Available online on www.ijppr.com
International Journal of Pharmacognosy and Phytochemical Research 2016; 8(9); 1545-1548

ISSN: 0975-4873

Research Article

Essential Oil Composition of *Centaurea choulettiana* Pomel (Asteraceae) from Algeria

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Available Online : 10th September, 2016

ABSTRACT
The essential oil of air-dried flowers of *Centaurea choulettiana* Pomel was obtained by steam distillation and was analyzed by GC and GC–MS. Forty components were identified in the essential oil with the sesquiterpenes were the most abundant class of compounds (32.61%). Carbonylic compounds were also identified in high quantities (24.6%), while Hydrocarbons were found in low quantities (14.85%). However, oxygenated monoterpenes were present in lower quantities with a percentage of 3.41%.

Keywords: Essential oil, sesquiterpenes, monoterpenes, *Centaurea choulettiana*, Asteraceae.

INTRODUCTION

The genus *Centaurea* belonging to the Asteraceae family, contains more than 700 species distributed all over the world. In Algeria, It is represented by 45 species[1]. Among them, *Centaurea choulettiana* Pomelis an endemic species with a limited geographical area. It is a perennial, flowering plant and often synonymous with *Centaurea acaulis* L. ssp. *Balansae* Boiss. et Reut.[1]. There is no previous report on the volatile constituents of *C. choulettiana*. A literature survey showed that the volatile constituents of many species of the genus *Centaurea* are the main groups of metabolites studied in this genus[2-8]. The composition of essential oils of *Centaurea* species are frequently characterized by components having sesquiterpenes skeleton such as caryophyllene, eudesmol, germacrene and spathulenol[9-11]; hydracarbons with alkanes skeleton such as tricosane, pentacosane, heptacosane and nonacosane[10-12]; fatty acids such as hexadecanoic acid, tetradecanoic acid, dodecanoic acid[13,14] and monoterpenes aspinene, terpinene, carvacrol[14,15] as the major compounds. To the best of our knowledge, this is the first report on the composition of essential oil extracted from the flowers of *Centaurea choulettiana* from Algeria.

EXPERIMENTAL

Plant materiel

The flowers of *Centaurea choulettiana* were collected in May 2013 from the M'Sila region and authenticated by Dr. Sarri Djamel, Department of Biology, M'Sila University, Algeria according to Quezel and Santa (Quezel and Santa, 1963). A voucher specimen has been deposited in the Herbarium of the VARENBIOMOL research unit, University of Frères Mentouri Constantine (CCA/05/2013).

Extraction of the essential oil

The flowers (200g) of *Centaurea choulettiana* were subjected to steam distillation in a Kaiser Lang apparatus for three hours. The obtained essential oil was collected and dried over anhydrous sodium sulfate and kept at 4°C until analysis. The yield of the oil was calculated in relation of the dry weight of the plant.

GC and GC-MS analysis

The essential oil was analyzed on an Agilent gas chromatograph (GC-FID) Model 6890, equipped with a HP-5 MS fused silica capillary column having (5%-phenyl) methylpolysyloxane stationary phase (25 m x 0.25 mm, film thickness 0.25 µm), programmed from 50°C (5 mn) to250 °C at 3°/mn and held for 10 mn. Injector and flame ionization detector temperatures were 280 and 300 °C, respectively. The essential oils was diluted in acetone 3.5% (v/v) and injected in split mode (1/60), hydrogen was used as a carrier gas (1.0 mL/mn). Solutions of standard alkanes (C8-C20) were analyzed under the same conditions to calculate retention indices (RI) with Van delDool and Kratz equations. Mass spectrometry was performed on an Agilent gas chromatograph-mass spectrometer (GC/MS) Model 7890/5975, equipped with HP-5 capillary column (25 m x 0.25 mm, film thickness 0.25 µm) programmed with the same conditions as for GC-FID. The mass spectrometer (MS) was in electron impact mode at 70 eV and electron multiplier was at 2200 V. Ion source and MS quadrupole temperatures were 230°C and 180°C, respectively. Mass spectral data were acquired in the scan mode in the *m/z* range 33-450. The essential oil

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Table 1: Components of the essential oil from the flowers of *Centaurea choulettiana* Pomel.

