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Original Article

Chemical Composition of the Essential Oil of *Tanacetum uniflorum* (Fisch. & C.A. Mey. ex DC.) Sch.Bip. from (Salmas) North-West of Iran

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Abstract

The genus *Tanacetum* L. belongs to the *Asteraceae* family and *Anthemideae* tribe is one of the most important medicinal plants that contains 26 species in Iran, 12 of them are endemic. This paper reports the essential oil composition of *Tanacetum uniflorum* (Fisch. & C.A. Mey. ex DC.) Sch.Bip. growing spontaneously in Salmas (North-West of Iran). Essentail oil extracted by water distillation and steam distillation from Plant on flowers and leaves were collected on July - 2016. The yields of water distillation from leaf were 0.12% and flower were 1.16% (V/W), and by steam distillation from leaf were 0.33% and flower were 0.76% (V/W), respectively, then samples were analyzed by GC and GC/MS. Main components obtained from water distillation from leaf were manoyl oxide 28.87% , α-cadinol 9.7% and γ-eudesmol acetate 4.77% and in flower were methyl pentanoate 88.28%, butyl acetate 5.13% and iso-dihydro carveol acetate 1.19% (V/W), and by steam distillation from leaf were γ- terpinene 17.99%, endo-fenchyl acetate 9.63% and butyl acetate 8.12% and in flower were methyl pentanoate 79.9%, bulnesol 2.70% and (E)-nerolidolol acetate 2.69% obtained, respectively.

Keywords: *Tanacetum uniflorum* (Fisch. & C.A. Mey. ex DC.) Sch.Bip., Essential oil, Water distillation, Steam distillation

Introduction

Several studies have shown that essential oils (EO) from some plant species present an anti-prolifertaive activity. The genus *Tanacetum* L., which is an important member of the *Asteraceae* family, is widespread in Europe and western Asia and exists in about 150-200 species. These species have traditionally been used as a spicy additive for food, in cosmetic and as herbal remedies [1]. These species have traditionally been used as a spicy additive for food, in cosmetics and as herbal remedies due to their biologically active compounds and many infectious diseases are known to be treated with herbal remedies throughout the history of mankind [2-5]. Previous chemical investigations on different species of *Tanacetum* L. have been shown the presence of acetylenes [7], flavonoides [8], sesquiterpene lactones and essential oils [10-12]. The essential oil of *Tanacetum fruticulosum* C.B.Clarke (A synonym of *Tanacetum gracile* Hook.f. & Thomson) from Iran was investigated by GC, GC/MS and NMR spectroscopy. Some new farnesyl derivatives were identified by their NMR spectra [12].

Nasiri *et al*. 2014, studied on chemical composition on essential oil of *Tanacetum uniflorum* (Fisch. & C.A. Mey. ex DC.) Sch.Bip. growing spontaneously in north-west of Iran. The essential

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oil was isolated by hydrodistallation from the aerial flowering parts and analyzed by GC and GC-MS. In total, 28 components representing about 99.2% of its composition were identified. Major components were 1,8-cineole 48%, camphor 15%, spathulenol 8.4% and germacrene D 3.2% [13] .

Rezaee, *et al*. 2012, studied on chemical composition of the essential oil of three *Tanacetum* L. species from north-west of Iran, on three species *Tanacetum angulatum* Willd. *Tanacetum canacens* DC. and *Tanacetum pinnatum* Boiss. growing wild in Iran. Plant flowers and leaves were collected from different locations of north- west of Iran. Samples were hydro-distilled to produce the oils in the yields *(v/w)* of 0.4% for leaves and 0.02% for flowers for both *T. angulatum* and *T. canacens*, collected from Azerbaijan province (Tabriz), in of 0.05% for leaves and 0.2% for flowers *T. pinnatum* from Zanjan province (Zanjan). Main oil components of *T angulatum* Willd. identified by GCIMS for leaves were 1,8-cineole (75.3%), camphor (8.1%) and for flowers were 1,8-cineole (66.0%), camphor (9.0%). For *T. canacens*, main oil components of leaves were 1,8-cineole (25.3%), u- calacorene (7.9%) and for flowers were n-eicosane (19.7%), u- calacorene (13.3%). Main oil constituents of *T. pinnatum* leaves were camphor (24.2%), o-calacorene (13.3%), and for flowers were germacrene B (33.0%), n-eicosane (10.5%) [14].

