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THE INVESTIGATION OF THE QUALITY OF SAGE (*SALVIA OFFICINALIS L.*) ORIGINATING FROM JORDAN

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Abstract. *The chemical composition of the plant species sage (Salvia officinalis L.) (flower part) originating from Jordan was investigated: common drug quality parameters, microelements content, essential oil content and the content of bioactive components in the essential oil. The common pharmacopea's, GCMS and AAS methods are used.*
The results obtained led to the conclusion that the sage originating from Jordan complied with the standard requirements for the plant species, so that it can be used as a high quality raw materials for the production of phytopreparations.

Key words: *Salvia officinalis L., chemical composition, essential oil, GCMS.*

INTRODUCTION

The sage is one of the oldest medicinal plants. Its Latin name *Salvia* is derived from old Roman verb *salvare* = save, cure, and *officinalis* also means medicinal. The fact that both Latin words in the sage's name refer to cure and medicine, unlike any other plant, shows the appreciation that this plant has had since Roman times.

The sage belongs to the genus *Salvia* of the *Labiaceae* family comprising about 900 plant species [1]. In the flora of Serbia 14 species have been investigated, the central position among them belonging to *Salvia officinalis L*. species [2].

The sage has a great industrial significance. Many Mediterranean countries where it grows have substantial gains from the production and export of the sage. It is used in the meat industry (aromatization), and it is also included as an ingredient in many phytopreparations, for mouth and throat gargling, for the treatment of inflammations and catarrhs, because it vitalizes the mucous tissue (tannin effect) and has antiseptic effect (essential oil effect). Herbal tea and other preparations based on the sage are used for the body strengthening, and before the discovery of the antibiotics were even used for

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treatment of inflammatory processes in the organism [3].

The main bioactive ingredient of the sage is its essential oil.

There are many references in literature to the composition of the sage essential oil (4-7), but the sage originating from Jordan has not been chemically fully investigated yet. Since the sage is one of the important plant species in the flora of Jordan, the scope of this work is the investigation of general drug quality parameters and the chemical composition of the essential oil from the sage originating from Jordan.

EXPERIMENTAL CONDITIONS

Plant material preparation

The plant material (flower part of the plant) was collected on two locations in the Kingdom of Jordan (Hfashiet Al Dbajbe and Al Fesalia) during 1996-1998. The plant material was dried in a draughty place at about 20^{o}C, thus preserving the natural colour of the flowers and leaves. The dried samples of the drug were ground in a special electric grinder in the Alabath Alzeraia Laboratory in Amman and sieved through 1.4 mesh sieve.

The Determination Of The Drug General Parameters

Moisture Content

For the determination of the moisture content the gravimetric method was used, drying the drug sample at 105^{o}C to constant weight. For a 10 g sample the drying time was about 3 hours.

Total ash content percentage

The drug sample (2 g) was burnt in a porcelain crucible at 600^{o}C until white ashes and then was cooled and weighed.

HCl insoluble Ashes Content percentage

After the determination of total ashes content, 15 cm^3 of 10% HCl was added and heated in a water bath for 20 minutes. After filtering the precipitate was burnt at 600^{o}C and weighed until constant weight.

Microelements Content Determination

The AAS method was used by the Varian A 20 apparatus to determine the following elements: zinc, iron, copper, manganese and lead.

Essential Oil Content Determination

The water-steam distillation method was used on a 500 g sample. The drug was immersed in 250 cm^3 of water, left 20 hours to swell and the essential oil was redistilled introducing steam for about 6 hours.

Essential Oil Composition and Bioactive components Analysis

For the qualitative and quantitative analysis of the obtained essential oil (sample II) the GCMS method was used. The equipment used consisted of a Hewlett Pacard gas

chromatograph, Hewlett Pacard mass detector, 0.25 mm ID SPB-5 column with 0.25 dF at 1 cm^3/min mobile helium gas flow rate, and a 3000 V EMV detector. The oil sample was diluted with ether (1:500). The mass spectra obtained were compared with Wiley Spectra Data Base (the investigations were carried out at the physical and chemical laboratory of the University of Damascus, Syria).

