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Chemical Constituents of *Salvia aegyptiaca*

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ABSTRACT. The essential oil of *Salvia aegyptiaca* was analysed by GC/MS technique. Eighteen compounds were identified. It was found that the essential oil comprises 40% terpenoidal constituents, opposite to 32% fat derivatives. The major terpenoidal component was 1(10)-aristolene (19.3%).

From the non-volatile matter, β-amyrin, lupeol, β-sitosterol, stigmasterol, β-sitosterol-β-D-glucopyranoside and stigmasterol-β-D-glucopyranoside as well as 3α-hydroxy-24-alkylcarboxylate-12-oleanan-28-oic acid. Fatty acids esters were isolated and identified by spectral means.

KEY WORDS: *Salvia aegyptiaca; Mentheae; Labiatae; Essential oil; Oeanane triterpenoids; Sterols.*

Introduction

Salvia L. (Tribe *Mentheae*), with over than 900 species[1], is one of the larger genera in the *Labiatae* (*Lamiaceae*). The genus was divided[2] into four subgenera: *Salvia, Sclarea, Leonia* and *Calosphace.* While subgenera *Salvia* and *Sclarea* are primarily Asiatic and European, and species of subgenus *Leonia* are reported in north America, *Salvia* subgenus *Calosphace* is exclusively Central and South American.

The genus *Salvia* comprises many medicinal plants. In Kuwait *S. aegyptiaca* is used for treating eye diseases[3]. In the Canary Islands *S. canariensis* is prescribed as a diuretic[4]. *S. fruticosa* is drunk as tea in Israel to relieve headaches and abdominal pains, while a herbal bath prepared with the herb is used to relieve rheumatism[5]. In Jordan it is used to relieve indigestion[6]. In Iraq *S. aegyptia* is used in diarrhoea, genorrhoea, haemorrhoids and in eye diseases[7]. Both *S. lavandulifolia* and *S. officinalis* is used in the traditional medicine as an antidiabetic[8].

Although *Salvia* is very large genus, phytochemical data is available for only a relatively small number of species. The presence of abietane and clerodane diterpenoids may be considered as a generic character. There seems to be clearly phytochemical differentiation between subgenera *Salvia*, *Sclarea* and *Leonia* on the one hand, and the American subgenus *Calosphace* on the other[9].

The percentage of essential oil corresponds remarkably well with Erdtman's two subfamilies; the *Nepetoideae* (oil-rich > 0.5% of dry weight) and the *Lamioideae* (oil- poor < 0.1% of dry weight). Iridoid glycosides occur in the *Lamioideae* but are absent in the *Nepetoideae. Salvia* is an exception to those general rules. It belongs to the subfamily *Nepetoideae,* but many *Salvia* species are oil- poor and contain iridoids[10].

Pentacyclic triterpenoids are common in *Salvia* spp.[11]. Both α- and β-amyrins were found in *S. amplexicaulis* and *S. apiana*[12].

In this article, we present the identification of the constituents of the essential oil as well as the isolation of some triterpenoids and sterols from the non-volatile matter of *S. aegyptiaca*, that was investigated previously only for abietane diterpenoids[13].

Experimental

General: GC/MS spectra were taken on QP-7000 Shimadzu, with a fused silica capillary column (30 mm × 0.25 mm ID), film (5% phenyl, 95% methyl-silicon) thickness 0.25 μ, injector temp. 250ºC, temp. program: 50ºC for 5 min., starting from 100ºC in rate 5ºC/min. for 5 mins', starting from 150ºC in rate 5ºC/min. for 5 mins', starting from 200ºC in rate 5ºC/min. for 5 mins', starting from 250ºC in rate 5ºC/min. for 5 mins', equil. Time 5-35 mins', and the output is an IBM computer with software class 5000 and NIST library for comparison; ^{1}H NMR spectra were taken on Bruker FT-NMR 400 MHz, using $CDCl_3$ as a solvent.

