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Identification of Essential Oil Components of *Salvia cryptantha* Montbret & Aucher ex Bentham, Growing Wild in Turkey

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The essential oils obtained by hydrodistillation of the aerial parts (leaves and stems) and flowers of *Salvia cryptantha* Montbret & Aucher ex Bentham (Labiatae), an endemic species of Turkey, were analyzed by GC-MS. The contents of essential oil were obtained 1.44 % in aerial part and 0.4 % in flower. Thirteen components in aerial parts oil and 10 components in flower oil were identified, representing 97.89 and 97.33 %, respectively. 1,8-Cineole (30.38 and 36.28 %), valencene (24.34 and 26.53 %) and camphor (12.29 and 14.72 %) were found as the major components of both aerial parts and flower oils, respectively.

Key Words: *Salvia cryptantha*, Hydrodistillation, Essential oil, GC/MS, 1,8-Cineole, Valencene.

INTRODUCTION

The important aromatic genus *Salvia* L., one of the largest Labiatae (or Lamiaceae) genera, includes about 900 species in world, 89 (with 50 % endemism) of them are naturally spread out in Flora of Turkey. An important part of these species have been locally used in folk medicine as a tonic, stimulant, carminative, antiseptic, for inflammations in the mouth and for infections[1,2] and a few species have been traded in worldwide. The species such as *S. triloba, S. officinalis, S. pomifera* and *S. sclarea* have the main economic importance[1].

S. cryptantha Montbret & Aucher ex Bentham used in folk medicine since long years is an endemic species for Turkey. *S. cryptantha* is a perennial herb and its flowering lasts from May to July. It grows in rocky lands, dry places, on chalky hills and in fallowing lands at altitudes between 700 and 2500 m[3].

Different results were obtained from the stem and hydrodistilled essential oils of *Salvia cryptantha* were analyzed by GC-MS in previous studies. Generally, the main components were identified[4-6] as 1,8-cineole, borneol, camphor, α-pinene and

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camphene. In addition, it was reported[7] that the major constituents in the hydro-distilled essential oil of dried flowers of *S. cryptantha* were camphor (18 %) and 1,8-cineole (18 %).

In all *Salvia* species, the essential oils are located in the glandular hairs of all aerial parts with an average concentration between 1.3-3.6 % on a dry weight basis. The essential oil ratio is maximum in leaves, intermediate in flowers and minimum in stems. The chemical composition of the essential oil varies among species, seasons and habitats, a fact that leads to significant qualitative differentiations[1].

The purpose of this study was to determine the content and chemical composition of essential oil in aerial parts and flowers of *Salvia cryptantha* growing wild in Turkey.

EXPERIMENTAL

The herbal parts of *S. cryptantha* Montbret & Aucher ex Bentham was collected from Eregli-Ivriz, Konya, Turkey when flowering, (June 17, 2007), at an altitude of 1209 m. The collected plants were dried in shadow at room temperature.

The essential oil content was determined separately in 50 g of ground aerial parts (leaves and stems) and flowers and using a Clevenger-type apparatus. The samples were distilled for 3 h in 500 mL water.

The essential oil was analyzed by GC-MS. The analysis was performed using a Hewlett Packard 6890 N GC, equipped with HP-5 MS capillary column (30 m × 0.25 μm) and HP 5973 mass selective detector. For GC-MS detection an electron ionization system with ionization energy of 70 eV was used. Helium was carrier gas, at a flow rate of 1 mL/min. Injector and MS transfer line temperatures were set at 220 and 290 ºC, respectively. Column temperature was initially kept at 50 ºC for 3 min, then gradually increased to 150 ºC at a 3 ºC/min rate, held for 10 min and finally raised to 250 ºC/min. Diluted samples (1/100 in acetone, v/v) of 1.0 μL were injected automatically and in the splitless mode[8]. Individual components were identified by spectrometric analyses using computer library. The library search also carried out using Flavour2.L, Wiley7n.1 and NIST98.L GC-MS library of essential oil.

RESULTS AND DISCUSSION

The essential oil components identified in the two samples are listed in Table-1, together with their relative percentages, in order of their retention indices.

The contents of essential oil were obtained 1.44 % in aerial parts and 0.4 % in flower. That the essential oil was found 0.9 % in the aerial parts of *S. cryptantha* collected from Pozanti, Ankara-Turkey reported by Demirci *et al.*[2].

Thirteen components in aerial parts oil and 10 components in flower oil, representing 97.89 and 97.33 %, respectively, were identified (Table-1). That about 53 (90.9 % of the total oil) and 22 constituents were identified in the essential oil of *S. cryptantha* from Turkey were explained by Tepe *et al.*[6] and Bayrak and Akgül[4].

TABLE-1
ESSENTIAL OIL COMPOSITIONS IN AERIAL PART AND FLOWER OF *Salvia cryptantha*

Components	RT	Aerial part (%)	Flower (%)
α-Pinene	8.58	9.35	4.64
Camphene	9.15	7.13	3.90
β-Pinene	10.31	3.16	2.19
Myrcene	11.02	0.59	-
ρ-Cymene	12.45	0.36	-
Limonene	12.63	1.43	0.77
1,8-Cineole	12.73	30.38	36.28
γ-Terpinene	14.03	0.42	0.64
Camphor	17.95	12.29	14.72
Isoborneol	18.96	5.82	6.29
Borneol	24.52	2.47	1.37
Aromadendrene	31.03	0.15	-
Valencene	37.14	24.34	26.53
Total		97.89	97.33

In present study, 1,8-cineole (30.38 and 36.28 %), valencene (24.34 and 26.53 %) and camphor (12.29 and 14.72 %) were found to be the major components of both aerial parts and flower oils, respectively. Generally, the main components were identified as 1,8-cineole (10.4-37 %), borneol (4.8-24.8 %), camphor (6.0-17.5 %), α-pinene (1.0-18.1%) and camphene (0.9-8%)4-6. But, Demirci *et al.*[2] revealed that linalool, limonene and β-pinene among the principal components were found. In previous GS-MS studies of *S. cryptantha* essential oil have not included valencene among the essential oil constituents identified. However, Hudaib *et al.*[9] stated that the essential oil of *S. sclarea* contained valencene, but its percentage was low (0.48 %). On the contrary these findings, valencene was the compound with the second highest value after 1,8-cineole in present two samples (Fig. 1A and 1B).

