1.4
33	Caryophyllene oxide	1498	1.3
34	Azulene	1540	0.3
35	β-Farnesene	1575	18.4
36	*iso*-Longifolene	1584	0.1
37	2-Pentadecanone	1635	0.1
38	Decanoic acid	1680	2.5
	Total		89.4

Regarding sesquiterpenes, β-farnesene (18.4 %) was found among the main compounds in *T. parviflorum* studied. This compound was detected also as a major constituent of the essential oil of *T. disciforme* (15.6 % and 22.46 %, respectively)[27,29] and in *T. corymbosum* (18.2 %)[28]. It was also found in the chloroform extract of flowers, stems and roots of *T. callosum*[30], but in amounts less than 1 %. β-Sesquiphellandrene was detected as one of the major compounds of the studied

T. parviflorum (10.1 %), like in *T. disciforme* (15.4 % and 17.85 %, respectively)[29,27] and of *T. corymbosum* (6.4 % in 28). Another sesquiterpene, α-cadinene has also been determined in the oil of *T. parviflorum* in 2.3 % (Table-1). It was one of the major compounds of *T. corymbosum* (7.2 %)[28]. Other sesquiterpene components such as 1-epi-cubenol and (E)-γ-bisabolene were reported among the major sesquiterpene components of *T. corymbosum* (16.1 % and 4.6 %, respectively)[28], although they were not found in our *T. parviflorum* essential oil (Table-1) neither in *T. disciforme*[27,29]. The essential oil of *T. disciforme* contained spathulenol (9.7 %) as the predominant constituent[29], but it is determined in *T. parviflorum* essential oil as minor component (1.4 %), similarly to the concentration of this sesquiterpene in the different developmental stages of *T. disciforme* essential oil (prior, during and after flowering: 0.93 %, 1.35 %, 1.48 % respectively)[27]. While caryophyllene oxide (1.3 %) was identified as minor component in *T. parviflorum* (Table-1) and in *T. disciforme* essential oil analyzed in different developmental stages (prior, during and after flowering (0.92, 1.36 and 1.14 % respectively)[27], this compound was not determined in the oil of *T. disciforme*[29]. In the same line, Javidnia *et al.*[29] demonstrated that sesquiterpenes were the main components (57 %) of the essential oil of *T. disciforme* and among these, sesquiterpene hydrocarbons were the major group in this oil (45.5 %). The studies mentioned previously display the different oil chemotypes, which strongly correlate with a different geographical origin, plant taxa and material, the vegetative period and method used for isolating the essential oils[27].

Conclusion

This paper reports the chemical composition of *T. parviflorum* collected from eastern Anatolian region in Elazig from Turkey and comments the pattern of distribution of the essential oil compounds within some species of the genus. The aerial parts of *T. parviflorum* could be a good source of β- farnesene and β-sesquiphellandrene, considering the compositional concentration. Research with other *Tripleurospermum* species have showed different type of essential oil composition, like β-farnesene/β-sesquiphellandrene/*p*-methoxy-β-cyclopropylstyrene in *T. disciforme*[27]; *p*-methoxy-β-cyclopropylstyrene/(E)-β-farnesene/β-sesquiphellandrene in *T. disciforme*[29] and (Z)-β-farnesene/1-epi-cubenol/β-patchoulene in *T. corymbosum*[28]. Regarding our research with *T. parviflorum*, it can said that, it has the β-farnesene/β-sesquiphellandrene/carvacrol methyl ether chemotype from Eastern Anatolian region of Turkey.

