



Essential oil composition of *Nepeta isaurica* Boiss. Heldr. apud Bentham and *Nepeta sulfuriflora* P.H. Davis growing naturally in Türkiye

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Abstract

Nepeta species are widely used in folk medicine as a diaphoretic, diuretic, antiseptic, astringent, anti-asthmatic, cough suppressant, antispasmodic, antipyretic, sedative and stomachic. This study was designed to examine the chemical composition of the essential oil of *Nepeta isaurica* and *Nepeta sulfuriflora*. It was determined that the aerial parts of the *N. isaurica* plant contained 0.72% essential oil, 37 compounds were identified representing 98.86% of the total oil analyzed via GC-MS. The major components of the essential oil obtained from these plants were trans-pinocarveol, α -pinene, linalool, 1,8-cineole, α -terpineol, α -cadinol, spathulenol and β -pinene. It was determined that the aerial parts of *N. sulfuriflora* contained 0.64% essential oil. GC-MS analysis identified 37 compounds representing 99.07% of the total oil. It has been determined that the main component of the essential oil in *N. sulfuriflora* is 1,8-cineol (72.05%). As a result of the study, it was concluded that *N. sulfuriflora* could be used as a 1,8-cineol reservoir.

Keywords: essential oil, GC-MS, *Lamiaceae*, *Nepeta isaurica*, *Nepeta sulfuriflora*

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Türkiye'de doğal olarak yetişen *Nepeta isaurica* Boiss. Heldr. apud Bentham and *Nepeta sulfuriflora* P.H. Davis'in uçucu yağ bileşimi

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Özet

Nepeta türleri halk hekimliğinde terletici, idrar söktürücü, antiseptik, büzücü, astım önleyici, öksürük kesici, spazm çözücü, ateş düşürücü, yatıştırıcı ve mide söktürücü olarak yaygın şekilde kullanılmaktadır. Bu çalışma, *Nepeta isaurica* ve *Nepeta sulfuriflora* bitkilerinin uçucu yağının kimyasal bileşimini belirlemek için planlanmıştır. *N. isaurica* bitkisinin toprak üstü kısımlarının %0,72 oranında uçucu yağ içerdiği, GC-MS analizinde toplam yağın %98,86'sını temsil eden 37 bileşik tespit edilmiş ve uçucu yağın ana bileşenlerinin trans-pinocarveol, α -pinen, linalool, 1,8-sineol, α -terpineol, α -cadinol, spathulenol ve β -pinen olduğu belirlenmiştir. *N. sulfuriflora*'nın toprak üstü kısımlarının %0,64 oranında uçucu yağ içerdiği belirlenmiştir. GC-MS analizinde ise toplam yağın %99,07'sini temsil eden 37 bileşik tanımlanmıştır. *N.sulfuriflora*'da bulunan uçucu yağın ana bileşeninin 1,8-sineol (%72,05) olduğu belirlenmiştir. Çalışma sonucunda *N. sulfuriflora*'nın 1,8-sineol deposu olarak kullanılabilceği sonucuna varılmıştır.

Anahtar kelimeler: uçucu yağ, GC-MS, *Lamiaceae*, *Nepeta isaurica*, *Nepeta sulfuriflora*

1. Introduction

Plants are a source of valuable, inexpensive and easily obtainable natural products. Natural products play a crucial role in pharmacy and agriculture to synthesize new herbal medicines. It has been proven by studies that many families such as *Myrtaceae*, *Lauraceae*, *Rutaceae*, *Lamiaceae*, *Asteraceae*, *Apiaceae*, *Cupessaceae*, *Poaceae*,

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Zingiberaceae and *Piperaceae* contain valuable essential oils with lipophilic structure and rich in many bioactive compounds. These active compounds, on the one hand, serve as alternatives to many synthetic pharmaceutical and agricultural drugs, on the other hand, they contribute to the discovery of new bioactive compounds extracted from plants [1, 2].

