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Chemical Composition of the Essential Oil of *Salvia verbenaca* (L.) Briq. ssp. *pseudo-jaminiana* (Chev.) M.

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ABSTRACT

The chemical composition of the essential oil of the endemic Saharian species *Salvia verbenaca* (L.) Briq. ssp. *pseudo-jaminiana* (Chev.) M. was analysed by GC and GC–MS, the identified components constituting 97.7% of the oil. Fifty three components were identified. The main constituents were β-caryophyllene (11.33%), muurola-3,5-diene (5.2%), cis muurola-4(14),5-diene (7.8%), bicyclogermacrene (10.9%), γ-cadinene (7.9%), spathulenol (3.0%), 1,10-di-epi-cubenol (20.9%) and epi-α-cadinol (11.6%). This is the first report on the chemical composition of the oil of *Salvia verbenaca* (L.) Briq. ssp. *pseudojaminiana* from Algeria.

Keywords: *Salvia verbenaca* (L.) Briq. ssp. *pseudo-jaminiana* L., essential oil, β-caryophyllene, bicyclogermacrene, 1,10-di-epi-cubenol, epi-α-cadinol.

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INTRODUCTION

The genus *Salvia* commonly called "Sage" comprising about 1000 species, is one of the largest and important aromatic genera of the Lamiaceae family. It grows in Central and South America, Asia and Mediteranean regions [1]. Plants from this genus are of economic importance for food flavouring as well as in cosmetics and pharmaceutical industry [2-5]. The essential oils of some species showed antibacterial, cytostatic, antiviral and antioxydant activities [6-10]. From 25 species existing in Algeria 8 are endemic to North Africa among which the Saharian species *Salvia verbenaca* (L.) Briq. ssp. *pseudo-jaminiana* (Chev.) M. [11,13].

Previous studies on the chemical composition of the oils of *Salvia* species [14-20] indicated the presence of four main chemotypes: monoterpenes, monoterpenes and sesquiterpenes, sesquiterpenes and those containing low molecular weight acids, aldehydes, esters [21]. Several markers have been identified in this genus, such as: 1,8-cineole, linalool, borneol, *б*-caryophyllene, germacrene D, bicyclogermacrene, spathulenol, and caryophyl lene oxide [4]. In continuation of our works on Saharian species [22-33], we report here the chemical composition of the essential oil *Salvia verbenaca* (L.) Briq. ssp. *pseudo-jaminiana* (Chev.) M. which is endemic to the septentrional Sahara. To the best of our knowledge, the chemical composition of its essential oil was not previously investigated.

MATERIAL AND METHODS

Experimental

Plant material

The studied sample was collected in April 2011 from flowering plants from the region of Bechar in the Southwest of Algeria and identified by M. Benabdelhakem from the National Agency of Preservation of Natural Resources of Bechar. Voucher specimens are kept in the Herbarium of The research Unity of Valorization of Natural Resources and Bioactive Molecules, University of Constantine, (SVPJ-N°106-2011).

Isolation of the essential oil

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The aerial parts (385g) of *Salvia pseudo-jaminianana* were steam distilled in a Kaiser Lang apparatus.

GC and GC-MS analysis

The essential oils were analyzed on an Agilent gas chromatograph (GC-FID) Model 6890, equipped with a HP-5 ms fused silica capillary column having (5%-phenyl) methylpolysyloxane stationary phase (25 m x 0.25 mm, film thickness 0.25 m), programmed from 50°C (5 mn) to 250 °C at 3°/mn and held for 10 mn . Injector and flame ionization detector temperatures were 280 and 300 °C, respectively. The essential oils were diluted in acetone 3.5% (v/v) and injected in split mode (1/60), helium was used as a carrier gas (1.0 mL/mn). Solutions of standard alkanes (C8-C20) was analyzed under the same conditions to calculate retention indices (RI) with Van del Dool and Kratz equation.

Mass spectrometry was performed on an Agilent gas chromatograph-mass spectrometer (GCMS) Model 7890/5975, equipped with HP-5 capillary column (25 m x 0.25 mm, film thickness 0.25 m) programmed with the same conditions as for GC-FID. The mass spectrometer (MS) was in electron impact mode at 70 eV and electron multiplier was at 2200 V. Ion source and MS quadrupole temperatures were 230°C and 180°C, respectively. Mass spectral data were acquired in the scan mode in the *m/z* range 33-450. The essential oil constituents were identified by matching their mass spectra and retention indices (RI) with those of reference compounds from libraries such as Adams [34] and Mc Lafferty & Stauffer [35]. The proportions of the identified compounds were calculated by internal normalization.

RESULTS AND DISCUSSION

The yield of steam distillation was 0.25% (w/w) in relation to the dry weight of the plant. A total of fifty three constituents were determined which account for about 97.7% of the essential oil of *Salvia pseudo-*

jaminiana . The components identified in the essential oil are listed in table 1 in order of their experimental retention times and retention indices.

