Composition of the Essential Oil of Endemic *Salvia cryptantha* (Lamiaceae) Montbret & Aucher Ex Bentham from

Türkiye'de Endemik *Salvia cryptantha* (Lamiaceae)'nın Montbret & Aucher Ex Bentham Uçucu Yağ Kompozisyonu

Research Article

Gülden Doğan[1], Şükrü Hayta[2], Azize Demirpolat[1], Eyüp Bağcı[1]
[1]Fırat University, Science Faculty, Biology Department, Elazığ, Turkey.
[2]Bitlis Eren University, Art & Science Faculty, Biology Department, Bitlis, Turkey.

ABSTRACT

In this study, the essential oil composition of *Salvia cryptantha* Montbret & Aucher ex Bentham from Turkey. The qualitative and quantitative essential oil contents of the this species was determined and compared with each other. The chemical composition of essential oils obtained by hydrodistillation of *Salvia cryptantha* was investigated by GC and GC-MS. The essential oils yield is 0.4 (v/w). Sixty three constituents were comprised the 98.7% of the total essential oil extracted from the *Salvia cryptantha*. The predominant compounds of *Salvia cryptantha* were determined as 1.8-cineole (21%), camphor (19.1%), α-pinene (12.5%), camphene (8.7%).

Key Words
Salvia cryptantha, GC-MS, Essential Oil, 1.8-Cineole, Camphor.

ÖZ

Bu çalışmada, Türkiye için endemik *Salvia cryptantha*'nın Montbret & Aucher ex Bentham uçucu yağ kompozisyonu analiz edildi. Bu türün nicel ve nitel uçucu yağ içeriği belirlendi ve birbirleriyle karşılaştırıldı. Uçucu yağın kimyasal kompozisyonu su damıtımı yardımıyla belirlendi ve GC/GC-MS kullanılarak incelendi. Uçucu yağ verimi 0.4% (v/w)'dir. *Salvia cryptantha*'tadan 63 bileşenin elde edilen toplam uçucu yağın %98.7'sini oluşturduğu görüldü. *Salvia cryptantha*'da temel bileşenler 1.8-sineol (%21), kafur (%19.1), α-pinen (%12.5) ve kamfen (%8.7) olarak belirlendi.

Anahtar Kelimeler
Salvia cryptantha, GC-MS, Uçucu Yağ, 1.8-Sineol, Kamfor.

Article History: Received: Mar 11, 2017; Revised: Aug 15, 2017; Accepted: Oct 25, 2017; Available Online: Dec 25, 2017.

DOI: 10.15671/HJBC.2017.171

Correspondence to: G. Doğan, Firat University, Science Faculty, Biology Department, Elazig, Turkey.
Tel: +90 (424) 237 0000 Fax: +90 (424) 237 0000 E-Mail: gdogan@firat.edu.tr

INTRODUCTION

Salvia L. is the largest genus of plants in the Lamiaceae family, with approximately 900 species including annual, biennial or perennial herbs, along with woody subshrubs [1]. The genus is distributed throughout the world with the center of diversity and origin appearing to be Central and Southwestern Asia [2]. An unusually large number of useful secondary metabolites belonging to various chemical groups, such as essential oils, terpenoid compounds, and phenolic derivatives, have been isolated from the genus, which features prominently in the pharmacopoeias of many countries throughout the world [3]. *Salvia* L. species which is represented by 95 species in total in Turkey [4]. *Salvia cryptantha* is represented in C group in Flora of Turkey. The species is endemic and Iran-Turan element. The wild growing species is endemic to the rocky lands and chalky hills of Turkey, widely distributed from 700 to 2500 m [5]. *S. cryptantha* is a perennial bush branching in a disorderly fashion on the ground. Its older branches are brittle and rough while the younger ones are soft and covered by fine fuzz. It flowers in May up to late August. *S. cryptantha* plants are generally propagated through cuttings [3]. *Salvia* crypthantha, named "tapir" in Turkish, is a plant growing wild in Middle Anatolia and its dried flowers are used as a herbal tea and local materia medica [6]. A less variable species than its close relative *S. multicaulis* and generally more western in its distribution. In areas where they overlap, e.g. Sivas and Niğde, they appear to retain their identity and no hybrids have been seen [5].

