Chemistry of Natural Compounds, Vol. 42, No. 2, 2006

ESSENTIAL OIL COMPOSITION OF *Nepeta satureioides* FROM IRAN

J. Hadian,[1] A. Sonboli,[2] S. Nejad Ebrahimi,[3] and M. H. Mirjalili[1]

UDC 547.913

The essential oil of Nepeta satureioides *Boiss. from Iran was isolated by hydrodistillation in yield of 0.06% (w/w). The chemical composition of the essential oil was analyzed by GC and GC-MS. Forty-five compounds accounting for 97.4% of the total oil were identified. The major components were linalool (23.8%), (Z,E)-farnesol (14.7%), linalyl acetate (11.1%),* β*-caryophyllene (6.6%), lavandulol acetate (6.6%), caryophyllene oxide (6.4%), and (Z)-*β*-farnesene (3.4%). Oxygenated terpenoids were the main group of compounds.*

Key words: *Nepeta satureioides*, Lamiaceae, essential oil composition, linalool, Iran.

The genus *Nepeta* belongs to the family Lamiaceae, comprises 69 species growing in Iran, 38 and 31 of which are endemic and native, respectively. *Nepeta satureioides* Boiss. is one of the aromatic endemic plants of Iran [1]. This plant, with the common local name of *Ostokhoddous*, has been of interest to Iranian traditional medicine, especially in Khorasan province. Infusion obtained from the aerial parts of *N. satureioides* is used traditionally for the following purposes: carminative and treatment for colds and bronchitis.

Although the literature survey showed the essential oil compositions of some other *Nepeta* species [2–11] have previously been studied, but *N. satureioides* has not been investigated for its essential oil composition. The yield of essential oil based on the dry weight of the plant was 0.06% (w/w). The percentage composition of the essential oil is listed in Table 1 along with the retention indices of the identified compounds, where all constituents are arranged in order of their elution on the DB-1 column. In total, 45 constituents were identified and quantified, representing 97.4% of the total oil. As can be seen in Table 1, the main constituents identified and their percentages were as follow: linalool (23.8%), (*Z,E*)-farnesol (14.7%), linalyl acetate (11.1%), *β*-caryophyllene (6.6%), lavandulol acetate (6.6%), caryophyllene oxide (6.4%), and (Z)-*β*-farnesene (3.4%).

The classification of the identified compounds based on functional groups is summarized at the end of Table 1. As shown, oxygenated mono- and sesquiterpenes were the main groups, representing 49.8% and 26.5% of the total oil, respectively. In contrast, five monoterpene hydrocarbons constituted a total of 0.1% of the oil. According to our results, nepetalactone isomers were not detected in *N. satureioides* oil as they were in *N. involucrate* [2], *N. ucranica* ssp. *Kopetdaghensis* [3], *N. makuensis* [4], *N. fissa* [5], *N. glomerulosa* [6], *N. macrosiphon* [7], *N. heliotropifolia* [8], *N. denudata* [9], *N. glomerulosa* subsp. *carmanica* [10], and *N. ispahanica* [11].

1) Department of Horticultural Science, Faculty of Horticulture and Plant Protection, Tehran University, Karaj, Iran, e-mail: m-mirjalili@cc.sbu.ac.ir; 2) Department of Biology, Medicinal Plants and Drugs Research Institute, Shahid Beheshti University, P.O. Box 19835-389, Evin, Tehran, Iran, e-mail: A-Sonboli@cc.sbu.ac.ir; 3) Department of Phytochemistry, Medicinal Plants and Drugs Research Institute, Shahid Beheshti University, P.O. Box 19835-389, Evin, Tehran, Iran. Published in Khimiya Prirodnykh Soedinenii, No. 2, pp. 144-145, March-April, 2006. Original article submitted July 11, 2005.

0009-3130/06/4202-0175

TABLE 1. Essential Oil Composition of *Nepeta satureioides* from Iran

Compound	RI	Percentage	Compound	RI	Percentage
1-Octen-3-ol	961	0.2	(*Z*)-*β*-Farnesene	1449	3.4
Myrcene	981	Tr.	*α*-Neoclovene	1458	0.6
Hexyl acetate	992	Tr.	Bicyclogermacrene	1500	0.4
α-Terpinene	1013	Tr.	*γ*-Cadinene	1513	0.1
p-Cymene	1016	Tr.	Laurinsaerure 2-hexen-1-yl ester	1561	3.4
1,8-Cineole	1024	0.3	Davanone	1567	1.2
(*Z*)-*β*-Ocimene	1036	0.1	Spathulenol	1577	1.0
γ-Terpinene	1050	Tr.	Caryophyllene oxide	1584	6.4
Linalool	1086	23.8	Humulene oxide	1606	0.1
1-Octen-3-yl acetate	1092	0.2	(*Z,E*)-Farnesol	1624	14.7
Lavandulol	1150	0.3	Widdrol	1630	0.2
Borneol	1155	0.2	(*Z, Z*)-Farnesol	1635	1.8
Pinocamphon	1158	0.1	(*E, Z*)-α-Bisabolene oxide	1652	0.2
Cryptone	1163	0.1	(*E, E*)-Farnesol	1657	0.9
4-Terpineol	1166	0.2	Tetradecanoic acid	1741	0.2
Hexyl butanoate	1173	0.1	Isobutyl phthalate	1826	0.2
α-Terpineol	1178	2.5	Palmitic acid	1949	3.0
Nerol	1212	0.5	Methyl linolate	2124	2.0
Cumin aldehyde	1218	0.2	Pentacosane	2501	0.2
Pulegone	1221	0.2			
Linalyl acetate	1242	11.1	Monoterpene hydrocarbons		0.1
Lavandulyl acetate	1272	6.6	Oxygenated monoterpenes		49.8
Neryl acetate	1342	1.3	Sesquiterpene hydrocarbons		11.2
Geranyl acetate	1362	2.7	Oxygenated sesquiterpenes		26.5
β-Damascenone	1368	0.1	Other		9.8
β-Caryophyllene	1429	6.6	Total		**97.4**