Turkey has a rich flora and fauna due to being at the intersection of three different phytogeographic regions and having different climate, environment and topography (Iran-Turonian, Mediterranean and Euro-Siberian) and being a transitional region between Europe and Asia. There are about 12.000 taxa in the flora of Türkiye and it is known that about 3,000 of these taxa are endemic. However, about 650 of these plant taxa are used as medicinal plants for therapeutic purposes by the public in various regions [3].

Aromatic plants belonging to the *Lamiaceae* family are annual or perennial, herbaceous or shrubby plants widely distributed in many parts of the world. *Nepeta*, which is one of the genera that contains the most taxa of the *Lamiaceae* family, is represented by approximately 250-300 taxa in the world [4, 5]. The genus *Nepeta* in the Flora of Turkey has been divided into 3 informal groups (designated as A, B and C) based on flower color and cluster characteristics. Group A (14 species): flowers white, yellow or pinkish, nutlets entire or tuberculous at the apex; group B (16 species): flowers lilac or dark blue, nutlets tuberculous or smooth; group C (3 species): flowers white, lilac or purple, nutlets tuberosus, spherical [6, 7].

In studies on *Nepeta* species used as traditional herbal medicine, it has been determined that it has various pharmacological effects such as antimicrobial, antioxidant, anti-inflammatory, sedative, relaxant, antihyperlipidemic, antiasthmatic, carminative, diuretic, diaphoretic, antipyretic, anthelmintic, herbicide and insecticide. It is known that lotions prepared from some *Nepeta* species are also used against snake and scorpion bites. While some of the *Nepeta* species are used to flavor foods, it is known that some of them are used as herbal tea in the treatment of stomach disorders, and some of them are used in the treatment of dental and rheumatic pains [8, 9]. In this article, we describe the essential oil content and chemical composition, antioxidant activity and total phenolic content of *N. isaurica* and *N. sulfuriflora*.

2. Materials and methods

Plant materials were collected in the Anamur district of Mersin, in southern Turkey. The aerial parts of *N. isaurica*, which is in the endemic and least concern (LC) category, were collected between Sugözü village and Tamtır Plateau (39° 19' 07" N, 32° 43' 18" E and 1950 m elevation) on 16 June 2021. Aerial parts of *N. isaurica*, which is in the endemic and conservation dependent (CD) category, were collected on June 16, 2021 between Sugözü and Boguntu Villages (36° 17' 50" N, 32° 47' 48" E and 1100 m elevation). The plant samples were identified by Dr. Ömer ÇEÇEN and voucher specimens have been deposited in the Biodiversity Application and Research Center at Karamanoglu Mehmetbey University.

Isolation of the essential oils: The air dried aerial parts of the plants were hydro distilled for 3h using a Clevenger type apparatus. The obtained oils were stored at +4°C until analyzed.

GC-MS analyses: The analysis of the main components of the essential oils of each samples were performed using Thermo Scientific ISQ Single Quadrupole Gas Chromatography- Mass Spectrometry device (Milan, Italy) fitted with TR- FAME capillary column (5% Phenyl Polysilphenylene- siloxane, 60 m × 0.25 mm i.d. × 0.25 µm film thickness). Helium (99.9%) was used as the carrier gas at a flow rate of 1 ml/min. Mass spectra were recorded at 70 eV, the mass range was from 1.2 to 1,200 m/z. Scan Mode was used for data collection. MS transfer line, ionization source and the injection port temperatures were 250, 230, and 220 °C, respectively [10].

3. Results

The essential oil content and components of *N. isaurica* and *N. sulfuriflora* are summarized in Table 1. The essential oil content of *N. isaurica* was obtained as 0.72%, while the oil content of *N. sulfuriflora* was obtained as 0.64%.

The chemical composition of *N. isaurica* essential oil included of 40 compounds and these compounds were identified representing 99.98% of the total composition. The major components of essential oil were determined as trans-pinocarveol, (8.30%), α -pinene (7.73%), linalool (7.33%), 1,8-cineole (6.80%), α -terpineol (6.77%), α -cadinol (6.57%), spathulenol (6.39%) and β -pinene (6.13%) (Table 1).

