

Rec. Nat. Prod. 11:3 (2017) 310-314

records of natural products

Essential Oil Composition of *Salvia tebesana* Bunge (Lamiaceae) from Iran

Seyed Mostafa Goldansaz ^{*1}, Mohammad Hossein Hakimi Meybodi ², Ali Mirhosseini ³ and Mohammad Hossein Mirjalili ⁴

¹Department of Natural resources, Sari University of Agricultural Sciences and Natural Resources, Sari, Iran

² Natural Resources and Desert Studies, Faculty of Natural Resources and Eremology, Yazd University, Yazd, Iran

³ Natural Resources and Agricultural Education and Research Center, Yazd, Iran ⁴ Department of Agriculture, Medicinal Plants and Drugs Research Institute, Shahid Beheshti University, G. C., Tehran, Iran

(Received July 04, 2016; Revised December 01, 2016; Accepted February 23, 2017)

Abstract: *Salvia tebesana* Bunge (Lamiaceae) is an endemic medicinal species which grows wild in center of Iran. In the present study, chemical composition of the essential oil of the plant at two developmental stages (vegetative and full flowering) was reported for the first time. The essential oils were obtained by hydrodistillation from air-dried samples and analyzed by GC-FID and GC-MS. The yield of oil (w/w %) in different stages was in the order: full flowering (0.32 %) > vegetative (0.14 %). In total 44 and 61 constituents were identified and quantified in the studied samples representing 99.6 and 99.2 % of the total oil, respectively. The main constituents were 7-epi- α -eudesmol, (*E*)-nerolidol, (*E*)-caryophyllene, α -pinene, caryophyllene oxide, and δ -cadinen. Oxygenated sesquiterpens (43.7% and 48.2%) followed by sesquiterpene hydrocarbons (30.3% and 32.7%) were the main group of compound in the oil of the plant at vegetative and full flowering stages, respectively.

Keywords: Salvia tebesana; Lamiaceae; essential oil; gas chromatography. © 2017 ACG Publications. All rights reserved.

1. Plant Source

The genus *Salvia* L. (tribe Mentheae: subtribe Salviinae), is one of the largest genera in the family Lamiaceae and represents approximately 1000 species displaying a remarkable diversity in growth forms, floral morphology, pollination biology, and secondary compounds [1]. *Salvia* is represented in the flora of Iran by 61 species, 17 of which as *Salvia tebesana* Bunge are endemic. *S. tebesana* is restricted to some regions around Tabas, Iran, where is locally named 'Maryamgoli Tabasi' [2].

The aerial parts of the plant were collected at both vegetative and full flowering stages during April and May 2015 from its natural habitat near Tabas (33° 23' N, 57° 15' E at an altitude of 1507 m). A voucher specimen has been deposited in the Herbarium of the Medicinal Plants and Drugs Research Institute, Shahid Beheshti University, Tehran, Iran.

^{*} Corresponding author: E-mail: Mostafagoldansaz@gmail.com

2. Previous Studies

The essential oil composition of *Salvia* species has been extensively studied from different distribution regions of the world [3-7]. There are different studies on genus of salvia such as *S. atropatana*, *S. oligophylla*, *S. aethiopis*, *S. bracteata*, *S. sclraea*, *S. reuterana*, *S. macrosiphon* which were obtained in yields of 0.2, 0.45, 0.23, 0.51, 0.3, 0.49 and 0.5% (w/w), respectively. The main composition of these genus is Caryophyllene oxide (19.26%), Occidentotal (24%), α -Copanaene (16.64%), α -pinene (29.60%), Germacrene D (12.67%), Germacrene D (11.17%), and Sclareol (8.60%), respectively [8, 9]. In the following, the literature survey showed that the oil of *Salvia* species has been found to be rich in β -phellandrene, linalool, camphor, spathulenol, α -pinene, caryophyllene oxide, myrcene, α -terpinene and germacrene D [10-14]. Salvia is used for antioxidant [15], antiinflammatory [16], wound treatment, bathing, washing, skin, hair care [17], opioid receptor activities [18], antifungal [19], antivirial [20], and antibacterial [21]. The present study describes the chemical composition of the essential oil from the aerial parts of *S. tebesana*, which has not been studied previously.

3. Present Study

The powdered aerial parts (100 g) from the both growth stages were hydrodistilled using a Clevenger type apparatus for 3 h [22]. The resulting essential oil was dried over anhydrous sodium sulfate and stored at 4° C until analyzed and tested.

Essential oil analysis: GC-FID analyses of the oil were conducted using a Thermoquest-Finnigan instrument equipped with a DB-5 fused silica column ($60 \text{ m} \times 0.25 \text{ mm}$ i.d., film thickness 0.25 µm). Nitrogen was used as the carrier gas at a constant flow of 1.1 mL/min. The split ratio was 1/50. The oven temperature was raised from 60 °C to 250 °C at a rate of 5 °C/min. The injector and detector (FID) temperatures were kept at 250 °C and 280 °C, respectively. GC-MS analysis was carried out on a Thermoquest-Finnigan Trace GC-MS instrument equipped with the same column and using the same temperature programming as mentioned for GC. Transfer line temperature was 250 °C. Helium was used as the carrier gas at a flow rate of 1.1 mL/min, with a split ratio equal to 1/50. The constituents of the essential oils were identified by calculation of their retention indices under temperature-programmed conditions for n-alkanes (C6–C24) and the oil on a DB-5 column under the same conditions. Identification of individual compounds was made by comparison of their mass spectra with those of the internal reference mass spectral library (Wiley 7.0) or with authentic compounds confirmed by comparison of their retention indices or with those reported in the literature [23].

The essential oils had a light yellow color with distinct sharp odor. The yield of the essential oils (w/w %) of the plant at vegetative and full flowering stages were 0.14% and 0.32%, respectively. The qualitative and quantitative analytical results are listed in Table 1 together with the retention indices of the identified compounds, where all the constituents are arranged in order of their elution on the DB-5 column. In total 44 and 61 constituents were identified and quantified in the studied samples representing 99.6 and 99.2 % of the total oil, respectively. A comparison among the composition of the essential oils revealed both quantitative and qualitative differences. The GC and GC-MS analyses showed that the distribution of monoterpene hydrocarbons and oxygenated monoterpenes of the oil from the aerial parts of the plant at vegetative stage was remarkably different from that of the oils at the flowering stage. The results revealed that the monoterpene hydrocarbons from the plant oil at vegetative stage (17.2%) were present in higher amount than in the other sample (8.3%). Terpinen-4ol, α-terpineol, myrtenol, *cis-p*-mentha-1(7),8-dien-2-ol, *trans*-2-hydroxy-pinocamphone, geranial and *p*-mentha-1-en-2-ol were found only in the oil of the plant at flowering stage. The major constituent of the oil at vegetative stage were α -pinene (14.8%), 7-epi- α -eudesmol (14.7%), caryophyllene oxide (12.7%), and (E)-caryophyllene (9.4%), but it was found that these compounds decreased gradually in subsequent developmental stage. On the contrary, (E)-nerolidol was found in the plant oil which increased remarkably during flowering stage. Essential oil composition of the Iranian Salvia species has been previously studied. Almost all of the reported oils contained α - and β -pinene as the monoterpene hydrocarbons, but the α -isomer was usually in higher concentration. The other reported major compounds in the oil of *Salvia* species were camphene and borneol for *S. santolinifolia* and *S. eremophila*. β -caryophyllene or caryophyllene oxide were reported as the major compounds of the oils of *S. atropatana*, *S. hypoleuca* and *S. chloroleuca* [14]. (*Z*,*E*)-Geranyl linalool (2.4%) was only found in the oil of the plant at vegetative stage.

