CONCLUSION

1) 9-Oxo- and 10-oxooctadecanoic, 12-oxooctadec-9-enoic, 9-oxooctadeca-10,12-dienoic, 9(10)-oxooctadec-10(8)-enoic, and 12(13)-oxooctadeca-9,13,15(9,11,15)-trienoic acids, which, with the exception of the 9-oxooctadeca-10,12-dienoic acid, are new natural compounds, have been isolated from the seed lipids of *Galeopsis bifida*.

2) These acids occupy any of the three positions of the oxoacyldiacylglycerols.

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THE CHEMICAL STUDY OF THE MAIN PHOSPHOLIPIDS OF THE SEED KERNELS OF COTTON PLANTS OF THE SPECIES *Gossypium barbadense*

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The qualitative and quantitative compositions and also the general and position distributions of the fatty acids of the seeds of the thin-fibered varieties of the cotton plant S-6022, S-6015, S-6034, S-6037, and 9123-I have been studied.

The pathogenic fungus *Fusarium* develops in the soil and damages cotton plants through their root system. Its toxins cause irreversible changes in the vascular system of the plant, which may lead to wilting.

An infected plant that has passed through the complete cycle of its development (the formation of full-value seeds) develops immunity to the action of the fungus for the new generation. By successive selection, new wilt-resistant varieties of the cotton plant are being created [1].

The formation of immunity in living organisms is largely determined by the state of their lipid metabolism, and the phospholipid fraction of the membranes determines their resistance to and their capacity for being penetrated by bacterial toxins [2, 3]. Thus, any changes in the qualitative and quantitative ratio of the phospholipids (PLs) in the seeds will play a definite role in the development of the cotton plant, i.e., these changes prob-

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ably affect not only the physicochemical properties of biomembranes but also the functional activity of the membrane enzymes which, in its turn, involves changes in the biosynthesis and metabolism of the cell components [4].

It is possible that changes in the qualitative and quantitative ratio of the PLs in the seeds may play a definite role also in the formation of the immunity of the cotton plant.

As can be seen from the literature [5], not only for each species but for each variety of cotton plant a definite strictly specific qualitative and quantitative composition of the PLs is characteristic, i.e., each new variety must be the object of an individual study.

We have investigated the cotton plant varieties S-6022, S-6015, 9123-I, S-6034, and S-6037, the first three being the parents of the varieties S-6029 and S-6030 studied previously [6]. At the present time, new medium-fibered varieties are being created by crossing a wilt-resistant variety with a susceptible one (the Tashkent variety) [1]. For the thin-fibered varieties selection is far more complicated because of the absence of varieties resistant to the action of *Fusarium*. Consequently, great practical and theoretical interest is presented by the chemical study of the structure of the PLs of the parental varieties of the cotton plant. With the aid of the experimental results available to us, we are attempting to answer questions relating to the changes taking place in the structure of PLs and inheritable from the parents for this type of cotton plant.

The parents of variety S-6029 are the varieties S-6022 and 9123-I, and those of variety S-6030 are S-6022 and S-6015, i.e., a common parent is variety S-6022.

With the aid of two-dimensional TLC and qualitative reactions we have identified ten phosphorus-containing compounds in variety S-6022 and ten each in S-6015, S-6034, S-6037, and 9123-I. It was found that the qualitative composition of variety S-6022 differed from that of S-6029 (seven PLs) and S-6030 (eight PLs) through unidentified PLs more polar than phosphatidylcholine (PC). In all cases, half the total amount consisted of PC and the stable phosphatidylethanolamine (PE) (11-12%) and the amount of phosphatidylinositol (PI) ranged from 17 to 29%, the lowest yield being for variety S-6029 (17%) and the highest for variety S-6030 (29%) while for the others it was between 22 and 24%.

Homogeneous PC, PE, and PI fractions of the cotton plant varieties studied were subjected to alkaline and enzymatic hydrolysis as described in [6]. The results obtained are given in Table 1.