The plant material: *Salvia aegyptiaca* L., in the flowering stage, was collected in January 2001 from Taief-Al Baha road, 50 km from Taief, and identified by Prof. Dr. A. Faied, Botany Department, King Abdulaziz University, Jeddah. A voucher specimen was deposited on the Herbarium of Botany Department, King Abdulaziz University.

Processing of plant material: Fresh whole plant, including the root (775 g) was soaked at room temperature in diethyl ether/methanol 1:1 for 24 h. The extract, obtained by filtration was concentrated to half its volume and steam distilled. The distillate was extracted with diethyl ether to give the essential oil (0.26 g), which is yellowish in colour, with the same odour of the plant. The

steam non-volatile components were extracted by $CHCl_3$ to give 39 g crude extract, which was defatted by dissolving in methanol, cooling, filtration and finally evaporated to give the defatted extract (18 g).

Separation of the compounds: The components of the essential oil were separated and identified by GC/MS technique. The non-volatile constituents (18 g) were separated on silica gel CC into four fractions (Sal-Sa4). Fraction Sal (3.2 g, eluted by pet. ether/ether 3:1) contained fats. Fraction Sa2a (2.9 g, eluted by pet. ether/ether 1:1) gave by TLC, 40 mg of which (silica gel, pet. ether/ether 3:2) **7** (12 mg, R_f 0.61) and lupeol (18 mg, R_f 0.52). Fraction Sa2b (1.7 g, eluted after Sa2a by the same solvent system) afforded a mixture of β-sitosterol and stigmasterol (2:1). Fraction Sa3 (1.9 g, eluted by pure ether) gave, 60 mg of which, by TLC (silica gel, pet. ether/ether 1:4) **8** (38 mg, R_f 0.68) in addition to fats. Fraction Sa4 (2.1 g, eluted by ether/methanol 9:1) gave a mixture of β-sitosterol-β-D-glucopyranoside and stigmasterol-β-D-glucopyranoside (2:1).

Results and Discussion

Identification of the Volatile Constituents

Identification of the constituents of the essential oil was achieved by using GC/MS technique which resulted in identification of fourteen components. The proposed structures were confirmed by comparing the MS spectra with authentic ones[14]. The results were tabulated in Table 1. From the table we can conclude that the essential oil of *S. aegyptiaca* comprises 40% terpenoidal constituents opposite to 32% fat derivatives and the major tepernoidal component is 1(10) aristolene (19.29%).

Identification of the Non-volatile Constituents

In addition to the known compounds b-amyrin **8**[12], lupeol, β-sitosterol, stigmasterol, β-sitosterol-β-D-glucopyranoside and stigmasterol-β-D-glucopyranoside[15], the chromatographic separation of the non-volatile material afforded a mixture of fatty acid esters of an oleanane triterpenoid **7**.

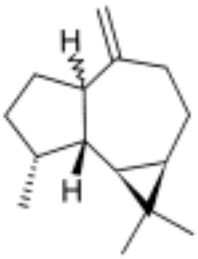
^{1}H NMR of **7** gave a triterpenoid pattern of signals with six singlets from δ 0.8 to δ 0.9 ppm. A multiplet at δ 2.81, together with a broad singlet at δ 5.28, typical of H-18 and H-12 of oleanolic acid derivatives were viewed in the spectrum. A pair of doublets with *gem* coupling of 14 Hz at δ 4.15 and δ 4.17, was in agreement with 24-alkyl carboxylate ester. This was coincident with the presence of fatty acids signals in the spectrum. A multiplet of H-3 was found at δ 3.21, in agreement with fatty acid ester of 3α-24-dihydroxy-12-oleanan-28-oic acid, that was isolated previously in the form of the free diol from *Salvia nicolsoniana*[16].

