CHEMICAL CONSTITUENTS OF THE ESSENTIAL OIL OF *NEPETA DEPAUPERATA* BENTH. FROM IRAN

[1]MITRA MEHRABANI, [2]ALI ASADIPOUR AND [3]SIROOS SABER AMOLI

[1]Department of Pharmacognosy, [2] Department of Medicinal Chemistry, Faculty of Pharmacy, Kerman University of Medical Sciences, Kerman, Iran, [3] Research Center of Agricalture and Natural Resources of Kerman, Kerman, Iran

ABSTRACT

The essential oil from flowering aerial parts of *Nepeta depauperata* Benth., an endemic Iranian plant, obtained by steam distillation was analyzed by GC/MS. The constituents were identified by their mass spectra and Kovats' indices. Thirty-three compounds consisting 82.52% of the total components were identified from the oil obtained with a yield of 0.3%v/w. Among them, spathulenol (31.84%), beta caryophyllene (12.93%) and caryophyllene oxide (10.27%) were the major components of the oil.

Keywords: *Nepeta depauperata* Benth.; Essential oil composition; GC/MS; Spathulenol; Beta caryo-phyllene; Caryophyllene oxide.

INTRODUCTION

The genus *Nepeta* with the common persian name of pune-sa includes 67 species that are found all over of Iran (1) and *Nepeta depauperata* Benth. *(Lamiaceae*) is one of the endemic species of this genus in Iran (2). *Nepeta* spp. have some biological activities and are used in folk medicine (3). Many reports on phytochemical analyses of this genus, including essential oil analysis are found in the literature and most oil of *Nepeta* species contain nepetalactones as the main components, but some differences in the essential oil composition were detected in several *Nepeta* oil (4-31). Some species are used as medicinal herbs in Iran (for example, *N. ispahanica*, *N. binaloudensis*, *N. bracteata*, *N. pogonosperma* and *N. pungens*), and *N. crispa* is used as a culinary herb(32). The medicinal properties of *Nepeta* species are usually attributed to their essential oils and flavonoids (30,32). Literature surveys revealed that the essential oil of the aerial parts of *N. depauperata* Benth. has not been chemically studied previously and this article deals with the detailed quantitive analysis of the oil prepared by hydrodistillation by GC/MS.

MATERIALS AND METHODES

Plant Material

The aerial parts of wild-growing *N. depauperata* Benth. were collected during the flowering period from northern slopes of Khabr mountain, (Kerman Province, Iran) at an altitude of ca. 3500 m in June 2002. The plant identity as *N. depauperata* Benth. was confirmed and a voucher specimen of the plant (No. 1224) was deposited in the Herbarium of Research Center of Agriculture and Natural Resources of Kerman, Kerman, Iran. The air-dried aerial parts of the plant were powdered and the volatile fraction was prepared by hydrodistillation apparatus (Clevenger) for 3 hours.

GC/MS analysis

The oil was analyzed by GC/MS using a Hewlett Packard 6890 mass selective detector coupled with a Hewlett Packard 6890 gas chromatograph, equipped with a cross-linked 5% PH ME siloxane HP-5MS capillary column (30 m × 0.25 mm, film thickness 0.25 µm). Operating conditions were as follows: carrier gas, helium with a flow rate of 2 ml/min; column temperature, 60-275ºC at 4ºC/min; injector and detector temperatures, 280 ºC; volume injected, 0.1 µl of the oil; split ratio, 1:50.

The MS operating parameters were as follows: ionization potential, 70 eV; ionization current, 2 A; ion source temperature, 200 ºC; resolution, 1000. Identification of components in the oil was based on retention indices relative to *n*-alkanes and computer matching with the WILEY 275.L library, as well as by comparison of the fragmentation patterns of the mass spectra with those reported in the literature (33-35).

RESULTS AND DISCUSSTION

Aerial parts of *N. depauperata* Benth. yielded 0.3% (v /w *vs* dried material) of a pale yellowish oil with a strong pleasant aroma. Thirty three components were characterized, representing 82.52% of the total oil components which were detected and are listed in table 1 with their

Correspondence : Dr. Mitra Mehrabani , Department of Pharmacognosy, Faculty of Pharmacy, Kerman University of Medical Sciences, Kerman, Iran. Email: mmehrabani@hotmail.com

Table 1. Components of the oil from the aerial parts of *Nepeta depauperata* Benth.

