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LIPIDS FROM FRUIT OF *Rindera oblongifolia*

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In continuation of the study of lipids from fruit of various plant species of the family Boraginaceae [1, 2] growing in Uzbekistan in order to identify plant sources rich in essential fatty acids, we investigated oil from fruit of *Rindera oblongifolia* M. Pop. The plant *R. oblongifolia* is widely distributed in Europe, South America, Russia, and Central Asia. The family in Uzbekistan is represented by 32 genera and 117 species [3] and is attractive to researchers due to a high content in fruit of essential fatty acids. Fruits of this plant were studied previously only in order to determine the composition of total fatty acids [4].

Herein we communicate results for the composition of neutral lipids (NL), glycolipids (GL), phospholipids (PL), and unsaponified substances in addition to the fatty acids of these lipid groups in the studied oil.

Total NL were extracted by soaking ground fruit in extractive benzine (bp 72–85°C). Their yield was 11.7%. Bound lipids were isolated by Folch treatment of defatted pulp [5]. Their yield was 1.71%. The content of chlorophylls was 203 mg% [6]. The resulting extract of bound lipids was separated into NL, GL, and PL. Their yields were 0.25, 0.30, and 1.16%, respectively.

NL were analyzed by TLC using solvent systems 1 and 2. The analysis showed that the principal components were triacylglycerides. Other observed constituents were hydrocarbons, free fatty acids, tocopherols, and aliphatic and cyclic alcohols.

According to TLC on silica gel using solvent system 3, the principal classes of GL were sterylglycosides and their esters, and mono- and digalactosyldiglycerides.

According to two-dimensional TLC using solvent systems 4 and 5, the PL contained phosphatidylcholines, phosphatidylethanolamines, phosphatidylinositols, and phosphatidic acids.

Fatty acids were isolated from NL, GL, and PL after basic hydrolysis and were identified by GC as the methyl esters (Table 1).

It can be seen that NL were significantly enriched in unsaturated fatty acids (91.6%) including 33.6% essential ones. The presence of 18:4 acid in NL of *R. oblongifolia* was reported previously [4]. The content of γ-linolenic acid 18:3 (6, 9, 12) in NL was 2.1%, which agreed with the literature [4]. The principal saturated acid in the NL was 16:0.

The second-highest amount of unsaturated fatty acids was found in PL, in which their content exceeded 70%. Almost one third of them were essential acids. The principal acids were 16:0, 18:1, and 18:2.

Total amounts of saturated and unsaturated fatty acids in GL were practically identical. The dominant ones were 16:0, 18:1, 18:2, and 24:0. The fraction of essential acids was 18.4%.

Unsaponified substances isolated from total lipids reached 5.7%. They were separated into fractions by PTLC on silica gel using solvent system 2. The yields were determined gravimetrically as hydrocarbons (6.4%), triterpenols (20.7), sterols (49.0), tocopherols + aliphatic alcohols (10.5), and unidentified components (13.4).

It can be seen that the unsaponified substances were enriched in biologically active substances such as tocopherols, triterpenols, and sterols.

GC of methyl esters was performed on a Chrom-5 instrument with a flame-ionization detector using a steel column (2.5 m) packed with Chromaton N-AW with 15% Reoplex 400 (0.16–0.20 mm), column temperature 192°C, and N_2 flow rate 30 mL/min. Chlorophylls were determined by a spectrophotometric method [7].

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TABLE 1. Fatty-Acid Composition of NL, GL, and PL from Fruit of *Rindera oblongifolia*, GC, % of Total

Acid	NL	GL	PL	Acid	NL	GL	PL
10:0	–	–	0.2	18:3 (9,12,15)	11.4	1.5	0.6
12:0	–	0.5	–	20:0	–	2.6	0.1
14:0	0.1	2.0	0.3	20:1 + 18:4	8.7	1.8	1.2
16:0	6.3	24.8	24.5	22:0	1.6	6.1	0.4
16:1	0.4	–	0.1	22:1	9.9	1.8	0.6
17:0	–	1.6	–	22:2	–	–	0.5
18:0	0.4	5.2	3.5	24:0	–	10.2	0.1
18:1	34.6	24.7	39.3	24:1	4.4	0.3	0.3
18:2	20.1	15.5	26.4	$\Sigma_{sat.}$	8.4	53.0	29.1
18:3 (6,9,12)	2.1	1.4	1.9	Σ_{unsat}	91.6	47.0	70.9

NL were extracted from previously ground fruit by extractive benzine, by soaking for 6 h at room temperature (3×). Bound lipids were extracted by the Folch method and separated by column chromatography over silica gel into separate lipid groups. NL were eluted by $CHCl_3$; GL, acetone; PL, MeOH. TLC was carried out using the solvent systems hexane:Et_2O (4:1, 1; 3:2, 2), $CHCl_3$:Me_2CO:MeOH:HOAc:H_2O (65:20:10:10:3, 3), $CHCl_3$:MeOH:NH_4OH (13:5:1, 4), $CHCl_3$:MeOH:HOAc:H_2O (14:5:1:1, 5).

NL were detected by I_2 vapor and aqueous H_2SO_4 (50%); GL, by α-naphthol; PL, by Vas′kovsky and Dragendorff reagents; tocopherols, by α,α'-dipyridyl solution.

NL, GL, and PL were hydrolyzed by KOH solution (10%) in MeOH with refluxing for 1 h.

Unsaponified substances were isolated as before [7] and were identified using Lieberman–Burchard qualitative reaction for triterpenols and sterols in addition to model samples of alcohols obtained by us earlier from natural sources.

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