Journal of Medicinal Plants and By-products (2014) 2: 187-191

Original Article

Study of Essential Oils Compositions of Three Species of Medicinal Plants from ShirKooh Mountain (Up village) on Yazd Province

Sayyed Mostafa Goldansaz[1*], Mohammad-Bagher Rezaee[2] , Kamkar Jaimand[2] and Ali Mirhoseini[3]

[1] PhD Student, Department of Natural Resource, Sari University of Agriculture Sciences and Natural Resources and Iranian Medicinal Plant Society, Iran
[2] Research institute of Forests and Rangelands, Tehran , Iran
[3]Research Institute of Agriculture and Natural Resources, Yazd, Iran

Article History: Received: 14 January 2014/Accepted in revised form: 05 April 2014

Abstract

In order to investigate the medicinal species from montain of ShirKooh (Up village), in Yazd provience, Iran on three species by scientific names were *Heracleum persicum* Desf. ex Fisch., C.A.Mey. & Avé-Lall.; *Ziziphora clinopodioides* Lam. and *Nepeta asterotricha* Rech.f. were collected on June, July and August 2011. Then all samples essential oils were extracted by hydro-distillation method (clavenger types). Then were analyzed by GC and GC/MS. The essential oil yield was *H. persicum* (2.5%); *Z. clinopodioides* (1.5%) and *N. asterotricha* (1.8%), respectively. Major component identificated in *H. persicum* were; trans-carveol 38.7%, α-terpineol 23.8% and isobornyl formate 9.2%, *Z. clinopodioides* were carvacrol 52.7%, linalool 15.9% and menthol 14% and *N. asterotricha* were terpinolene 21.2% , n-dodecanol 18.6% and n-undecane 12%, respectively. In *H. persicum* with trans-carveol (38.7%), which can use as stimulates central nervous system, allergenic, and in *Z. clinopodioides* with major compound carvacrol (52.7%), which can use as a Anesthetic, kills and expels worms, may help prevent alzheimer's disease, antiinflammatory, antioxidant, antiplaque, antiseptic, bactericide, relieves flatulence, relaxes intestines, expectorant, prostaglandin-inhibitor, relaxes trachea. Can cause spasms, and also in *N. asterotricha* with major compound of terpinolene (21.2%), which can use as a Deodorant.

Key words: Essential oils, *Heracleum persicum*; *Ziziphora clinopodioides*, *Nepeta asterotricha*, Chromatograms, GC, GC/MS

Introduction

The genus *Heracleum* L. is represented in Iran by ten species, four of them being endemic [1]. *H. persicum* Desf. ex Fisch., C.A.Mey. & Avé-Lall. (*Umbelliferae*) is an annual herb known as "Golpar" in Iran. The fruits of *H. persicum* are widely used as spices [2] and the young stems are also used for making pickles. In Iranian folk medicine, the fruits of *H. persicum* were used as a carminative herbal drug [3]. Because of wide usage of the fruits of *H. persicum* as medicinal plant and its use as flavouring agent, it was decided to carry out a phytochemical study on the fruits of this plant. Chemical composition of different parts of *H. persicum* has been investigated by several authors. Pimpinellin, isopimpinellin, bergapten, isobergapten and sphonding are furanocoumarins which are reported from roots of the plant [4]. There is a report that showed the presence of six furanocoumarins [5] and flavonoids [6] in the fruits of *H. persicum.* Chemical constituents of the essential oils of fruits, leaves, stems and roots of *H persicum* were reported previously. The fruit oil contained about 95% aliphatic esters, 4% aliphatic alcohols and 1% monoterpenes [7]. The major

*****Corresponding author: Department of Natural Resource, PhD Student, Sari University of Agriculture Sciences and Natural Resources and Iranian Medicinal Plant Society, Iran
E-mail Address: Mostafagoldansaz@yahoo.com

components of both leaves and stems oil were reported as trans-anethole [8,9]. Viridiflorol was also identified as predominant constituent of the volatile oil of the root of *H. persicum* [10]. In this article isolation and elucidation of xanthotoxin from the fruits of this plant are described.

