This is the first time that the $C_{31:0}$ and $C_{29:0}$ aliphatic acids have been detected as natural compounds, and it is the first time that the ethyl esters of the C_{32}, C_{31}, C_{30}, C_{29}, and C_{28} fatty acids have been isolated from the seed oils of higher plants.

LITERATURE CITED

1. H. Budzikiewicz, C. Djerassi, and D. Williams, Interpretation of Mass Spectra of Organic Compounds, Holden-Day, San Francisco (1964).
2. N. P. Rylander and S. Meyerson, J.Am. Chem. Soc., 78, 5799 (1956).
3. M. Kates, Techniques of Lipidology, North-Holland, Amsterdam; American Elsevier, New York (1972).
4. T. M. Jeong, T. Itoh, T. Tamura, and T. Matsumoto, Lipids, 9, 921 (1974).
5. Beilstein. Handbuch der organischen Chemie, 6, 593.
6. G. Slamp and F. A. McKeller, J. Am. Chem. Soc., 84, 204 (1962).
7. T. Tamura and T. Matsumoto, Lipids, 9, 173 (1974).

PHOSPHOLIPIDS OF *Goebelia* SEEDS

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The qualitative and quantitative compositions of the phospholipids of the seeds of *Goebelia pachycarpa* and the fatty-acid composition of the total phospholipids and of homogeneous fractions have been studied. The molecular weights of the main fractions have been calculated.

Goebelia pachycarpa Bunge. (*Sophora pachycarpa* C. A. Mey.), family Leguminosae (Fabaceae) is a perennial herbaceous plant which is widely distributed in the desert-steppe territories of Central Asia [1].

A few representatives of this family have been studied for their phospholipid (PL) content [2-8] and the total phospholipids of their seeds proved to be extremely diverse both in the qualitative and in the quantitative respect. The detailed molecular compositions of the individual classes of PLs have been studied for only two representatives of this family — *Glycine max* (an industrial soybean crop) [7] and *Psoralea drupaceae* (scurf pea) [8].

We have investigated the fractional and fatty-acid compositions of the PLs of the seeds of *Goebelia pachycarpa* collected in the environs of Tashkent.

The total PLs were obtained and freed from accompanying impurities by a known procedure [9, 10]. The yield of purified total material was 1.5% on the weight of the air-dry seeds. By two-dimensional TLC in systems 1 and 2 we determined the qualitative compositions of the total PLs and, by determining the amounts of phosphorus in the spots [11], the quantitative distribution of the individual PL fractions in the total. The mean results of three determinations were as follows (%): phosphatidylcholines (PCs), 41.7; phosphatidylinositols (PIs), 25.6; phosphatidylethanolamines (PEs), 18; N-acyllysophosphatidylethanolamines (N-acyllyso-PEs), 5.5; lysophosphatidylcholines (lyso-PCs), 5.1; and N-acylphosphatidylethanolamines (N-acyl-PEs), 4.1.

The individual groups of phospholipids were separated by column chromatography on silica gel, being eluted with mixtures of chloroform and methanol in various ratios, followed by subfractionation in a thin layer of silica gel in system 1.

The structures of the phospholipids were confirmed by the results of determinations of their contents of P, N, and ester groups, and also by identifying the water-soluble products of acid hydrolysis.

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TABLE 1. Composition and Position Distributions of the Fatty Acids and Phospholipids of *Goebelia pachycarpa*

Phospholipids	Fatty acid, %									
	12:0	14:0	16:0	16:1	18:0	18:1	18:2	18:3	ΣП	ΣН
Total phospholipids	0,9	1,2	30,8	3,2	7,0	17.8	33,9	5,2	39,9	60,1
Phosphatidylcholines										
total	0,3	0,4	15,6	0,8	4,6	26,7	51,6	—	20,9	79,1
position 1	0,3	0,4	26,3	1,0	9,0	24,7	38,3	—	36,0	64,0
position 2	—	—	2,0	1,0	—	29,0	68,0	—	2,0	98,0
Phosphatidylethanolamine										
total	0,3	0,3	20,0	0,6	3,7	24,5	50,6	—	24,3	75,7
position 1	0,4	0,5	31,8	0,9	5,6	22,6	38,2	—	38,3	66,7
position 2	—	—	6,0	—	4,0	24,2	65,8	—	10,0	90,0
Phosphatidylinositols										
total	0,5	0,6	27,0	1,9	5,7	15,0	47,6	1,7	33,8	61,2
position 1	1,0	1,9	44,0	2,6	9,8	11,3	23,0	6,4	56,7	43,3
position 2	1,1	1,6	5,3	2,40	2,3	18,2	69,1	—	10,3	89,7
N-Acylphosphatidylethanol-amines	1,9	2,4	8,1	3,8	7,2	12,2	64,4	—	19,6	80,4
N-Acyllysophosphatidyl-ethanolamines	2,0	2,1	26,0	3,2	4,8	14,6	25,7	21,6	34,9	65,1
Lysophosphatidylcholines	1,3	1,7	26,0	3,9	8,2	20,6	38,3	—	37,2	62,8

The total fatty-acid composition of the PLs and the position distribution in the acyl radicals of the components present in largest amount were established by methods described previously [12] (Table 1).

In the mixture of fatty acids from the total phospholipids and from the individual fractions, 7-8 acids were identified by the GLC method. The predominating acid among the saturated members for all the phospholipids was palmitic, and among the unsaturated acids linoleic. It is mainly at the expense of these acids that a change took place in the fatty-acid composition of the phospholipids: The PCs and N-acyl-PEs had similar degrees of unsaturation and the PI molecules were more saturated. The fatty-acid radicals present in positions 2 of the main PLs were characterized by unsaturation (89.5-98.1%), while the positions 1 were esterified predominantly with saturated acids.