TABLE 1. GC analytical data of the essential oil of *S. aegyptiaca.*

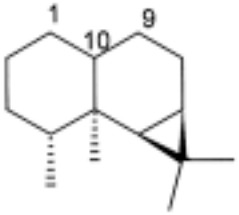
Peak no.	R_t (min)	%	Identification
1	6.18	1.14	Aromadendrene **1**
2	6.35	19.29	1(10) Aristolene **3**
3	6.48	6.14	Butylated hydroxytoluene*
4	6.57	5.71	γ-Elemene **5**
5	6.81	3.43	9-Aristolene **4**
6	8.24	1.29	Alloaromadendrene **2**
7	8.59	18.43	Diphenyl amine*
8	12.96	1.71	Phthalate ester[#]
9	13.35	2.43	1-Hexadecanol
10	14.21	10.57	Methyl palmitate
11	15.03	7.00	E,E,E-Cembrene A **6**
12	17.48	3.71	Methyl linoleate
13	17.59	8.00	Methyl linolenate
14	17.79	2.00	Phytol
15	19.51	1.57	Hexadecane
16	20.40	1.43	Phthalate ester[#]
17	21.34	2.86	Octadecane
18	23.39	3.00	Eicosane

[*,#]Contaminants from the solvent; [*]antioxidant, [#]plasticizer.

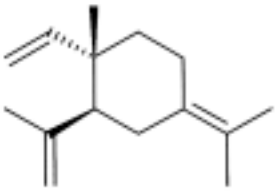
Known compounds were identified by comparing their ^{1}H NMR spectra with authentic ones.



1; 1α H
2; 1β H



3; $\Delta^{1(10)}$
4; Δ^{9}



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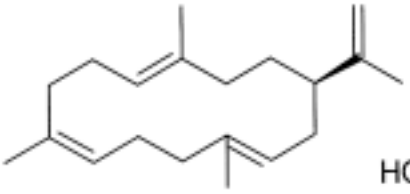

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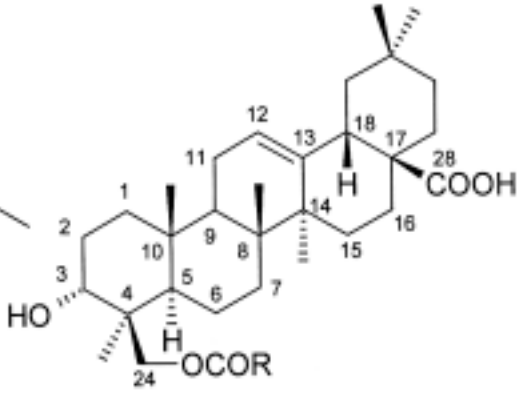
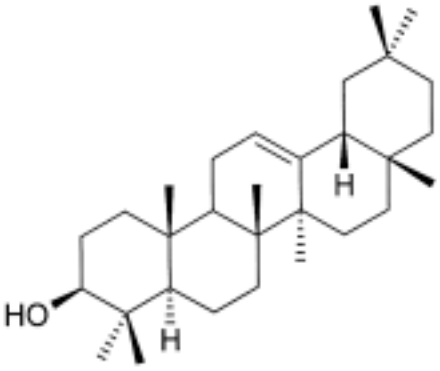


7; R = alkyl groups of fatty acids



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المكونات الكيميائية لنبات سالفيا إيجيبتياكا

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المستخلص. في هذا البحث تم تحليل الزيت الطيار لنبات سالفيا إيجبتياكا بتطبيق تقنية كروماتوجرافيا الغاز المقترن بمطياف الكتلة. تم تعريف ثمانية عشر مركباً. و قد وجد أن الزيت العطري يتكون من ٤٠٪ مكونات تربينية مقابل ٣٢٪ مواد دهنية. المكونة التربينية الرئيسة هي ١(١٠) أريستولين (١٩,٣٪).

ومن الجزئية غير المتطايرة من الخلاصة تم فصل بيتا أميرين ، ليوبيول ، بيتاسيتواستيرول ، استجمااستيرول ، بيتاسيتواستيرول-بيتا-D-جلوكوبيرانوزايد ، استجمااستيرول-بيتا-D-جلوكوبيرانوزايد وإسترات أحماض دهنية لحامض ٣ ألفاهيدروكسي-٢٤-ألكايل كربوكسيلات-١٢-أوليانان-٢٨-أويك. و قد تم تعريف المركبات المفصولة بالطرق الطيفية (^{1}H NMR & MS).