

LIPIDS OF SILKWORM COCOONS

I. Tolibaev,^a Sh. R. Mad'yarov,^b and A. I. Glushenkova^a

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The lipid complex of silkworm cocoons had been investigated. The qualitative and quantitative compositions of the total neutral lipids and glyco- and phospholipids have been determined. Considerable differences have been noted in the amounts of individual fatty acids in the neutral lipids and the phospholipids.

The separation of the lipids of silkworm cocoons into neutral and polar classes (NLs and PLs, respectively) was achieved by CC [1]. The total NLs were obtained by eluting the column with chloroform, and the glyco- and phospholipids (GLs and PhLs) with acetone, chloroform-methanol (2:1), and methanol, respectively [sic]. The percentages of the lipid classes obtained were: NLs, 86.5; PhLs, 8.3; GLs, 5.2. In the NLs, seven classes of lipids were detected with the aid of TLC, of model samples of lipids, and of literature information on the mobilities of the different classes.

The qualitative and quantitative compositions of the neutral lipids and the phospho- and glycolipids are shown in Table 1. The main components were triacylglycerols (TAGs) and fatty acids (FAs). In the phospholipids, phosphatidylcholines (PCs), phosphatidylethanolamines (PEs), and phosphatidylinositols (PIs) predominated, and, in the glycolipids, sterol glycosides and their esters.

The sphingomyelins (SPMs) among the PhLs were identified as described by Kates [2]. The total GLs were subjected to severe hydrolysis. Arabinose was detected in the aqueous fraction by PC and TLC. In plants, the GLs usually contain hexoses (galactose and mannose). The detection of a representative of the pentose monosaccharides (arabinose) in the products of the acid hydrolysis of the GLs of silkworm cocoons confirms once again that plant and animal materials differ not only in composition and in the amounts of individual classes of lipids but also in the composition of the sugars.

TABLE 1. Class Compositions of the NLs, PhLs, and GLs of Silkworm Cocoons

Class of lipids	Amount, % by weight
Neutral lipids	
Sterol esters	8.0
Triacylglycerols	60.6
Fatty acids	20.0
Diacylglycerols	2.4
Sterols	6.9
Monoacylglycerols	1.2
Pigments	0.9
Phospholipids	
N-Acylphosphatidylethanolamines	7.8
Phosphatidylglycerols	12.2
Phosphatidylethanolamines	24.8
Phosphatidylcholines	32.9
Phosphatidylinositols	14.4
Phosphatidylserines	5.7
Sphingomyelins	2.2
Glycolipids	
Sterol glycoside esters	24.6
Monogalactosyldiglycerides	26.4
Sterol glycosides	31.4
Cerebrosides	5.0
Digalactosyldiglycerides	12.6

a) Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, Tashkent, fax (3712) 89 14 75. b) Uzbek Scientific-Research Institute of Sericulture, Tashkent, tel. (3712) 46 52 03. Translated from *Khimiya Prirodnykh Soedinenii*, No. 5, pp. 664-666, September-October, 1995. Original article submitted November 7, 1994.

TABLE 2. Fatty Acid Compositions of the Total and Individual Classes of Silkworm Cocoon Lipids

Lipid class.	12:0	14:0	16:0	16:1	18:0	18:1	18:2	18:3	ΣΠ	ΣH
Total NLs	1.5	1.0	39.5	1.2	7.0	42.8	5.6	1.4	49.0	51.0
Sterol esters	7.3	10.7	40.4	8.6	6.3	17.0	9.7	Tr.	64.7	35.3
TAGs	1.0	1.3	40.1	3.3	4.2	43.8	4.2	2.1	46.6	53.4
sn-2-MAGs	—	0.2	9.4	2.4	—	71.5	5.7	10.8	9.6	90.4
FFAs	1.8	2.7	18.0	1.0	11.2	34.4	30.4	0.5	33.7	66.3
DAGs	2.5	3.4	44.8	1.3	12.8	33.5	1.7	Tr.	63.5	36.5
MAGs	1.4	3.1	43.5	3.1	12.2	33.2	3.5	—	60.2	39.8
Total PhLs	2.4	2.0	15.5	0.9	12.0	18.8	11.7	36.6	32.0	68.0
PCs	1.9	1.2	17.8	1.4	13.4	21.4	14.2	28.7	34.3	65.7
PEs	2.8	2.4	18.5	2.3	12.1	19.2	11.5	31.2	35.8	64.2
PGs	1.7	1.5	16.7	2.6	13.7	20.9	12.6	30.3	33.6	66.4
PSs	1.0	0.9	19.2	0.8	14.8	24.6	9.8	28.9	35.9	64.1
PIs	2.4	1.2	18.1	1.0	11.2	19.7	12.1	34.3	32.9	67.1
SPMs	2.0	2.5	19.1	1.0	10.8	23.3	10.7	30.6	34.4	65.6
N-Acyl-PEs	4.2	3.8	18.4	0.7	14.1	20.2	8.4	30.2	40.5	59.5
Total GLs	3.2	1.6	42.6	7.3	11.6	24.3	7.8	1.6	59.0	41.0

The FA compositions of all the acyl-containing lipids were determined, and pancreatic lipolysis of the TAGs was carried out (Table 2). The lipid complex of the silkworm cocoons contained eight fatty acids. Among the saturated acids, palmitic and stearic predominated, and in some of the components (sterol esters, N-acyl-PEs) there were considerable amounts of lauric and myristic acids. Unsaturated acids were represented in the main by oleic, linoleic, and linolenic. In the phospholipids the main unsaturated acids were linolenic, linoleic, and oleic (see Table 2). In the neutral lipids (apart from the FFAs) and in the glycolipids, many of the fractions were enriched with saturated fatty acids. While in the GLs linoleic acid was present in minor amount, in the phospholipids it reached 36.6%. The possibility of the participation of linolenic acid in the biosynthesis of phospholipids and the use of the latter in the process of silk formation has been reported previously [1].

EXPERIMENTAL

The lipid extract of silkworm cocoons was obtained from the Uzbek Scientific-Research Institute of Sericulture. TLC and CC and the identification of the total and individual classes of lipids, pancreatic lipolysis of the TAGs, and acid hydrolysis of the total GLs were conducted as in [3], the GLC of the carbohydrates as in [4], and the saponification of the total lipids and of individual classes as in [5].

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