The main object of our discussion is the specific distribution of the fatty acid radicals in the molecules of the main PLs of the varieties of cotton plant studied. It can be seen from the results obtained that the sets of fatty acids in the PLs of these varieties differed both qualitatively and quantitatively, which, in its turn, was reflected on the position distribution of the fatty acid radicals in the PL molecules. The ΣS/ΣU ratio of the fatty acids in the PLs was as follows:

	PC	PE	PI
C-6022	22,3/77,7	31,4/68,6	37,8/62,2
C-6030	23,8/76,2	35,2/64,8	42,9/57,1
C-6015	24,4/75,6	31,3/68,7	35,6/64,4
C-6022	22,3/77,7	31,4/68,6	37,8/62,2
C-6029	30,9/69,1	31,1/68,9	42,9/57,1
9123-I	26,0/74,0	31,6/68,4	39,0/61,0

On consideration of the question of "parent-child" PLs it can be seen that the PC of variety S-6029 did not acquire the total unsaturation of the fatty acids from the parent, i.e., it was more saturated than the PCs of varieties S-6022 and 9123-I, while the PE was retained in the same form as in the parents, and for the PI the unsaturation of the fatty acids increased. The degree of unsaturation of the PC of variety S-6030 proved to be intermediate between the parents, i.e., closer to the resistant variety S-6022. In the PE and PI, the degree of unsaturation of the fatty acids had risen. It was found that variety S-6029 had not inherited resistance to *Fusarium* from the parental variety S-6022 while variety S-6030 had acquired resistance.

In a study of the molecular compositions of the main PLs (PC, PE, PI) it was found that in the PC the molecular species U-U (where U represents unsaturated fatty acids), and also ΣU-U (ΣU-U represents the species PC + PE + PI) for the resistant varieties — 54.7 (111.1) for S-6030, 55.4 (117.4) for S-6022, 49.8 (127.3) for S-6037, and 57.8 (124.6) for Termez 7 [7] — were in the basic quantitative respect higher than for the susceptible varieties — 50.3

TABLE 1. Compositions and Composition Distributions of the Fatty Acids in the Main Phospholipids of Varieties S-6022, S-6015, S-6034, S-6037, and 9123-I

Phospholipid position	Fatty acid										
	10:0	12:0	14:0	16:0	16:1	18:0	18:1	18:2	18:3	ΣП	ΣН
Variety 9123-I											
PCs, tot.	—	—	0,8	22,9	0,3	2,3	25,7	48,0	—	26,0	74,0
1	—	—	0,7	43,3	0,2	4,6	21,7	29,5	—	48,6	51,4
2	—	—	0,9	2,5	0,4	—	29,7	66,5	—	3,4	96,6
PEs, tot.	—	1,1	0,8	25,8	1,0	3,9	12,1	55,3	—	31,6	68,4
1	—	2,0	1,0	49,2	—	7,8	10,9	29,1	—	60,0	40,0
2	—	0,2	0,6	2,4	2,0	—	13,3	81,5	—	3,2	96,8
PIs, tot.	—	1,4	0,8	31,7	1,4	5,1	9,3	50,3	—	39,0	61,0
1	—	2,4	1,4	61,6	2,4	10,2	9,5	12,5	—	75,6	24,4
2	—	0,4	0,2	1,8	0,4	—	9,1	88,1	—	2,4	97,6
Variety S-6022											
PCs, tot.	—	0,2	0,5	18,9	0,9	2,7	26,1	50,7	—	22,3	77,7
1	—	0,3	0,8	35,0	1,0	4,7	23,5	34,7	—	40,8	59,2
2	—	0,1	0,2	2,8	0,8	0,7	28,7	66,7	—	3,8	96,2
PEs, tot.	0,1	0,2	0,6	27,2	1,0	3,3	14,3	53,3	—	31,4	68,6
1	0,1	0,2	1,2	49,0	1,0	5,0	10,0	33,5	—	55,5	44,5
2	0,1	0,2	—	5,4	1,0	1,6	18,6	73,1	—	7,3	92,7
PIs, tot.	—	—	0,2	31,1	0,9	6,5	9,4	51,9	—	37,8	62,2
1	—	—	0,2	53,3	0,6	13,0	5,8	27,1	—	66,5	33,5
2	—	—	0,2	8,9	1,2	—	13,0	76,7	—	9,1	90,9
Variety S-6015											
PCs, tot.	—	—	1,9	22,5	—	—	29,7	45,9	—	24,4	75,6
1	—	—	3,8	43,5	—	—	20,2	23,5	—	47,3	52,7
2	—	—	—	1,5	—	—	30,2	68,3	—	1,5	98,5
PEs, tot.	—	1,5	1,5	28,3	2,2	—	16,0	50,5	—	31,3	68,7
1	—	1,7	1,2	53,1	2,6	—	11,4	30,0	—	56,0	44,0
2	—	1,3	1,8	3,5	1,8	—	20,6	71,0	—	6,6	93,4
PIs, tot.	—	1,1	1,3	33,2	1,6	—	16,1	46,7	—	35,6	64,4
1	—	0,3	0,6	55,1	—	—	17,9	26,1	—	56,0	44,0
2	—	1,9	2,0	11,3	3,2	—	14,3	67,3	—	15,2	84,8
Variety S-6034											
PCs, tot.	4,8	—	0,9	19,8	1,9	1,6	22,7	48,3	—	27,1	72,9
1	7,8	—	1,8	36,1	1,2	3,2	20,7	29,2	—	48,9	51,1
2	1,8	—	—	3,5	2,6	—	24,7	67,4	—	5,3	94,7
PEs, tot.	1,7	—	1,7	27,2	1,5	2,4	12,4	53,1	—	33,0	67,0
1	3,4	—	3,4	52,0	1,6	4,8	4,3	30,5	—	63,6	36,4
2	—	—	—	2,4	1,4	—	20,5	75,7	—	2,4	97,6
PIs, tot.	3,7	1,2	0,7	31,7	3,3	3,3	7,0	49,1	—	40,6	59,4
1	6,0	2,4	1,4	60,2	6,6	6,6	5,0	11,8	—	76,6	23,4
2	1,4	—	—	3,2	—	—	9,0	86,4	—	4,6	95,4
Variety S-6037											
PCs, tot.	0,3	0,3	1,2	20,9	0,8	3,9	25,0	46,1	1,5	26,6	73,4
1	0,3	0,3	1,3	37,0	—	7,8	19,7	33,6	—	46,7	53,3
2	0,3	0,3	1,1	4,8	1,6	—	30,3	58,6	3,0	6,5	93,5
PEs, tot.	0,2	—	0,5	23,7	0,9	2,4	14,6	55,9	1,8	26,8	73,2
1	—	—	0,6	44,2	0,8	4,8	9,2	37,7	2,7	49,6	50,4
2	0,4	—	0,4	3,2	1,0	—	20,0	74,1	0,9	4,0	96,0
PIs, tot.	0,5	—	1,1	30,8	1,1	6,1	11,1	48,3	1,0	38,5	61,5
1	0,3	—	0,6	56,7	1,1	9,3	9,3	22,7	—	66,9	33,1
2	0,7	—	1,6	4,9	1,1	2,9	12,9	73,9	2,0	10,1	89,9