1 a-Pinene 938 14.8 7.5 2 Camphene 950 0.6 0.1 3 β-Pinene 979 0.8 0.3 4 p -Cymene 1025 0.7 0.2 5 Sylvestrene 1029 0.3 0.2 6 Camphor 1148 0.3 0.2 7 Borneol 1172 1.1 1.2 8 reprinen-4-ol 1182 - 0.3 9 α -Terpineol 1196 - 0.2 10 Myrenol 1202 - 0.2 11 trans-2-hydroxy-Pinocamphone 1252 - 0.1 14 Geranial 1276 - 0.2 16 16 Bornyl acetate 1288 0.9 2.1 17 17 p-Mentha-1-en-9-ol 1300 - 0.2 19 16 Gorbebene 1350 - 0.2 14 0	No.	Compound ^{a)}	RI ^{b)}	Vegetative	% Full flowering
2 Camphene 950 0.6 0.1 3 β-Pinene 979 0.8 0.3 4 p-Cymene 1025 0.7 0.2 5 Sylvestrene 1029 0.3 0.2 6 Camphor 1148 0.3 0.2 7 Borneol 1172 1.1 1.2 8 Terpinen-4-ol 1182 - 0.3 9 a-Terpineol 1196 - 0.2 10 Myrtenol 1202 - 0.2 11 cfarpineon 1233 - 0.1 12 Isoamyl hexanoate 1233 - 0.1 13 trans-2-hydroxy-Pinocamphone 1252 - 0.1 14 Geranial 1273 - 0.2 1 17 p-Menth-1-en-7-al 1276 - 0.2 1 14 Geranial 1273 - 0.2 1 1 1.3 19 022.0 A-Cubebene 1350 - 0.2 <td< th=""><th>1</th><th>α-Pinene</th><th>938</th><th></th><th>Č.</th></td<>	1	α-Pinene	938		Č.
3 β-Pinene 979 0.8 0.3 4 p -Cymene 1025 0.7 0.2 5 Sylvestrene 1029 0.3 0.2 6 Camphor 1148 0.3 0.2 7 Borneol 1172 1.1 1.2 8 Terpineol 1196 - 0.2 0 Myrtenol 1202 - 0.2 10 Myrtenol 1202 - 0.1 12 Isoamyl hexanoate 1250 - 0.4 13 trans-2-hydroxy-Pinocamphone 1252 - 0.1 14 Geranial 1273 - 0.2 15 p-Mentha-1-en-7-al 1276 - 0.2 16 Bornyl acetate 1380 - 0.2 17 p-Mentha-1-en-7-al 1276 - 0.2 18 a-Cubebene 1350 - 0.2 19 (2E)-Undecenal 1364 - 0.1 10 Isoleden 1374 -					
4 p -Cymene 1025 0.7 0.2 5 Sylvestrene 1029 0.3 0.2 6 Camphor 1148 0.3 0.2 7 Borneol 1172 1.1 1.2 8 Terpinen-4-ol 1182 - 0.3 9 a -Terpineol 1202 - 0.2 10 Myrienol 1202 - 0.2 11 tissomyl hexanoate 1250 - 0.4 13 trans-2-hydroxy-Pinocamphone 1252 - 0.1 14 Geranial 1273 - 0.2 1 16 Bornyl acetate 1288 0.9 2.1 1 7 p -Menth-1-en-7-al 1276 - 0.2 1 17 p -Menth-1-en-9-ol 1300 - 0.3 2 18 a -Cubehene 1374 - 0.2 2 19 (2E)-Undecenal 1374 - 0.2 2 10 kocubehene 1374 -					
5 Sylvestrene 1029 0.3 0.2 6 Camphor 1148 0.3 0.2 7 Borneol 1172 1.1 1.2 8 Terpinen4-ol 1182 - 0.3 9 cTerpineo1 1196 - 0.2 10 Myrienol 1202 - 0.2 11 cis-p-Mentha-1(7),8-dien-2-ol 1233 - 0.1 12 Isoanyl hexanoate 1250 - 0.4 13 trans-2-hydroxy-Pinocamphone 1252 - 0.1 14 Geranial 1273 - 0.2 15 p-Mentha-1-en-7-al 1276 - 0.2 16 Bornyl acetate 1380 - 0.2 17 p-Menth-1-en-9-ol 1300 - 0.2 18 a-Cubebene 1374 - 0.2 19 (2E)-Undecenal 1374 - 0.2 21 a-Cubebene 1391 1.5 0.2 22 (3C)-Hexenyl hexanoate					
6 Camphor 1148 0.3 0.2 7 Borneol 1172 1.1 1.2 8 Terpinen-4-ol 1182 - 0.3 9 a -Terpineol 1196 - 0.2 10 Myrtenol 1202 - 0.2 11 $cls.p-Mentha-1(7).8-dien-2-ol 1233 - 0.1 12 Isoamyl hexanoate 1250 - 0.4 13 trans-2-hydroxy-Pinocamphone 1252 - 0.1 14 Geranial 1273 - 0.2 15 p-Mentha-1en-7-al 1276 - 0.2 16 Bornyl acetate 1288 0.9 2.1 17 p-Mentha-1en-9-ol 1300 - 0.2 16 Bornyl acetate 1378 - 0.2 17 p-Mentha-1en-9-ol 1300 - 0.1 20 Isoleden 1374 - 0.2 21 a-Cuphene 1378 - 1.9 22 (32)-Hexenyl he$					
7 Borneol 1172 1.1 1.2 8 Terpinen4-ol 1182 - 0.3 9 a. Terpineol 1196 - 0.2 10 Myrtenol 1202 - 0.2 11 cix-p-Mentha-1(7).8-dien-2-ol 1233 - 0.1 12 Isoamyl hexanoate 1250 - 0.4 14 Geranial 1273 - 0.2 15 p-Mentha-1-en-7-al 1273 - 0.2 16 Bornyl acetate 1380 - 0.3 17 p-Menth-1-en-9-ol 1300 - 0.3 18 aCubebene 1350 - 0.2 19 (2E)-Undecenal 1364 - 0.1 20 Isoleden 1374 - 0.2 21 aCubebene 1381 - 0.2 23 β-Cubebene 1391 1.5 0.2 24 1-Tetradecene 1405 0.8 0.1 25 a.Gurjunene 1433		•			
8 Terpinen-4-ol 1182 - 0.3 9 a -Terpineol 1196 - 0.2 10 $dyrenol$ 1202 - 0.2 11 cis_p -Mentha-1(7),8-dien-2-ol 1233 - 0.1 12 Isoamyl hexanoate 1250 - 0.4 13 trans-2-hydroxy-Pinocamphone 1252 - 0.1 14 Geranial 1276 - 0.2 15 p -Mentha-1-en-7-al 1206 - 0.2 16 Bornyl acetate 1288 0.9 2.1 17 p -Menth-1-en-9-ol 1300 - 0.2 18 a -Cubebene 1378 - 0.2 19 (2E)-Undecenal 1364 - 0.1 20 Isoleden 1378 - 0.2 17 d -Kapphylene 1412 - 1.2 18 $c-Copaene 1391 1.5 0.2 23 \beta-Curyonpyllene 14131 0.4 0.5 24 $					
9 a -Terpineol 1196 - 0.2 10 Myrtenol 1202 - 0.2 11 cis-p-Mentha-1(7),8-dien-2-ol 1233 - 0.1 12 Isoamyl hexanoate 1250 - 0.4 13 trans-2-hydroxy-Pinocamphone 1252 - 0.1 14 Geranial 1273 - 0.2 15 p-Mentha-1-en-7-al 1273 - 0.2 16 Bornyl acetate 1380 - 0.3 a -Cubebene 1350 - 0.2 19 (2E)-Undecenal 1364 - 0.1 10 Isoleden 1374 - 0.2 21 a -Cubebene 1391 1.5 0.2 21 a -Copaene 1378 - 1.9 23 β-Cubebene 1412 - 1.2 26 (E)-Caryophyllane 1431 0.4 0.5 27 $4,8$				-	