REFERENCES

1. J.A. Teixeira da Silva, *Afr. J. Biotech.*, **3**, 706 (2004).
2. K. Bremer, *Timb. Port.*, **10**, 295 (2004).
3. J. Vall, T. Garnatje, S. Garci, M. Santz and A. Korobkov, *Bot. J. Linn. Soc.*, **148**, 77 (2005).
4. C. Oberprieler, R. Vogt and L.E. Watson, in eds.: J.W. Kadereit and C. Jeffrey, In: The Families and Genera of Vascular Plants VIII, Flowering Plants, Eucots, Asterales. XVI. Tribe Anthemideae Cass.Springer Berlin, Vol. 8, pp. 342-374 (2007).
5. W.L. Applequist, *Taxon.*, **51**, 757 (2002).
6. K. Bremer and C. Humphries, *Botany Series*, **23**, 71 (1993).
7. K. Bremer, Portland, OR: Timber Press (1994).
8. S. Garcia, H. Inceer, T. Garnatje and J. Valles, *Biol. Plant.*, **49**, 381 (2005).
9. P.H. Davis, Flora of Turkey and East Aegean Islands. University Press, Edinburgh, **5**, 193 (1975).
10. H. Inceer and O. Beyazoglu, *Turk. J. Bot.*, **28**, 599 (2004).
11. H. Inceer and S.A. Hayirlioglu, *Bot. J. of Linn. Soc.*, **158**, 696 (2008).
12. A. Kocak, E. Bagci and A. Bakoglu, *Asian J. Chem.*, **22**, 3653 (2010).
13. E. Bagci, M. Kursat and S. Civelek, *J. Essen. Oils Bearing Plants*, **13**, 66 (2010).
14. E. Bagci, *Asian J. Chem.*, **21**, 6547 (2009).
15. E. Bagci, S. Hayta, O. Kilic and A. Kocak, *Asian J. Chem.*, **22**, 6239 (2010).
16. E. Herrera, Mexico State New University Guide H., p. 221 (1995).
17. F. Mojab, M. Kamalinejad, N. Ghaderi and H.R. Vahidipour, *Iran J. Pharm. Res.*, **2**, 77 (2003).
18. M. Hosseini, S. Parvini and A. Bakhtiarian, *Tox. Lett.*, **172**, 47 (2007).
19. B. Grainger and M. Wichtl, Herbal Drugs and Phytopharmaceuticals. Medpharm, Stuttgart: Scientific Publishers (2004).
20. D.N. Ghassemi, G.H.R. Amin, R. Rahiminejad, M. Salehi and A. Jafarpisheh, *Res. Build.*, **4**, 42 (2003).
21. G. Amin, A. Dehmoobed-Sharifabadi, M.S. Salehi Surmaghi, N. Yasa and Y. Ayenechi, *Daru*, **10**, 38 (2004).
22. M. Minaiyan, D.N. Ghassemi and B. Mohammadzadeh, *Res. Pharm. Sci.*, **1**, 15 (2006).
23. E. Souri, P. Sarkhail, P. Kaymanesh, M. Aminil and H. Farsam, *Pharm. Bio.*, **43**, 620 (2005).
24. R.C. Regnault, B.J. Philogène and C. Vincent, Biopesticides d'origine végétale. Paris: TecDoc Editions, Lavoisier, p. 337 (2002).
25. Y. Huang, J.M. Tan, R.M. Kini and S.H. Ho, *J. Stor. Prod. Res.*, **33**, 289 (1997).
26. B. Dal, G. Padin, L. Lopez and C.M. Fabrizio, *J. Stor. Prod. Res.*, **37**, 77 (2001).
27. A. Chehregani, F. Mohsenzadeh, N. Mirazi, S. Hajisadeghian and Z. Baghali, *Pharm. Biol.*, **48**, 1280 (2010).
28. E. Ozturk, H. Ozer, A. Cakir, E. Mete, A. Kandemir and T. Polat, *J. Essent. Oil Bear. Plant.*, **13**, 148 (2010).
29. K. Javidnia, R. Miri and A.R. Khosravi, *Chem. Nat. Comp.*, **44**, 800 (2008).
30. A. Yasar, O. Ucuncu, C. Gulec, H. Inceer, S. Ayaz and N. Yayli, *Pharm. Biol.*, **43**, 108 (2005).