RI: retention indices relative to C_6-C_{24} *n*-alkanes on the DB-1 column.
Tr.: trace <0.1%.

EXPERIMENTAL

Plant Material and Isolation Procedure. The aerial parts of *N. satureioides* were collected during the flowering stage in May 2005 from Khorasan Province: Bejestan-Ferdows road, Serideh village, at an altitude of 1300 m. A voucher specimen (mp-885) was deposited in the Medicinal Plants and Drugs Research Institute Herbarium, Shahid Beheshti University,Tehran, Iran. Plant material was taken immediately to the laboratory to be dried at ambient temperature in the shade. Air-dried aerial parts (100 g) were subjected to hydrodistillation for 3 h, using a Clevenger-type apparatus. The oil was dried over anhydrous sodium sulfate and stored in sealed vials. The yield of the oil was found to be 0.06% (w/w) and it was stored at 4°C until analysis.

Gas Chromatography. GC analysis was performed using a Thermoquest gas chromatograph with a flame ionization detector (FID). The analysis was carried out using fused silica capillary DB-1 column (60 m × 0.25 mm i.d.; film thickness 0.25 μm). The operating conditions were as follows: injector and detector temperatures were 250°C and 300°C, respectively. Nitrogen was used as carrier gas at a flow rate of 1 mL/min; oven temperature programes, 60–250°C at the rate of 5°C/min, and finally held isothermally for 10 min.

Gas Chromatography-Mass Spectrometry. GC-MS analysis was performed using a Thermoquest-Finnigan gas chromatograph equipped with the above - mentioned column and coupled to a TRACE mass. Helium was used as carrier gas with ionization voltage 70 eV. Ion source and interface temperatures were 200°C and 250°C, respectively. Mass range was from *m/z* 43–456. Gas chromatographic conditions were as given for GC.

Identification of Compounds. The constituents of the essential oil were identified by calculation of their retention indices under temperature-programmed conditions for *n*-alkanes (C_6–C_{24}), and the oil on a DB-1 column under the same chromatographic conditions. Identification of individual compounds was made by comparison of their mass spectra with those of the internal reference mass spectra library or with authentic compounds and confirmed by comparison of their retention indices with authentic compounds or with those reported in the literature [12, 13]. For quantification purpose, relative area percentages obtained by FID were used without correction factors.

ACKNOWLEDGMENT

We are grateful to the Tehran University Research Council for financial support of this work. The authors wish to thank Dr. Peyman Salehi for his generous cooperation in preparing the GC and GC-MS spectrum.

REFERENCES

1. K. H. Rechinger, *Nepeta*, in: K. H. Rechinger, (ed.), *Flora Iranica*, No. 150, Graz, Austria, 1982.
2. A. Sonboli, P. Salehi, and L. Allahyari, *Chem. Nat. Comp.*, **41**, 683 (2005).
3. K. Javidnia, R. Miri, I. Mehregan, and H. Sadeghpour, *Flavour Fragr. J.*, **20**, 219 (2005).
4. Z. Habibi, S. Masoudi, and A. Rustaiyan, *J. Essent. Oil Res.*, **16**, 214 (2004).
5. F. Sefidkon, M. Dabiri, and A. Alamshahi, *Flavour Fragr. J.*, **17**, 89 (2002).
6. F. Sefidkon, *J. Essent. Oil Res.*, **13**, 422 (2001).
7. K. Javidnia, R. Miri, A. Jafari, and H. Rezai, *Flavour Fragr. J.*, **19**, 156 (2004).
8. S. E. Sajjadi and M. Khatamsaz, *J. Essent. Oil Res.*, **13**, 204 (2001).
9. A. Rustaiyan, H. Komeilizadeh, A. Monfared, K. Nadji, S. Masoudi, and M. Yari, *J. Essent. Oil Res.*, **11**, 459 (2000).
10. S. E. Sajjadi and N. Ghassemi, *Flavour Fragr. J.*, **14**, 265 (1999).
11. A. Rustaiyan and K. Nadji, *Flavour Fragr. J.*, **14**, 35 (1999).
12. T. Shibamoto, *Retention Indices in Essential Oil Analysis*, in: P. Sandra and C. Bicchi (eds.), *Capillary Gas Chromatography in Essential Oil Analysis*, Huethig Verlag, New York, 1987.
13. R. P. Adams, *Identification of Essential Oils by Gas Chromatography/Mass Spectroscopy*. Allured, Carol Stream, IL, 1995.