The genus *Ziziphora* L. belongs to the family Labiatae consists of four species (*Z. clinopodioides* Lam., *Z. captitata* L., *Z. persica* Bunge. and *Z. tenuior* L.) that widespread all over Iran. *Z. clinopodioides* Lam. with the common Persian name "kakuti-e kuhi" is an endemic species, grows wild in Iran and also Afghanistan, Iraq, and Talish. *Z. clinopodioides* Lam. is an edible medicinal plant and that leaves, flowers and stems are frequently used as wild vegetable or additive in foods to offer aroma and flavor (Zargari, 1995). In addition and Turkish folk medicine, *Ziziphora* speices have been used as infusion for various purposes such as sedative, stomachache and carminative. In Iranina folklore, the dried aerial parts of this plant have been frequently used as culinary and also in cold and cough treatments. *Ziziphora* species has been also used to treat various ailments such as antiseptic and wound healing [11]. A literature survey showed that the oil of *Ziziphora* species has been found to be rich in pulegone. The main constituents found in the oil of *Z. vychodceviana* and *Z. persica* collected from Kazakhestan were pulegone (57.5-66%) and isomenthone (5.1.-15.7%) [12]. The major constituent found in the oil of *Z. tenuior* L. has been reported to be pulegone (87.1%) [13]. The essential oil of Turkish endemic *Z. taurica* subsp. clenioides was found to contain pulegone (81.9%) limonene (4.5%) and piperitenone (2.3%) [14]. The chemical composition of the essential oil of *Z. clinopodiiodes* from Turkey has been studied by GLC [15].

The results of the present study would be useful in promoting research aiming at the development of new agent for mosquito control based on bioactive chemical compounds from indigenous plant source.

The genus *Nepeta* L. of the *Lamiaceae* family includes more than 250 species all around the world [16]. Sixty-seven species of *Nepeta* are found in Iran, of which the majority is endemic. The rate of endemism in the genus *Nepeta* in Iran is ca. 58% [17]. *Nepeta* species are widely used in folk medicine because of the antispasmodic, diuretic, antiseptic, antitussive, antiasthmatic, ethnobotanical effect, diaphoretic, vulneary, antispasmodic, tonic [18-21]. The compounds of essential oil of *Nepeta* are considered to be responsible for the feline attractant activity of *Nepeta* species [22,23].The main components of *Nepeta* species of Iranian origin are: 4a-7-7a-nepetalactone (*N. cephalotes* Boiss. [24]) and *N. racemosa* Lam. [25], 1,8-cineole (*N. binaloudensis* Jamzad, *N. ispahanica* Boiss. [26]) and *N. denudata* (Benth.) Kuntze [25]), terpinen-4-ol (*N.asterotrichus* [27]) and viridiflorol (*N. makuensis* Jamzad & Mozaff. [28]). The water-distilled oil obtained from the stems of *N. asterotricha* has been subject of our previous studies. Thirty-two compounds comprising about 91.3% of the oil were identified, among which were monoterpene hydrocarbons and oxygenated monoterpenes. The major components were terpinene-4-ol (22.8%), 1, 8-cineole (17.4%) and linalool (12.5%) [29].

In the present paper we report the Study of essential oils compositions of three species by scientific names were *H. persicum* ; *Z. clinopodioides* and *N. asterotricha* of medicinal plants from montaine of ShirKooh (Up village) on Yazd provience in Iran, were collected on June, July and August 2011.

Material and Methods

Plant material

The plant material of *H. persicum*; *Z. clinopodioides* and *N. asterotricha* were collected on June, July and August 2011 from montain of ShirKooh (Up village) on Yazd provience, Iran, and were dried in the shade at room temperature. The specimen is deposited in Central Herbarium of Iran (TARI). (See: Holmgren, Index Herbariorum).

