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LIPIDS OF *Silene brahuica*

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The qualitative and quantitative compositions of the lipid complex of the epigeal part of Silene brahuica *Boiss. (family Caryophyllaaceae) have been studied. The fatty acid composition of the acyl-containing lipids has been determined. Some differences have been found in the compositions of the fatty acids of the neutral lipids and the phospholipids.*

The lipid complex of the epigeal part of *S. brahuica* gathered in the valley of the Angren River, Tashkent province, has been investigated. The neutral lipids were extracted by steeping with hexane. The yield of hexane extract amounted to 0.5% (on the weight of the air-dry comminuted raw material). On TLC (with solvent systems 1 and 2), with the aid of model samples and characteristic color reactions of individual compounds, the following classes of neutral lipids (NLs) were detected in the hexane extract: hydrocarbons, sterol and triterpenol esters, triacylglycerides (TAGs), free fatty acids (FFAs), triterpene alcohols, sterols, chlorophylls, diacylglycerols (DAGs), and monoacylglycerols (MAGs). The quantitative composition of the lipids was determined by column chromatography of the extracts followed by preparative separation of individual fractions (Table 1). The main lipid classes were FAAs, sterol and triterpenol esters, and TAGs.

According to their mass spectrum, the hydrocarbons consisted mainly of saturated homologues with small amounts of monoenes: m/z 380 (C_{27}), 408 (C_{29}), 436 (C_{31}), 464 (C_{33}), 492 (C_{35}), 506 (C_{36}), 520 (C_{37}). Monoenes: m/z 490 (C_{35}), 504 (C_{36}), 518 (C_{37})

The products of the severe hydrolysis of the sterol and triterpenol esters [1] and the sterols and triterpenols were studied by the use of TLC and by the mass spectrometry of individual classes of compounds. The results showed that the lipids of the epigeal part of *S. brahuica* contained three sterols and two triterpenols, mainly in the free form and to a smaller degree in the bound form. The sterols were β-sitosterol, stigmasterol, and campesterol, which are characteristic compounds of the lipids of higher plants [2]. The mas spectrum of the sterols contained the peaks of ions with m/z M^+ 414, 412, and 400, which were assigned to β-sitosterol, stigmasterol, and campesterol, respectively. The triterpenol alcohols consisted of two components - α- and β-amyrins. The mass spectrum of the triterpenols: m/z 426 M^+, 411 $[M - 15]^+$, 408 $[M - 18]^+$, 393, 218, 207, 204, 203 (α-amyrin with a small amount of the β- analogue).

To estimate the acyl-containing classes of lipids we determined their fatty acid compositions (Table 2). In all the acyl-containing classes of lipids, among the saturated acids palmitic and stearic predominated. The amount of oleic acid was higher in the sterol and triterpenol ester fraction and in the FFAs. The main unsaturated fatty acids were linolenic and oleic. The total amount of saturated acids in the DAGs, MAs, and the sterol and triterpenol esters was considerably greater than in the FFAs. To establish the composition of the fatty acids in the sn-2 positions of the TAGs we used hydrolysis by pancreatic lipase. The composition of the fatty acids of the sn-2-MAGs is given in Table 2, from which it can be seen that the central position of the TAGs was esterified mainly by linolenic and oleic acids.

The total phospholipids (PLs) were obtained by Folch's method [3]. The composition of the total phospholipids established with the aid of two-dimensional TLC (systems 3-5) is given in Table 1. The main components of the total phospholipids were PGs, PCs, PEs, and PIs. The fatty acid compositions of the total phospholipids and of the individual classes

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TABLE 1. Composition of the Lipids of *Silene brahuica*

Neutral lipids		Phospholipids	
Class	Amount, % by weight of the extract	Class	Amount, % by weight
Hydrocarbons	4,0	N-Acyl-PEs	9,6
Sterol and triterpenol esters	20,8	N-Acyllyso-PEs	6,2
TAGs	18,2	PGs	23,2
FFAs	39,2	PCs	26,3
Triterpenols	2,6	PEs	16,8
Sterols	6,2	PIs	15,4
DAGs	2,9	PAs	2,5
Chlorophylls	3,6		
MAGs	2,5		

