ESSENTIAL OIL COMPOSITION OF *Teucrium montbretii* SUBSP. *montbretii* BENTH. (LAMIACEAE)

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Essential oils obtained by hydrodistillation of *Teucrium montbretii* subsp. *montbretii* Benth. (Lamiaceae) from Hatay (Turkey), were analyzed by GC/MS. Forty-four volatile components were identified in the oils, representing 98.12 % of the total oils. The sample was yielded 0.24% of yellowish oil (w/w), with a pleasant smell. The main essential oil compounds of the plant were trans-caryophyllene, germacrene-D and caryophyllene oxide, representing 66.7%. Trans-caryophyllene, which has the highest ratio (36.78%), also known as β-caryophyllene, is a component that is the main constituent of many plants included in the sesquiterpene chemical class. Second main component germacrene-D (19.87%) is also sesquiterpene and detected in the essential oil of many plants. α-Copaene, humulene, aromadendrene and globulol were the other components detected at ratio of 5.45%, 4.29%, 3.99% and 3.35%, representing 17.08%, respectively.

Keywords: essential oil, GC-MS, *Teucrium montbretii* subsp. *montbretii* Benth.

INTRODUCTION

Teucrium montbretii Benth. (Lamiaceae) with its 6 subspecies, is an Eastern Mediterranean species naturally distributed in Lebanon, Western Syria, Palestine, Türkiye's Mediterranean region and South Aegean Islands (Navarro, 2020; POWO, 2022). Its subspecies and distribution areas are as follows: *Teucrium montbretii* subsp. heliotropiifolium (Barbey) P.H. Davis endemic to the Kárpathos Island; *Teucrium montbretii* subsp. judaicum P.H. Davis, endemic to Israel; *Teucrium montbretii* subsp. libanoticum P.H. Davis, endemic to Lebanon; *Teucrium montbretii* subsp. montbretii Benth. have a narrow distribution between South Türkiye and North-West Syria; *Teucrium montbretii* subsp. pamphylicum P.H. Davis, endemic to Türkiye; *Teucrium montbretii* subsp. yildirimlii Dinç & Dogu, endemic to Türkiye.

Although it is not endemic to a country because it is found in both Türkiye and Syria, *Teucrium montbretii* subsp. *montbretii* Benth., is a taxon that can be considered as geographical endemic since it naturally found in a narrow region, around the Türkiye-Syria border, in characteristic, rocky habitats. Of these subspecies, only *Teucrium montbretii* ssp. *heliotropiifolium* (Martino *et al.*, 2010; Menichini *et al.*, 2009) and *T. montbretii* subsp. *pamphylicum* (Küçük *et al.*, 2016), investigated in terms of essential oil composition. There is no literature on essential oil compositions of other subspecies, including *Teucrium montbretii* subsp. *montbretii*. The only two studies on the phytochemical content of *Teucrium montbretii* subsp. *montbretii* is the study in which diterpenoids isolated from acetone extracts of aerial parts by column chromatography and determined by physical and spectroscopic (1H NMR, MS) analyses and by comparisons with authentic samples (mmp, TLC) (Bruno *et al.*, 1992; Aydoğan, 2019). As a result of this studies, neo-derodane diterpenoids such as 2-deoxychamaedroxide, teuflin, 6-ketoteuscordin, montanin C, 6-acetylteucjaponin B,

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teucrin H2, 6β-hydroxyteuscordin, 2β-hydroxyteuscordinon, montanin D and teugin were detected in the subspecies.

In addition, Atay and Özdikmen (2022) reported that the first host record of *Chrysolina blanchei* (Fairmaire, 1865) (Chrysomelidae: Chrysomelinae) was made on *Teucrium montbretii* subsp *montbretii* from Hatay province on Türkiye.

This study will be the first publication on the essential oil content of the subspecies.

EXPERIMENTAL

Plant Material

Plant material (Figure 1) was collected from the natural habitat and identified by Dr. Yelda Güzel. Voucher specimen was deposited in the herbarium of HMKÜ Biology department. Collection details are as follows: *Teucrium montbretii* subsp. *montbretii*: Antakya, Habib-i Neccar Mountain, Demirkapı vicinity, rock crevices of the cliffs, 190 m elevation, 36°12′10″N 36°10′45″E, 29 v 2020, Y. Güzel-3134.

Figure 1. *Teucrium montbretii* subsp. *montbretii*. General appearance

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Figure 1. *Teucrium montbretii* subsp. *montbretii*. detailed appearance

Essential Oil Isolation

The essential oil was obtained from dried leaves. A total of 50 g of the ground plant samples was used for hydrodistillation experiment. A sample weight was individually and carefully placed into a 2000 mL flask. Distilled water was added until it covered the sample completely. Essential oils were obtained by hydrodistillation method which was carried out in an all-glass Clevenger-type distillation. The essential oil ratio was calculated according to dry weight of plant materials and amount of essential oils obtained. The obtained essential oil samples were dried over anhydrous sodium sulfate and stored in amber vials at +4 .

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GC-MS Analysis of the Essential Oils

Analysis of the essential oil was carried out using a Thermo Scientific Focus gas chromatograph equipped with MS, auto sampler, and TR-5MS (5% phenyl polysilphenylene-siloxane, 0.25 mm i.d. x 60 m length, film thickness 0.25 µm). The carrier gas was helium (99.9%) at a flow rate of 1 mL/min; ionization energy 70 eV. Mass range m/z 50–650 amu. Data acquired at scan mode. MS transfer line temperature 250°C; MS ionization source temperature 220°C, injection port temperature 220°C. The samples were injected with a 250 split ratio. The injection volume was 1 µL. Oven temperature was programmed from 50°C to 220°C at 3°C/min. The structure of each compound was identified by comparison of their mass spectrum with the Wiley Registry, 9th edition. Data acquisition used the Xcalibur software program. The retention indices (RIs) were calculated for all volatile constituents using a homologous series of n-alkane standard solutions C8–C20 (Fluka, product No. 04070) and C21–C40 (Fluka, product No. 04071).