Isolation of the essential oil

Samples plants of three species from dried airal parts of *N. asterotricha*; *Z. clinopodioides* and seeds of *H. persicum* were extracted by hydro-distillation (Clavanger type), The essential oil yield were 1.8%, 1.5% and 2.5% respectively. The quantitative and qualitative analyses of the oils were performed by GC and GC-MS, respectively.

Gas Chromatography

GC analyses were performed using a Ultera Fast Module gas chromatograph equipped with a flame ionization detector (F.I.D.), and quantitation was carried out on Chrom-card 2006 from Thermo by the area normalization method neglecting response factors. The analysis was carried out using a Ph-5 semi polar column (10 m x 0.1 mm, film thickness 0.4 μ). Planning thermal column, from 60 to 285 °C with a rate of temperature increase of 3 °C min,

In Time 8.5 minutes is done. Carrier gas, Helium pressure in the first column of 3 kg per square centimeter, Split ratio of 1:100, To dilute the sample, the injection temperature of 280 °C and detector temperature was set at 280 °C.

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 [30-32], and by computer matching with the Wiley 5 mass spectra library, whenever possible, by co-injection with standards available in the laboratories.

Results

Table 1 The chemical composition of the essential oil from *Heracleum persicum Desf. ex Fisch., C.A.Mey. & Avé-Lall.*

S. No.	Compound names	R.I.	%
1	2-heptanone	891	3.7
2	α- pinene	957	0.4
3	δ-3-carene	1010	2.7
4	(E)- β - ocimene	1051	2.5
5	Terpinolene	1085	2.1
6	Cis-thujone	1104	0.3
7	Heptyl acetate	1113	0.4
8	Camphor	1145	4.7
9	α-terpineol	1184	23.8
10	*Trans*- piperitol	1205	3.6
11	*Trans*-carveol	1211	38.7
12	Isobornyl formate	1239	9.2
13	Methyl decanoate	1326	0.4
14	δ- elemene	1341	1.0
15	α- copaene	1376	2.9
16	Z- β -farnesen	1444	2.1
17	Caryophyllene oxide	1582	0.3
18	*n*- nonadecane	1906	0.6

Characterized for the stem oil before flowering with (E)- anethole (47.1%), terpinolene (20%), γ-terpinene (11.6%) and limonene (11.5%) as the main constituents.

Table 2 The chemical composition of the essential oil from *Ziziphora clinopodioides* Lam.

S. No.	Compound names	R.I.	%
1	β- pinene	984	0.3
2	Hexyl acetate	1010	0.2
3	γ- terpinene	1056	0.7
4	*n*-octanol	1066	2.8
5	Linalool	1095	15.9
6	Hepty acetate	1118	4.0
7	Menthol	1171	14.0
8	*Trans*- piperitol	1205	1.3
9	*Trans*-carveol	1211	1.7
10	*Cis*-p-mentha-1 (7), 8-dien-2-ol	1228	1.1
11	Pulegone	1234	0.2
12	Carvone	1251	0.5
13	Carvacrol	1283	52.7
14	Piperonal	1331	1.1
15	β- bourbonene	1386	2.8
16	*n*-dodecanol	1475	0.3

Table 3 The chemical composition of the essential oil from *Nepeta asterotricha* Rech.f.

S. No.	Compound names	R.I.	%
1	Ethyl isovalerate	854	0.4
2	α- pinene	942	0.8
3	Camphene	954	0.8
4	β- pinene	984	1.7
5	Hexyl acetate	1010	1.7
6	1,8-cineole	1031	1.3
7	(Z)- β- ocimene	1046	4.8
8	(E)- β- ocimene	1051	3.0
9	γ- terpinene	1056	1.2
10	Terpinolene	1066	21.2
11	Terpinolene	1085	5.8
12	n-undecane	1100	12.0
13	Heptyl acetate	1113	6.9
14	Methyl octanoate	1127	0.8
15	p-menth-3-en-8-ol	1150	0.6
16	δ- terpineol	1167	0.2
17	α- terpineol	1188	0.7
18	*Trans*-carveol	1217	8.2
19	Cis-carveol	1228	2.9
20	Carvone hydrate	1425	4.0
21	*n*-dodecanol	1469	18.6
22	Viridiflorene	1493	0.8
23	Myristicin	1518	0.2
24	δ- cadinene	1523	0.3
25	*Trans*-calamenene	1529	0.4

