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Original Article

Essential Oil Analysis of *Nepeta crispa* and *N. menthoides* from Iran

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Abstract

The composition of the essential oils of *Nepeta crispa* Willd. and *N. menthoides* Boiss. and Buhse (Lamiaceae) was investigated by means of gas chromatography (GC) and GC- mass spectrometery (MS). 1, 8-Cineole was the most abundant component in oils: *Nepeta crispa* (71%) and *N. menthoides* (41.1%). In the oil of *N. crispa*, β-pinene (5%) and δ-terpineol (4.1%) were found to be the major constituents. Dihydromyrcen-1-ol (9.2%), 4-terpineol (7.1%), and geranyl acetate (6.1%) were the predominant compounds in the oil of *N. menthoides*.

Keywords: 1,8-Cineole ; Essential oil ; Lamiaceae ; *Nepeta crispa* ; *N. menthoides*; *Received:* June 9, 2008; *Accepted:* September 2, 2008.

1. Introduction

The genus *Nepeta* (Lamiaceae), with almost 280 species, is widespread in Europe, Asia and a few parts of Africa [1]. This genus has 67 species, mostly endemic in Iran [2]. Some species are used in Iranian traditional medicine, *N. cataria* (catnip), for instance, is used as a fortifier, a disinfectant and cure against colds [3]. *N. menthoides* has been used in phytotherapy (in Iran), at the name 'Stoechas' as a relief agent for stomach pains, febrifuge and sedative, *N. bracteata*, at the name 'Zofa' as carminative and antiasthmatic and *N. racemosa*, at the name 'Gol-e moro' as stomachic, disinfectant and carminative [4].

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The essential oil of several species of the genus *Nepeta* has been examined, e.g. *N. persica* Boiss. [5], *N. ispahanica* Boiss. and *N. binaludensis* Jamzad [6], *N. daenensis* [7], *N. sibirica* [8], *N. sintenisii* [9], *N. involucrate* [10], *N. pannonica* [11], *N. satureioides* [12], *N. hellotropifolia* [13] and *N. meyeri* [14-16]. These oils are characterized by the presence of 1,8-cineole or various of nepetalactone isomers, which are known as powerful attractant for cats [17].

As a part of our research on the aromatic flora of Iran, we decided to investigate the chemical composition of the oils isolated from *N. crispa* Willd. and *N. menthoides* Boiss. and Buhse, endemics of Iran by means of gas chromatography (GC) and GC- mass spectrometery (MS) in combination with retention indices. Literature survey has shown

Table 1. Composition of the essential oils from *Nepeta crispa* and *N. menthoides.*

Compound	RI	*N. crispa* (%)	*N. menthoides* (%)
Ethyl isovalerate	856	-	0.2
Propyl butyrate	896	-	0.1
α-Pinene	936	1.8	0.2
Sabinene	970	-	2.4
β-Pinene	976	5.0	5.6
n-Decane	999	-	0.4
1,8-Cineole	**1032**	**71.0**	**41.1**
γ-Terpinene	1058	-	0.1
Linalool	1085	1.4	0.9
α-Fenchol	1117	-	1.0
Dihydromyrcen-1-ol*	-	-	9.2
trans-Pinocarveol	1126	0.7	-
Sabinol	1136	0.4	-
Isopulegol	1146	-	0.1
Menth-3-en-1-ol	1149	-	0.8
δ-Terpineol	1152	2.8	0.9
Pinocamphone	1160	-	2.3
Pinocarvone	1162	-	0.4
4-Terpineol	1167	2.3	7.1
α-Terpineol	1178	4.1	5.7
Geraniol	1226	-	0.2
Myrthanol	1252	-	1.8
Geranial	1270	-	0.2
trans-Anethol	1283	0.6	0.9
Isobornyl propanoate	1381	-	0.1
Geranyl acetate	1383	-	6.1
Benzyl pentanoate*	-	-	0.8
β-Farnesene	1450	0.3	-
α-Farnesene	1495	0.6	-
Spathulenol	1576	-	0.1
Methyl hexadecanoate	1927	-	0.8

*Identified by comparison with mass spectra.

that the plants have previously been investigated for any compounds [18-20]. For confirmation of previous works and for addition of new data, we decided to analysis of these oils.