Salvia species have been recorded to be used for memory enhancement in European folk medicine [7] and have been also used as folk remedy in tea form against simple disordes in Anatolia [8]. Several species are used to treat microbial infections, cancer, malaria, inflammation, loss of memory and to disinfect homes after sickness [2]. In Turkish folk medicine, some *Salvia* species have been recorded to be used against wounds, inflammatory and skin diseases [9-11]. For instance; the roots of *Salvia* aethiopsis are boiled together with the resin of *Abies bornmülleriana*, butter, and basewax, the mixture is then condensed into an ointment form, which is applied every day on cuts and other wounds for 5-10 days. The aerial parts of *Salvia tomentosa* Mill. are used againist rheumatic pain. *Salvia nemorosa* is pounded and applied externally to stop bleedings and to heal wounds [12]. Infusion prepared with aerial parts of *Salvia cryptantha* is used for stomach disorders internally; the decoction obtained from aerial parts is used as antiseptic for wounds [11]. It is reported that the *S. cryptantha* has antitumoral potential aganist breast cancer [13].

Recently, the essential oils and various extracts of plants have provoked interest as sources of natural products. They have been screened for their potential uses as alternative remediesfor the treatment of many infectious diseases and the preservation of foods from the toxic effects of oxidants. Particularly, the anti-microbial activities of plant oils and extracts have formed the basis of many applications, including raw and processed food preservation, pharmaceuticals, alternative medicine and natural therapies [14,15].

MATERIALS and METHODS

Plant Material

Salvia cryptantha specimens were collected during to flowering stage in June, 2011, at an altitude of 1330 m, Darende (Sivas-Turkey). Voucher specimens are kept at the Firat University Herbarium (FUH-9010). Air-dried aerial parts of the plant materials (100 g) were subjected to hydrodistillation using a Clevenger-type apparatus for 3 h to yield. The essential oil was analyzed by using GC and GC-MS.

Isolation of the Essential Oils

Air-dried aerial parts of the plant materials (100 g) were subjected to hydrodistillation using a Clevenger-type apparatus for 3 h.

Gas Chromatographic (GC) Analysis

The essential oil was analysed using HP 6890 GC equipped with FID detector and HP- 5 MS (30 m x 0.25 mm *i.d.*, film tickness 0.25 μm) capillary column was used. The column and analysis conditions were the same as in GC-MS expressed as below. The percentage composition of the essential oils was computed from GC-FID peak areas without correction factors.

Gas Chromatography/Mass Spectrometry (GC-MS) Analysis

The oils were analyzed by GC-MS, using a Hewlett Packard system. HP- Agilent 5973 N GC-MS system with 6890 GC in Plant Products and Biotechnology Res. Lab. (BUBAL) in Firat University. HP-5 MS column (30 m x 0.25 mm *i.d.*, film tickness 0.25 μm) was used with helium as the carrier gas. Injector temperature was 250°C, split flow was 1 ml/min. The GC oven temperature was kept at 70°C for 2 min. and programmed to 150°C at a rate of 10°C/min and then kept constant at 150°C for 15 min to 240°C at a rate of 5°C/min. Alkanes were used as reference points in the calculation of relative retention indices (RRI). MS were taken at 70 eV and a mass range of 35-425. Component identification was carried out using spectrometric electronic libraries (Wiley, Nist).

RESULTS and DISCUSSIONS

The chemical composition of essential oils obtained by hydrodistillation of *Salvia cryptantha* was investigated by GC and GC-MS. The essential oils yield is 0.4 (v/w). Sixty three constituents were comprised the 98.7% of the total essential oil extracted from the *Salvia cryptantha*. The predominant compounds of *Salvia cryptantha* were determined as 1,8-cineole (21%), camphor (19.1%), α-pinene (12.5%), camphene (8.7%) (Table 1). The oil was complex mixtures of non-terpenes, monoterpenes and sesquiterpenes: 63 components were identified in essential oil under study. The essential oil is mainly composed of monoterpene derivatives. The essential oil analysis showed that oxygenated monoterpenes and monoterpenes concentrations were higher than those of oxygenated sesquiterpenes and sesquiterpenes.