No.	Compound	RI	%	No.	Compound	RI	%
1	α-pinene	939	1.05	18	α - humulene	1456	0.41
2	β-pinene	981	0.86	19	Trans β - farnesene	1463	0.22
3	ρ-cymene	1029	0.28	20	Allo aromadendren	1464	0.99
4	Limonene	1033	0.15	21	Germacrene D	1483	0.49
5	1,8 – cineole	1037	3.97	22	7- epi α - selinene	1486	0.13
6	γ- terpinene	1062	0.08	23	β - selinene	1488	0.24
7	Linalool	1103	1.25	24	Bicyclo germecrene	1498	1.69
8	α -campholen aldehyde	1130	0.12	25	γ - cadinene	1515	0.17
9	Trans- pinocarveol	1145	0.26	26	δ - cadinene	1527	2.80
10	Pinocarvone	1168	0.12	27	Elemol	1556	0.15
11	Terpinen 4- ol	1181	0.19	28	**Spathulenol**	1590	31.84
12	α- terpineol	1194	0.52	29	Caryophyllene oxide	1593	10.27
13	Myrtenol	1199	0.30	30	τ - cadinol	1648	2.03
14	α - copaene	1378	0.41	31	β - eudesmol	1657	2.16
15	β - bourbonene	1387	0.70	32	α - cadinol	1662	5.41
16	β -elemen	1393	0.13	33	Valeranol	1668	0.20
17	β -caryophyllne	1425	12.93	-			

RI=Retention indices on HP_5-MS capillary column

percentage composition. The major constituents of the sesquiterpene-rich oil of *N. depauperata* Benth. were spathulenol (31.84%), beta caryophyllene (12.93%) , caryophyllene oxide (10.27%) , alpha cadinol (5.41%). The oil contains: monoterpene hydrocarbons (2.42%), oxygen-containing monoterpenes (6.73%), sesquiterpene hydrocarbons (21.31%) and oxygen-containing sesquiterpenes (52.06%).

Nepetalactone isomers has been reported in *N. crassifolia*(15), *N. nuda* ssp. *albiflora*(16), *N. italica*(17), *N. cadmea*(18), *N. persica*(19), *N. ispahanica*(20,21), *N. binaludensis*(21), *N. argolica* ssp. *argolica*(22, 23), *N. racemosa*(4, 24), *N. rtanjensis*(25), *N. denudata*(26), *N. cephalotes* (26), *N. argolica* ssp. *dirphya* (27) and *N. meyeri* (28), but in *N. depauperata* Benth. such as *N. cilicia*(5), *N. nuda* ssp. *nuda*(9), *N. glomerulosa* ssp. *carmanica* (10), *N. fissa*(11,29), *N. camphorata*(27) and *N. macrosiphone*(30,31) no nepetalactones were found. The predominance of spathulenol and caryophyllene oxide has been found in essential oils of *N. nuda* ssp. *nuda*(9), *N. betonicifolia*(12) and *N. macrosiphone*(30,31).

REFERENCES

1. Mozaffarian, V. (1996) A Dictionary of Iranian Plant Names. Farhang Moaser, Tehran, p 360-361.
2. Rechinger, K.H. (1982) Flora Iranica, No 150, Akademishe Druck-u. , Verlagsanstalt, Graz., p 158.
3. Amin, Gh. (1991) Popular Medicinal Plants of Iran. Iranian Research Institute of Medicinal Plants, Tehran, p 40,51,55.
4. Dabiri, M., Sefidkon, F. (2003) Chemical composition of essential oil of *Nepeta racemosa* from Iran. Flavour Fragra. J. ,18:157-158.
5. Kokdil, G., . Tanker , M., Kurucu , S., Topcu , G. (1997) Essential oil analysis of *Nepeta cilicia* Boiss. Flavour Fragr. J.,12: 99-101.
6. Baser , K.H.C., Demircakmak , B.,Duman, H. (1998) Composition and the essential oils of *Nepeta sulfuriflora.* J. Essent. Oil Res. 10: 179-181.
7. Baser , K.H.C., Demircakmak, B.,Altinas ,A., Duman, H.(1998) Essential oil of *Nepeta flavida* Hub.-Mor. J. Essent. Oil Res.,10: 299-300.
8. Chalcat, G.C., Petrovic, S.D., Gorunovic, M.S. (1998) Quantity and composition of essential oil of the wild plant *Nepeta nuda* L. from Yugoslavia. J. Essent. Oil Res. 10: 423-425.
9. Kokdil, G., Kurucu, S., Yildiz, A. (1998) Essential oil composition of *Nepeta nuda* ssp. *nuda*. Flavour Fragr. J. 13:233-234.
10. Sajjadi, S.E., Ghassemi, N. (1999) Volatile constituents of *Nepeta glomerulosa* Boiss. subsp. *carmanica*. Flavour Fragr. J. 14: 265-267.
11. Baser, K.H.C., Ozek, T., Yildiz, B., Bahcecioglu, Z. Tumen, G. (2000) Composition of the essential oil of *Nepeta fissa* C.A. Meyer. J. Essent. Oil Res. 12: 27-28.
12. Baser, K.H,C., Ozek, T., Bemirci, B. Tumen, G. (2001) Composition of the essential oil of *Nepeta betonicifolia* C.A. Meyer from Turkey. J. Essent. Oil Res. 13: 35-36.
13. Sajjadi SE and Khatamsaz M. (2001) Volatile constituents of *Nepeta heliotropifolia* Lam. J. Essent. Oil Res. 13: 204-205.

