RESEARCH ON OILS OF OCIMUM BASILICUM L. GROWN IN UZBEKISTAN

D. T. Asilbekova[1], Kh. M. Bobakulov[2], N. D. Abdullaev[3]

[1]Leading researcher, DSc, S. Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, Tashkent,

[2]Head of Laboratory, S. Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, Tashkent,

[3]Professor, S. Yu. Yunusov Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, Tashkent

https://doi.org/10.5281/zenodo.15545826

Abstract. *In the current work the aerial part of green Ashraykhon and Sadaraykhon varieties of Ocimum basilicum L. cultivated in Uzbekistan were comparatively studied in terms of chemical composition of the fixed oils by using TLC and GC-MS techniques. These basil varieties produce volatiles with a high abundance linalool and methyl chavicol as a major constituent. It is revealed that fixed oils from both basil varieties comprised biologically active substances such as linolenic acid, phytosterols, pigments, and major components of basil essential oil.*

Key words: *Lamiaceae family, Ocimum basilicum L., fixed and essential oils, fatty acids, chlorophylls.*

Introduction. The genus *Ocimum* L. (Lamiaceae family) comprises about 150 taxa and some varieties of herbs and shrubs from the tropical regions of Asia, Africa, Central and South America. One of the most important members of the genus is *Ocimum basilicum* L. (sweet basil) cultivated worldwide as a plant with commercial importance. There are European, Egyptian, Bulgarian and other basil oils, which differ in smell and chemical composition (1).

In the Uzbekistan basil is widely cultivated for culinary purposes as a fresh herb and as a dried spice. There are two cultivated varieties of sweet basil with green (*O. basilicum* L. cv green, namely Ashraykhon) and dark purple (*O. basilicum* L. cv purple, Kararaykhon) plant color. There is bush basil with green or purple color named Sadaraykhon, which is smaller in size and more compact than sweet basil.

The flowers of green and dark purple *O. basilicum* varieties have been studied by us in terms of chemical composition of the essential and lipids (fixed oils). These varieties of basil have been found to contain bioactive substances such as essential oils, lipids, unsaturated fatty acids, phytosterols and pigments (2). In this work we comparatively studied the fixed oil components from Ashraykhon and Sadaraykhon varieties of basil with green color.

Materials and Methods. Ashraykhon and Sadaraykhon varieties of basil were grown in the open soil of an experimental plot of the Institute of the Chemistry of Plant Substances under the same conditions. Basil varieties have been identified in the laboratory of medicinal and technical plants of this institute by the botanist Dr. Alim Nigmatullaev.

The fixed oil was extracted from the both samples of basil aerial part in flowering phase (100 gr powdered sample x 5 time) with hexane. Non-saponified substances of oils were obtained from aliquot of hexane extract (0.5 g of each sample) by alkaline hydrolysis with 10%

KOH in methanol at reflux for 60 min. They were extracted with hexane, yielding 0.051 and 0.035 g of yellow residues.

The components of the fixed oil and their non-saponified substances were identified by thin-layer chromatography (TLC) using solvent mixture of hexane: diethyl ether: CH_3COOH, 70:30:1 as mobile system, and reagents (J_2, H_2SO_4). The mobility (R_f) of substances on a thin layer of sorbent Silufol plate was compared with the corresponding groups of standard substances (sunflower oil, fatty acids, beta-sitosterol). Fixed oils and their non-saponified substances from both studied basil varieties were also analyzed using GC-MS.

GC-MS analysis was performed using an Agilent 7890A GC/5975C Inert MSD system (Agilent Technologies, USA) with an HP-Innowax column (30 m × 0.25 mm id with 0.25 μm film thickness). The temperature was programmed in the range 60–240° C.

The identification of the components was performed on the basis of chromatographic retention indices (RRI) and by comparison of the recorded mass spectral characteristics with data of the Wiley Registry of Mass Spectral Data (9th Ed.) and the NIST Mass Spectral Library (2011) electronic databases. Retention indices were calculated by means of a mixture of homologue n-alkanes (C_9-C_{32}) analyzed under the same chromatographic conditions used for the analysis of fixed oils.

Results and discussion. The yield of fixed oils (hexane extracts) from basil varieties Ashraykhon and Sadaraykhon was similar and amounted to about 5.0% by dry weight. They consisted of the ingredients of plant neutral lipids – fatty acids (R_f - 0.75), their esters with fatty alkanols and sterols (R_f - 0.95), triacylglycerols (R_f - 0.92), diacylglycerols (R_f - 0.35 and 0.31), as well as lipophilic substances – carotenoid pigments (R_f - 0.98), natural and altered chlorophylls (R_f - 0.27; 0.20; 0.12).

The yield of non-saponified substances from fixed oils of Ashraykhon and Sadaraykhon were 10.2 and 7.0%, respectively. TLC analysis showed that they contain esters of fatty alcohols and lipophilic substances, as well as free fatty alcohols (R_f - 0.78), phytosterols (R_f - 0.35-0.33), hydrocarbons with carotenoids (Rf - 0.98) and some components of basil essential oil. These lipophilic substances from both basil varieties were identical. The results of GC-MS analysis of fixed oils are presented in Table.

