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THE CONTENT OF FATTY ACIDS IN LIPOPHILIC EXTRACTS OF VERONICA CHAMAEDRYS L. AND VERONICA OFFICINALIS L.

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Summary

There is indicated the results of the investigation of lipophilic fraction obtained from the herbs of *Veronica chamaedrys* L. and *Veronica officinalis* L., determined the yield of the lipophilic fraction in relation to the raw materials, settled the content of fatty acids in lipophilic extract. It is noted that linoleic and linolenic fatty acids dominated in the investigation materials.

Keywords: fatty acids, herb, *Veronica chamaedrys* L., *Veronica officinalis* L., a gas chromatography-mass spectrometry.

Introduction. *Veronica* genus (*Veronica* L.) belongs to the Figwort family (Scrophulariaceae). The genus includes perennial or annual herbs, rarely shrubs. The flowers are small, collected in raceme. Calyx is left with the fruit box but the bottom, sympetalous corolla falls off. It is often different shades of blue, looks as tetragynous, although it consists of five petals and two stamens. The genus includes about 160 species distributed in temperate zones of both hemispheres. About 150 species grow in Ukraine and Russia. Almost all of

them are sophisticated, many are bred in gardens outdoors. The most widespread in Ukraine are *Veronica officinalis* - with blue, and some species with pink or white flowers and *Veronica chamaedrys* – with few-flowered paired racemes of bright blue color with dark veins. Most species of *Veronica* are very hardy, they can grow on impoverished soil, some can withstand at winter temperatures up to - 29 °C.

In traditional medicine, *Veronica officinalis* is used more frequently. The other types of *Veronica*, which have the similar therapeutic effect - *V. chamaedrys* or *V. prostrata* are used at its absence. The drugs of *Veronica officinalis* exhibit analgesic, antispasmodic and anti-inflammatory activities. They have homeostatic, antitoxic, fungicide, anti gout, expectorant and wound-healing properties. In traditional medicine, the drugs are used in the cases of colds, cough, sore throat, asthma, bronchitis and pulmonary tuberculosis, reduced appetite, gastric ulcers, diarrhea, liver, spleen, kidney and bladder diseases, insomnia, nervous exhaustion, rheumatism, aches and internal bleeding during menopause period. The application of *Veronica officinalis* for the treatment of skin diseases (rashes, eczema, pyoderma, different kinds of itch, fungal lesions, etc.) is especially effective [3, 8, 9].

The analysis of literature sources showed that the plants from *Veronica* genus haven't been studied yet enough, so we consider to examine the chemical composition of the major biologically active substances of some species of the genus.

The aim of our study is to determine the content of fatty acids in lipophilic extracts from plants of *Veronica* genus - *Veronica officinalis* and *Veronica chamaedrys*.

Materials and methods. The objects of the research were the herb of *Veronica chamaedrys* (*V. chamaedrys*) and the herb of *Veronica officinalis* (*V. officinalis*), which had been harvested during the mass flowering period. The herb of *Veronica chamaedrys* had been collected on the edges of mixed forests in the territory of Zalischyky, Ternopil region; the herb of *Veronica officinalis* - on the outskirts of the city Galych, Ivano-Frankivsk region.

The chromatographic separation and identification of fatty acids was performed on a gas chromatography-mass spectrometry system Agilent 6890N / 5973inert (Agilent technologies, USA). The capillary column HP-5ms (30m × 0,25mm × 0,25mkm, Agilent technologies, USA). The evaporation temperature is 250 °C, the temperature of interface is 280 °C. The separation was carried out at the mode of temperature programming - initial temperature of 60 °C was kept for 4 min., raised with gradient 4 °C/min up to 250 °C, was maintained during 6 min., with gradient 20 °C raised up to 300 °C, and was kept for 5 minutes. The sample with the volume of 1 ml, was injected into the flow separation mode

1:20. The detection was performed in SCAN mode in the range (38-400 m/z). The flow rate of carrier gas (helium) through a column was 1.0 ml/min.

The identification was carried out using the library of mass spectrum NIST 02; the quantitative analysis was made by the adding of the internal standard solution into the studied samples [5, 6]. The undecanoic acid was used as the internal standard.

