Chemistry of Natural Compounds, Vol. 46, No. 6, 2011

CHEMICAL COMPOSITION OF ESSENTIAL OILS OF THREE *Salvia* SPECIES GROWING WILD IN IRAN

Mohammad Ali Khaliazadeh,[1] Akbar Esmaeili,[2] Abdolhossein Rustaiyan,[3*] Bahman Eslami,[1] and Shiva Masoudi[4]

UDC 547.913

Salvia, the largest genus of the family Lamiaceae, includes about 900 species widespread all over the world. Fifty-eight species of the genus are found in Iran, seventeen of which are endemic [1, 2].

Some of these species feature prominently in the pharmacopoeias of many countries throughout the world. The range of traditional applications of the herbs in domestic medicine seems to be endless: they have been used as a medication against perspiration and fever; as a carminative; a spasmolytic; an antiseptic/bactericide; an astringent; a gargle or mouthwash against inflammation of the mouth, tongue, and throat; a wound-healing agent; skin and hair cure; against rheumatism and sexual debility; in treating mental and nervous conditions; and as an insecticide [3–6]. Tanshen, the rhizome of *Salvia miltiorrhiza* Bunge., has been used in Chinese traditional medicine for multiple therapeutic remedies. Tanshen has been used primarily for the treatment of coronary heart disease, particularly angina pectoris and myocardial infarction [7]; it has also been included for the treatment of hemorrhage, dysmenorrhea, miscarriage, swelling, and insomnia [8, 9], as well as inflammatory; diseases such asedema, arthritis, and endangitis [10]; liver fibrosis has also been treated with Tanshen for centuries [11].

Within the framework of our investigation and of others on the oils of *Salvia* species [12–15], we report here the chemical composition of essential oils of *S. urumiensis*, *S. chloroleuca,* and *S. xanthocheila*. To the best of our knowledge, this is the first report on the oil composition of these species of the genus *Salvia*.

The essential oils isolated by hydrodistillation from the aerial parts of *S. urumiensis, S. chloroleuca*, and *S. xanthocheila* were obtained in yields of 0.25%, 0.45%, and 0.35% (w/w), respectively. The composition of the essential oils of the *Salvia* species is listed in Table 1, in which the percentage and retention indices of components are given. Twenty-nine constituents, representing 87.0% of the total components in the oil of *S. urumiensis*, were characterized by spathulenol (14.6%) and α-pinene (14.0%), bornyl acetate (7.7%), and germacrene D (5.2%). Monoterpenes comprised 55.0%, while sesquiterpenes consisted of 31.7% of the oil. *S. chloroleuca* oil contained bicyclogermacrene (17.0%), germacrene D (15.7%), β-pinene (11.4%), α-pinene (9.7%), sabinene (9.6%), β-caryophyllene (5.2%), and spathulenol (5.1%) among the twenty-nine constituents characterized, comprising 97.3% of the total components detected. Sesquiterpenes comprised 50.8% and monoterpenes consisted of 46.3% of the oil. Germacrene D (17.6%), caryophyllene oxide (15.5%), β-caryophyllene (14.8%), α-copaene (14.1%), and spathulenol (7.0%) were the main constituents among the eighteen characterized, comprising 90.5% of the total components detected in the oil of *S. xanthocheila*. Monoterpenes comprised 90.2%, while the sesquiterpene fraction was relatively small, representing only 0.3% of the total oil. The dominant compounds in the oil of *S. eremophila* were α-pinene (24.3%), bornyl acetate (18.9%), camphene (16.0%), and borneol (14.3%) [5]. During the flowering period, the two oils of *S. rhytidea* and *S. limbata* consisted mainly of monoterpenes, while in *S. palaestina* oil, sesquiterpenes predominated over monoterpenes. The major components of the oil of *S. rhytidea* were β-phellandrene (22.7%), and sabinene (13.5%). In the oil of *S. limbata*, α-pinene (23.7%), β-pinene (18.7%), and sabinene (14.5%) were found to be the major constituents. β-Cryophyllene (36.4%) was the predominant compound in the oil of *S. palaestina* [13, 15].