At full flowering stage, 33 components were identified in the stem oil with (e)-anethole (60.2%), terpinolene (11.3%), and γ-terpinene (7.1%) as the major components. Among the 30 compounds identified in the seed oil of *H.persicum*, the major constituents were hexyl butyrate (22.5% and

35.5%), octyl acetate (19% and 27%) and hexyl isobutyrate (9.1% and 3.2%) in unripe and ripe seeds, respectively. Our results are different with Sefidkon [33].

In our study on *Z. clinopodioides*, the essential oil yield obtained were (1.5%), major component identificated were carvacrol 52.7%, linalool 15.9% and menthol 14%. But Mohammadreza Verdian-rizi, work on essential oil composition and biological activity of *Z. clinopodioides* Lam. from Iran, the essential oil obtained by hydrodistillation from the aerial parts of *Z. clinopodioides* Lam. growing in Iran was analysed by GC and GC/MS. Twenty-six components accounting to 97.6% of the total oil were identified. The major components were pulegone (36.45%), piperitenone (19.12%), Menth-2-en-1-ol (5.31%), carvacrol (5.10%), neomenthol (4.78) and menthone (4.46%). Our results are different with Mohammadreza Verdian-rizi [34]. Also, Sonboli , work on the essential oil obtained from the aerial flowering parts of *Z. clinopodioides* subsp. *bungeana* (Juz.) Rech. f. was analyzed by GC and GCMS. Thirty-two components representing 97.1% of the total oil were identified. Oxygenated monoterpenes (94.3%) were the predominant fraction of the oil with pulegone (65.2%), isomenthone (11.9%), 1,8-cineole (7.8%) and piperitenone (6.5%) as the main constituents. Our results are different with Sonboli, [35].

And also in this study on *N. asterotricha*, the essential oil yield obtained were (1.8%), major component identificated were terpinolene 21.2% , n-dodecanol 18.6% and n-undecane 12%. Fallah Iri Sofla, study on chemical composition and antibacterial activity of the essential oil of *N. asterotricha* from Iran, the essential oil was isolated by steam distillation of the stems of the plant and the oil was obtained with 0.67% yield, which was analyzed by capillary GC and GC-MS. Studies of essential oil revealed terpinene-4-ol (18.79%), linalool (14.93%), γ-terpinene (8.73%), cis-sabinene hydrate (8.69%), 4aα-7ß-7aα-nepetalactone (7.49%) and 1,8-cineole (5.61%), as the major constituents. Our results are different with Fallah Iri Sofla [36].

Also, Masoudi, has worked on **C**omposition of the essential oils and antibacterial activities of Hymenocrater yazdianus, *Stachys obtusicrena* and *N. asterotricha* three Labiatae herbs growing wild in Iran, the essential oil from stems and flowers of *N. asterotricha* Rech.f., which are endemic to Iran, were extracted by hydro-distillation and analyzed by GC and GC/MS. Thirty-five compounds representing 93.0% of the stem oil of *N. asterotrica* were identified among which terpinen-4-ol (22.8%) and γ-terpinene (14.1%) were the major ones. The flower oil of the species was characterized by higher amounts of terpinen-4-ol (24.8%), 4a α, 7a β-nepetalactone (18.2%) and 1,8-cineole (11.6%) among the thirty-three components comprising 98.5% of the total oil detected. Our results are different with, Masoudi [37].

Acknowledgment

We are grateful to acknowledge the Medicinal Plants Department in Research Institute of Forests and Rangelands, Tehran, Iran, for the financial support of this investigation.

