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Chemical Composition of the Essential Oil of *Salvia aegyptiaca* L.

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ABSTRACT

The chemical composition of the essential oil of *Salvia aegyptiaca* L. was analysed by GC and GC–MS, the identified components constituting 91.1% of the oil. Thirty five components were identified. The main constituents were limonene (3.2%), bornyl acetate (8.5%), β-bourbonene (2.9%) , β-caryophyllene (10.2%), β-gurjunene (7.6%), selina-4,11-diene (9.7%), germacrene D (7.0%), bicyclogermacrene (2.3%), δ-cadinene (3.4%), germacrene B (4.8%), spatulenol (3.1%), β-caryophyllene oxide (6.2%) and α-cadinol (2.9%). This is the first report on the chemical composition of the oil of *Salvia aegyptiaca* from Algeria.

Keywords: *Salvia aegyptiaca* L., essential oil, bornyl acetate, β-caryophyllene, β-gurjunene, selina-4,11-diene, germacrene D, β-caryophyllene oxide.

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INTRODUCTION

Salvia is the largest genus of the Lamiaceae family comprising about 1000 species distributed in Central and South America, Asia and Mediteranean regions [1]. Essential oils from *Salvia* species showed antibacterial, cytostatic, antiviral and antioxydant activities [2-6]. The essential oils of *Salvia* species were also used as cosmetics, flavoring agents in perfumery, and food condiments [7-10].

There are many reports on the chemical composition of the oils of *Salvia* species [11-17] which indicated that 1,8-cineole and borneol are the main/or the characteristic constituents of *Salvia* oils [9]. One study on Iranian *Salvia* species revealed the presence of four main chemotypes: monoterpenes, monoterpenes and sequiterpenes, sesquiterpenes and those containing low molecular weight acids, aldehydes, and esters [18]. The chemical composition of different samples of *Salvia aegyptiaca* L. was previously studied. The oil of a sample of *Salvia aegyptiaca* from Saudi Arabia was rich in 1,10-aristolene (19.3%) [7], while the most abundant components of the oil of a sample from Egypt were trans, trans-farnesol, phytol, spathulenol and cis,trans-farnesol [19]. In continuation of our works on Saharian species [20-31], we report here the chemical composition of the essential oil of *Salvia aegyptiaca* from Algeria. To the best of our knowledge this sample was not previously investigated.

MATERIAL AND METHODS

Plant material

The studied sample was collected in April 2012 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, (SA-N°179-2012).

Isolation of the essential oil

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The aerial parts (252g) of *Salvia aegyptiaca 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 [32] and Mc Lafferty & Stauffer [33]. The proportions of the identified compounds were calculated by internal normalization.

RESULTS AND DISCUSSION

The yield of steam distillation was 0.95% (w/w) in relation to the dry weight of the plant. A total of thirty five constituents were determined which account for about 91.1% of the essential oil of *Salvia aegyptiaca* . 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 (10.2%), selina-4,11-diene (9.7%), bornyl acetate (8.5%), β-gurjunene (7.6%), germacrene D (7.0%) and β-caryo phyllene oxide

(6.2%). At less extent the other main constituents were germacrene B (4.8%), δ-cadinene (3.4%), limonene (3.2%), spatulenol (3.1%), β-bourbonene (2.9%) , bicycloger macrene (2.3%), and α-cadinol (2.9%).

Monoterpenic hydrocarbons were present at moderate proportion (15.8%) while the sesquitepernic fraction represented the major fraction (71.9%). The oxygenated fraction represented 28.3% of the total oil composition. The chemical composition of our sample was different from those of samples from Saudi Arabia and Egypt. Our sample may be categorized as monoterpene and sesquiterpene chemotype among the four chemotypes identified for *Salvia* species.

Table 1: Volatile oil composition of *Salvia aegyptiaca* L.

RI	RT	Compounds	%
979	11.703	β-pinene	0.4
989	12.104	myrcene	0.5
1025	13.316	para cymene	0.5
1030	13.470	limonene	3.2
1034	13.587	1,8-cineol	0.4
1037	13.685	(Z)- β-ocimene	1.8
1105	15.931	nonanal	0.7
1175	18.050	borneol	0.5
1207	18.995	decanal	0.4
1286	21.233	bornyl acetate	8.5
1378	23.687	β-copaene	1.1
1387	23.908	β-bourbonene	2.9
1423	24.835	β-caryophyllene	10.2
1435	25.109	β-gurjunene	7.6
1452	25.551	(E)- β-farnesene	1.9
1460	25.731	α-humulene	1.1
1464	25.835	alloaromadendrene	1.5
1476	26.134	selina-4,11-diene	9.7
1484	26.345	germacrene D	7.0
1495	26.614	valencene	0.4
1498	26.691	bicyclogermacrene	2.3
1511	26.990	germacrene A	0.5
1516	27.095	γ-cadinene	1.3
1520	27.194	δ-cadinene	3.4
1539	27.649	α-cadinene	0.6
1563	28.202	germacrene B	4.8
1580	28.605	spathulenol	3.1
1587	28.756	oxyde de caryophyllene	6.2
1619	29.482	1,10-di-epi-cubenol	0.9
1638	29.908	caryophylla-4(14),8(15)-diene-5-ol	0.4
1645	30.067	epi α-cadinol	1.2
1647	30.102	epi α-muurolol	0.9
1659	30.368	α-cadinol	2.9
1699	31.264	heptadecane	0.3
1840	34.206	6,10,14-trimethyl-pentadecan-2-one	2.0

CONCLUSION

This study reported for the first time the chemical composition of the essential oil of *Salvia aegytiaca* L. from Algeria. Our results showed that the oil was different from those previously described for this species. The oil was characterized by a high level of the sesquiterpenic fraction and a moderate yield of the monoterpenic components. The major compounds were β-caryophyllene (10.2%), selina-4,11-diene (9.7%), bornyl acetate (8.5%), β-gurjunene (7.6%), germacrene D (7.0%) and β-caryophyllene oxide (6.2%).

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