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CHEMICAL COMPOSITION OF ESSENTIAL OIL FROM *SALVIA AETHIOPIS* L. FROM BULGARIA

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ABSTRACT

The aim of present investigated is to examine the oil and its chemical composition of flowers and leaves from S. aethiopis L. from Bulgaria. The wild plants from Salvia aethiopis L., grown in South Bulgaria grown in the region of Plovdiv town were collected at flowering stage in 2016. The oils were prepared by hydrodistilled for 2 h. GC/MS analysis was performed using gas chromatograph. The moisture of the plants for flowers was 83.03 % and for leaves — 84.8 %. The yield of essential oil, % in abs. dry mass was 0,19 % and 0,03 %, respectively. The results indicated that Bulgarian essential oil obtained from flowers and leaves of S. aethiopis is also a germacrene D and β-caryophyllene chemotype. The total sesquiterpene hydrocarbons constituted the highest percentage of the components of the essential oil constituting 94.0 % and 95.82 % in the oil of flowers and leaves, respectively. The main compounds of essential oils of flowers and leaves were as follows, respectively: germacrene D (29.37—24.19 %), β-caryophyllene (23.55—21.91 %), α-copaene (13.35—17.24 %), β-cubebene (7.02—9.71 %), δ-cadinene (5.56—6.69 %) and α-caryophyllene (5.46—6.79 %).

ХІМІЧНИЙ СКЛАД ЕФІРНОЇ ОЛІЇ ІЗ ШАВЛІЇ (*SALVIA AETHIOPIS* L.), ВИРОЩЕНОЇ В БОЛГАРІЇ

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У статті проведено дослідження з метою оцінки хімічного складу ефірної олії з квіток і листя шавлії (Salvia aethiopis L.), вирощеної в Болгарії. Дикорosла шавлія була зібрана на стадії цвітіння в 2016 р. в Південному регіоні

Болгарії в Пловдивській області. Олія готувалася методом гідродистиляції протягом 2 годин. Вологість квіток складала 83,03 %, листя — 84,8 %. Вихід ефірної олії (% абс. сухої речовини) склав 0,19 % і 0,03 % відповідно. Результати показали, що болгарська ефірна олія, отримана з квіток і листя шавлії, відноситься до хемотипу гермакрен D і β-каріофілен. Найвищий відсоток компонентів ефірної олії складали сесквитерпенові вуглеводні, відповідно 94,0 % і 95,82 % в олії квіток і листя. Основні з'єднання ефірних олій з квітів і листя розподілилися таким чином: гермакрен D (29,37—24,19 %), β-каріофілен (23,55—21,91 %), α-копаен (13,35—17,24 %), бета-кубенен (7,02—9,71 %), δ-кадинен (5,56—6,69 %) і α-каріофілен (5,46—6,79 %).

Ключові слова: *шавлія ефіопська, ефірна олія, хімічний склад.*

Introduction. The genus *Salvia* L. (Lamiaceae) comprised about 900 species mainly dispersed in the area of Mediterranean, Southeast Africa, and Central and South America. *Salvia* species which contain more than 1 % of essential oil represent the commercial sage species. In Bulgaria, the sage oil is produced mainly by *S. officinalis* L. and it was used widely in folk medicine and in phytotherapy [4, 8].

Mediterranean sage (*S. aethiopis* L.) is an invasive biennial plant with square stems reaching up to 1.5 m tall. Mature plants become less hairy and develop prominent venation on the leaves. Rosette leaves are grayish-green, petiolate, and 10.2 to 30.5 cm long. Rosettes can be 0.3 to 1.2 m in diameter. The stem leaves are opposite, smaller than the rosette leaves, and aromatic when crushed. Leaves become smaller toward the apex of the stem. Flowering stems are highly branched and develop in June to August. The flowers have large blue- lilac tinted bracts that make the whole display very impressive. The flower and bract colour can be variable from white to pink and lilac. The plant is typically found in degraded sagebrush communities, disturbed sites, fields, rangelands, roadsides, and some agronomic crops. The plant is native to Europe, America and Africa.