Rezaee, *et al*. 2013, published composition of the essential oil of *Tanacetum polycephalum* subsp. *polycephalum* from different locations of Azerbaijan province, Iran. Flowers and leaves were collected from different location of Azerbaijan province (Marand, Mianeh and Tabriz), hydro-distilled to produce the oils and analyzed by gas chromatography/mass spectrometry (GC/MS). The yields of leaves and flowers oils were in the range of 0.04 -1.0% (V/W). Main components of leaves essential oil from Marand, Mianeh and Tabriz were 1,8-cineole (63.5%) and chrysanthenone (5.5%), while for flowers were chrysanthenone (39.5%) and 1,8-cineole (18.9%). For Mianeh sample, principal components of leaves were 1,8-cineole (34.8%) and chrysanthenone (16.1%) and for flowers were dihydro-eudesmol (12.0%) and nootkatin (9.6%). Camphor (29%) and 1,8-cineole (14.3%) were identified as the main constituents of plant leaves from Tabriz and for flowers were trans-sabinene hydrate (56.7%), and 1,8-cineole (10.7%) [15]. The present work presents the chemical composition of *Tanacetum uniflorum* (Fisch. & C.A. Mey. ex DC.) Sch.Bip. from (Salmas) North-West of Iran. origin and results are compared to those reported in the literature.

Material and Methods

Plant Material

The plant of *Tanacetum uniflorum* (Fisch. & C.A. Mey. ex DC.) Sch.Bip. from (Salmas) North-West of Iran, were collected, from salman in, Azarbaijan west province, Iran at altitude of 1700 m on july 2015. Samples were collected by M.Golipour and identity of the plant was determined by V.Mozaffarian in Iranian Botanical Garden (IBG). The samples were extracted by water distillation and steam distillation from flowers and leaves Plant. The yields of essences with method of water distillation from leaf were 0.12% and flower were 1.16% (V/W), and by method of steam distillation from leaf were 0.33% and flower were 0.76% (V/W), then samples were analyzed by GC and GC/MS.

GC Analysis: GC analysis was performed on a Shimadzu 15A gas chromatograph equipped with a split/splitless injector and a flame ionization detector at 250°C. N_2 was used as a carrier gas (1 mL min^{-1}) and a DB-5 type was utilized as the capillary (50 mx0.2 mm, film thickness 0.32 µm). Temperature within the column for 3 min was retained at 60°C, after that the column was heated at a rate of 5°C min^{-1} until it reached at 220°C and maintained in this condition for 5 min. The percentages of relative amounts were calculated from peak area using a shimadzu C-R4A chromatopac without applying correction factors.

Gas Chromatography - Mass Spectrometry

The GC/MS unit consisted of a Varian Model 3400 gas chromatograph coupled to a Saturn II ion trap detector was used . The column was same as GC, and the GC conditions were as above. Mass spectrometer conditions were: ionization potential 70 eV; electron multiplier energy 2000 V.

The identity of the oil components was established from their GC retention indices, relative to C_7- C_{25} n-alkanes, by comparison of their MS spectra with those reported in the literature [16-18], and by computer matching with the Wiley 5 mass spectra library, whenever possible, by co-injection with standards available in the laboratories.

