Quantity and Composition of the SDE Prepared Essential Oil of Nepeta macrosiphon Boiss


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Abstract

The essential oil from flowering aerial parts of Nepeta macrosiphon Boiss. growing wild in Kermanshah Province, Iran, was analyzed by GC/MS. This essential oil was prepared by a modified Likens-Nickerson’s simultaneous distillation-extraction (SDE) method. Forty-five compounds consisting 95.1% of the total components were identified from the oil obtained with a yield of 0.1%w/w. Among them, spathulenol (14.1%), germacrene D (9.2%) and caryophyllene oxide (8.1%) were the major components of the oil.

Keywords: Nepeta macrosiphon; Lamiaceae; Essential oil composition; GC/MS; Spathulenol; Germacrene D; Caryophyllene oxide.

Introduction

The genus Nepeta, also called Glechoma and Cataria, is named after the ancient Italian city of Nepi (1). This genus which belongs to Stachyioideae-Nepeteae tribe, Lamiaceae family, consists of about 250 species distributed in the central and southern parts of Europe, Asia and Middle East (2, 3). Many reports on phytochemical analysis of this genus, including essential oil analysis, are found in the literature (4-27). Most oils of Nepeta species contain nepetalactones as the main components, but some differences in the essential oil composition were detected in several Nepeta oils (15-27). Antibacterial, fungicidal, antiviral and opioid analgesic activities have been attributed to nepetalactones (19, 21). Nepeta species are still used in the traditional medicine of many countries as diuretic, diaphoretic, vulnerary, antitussive, antispasmodic, anti-asthmatic, tonic, febrifuge, emmenagogue and sedative agents (22, 27, 28). Some of Iranian Nepeta species has been of great interest to Iranian folk and traditional medicines and used in the treatment of various disorders, such as some nervous, respiratory and gastrointestinal diseases (27, 29).

The Iranian flora comprises 67 species of Nepeta and one of them is Nepeta macrosiphon Boiss (2, 30). This herb distributed in different rocky western areas of Iran (2). The Persian names of the plant are “punesaye sisakhti” and “punesaye lulehboland” (30). Our literature surveys revealed that the essential oil of the aerial parts of N. macrosiphon has not been chemically studied to date, therefore this article deals with the detailed quantity and composition of the SDE oil prepared by GC/MS.

Experimental

Plant Material

The aerial parts of wild-growing N. macrosiphon were collected during the flowering period from northern slopes of Dalakhani mountain, Songhur (Kermanshah Province, Iran) at an altitude of ca. 2300 m in
June 2001. The plant identity as *N. macrosiphon* was confirmed by the Herbarium Department of the Faculty of Pharmacy, Shiraz University of Medical Sciences, Shiraz, Iran. A voucher specimen of the plant was deposited in the Herbarium of the Department of Pharmacognosy, School of Pharmacy and Pharmaceutical Sciences, Isfahan University of Medical Sciences, Isfahan, Iran.

The air-dried aerial parts of the plant were powdered and the volatile fraction was prepared by a modified Likens-Nickerson’s simultaneous distillation and extraction (SDE) method (31, 32). A microscale simultaneous distillation extraction apparatus (Ashke Shishe, Tehran, Iran) was used. Dried powdered plant was homogenized with distilled water and the homogenate subjected to SDE apparatus for 3 h using pentane (chromatography grade reagent, Merck) as solvent and then extract was concentrated with nitrogen.

**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, 60-275ºC at 4ºC/min; injector and detector temperatures, 280ºC; 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, 200ºC; 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 (33-36).

**Results and Discussion**

Aerial parts of *N. macrosiphon* yielded 0.1% (w/w vs dried material) of a pale yellowish oil with a strong pleasant aroma. Forty-five components were characterized, representing 95.1% of the total oil compounds detected. These are listed in Table 1 with their percentage composition. The major constituents of the sesquiterpene-rich oil of *N. macrosiphon* were spathulenol (14.1%), germacrene D (9.2%), caryophyllene oxide (8.1%), alpha-muurolene (6.0%) and bicyclogermacrene (5.7%). Other components were present in amounts less than 5%. Many of the unidentified compounds were present in trace amounts.

Although the presence of nepetalactones in several *Nepeta* species in relatively high concentrations has been reported (15-27), no nepetalactones were found in this oil. The predominance of spathulenol and caryophyllene oxide has been found in essential oils of two Turkish *Nepeta* species (9, 12). These compounds and germacrene D are typical in most *Nepeta* species (4-27).
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