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Composition of the essential oil of *Salvia aramiensis* Rech. fil. growing in Turkey†

Betül Demirci,[1] Kemal Hüsnü Can Başer[1]* and Gülendam Tümen[2]

[1]Anadolu University, Medicinal and Aromatic Plant and Drug Research Centre (TBAM), 26470 Eskişehir, Turkey
[2]Balikesir University, Faculty of Education, 10100 Balikesir, Turkey

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ABSTRACT: Water-distilled essential oils from aerial parts of *Salvia aramiensis* Rech. fil., collected in three different seasons (pre-flowering, flowering and post-flowering stages) from Hatay, were analysed by GC–MS. 1,8-Cineole (43–49%) was identified as the main constituent in all the samples. Copyright © 2001 John Wiley & Sons, Ltd.

KEY WORDS: *Salvia aramiensis* Rech. fil.; Lamiaceae; essential oil; GC–MS; 1,8-cineole

Introduction

The genus *Salvia* (Lamiaceae) is represented in Turkey by 89 species and 94 taxa altogether, 45 of which are endemic in Turkey. The ratio of endemism in the genus *Salvia* in Turkey is 45%.[1,2] Some species of *Salvia* are used as medicinal and aromatic plants. Dried leaves of *Salvia officinalis* L. and *S. fruticosa* Miller (Syn. *S. triloba* L.) are commonly traded and used as herbal tea, food flavour, and as sources of essential oil. They are utilized mainly in the food, cosmetic, perfumery and pharmaceutical industries.

Previously, we reported the essential oil compositions of several *Salvia* species.[3–8] In a previous study, camphor, 1,8-cineole, α-terpineol, borneol, terpinen-4-ol, α-pinene, β-pinene and camphene were reported as main constituents of the oil of *S. aramiensis* Rech. fil.[9] This species, which is morphologically similar to *S. fruticosa*, is also a commodity of trade for similar uses. This paper reports on seasonal variations in the yield and composition of the essential oil of *Salvia aramiensis*.

Experimental

Plant Material

The aerial parts of *S. aramiensis* were collected in three different seasons from Hatay in Turkey. Voucher specimens are kept at the Herbarium of the Faculty of Pharmacy of Anadolu University in Eskişehir, Turkey (ESSE). The plant materials, collection sites, dates and yields of essential oils are given in Table 1.

Distillation Method

The aerial parts of *Salvia aramiensis* were hydrodistilled for 3 h using a Clevenger-type apparatus to yield essential oils. The yields were calculated on dry weight basis (Table 1).

Analysis of Essential Oils

The oils were analysed by GC–MS using a Hewlett-Packard GCD system. An HP-Innowax FSC column (60 m × 0.25 mm i.d., film thickness 0.25 µm) was used, with helium as the carrier gas (1 ml/min). GC oven temperature was kept at 60°C for 10 min and programmed to 220°C at a rate of 4°C/min, then kept constant at 220°C for 10 min, and then programmed to 240°C at a rate of 1°C/min. The split ratio was adjusted to 50 : 1. The injector temperature was at 250°C. MS were taken at 70 eV. Mass range was 35–425 m/z.

Identification of Components

The components were identified by comparison of their mass spectra with Wiley GC–MS Library and TBAM Library of Essential Oil Constituents. Relative percentage amounts of the separated compounds were calculated

*Correspondence to: K. H. C. Başer Anadolu University, Medicinal and Aromatic Plant and Drug Research Centre (TBAM), 26470 Eskişehir, Turkey.
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Table 1. *Salvia aramiensis* materials used in this study

Code	Plant part	Collection site	Collection date	Yield (%)	ESSE
A	Leaf + branch	Hatay: Samandağ	April 1998	2.2	12800
B	Aerial part	Hatay: Antakya	May 1998	1.0	12830
C	Aerial part	Hatay: Antakya	July 1998	2.1	12803

A, pre-flowering stage; B, flowering stage; C, post-flowering stage.