Table 1 Essential oil composition of *Tanacetum uniflorum* (Fisch. & C.A. Mey. ex DC.) Sch.Bip. from North-West of Iran by methods of water and steam distillation

Compounds name	R.I.	Water distillation		Steam distillation	
		Flower	Leaf	Flower	Leaf
Butyl acetate	811	5.13	0.89	2.16	8.12
Methyl pentanoate	826	88.28	-	79.9	-
Isovaleric acid	834	0.67	-	0.52	-
(E)-3- hexenol	854	-	-	0.65	-
α- pinene	945	-	0.57	-	-
β - pinene	978	-	-	-	1.70
(Z) - β –ocimene	1043	-	-	-	0.71
(E) - β –ocimene	1053	-	2.68	0.72	6.54
γ- terpinene	1067	-	-	0.33	17.99
α- terpinolene	1084	-	-	-	1.99
Trans-sabinene hydrate	1097	-	-	-	5.40
n-undecane	1100	-	-	-	2.48
Trans-thujone	1111	-	-	-	1.46
Cis-limonene oxide	1135	0.36	-	0.19	7.86
Isoborneol	1150	0.34	-	-	4.11
Borneol	1165	-	-	-	4.28
Terpin-4-ol	1173	-	-	-	0.62
n-decanal	1202	-	-	0.11	6.25
Trans-carveol	1214	-	-	-	1.05
Endo-fenchyl acetate	1225	-	-	-	9.63
Cis-carveol	1230	-	-	-	1.95
Carvone	1241	-	-	-	5.87
Trans-sabiene hydrate acetate	1255	1.35	1.01	-	1.17
Cis-chrysanthenyl acetate	1263	-	-	-	2.19
n-decanol	1275	-	-	-	0.89
Methyl acetate	1294	-	0.55	-	3.21
Iso-dihydro carveol acetate	1320	1.19	1.88	-	0.46
Methyl undecanoate	1425	0.29	0.69	-	-
β- humulene	1440	-	1.08	0.72	-
α- acoradiene	1464-7	-	1.33	---	0.41
Germacrene D	1480	-	1.60	0.62	-
Methyl dodecanoate	1525	-	0.61	-	-
α- calacorene	1545	-	2.83	-	-
Germacrene B	1556	-	3.04	-	-
α- cadinol	1651	0.53	9.7	0.82	2.10
Bulnesol	1668	0.53	3.32	2.70	0.82
α- caryophyllene	1694	-	1.16	-	-
n-heptadecane	1706	-	1.53	0.74	-
(E)- nerolidolol acetate	1716	-	1.41	2.69	-
(E, Z)-farnesol	1738	0.93	4.06	0.68	0.57
α- sinensal	1753	-	0.94	-	-
Cedryl acetate	1765	-	1.21	-	-
γ – eudesmol acetate	1775	-	4.77	-	-
Iso-longifolol acetate	1815	-	2.48	-	-
(Z)- lanceol acetate	1865	0.35	2.94	0.57	-
Calalponone	1888	-	0.87	-	-
n-nonadecane	1912	-	1.31	-	-
Phytol	1948	-	0.93	-	-
1-eicosene 1988	1989	-	28.87	-	-
n-eicosane	2010	-	-	-	-
n-heneicosane	2111	-	-	-	-
Methyl octadecanoate	2131	-	2.51	-	-
Incensole acetate	2176	-	3.34	-	-
Ethyl octadecanoate	2184	-	3.00	-	-
Octadecanol acetate	2210	-	1.20	0.38	-
Dehydro abietal	2261	-	---	1.16	-
n-tricosane	2310	-	0.92	-	-
Trans-ferruginol	2331	-	1.16	-	-