The results presented in the table indicate that the fixed oils of both varieties contain a set of components of basil essential oil (1,8-cineole, γ-terpinene, linalool, bornyl acetate, methyl chavicol, *tau*-cadinol, chavicol), saturated (dodecanoic, tetradecanoic, hexadecanoic, heptadecanoic, octadecanoic) and unsaturated ((*Z*)-octadeca-9-enoic, (*Z,Z*)-octadeca-9,12-dienoic, (*Z,Z,Z*) octadeca-9,12,15-trienoic) fatty acids as well as lipophilic substances (phytol, hexacosan-1-ol).

The essential oil components in extracts of fixed oil from Ashraykhon and Sadaraykhon are rich in monoterpene linalool (12.9% and 15.4%, respectively) and phenylpropanoid methyl chavicol (estragole, 16.0 and 8.6%). A higher percentage of *tau*-cadinol was found only in the Ashraykhon variety.

Based on many studies of essential oils from sweet basil aerial parts, four chemotypes of this species (linalool, methyl chavicol, methyl eugenol, and methyl cinnamate) have been established, and also numerous subtypes (1, 2).

Both of our previously studied green Ashraykhon and dark purple Kararaykhon varieties were the richest in monoterpenes and presented a high content of linalool (52,4% and 72,3%, respectively) which could be defined as their chemotype 'linalool' (2). Methyl eugenol was as minor component in two volatiles, and methyl cinnamate not detected. *tau*-Cadinol was the next

major component of two volatiles, but its content was higher than methyl chavicol in volatile of Kararaykhon.

Green Ashraykhon variety from Uzbekistan is similar to Italian basil oil (European type) with linalool and methylchavicol as the main compounds. Respectively, the volatile oil of Ashraykhon variety (*O. basilicum* L., cv green) consist a high content of linalool and methyl chavicol which have been defined its subtype as 'linalool – methyl chavicol'. The literature reports that basil oil, which contains mainly linalool and methyl chavicol, also possesses antibacterial agents which are effective against a variety of Gram-positive and Gram-negative bacteria (3).

Table. Components of fixed oils from the varieties of Ashraykhon and Sadaraykhon, % GC-MS

No	COMPONENT	RRI	Ashraykhon	Sadaraykhon
1.	1,8-Cineole (=Eucalyptol)	1208	2.9	5.9
2.	γ-Terpinene	1249	2.2	0.1
3.	Linalool	1525	12.9	15.4
4.	Bornyl acetate	1543	2.1	0.1
5.	Methyl chavicol (=Estragole)	1629	16.0	8.6
6.	*tau*-Cadinol	2120	4.7	Trace
7.	Chavicol	2255	0.1	1.9
8.	Dodecanoic acid	2491	0.1	Trace
9.	Phytol	2590	8.6	10.1
10.	Tetradecanoic acid	2647	1.3	Trace
11.	Hexadecanoic acid	2848	20.5	10.0
12.	Heptadecanoic acid	2949	0.1	0.7
13.	Octadecanoic acid	3050	3.6	2.8
14.	(*Z*)-Octadeca-9-enoic acid	3080	5.5	5.5
15.	(*Z,Z*)-Octadeca-9,12-dienoic acid	3128	3.8	3.5
16.	(*Z,Z,Z*) Octadeca-9,12,15-trienoic acid	3190	10.0	13.7
17.	1-Hexacosanol	3398	-	13.1
Σ Identified components			94.4	91.4
Σ Unidentified components			5.6	8.6
Σ Unsaturated fatty acids			19.3	22.7
Σ Saturated fatty acids			25.6	13.5

Trace: <0.1%

According to our GC-MS results Sadaraykhon variety compared to Ashraykhon variety presented a higher content of linalool (15.4 vs. 12.9%) and significantly less methyl chavicol (8.6 vs. 16.0%) which can be defined as their chemotype as 'linalool'.

Comparison fatty acid compositions of studied varieties revealed that the amount of unsaturated components, including the percentage of (*Z,Z,Z*) octadeca-9,12,15-trienoic (linolenic) acid was more in Sadaraykhon than in Ashraykhon. It should be noted that hexadecanoic acid (palmitic) was predominant components in the saturated acids of both basil varieties. The level of this acid was more in the fixed oil of Ashraykhon.

Conclusion. Thus, fixed oils from aerial parts of two varieties of basil (Ashraykhon and Sadaraykhon) which widely cultivated in Uzbekistan were studied for the first time.

The components of these fixed oil were qualitatively identical, but differed in the content of major and minor components, which may also influence their odor profile and biological activity.

It was found that extract of fixed oil from Ashraykhon and Sadaraykhon varieties of the basil contains biologically active lipid nature substances, such as unsaturated fatty acids of the ω3 type (linolenic), phytosterols, pigments, as well as volatile components of basil oil such as linalool and methyl chavicol.

REFERENCES

1. P. Pushpangadan and V. Georg. Handbook of herbs and spices© Woodhead Publishing Limited, 2012, –P.323.
2. Kh. M. Bobakulov, G. Ozek, T. Ozek, D. T. Asilbekova, N. D. Abdullaev, Sh. Sh. Sagdullaev, K. H. C. Başer. Essential oils and lipids from the flowers of two varieties of *Ocimum basilicum* L., cultivated in Uzbekistan. Journal of Essential Oil Research, 32(4), 2020, –P.323.
3. S. Filip. Basil (*Ocimum basilicum* L.) a source of valuable phytonutrients. International Journal of Clinical Nutrition & Dietetics, 3, 2017, –P.118.