

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

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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 caryophyllene; 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. ispahanicum*, *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 quantitative analysis of the oil prepared by hydrodistillation by GC/MS.

MATERIALS AND METHODS

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, 60-275°C at 4°C/min; injector and detector temperatures, 280 °C; 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 °C; 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 DISCUSSION

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

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 HP₅-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. *dirphyia* (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).

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