(101.1) for S-6029, 48.2 (110.4) for 9123-I, and 58.5 (108.3) for 5904-I [7]. The same feature was observed for the PLs of the medium-fibered varieties Tashkent 1, 2, and 3 — 54.3 (126.4), 51.3 (100.2), and 57.6 (136.8) — which are more resistant than to variety 108-F — 47.6 (97.2) [8] — and also in the type compositions of the triglycerides of the oils of varieties Tashkent 1, 2, and 3 — 45.50, 44.49, 45.52 (SUU) and 37.32, 37.72, and 36.87 (UUU) as compared with variety 108-F — 39.97 (SUU), and 36.51 (UUU) [9].

This means that for the resistant varieties an increase in the total unsaturation of the fatty acids in the PCs as compared with the susceptible varieties is characteristic. To confirm this hypothesis, let us discuss results on variety S-6029 [10] grown on a wilt-infected background. In this case, the plant, resisting infection, passed through a complete cycle of its development as far as the development of ripe seeds, and when its PLs were compared with the PLs of plants grown on a healthy background we observed the following fact:

an increase in the total degree of unsaturation of the fatty acids of the PC of the plants grown on the infected background and a quantitative increase in the species U-U, i.e., there was a redistribution of the unsaturation within the molecules, which can be explained by a tendency of the cells to retain a definite physicochemical state of the membrane with a change in the conditions of the environment [11].

In all cases, variety S-6029 grown on an infected background occupied an intermediate position between the same variety grown on a healthy background and resistant varieties, i.e., there was a tendency to approach the resistant form. This means that the changes in the PLs of the resistant varieties as compared with the susceptible varieties are characteristic for these fine-fibered varieties.

EXPERIMENTAL

The isolation and purification of homogeneous PLs, and also the alkaline and enzymatic hydrolysis of the PLs were carried out as described previously [6]. In two-dimensional TLC the first direction was run with chloroform–methanol–25% ammonia (14:5:1) and the second direction with chloroform–methanol–acetic acid–water (14:5:1:1). The methyl esters of the fatty acids were analyzed as described in [12].

CONCLUSION

The qualitative and quantitative compositions, and also the total and positions distributions of the fatty acids of the main PLs of the fine-fibered varieties of the cotton plant S-6022, S-6015, S-6034, S-6037, and 9123-I have been studied.

The changes in the qualitative and quantitative ratio of the PLs and also of the fatty acids in the PC molecules of the PCs may play a definite role in the formation of the immunity of the plants and also be a characteristic of resistance to the action of the fungus *Fusarium*.

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