

ANALYSIS OF THE ESSENTIAL OIL OF *NEPETA SINTENISII* BORNM. FROM IRAN

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ABSTRACT

Nepeta is a one of the most important genera of the Lamiaceae family with regard to the number of species. Some species of this genus are important medicinal plants and their extracts have been used for medicinal purposes. In this investigation aerial parts of *Nepeta sintenisii* Bornm. was subjected to hydrodistillation and the chemical composition of the isolated essential oil was analyzed by GC/MS method for first time. Forty constituents (96.5% of the total oil) were identified of which 4 α ,7 α ,7 β -nepetalactone (23.4%), elemol (16.1%), E- β -farnesene (9.5%), 1,8-cineole (8.2%), *cis*-sabinene hydrate (6.5%), β -bisabolene (4.2%) and germacrene-D (3.5%) were the main components. The constituents of the volatile oil of *N. sintenisii* is similar to the composition of the other *Nepeta* genus.

Keywords: *Nepeta sintenisii*, Lamiaceae, Essential oil composition, 4 α ,7 α ,7 β -Nepetalactone, Elemol

INTRODUCTION

Nepeta (Lamiaceae) is a genus of perennial or annual herbs which is found in Asia, Europe and North Africa. About 250 species of *Nepeta* are reported (1) of which, 67 species are present in Iran (2).

Nepeta species are widely used in folk medicine because of their antispasmodic, expectorant, diuretic, antiseptic, antitussive, antiasthmatic and febrifuge activities (3-5). *Nepeta cataria* (Catnip) is the most famous *Nepeta* species which has a long history of use as a tea in Europe before real tea was imported from the orient. The flowering tops of plant have also been used as a sedative drug (6).

Many reports on the essential oils of *Nepeta* species show that the main constituents of the oil are diastereomeric nepetalactones. These compounds are responsible for their feline attractant or insect repellent properties (7).

Nepeta sintenisii Bornm. is a herbaceous wild plant endemic to Iran (2, 8) and no phytochemical studies about this plant has been reported. In continuation of investigations on chemical composition of the essential oils of various *Nepeta* species which are grown in Iran, chemical composition of the essential oil from *N. sintenisii* Bornm. is reported for first time.

MATERIALS AND METHODS

Plant Material:

Aerial parts of *N. sintenisii* at full flowering stage were collected from Charat (Savadkooh, Mazandaran Province) in June 2002 at an altitude of 2250m. The plant was identified at the Botany

Department of the Faculty of Sciences, Isfahan University, Isfahan, Iran and a voucher specimen has been deposited in the Faculty of Pharmacy and Pharmaceutical Sciences, Isfahan University of Medical Sciences, Isfahan, Iran (NO. 1114).

Isolation of the Oil:

The air-dried aerial parts of *N. sintenisii* were reduced to a coarse powder and the oil was isolated by 3 hours hydrodistillation according to the British Pharmacopoeia (9). The oil was then dried over anhydrous sodium sulfate and stored at 4-6 °C.

GC-MS Analysis:

GC-MS analysis was carried out on a Hewlett-Packard 6890 gas chromatograph fitted with a fused silica HP-5MS capillary column (30 m \times 0.25 mm; film thickness 0.25 μ m). The oven temperature was programmed from 60°-280°C at 4°C/min. Helium was used as carrier gas at a flow rate of 2 mL/min. The gas chromatograph was coupled to a Hewlett-Packard 6890 mass selective detector. The MS operating parameters were: ionization voltage, 70 eV; ion source temperature, 200 °C.

Identification of components of the volatile 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 (10, 11).

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Table 1. Composition of the oil of *Nepeta sintenisii* Bornm.