Results and Discussion

The genus *Tanacetum* L. belongs to the *Asteraceae* family and *Anthemideae* is one of the most important medicinal plants that contains 26 species in Iran, 12 of them are endemic. Some earlier works have been reported on the essential oils of various *Tanacetum* L. species [19,20,21]. In addition the volatile compounds from *T. vulgare* L. have been examined in detail [22,23]. This paper reports the essential oil composition of *Tanacetum uniflorum* (Fisch. & C.A. Mey. ex DC.) Sch.Bip. growing spontaneously in Salmas (North-West of Iran). Essentail oil extracted by water and steam distillation from Plant on flowers and leaves were collected on July - 2015. The essential oil yields of water distillation from leaf were 0.12% and flower were 1.16% (V/W), and by steam distillation from leaf were 0.33% and flower were 0.76% (V/W), then samples were analyzed by GC and GC/MS. Main components obtained from water distillation of leaf were manoyl oxide 28.87% , α-cadinol 9.7% and γ-eudesmol acetate 4.77% and in flower were methyl pentanoate 88.28%, butyl acetate 5.13% and iso-dihydro carveol acetate 1.19% (V/W), and Main components by steam distillation from leaf were γ- terpinene 17.99%, endo-fenchyl acetate 9.63% and butyl acetate 8.12% and in flower were methyl pentanoate 79.9%, bulnesol 2.70% and (E)-nerolidolol acetate 2.69%.

With compare our work with Nasiri *et al*. 2014, studied on chemical composition on essential oil of *Tanacetum uniflorum* (Fisch. & C.A. Mey. ex DC.) Sch.Bip. growing spontaneously in north-west of Iran. The essential oil was isolated by hydrodistallation from the aerial flowering parts and analyzed by GC and GC-MS. In total, 28 components representing about 99.2% of its composition were identified. Major components were 1,8-cineole 48%, camphor 15%, spathulenol 8.4% and germacrene D 3.2% [13], which results components are different in our study, Sonboli *et al*. 2014 extracted essential oil from the aerial flowering parts but we extracted essential oil from flowers and leaves seperately and major compound in flower were methyl pentanoate, commonly known as methyl valerate, is the methyl ester of pentanoic acid (valeric acid) with a fruity odor. Methyl pentanoate is commonly used in fragrances and insecticide [24].

Results shows difference in leaf between methods of distillation in water distillation major components were 1-eicosene (28.87%) but in steam distillation were γ- terpinene 17.99%, endo-fenchyl acetate 9.63% and butyl acetate 8.12% and cis-limonene oxide 7.86%. But for flower major compound were methyl pentanoate in water distillation 88.28% and in steam distillation were 79.9%, which show not much changes but compounds in leaf because of methods of distillation are very changed able.

References

1. Rohloff J, Mordal R, Dragland S. Chemotypical variation of Tansy (Tanacetum vulgare L) from 40 different locations in Norway. J Agric Food Chem. 2004;52: 1742-48.
2. Nezhadali A, Akbarpour M, Zarrabi Shirvan B., Chemical composition of the essential oil from the aerial parts of Artemisia Herba., E-J Chemistry. 2008;5:557-561.
3. Nezhadali A, Soleymani Roudi B, and Akbarpour M,. Chemical composition of the essential oils from the flower of *Tanacetum Polycephalum* Subsp. *Duderanum* as a herbal plant in Iran, Der Pharma Chemica. 2009;1: 27-31.
4. Nezhadali A, Khazaeifar A, Akbarpour M, and Masrournia M,. Chemical composition of essential oil and antibacterial activity of Dracocephalum subcapitatum, J Essent Oil Bearing Plan. 2010;13:112-117.
5. Nezhadali A, Akbarpour M, Zarrabi Shirvan B and Mousavi M, Comparison of volatile organic compounds of Thymus vulgaris using hydrodistillation and headspace solid phace microextraction gas chromatography mass spectrometry, J Chinese Chem Soc. 2010;57:40-43.
6. Bohlman, F., Fanglänel, L., Kleine, K.M., Kramer, H.D., Mönch, H. and Schuber, J. Über neue polyine der Gattung *Chrysanthemum* L. Chem. Ber. 1965;98:2596-2597.
7. Harborne, J.B., Heywood, V.H. and Saleh, N.A.M. Chemosystematics of the Compositae: flavonoid patterns in the *Chrysanthemum* complex of the tribe Anthemidae. Phytochemistry. 1970;9:2011-2016.
8. Rustaiyan A., Zare, K., Habibi, Z. and Haschemi, M. Germacranolides from *Tanacetum polycephalum.* Phytochemistry. 1990;29:3022-3023.
9. Rustaiyan A., Mojab, F., Salsali, M., Masoudi, S. and Yari, M. Composition of the essential oil of *Tanacetum polycephalum* Schultz. Bip J Essent Oil Res. 1999; 11:497-498.
10. Majed-Jabari T., Vatanpour, V., Rustaiyan, A. and Monfared, A.Composition of the essential oil of *Tanacetum khorassanicum* (Krasch.) Parsa. a new species from Iran. J. Essent. Oil Res. 2002;14:380-381.
11. Monfared A., Davarani, S., Rustaiyan, A. and Masoudi, S. Composition of the essential oil of *Tanacetum*