The major constituents of the oil were β-caryophyllene (11.33%), muurola-3,5-diene (5.2%), cis muurola-4(14),5-diene (7.8%), bicyclogermacrene (10.9%), γ-cadinene (7.9%), spathulenol (3.0%), 1,10-di-epi-cubenol (20.9%) and epi-α-cadinol (11.6%). At less extent the other main constituents were alpha humulene (1.9%), cadina-1(6),4-diene (1.2%), germacrene A (1.1%), cis calamenene (2.0%), caryophyllene oxyde (1.4%), manoyl oxyde (1.1%) and (E,E)-7,11,15-trimethyl-3-methylene-hexadeca-1,6,10,14-tetraene (1.3%).

Monoterpenic hydrocarbons were present at low proportion (2.5%) while the sesquitepernic fraction represented the major fraction (94.5%). The oxygenated fraction represented 40.4% of the total oil composition. Our sample may be categorized as sesquiterpene chemotype among the four chemotypes identified for *Salvia* species [21].

Table 1: Volatile oil composition of *Salvia verbenaca* (L.) Briq. ssp. *pseudo-jaminiana* (Chev.) M.

	RI	RT	Compounds	%
1	908	9.00	santolinatriene	0.2
2	939	10.13	α-pinene	0.1
3	976	11.53	sabinene	0.1
4	979	11.69	β-pinene	0.1
5	991	12.10	myrcene	0.1
6	1005	12.68	α-phellandrene	0.1
7	1009	12.76	sylvestrene	0.1
8	1018	13.04	α-terpinene	0.1
9	1025	13.31	p-cymene	0.1
10	1029	13.46	limonene	0.1
11	1032	13.58	1,8-cineol	0.3
12	1037	13.68	(Z)- β-ocimene	0.6
13	1050	14.03	(E)- β-ocimene	0.3
14	1089	15.31	terpinolene	0.4
15	1114	16.36	β-thujone	0.5
16	1146	17.29	camphre	0.1
17	1154	17.40	Isoamyle tiglate	tr
18	1330	22.21	hexan-3-enyle tiglate	0.3
19	1351	23.02	α-cubebene	0.1
20	1390	24.15	β-cubebene	0.6
21	1409	24.50	α-gurjunene	0.2
22	1418	24.85	β-caryophyllene	11.3
23	1424	24.98	β-cedrene	0.7
24	1441	25.29	aromadendrene	0.4
25	1454	25.47	muurola-3,5-diene	5.2
26	1457	25.60	(E)- β-farnesene	0.2
27	1455	25.73	α-humulene	1.9
28	1460	25.81	cadina-1(6),4-diene	1.2
29	1460	25.90	muurola-4'14),5-diene	7.8
30	1480	26.19	γ-curcumene	0.2
31	1491	26.48	valencene	0.3
32	1493	26.57	viridiflorene	0.3
33	1494	26.72	bicyclogermacrene	10.9
34	1503	26.88	germacrene A	1.1
35	1510	27.12	γ-cadinene	7.9
36	1517	27.19	δ-cadinene	0.3
37	1521	27.27	cis-calamenene	2.0

38	1535	27.50	10-epi-cubebol	0.2
39	1539	27.64	α-cadinene	0.4
40	1546	27.76	α-calacorene	0.1
41	1552	27.91	muuro-5-en-4-β-ol cis	0.1
42	1561	28.15	muuro-5-en-4-α-ol cis	0.1
43	1566	28.23	β-calacorene	0.1
44	1578	28.45	hex-3-enyle benzoate	0.1
45	1582	28.63	spathulenol	3.0
46	1583	28.76	caryophyllene oxyde	1.4
47	1585	29.03	gleenol	0.8
48	1608	29.39	1,2-epoxy humulene	0.1
49	1619	29.54	1,10-di-epi-cubenol	20.9
50	1640	30.10	epi-α-cadinol	11.6
51	1689	31.05	muurol-5-en-4-one cis	0.2
52	1998	37.29	manoyl oxyde	1.1
53	2022	37.73	(E,E)-7,11,15-trimethyl-3-methylene-hexadeca-1,6,10,14-tetraene	1.3

CONCLUSION

This study reported for the first time the chemical composition of the essential oil of *Salvia pseudo-jaminiana* from Algeria. The oil was characterized by a high level of the sesquiterpenic fraction . The major compounds were β-caryophyllene (10.2%), 1,10-di-epi-cubenol (20.9%) and epi-α-cadinol (11.6%).