TABLE 2. Fatty Acid Composition of the Total Lipids from *Silene brachuica* and of Their Individual Components

Class of lipids	Fatty acid										
	10:0	12:0	14:0	16:0	16:1	18:0	18:1	18:2	18:3	ΣП	ΣН
Sum of the neutral lipids	1,1	2,6	3,2	43,0	5,7	4,1	8,3	14,4	17,6	54,0	46,0
Sterol and triterpenol esters	1,7	5,2	5,8	47,3	0,6	7,8	18,5	9,0	4,1	67,8	32,2
TAGs	1,8	2,0	2,2	41,0	4,8	6,6	9,5	15,4	16,7	53,6	46,4
s-2-MAGs	—	—	0,7	18,5	8,6	—	18,0	25,2	29,0	19,2	80,8
FFAs	1,1	1,3	1,6	30,0	1,6	10,2	14,4	21,0	18,8	44,2	55,8
DAGs	1,7	6,2	6,7	42,8	1,7	10,3	8,4	10,1	12,1	67,7	32,3
MAGs	1,2	7,8	5,4	43,2	0,9	12,4	8,1	8,0	13,0	70,0	30,0
Total phospholiopids	0,6	0,7	1,9	44,0	11,1	4,5	10,0	12,1	15,1	51,7	48,3
N-Acyl-PEs	1,2	1,4	3,2	38,0	14,1	6,8	12,2	9,9	13,2	50,6	49,4
N-Acyllyso-PEs	1,5	2,6	4,4	42,6	10,1	7,1	9,3	10,6	11,8	58,2	41,8
PGs	0,8	1,1	3,7	39,5	9,8	10,3	11,5	10,3	13,0	55,4	44,6
PCs	1,9	2,0	3,1	39,1	11,9	9,6	9,2	9,6	13,6	55,7	44,3
PEs	1,0	1,2	2,6	37,0	11,4	8,4	10,0	12,8	15,6	50,2	49,8
PIs	1,1	1,3	1,6	40,8	9,7	9,6	10,3	11,4	14,2	54,4	45,6
PAs	1,0	1,6	2,2	42,3	7,8	6,7	10,8	12,1	15,5	53,8	46,2

were determined after mild alkaline hydrolysis. The fatty acids were methylated and analyzed by GLC (Table 2). The qualitative and quantitative compositions of the FAs of the neutral lipids and of the phospholipids scarcely differed. The amount of low-molecular-mass acids in the total PLs was considerably lower than in the total NLs, while the amount of palmitoleic acid was twice that in the total NLs. No appreciable differences were observed in relation to the other acids.

EXPERIMENTAL

For TLC we used Silufol and Chemapol silica gel 5/40 μm (Czechoslovakia). The spots of the NLs were revealed with iodine vapor and by spraying with 50% sulfuric acid followed by heating to 110-120°C for 3-5 min, and those of the PLs by the Dragendorff and Vaskovskii reagents and with ninhydrin. Column chromatography was conducted on Chemapol silica gel 100/160 μm at a ratio of the total MLs to adsorbent of 1:30 and of the total PLs to adsorbent of 1:40.

Solvent systems: hexane–ether–acetic acid (70:30:1); 2) hexane–ether–acetic acid (90:10:1); 3) chloroform–methanol–water (65:35:3); 4) chloroform–methanol–ammonia (65:35:5); 5) chloroform–methanol–acetone–acetic acid–water (10:5:4:2:1).

GLC was conducted on a Chrom-4 instrument with a flame-ionization detector. For the analysis of the FAMEs we used a stainless steel column (4 mm × 2.5 m) filled with 17% of PEGS on Celite 545. Temperature 198°C.

Mass spectra were taken on a MKh 1303 spectrometer at an energy of the ionizing electrons of 40 eV. The alkaline hydrolysis of the total NLs, PLs, TAGs, DAGs, and MAGs was carried out as described in [4], and the pancreatic lipolysis of the TAGs as in [5].

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