It is know that the essential oil from the species *S. aethiopis* L. has an antibacterial activity [2]. The investigations on the chemical composition of the essential oil from this shown that the main components vary depending on the origin and the part of the plant processed. The sesquiterpenes were found as a major constituents of oils produced on Yugoslavia [3], Serbia [14, 15], Iran [7, 10, 11, 12,], Spain [13], Turkey [5] and Romania [2].

In the flora of Bulgaria the genus *Salvia* L. represented with 18 species [6], of which *S. aethiopis* L. is wild growing species in several isolated habitats in the country. In Bulgaria there is no data on the use of the plant or its oil and extracts in folk medicine.

The aim of present investigated is to examine the oil and its chemical composition of flowers and leaves from *S. aethiopis* L. from Bulgaria.

Goal of the article. The aim of present investigated is to examine the oil and its chemical composition of flowers and leaves from *S.aethiopis* L. from Bulgaria.

Materials and methods. The wild plants from Salvia aethiopis L., grown in South Bulgaria grown in the region of Plovdiv town were collected at flowering stage in 2016.

Voucher specimen (№ 7290) was deposited in the Herbarium of the Higher Institute of Agriculture, Plovdiv, Bulgaria.

The row materials moisture content was determined by drying up to constant weight, at 105 °C [9].

The oils were prepared by hydrodistilled for 2 h in laboratory glass apparatus of British Pharmacopoeia, modified by Balinova and Diakov [1]. The oils were dried over anhydrous sulfate and stored in tightly closed dark vials at 4 °C until analysis.

GC analysis was performed using gas chromatograph Agilent 7890A; column HP-5 ms (30m x 250μm x 0.25μm); temperature: 35 °C/3 min, 5 °C/min to 250 °C for 3 min, total 49 min; carrier gas helium 1 ml/min constant speed; split ratio 30:1. GC/MS analysis was carried out on a mass spectrometer Agilent 5975C, carrier gas helium, column and temperature as the same as the GC analysis.

The identification of chemical compounds was made by comparison to their relative retention time and library data. The identified components were arranged in order to the retention time and quantity in percentage.

Results and discussion. The moisture of the plants for flowers was 83.03 % and for leaves — 84.8 %.

The yield of essential oil, % in abs. dry mass was 0.19 % and 0.03 %, respectively. The quantities are different from the reported in literature: for aerial parts — 0.23 %) [11], 0.27 % [5], 0.5 % [14] and 1.6 % [7]; for leaves — 0.5 % [15]; for flowers — 0.4 % [15] are probably due to the climatic conditions in the respective locality in which the plant is growing and the part of the plant processed. All of the oils were light yellow and had sharp odor.

Chemical compositions of the oils are listed in Table 1.

As seen 20 components representing 92.43 % of the total content were identified in the oil from flowers. Seven of them were in concentrations over 1 % and the rest 13 constituents were in concentrations under 1 %. As seen the major constituents (up 3 %) of the oil are as follows: germacrene D (29.37 %), β-caryophyllene (23.55 %), α-copaene (13.35 %), β-cubebene (7.02 %), δ-cadinene (5.56 %) and α-caryophyllene (5.46 %).

Table 1. **Chemical composition of oils from *S. aethiopis***

№	Compounds, %	**RI**	flowers	leaves
1	2	**3**	4	5
1	α-Pinene	938	0,17	0,19
2	β-Pinene	979	0,20	0,23
3	α-Cubebene	1366	0,97	0,64
4	α-Copaene	1375	13,35	17,24
5	β-Cubebene	1410	7,02	9,71
6	β-Caryophyllene	1418	23,55	21,91
7	α-Caryophyllene	1455	5,46	6,79
8	Germacrene D	1480	29,37	24,19
9	γ-Elemene	1497	0,62	1,28
10	γ-Cadinene	1506	0,98	0,63
11	δ-Cadinene	1514	5,56	6,69
12	(–)-Spathulenol	1536	0,10	0,24
13	Caryophyllene oxide	1572	0,09	0,35

Continuation of tabl. 1.