GC-MS analysis revealed that the major constituents of the *S. cryptantha* and *S. multicaulis* oils were α-pinene (18.1 and 21.9%), 1,8 cineole (eucalyptol) (15.3 and 20.1%), camphor (7.7 and 11.0%), camphene (6.4 and 7.8%) and borneol (4.8 and 7.3%), respectively [16]. Our analysis results study were showed similarity with the Tepe's findings, because of the presence of the major components; 1,8 cineole (21%), camphor (19.1%), α-pinene (12.5%), camphene (8.7%) in our sample. 1,8-Cineole (15.7-37.1%), camphor (6.0-13.0%), α-pinene (1.0-11.9%) and camphene (0.9 - 7.7%) were found to be the major components in the *S. crypthantha* oils [17]. Bayrak and Akgül stated that oil of *S. crypthantha* contained borneol (24.8%), camphor (17.5%), 1,8-cineole (10.4%) and α-pinene (5.8%) as major components [18]. It was reported that camphor (18.1%), 1,8-cineole (17.8%), bornyl acetate (11.4%) and borneol (5.8%) as the main components in *S. crypthantha* oil [19]. A survey of the literature reveals that oil of *S. crypthantha* was found to contain 1,8-cineole (27.9%), bornyl acetate (17.1%) and camphor (15.6%) [20].

Saadia et al. [6] reported that oil of *S. cryptantha* contained camphor (25.6%). 1,8-Cineole (20.3%), β-pinene (12.8%), n-hexane (10.6%), borneol (5.1%) and α-pinene (4.1%) were the other important components. The volatile fraction of the Turkish *S. crypthantha* differs from many *Salvia* species growing in the Mediterranean region, in regards to compounds, in the variety of its components and their relative quantity [6].

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 [21].

The essential oil composition of the *Salvia* trichoclada and S. multicaulis- belongs to the same group B in genus *Salvia* from Turkey; 1,8-cineole (17.0%), camphor (13.2%), α-pinene (9.3%), valeranone (8.5%) and α-eudesmol (5.7%) were determined to be present at a high compounds of the *S. multicaulis* oil and β-pinene (13.7%), camphor (11.3%), caryophyllene oxide (7.0%), 1,8-cineole (5.9%) and trans-caryophyllene (5.5%) were in *S. trichoclada* essential oil [22]. Another our study essential oil composition of *S. palaestina* and *S. tomentosa* the major components β-caryophyllene (18%), germacrene D (16.5%), linalool L (9.2%), caryophyllene oxide (7.3%), linalyl acetat (6%), α-copaene (4.3%),

Table 1. Constituents of the essential oil from *S. crypthantha*.

No	Compounds	RRI	%
1	Hexanal	936	0.1
2	Tricyclene	1014	0.4
3	α-Thujone	1016	0.3
4	α-Pinene	1021	12.5
5	Camphene	1035	8.7
6	Sabinene	1052	0.4
7	β-Pinene	1056	4.6
8	3-Octanone	1061	0.1
9	β-Myrcene	1064	1.3
10	α-Terpinene	1085	0.1
11	p-Cymene	1092	1.2
12	Limonene	1094	2.3
13	1,8-Cineol	1098	21.0
14	cis-Ocimene	1100	0.1
15	γ-Terpinene	1116	0.2
16	cis-Sabinenehydrate	1126	0.4
17	α-Terpinolene	1137	0.2
18	Linalool-L	1148	0.2
19	Undecane	1149	0.3
20	Camphor	1185	19.1
21	Borneol-L	1199	3.5
22	Terpinen -4 -ol	1205	0.9
23	Myrtenol	1216	0.5
24	İsoborneol	1222	0.1
25	Bornyl acetate	1282	1.3
26	α-Cubebene	1337	0.2
27	α-Ylangene	1355	0.2
28	α-Copaene	1360	1.0
29	β-Bourbonene	1366	0.1
30	α-Copaene	1369	0.1
31	cis-Jasmone	1372	0.1
32	Cycloprop(e)azulene	1383	0.2
33	β-Caryophyllene	1393	1.0
34	β-Copaene	1400	0.3
35	α-Selinene	1404	0.1
36	Aromadendrene	1406	0.3

Table 1. Constituents of the essential oil from *S. crypthantha*. (continue)