In Table 2 the corresponding general drug quality parameters are given.

Table 1. Locality, weather conditions, geological substrate and habitat, altitude and vegetation phase of the sage (*Salvia officinalis* L.) picked in Jordan

No	Habitat and Locality	Geological Substrate	Altitude (m)	Collection period (h)	Collection Date	Weather Conditions	Mass (kg)	Plant Vegetation Phase	Plant age (years)	Plant Material Appearance	Ref. No
1.	pasture Hfashiet Al Dbajbe	silicate rocks	around 880	around 11^{00}	23.05.'96	sunny around 19°C	5	before blooming	around 4	dry green silvery shaded	I
2.	pasture Hfashiet Al Dbajbe	silicate rocks	around 880	around 11^{00}	6.06.'96	sunny around 31°C	5	blooming phase	around 4	fresh green silvery shaded	II
3.	pasture Hfashiet Al Dbajbe	silicate rocks	around 880	around 11^{00}	23.05.'97	sunny around 26°C	5	fruition phase	around 4	fresh green silvery shaded	III
4.	pasture Hfashiet Al Dbajbe	silicate rocks	around 880	around 12^{00}	23.05.'96	sunny around 27 °C	5	before blooming	around 4	dry green silvery shaded	IV
5.	pasture Hfashiet Al Dbajbe	silicate rocks	around 880	around 11^{00}	6.06.'96	sunny around 35 °C	5	blooming phase	around 4	dry green silvery shaded	V
6.	pasture Hfashiet Al Dbajbe	silicate rocks	around 880	around 11^{00}	20.06.'97	foggy around 8 °C	2	fruition phase	around 4	fresh green silvery shaded	VI
7.	pasture Hfashiet Al Dbajbe	silicate rocks	around 880	around 12^{00}	12.01.'98	sunny around 24 °C	3	winter sage	around 4	silvery shaded green	VII
8.	pasture Al Fesalia	silicate rocks with boulders	around 530	around 10^{00}	24.05.'97	sunny around 29 °C	3	before blooming	around 4	silvery shaded green	VIII
9.	pasture Al Fesalia	silicate rocks with boulders	around 530	around 11^{00}	13.06.'97	sunny around 33 °C	3	blooming phase	around 4	fresh green silvery shaded	IX
10.	pasture Al Fesalia	silicate rocks with boulders	around 530	around 11^{00}	25.06.'97	sunny around 6 °C	3	fruition phase	around 4	fresh green silvery shaded	X
11.	pasture Al Fesalia	silicate rock with boulders	around 530	around 11^{00}	9.01.'98	sunny around 19 °C	1,5	winter sage	around 1,5	silvery shaded green	XI

Table 2. Quality parameters of the sage (*Salvia officinalis L.*) from Jordan

Sample	Moisture %	Ash %	HCl insoluble ash %	Essential oil %
I	9,22	12,44	2,42	1,32
II	9,41	12,57	2,45	2,09
III	9,11	12,67	2,46	1,93
IV	8,14	12,09	2,39	1,29
V	8,53	12,13	2,41	2,13
VI	8,41	12,07	2,42	1,83
VII	9,83	11,91	2,35	1,23
VIII	8,63	12,15	2,41	1,28
IX	8,75	12,42	2,38	2,02
X	8,83	12,36	2,37	1,92
XI	9,13	12,01	2,40	1,18

From the above data it can be concluded that the ash content, HCl insoluble ash content and moisture content vary in a relatively narrow range, which shows that they do not depend on the locality or vegetative phase of the plant. On the contrary, essential oil content varies between 1.18 and 2.13%, reaching its maximum in the blooming period and the minimum in the samples picked during the winter (the so called "winter sage" in Jordan).

The sage (*Salvia officinalis L.*) samples originating from Jordan were also investigated for the content of microelements and heavy metals (Table 3).