10 Myrtenol 1202 - 0.2 11 $cis-p$ -Mentha-1(7),8-dien-2-ol 1233 - 0.1 12 Isoanyl hexanoate 1250 - 0.4 13 $trans-2$ -hydroxy-Pinocamphone 1252 - 0.1 14 Geranial 1273 - 0.2 15 p -Mentha-1-en-7-al 1276 - 0.2 16 Bornyl acetate 1288 0.9 2.1 17 p -Mentha-1-en-9-ol 1300 - 0.2 18 a -Cubebene 1378 - 0.2 18 a -Cubebene 1378 - 1.9 21 a -Copaene 1378 - 0.2 17 d -Extracene 1405 0.8 0.2 18 a -Cubebene 1391 1.5 0.2 22 $(3Z)$ -Hexenyl hexanoate 1381 - 0.2 24 1-Tetradecene 1405 0.8 0.2 25 a -Gurjunene 1412 - 1.2 26<				_	
11 $cis p$ -Mentha-1(7),8-dien-2-ol 1233 - 0.1 12 Isoamyl hexanoate 1250 - 0.1 13 trans-2-hydraxy-Pinocamphone 1252 - 0.1 14 Geranial 1273 - 0.2 15 p-Mentha-1-en-7-al 1276 - 0.2 16 Bornyl acetate 1288 0.9 2.1 17 p-Menth-1-en-9-ol 1300 - 0.3 a Cubebene 1350 - 0.2 9 (2E)-Undecenal 1364 - 0.1 20 Isoleden 1374 - 0.2 21 a-Copaene 1378 - 1.9 2(32)-Hexenyl hexanoate 1381 - 0.2 23 β-Cubebene 1391 1.5 0.2 25 a-Gurjunene 1412 - 1.2 26 (E)-Caryophyllene 1425 9.4 7.7 24 1-Tetradecene 1431 0.4 0.5 30 Aromadendrene <td></td> <td></td> <td></td> <td>_</td> <td></td>				_	
12 Isoamyl hexanoate 1250 - 0.4 13 trans-2-hydroxy-Pinocamphone 1252 - 0.1 14 Geranial 1273 - 0.2 15 p-Mentha-1-en-7-al 1276 - 0.2 16 Bornyl acetate 1288 0.9 2.1 7 p-Menth-1-en-9-ol 1300 - 0.3 18 a-Cubebene 1350 - 0.2 19 (2E)-Undecenal 1364 - 0.2 21 a-Copaene 1378 - 1.9 22 (32)-Hexenyl hexanoate 1381 - 0.2 23 β-Cubebene 1391 1.5 0.2 24 1-Tetradecene 1405 0.8 0.2 25 α-Gurjunene 1412 - 1.2 6 Curyophyllene 1435 0.6 0.1 9 σ-Gurjunene 1435 0.6 0.1 9 a-Gurjunene 1435 0.6 0.1 9 a-Gurjunene				_	
13 trans ² -hydroxy-Pinocamphone 1252 - 0.1 14 Geranial 1273 - 0.2 15 p-Mentha-1-en-7-al 1273 - 0.2 16 Bornyl acetate 1288 0.9 2.1 17 p-Menth-1-en-9-ol 1300 - 0.3 18 a-Cubebene 1350 - 0.2 19 (2E)-Undecenal 1364 - 0.1 20 Isoleden 1374 - 0.2 21 a-Copaene 1378 - 1.9 23 β-Cubebene 1391 1.5 0.2 24 1-Tetradecene 1405 0.8 0.2 25 a-Cubryphyllene 1412 - 1.2 26 (E)-Caryophyllene 1433 0.4 0.5 3 β-corpone 1433 0.4 0.5 3 Gorijunene 1443 3.8 4.5 4 Homolynene 1443 3.8 0.1 2 9-epi-(E)-Caryophyllene					
14 Geranial 1273 - 0.2 15 p -Mentha-1-en-7-al 1276 - 0.2 16 Bornyl acetate 1288 0.9 2.1 17 p -Menth-1-en-9-ol 1300 - 0.3 18 a -Cubebene 1350 - 0.2 19 (22)-Undecenal 1364 - 0.1 20 Isoleden 1374 - 0.2 21 a -Copaene 1378 - 1.9 23 β -Cubebene 1391 1.5 0.2 24 1-Tetradecene 1405 0.8 0.2 25 a -Guryinene 1412 - 1.2 26 (E)-Caryophyllene 1425 9.4 7.7 27 4.8 β-epoxy-Caryophyllane 1435 0.6 0.1 2 a -Guraiene 1435 0.6 0.1 33 p -Guryinnene 1443 3.8 4.5 34 p -Guryinene 1443 3.8 0.1 35 p -Selinen				-	
15p-Mentha-1-en-7-al1276-0.216Bornyl acctate12880.92.117p-Menth-1-en-9-ol1300-0.318a-Cubebene1350-0.219 $(2E)$ -Undecenal1364-0.120Isoleden1374-0.210Isoleden1374-0.221a-Copaene1378-1.922 $(3Z)$ -Hexenyl hexanoate1381-0.223β-Cubebene13911.50.2241-Tetradecene14050.80.225a-Gurjunene1412-1.226(E)-Caryophyllene14259.47.777.4.8β-epoxy-Caryophyllane14350.60.129a-Guaiene14350.60.10.520Aromadendrene14433.84.531a-Humulene14570.90.8329-epi-(E)-Caryophyllene14641.11.33γ-Gurjunene14790.50.935β-Selinene14890.20.836Viridiflorene14890.61.5444.770.20.20.245β-Curgurene15183.83.036δ-Selinene15470.20.245β-Selinene15470.20.246Viridiflorene15590.8 <td></td> <td></td> <td></td> <td>-</td> <td></td>				-	
16Bornyl acetate12880.92.117 p -Menth-1-en-9-ol1300-0.318 a -Cubebene1350-0.219 $(2E)$ -Undecenal1364-0.120Isoleden1374-0.221 a -Copaene1378-1.922 $(3Z)$ -Hexenyl hexanoate1381-0.223 β -Cubebene13911.50.2241-Tetradecene14050.80.225 a -Gurjunene1412-1.226(E)-Caryophyllene14259.47.7274.8 β-epoxy-Caryophyllane14330.60.19 a -Guaiene14350.60.19 a -Guaiene14350.60.19 a -Guaiene14350.60.19 a -Guaiene14350.90.8329-epi-(E)-Caryophyllene14641.11.333 γ -Gurjunene14750.80.134 γ -Muurolene14790.50.935 β -Selinene14890.20.833 γ -Catinene15183.83.034 γ -Muurolene15030.80.835 γ -Cadinene15470.20.235 γ -Cadinene15380.61.544(E)-Nerolidol15711.712.145 a -Cadaroene1559 <t< td=""><td></td><td></td><td></td><td>-</td><td></td></t<>				-	
17p-Menth-1-en-9-ol1300-0.318a-Cubebene1350-0.219 $(2E)$ -Undecenal1364-0.120Isoleden1374-0.221a-Copaene1378-1.922 $(3Z)$ -Hexenyl hexanoate1381-0.223 β -Cubebene13911.50.2241-Tetradecene14050.80.225a-Gurjunene1412-1.226(E)-Caryophyllene14350.40.528β-Gurjunene14350.60.129a-Guaiene14350.60.129a-Guaiene14433.84.531a-Humulene14570.90.8329-epi-(E)-Caryophyllene14641.11.333γ-Gurjunene14790.50.935β-Selinene14890.20.836Viridiflorene14890.61.637a-Muurolene15030.80.838γ-Cadinene15183.83.039δ-Cadinene15380.61.541a-Calacorene15470.20.242c:s-Muurol-s-en-4β-ol15590.81.2433.5-9-Trimethyl-deca-2,4.8-trien-1-ol15590.81.244E)-Nerolidol15711.712.145a-Cedrene epoxide1579 <td></td> <td></td> <td></td> <td>-</td> <td></td>				-	