The *Goebelia* phospholipids differed from the scurf pea PLs by the absence of PGs [8] and by the distribution of fatty acids in the individual classes of PLs. Thus, in *Goebelia* the 18:3 acid was localized mainly in the N-acyllyso-PE fraction and to a smaller extent in the PIs, while in the scurf pea it was distributed uniformly among all the classes of PLs.

The results on the position distribution of the fatty acids in the main PL fractions enabled us to calculate the possible molecular species: in the PCs and PEs 28 each, and in the PIs 56 species. According to unsaturation, these can be given as follows (%):

	PCs	PEs	PIs
Disaturated	0.8	3.5	5.8
Diunsaturated	62.6	55.8	38.8
Saturated-unsaturated	35.3	34.8	50.9
Unsaturated-saturated	1.3	5.9	4.5

Thus, diunsaturateds predominate in the PCs and PEs, and unsaturated-saturateds in the PIs.

EXPERIMENTAL

The solvents were purified and rendered absolute by standard methods [13]. For chromatography we used type KSK silica gel: up to 100 μ for thin-layer chromatography, and 160-250 μ for column chromatography. The solvent systems for TLC were: 1) chloroform–methanol–25% ammonia (65:35:5) [14], and 2) chloroform–methanol–water (65:25:4) [15]. For the water-soluble products of acid hydrolysis we used 2% ammonia–methanol (2:3) [16].

The fatty acid methyl esters were analyzed on a Khrom-41 gas-liquid chromatograph with a flame-ionization detector in a steel column (2500 × 3 mm) filled with 17% of poly(ethylene succinate) on Celite-545. The temperature of the column was 196-198°C and of the evaporator 250°C. The rate of flow of carrier gas (helium) was 35 ml/min.

SUMMARY

It has been established that the composition of the phospholipids of *Goebelia pachycarpa* is the usual one. A structural analysis has been performed of homogeneous fractions of phospholipids and it has been found that in the main fractions linoleic acid occupies position 2 predominantly, and linolenic acid is mainly localized in the N-acyllysophosphatidylethanolamines.

LITERATURE CITED

1. M. M. Lakhina, Flora of Uzbekistan [in Russian], Tashkent, Vol. III (1955), p. 401.
2. C. R. Scholfield and H. J. Dutton, J. Biol. Chem., 214, 633 (1955).
3. A. C. Wagenknecht, L. M. Lewis, and H. E. Carter, J. Biol. Chem., 234, 2265 (1959).
4. H. Pardum, Fette Seifen, Anstrichmittel, 64, 536 (1962).
5. R. Aneja, J. S. Chadra, and J. A. Knoggs, Biochim. Biophys. Res. Commun., 36, 401 (1969).
6. R. M. C. Dawson, N. Klarke, and R. H. Quarles, Biochim. J., 114, 265 (1969).
7. S. Kimura et al., J. Food Sci. Technol., 16, 564 (1969). (From RZhKhim, 20R, 375 (1970).
8. Kh. S. Mukhamedova and S. T. Akramov, Khim. Prir. Soedin., 12 (1979).
9. J. Folch, M. Lees, and J. H. Sloane-Stanley, J. Biol. Chem., 226, 497 (1957).
10. M. E. McKillican and J. A. G. Larose, J. Am. Oil Chemists' Soc., 47, 256 (1970).
11. D. Tevekelov, Izv. Instituta po Khranene, Bolg. Akad. Nauk, 7, 5 (1968).
12. Kh. Karshiev, L. A. Shustakova, and S. T. Akramov, Khim. Prir. Soedin., 693 (1975).
13. Preparative Organic Chemistry [in Russian], Moscow–Leningrad (1965).
14. H. Wagner, L. Horhammer, and P. Wolff, Biochem. Z., 334, 175 (1961).
15. É. V. Dyatlovitskaya, T. I. Torkhovskaya, and L. D. Bergel'son, Biokhimiya, 34, 177 (1969).
16. O. W. Thole and W. Wober, Z. Analyt. Chem., 205, 442 (1964).

COMPOSITION OF THE TRIACYLGLYCEROLS OF THE SEEDS OF SOME REPRESENTATIVES OF THE FAMILY LABIATAE

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The fatty acid compositions of five species and the compositions of the triacylglycerols of 22 species of the family labiatae have been studied for the first time. Octadeca-ω12,13-dienoic acid has been detected in five species. The typical compositions of the triacylglycerols differs from those of known plant oils with a similar set of fatty acids by the absence of triacylglycerols of the S_3 type and the presence of the S_2U type (0.1-1.6%). The main types are SU_2 (5-24%) and U_3 (74-95%). In a comparison of the position-species composition of the oils studied it was found that the oils of the plants of this family are distinguished by a greater diversity of species of triacylglycerols and also by the nature of the distribution of the unsaturated acyl residues between the 1,3- and 2-positions. In the majority of oils studied, the 2- position is enriched with the 18:1 acid, while the 18:2 acid is distributed predominantly in the 1,3- positions, and the nature of the distribution of the 18:3 acid is determined by its proportion in the total.

The position distribution of the acids in triacylglycerols (TAGs) depends to a certain degree on the structure of the acyl radicals. In the general case, in plant oils unsaturated acyls occupy the 2- position of the TAGs and the saturated acyls the 1,3- positions, in contrast to animal fats where the secondary hydroxyl of glycerol is esterified mainly with saturated acids [1]. In addition to saturated acids of the C_{16} and C_{18} series, the 1,3- posi-

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