37	5,9-Undecadien	1411	0.1
38	α-Farnesene	1415	0.1
39	α-Humulene	1418	1.5
40	apthalene	1431	0.9
41	α-Amorphene	1434	0.1
42	Germacrene D	1435	0.1
43	β-Selinene	1441	0.4
44	ethyl-isoeugenol	1442	0.8
45	icyclogermacrene	1445	1.5
46	α-Cadinene	1458	0.2
47	Cis-Calamenene	1461	0.2
48	Muurola-3,7-diene	1468	0.2
49	α-Calacorene	1473	0.3
50	α-Calacorene	1486	0.1
51	1,5-Epoxy*Salvia*l-4[14]-ene	1490	0.7
52	Caryophyllenoxide	1498	0.5
53	Gauaiol	1500	0.1
54	*Salvia*l-4[14]en-1-one	1504	0.6
55	Muurolene	1506	0.3
56	Jasmone	1512	0.6
57	Isolongifolene	1517	0.1
58	Germacrene B	1524	0.4
59	α-Cadinol	1533	0.4
60	α-Eudesmol	1540	2.0
61	Valeranone	1550	2.0
62	Ethanone	1555	1.0
63	Abietane	1756	0.1
	Total		98.7

RRI: Relative Retention Index

sclaerol (6.6%) ve spathulenol (4.1%); α-pinene (33.7%), germacrene D (7.5%), β-pinene (6.8%), α-humulene (6%), veridiflorol (3.8%) ve limonene (3.1%) respectively [23]. Recently we have stated in a study, essential oils of the aerial parts of *S. russellii* and *S. bracteata* major constituents of *S. russellii* were thymol (31.9%), α-terpinol (13.1%), γ-terpinene (12.5%), whereas those *S. bracteata* were caryophyllene oxide (17.8%) α-caryophyllene (16.7%), β-pinene (10.5%) [24].

In conclusion, our findings were generally similar to the literature results by the major components,because of minor differences from the research parameters. These variations may be due to the climatological factors, drying conditions, made of distillation and vary also qualitatively and/or quantitatively with collection period. These factors also play a role in the oil composition. This study demonstrates the

occurrence of 1.8-cineole/camphor chemotype of *S.cryptantha* in eastern Anatolian region of Turkey.