1	2	3	4	5
14	Hexahydrofarnesyl acetone	1755	0,47	0,12
15	Myristic acid, isopropylester	1814	0,08	1,36
16	Geranylgeraniol	2092	0,67	0,20
17	n-Heneicosane	2100	0,94	0,32
18	n-Hexacosane	2600	1,73	0,51
19	n-Heptacosane	2700	0,69	0,20
20	n-Octacosane	2800	0,41	0,17

20 compounds representing 92.97 % of the total content identified in the oil from leaves. Eight of them were in concentrations over 1 % and the rest 12 constituents were in concentrations under 1 %. As seen the major constituents (up 3 %) of the oil are as follows: germacrene D (24.19 %), β-caryophyllene (21.91 %), α-copaene (17.24 %), β-cubebene (9.71 %), α-caryophyllene (6.79 %) and δ-cadinene (6.69 %).

The results indicated that Bulgarian essential oil obtained from flowers and leaves of *S. aethiopis* is also a germacrene D and β-caryophyllene chemotype.

The difference in chemical composition of our investigations and the reported data may be due to environmental conditions under which the plant has grown as well as the variation in conditions of analysis.

The classification of the identified compounds, based on functional groups, is summarized in Figure 1.

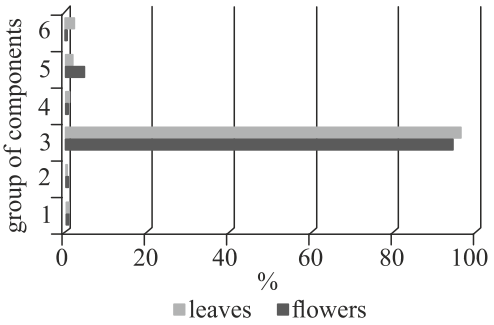

Fig. 1. Group of components in essential oils from *S. aethiopis*,%:
1 — monoterpene hydrocarbons, 2 — oxygenated monoterpenes, 3 — sesquiterpene hydrocarbons, 4 — oxygenated sesquiterpenes, 5 — hydrocarbons, 6 — others

The total sesquiterpene hydrocarbons constituted the highest percentage of the components of the essential oil constituting 94.0 % and 95.82 % in the oil of flowers and leaves, respectively. The oil of flowers consisted above 1 % concentration hydrocarbons (4.08 %). The oil of leaves consisted above 1 % concentration hydrocarbons (1.29 %) and others (1.46 %). The percentage of monoterpene hydrocarbons, oxygenated monoterpenes and oxygenated sesquiterpenes are under 1 %.

Conclusion

For the first time in Bulgaria new essential oils from flowers and leaves of *Salvia aethiopis* L. were obtained by hydrodistillation.

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ХИМИЧЕСКИЙ СОСТАВ ЭФИРНОГО МАСЛА ИЗ ШАЛФЕЯ (*SALVIA AETHIOPIS* L.), ВИРОЩЕННОГО В БОЛГАРИИ

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В статье проведено исследование с целью оценки химического состава эфирного масла из цветков и листьев шалфея (Salvia aethiopis L.), выращенного в Болгарии. Дикорастущий шалфей был собран на стадии цветения в 2016 г. в Южном регионе Болгарии в Пловдивский области. Масло готовилась мето-

дом гидродистиляции в течении 2 часов. Влажность цветков составляла 83,03 %, листьев — 84,8 %. Выход эфирного масла (% абс. сухого вещества) составил 0,19 % и 0,03 % соответственно. Результаты показали, что болгарское эфирное масло, полученное из цветков и листьев шалфея, относится к хемотипу гермакрен D и β-кариофилен. Наивысший процент компонентов эфирного масла составляли сесквитерпеновые углеводороды, соответственно 94,0 % и 95,82 % в масле цветков и листьев. Основные соединения эфирных масел из цветов и листьев распределились следующим образом: гермакрен D (29,37—24,19 %), β-кариофилен (23,55—21,91 %), α-копаен (13,35—17,24 %), бета-кубенен (7,02—9,71 %), δ-кадины (5,56—6,69 %) и α-кариофиллен (5,46—6,79 %).

***Ключевые слова**: шалфей эфиопский, эфирное масло, химический состав.*