# 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 4aβ,7α,7aβ-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, 4aβ,7α,7aβ-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 repellant 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 (N0. 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 × 0.25 mm; film thickness 0.25 μm). 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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**Table1.** 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 | ρ-cymene | 0.6 | 1022 |
| **9** | **1,8-cineole** | **8.2** | **1031** |
| 10 | *Z*-β-ocimene | 0.2 | 1036 |
| 11 | *E*-β-ocimene | 0.8 | 1045 |
| 12 | γ-terpinene | 0.8 | 1058 |
| **13** | ***cis*- sabinene hydrate** | **6.5** | **1068** |
| 14 | terpinolene | 0.2 | 1085 |
| 15 | *trans* - sabinene hydrate | 0.6 | 1096 |
| 16 | nonanal | 0.1 | 1101 |
| 17 | *cis*-ρ-menth-2-en-1-ol | 0.2 | 1118 |
| 18 | geijerene[a] | 0.9 | 1140 |
| 19 | *trans* -α- dihydro terpineol | 0.4 | 1158 |
| 20 | terpine-4-ol | 2.5 | 1175 |
| 21 | α-terpineol | 2.3 | 1190 |
| 22 | 4aα, 7α, 7aβ-nepetalactone | 1.6 | 1357 |
| 23 | α-copaene | 0.2 | 1372 |
| 24 | β-bourbonene | 1.5 | 1380 |
| **25** | **4aβ, 7α, 7aβ-nepetalactone** | **23.4** | **1400** |
| 26 | β-caryophyllene | 0.6 | 1416 |
| 27 | β-gurjunene | 0.8 | 1428 |
| **28** | ***E*-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 4aα,7α,7aα-nepetalactone is the most frequently encountered nepetalactone in oils of *N. govaniana* (12), *N. cadmea* (13), *N. cephalotes* (14), *N.*

*racemosa* (15), *N. binaludensis* (16) and *N. sulforiflora* (17), in the oils of *N. nuda* ssp. *albiflora* (18) and *N. rtanjensis* (19), 4aα,7α,7aβ-nepetalactone, and in the oil of *N. asterotrichus* (20), 4aβ,7α,7aβ-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%) an *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 4aβ,7α,7aβ-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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