Peak No	Compounds	[a]RT	[b]RI	%
1.	Linalool	8.72	1097	0.43
2.	Nonanal	8.76	1099	0.46
3.	trans verbenol	9.65	1147	0.68
4.	Safranal	10.49	1192	1.11
5.	Decanal	10.60	1198	1.14
6.	Verbenone	10.67	1202	0.75
7.	4-methylene isophorone	10.95	1217	0.46
8.	tridecan-1-ene	12.16	1287	1.63
9.	alpha copaene	13.69	1380	1.85
10.	beta caryophyllene	14.23	1414	0.51
11.	10-epi-beta-acoradiene	15.12	1472	0.58
12.	Ar-curcumene	15.18	1476	0.47
13.	pentadecan-1-ene	15.27	1482	0.78
14.	1,5-epoxysalvial-4(14)-ene	16.62	1574	6.60
15.	Spathulenol	16.66	1577	1.78
16.	caryophyllene oxide	16.76	1584	4.28
17.	salvial-4(14)-en-1-one	16.90	1594	1.18
18.	beta oplopenone	17.06	1605	0.56
19.	nor-copaanone	17.10	1609	0.91
20.	humulene epoxide II	17.14	1611	0.88
21.	epi-alpha muurolol	17.49	1638	0.87
22.	beta eudesmol	17.68	1652	6.77
23.	7-epi-α-eudesmol	17.79	1661	3.08
24.	germacra-4(15),5,10(14)-trien-1-alpha-ol	18.17	1689	2.29
25.	Pentadecanal	18.44	1710	0.83
26.	Hexadecanal	19.76	1808	0.51
27.	6,10,14-trimethyl-pentadecane-2-one	20.13	1838	2.87
28.	Phthalate	20.43	1862	1.07
29.	heptadecanal + methyl hexadecanoate	21.01	1909	0.39
30.	Phthalate	21.71	1968	17.31
31.	Nonadecanal	23.27	2104	0.41
32.	Docosane	24.14	2184	0.24
33.	tricosan-1-ene	24.91	2258	0.72
34.	Tricosane	25.19	2284	3.31
35.	Tetracosane	26.19	2383	0.61
36.	Pentacosane	27.16	2483	2.57
37.	Hexacosane	28.08	2581	0.22
38.	Heptacosane	28.99	2672	3.06
39.	Octacosane	29.85	2698	0.24
40.	Nonacosane	30.69	2695	1.47
Oxygenated monoterpenes				3.42
Sesquiterpene hydrocarbons				3.41
Oxygenated sesquiterpenes				29.21
Hydrocarbons alkanes				14.85
Carbonylic compounds				6.22
Phtalate				18.38
Total				75.49

[a]Compounds listed in order of their RT

[b]RI (retention index) measured relative to n-alkanes (C8-C20) using HP-5 ms

constituents were identified by matching their mass spectra and retention indices (RI) with those of reference compounds from libraries such as Adams[16] and McLafferty & Stauffer[17]. The proportions of the identified compounds were calculated by internal normalization.

RESULTS AND DISCUSSION

The essential oil of the flowers of *C. choulettiana* was obtained in yield of about 0.02% (v/w) based on dry weight. The chemical composition of the essential oil, the retention time, the retention indices and the percentage content were given in Table 1. A total of forty constituents, representing 75.49 % of the oil were identified and distributed into five chemical classes. The main constituents in this oil were phtalate (18.38%),