References

1. Mozaffarian V. A Dictionary of Iranian Plant Names. Tehran: Farhang Moaser; 1996. p. 271- 272.
2. Zargari A. Medicinal Plants. Vol 2. Tehran: Tehran University Publications; 1988. p. 619.
3. Iranian Herbal Pharmacopoeia. Vol 1. Tehran: Food and Drug Deputy of Health Ministry; 2002. p. 698.
4. Aynehchi Y, Aliabadi Z, Salehi-Surmaghi MH. Furanocoumarines in roots of *Heracleum persicum.* Acta Hort. 1978;73:103-107.
5. Merijanian A, Colasurdo T, Samtak P, Ullrich J, Spagnuolo J. The furanocomarins of *Heracleum persicum* L. Rev Latinoam Quim. 1980;11:51-53.
6. Ghodsi B. Flavonoids of three *Heracleum* species: *H. Persicum* L., *H. sphondylium* L. and *H. montanum* Schl. Bull Trav Soc Pharm Lyon. 1976;20:3-8.
7. Scheffer JJC, Hiltunen R, Aynehchi Y, Von Schantz M, Baerheim-Svendsen A.
Composition of the essential oil of *Heracleum persicum* fruits. Planta Med. 1984;50:56-60.
8. Mojab F, Rustaiyan A, Jasbi AR. Essential oil of *Heracleum persicum* Desf. ex Fischer leaves. Daru. 2002;10:6-8.
9. Sefidkon F, Dabiri M, Mohammad N. Analysis of the oil of *Herac/eum persicum* L. (leaves and flowers). J Essent Oil Res. 2004;16:295-297.
10. Mojab F, Nickavar B. Composition of the Essential Oil of the Root of *Herac/eum persicum* from Iran. Iranian J Pharm Res. 2003;2:245-247.
11. Zargari A. "Iranian Medicinal Plants," Vol. 4, Tehran University Press, Tehran, 1995;pp: 103-104.
12. Ozturk Y, Aydin S, Tecik B Baser KHC. Effects of essential oils from *Ziziphora* species on swimming performance in mice. Phytotherapy Research, 1995;9: 225-227.