14. Sefidkon, F. (2001) Essential oil of *Nepeta glomerulosa* Boiss. from Iran. J. Essent. Oil *Res*. (2 13: 422-423.
15. Dabiri, M., Sefidkon, F. (2003) Chemical composition of *Nepeta crassifolia* Boiss. & Buhse oil from Iran. Flavour Fragr. J. 18: 225-227.
16. Kokdil, G., Kurucu, S., Topcu, G. (1996) Composition of the essential oil of *Nepeta nuda* L. ssp. *albiflora* (Boiss.) Gams. Flavour Fragr. J. 11: 167-169.
17. Kokdil, G., Kurucu, S., Topcu, G. (1997) Chemical constituents of the essential oils of *Nepeta italica* L. and *Nepeta sulfuriflora* P.H. Davis. Flavour Fragr. J. 12: 33-35.
18. Baser, K.H.C., Demircakmak, B., Altinas, A. Duman, H. (1998) Composition of the essential oils of *Nepeta cadmea* Boiss. J. Essent. Oil Res. 10: 327-328.
19. Javidnia, K., Miri, R., Safavi, F., Azarpira, A., Shafiee, A. (2002) Composition of the essential oil of *Nepeta persica* Boiss from Iran. Flavour Fragr. J. 17:20-22.
20. Rustaiyan, A., Nadji, K. (1999) Composition of the essential oils of *Nepeta ispahanica* Boiss. and *Nepeta binaludensis* Jamzad from Iran. Flavour Fragr. J. 14: 35-37.
21. Sajjadi S.E., Mehrabani M. (2003) Essential oil composition of *Nepeta ispahanica* Boiss. Research in Medical Sciences. 7(supp. 2): 136-142.
22. Skaltsa, H.D., Lazari, D.M., Loukis, A.E. (2000) Constantinidis T. Essential oil analysis of *Nepeta argolica* Bory & Chaub. Subsp. *argolica* (Lamiaceae) growing wild in Greece. Flavour Fragr. J. 15: 96-99.
23. Tzakou, O., Harvala, C., Galati, E.M.. Sanogo, R. (2000) Essential oil composition of *Nepeta argolica* Bory et Chaub. Subsp. *argolica.* Flavour Fragr. J. 15: 115-118.
24. Rustaiyan, A., Khosravi, M., Larijany, K., Masoudi, S. (2000) Composition of the essential oil *of Nepeta racemosa* Lam. from Iran. J. Essent. Oil Res. 12: 151-152.
25. Chalcat, J.C., Gorunovic, M.S., Petrovic, S.D. Maksimovic, Z.A. (2000) Composition of the essential oil of *Nepeta rtanjensis* Diklic et Milojevic, Lamiaceae from Serbia. . J. Essent. Oil Res. 12: 238-240.
26. Rustaiyan, A., Komeilizadeh, H., Monfared, A., Nadji, K., Masoudi, S., Yari, M. (2000) Volatile constituents of *Nepeta denudata* Benth. and *N. cephalotes* Boiss. from Iran. J. Essent. Oil Res. 12: 459-461.
27. Kalpoutzakis E., Aligiannis N., Mentis A., Mitaku S., Chavala C. (2001) Compsition of essential oil of two *Nepeta* species and in vitro evaluation of their activity against *Helicobacter pylori.* Planta Medica. 67: 880-883.
28. Sefidkon F., Shaabani A. (2004) Essential oil composition of *Nepeta meyeri* Benth. From Iran. Flavour Fragr. J. 19: (in press).
29. Sefidkon, F., Dabiri, M., Alamshahi, A. (2002) Analysis of the essential oil of *Nepeta fissa* C.A. Mey from Iran. . Flavour Fragr. J. 17:89-90.
30. Ghannadi,A.,Aghazari, F., Mehrabani, M., Mohagheghzadeh , A., Mehregan, I. (2003) Quantity and Composition of the SDE Prepared Essential Oil of *Nepeta macrosiphon* Boiss. Iranian Journal of Pharmaceutical Research 2(2):103-105.
31. Javidnia K., Miri R., Jafari A., Rezai H. (2004) Analysis of the volatile oil of *Nepeta macrosiphone* Boiss. Grown in Iran . Flavour Fragr. J. 19: 156-158.
32. Jamzad Z., Grayer R.J., Kite G.C., Simmonds M.S.J., Ingrouille M., Jalili A. (2003) Leaf surface flavonoids in Iranian species of *Nepeta* (Lamiaceae) and some related genera , Biochemical Systematics and Ecology 31: 587–600.
33. Adams, R.P. (1995) Identification of essential oil components by GC-MS. Allured Publ. Corp., Carol Stream, IL.
34. Ramaswami, S.K., Von Geldem, T., Gargiullo R.J. (1986) Sesquiterpene hydrocarbons from mass confusion to orderly Line-up. Flavor and Fragrance, 951-980: 16-20.
35. Swigar AA and Silverstein RM (1981) Monoterpenes- Infrared, Mass,Proton-NMR, Carbon-NMR Spectra and Kovats Indices. Aldrich Chemical Company Inc., Wisconsin.