2. Materials and methods

2.1. Plant materials

The leaves and flowers of the two *Nepeta* species were collected from several natural sites in 2007 in Iran. *Nepeta crispa* Willd. was collected from Alvand Mountains, province of Hamadan, and *N. menthoides* was collected from Sabalan Mountains, province of Ardabil. Voucher specimens were deposited in the Herbarium of the Research Institute of Forests and Rangelands (TARI), Tehran, Iran. Plant materials were hydrodistillated in a Clevenger-type apparatus for 3 h. The essential oils were dried over anhydrous sodium sulphate and stored at 2 °C in a dark.

2.2. Gas chromatography (GC)

GC analyses were performed using a Packard 439 gas chromatograph equipped with a CP-Sil-5CB column (25 m 0.25 mm i.d., film thickness 0.39 μm); temperature programmed at 60 °C, rising by 5 °C/min. to 220 °C; carrier gas, N_2 (0.8 ml/min.); injector and detector temperature were 270 °C.

2.3. Gas chromatography-mass spectrometry (GC-MS)

Varian 3700 chromatography with a CP Sil 5CB column (25 m×0.25 mm i.d., film thickness 0.39 μm) combined with a Varian MAT 44S, ionization energy 70ev. The carrier gas was He and injector temperature was 270 °C. Approximately, 0.1 μl of neat oil was

Table 2. Class composition of compounds in *N. crispa* and *N. menthoides*

Class of compounds	*N. crispa* (%)	*N. menthoides* (%)
Monoterpenoids	89.5	87.2
Sesquiterpenoids	0.9	0.1
Phenyl propanes	0.6	0.9
Others	-	2.3
Total	91.0	90.5

injected under split condition (100:1) and the oven temperature was held at 60 °C for 5 min., programmed at 5 °C/min. to 220 °C and then holds at this temperature for 20 min.

3. Result and discussion

Oil yields of the *Nepeta crispa* and species *N. menthoides* were 0.9% and 0.5%, respectively. The identification of the compounds was carried out by comparison of their mass spectra with those of authentic samples together with the retention indices (RI) [21]. Only the compounds representing at least 0.1% of the mixture are given in the Table 1 in order of their elution on the column. The results represented in Table 1 reveal a clear difference in the chemical composition of the oils.

N. crispa oil contained 1,8-cineole (71%) among the 12 constituents characterized, comprising 93% of the total components detected. Monoterpenoids predominated over sesquiterpenes here as well. 1,8-Cineol was the main constituents among the 27 components characterized, comprising 41.1% of the total components detected in the oil of *N. menthoides*, and 91% of the oil components detected.

The major component of two oil was 1,8-cineole. On the other hand, the amount of 1,8-cineole of *N. crispa* was higher (71%) than that found in the oil of *N. menthoides* (41%). In the oils isolated from other *Nepeta species*, the percentage of 1,8-cineole varied from trace to 80 % [22-26]. In the oils of *N. crispa* and *N. menthoides* we could not find any trace of nepetalactone. The lack of nepetalactone is known in the oil of some *Nepeta* species; *N. cataria* [25] and *N. caesarea* [26]. Concerning the sesquiterpenes, the essential oil of *N. menthoides* and *N. crispa* cotained 0.1% and 0.9%, respectively. The results of our analysis are very same to previous works. Other researchers could identify 1, 8-cineole as major component in these oils, too [18, 19]. They could identify nepetalactones in the oil of *N. crispa*, but we couldn't identify any of them. We also could identify sabinol and *E*-anethol in *N. crispa*. The major components of *N. menthoides* in our research were same to previous work [20]. Major components in both them were 1,8-cineole, β-pinene and geranyl acetatae. The results of our analysis on *N. crispa* and *N. menthoides* confirm previous works on the same herbs. The minor different in these analysis can be related to time and place of plant harvesting.

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