sesquiterpenes (32.62%) from which oxygenated sesquiterpenes were the most present with a percentage of 29.21%, hydrocarbons (14.85%) followed by carbonylic compounds with a percentage of 6.22%, while oxygenated monoterpenes were presented only with a total of 3.42%. However, β-eudesmol (6.8%), 1,5-epoxysalvial-4(14)-ene (6.6%), caryophyllene oxide (4.28%) and epi-α-eudesmol (3.08%) were the most oxygenated sesquiterpene present in the essential oil. Tricosane (3.31%), heptacosane (3.06%) and pentacosane were the most hydrocarbons present. In accordance with the results obtained in previous studies on essential oils from other *Centaurea* species, the oil was characterized by a high content of oxygenated sesquiterpenes, as it can be seen that β-eudesmol and caryophyllene oxide were the main constituents in several *Centaurea* species such as *C. mucronifera* (17.4% and 5.2%) respectively[2], *C. aladaghensis* (11.8% and 7.5%) respectively[18], *C. gracilenta* (12.8% and 6.7%) respectively[19] and *C. ensiformis* (29.8% and 7.6%) respectively[20]. Furthermore, caryophyllene oxide has been reported as the main compound (38.5%) from *C. pullata* essential oil from Algeria[21]. On the other hand, it is worthy to point out that monoterpene hydrocarbons were totally absent from this oil as well as from *C. pullata* and *C. grisebachii* subsp. *Grisebachi* oils[21]. Fatty acids were also absent from the essential oil of *C. choulettiana* while, they were found in considerable quantities in other *Centaurea* species[22,23].

CONCLUSIONS

The essential oil of *C. choulettiana* Pomel, collected from M'Sila region was characterized by the main presence of phtalate (18.38%), β-eudesmol (6.8%), 1,5-epoxysalvial-4(14)-ene (6.6%), caryophyllene oxide (4.28%), tricosane (3.31%), epi-α-eudesmol (3.08%) and heptacosane (3.06%). We also note that the hydrocarbons monoterpenes and fatty acids were totally absent from this oil. Comparative study of the main volatiles identified in *Centaurea* species showed that *C. choulettiana* had a unique oil composition.

ACKNOWLEDGEMENTS

This investigation was financially supported by the Algerian Ministry of Higher education and Scientific Research (MESRS).

REFERENCES

1. Quezel P and Santa S. *Nouvelle Flore de l'Algérie et des Régions Désertiques et Méridionales*. Edition CNRS, Tome II, Paris, 1963, 1016.
2. Dural H, Bagci Y, Ertugrul K, Demirelma H, Flamini G, Cioni PL, Morelli I. Essential oil composition of two endemic *Centaurea* species from Turkey *Centaurea mucronifera* and *Centaurea chrysantha* collected in the same habitat. *Biochemical Systematics and Ecology* 2003; 31: 1417–1425.
3. Ertugrul K, Dural H, Tugay O, Flamini G,Cioni PL, Morelli I. Essential oils from flowers of *Centaurea kotschyi* var. *kotschyi* and *C. kotschyi* var. *decumbens* from Turkey. Flavour and Fragrance Journal 2003; 18: 95–97.
4. Kose YB, Altintas A, Demirci B, Celik S, Baser KHC. Composition of the essential oil of endemic *Centaurea paphlagonica* (Bornm) Wagenitz from Turkey. Asian Journal of Chemistry 2009; 21: 1719–1724.
5. Polatoğlu K, Şen A, Bulut G, Bitiş L,Gören N. Essential Oil Composition of *Centaurea kilaea* Boiss. and *C. Cuneifolia* Sm. from Turkey. *Nat. Vol. & Essent. Oils* 2014; 1(1): 55-59.
6. Kahriman N, Tosun G, İskender NY, Karaoğlu ŞA,Yayli N. Antimicrobial activity and a comparative essential oil analysis of *Centaurea pulcherrima* Willd. var. *pulcherrima* extracted by hydrodistillation and microwave distillation. *Natural Product Research* 2012; 26(8): 703–712.
7. Zengin G, Aktumse kA, Guler GO, Cakmak YS, Kan Y. Composition of essential oil and antioxidant capacity of *Centaurea drabifolia* Sm. subsp. *detonsa* (Bornm.) Wagenitz, endemic to Turkey. *Natural Product Research* 2012; 26(1): 1–10.
8. Yayli N, Yaşar A, Yayli N, Albay C, Aşamaz Y, Çoşkuncelebi K, Karaogluş A.Chemical composition and antimicrobial activity of essential oils from *Centaurea appendicigera* and *Centaurea helenioides*. *Pharmaceutical Biology* 2009; 47: 7–12.
9. Dob T, Dahmane D, Desrdy BG, Daligault V. Essential oil composition of *Centaurea pullata* L. *Journal of Essential Oil Research* 2009; 21(5): 417-422.
10. Formisano C, Senatore F, Bancheva S, Bruno M, Maggio A, Rosselli S.Volatile Components of Aerial Parts of *Centaurea nigrescens* and *C. stenolepis* Growing Wild in the Balkans.*Natural Product Communications* 2010; 5(2): 273-278.
11. Senatore F, Rigano D, De Fusco R, Bruno M. Volatile components of *Centaurea cineraria* L. subsp *umbrosa* (Lacaita) Pign. and *Centaurea napifolia* L. (Asteraceae), two species growing wild in Sicily. *Flavour& Fragrance Journal* 2003; 18: 248-251.
12. Demirci B, Kose YB, Başer K.H.C, Yucel E. Composition of the Essential Oil of three endemic *Centaurea* species from Turkey. *Journal of Essential Oil Research* 2008; 20: 335-338.
13. Formisano C, Mignola E, Senatore F, Bancheva S, Bruno M, Rosselli S. Volatile constituents of aerial parts of *Centaurea sibthorpii* (Sect. Carduiformes, Asteraceae) from Greece and their biological activity. *Natural Product Research* 2008; 22(10): 840–845.
14. Karamenderes C, Demirci B, Baser K.H.C. Composition of essential oils of ten *Centaurea* L. taxa from Turkey. Journal of Essential Oil Research 2008; 20: 342–349.