balsamitoides (Schultz Bip.) Grierson from Iran. J. Essent. Oil Res. 2002:14:1-2.
12. Weyerstahl P., Marschall, H., Thefeld, K. and Rustaiyan, A. Constituents of the essential oil of *Tanacetum* (syn. *Chrysanthemum*) fruticulosum Ledeb. from Iran. Flav Frag J. 1999;14:112-120.
13. Nasiri N., Sonboli A., Aliahmadi A. The effect of antimicrobial essential oils of two species of the genus *Tanacetum uniflorum* and *T. .chiliophylum var. Heimerlii*, The second National Conference of medicinal plants and sustainable agriculture, Community Environmental Assessment, Hamedan ,Iran, 2014. http://www.civilica.com/Peper- MPSA02-514.html
14. Rezaee MB., Jaimand K, and Naderi M, Chemical Composition of the Essential Oil of Three Tanacetum Species from North-West of Iran., J Med Plants By-prod. 2014;2:79-82.
15. Rezaee MB., Jaimand K, and Naderi M, Chemical Composition of the Essential Oil of *Tanacetum polycephalum* subsp. *polycephalum* from Different Locations of Azerbaijan Province, Iran., J Med Plants By-prod. 2012;1:71-74
16. Shibamoto T, Retention Indices in Essential Oil Analysis. In: Capillary Gas Chromatography in Essential oil analysis. Edits., P.Sandra and C.Bicchi, ,Dr. Alfred Huethig Verlag, Heidelberg,. 1987;259-274.
17. Davies N.W, Gas Chromatographic Retention Index of Monoterpenes and Sesquiterpenes on Methyl silicone and Carbowax 20 M phases. J. Chromatogr. 1990;503:1-24.
18. Adams R.P, Identification of essential oils by Ion trap Mass Spectroscopy. Academic Press, San Diego, CA.1989.
19-Akpulat, H.A., Tepe, B., Sokmen, A., Daferera, D. and Polissiou, M. Composition of the essential oils of Tanacetum argyrophyllum (C.Koch) Tvzel. Var. argyrophyllum and Tanacetum parthenium (L.) Schultz Bip. (Asteraceae) from Turkey. Biochem. Syst. Ecol. 2005;33:511-516.
20. Beauchamp, P., Dev, V., Kashyap, T., Melkani, A., Mathela, C. and Bottini, A.T. Composition of the essential oil of Tanacetum nubigenum Wallich ex DC. J. Essent. Oil Res. 2001;13:319-323.
21. Goren, N., Demirci, B. and Baser, K.H.C. Composition of the essential oils of Tanacetum spp. from Turkey. Flav Fragr J. 2001; 19:191-194.
22. Keskitalo, M., Pehu, E. and Simon, J.E. Variation in volatile compounds from tansy (Tanacetum vulgare L.) related to genetic and morphological differences of genotypes. Biochem Syst Ecol. 2002; 29:267-285.
23. Judzentiene, A. and Mockute, D. The inflorescence and leaf essential oils of Tanacetum vulgare L. var. vulgare growing wild in Lithuania. Biochem Syst Ecol. 2005; 33:487-498.
24. Merck Index, 12th Edition, 10042. 1996.