As seen in Fig. 2, these three components (1,8-cineole, valencene and camphor) were recorded higher in flower than aerial parts. Akgül *et al.*[7] reported that the major constituents in the hydrodistilled essential oil of dried flowers of *S. cryptantha* were camphor (18 %) and 1,8-cineole (18 %).

The other important components of aerial parts and flower were α-pinene, camphene, isoborneol and β-pinene. Only isoborneol among these components was observed slightly higher (0.47 %) in flower than in aerial parts. Remarkably difference in the contents of α-pinene and camphene were also recorded between two samples. These two components were approximately twice times higher in aerial parts than in flower. Bayrak and Akgül[4] and Tepe *et al.*[6] reported that borneol was identified in essential oil from aerial parts of *S. cryptantha*, 24.8 and 4.8 %, respectively. In present study, borneol was recorded 2.47 and 1.37 % in the essential oils of aerial parts and flowers, respectively. In addition, myrecene, *p*-cymene, γ-terpinene

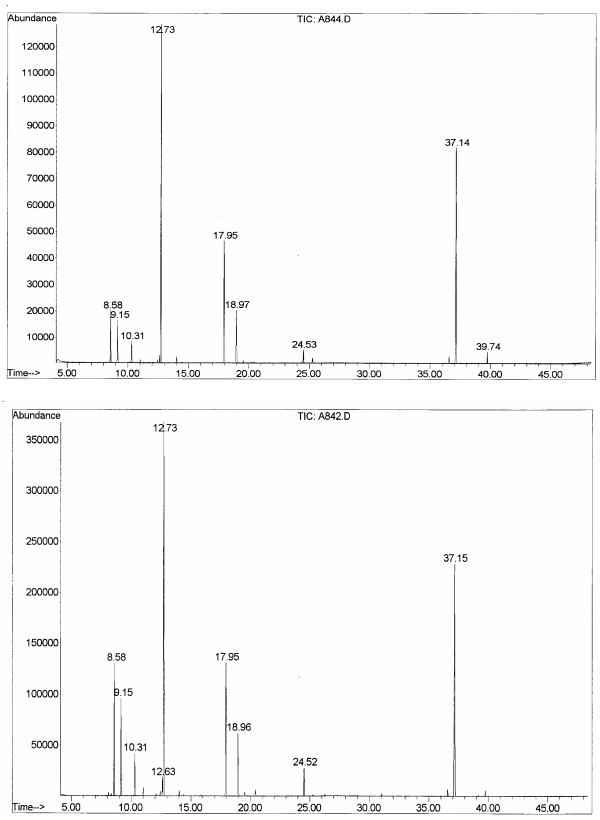

Fig. 1. Typical GC profiles of essential oils from flower (A) and aerial part (B) of *Salvia cryptantha* (for the identification of peaks see the Table-1).
The components in the peak at approximately 12.73 and 37.15 min are 1,8-cineole and valencene, respectively. Information from Data File in GC-MS for these components: Search Libraries: C:\Database\Flavor2.L, C:\Database\Wiley7n.1, C:\Database\NIST98.L; Unknown Spectrum: Apex; Integration Events: ChemStation Integrator-autoint1.e; RT:12.73, 37.15 (aerial part), 12.73, 37.14 (flower); Area (%):30.38, 24.34 (aerial part), 36.28, 26.53 (flower); Library/ID: \Database\Flavor2.L for two components; Ref#:64, 156; Cas#:000470-82-6, 004630-07-3;Qual:98, 93, respectively.

and aromadendrene in aerial parts and, limonene and γ-terpinene in flower were found below 1 %. Although myrecene, *p*-cymene and aromadendrene were found in the aerial parts essential oil, they were not recorded in flower one.

When the present results were compared with the literature, the recorded components of essential oils in the present study showed significant differences, which can be attributed several factors, such as the part of plant under analysis, the stage of plant development, the time of harvesting or picking, differences in climatic and ecological conditions and the different distillation methods used in the studies *etc.*[9-17]. For example, limonene was one of the major components of *Salvia multicaulis* in the one study[18], whereas it was not detected in the other study[6].

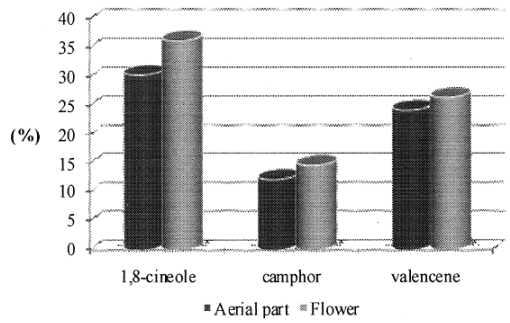

Fig. 2. The first three components having the highest value in two samples essential oil of *Salvia cryptantha*

In conclusion, the essential oil ratio of aerial part was approximately fourth times higher than one of flower. The first 3 components with the highest value in essential oil from 2 samples were the same. However, these components had higher percentage in flower essential oil than in aerial parts essential oil. Also, noticeable differences in the other components of essential oil from two samples were observed. Contrary to the previous studies, the compound valencene had the high amount among the others in present study.

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