1) Department of Chemistry, Islamic Azad University, Qaemshahr Branch, Qaemshahr, Iran; 2) Department of Chemical Engineering, North Tehran Branch, Islamic Azad University, Tehran, Iran; 3) Department of Chemistry, Islamic Azad University, Science and Research Campus, P. O. Box 14515-775, Tehran, Iran, fax: +98 21 22726794, e-mail: arustaiyan@yahoo.it; 4) Department of Chemistry, Islamic Azad University, Central Tehran Branch, Tehran, Iran. Published in Khimiya Prirodnykh Soedinenii, No. 6, pp. 836–837, November–December, 2010. Original article submitted July 8, 2009.

0009-3130/11/4606-0985

TABLE 1. Percentage of the Essential Oil of *Salvia urumiensis*, *S. choloroleuca*, and *S. xanthocheila*

Compound	RI	1	2	3	Compound	RI	1	2	3
α-Pinene	939	14.0	9.7	–	δ-Elemene	1239	4.9	–	–
Camphene	953	4.0	1.2	–	α-Cubebene	1351	–	–	0.8
Sabinene	976	3.4	9.6	0.3	α-Copaene	1376	1.5	0.3	14.1
β-Pinene	980	8.5	11.4	–	β-Bourbonene	1384	–	0.3	0.9
Myrcene	991	0.4	1.1	–	β-Cubebene	1390	–	–	4.4
3-Octanol	993	0.3	–	–	β-Elemene	1391	0.6	–	–
δ-3-Carene	1011	–	0.3	–	β-Caryophyllene	1418	0.6	5.2	14.8
α-Terpinene	1018	–	0.2	–	γ-Elemene	1433	–	0.6	–
p-Cymene	1026	1.0	0.3	–	α-Humulene	1452	–	–	1.9
Limonene	1031	1.4	2.0	–	Germacrene D	1480	5.2	15.7	17.6
1,8-Cineole	1033	–	4.6	–	Bicyclogermacrene	1494	3.8	17.0	3.0
(*Z*)-β -Ocimene	1040	1.0	0.3	–	δ-Cadinene	1524	0.5	0.3	3.4
(*E*)-β -Ocimene	1050	0.4	2.5	–	Cadina-1,4-diene	1532	–	–	0.6
γ-Terpinene	1062	–	1.0	–	8,14-Cedranoxide	1532	–	–	1.4
Terpinolene	1088	2.7	0.3	–	Occidentalol	1548	–	–	1.2
Linalool	1098	0.6	0.2	–	Elemol	1549	–	0.6	–
α-Campholenal	1125	0.8	–	–	β-Calacorene	1563	–	–	0.6
trans-Pinocarveol	1139	1.5	–	–	Caryophyllene alcohol	1568	–	–	1.3
trans-Verbenol	1144	2.0	–	–	Spathulenol	1576	14.6	5.1	7.0
Pinocarvone	1162	1.1	–	–	Caryophyllene oxide	1581	–	2.8	15.5
Borneol	1165	1.1	0.7	–	epi-α-Muurolol	1641	–	–	1.7
Terpinen-4-ol	1177	0.6	1.1	–	β-Eudesmol	1649	–	1.7	–
p-Cymen-8-ol	1163	1.1	–	–	α-Eudesmol	1672	–	1.2	–
Myrtenol	1194	1.7	–	–	Total		87.0	97.3	90.5
Bornyl acetate	1239	4.9	–	–					

1 – *S. urumiensis*, 2 – *S. choloroleuca*, 3 – *S. xanthocheila.*

Plant Material. The aerial parts of three *Salvia* species were collected during the flowering stage at the following places: *S. urumiensis* (Voucher No. 6612) was collected in July 2006 in Urumieyeh, province of Azerbaijan, Iran. *S. chloroleuca* (Voucher No. 6567) was collected from Fasham, province of Tehran, Iran, in July 2006. *S. xanthocheila* (Voucher No. 6617) was collected from Gadok, province of Mazandaran, North of Iran, in July 2006. Voucher specimens have been deposited at the Herbarium of the Research Institute of Forests and Rangelands (TARI), Tehran, Iran.