15. Sadeghifar S, Khalilzadeh M, Sadeghifar H. Chemical Composition of the Essential Oils From Leaves, Flowers, Stem and Root of *Centaurea zuvandica* Sosn. *Journal of Essential Oil Research* 2009; 21(4): 357-359.
16. Adams RP. Identification of essential oil components by gas chromatography/mass spectrometry.4th ed, IL, Allured Publishing Co, Carol Stream, 2007.
17. Mc Lafferty FW, Stauffer DB. The Wiley/NBS registry of mass spectral data. 5th Edition, J. Wiley and Sons, New York, 1991.
18. Flamini G, Tebano M, Cioni PL, Bağci Y, Dural H, Ertuğrul K, Uysal T,Savran A.A multivariate statistical approach to Centaurea classification using essential oil composition data of some species from Turkey, Plant Syst. Evol 2006; 261: 217-228.
19. Formisano C, Rigano D, Senatore F, Bancheva S, Bruno M, Maggio A, Rosselli S. Volatile components from aerial parts of *C. gracilenta* and *C. ovina* ssp. *besserana* growing wild in Bulgaria, *Nat. Prod. Commun* 2011; 6: 1339-1342.
20. Kose YB, Altintas A, Tugay O, Uysal T, Demirci B, Ertuğrul K, Başer KHC. Composition of the essential oils of *C. sericeae* Wagenitz and *Centaurea ensiformis* P.H. Davis from Turkey, *Asian J. Chem* 2010; 22: 7159-7163.
21. Djeddi S, Sokovic M,Skaltsa H. Analysis of the Essential Oils of Some *Centaurea* Species (Asteraceae) Growing Wild in Algeria and Greece and Investigation of their Antimicrobial Activities *Jeobp* 2011; 14(6): 658 – 666.
22. Senatore F, Formisano C, Raio A, Bellone G, Bruno M. Volatile components from flower-heads of *Centaurea nicaeensis* All., *C. parlatoris* Helder and *C. solstitialis* L. ssp. *Schouwii* (DC.) Dostal growing wild in southern Italy and their biological activity. *Natural Product Research* 2008; 22(10): 825–832.
23. Senatore F, Arnold NA, Bruno M. Volatile components of *Centaurea eryngioides* Lam. and *Centaurea iberica* Trev. var. *hermonis* Boiss. Lam., two Asteraceae growing wild in Lebanon. Natural Product Research 2005; 19(8) 749–754.