The mass of fatty acid per 1 kg of raw materials in mg was calculated using the formula:

$$X = \frac{S_x \times M_{is} \times 1000}{S_{is} \times m}$$

where:

S_x - peak area of the fatty acid

M_{is} - mass of the internal standard in the sample

S_{is} - peak area of the internal standard

m – mass of the raw materials

Results of investigation and discussion. In the lipophilic fraction of the studied objects, the presence of saturated and unsaturated fatty acids, low molecular weight organic acids, high molecular alkanes, phytosterols and low molecular benzoic derivatives has been established (Fig. 1-2).

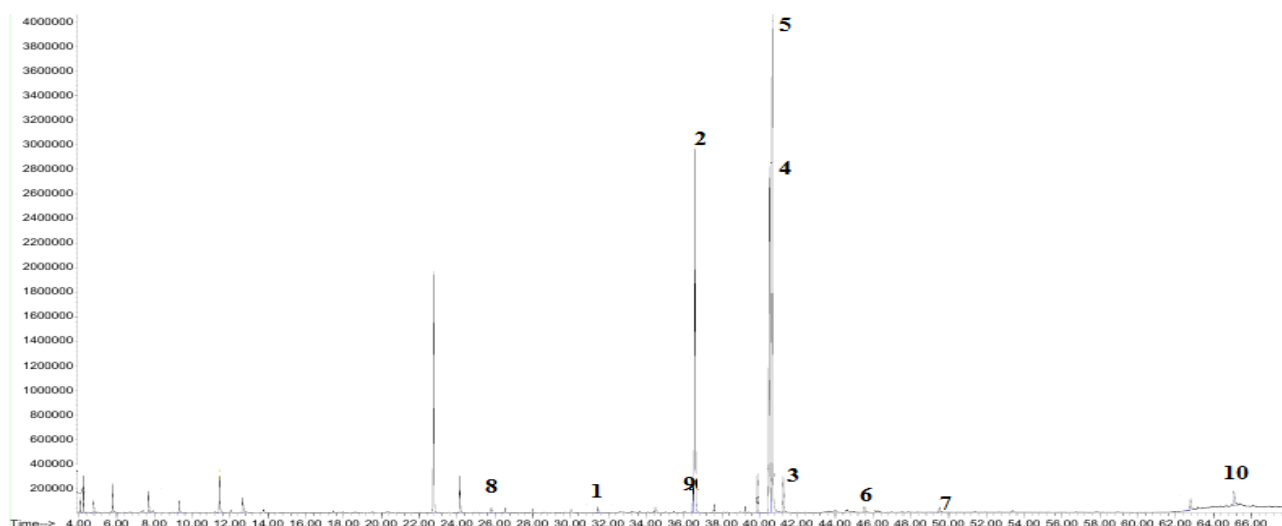


Fig. 1. The chromatogram GC-MS of the analysis of the methyl esters of lipophilic fraction of the herbs of *Veronica chamaedrys*: 1 - myristic acid; 2 - palmitic acid; 3 - stearic acid; 4 - linoleic acid; 5 - linolenic acid; 6 - arahic acid; 7 - nylon acid; 8 - lauric acid; 9 - palmitoleic acid; 10 - γ -sitosterol.