Air-dried parts of *S. urumiensis*, *S. chloroleuca*, and *S. xanthocheila* were separately subjected to hydrodistillation using a Clevenger-type apparatus for 3 h.

Analysis. GC analysis was performed on a Shimadzu 15A gas chromatograph equipped with a split/splitless injector (250°C) [12, 13].

GC/MS. Analysis was performed using a Hewlett-Packard 5973 with a HP-5 MS column (30 m × 0.25 mm, film thickness 0.25 μm). The column temperature was kept at 60°C for 3 min and programmed to 220°C for 5 min. The flow rate of helium as 4 carrier gas with (1 mL/min). MS were taken at 70 eV. The compounds were identified by comparison of their retention indices (RRI, DB5) with those reported in the literature and by comparison of their mass spectra with the Wiley library or with the published mass spectra [16].

ACKNOWLEDGMENT

We are grateful to Dr. V. Mozaffarian (Research Institute of Forests and Rangelands, Tehran) for helpful assistance in the collection of plant material and for botanical identification.

REFERENCES

1. I. C. Hedge, *Salvia*, in: *Flora Iranica. Labiatae*, No. 150, K. H. Rechinger (ed.), Akademische Druck and Verlagsanstalt, Graz, Austria, 1982, pp. 447, 458, 449.
2. O. Stapf, *Labiatae in die Botanichen Ergebnisse der Polakischen Expedition Nach Persien um Jahre 1882*, Deutscher Akad. Wiss. Wienmath.-nat. Kl., **50**, 1885, p. 41.
3. V. N. Dobrynin, M. N. Kolosov, B. K. Chernov, and N. A. Derbentseva, *Khim. Prir. Soedin*., 686 (1976).
4. I. Janosik, Liquid Preparation for Treating Psoriasis and Seborrheic Eczemas, Czech. Patent, **185**, 1980, pp. 262–263.
5. H. Hitikoto, S. Morozumi, T. Wauke, S. Sakai, and H. Kurata, *Appl. Environ. Microbiol.*, **39**, 818 (1980).
6. H. M. Chang and P. P. But, *Pharmacology and Application of Chinese Materia Medica*, Vol. **1**, World Science Publishing Co., Singapore, 1986, p. 255.
7. X. Wang, S. L. Morris-Natshke, and K. H. Lee, *Med. Res. Rev.*, **27**, 133 (2007).
8. A. R. Lee, W. L. Wu, W. L. Chang, H. C. Lin, and M. L. King, *J. Nat. Prod*., **50**, 157 (1987).
9. W. L. Wu, W. L. Chang, and C. F. Chen, *Am. J. Chin. Med*., **19**, 207 (1991).
10. S. Y. Ryu, C. O. Lee, and S. U. Choi, *Planta Med*., **63**, 339 (1997).
11. S. I. Jang, S. I. Jeong, K. J. Kim, H. J. Kim, H. H. Yu, R. Park, H. M. Kim, and Y. O. You, *Planta Med*., **69**, 1057 (2003).
12. A. Rustaiyan, S. Masoudi, A. Monfared, and H. Komeilizade, *Flav. Fragr. J*., **14**, 276 (1999).
13. A. Rustaiyan, M. R. Akhgar, S. Masoudi, and F. Nematollahi, *J. Essent. Oil Res*., **17**, 522 (2005).
14. M. Bigdeli, A. Rustaiyan, M. Nadimi, and S. Masoudi, *J. Essent. Oil Res*., **17**, 82 (2005).
15. M. Kurkcuoglu, B. Demirci, K. H. C. Basar, T. Dirmenci, G. Tumen, and U. Ozgen, *J. Essent. Oil Res*., **17**, 192 (2005).
16. R. P. Adams, *Identification of Essential Oil Components by Gas Chromatography/Quadrupole Mass Spectroscopy*, Allured Publ. Corp., Carol Stream, IL, 2000.