References

1. B. Clebsch, C.D. Barner, The New Book of *Salvias*, Timber Pres, USA, p. 18. 2003.
2. G.P.P. Kamatou, N.P. Makunga, W.P.N. Ramogola, A.M. Viljoen, South African *Salvia* species: a review of biological activities and phytochemistry, J. Etnopharmacology, 119 (2008) 664-672.
3. A. Ipek, B. Gürbüz, M.Ü. Bingöl, F. Geven, G. Akgül, K. Afshar Pour Rezaeieh, B. Coşges, Comparison of essential oil components of wild and field grown *Salvia cryptantha* Montbert & Aucher ex Benthan, in Turkey, Turk J. Agric. For., 36(2012) 668-672.
4. F. Celep, M. Doğan, A. Duran, A new record for the Flora of Turkey: Jacq (Labiatae), Turkish J. Botany, 33 (2009) 57-60.
5. P.H. Davis, Flora of Turkey and The East Aegean Island, Vol. 7, Edinburgh University Press, 1982.
6. Z. Saadia, M.M. Özcan, Y. Bagci, A. Ünver, D. Arslan, G. Durak, F. Er, C. Saglam, Chemical Composition of the Essential oil of *Salvia cryptantha*, JEOBP, 13 (2010) 200-204.
7. N. Perry, G. Court, Bidet, J. Court, E.K. Perry, Cholinergic activites of European herbs and potential of dementia therapy, J. Ger. Psy., 11 (1996) 1063-1069.
8. T. Baytop, Therapy with Medicinal Plants in Turkey (Past and Present). İstanbul University Publications No: 3255, Nobel Presshouse, İstanbul, 1999.
9. M. Tabata, E. Sezik, G. Honda, E. Yeşilada, H. Fukui, K. Goto, Y. Ikeshiro, Traditional medicine in Turkey. III. Folk medicine in East Anatolia, Van and Bitlis Provinces, Int. J. Pharmacognosy, 32 (1994) 3-12.
10. E. Yeşilada, G. Honda, E. Sezik, M. Tabata, T. Fujita, T. Tanaka, Y. Takeda, Y. Takaishi, Traditional medicine in Turkey. V. Folk medicine in the iner Taurus Mountains, J. Etnopharmacology, 46 (1995) 133-152.
11. G. Honda, E. Yeşilada, M. Tabata, E. Sezik, T. Fujita, Y. Takeda, Y. Takaishi, T. Tanaka, Traditional medicine in Turkey. VI. Folk medicine in West Anatolia: Afyon, Kütahya, Denizli, Muğla, Aydın provinces, J. Etnopharmacology, 53 (1996) 75-87.
12. E. Sezik, E. Yeşilada, M. Tabata, G. Honda, Y. Takaishi, F. Tetsuro, T. Tanaka, Y. Takeda, Traditional medicine in Turkey. VIII. Folk medicine in East Anatolia; Erzurum, Erzincan, Ağrı, Kars, Iğdır provinces, Economic Botany, 51 (1997) 195-211.
13. H. Ozer, A. Altun, S.U. Saraydın, S. Soylu, S. Goktas, E. Tuncer, D.S. Inan, B. Koksal, T.K. Temiz, B. Tepe, M. Şen, K. Karaday, M. Turan, Antitumoral effects of *Salvia* absconditiflora Greuter & Burdet syn. *Salvia cryptantha* Montbret & Aucher ex Benth. On Breast Cancer, 12 (2013) 390-397.
14. M. Lis- Balchin, S.G. Deans, Bioactivity of selected plant essential oils against *Listeria monocytogenes*, J. Appl. Bacteriol., 82 (1997) 759- 762.
15. J.E.F. Reynolds, *Martindale- the extra pharmacopeia* (31 st ed.). London: Royal Pharmaceutical Society of Great Britain, 1996.
16. B. Tepe, E. Dönmez, M. Unlu, F. Candan, D. Daferera, G. Vardar-Unlu, M. Polissiou, A. Somken, Antimicrobial and antioxidative activity of the essential oils and methanol extracts of *Salvia cryptantha* (Montbret et Aucher ex Benth.) and *Salvia multicaulis* (Vahl.), Food Chem., 84 (2004) 519-525.
17. K.H.C. Başer, S.H. Beis, T. Özek, Composition of the essential oil of *Salvia cryptantha* Montbret et Aucher ex Bent. from Turkey, J. Esent. Oil Res., 7 (1995) 113-114.
18. A. Bayrak, A. Akgül, Composition of essential oils of Turkish *Salvia* species, Phytochem., 26 (1987) 846-847.
19. A. Akgül, M. Özcan, F. Chialva, F. Monguzzi, Essential oils of four Turkish wild- growing Labiatae Herbs: *Salvia* crypthantha Montbr. Et Auch., *Satureja cuneifolia* Ten., *Thymbra spicata* L. and *Thymus cilicicus* Boiss. Et Bal., J. Essent. Oil Res., 11 (1999) 209-214.
20. A. Dogan, Studies on the essential oil of *Salvia crypthantha* Montbr. et Auch, Ankara Univ., Publ. No. 622, Ankara, Turkey, 1972.
21. U. Bingol, B. Coşge, A. İpek, B. Gurbuz, F. Geven F, Identification of essential oil components of *Salvia cryptantha* Montbert & Aucher ex Benthan, growing wild in Turkey, Asian J. Chem., 21 (2009) 3836–3840.
22. E. Bağcı, A. Koçak, Essential oil composition of two *Salvia* L. (*S. multicaulis* Vahl. Enum. and *S. trichoclada* Bentham) species from East Anatolian Region (Turkey), Int. J. Sci. Tech., 3 (2008a) 13-18.
23. E. Bağcı, A. Koçak, *Salvia palaestina* Bentham *S. tomentosa* Miller türlerinin uçucu yağ kompozisyonu, kemotaksonomik bir yaklaşım, Fırat Üniversitesi Fen ve Mühendislik Bilimleri Dergisi, 20 (2008) 35-41.
24. G. Dogan, A. Demirpolat, E. Bagci, Essential oil composition of aerial parts of two *Salvia* L. (*S. russellii* Bentham and *S. bracteata* Banks and Sol.) species, Asian J. Chem., 26 (2014) 5998-6000.