18 a -Cubebene 1350 - 0.2 19 (2E)-Undecenal 1364 - 0.1 20 Isoleden 1374 - 0.2 11 a -Copaene 1378 - 1.9 22 (3Z)-Hexenyl hexanoate 1381 - 0.2 23 β -Cubebene 1391 1.5 0.2 24 1-Tetradecene 1405 0.8 0.2 25 a -Gurjunene 1412 - 1.2 26 (E)-Caryophyllene 1435 0.6 0.1 29 a -Guaiene 1435 0.6 0.1 29 a -Guaiene 1435 0.6 0.1 29 a -Guaiene 1443 3.8 4.5 31 a -Humulene 1443 0.8 0.6 29 a -Gurjunene 1457 0.9 0.8 29 a -Gurjunene 1479 0.5 0.9 35 β -Sclinene 1479 0.5 0.9 35 β -Sclinene <td< td=""><td></td><td></td><td></td><td></td><td></td></td<>					
19(2E)-Undecenal1364-0.120Isoleden1374-0.221 a -Copaene1378-1.922(3Z)-Hexenyl hexanoate1381-0.223 β -Cubebene13911.50.2241-Tetradecene14050.80.225 a -Gurjunene1412-1.226(E)-Caryophyllene14259.47.7274.8 β-epoxy-Caryophyllane14310.40.528β-Gurjunene14350.60.19 a -Guaiene1438-0.530Aromadendrene14433.84.531 a -Humulene14570.90.829 $-epir(E)$ -Caryophyllene14641.11.333 γ -Gurjunene14750.80.134 γ -Muurolene14790.50.935 β -Selinene14981.61.637 a -Muurolene15030.80.838 γ -Cadimene15183.83.039 δ -Cadinene15284.14.744(E)-Nerolidol15711.712.145 a -Cedrene epoxide15790.40.544(E)-Nerolidol15790.40.545 a -Cedrene epoxide15790.40.544(E)-Nerolidol15790.40.545 a -Cuderene epoxide<				-	
20 İsoleden 1374 - 0.2 21 α-Copane 1378 - 1.9 22 (3Z)-Hexenyl hexanoate 1381 - 0.2 23 β-Cubebene 1391 1.5 0.2 24 1-Tetradecene 1405 0.8 0.2 25 α-Gurjunene 1412 - 1.2 26 (E)-Caryophyllene 1425 9.4 7.7 7 4,8 β-epoxy-Caryophyllane 1431 0.4 0.5 28 β-Gurjunene 1435 0.6 0.1 29 α-Guaiene 1438 - 0.5 30 Aromadendrene 1443 3.8 4.5 31 α-Humulene 1457 0.9 0.8 32 9-epi-(E)-Caryophyllene 1464 1.1 1.3 33 γ -Gurjunene 1475 0.8 0.1 4 γ -Muurolene 1479 0.5 0.9 5 β-Selinene 1489 0.2 0.8 33 γ -Carjophyllen				-	
21 α-Copaene 1378 - 1.9 22 (32)-Hexenyl hexanoate 1381 - 0.2 23 β-Cubebene 1391 1.5 0.2 24 1-Tetradecene 1405 0.8 0.2 25 α-Gurjunene 1412 - 1.2 26 (E)-Caryophyllene 1425 9.4 7.7 27 4.8 β-epoxy-Caryophyllane 1431 0.4 0.5 28 β-Gurjunene 1435 0.6 0.1 29 α-Guaiene 1438 - 0.5 30 Aromadendrene 1443 3.8 4.5 31 α-Humulene 1457 0.9 0.8 29 -epi-(E)-Caryophyllene 1464 1.1 1.3 34 γ-Muurolene 1475 0.8 0.1 34 γ-Muurolene 1498 1.6 1.6 36 Viridiflorene 1498 1.6 1.6 37 α-Muurolene 1533 0.6 1.5 38 γ-Cadinen				-	
22 $(3Z)$ -Hexenyl hexanoate 1381 - 0.2 23 β-Cubebene 1391 1.5 0.2 24 1-Tetradecene 1405 0.8 0.2 25 α -Gurjunene 1412 - 1.2 26 (E)-Caryophyllene 1425 9.4 7.7 7 4.8 β-epoxy-Caryophyllane 1431 0.4 0.5 28 α -Gurjunene 1435 0.6 0.1 9 α -Guaiene 1443 3.8 4.5 30 Aromadendrene 1443 3.8 4.5 31 α -Humulene 1457 0.9 0.8 32 9-epi-(E)-Caryophyllene 1464 1.1 1.3 33 γ -Gurjunene 1475 0.8 0.1 34 γ -Muurolene 1479 0.5 0.9 35 β -Selinene 1489 0.2 0.8 36 Viridiflorene 1503 0.8 0.8 37 α -Muurolene 1518 3.8 3.0 3 <td></td> <td></td> <td></td> <td>-</td> <td></td>				-	
23β-Cubebene13911.50.2241-Tetradecene14050.80.225α-Gurjunene1412-1.226(E)-Caryophyllene14259.47.7274,8 β-epoxy-Caryophyllane14310.40.528β-Gurjunene14350.60.129α-Guaiene14333.84.530Aromadendrene14433.84.531α-Humulene14570.90.8329-epi-(E)-Caryophyllene14641.11.333γ-Gurjunene14750.80.134γ-Muurolene14790.50.935β-Selinene14890.20.838γ-Cadinene15030.80.839δ-Cadinene15183.83.039δ-Cadinene15284.14.740γ-Cuprenene15380.61.541α-Calacorene15470.20.242cis-Muurol-5-en-4β-ol15590.81.2433,5,9-Trimethyl-deca-2,4,8-trien-1-ol15653.93.544(E)-Nerolidol15711.712.145α-Cedrene epoxide15790.40.546Caryophyllene oxide159012.76.847Viridiflorol15980.50.448Ledol16102.92.349Humulene epoxide				-	
241-Tetradecene14050.80.225α-Gurjunene1412-1.226(E)-Caryophyllene14259.47.7274,8 β-epoxy-Caryophyllane14310.40.528β-Gurjunene14350.60.129α-Guaiene1438-0.530Aromadendrene14433.84.531α-Humulene14570.90.8329-epi-(E)-Caryophyllene14641.11.333γ-Gurjunene14750.80.134γ-Muurolene14790.50.935β-Selinene14890.20.836Viridiflorene15030.80.837α-Cadinene15183.83.039 δ -Cadinene15284.14.740γ-Cuprenene15380.61.541α-Calacorene15470.20.242cis-Muurol-sen-4β-ol15590.81.2433,59-Timethyl-deca-2,4,8-trien-1-ol15553.93.544(E)-Nerolidol15711.712.145α-Cedrene epoxide15790.40.547Viridiflorol15980.50.448Ledol16102.92.349Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16260.81.0521-epi-Cu				-	