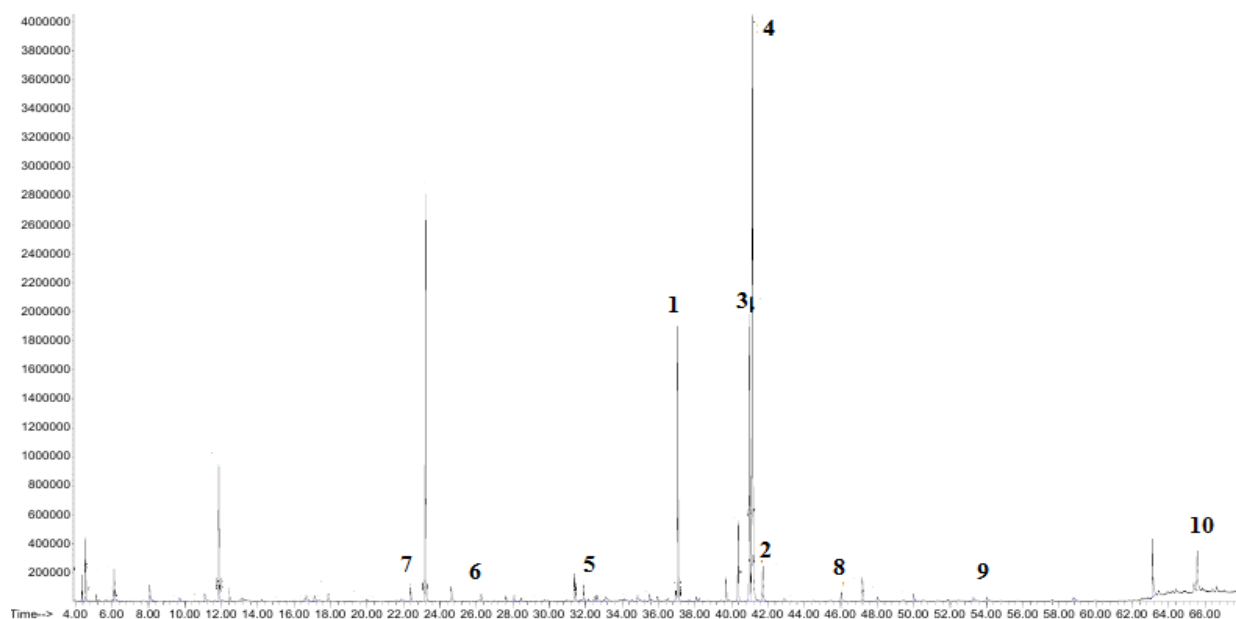


Fig. 2. The chromatogram GC-MS analysis of the methyl esters of lipophilic fraction of the herb of *Veronica officinalis*: 1 - palmitic acid; 2 - stearic acid; 3 - linoleic acid; 4 - linolenic acid; 5 - behenic acid; 6 - lauric acid; 7 - nylon acid; 8 - arachidonic acid; 9 - lignoceric acid; 10 - γ -sitosterol.

Table 1 – The quantitative content of acids in lipophilic fraction

| Name of acids | Chemical formula | Content in % from the total amount | |
|-----------------|------------------|------------------------------------|-----------------------------|
| | | <i>Veronica chamaedrys</i> | <i>Veronica officinalis</i> |
| Capric | C 10:0 | n/f | 0,14 |
| Lauric | C 12:0 | 0,26 | 0,36 |
| Myristic | C 14:0 | 0,32 | 0,33 |
| Palmitic | C 16:0 | 21,92 | 12,93 |
| Palmitoleic* | C 16:1n7 | 1,54 | n/f |
| Stearic | C 18:0 | 2,31 | 1,76 |
| Linoleic* | C 18:2n9,12 | 22,74 | 13,98 |
| Linolenic | C 18:2n9,12,15 | 33,05 | 32,67 |
| Eicosanic | C 20:0 | 0,42 | n/f |
| Arachidonic* | C 20:4n6 | n/f | 0,53 |
| Behenic | C 22:0 | 0,39 | 0,47 |
| Lignoceric | C 24:0 | n/f | 0,29 |
| Other volatiles | | 17,05 | 36,54 |

Notes:

1 - n/f – not found

2. * - unsaturated acids

The chemical profile of fatty acids established in the studied objects which are represented by a number of compounds from capric (C 10: 0) to lignoceric (C24:0) acids. 9 fatty acids are found in the lipophilic extract of *Veronica chamaedrys*, 3 of which are unsaturated (palmitoleic, linoleic and linolenic); the extract of the herb of *Veronica officinalis* consists of 10 fatty acids, 3 of which are unsaturated (linoleic, linolenic and arachidonic).

