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

T. V. Panekina, S. D. Gusakova, E. M. Zalevskaya, and A. U. Umarov

UDC 547.915:665.3

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-

Institute of the Chemistry of Plant Substances, Academy of Sciences of the Uzbek SSR, Tashkent. Translated from Khimiya Prirodnykh Soedinenii, No. 5, pp. 618-625, September-October, 1979. Original article submitted May 4, 1979.

 0009-3130/79/1505-0538$07.50

tions in vegetable TAGs are also acylated by unsaturated acids with chains having more than 18 carbon atoms. Oleic acid (18:1) and linolenic acid (18:3) may occupy any of the three positions of the TAGs. Enrichment of the second position with these acids is observed when they are present in considerable amount. Linoleic acid (18:2) is concentrated mainly in position 2 [2].

Although the structure of the TAGs of plant oils, especially edible oils, has been studied in more detail than the TAGs of animal fats, the nature of the distribution of the individual acids has not been elucidated completely because of a deficiency of experimental facts.

Let us consider the results of a study of the position-species composition of the TAGs of the seeds of 22 wild and two cultivated species (24 samples) of the family Labiatae and the features of the distribution of the fatty acids in the oils of the plants of this family over the three positions of the TAGs.

The seeds of 18 species were collected in August-September, 1977-1978. To calculate the composition of the TAGs of the species *Salvia sclarea* [3], *Ziziphora pedicellata* [4], *Origanum tytthanthum*, and *Mentha asiatica* [5] we used information obtained previously. The seeds of species of *Monarda*, *Eremostachys*, and *Marrubium*, and of *Salvia aethiopsis* and *Hyssopus* were collected in the Tashkent botanical garden and those of *Lavandula* and *Salvia sclarea* (cultivated species, seed pool) in the fields of the "Dolina roz" communal farm, Moldavian SSR, of *Nepeta pannonica** in the valley of the river Chon-Kemin, KirgSSR; and the other species† in Tashkent province. The seeds of *Ocimum basilicum* and *Monarda rosea* consisted of a mixture of garden forms, and samples I and II of the species *Monarda fistulosa* were obtained from two collections. The species affiliation of the three plants of the genera *Monarda*, *Salvia*, and *Stachyopsis* have not yet been determined.

Information on the fatty-acid compositions of the oils of the seeds of 14 species of the family Labiatae growing in Central Asia and elsewhere has been published previously [3-7]. The compositions of the acids of five species (*Eremostachys hissarica*, *Lavandula vera*, *Marrubium alternidens*, *Monarda rosea*, and *Phlomis salicifolia*) and the position-species composition of the TAGs of 22 species (24 samples) of plants of this family are given here for the first time.

In all cases, the oils isolated from the clean seeds were mobile liquids with a yellow coloration of various tinges and with a faint pleasant odor. The total TAGs were isolated from the oils by chromatography on a column of silica gel. In the separation of oils with high contents of the 18:3 acid, far-reaching fractionation of the TAGs took place on the column, i.e., the first fractions were enriched with the less polar species (POO, SLeL, PLL, etc.), and the last fractions consisted of the most polar species LeLeL and LeLeLe.‡ Since these fractions also contained other components of the oils similar in polarity, they were rechromatographed and were then combined with the bulk of the TAGs.

We isolated the acids from the total TAGs by alkaline hydrolysis, and these were analyzed in the form of their methyl esters by TLC to find the total acid composition. Another part of the total material was hydrolyzed with the aid of porcine pancreatic lipase. The degree of hydrolysis was monitored from the amounts of fatty acids and diacylglycerides liberated in the amount of uncleaved TAGs found by TLC. The 2-monoacylglycerols (2-MAGS) were isolated by preparative TLC and were saponified, and the resulting acids were methylated and were analyzed by GLC. The position-species composition of the TAGs was calculated by Coleman's method [8] using the results of lipolysis.

The results of the analysis of the composition of the acids are given in Table 1. As can be seen from Table 1, six species (18 samples) related with respect to the composition of the acids to the linolenic-, two species to the linoleic-, and three species to the oleic-containing oils. In the TAGs of *Salvia splendens* the amounts of 18:2 and 18:3 acids were approximately equal. The 16:1 acid was present in trace amounts in all the oils, and the sum of the saturated acids, in which the 16:0 compound predominated, did not exceed 9%. In five of the oleic- and linoleic- containing oils the presence of laballenic acid was established

*Collected by S. Melibaev of the Laboratory of Medicinal Plants.

†Collected by A. Dzhabbarov of the Laboratory of Medicinal Plants.