25α-Gurjunene1412-1.226(E)-Caryophyllene14259.47.7274,8 β-epoxy-Caryophyllane14310.40.528β-Gurjunene14350.60.129α-Guaiene1438-0.530Aromadendrene14433.84.531α-Humulene14570.90.8329-epi-(E)-Caryophyllene14641.11.333γ-Gurjunene14750.80.134γ-Muurolene14790.50.935β-Selinene14890.20.836Viridiflorene15030.80.837α-Guainene15183.83.038γ-Cadinene15183.83.039δ-Cadinene15284.14.740γ-Cuprenene15380.61.541α-Calacorene15470.20.242cis-Muurol-5-en-4β-ol15590.81.2433,5,9-Trimethyl-deca-2,4,8-trien-1-ol15653.93.544(E)-Nerolidol15711.712.145α-Cedrene epoxide15790.40.547Viridiflorol15980.50.448Ledol16150.60.449Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16260.81.0521-epi-Cube		•			
26(E)-Caryophyllene14259.47.7274,8 β-epoxy-Caryophyllane14310.40.528β-Gurjunene14350.60.129 α -Guaiene14350.60.130Aromadendrene14433.84.531 α -Humulene14433.84.5329-epi-(E)-Caryophyllene14641.11.333 γ -Gurjunene14750.80.134 γ -Muurolene14790.50.935β-Selinene14890.20.836Viridiflorene14981.61.637 α -Muurolene15030.80.838 γ -Cadinene15183.83.039 δ-Cadinene 15284.1 4.7 40 γ -Cuprenene15370.20.242 <i>cis</i> -Muurol-5-en-4β-ol15590.81.2433,5,9-Trimethyl-deca-2,4,8-trien-1-ol15653.93.544(E)-Nerolidol15711.712.145 α -Cedrene epoxide15790.40.546Caryophyllene oxide159012.76.847Viridiflorol15980.50.448Ledol16102.92.349Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16200.60.25110-epi-Y-Eudesmol16260.81				0.8	
274,8 β-epoxy-Caryophyllane14310.40.528β-Gurjunene14350.60.129 α -Guaiene1438-0.530Aromadendrene14433.84.531 α -Humulene14570.90.8329-epi-(E)-Caryophyllene14641.11.333 γ -Gurjunene14750.80.134 γ -Muurolene14790.50.935β-Selinene14890.20.836Viridiflorene14890.20.838 γ -Cadinene15030.80.839 δ -Cadinene15030.80.839 δ -Cadinene15183.83.039 δ -Cadinene15590.81.241 α -Calacorene15590.81.242 <i>cis</i> -Muurol-5-en-4β-ol15590.81.2433,5,9-Trimethyl-deca-2,4,8-trien-1-ol15653.93.544(E)-Nerolidol15711.712.145 α -Celarene epoxide159012.76.847Viridiflorol15980.50.448Ledol16102.92.349Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16260.81.05110-epi- γ -Eudesmol16340.30.853 γ -Eudesmol16380.40.4<					
28 β -Gurjunene14350.60.129α-Guaiene1438-0.530Aromadendrene14433.84.531 α -Humulene14570.90.8329-epi-(E)-Caryophyllene14641.11.333 γ -Gurjunene14750.80.134 γ -Muurolene14790.50.935 β -Selinene14890.20.836Viridiflorene14981.61.637 α -Muurolene15030.80.838 γ -Cadinene15183.83.039 δ -Cadinene15284.14.740 γ -Cuprenene15380.61.541 α -Calacorene15470.20.242cis-Muurol-5-en-4β-ol15590.81.2433,5.9-Trimethyl-deca-2,4,8-trien-1-ol15653.93.544(E)-Nerolidol15711.712.145 α -Cedrene epoxide159012.76.847Viridiflorol15980.50.448Ledol16102.92.349Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16200.60.25110-epi- γ -Eudesmol16380.40.4521-epi-Cubenol16380.40.453 γ -Eudesmol16380.40.454 </td <td></td> <td></td> <td>1425</td> <td>9.4</td> <td></td>			1425	9.4	
29 α -Guaiene1438-0.530Aromadendrene14433.84.531 α -Humulene14570.90.8329-epi-(E)-Caryophyllene14641.11.333 γ -Gurjunene14750.80.134 γ -Muurolene14790.50.935 β -Selinene14890.20.836Viridiflorene14981.61.637 α -Muurolene15030.80.838 γ -Cadinene15183.83.039 δ -Cadinene15183.83.039 δ -Cadinene155284.14.740 γ -Cuprenene15380.61.541 α -Calacorene15470.20.242cis-Muurol-5-en-4 β -ol15590.81.2433,5,9-Trimethyl-deca-2,4,8-trien-1-ol15653.93.544(E)-Nerolidol15711.712.145 α -Cedrene epoxide15790.40.546Caryophyllene oxide159012.76.847Viridiflorol15980.50.448Ledol16102.92.349Humulene epoxide II16150.60.25110-epi-Cubenol16340.30.8521-epi-Cubenol16340.30.853 γ -Eudesmol16340.30.854 <td></td> <td>4,8 β-epoxy-Caryophyllane</td> <td>1431</td> <td>0.4</td> <td>0.5</td>		4,8 β-epoxy-Caryophyllane	1431	0.4	0.5
30Aromadendrene14433.84.531 α -Humulene14570.90.8329-epi-(E)-Caryophyllene14641.11.333 γ -Guijunene14750.80.134 γ -Muurolene14790.50.935 β -Selinene14890.20.836Viridiflorene14981.61.637 α -Muurolene15030.80.838 γ -Cadinene15183.83.039 δ -Cadinene15183.83.039 δ -Cadinene15380.61.541 α -Calacorene15470.20.242 cis -Muurol-5-en-4 β -ol15590.81.2433,5,9-Trimethyl-deca-2,4,8-trien-1-ol15653.93.544(E)-Nerolidol15711.712.145 α -Cedrene epoxide15790.40.546Caryophyllene oxide159012.76.847Viridiflorol15980.50.448Ledol16102.92.349Humulene epoxide II16150.60.25110-epi-Cubenol16340.30.8521-epi-Cubenol16340.30.853 γ -Eudesmol16340.30.854 α -Muurolol16483.63.4		β-Gurjunene	1435	0.6	0.1