RESULTS AND DISCUSSION

The sample was yielded 0.24% of yellowish oil (w/w), with a pleasant smell. A total of 44 essential oil components were identified from dried leaves of *Teucrium montbretii* subsp. *montbretii* Benth (Table 1). The main essential oil compounds of the plant were trans-caryophyllene, germacrene-D and caryophyllene oxide, representing 66.7%. Similar to the present study, in studies on essential oil components of some Teucrium species, trans-caryophyllene and germacrene-D were main components (Gagliano Candela *et al*., 2021; Hayta *et al*., 2017; Baser and Demirçakmak, 1997) and also addition to these components, caryophyllene oxide in the study of Çakir *et al.* (1998). Trans-caryophyllene, which has the highest ratio (36.78%), also known as β-caryophyllene, is a component that is the main constituent of many plants included in the sesquiterpene chemical class. It was reported that trans-caryophyllene has anti-inflammatory effects in many different models of inflammation (Fernandes *et al.*, 2007). In the same as trans-caryophyllene, second main component germacrene-D (19.87%) is also sesquiterpene and detected in the essential oil of many plants. Noge and Becerra (2009) determined that germacrene-D have inhibition effects to herbivores and act as repellent against aphids, ticks and mosquitoes. The third major constituent caryophyllene oxide, which belongs to sesquiterpene class of terpenoids was identified at a ratio of 10.07% as in Table 1. This component has a significant role in plant defense and serves as insecticidal and antifungal (Bettarini *et al.*, 1993). α-Copaene, humulene, aromadendrene and globulol were the other components detected at ratio of 5.45%, 4.29%, 3.99% and 3.35%, representing 17.08%, respectively. It should be noted that this is the first report on the essential oil composition of *Teucrium montbretii* subsp. *montbretii* Benth.

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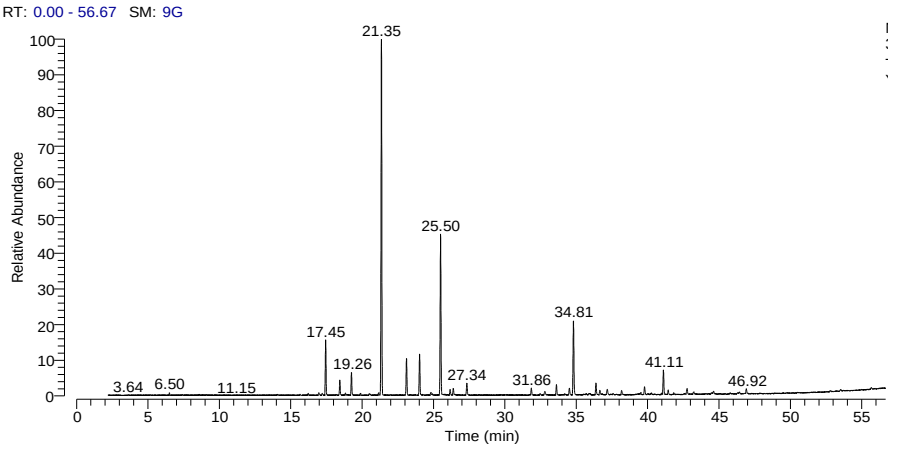

Figure 2. Essential oil chromatograms obtained from *Teucrium montbretii subsp. montbretii*

Table 1. Essential oil composition of *Teucrium montbretii* subsp. *montbretii* Benth.

RI	Compound Name	Area %
1170	Sabinene	0.19
1440	2-methyldecane	0.13
1456	α-Cubebene	0.20
1474	Cyclosativene	0.27
1480	α-amorphene	0.19
1486	α-copaene	5.45
1511	β-bourbonene	1.74
1522	α-gurjunene	0.27
1551	Linalool	0.20
1588	*trans*-caryophyllene	36.78
1635	Aromadendrene	3.99
1660	Humulene	4.29
1680	Alloaromadendrene	0.37
1698	Germacrene D	19.87
1717	α-muurolene	0.59
1723	Bicyclogermacrene	0.71
1750	σ-cadinene	1.32
1930	Cubenol	1.81
1967	Caryophyllene oxide	10.07
2014	Ledol	1.25
2024	1,2-dimethylcyclooctene	0.57
2047	α-funebrene	0.10
2073	Veridiflorol	0.49
2122	Spathulenol	0.18
2136	Hexahydrofarnesyl acetone	0.87
2158	8-dimethylamino-1-naphthalenecarboxylic acid	0.21
2200	Globulol	3.35
2219	α-cadinol	0.32
2243	τ-muurolol	1.22
2286	2H-pyran, 2-(7-heptadecynyloxy)tetrahydro-	0.22

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RI	Compound Name	Area %
2350	Hexadecatrienoic acid, methyl ester	0.39
2611	Triethylene glycol monododecyl ether	0.22
2689	Decaoxabicyclo[15.13.0]triacontane	0.29

CONCLUSIONS

In our study, trans-caryophyllene, germacrene-D, α-copaene, humulene, aromadendrene and globulol were found to be the most abundant essential oil components. Similar to the present study, in studies on essential oil components of some *Teucrium* species, trans-caryophyllene and germacrene-D were main components (Gagliano Candela *et al.*, 2021; Hayta *et al.*, 2017; Baser and Demirçakmak, 1997).

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