The largest percentage of the saturated fatty acids accounted for palmitic acid (C 16:0): the herb of *Veronica chamaedrys* contains 21,92 %; the herb of *Veronica officinalis* contains 12.93 %. The linoleic acid dominates among the unsaturated fatty acids (the herb of *Veronica chamaedrys* contains 33.05 %, the herb of *Veronica officinalis* contains 32.67 %). The amount of linoleic acid in the herb of *Veronica chamaedrys* is 22.74 %, in the herb of *Veronica officinalis* – 13.98 %. It is established that the content of unsaturated fatty acids in the herb of the plants from *Veronica* genus prevails over saturated (Fig. 3).

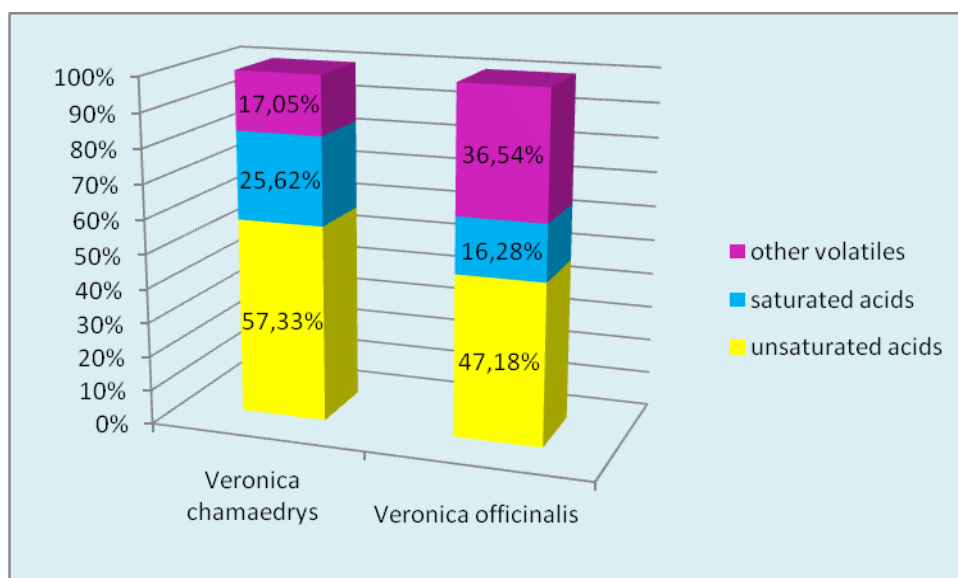


Fig. 3. Ratio of the components of lipophilic fraction in the investigated objects of the plants of *Veronica* genus

Linoleic, linolenic and arachidonic acids are vitally essential fatty acids. Arachidonic acid, which is the constituent of the herb of *Veronica officinalis*, is conventionally indispensable. It can be found mainly in the animal fats and it synthesizes in the animal's body from linoleic and linolenic acids. Linoleic and linolenic acids are polyunsaturated acids and they form a group of vitamin compounds - Vitamin F.

Unsaturated fatty acids are essential for the functioning body. The connection of unsaturated fatty acids with cholesterol metabolism has been discovered. They contribute the transformation of cholesterol to folic acid and eliminate it from the body, exhibit the

normalizing effect on the walls of blood vessel, increasing their flexibility and reduce permeability. The connection of unsaturated fatty acids and metabolism of vitamins of group B has been discovered too. In their deficiency the rate of growth and resilience to adverse external and internal factors is reduced and suppressed the reproductive function.

Application of polyunsaturated fatty acids stimulates the immune system of the body, has a beneficial effect on the skin, promotes the rapid healing of inflammatory diseases of the stomach, gastric ulcer and duodenal ulcer, promotes recovery of the body and improves the function of capillaries. Polyunsaturated fatty acids are effective in the treatment of diabetes and asthma [1].

Veronica chamaedrys and *Veronica officinalis* contain small amounts of gamma-sitosterol, which will enhance the anticholesterol effect of vitamin F.

Conclusions. By the chromatography-mass spectrometry method it was established the qualitative composition and quantitative contents of fatty acids in the herb of *Veronica chamaedrys* and *Veronica officinalis*. It is determined that polyunsaturated fatty acids - linoleic and linolenic dominated in the investigation objects.

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