31 α -Humulene14570.90.8329-epi-(E)-Caryophyllene14641.11.333 γ -Gurjunene14750.80.134 γ -Muurolene14790.50.935 β -Selinene14890.20.836Viridiflorene14981.61.637 α -Muurolene15030.80.838 γ -Cadinene15183.83.039 δ -Cadinene15284.14.740 γ -Cuprenene15380.61.541 α -Calacorene15470.20.242 cis -Muurol-5-en-4 β -ol15590.81.2433,5,9-Trimethyl-deca-2,4,8-trien-1-ol15653.93.544(E)-Nerolidol15711.712.145 α -Cedrene epoxide15790.40.546Caryophyllene oxide159012.76.847Viridiflorol15980.50.448Ledol16102.92.349Humulene epoxide II16150.60.25110-epi- γ -Eudesmol16260.81.0521-epi-Cubenol16340.30.853 γ -Eudesmol16380.40.454 α -Muurolol16483.63.4		α-Guaiene	1438	-	
329-epi-(E)-Caryophyllene14641.11.333 γ -Gurjunene14750.80.134 γ -Muurolene14790.50.935 β -Selinene14890.20.836Viridiflorene14891.61.637 α -Muurolene15030.80.838 γ -Cadinene15183.83.039 δ -Cadinene15284.14.740 γ -Cuprenene15380.61.541 α -Clacorene15470.20.242 cis -Muurol-5-en-4 β -ol15590.81.2433,5,9-Trimethyl-deca-2,4,8-trien-1-ol15653.93.544(E)-Nerolidol15711.712.145 α -Cedrene epoxide15790.40.546Caryophyllene oxide159012.76.847Viridiflorol15980.50.448Ledol16102.92.349Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16260.81.05110-epi- γ -Eudesmol16340.30.853 γ -Eudesmol16380.40.454 α -Muurolol16483.63.4	30	Aromadendrene	1443	3.8	4.5
33γ-Gurjunene14750.80.134γ-Muurolene14790.50.935β-Selinene14890.20.836Viridiflorene14981.61.637 α -Muurolene15030.80.838γ-Cadinene15183.83.039 δ-Cadinene 15284.1 4.7 40γ-Cuprenene15380.61.541 α -Calacorene15470.20.242cis-Muurol-5-en-4β-ol15590.81.2433,5,9-Trimethyl-deca-2,4,8-trien-1-ol15653.93.544(E)-Nerolidol15711.712.145 α -Cedrene epoxide159012.76.847Viridiflorol15980.50.448Ledol16150.60.449Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16260.81.0521-epi-Cubenol16340.30.853γ-Eudesmol16380.40.454 α -Muurolol16483.63.4	31	α-Humulene	1457	0.9	0.8
34 γ -Muurolene14790.50.935 β -Selinene14890.20.836Viridiflorene14981.61.637 α -Muurolene15030.80.838 γ -Cadinene15183.83.039 δ -Cadinene15183.83.039 δ -Cadinene15284.14.740 γ -Cuprenene15380.61.541 α -Calacorene15470.20.242cis-Muurol-5-en-4 β -ol15590.81.2433,5,9-Trimethyl-deca-2,4,8-trien-1-ol15653.93.544(E)-Nerolidol15711.712.145 α -Cedrene epoxide15790.40.546Caryophyllene oxide159012.76.847Viridiflorol15980.50.448Ledol16102.92.349Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16200.60.25110-epi- γ -Eudesmol16260.81.0521-epi-Cubenol16340.30.853 γ -Eudesmol16380.40.454 α -Muurolol16483.63.4	32	9-epi-(E)-Caryophyllene	1464	1.1	1.3
35 $\hat{\beta}$ -Selinene14890.20.836Viridiflorene14981.61.637 α -Muurolene15030.80.838 γ -Cadinene15183.83.039 δ -Cadinene15183.83.039 δ -Cadinene15284.14.740 γ -Cuprenene15380.61.541 α -Calacorene15470.20.242cis-Muurol-5-en-4 β -ol15590.81.2433,5,9-Trimethyl-deca-2,4,8-trien-1-ol15653.93.544(E)-Nerolidol15711.712.145 α -Cedrene epoxide15790.40.546Caryophyllene oxide159012.76.847Viridiflorol15980.50.448Ledol16102.92.349Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16260.81.0521-epi-Y-Eudesmol16340.30.853 γ -Eudesmol16380.40.454 α -Muurolol16483.63.4	33	γ-Gurjunene	1475	0.8	0.1
36Viridiflorene14981.61.637 α -Muurolene15030.80.838 γ -Cadinene15183.83.039 δ -Cadinene15183.83.039 δ -Cadinene15284.14.740 γ -Cuprenene15380.61.541 α -Calacorene15470.20.242cis-Muurol-5-en-4 β -ol15590.81.2433,5,9-Trimethyl-deca-2,4,8-trien-1-ol15653.93.544(E)-Nerolidol15711.712.145 α -Cedrene epoxide15790.40.546Caryophyllene oxide159012.76.847Viridiflorol15980.50.448Ledol16102.92.349Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16260.81.0521-epi-Cubenol16340.30.853 γ -Eudesmol16380.40.454 α -Muurolol16483.63.4	34	γ-Muurolene	1479	0.5	0.9
36Viridiflorene14981.61.637 α -Muurolene15030.80.838 γ -Cadinene15183.83.039 δ -Cadinene15284.14.740 γ -Cuprenene15380.61.541 α -Calacorene15470.20.242cis-Muurol-5-en-4 β -ol15590.81.2433,5,9-Trimethyl-deca-2,4,8-trien-1-ol15653.93.544(E)-Nerolidol15711.712.145 α -Cedrene epoxide159012.76.847Viridiflorol15980.50.448Ledol16102.92.349Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16260.81.0521-epi-Cubenol16340.30.853 γ -Eudesmol16380.40.454 α -Muurolol16483.63.4	35		1489	0.2	0.8
37α-Muurolene15030.80.838 γ -Cadinene15183.83.039δ-Cadinene15183.83.039δ-Cadinene15284.14.740 γ -Cuprenene15380.61.541 α -Calacorene15470.20.242cis-Muurol-5-en-4β-ol15590.81.2433,5,9-Trimethyl-deca-2,4,8-trien-1-ol15653.93.544(E)-Nerolidol15711.712.145 α -Cedrene epoxide15790.40.546Caryophyllene oxide159012.76.847Viridiflorol15980.50.448Ledol16102.92.349Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16260.81.0521-epi-Cubenol16340.30.853 γ -Eudesmol16380.40.454 α -Muurolol16483.63.4	36		1498	1.6	1.6