Table 3. The content of elements in the sage (*Salvia officinalis L.*) samples originating from Jordan

Harvest	Zinc (mg/kg)	Iron (mg/kg)	Copper (mg/kg)	Manganese (mg/kg)	Lead (mg/kg)
I	29	122	65	102	32
II	28	163	61	92	21
III	28	159	61	90	22
IV	27	136	64	94.8	18
V	25	178	62	92	17
VI	26	178	61	92	17
VII	26	161	65	98	23
VIII	23	148	69	109	–
IX	22	184	64	105	–
X	22	182	64	105	–
XI	24	153	70	108	–
Yugoslav sage	32	150	26	126	69

The results obtained lead to the conclusion that small content of lead appearing in the samples I-VII were due to the emission of exhaust gases produced by motor cars (locality Hfashiet Al Dbajbe is situated near the Amman-Sahab highway). In comparison to the data for the Yugoslav sage [8] we can conclude that (with respect to the lead content) Jordan have better environmental conditions.

The results of the bioactive components investigation in the essential oil from sage originating from Jordan show that this oil contains all the components that determine the chromatographic picture of the plant in accordance with the International standards (α-

pinene, camphene, limonene, 1,8-cineole, α and β-thujone, camphor, lonalool, linalyl acetate, bornyl acetate and humulene. In the essential oil 29 components were detected, 28 of them were identified and a dominant share had α-thujone (29.9%), β-thujone (13.68%), camphor (15.74%) and 1,8-cineole (12.31%) (Table 4).

Table 4. GCMS analysis of essential oil of sage (*S. officinalis L.*)

No.	Ret. T	Area	Amount %	Compound Name
1.	10,21	320739	2,63	α-pinene
2.	10,93	1073322	0,88	β-pinene
3.	12,18	3707720	3,04	camphene
4.	12,66	414665	0,34	myrcene
5.	14,70	15014088	12,31	1,8-cineole
6.	13,20	524474	0.43	limonene
7.	16,08	707413	0,58	o-cymene
8.	19,50	1683102	1,38	linalool
9.	20,30	36467775	29,90	α-thujone
10.	21,21	16684923	13,68	β-thujone
11.	20,00	1134365	0,93	menthone
12.	23,20	20051328	15,74	camphor
13.	23,64	60923	0,05	terpinen-4-ol
14.	24,20	1988108	1,63	menthol
15.	24,32	2195370	1,80	borneol
16.	25,24	48796	0,04	α-terpineol
17.	27,50	36560	0,03	nerol
18.	28,20	865959	0,71	carvone
19.	29,10	548797	0,45	linalyl acetate
20.	29,28	256119	0,21	geraniol
21.	30,10	2719744	2,23	bornyl acetate
22.	32,00	2329613	1,91	thymol
23.	36,32	85356	0,07	geranyl acetate
24.	40,18	2939303	2,41	humulene
25.	43,12	743993	0,61	farnesol
26.	56,75	4049289	3,32	carvacrol
27.	46,23	1634426	1,34	caryophyllene
28.	54,60	987965	0,81	salvin
29.	55,80	658632	0,64	n.d.
		121966105	100%	

CONCLUSION

The chemical composition of the plant species sage (*Salvia officinalis L.*) (flower part) originating from Jordan was investigated: common drug quality parameters, microelements content, essential oil content and the content of bioactive components in the essential oil.

The results obtained lead to the conclusion that the sage originating from Jordan complied with the standard requirements for the plant species, so that it can be used as a high quality raw material for the production of phytopreparations.

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ISPITIVANJE KVALITETA ŽALFIJE (*SALVIA OFFICINALIS L.*) POREKLOM IZ JORDANA

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Ispitivan je hemijski sastav biljne vrste žalfija (Salvia officinalis L.) (cvetni deo) poreklom iz Jordana: opšti parametri kvaliteta droge, sadržaj, mikroelemenata i sadržaj bioaktivnih komponenata u eteričnom ulju. primenjene su standardne farmakopedske metode, AAS i GSMS.

Na osnovu dobijenih rezultata može se zaključiti da žalfija poreklom iz Jordana zadovoljava zahteve standarda za ovu biljnu vrstu pa se može koristiti kao visoko kvalitetna sirovina za proizvodnju fitopreparata.

Ključne reči: *žalfija Salvia officinalis L., hemijska analiza, etersko ulje, GCMS*