13. Dembistikii AD, Bergalier ES, Kyazimer IM. Morphological and Phytochemical Study of *Ziziphora tenuior L.* Chem Nat Compd. 1995;31:673-675.
14. Meral GE, Konyalioglu S, Ozturk B. Essential oil composition and antioxidant activity of endemic Ziziphora taurica subsp . Cleonioides Fitoterapia. 2002; 73:716-718.
15. Belyaev NF, Demeubaeva AM. Chromatographic study of the composition of the essential oil of Ziziphora clinopodioides, a vicarious of Origanum vulgare. Chem Nat Compd. 1999;35:52-54.
16. Mozaffarian, V.A., 1996. Dictionary of Iranian Plant Names, Farhang Moaser Publishers, Tehran, Iran.
17. Rechinger KH. Nepeta, in: Flora Iranica, Labiatae, No. 150, Edits., Rechinger,K.H. and Hedge, I.C, Akademische Druck and Verlagsantalt, Graz, Austria, 1982;108-216 .
18. Ghannadi A, Aghazari F, Mehrabani M, Mohaghzadeh A, Mehregan A. Quantity and Composition of the SDE prepared essential oil of *Nepeta macrosiphon* Boiss. Iranian Pharm Sci. 2003;2:103-105.
19. Gkinis G, Tzakou Q, IIiopoulou D, Roussis VZ. Chemical composition and biological activity of *Nepeta parnassica* oil and isolated *Nepeta* lactons. Natur forsch. 2003;58:681- 686 .
20. Dorman HJ, Deans SG. Antibacterial activity of plant volatile oils. J Appl Microbiol. 2000;88:308-316.
21- Zenasni L, Bouidida H, Hancali A, Boudhane A, Amzal H, Idrissi A, Aouad R, Benjouad Y. The essential oils and antimicrobial activity of four *Nepeta* species from Morocco, J Med Plants Res. 2008;2:111.
22. Dabiri M, Sefidkon F. Chemical composition of *Nepeta crassifolia* Boiss. Flav Fragr J. 2003;18:225-227.
23. Hussain J, Jamila N, Gilani SA, Abbas Ahmed S. Platelet gregation, antiglycation, cytotoxic, phytotoxic an antimicrobial activities of extracts of *Nepeta juncea*, Afr. J Biotechnol. 2009;8:935-940.
24. Rustaiyan A, Komeilizadeh H, Monfared A, Nadji K. Volatile constituents of *Nepeta denudate* Benth. And *Nepeta cephalotes* Boiss. from Iran. J Essent oil Res. 2000;11:459-461.
25. Rutaiyan A, Khosravi M, Larijani K, Masoudi S. Composition of the essential oil of *Nepeta recemosa*Lam. From Iran. J Essent oil Res. 2000;12: 151-152 **.**
26. Rustaiyan A. Nadji K. Composition of the essential oil of *Nepeta ispahanica* Bois. and *Nepeta binaludensis* Jamzad from Iran. Flav Fragr J. 1999;14: 35-37.
27. Rustaiyan A, Monfared A, Masoudi S. Composition of the essential oil of *Nepeta asterotrichus* Rech. F. et Aell. From Iran. J Essent Oil Res. 1999;11:229-230.
28- Habibi Z, Masoudi S, Rustaiyan A. Essential oil of *Nepeta makuensis* Jamzad et Mozaffarian from Iran. J Essent Oil Res. 2004;16:214-215.
29. Masoudi S, Rustaiyan A, Mohebat R, Mosslemin, MH. Composition of the essential oils and antibacterial activities of *Hymenocrater yazdianus, Stachys obtusicrena* and *Nepeta asterotricha* three Labiatae herbs growing wild in Iran. Nat Prod Commun. 2012;7:117-120 .
30. Shibamoto T. Retention Indices in Essential Oil Analysis. In: Capillary Gas Chromatography in Essential oil analysis. Edits., Sandra P, and Bicchi C, Dr. Alfred Huethig Verlag, Heidelberg. 1987;259-274.
31. Davies NW. Gas Chromatographic Retention Index of Monoterpenes and Sesquiterpenes on Methyl silicone and Carbowax 20 M phases. J. Chromatogr. 1990;503:1-24.
32. Adams RP, Identification of essential oils by Ion trap Mass Spectroscopy. Academic Press, San Diego, CA.1989.
33. Sefidkon F, Dabiri M, Mohammad N. Analysis of the Oil of Heracleum persicum L. (Seeds and Stems), J. Essent. Oil Res. 2004;16:296-298.
34. Verdian-rizi M. Essential Oil Composition and Biological Activity of *Ziziphora clinopodioides* Lam. From Iran. , American-Eurasian Journal of Sustainable Agriculture. 2008;2:69-71.
35. Sonbolia A Mirjalilib MH, Hadianb J, Nejad Ebrahimid S, Yousefzadie M. Antibacterial Activity and Composition of the Essential Oil of *Ziziphora clinopodioides* subsp. *bungeana* (Juz.) Rech. f. from Iran , Z. Naturforsch. 2006;61:677-680.
36. Fallah Iri Sofla S, Ezzatzadeh E. Chemical Composition and Antibacterial Activity of the Essential Oil of *Nepeta asterotricha* Rech. f. from Iran., Trends in Modern Chemistry. 2013;6:24-28.
37. Masoudi S, Rustaiyan A, Mohebat R, Mosslemin MH. **C**omposition of the essential oils and antibacterial activities of Hymenocrater yazdianus, Stachys obtusicrena and Nepeta asterotricha three Labiatae herbs growing wild in Iran. Nat. Prod. Commun. 2012;7:117-20.