Table 2. The composition of the essential oils of *Salvia aramiensis*

RRI	Compound	A(%)	B(%)	C(%)
1014	Tricyclene	0.3	0.1	0.2
1032	α-Pinene	5.1	4.3	5.3
1035	α-Thujene	0.3	0.2	0.4
1076	Camphene	5.6	3.3	3.9
1118	β-Pinene	10.0	10.8	10.2
1132	Sabinene	1.3	2.2	2.2
1174	Myrcene	1.8	2.2	2.1
1188	α-Terpinene	0.2	0.1	0.2
1203	Limonene	2.0	0.9	2.0
1213	**1,8-Cineole**	**42.7**	**46.0**	**49.3**
1225	(*Z*)-3-Hexenal	0.1	0.1	0.1
1255	γ-Terpinene	0.4	0.3	0.5
1280	*p*-Cymene	0.2	0.2	0.1
1290	Terpinolene	0.1	0.1	0.2
1452	1-Octen-3-ol	0.3	0.2	0.2
1474	*trans*-Sabinene hydrate	0.5	0.6	0.6
1499	α-Campholene aldehyde	—	0.1	—
1532	Camphor	10.1	7.5	8.4
1553	Linalool	0.2	0.2	0.2
1556	*cis*-Sabinene hydrate	0.3	0.2	0.2
1571	*trans*-*p*-Menth-2-en-1-ol	0.1	tr	0.1
1586	Pinocarvone	0.2	0.2	tr
1589	β-Ylangene	tr	0.1	tr
1597	Bornyl acetate	0.4	0.7	1.4
1611	Terpinen-4-ol	1.2	0.9	0.8
1612	β-Caryophyllene	—	2.0	1.0
1639	*trans*-*p*-Mentha-2,8-dien-1-ol	0.1	0.1	0.1
1648	Myrtenal	0.2	0.2	tr
1664	*trans*- Pinocarveol	0.3	0.2	—
1682	δ-Terpineol	0.4	0.3	0.7
1687	α-Humulene	0.5	0.8	0.4
1700	*p*-Mentha-1,8-dien-4-ol (= Limonen-4-ol)	0.1	—	0.1
1706	α-Terpineol	0.5	0.4	0.9
1719	Borneol	5.0	3.6	2.2
1726	Germacrene D	0.1	1.1	0.4
1755	Bicyclogermacrene	—	0.4	0.1
1765	Geranyl acetate	—	0.1	0.2
1773	δ-Cadinene	0.1	0.1	0.1
1804	Myrtenol	0.4	0.3	0.2
1845	*trans*-Carveol	0.1	tr	—
1864	*p*-Cymen-8-ol	0.1	tr	—
1865	Isopiperitenone	—	—	0.1
1896	*cis*-*p*-Mentha-1(7),8-diene-2-ol	0.1	tr	tr
1949	Piperitenone	tr	—	0.1
2001	Isocaryophyllene oxide	tr	0.1	tr
2008	Caryophyllene oxide	1.1	1.9	0.9
2045	Humulene epoxide-I	0.1	tr	tr
2071	Humulene epoxide-II	0.7	0.3	0.2
2096	Elemol	0.1	0.1	0.1
2104	Guaiol	0.5	0.6	0.6
2144	Spathulenol	1.5	0.7	0.3
2239	Carvacrol	—	0.1	0.6
2248	Bulnesol	0.9	0.1	0.4
2250	α-Eudesmol	0.1	0.1	0.1
2257	β-Eudesmol	0.2	0.1	0.1
2316	Caryophylla-2(12),6(13)-dien-5β-ol (= Caryophylladienol I)	—	—	0.1
2324	Caryophylla-2(12),6(13)-dien-5α-ol (= Caryophylladienol II)	0.2	0.3	0.2
2357	14-Hydroxy-β-caryophyllene	—	0.1	—

Table 2. (*Continued*)

RRI	Compound	A(%)	B(%)	C(%)
2392	Caryophylla-2(12),6-dien-5β-ol (= Caryophyllenol II)	0.1	0.3	—
2512	Benzophenone	—	0.2	—
	Total	96.9	96.1	98.8

A, preflowering stage;
B, flowering stage;
C, postflowering stage.
RRI, relative retention indices.
tr, trace (<0.1%).

automatically from peak areas of the total ion chromatograms. Alkanes were used as reference points in the calculation of relative retention indices (RRIs). The compounds identified in the oil can be seen in Table 2.

Results and Discussion

Water-distilled essential oils from aerial parts of *Salvia aramiensis* Rech. fil. collected from Hatay in three vegetative stages were analysed by GC–MS. The identified compounds and their percentages are given in Table 2. The yields of essential oils showed a minimum during flowering (1%), and a maximum at the preflowering stage (2.2%).

Fifty-one components were identified in the oil of *Salvia aramiensis* at preflowering stage, representing 96.9% of the total oil. In the oil of the plant collected during flowering, 56 components, representing 96.1%, were identified; 53 compounds, representing 98.8%, were characterized in the oil of the same species collected at postflowering stage. The compositions showed similar patterns at different stages. 1,8-Cineole was the main component in three different phases of vegetation. The maximum percentage of 1,8-cineole (49.3%) was observed in the oil from aerial parts of the plant collected during postflowering stage. In the only previous study on the essential oil of *S. aramiensis*, obtained in 3% yield, the main components were characterized as camphor, 1,8-cineole, α-terpineol, borneol, terpinen-4-ol in the oxygenated hydrocarbons fraction; and α-pinene, β-pinene and camphene in the monoterpene hydrocarbons fraction, using gas chromatography alone. As the author did not indicate any percentage values, the relative amounts of main components cannot be determined.[9]

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