Peak	Component	Percentage	RI
1	α -thujene	0.3	927
2	α -pinene	0.4	935
3	sabinene	1.2	972
4	β -pinene	0.9	976
5	3-octanone	0.1	983
6	myrcene	0.3	988
7	α -terpinene	0.4	1014
8	<i>p</i> -cymene	0.6	1022
9	1,8-cineole	8.2	1031
10	<i>Z</i> - β -ocimene	0.2	1036
11	<i>E</i> - β -ocimene	0.8	1045
12	γ -terpinene	0.8	1058
13	<i>cis</i>-sabinene hydrate	6.5	1068
14	terpinolene	0.2	1085
15	<i>trans</i> -sabinene hydrate	0.6	1096
16	nonanal	0.1	1101
17	<i>cis</i> - <i>p</i> -menth-2-en-1-ol	0.2	1118
18	geijerene ^a	0.9	1140
19	<i>trans</i> - α -dihydro terpineol	0.4	1158
20	terpine-4-ol	2.5	1175
21	α -terpineol	2.3	1190
22	4 α , 7 α , 7 β -nepetalactone	1.6	1357
23	α -copaene	0.2	1372
24	β -bourbonene	1.5	1380
25	4$\alpha$$\beta$, 7$\alpha$, 7$\beta$-nepetalactone	23.4	1400
26	β -caryophyllene	0.6	1416
27	β -gurjunene	0.8	1428
28	<i>E</i>-β-farnesene	9.5	1459
29	germacrene-D	3.5	1480
30	zingiberene	0.4	1492
31	β-bisabolene	4.2	1508
32	γ -cadinene	0.4	1511
33	β -sesquiphellandrene	2.8	1523
34	elemol	16.1	1550
35	spathulenol	0.3	1576
36	caryophyllene oxide	0.3	1580
37	γ -eudesmol	0.5	1628
38	α -epi-cadinol	1.3	1639
39	β -eudesmol	0.7	1648
40	α -eudesmol	0.5	1650

Retention indices on HP-5 capillary column

^a MS, 70 eV, 200°C, m/z (rel. int.): 162[M]⁺(2.5), 147(9.5), 120(3.5), 105(6), 94(41), 79(100), 67(6), 53(12), 41(16)

RESULTS AND DISCUSSION

Aerial parts of *N. sintenisii* yielded 0.3% of a clear yellowish oil. Forty components, representing 96.5% of the total oil were identified. The detected constituents of the oil and their percentage are shown in Table 1. As it could be seen from the table, the essential oil of *N. sintenisii* contains 27.7% monoterpenes with 1,8-cineole (8.2%), *cis*-sabinene hydrate (6.5%), 4-terpineol (2.5%), α -terpineol (2.3%) and sabinene (1.2%) as principle constituents. The sesquiterpene fraction amounted to 43.6% of the oil and the main components of the sesquiterpenes

were elemol (16.1%), *E*- β -farnesene (9.5%), β -bisabolene (4.2%), germacrene-D (3.5%), β -sesquiphellandrene (2.8%), β -bourbonene (1.5%) and α -epi-cadinol (1.3%). In addition, nepetalactones which are common components of the essential oil of many *Nepeta* species, represented 25.0% of the total oil of *N. sintenisii*. According to the available data, *Nepeta* species can be divided into two groups of nepetalactone-containing and nepetalactone-free species. While 4 α ,7 α ,7 α -nepetalactone is the most frequently encountered nepetalactone in oils of *N. gowaniana* (12), *N. cadmea* (13), *N. cephalotes* (14), *N.*

racemosa (15), *N. binaludensis* (16) and *N. sulfuriflora* (17), in the oils of *N. nuda* ssp. *albiflora* (18) and *N. rranjensis* (19), 4 α ,7 α ,7 β -nepetalactone, and in the oil of *N. asterotrichus* (20), 4 α ,7 α ,7 β -nepetalactone, are reported as the main nepetalactones contents respectively. Literature survey on the composition of the volatile oils of nepetalactone-free *Nepeta* species have shown that 1,8-cineole is the main constituents of the oils of *N. sulfuriflora* (46.4%) and *N. heliotropifolia* (19.0%) (21,22). Caryophyllene oxide is also the major components of the volatile oils of *N. cilicia* (40.7%), *N. betonicifolia* (39.2%) and *N. nuda* L. ssp. *nuda* (21.8%) (23-25).

α -Pinene (18.3%) and β -caryophyllene (17.4%) are also reported as the major constituents of the essential oils of *N. glomerulosa* and *N. fissa* respectively (26, 27). According to the nepetalactone-content, *N. sintenisii* could be classified in the group which 4 α ,7 α ,7 β -nepetalactone is the major component. In conclusion, the constituents of volatile oil of *N. sintenisii* are similar to the composition of the *Nepeta* genus.