38 γ -Cadinene15183.83.039 δ -Cadinene15284.14.740 γ -Cuprenene15380.61.541 α -Calacorene15470.20.242cis-Muurol-5-en-4 β -ol15590.81.2433,5,9-Trimethyl-deca-2,4,8-trien-1-ol15653.93.544(E)-Nerolidol15711.712.145 α -Cedrene epoxide15790.40.546Caryophyllene oxide159012.76.847Viridiflorol15980.50.448Ledol16102.92.349Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16260.81.0521-epi-Cubenol16340.30.853 γ -Eudesmol16380.40.454 α -Muurolol16483.63.4					
39 δ-Cadinene5-Cadinene15284.14.740 γ -Cuprenene15380.61.541 α -Calacorene15470.20.242cis-Muurol-5-en-4β-ol15590.81.2433,5,9-Trimethyl-deca-2,4,8-trien-1-ol15653.93.544(E)-Nerolidol15711.712.145 α -Cedrene epoxide15790.40.546Caryophyllene oxide159012.76.847Viridiflorol15980.50.448Ledol16102.92.349Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16200.60.25110-epi-γ-Eudesmol16340.30.853 γ -Eudesmol16380.40.454 α -Muurolol16483.63.4					
40γ-Cuprenene15380.61.541 α -Calacorene15470.20.242cis-Muurol-5-en-4β-ol15590.81.2433,5,9-Trimethyl-deca-2,4,8-trien-1-ol15653.93.544(E)-Nerolidol15711.712.145 α -Cedrene epoxide15790.40.546Caryophyllene oxide159012.76.847Viridiflorol15980.50.448Ledol16102.92.349Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16200.60.25110-epi-γ-Eudesmol16340.30.853γ-Eudesmol16380.40.454 α -Muurolol16483.63.4					
41 α -Calacorene15470.20.242 cis -Muurol-5-en-4 β -ol15590.81.2433,5,9-Trimethyl-deca-2,4,8-trien-1-ol15653.93.544(E)-Nerolidol15711.712.145 α -Cedrene epoxide15790.40.546Caryophyllene oxide159012.76.847Viridiflorol15980.50.448Ledol16102.92.349Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16200.60.25110-epi- γ -Eudesmol16340.30.853 γ -Eudesmol16380.40.454 α -Muurolol16483.63.4					
42cis-Muurol-5-en-4β-ol15590.81.2433,5,9-Trimethyl-deca-2,4,8-trien-1-ol15653.93.544(E)-Nerolidol15711.712.145 α -Cedrene epoxide15790.40.546Caryophyllene oxide159012.76.847Viridiflorol15980.50.448Ledol16102.92.349Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16200.60.25110-epi-γ-Eudesmol16340.30.853γ-Eudesmol16380.40.454 α -Muurolol16483.63.4					
43 $3,5,9$ -Trimethyl-deca- $2,4,8$ -trien-1-ol 1565 3.9 3.5 44(E)-Nerolidol 1571 1.7 12.1 45 α -Cedrene epoxide 1579 0.4 0.5 46Caryophyllene oxide 1590 12.7 6.8 47Viridiflorol 1598 0.5 0.4 48Ledol 1610 2.9 2.3 49Humulene epoxide II 1615 0.6 0.4 50 $1,10$ -di-epi-Cubenol 1620 0.6 0.2 51 10 -epi- γ -Eudesmol 1626 0.8 1.0 52 1 -epi-Cubenol 1634 0.3 0.8 53 γ -Eudesmol 1638 0.4 0.4 54 α -Muurolol 1648 3.6 3.4					
44(E)-Nerolidol15711.712.145 α -Cedrene epoxide15790.40.546Caryophyllene oxide159012.76.847Viridiflorol15980.50.448Ledol16102.92.349Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16200.60.25110-epi- γ -Eudesmol16260.81.0521-epi-Cubenol16340.30.853 γ -Eudesmol16380.40.454 α -Muurolol16483.63.4					
45 α -Cedrene epoxide15790.40.546Caryophyllene oxide159012.76.847Viridiflorol15980.50.448Ledol16102.92.349Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16200.60.25110-epi- γ -Eudesmol16260.81.0521-epi-Cubenol16340.30.853 γ -Eudesmol16380.40.454 α -Muurolol16483.63.4					
46Caryophylene oxide159012.76.847Viridiflorol15980.50.448Ledol16102.92.349Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16200.60.25110-epi- γ -Eudesmol16260.81.0521-epi-Cubenol16340.30.853 γ -Eudesmol16380.40.454 α -Muurolol16483.63.4					
47Viridifiorol15980.50.448Ledol16102.92.349Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16200.60.25110-epi- γ -Eudesmol16260.81.0521-epi-Cubenol16340.30.853 γ -Eudesmol16380.40.454 α -Muurolol16483.63.4					
48Ledol16102.92.349Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16200.60.25110-epi- γ -Eudesmol16260.81.0521-epi-Cubenol16340.30.853 γ -Eudesmol16380.40.454 α -Muurolol16483.63.4					
49Humulene epoxide II16150.60.4501,10-di-epi-Cubenol16200.60.25110-epi- γ -Eudesmol16260.81.0521-epi-Cubenol16340.30.853 γ -Eudesmol16380.40.454 α -Muurolol16483.63.4					
501,10-di-epi-Cubenol16200.60.25110-epi-γ-Eudesmol16260.81.0521-epi-Cubenol16340.30.853γ-Eudesmol16380.40.454 α -Muurolol16483.63.4					
53γ-Eudesmol16380.40.454 α -Muurolol16483.63.4					
54 α-Muurolol 1648 3.6 3.4					
55 7-epi-α-Eudesmol 1663 14.7 17.5					
	55	7-epi-α-Eudesmol	1663	14.7	17.5