The chemical composition of *N. sulfuriflora* essential oil included of 37 compounds and these compounds were identified representing 99.07% of the total composition. While the main component of the essential oil was 1,8-cineole with 71.62%, only verbenol (2.81%) and caryophyllene oxide (2.27%) were greater than 2% and the other 33 components were less than 2% (Table 1).

1,8-Cineole is a colorless liquid natural compound and is used as a flavoring in food products and in cosmetics due to its pleasant aroma and taste. According to data from the five major cigarette manufacturers, 1,8-Cineole is one of the 599 contributors to cigarettes. 1,8-Cineole is used in the treatment of upper and lower respiratory tract diseases. In addition, 1,8-Cineole is used as an insecticide and insect repellent [11-14]. Loi et al [15] reported that 1,8-Cineole has allelopathic effects on plants.

Table 1. Chemical composition of *Nepeta isaurica* and *Nepeta sulfuriflora*

| RT | Compounds | <i>N. isaurica</i> | <i>N. sulfuriflora</i> |
|--------------------------------|-----------------------|--------------------|------------------------|
| 6.57 | α -Pinene | 7.73 | 1.66 |
| 8.39 | β -Pinene | 6.13 | 1.46 |
| 8.70 | β -Phellandrene | 1.18 | 0.85 |
| 10.04 | Limonene | 4.71 | 0.20 |
| 11.03 | γ -Terpinene | 0.32 | 0.30 |
| 11.98 | 1.8-cineole | 6.80 | 71.62 |
| 12.67 | o-Cymene | 1.02 | 1.42 |
| 17.22 | 1-Octen-3-ol | 0.15 | 0.14 |
| 18.13 | Linalool oxide | 1.49 | - |
| 20.33 | Linalool | 7.33 | 0.21 |
| 23.27 | α -Campholenal | 0.96 | 0.40 |
| 24.03 | trans-Caryophyllene | 1.35 | 0.73 |
| 24.19 | Terpinen-4-ol | 1.76 | 1.28 |
| 24.94 | α -Muurolene | 0.49 | 0.30 |
| 25.17 | trans-Pinocarveol | 8.30 | 1.03 |
| 25.91 | Camphor | 0.96 | - |
| 26.26 | Verbenol | 4.21 | 2.81 |
| 26.42 | Eremophylene | 0.97 | 0.32 |
| 27.12 | α -Terpineol | 6.77 | 1.66 |
| 27.48 | Borneol | 1.25 | 0.71 |
| 28.41 | Bicycloelemene | 0.46 | - |
| 28.64 | Myrtenal | 2.36 | 0.91 |
| 28.81 | Trans-pinane | - | 0.31 |
| 29.50 | Myrtenol | 1.56 | 0.47 |
| 30.62 | trans-Carveol | 1.0 | 0.37 |
| 31.12 | Germacrene B | - | 0.75 |
| 31.59 | Carvone | 1.45 | 0.35 |
| 32.49 | p-Cumic aldehyde | - | 0.18 |
| 33.54 | D-Verbenone | 1.33 | 0.95 |
| 35.49 | Palustrol | 1.54 | 0.12 |
| 37.77 | Ledene | 0.20 | 0.89 |
| 38.48 | Ledol | 4.72 | - |
| 38.73 | Veridiflorol | 0.46 | - |
| 40.10 | Caryophyllene oxide | 4.05 | 2.27 |
| 40.36 | Spathulenol | 6.39 | - |
| 41.66 | β -Bourbonene | 0.99 | 1.79 |
| 42.24 | α -Cadinol | 6.57 | 0.64 |
| 43.60 | β -Eudesmol | 0.93 | 0.26 |
| 42.51 | Levantenolide | 0.24 | - |
| 46.11 | Junipene | 0.54 | 0.19 |
| 46.50 | Patchoulane | - | 0.75 |
| 46.52 | Ethyl linoleate | 0.31 | 0.34 |
| 49.02 | Cedrenol | 0.40 | - |
| 49.37 | cis-Jasmone | 0.60 | 0.26 |
| 52.54 | Cyperone | - | 0.17 |
| Number of identified compounds | | 40 | 37 |
| Total (%) | | 99.98 | 99.07 |
| Essential oil content (%) | | 0.72 | 0.64 |

RT: Retention time

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