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REFERENCES

1. Evans WC. Trease and Evans' pharmacognosy. London: W.B. Saunders Company; 1996. p. 48.
2. Mozaffarian V. A dictionary of Iranian plant names. Tehran: Farhang Moaser; 1996. p. 360.
3. Newall CA, Anderson LA, Phillipson JD. Herbal medicines, a guide for health-care professionals. London: The Pharmaceutical Press; 1996. p. 154.
4. Zargari A. Medicinal plants. Vol. 4, Tehran: Tehran University Publications; 1990. p. 106-111.
5. Baser KHC, Kirimer N, Kurkcuglu M, Demirci B. Essential oil of *Nepeta* species growing in Turkey. Chem Nat Comp 2000; 36(4): 356-359.
6. Chiej R. The Macdonald encyclopedia of medicinal plants. London: Macdonald and Co (Publishers) Ltd.; 1988. p. 204.
7. Kokdil G, Kurucu S, Topcu G. Composition of the essential oil of *Nepeta nuda* L. ssp. *albiflora* (Boiss.) Gams. Flav Fragr J 1996; 11: 167-169.
8. Rechinger KH. Flora Iranica. No. 150, Graz: Akademische Druck-u. Verlagsanstalt; 1982. p. 187.
9. British pharmacopoeia. Vol. 2, London: HMSO; 1988. p. A137-A138.
10. Adams RP. Identification of essential oil components by gas chromatography /mass spectroscopy. Illinois: Allured Publ. Corp.; 1995. p. 69-351.
11. Swigar AA, Silverstein RM. Monoterpenes. Infrared, mass, $^1\text{H-NMR}$, $^{13}\text{C-NMR}$ spectra and Kovats indices. Wisconsin: Aldrich Chemical Company Inc.; 1981. p. 1-121.
12. Thappa RK, Agarwal SG, Srivastava TN, Kapahi BK. Essential oil of four Himalayan *Nepeta* Species. J Essent Oil Res 2001; 13: 189-191.
13. Baser KHC, Demircakmak B, Altintas A, Duman H. Composition of the essential oils of *Nepeta cadmea* Boiss. J Essent Oil Res 1998; 10: 327-328.
14. Rustaiyan A, Komeilizadeh H, Monfared A, Nadji K, Masoudi Sh., Yari M. Volatile constituents of *Nepeta denudata* Benth. and *N. cephalotes* Boiss. from Iran. J Essent Oil Res 2000; 11: 459-461.
15. Rustaiyan A, Khosravi M, Larijany K, Masoudi Sh. Composition of the essential oil of *Nepeta racemosa* Lam. from Iran. J Essent Oil Res 2000; 12: 151-152.
16. Rustaiyan A, Nadji N. Composition of the essential oils of *Nepeta isphahanica* Boiss. and *Nepeta binaludensis* Jamzad from Iran. Flav Fragr J 1999; 14: 35-37.
17. Kokdil G, Kurucu S, Topcu G. Chemical constituents of the essential oils of *Nepeta italica* L. and *Nepeta sulfuriflora* P.H. Davis. Flav Fragr J 1997; 12: 33-35.
18. Kokdil G, Kurucu S, Topcu G. Composition of the essential oil of *Nepeta nuda* L. ssp. *albiflora* (Boiss.) Gams. Flav Fragr J 1996; 11: 167-169.
19. Chalchat JC, Gorunovic MS, Petrovic SD, Maksimovic ZA. Composition of the essential oils of *Nepeta rranjensis* Diklic et Milojevic, Lamiaceae from Serbia. J Essent Oil Res 2000; 12: 238-240.
20. Rustaiyan A, Monfared A, Masoudi Sh., Composition of the essential oil of *Nepeta asterotrichus* Rech. F. et Aell. from Iran. J Essent Oil Res 1999; 11: 229-230.
21. Baser KHC, Demircakmak B, Duman H. Composition of the essential oils of *Nepeta sulfuriflora* P.H. Davis. J Essent Oil Res 1998; 10: 179-181.
22. Sajjadi SE, Khatamsaz M. Volatile constituents of *Nepeta heliotropifolia* Lam. J Essent Oil Res 2001; 13: 204-205.

23. Kokdil G, Tanker M, Kurucu S, Tupco G. Essential oil analysis of *Nepeta cilicia* Boiss. *Flav Fragr J* 1997; 12: 99-101.
24. Baser KHC, Ozek T, Demirci B, Tumen G. Composition of the essential oil of *Nepeta betonicifolia* C. A. Meyer from Turkey. *J Essent Oil Res* 2001; 10: 35-36.
25. Kokdil G, Kurucu S, Yildiz A. Essential oil composition of *Nepeta nuda* L. ssp. *nuda* *Flav Fragr J* 1998; 13: 233-234.
26. Sajjadi SE, Ghassemi N. Volatile constituents of *Nepeta glumerulosa* Boiss. subsp. *carmanica* *Flav Fragr J* 1999; 14: 265-267.
27. Sefidkon F, Dabiri M, Alamshahi A. Analysis of the essential oil of *Nepeta fissa* C.A. Mey from Iran. *Flav Fragr J* 2002; 17: 89-90.

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