Table 1. Essential oil composition of Salvia tebesana Bunge

56	14-hydroxy-9-epi-(E)-Caryophyllene	1679	0.3	0.6
57	(E)-Nerolidyl acetate	1726	0.6	0.1
58	iso-Longifolol acetate	1823	-	0.2
59	Hexahydrofarnesyl acetone	1846	1.4	0.5
60	(Z,E)-Geranyl linalool	2003	2.4	-
61	(E,E)-Geranyl linalool	2033	0.4	0.3
	Monoterpene hydrocarbons		17.2	8.3
	Oxygenated monoterpenes		2.3	5.1
	Sesquiterpene hydrocarbons		30.3	32.7
	Oxygenated sesquiterpenes		43.7	48.2
	Others		6.1	4.9
	Total identified		99.6	99.2

^a) Mode of identification: retention index (RI), mass spectrometery (MS), and co-injection (CoI) with some available authentic compounds. ^b) RI: calculated retention indices determined in the present work relative to C6–C24 *n*-alkanes on the DB-5 column [23,24].

References

- [1] I. C. Hedge. (1982). *Salvia*, in Flora Iranica Ed. K. H. Rechinger, Labiatae, No. 150, Akademische Druck und Verlagsanstalt. Graz, Austria.
- [2] V. Mozafarian. (2003). A Dictionary of Iranian Plant Names. Farhang Moaser, Tehran.
- [3] A. Sonboli, P. Salehi and S. Gharehnaghadeh (2016). Chemical variability in the essential oil composition of *Salvia hypoleuca*, an endemic species from Iran, *J. Essent. Oil Res.* **28** (5), 421-427.
- [4] B. Li, C. Zhang, L. Peng, Z. Liang, X. Yan, Y. Zhu and Y. Liu (2016). Comparison of essential oil composition and phenolic acid content of selected *Salvia* species measured by GC-MS and HPLC methods, *Ind. Crop Prod.* 69, 329-334.
- [5] H. I. Al-Jaber (2015). Essential oil composition of the aerial parts of fresh and air-dried *Salvia verbenaca* L. growing wild in Jordan, *J. Essent. Oil Bear. Pl.* **18**, 718-724.
- [6] K. Morteza-Semnani, M. Saeedi and M. Akbarzadeh (2014). Chemical composition of the essential oil of Salvia limbata C. A. Mey., J. Essent. Oil Res. 17, 623-628.
- [7] M. M. Barazandeh (2004). Volatile constituents of the oil of *Salvia hydrangea* DC. ex Benth. from Iran, *J. Essent. Oil Res.*16, 20-21.
- [8] A. S. Shawl, V. K. Raina, S. K. Srivastava and T. Kumar (2001). Essential oil composition of *Salvia moorcraftiana*, *J. Essent. Oil Res.***13**, 238-239.
- [9] F. Salimpour, A. Mazooji and S. Akhoondi Darzikolaei (2011). Chemotaxonomy of six Salvia species using essential oil composition markers, *J. Med. Plant. Res.* **5**, 1795-1805.
- [10] H. Amiri (2007). Quantative and qualative changes of essential oil of Salvia bracteata Bank et Sol. in different growth stages, *J. Daru.* **15**, 79-82.
- [11] K. Morteza-Semnani, K. Moshiri and M. Akbarzadeh (2005). The essential oil composition of *Salvia multicaulis* Vahl, *J. Essent. Oil Res.* **8**, 6-10.
- [12] F. Chialva, F. Monguzzi and P. Manitto (1992). Composition of the essential oils of five Salvia species, J. Essent. Oil Res. 4, 447-455.
- [13] A. Rustaiyan, H. Komeillizadeh, S. masoudi and A. R. Jassbi (1997). Composition of the essential oil of *Salvia sahendica* Boiss. & Buhse, *J. Essent. Oil Res.* 9, 713-714.
- [14] A. R. Jassbi, M. Asadollahi, M. Masroor, M. C. Schuman, Z. Mehdizadeh, M. Soleimani and R. Miri (2012). Chemical classification of the essential oils of the Iranian Salvia species in comparison with their botanical taxonomy, *Chem. Biodiv.* 9, 1254-1271.
- [15] H. Ögütçü, A. Sökmen, M. Sökmen, M. Polissiou, J. Serkedjieva, D. Daferera, F. Sahın, Ö. Baris and M. Güllüce (2008). Bioactivities of the various extracts and essential oils of *Salvia limbata* C.A.Mey. and *Salvia sclarea* L, Turk. J. Biol. **32**, 181-192.
- [16] M.D.L. Moretti, A.T. Peana and M. Satta (1997). A study on anti-inflammatory and peripheral analgesic action of *Salvia sclearea* oil and its main components, *J. Essent. Oil Res.* **9**, 199-204.
- [17] S.E. Kintzios (2000). Sage The Genus Salvia. Harwood, Amsterdam, Netherlands.
- [18] Ö.G. Çınar, H. Kirmizibekmez, G. Akaydın and E. Yesilada (2011). Investigation of in vitro opioid receptor binding activities of some Turkish Salvia species, *Rec. Nat. Prod*, **5**, 281-289.
- [19] A. Džamic, M. Sokovic, M. Ristic, S. Grujic-Jovanovic, J. Vukojevic and P.D. Marin (2008). Chemical composition and antifungal activity of *Salvia sclarea* (Lamiaceae) essential oil, *Arch. Biol. Sci.* 60, 233-237.

- [20] B. Dikova (2009). Establishment of some viruses polyphagues on economically important essential oil–bearing and medicinal plants in Bulgaria, *Biotechnology* **23**, 80-85.
- [21] L. Jirovetz, G. Buchbauer, Z. Denkova, A. Slavchev, A. Stoyanova and E. Schmidt (2006). Chemical composition, antimicrobial activities and odor descriptions of various Salvia sp. and Thuja sp. essential oils, *Nutrition* **90**, 152-159.
- [22] British Pharmacopoeia (1993). HMSO, London.
- [23] S. D. Hatipoglu, N. Zorlu, T. Dirmenci, A.C. Goren, T. Ozturk and G. Topcu (2016). Determination of volatile organic compounds in fourty five Salvia species by thermal desorption-GC-MS technique, *Rec. Nat. Prod.* **10** (6), 659-700.
- [24] R.P. Adams (2007). Identification of Essential Oils Components by Gas Chromatography/Quadrupole Mass Spectroscopy. Allured Publishing Corporation, Carol Stream, IL.

A C G

© 2017 ACG Publications