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REFERENCES

[1] Walker JB, Sytsma KJ, Treutlein J and Wink M. Am J Bot 2004; 91(7): 1115–25.
[2] Basaif AS, JKAU: Sci, 2004; 16: 33-39.
[3] Longaray Delamare AP, Moschen-Pistorello IT, Artico L, Atti-Serafini L and Echeverrigaray S. Food Chem 2007; 100: 603-608.
[4] Kelen M and Tepe B. Biores Tech J 2008; 99, 4096-4104.
[5] Tepe B, Dönmez E, Unlu M, Candan F, Dimitra D and Vardar-Unlu G, Food Chem 2004; 84: 519–525.
[6] Janssen AM, Scheffer JJC and Baerheim SA. Planta Med 1987; 53: 395-398.
[7] Gonzalez AG, Abad T, Jimenez IA, Ravelo AG, Luis JG, Aguiar Z, Andres LS, Plasencia M, Herrera JR and Moujir L. Biochem Syst Ecol 1989; 17: 293-295.
[8] Darias V, Bravo L, Rabanal R, Sanchez-Mateo CC and Martin-Herrera DA. Planta Med 1990; 56:70-72.
[9] Tada M, Okuno K, Chiba K, Ohnishi E and Yoshii T. Phytochem 1994; 35: 539- 541.
[10] Weng XC and Wang W. Food Chem 2000; 71: 489-493.
[11] Quezel P and Santa S, Nouvelle Flore de L'Algérie et des Régions Désertiques Méridionales. Editions du Centre National de la Recherche Scientifique, Paris 7eme 1963; 793.
[12] Ozenda P, Flore du Sahara Septentrional et Central, Editions du Centre National de la Recherche Scientifique, Paris 7eme 1958; 405.

[13] El Oualidi J, Khamar H, Fennane M, Ibn Tattou M, Chauvet S and Taled MS, Checklist des endémiques et spécimens types de la flore vasculaire de l' Afrique du Nord, Documents de l'Institut Scientitifique, Université Mohamed V-Agdal, Rabat 2012; N° 25.
[14] Torres ME, Velasco-Negueruela A, Perez-Alonso MJ and Pinilla MG. J Essent Oil Res 1997; 9: 27–33.
[15] Baser KHC, Ozek T, Kirimer N and Tumen G. J Essent Oil Res 1993; 5: 347–348.
[16] Baser KHC, Beis SH and Ozek T. J Essent Oil Res 1995; 7: 113–114.
[17] Baser KHC, Kurkcuoglu M, Ozek T and Sarikardasoglu S. J Essent Oil Res 1995; 7:229-230.
[18] Ahmadi L and Mirza M. J Essent Oil Res 1999; 11: 289-290.
[19] Rustaiyan A, Masoudi S, Monfared A and Komeilizadeh H. Flav Frag J 1999; 14: 276-278.
[20] Couladis M, Tzakou O, Stojanovic D, Mimica-Dukic N and Jancic R. Flav Frag J 2001; 16: 227-229.
[21] Jassbi AR, Asadollahi M, Masroor M, Schuman MC, Mehdizadeh Z, Soleimani Mand Miri R. Chem Biodivers 2012; 9(7): 1254-1271.
[22] Mezhoud S, Mekkiou R, Chalard P, Figuérédo G, Benayache S and Benayache F. Res J Pharm Biol Chem Sci 2014; 5(3): 1367-1372.
[23] Aissaoui M , León F, Brouard I, Benayache F and Benayache S**,** Der Pharm Lett 2014; 6(1): 186-189.
[24] Benaissa O, Amrani A, Bicha S, Zama D, Benayache F**,** Marchioni E and Benayache S. Der Pharm Lett 2013; 5 (5):234-240.
[25] Mezrag A, Bouheroum M, Beghidja N, Khalfaoui A, Zaiter L, Benayache S and Benayache F. Chem Nat Compd 2013; 49(4): 749-750.
[26] Bicha S, Chalard P, Hammoud L, León F, Brouard I, Garcia VP, Lobstein A , Bentamene A, Benayache S, Bermejo J and Benayache F. Rec Nat Prod 2013; 7(2):114-118.
[27] Dendougui H, Seghir S, Jay M, Benayache F and Benayache S. Int J Med Arom Plants 2012; 2(4): 589-595.
[28] Mezhoud S, Derbré S, Ameddah S, Mekkiou R, Boumaza O, Seghiri R , Benayache S, Richomme P and Benayache F. Int J Med Arom Plants 2012; 2(3): 509-513.
[29] Kolli EH, León F, Benayache F, Estévez S , Quintana J, Estévez F, Brouard I, Bermejo J, Benayache S. J Brazil Chem Soc 2012; 23(5): 977-983.
[30] Dendougui H, Seghir S, Belloum Z**,** Benayache F, León F , Brouard I , Bermejo J and Benayache S. Rec Nat Prod 2011; 5(4): 300-304.
[31] Bicha S, Bentamene A , Benaissa O, Benayache S, Garcia VP, Bermejo J and Benayache F. Chem Nat Compd 2011; 47(1): 105-106.
[32] Bentamene A, Benayache S, Creche J, Bermejo J and Benayache F. Chem Nat Compd 2007; 43(6): 749-750.
[33] Dendougui H , Jay M, Benayache F and Benayache S. Biochem Syst Ecol 2006; 34 (9): 718-720.
[34] Adams RP, Identification of essential oil components by gas chromatography / mass spec troscopy. Allured Publishing Co. Carol Stream, Illinois. 1995.
[35] Mc Lafferty FW and Stauffer DB, The Wiley/NBS registry of mass spectral data. 5th Edition, J. Wiley and Sons, New York, 1991.