‡P, S, O, L, and Le represent the acyl radicals of the 16:0, 18:0, 18:1, 18:2, and 18:3 acids, respectively.

TABLE 1. Compositions of the Acids of the Triacyl- and 2-Monoacylglycerols of Oils of the Family Labiatae

Plant species	Yield of oil, %	Acid (GLC, mole%)											
		16:0		16:1		18:0		18:1		18:2		18:3	
		TAGs	MAGs	TAGs	MAGs	TAGs	MAGs	TAGs	MAGs	TAGs	MAGs	TAGs	MAGs
Eremostachys hyssarica	11,4	6,1	2,2	1,1	0,8	Tr.	Tr.	69,5	73,4	19,3*	17,4	4,0	6,2
Marrubium alternidens	22,9	3,9	1,3	0,2	0,6	0,6	Tr.	25,4	32,0	68,7*	62,7	1,2	3,4
Phlomis salicifolia	12,0	4,6	1,4	0,6	0,5	Tr.	Tr.	68,3	62,9	26,4*	31,1	0,1	4,1
Stachys betoniciflora	28,5	1,3	0,7	Tr.	Tr.	0,5	Tr.	28,0	36,5	68,8*	61,6	1,4	1,2
Stachyopsis sp.	11,4	3,2	1,4	0,4	0,8	Tr.	Tr.	64,0	66,8	31,4*	29,6	1,0	1,4
Hyssopus officinalis	24,2	4,8	1,3	Tr.	Tr.	1,3	Tr.	13,9	16,4	17,2	21,6	62,8	60,7
Lavandula vera (cult.)	20,0	4,3	5,0	Tr.	0,9	0,5	1,5	8,6	15,3	10,2	17,5	76,4	59,3
Melissa officinalis	22,7	4,7	1,0	Tr.	Tr.	1,6	Tr.	7,3	9,4	30,1	41,0	56,3	48,6
Mentha asiatica	22,2	5,7	8,0	Tr.	Tr.	1,6	3,1	7,6	15,4	29,5	30,9	55,6	42,6
Monarda didyma	18,7	2,4	2,4	Tr.	Tr.	1,0	0,1	9,3	19,9	13,1	19,5	74,2	59,8
Monarda fistulosa I	20,4	2,8	1,8	Tr.	0,4	1,1	0,3	13,4	38,4	13,0	19,3	69,7	39,8
Monarda fistulosa II	19,5	2,4	1,8	Tr.	Tr.	1,1	0,4	11,8	21,9	11,8	15,8	72,9	60,1
Monarda rosea	22,5	2,8	1,5	Tr.	0,3	0,9	0,3	8,1	21,5	15,0	22,1	73,2	54,3
Monarda sp.	25,7	2,4	1,6	Tr.	Tr.	0,7	0,4	11,7	19,8	10,3	16,2	74,9	62,0
Nepeta pannonica	24,6	3,0	8,7	0,3	Tr.	0,6	Tr.	5,5	15,5	18,8	27,0	71,8	48,8
Ocimum basilicum	24,2	6,3	1,9	Tr.	Tr.	1,3	0,5	9,6	13,1	19,4	31,7	63,4	52,8
Origanum tythanthum	26,7	6,4	1,0	Tr.	Tr.	1,8	—	7,8	12,8	19,8	26,5	64,2	59,7
Salvia aethiopis	17,7	6,2	4,1	0,2	0,4	Tr.	0,5	22,7	13,7	14,8	18,9	56,1	62,4
Salvia sclarea	32,3	7,2	1,8	Tr.	Tr.	2,0	0,9	20,5	26,6	16,4	19,8	53,9	50,9
Salvia sclarea (cult.)	21,5	5,8	2,8	Tr.	0,4	1,2	0,4	16,0	23,8	16,6	23,6	60,4	49,0
Salvia sp.	17,1	6,4	4,4	Tr.	0,8	Tr.	0,9	24,3	35,5	15,3	18,0	54,0	40,4
Salvia virgata	25,1	5,5	0,9	Tr.	Tr.	1,6	Tr.	10,6	10,8	24,5	27,7	57,8	60,6
Salvia splendens	26,5	6,8	1,9	Tr.	Tr.	2,3	0,5	12,7	12,5	41,5	43,0	36,7	42,1
Ziziphora pedicellata	—	6,1	0,7	Tr.	Tr.	1,2	—	9,1	14,2	16,1	22,6	67,5	62,5

*Includes the ordinary 18:2 acid (linoleic) and the ω12,13-18:2 acid (laballenic).

TABLE 2. Selectivity Factors and Indices of the Saturation of the Acids in the 2- Positions of the Triacylglycerols

Plant species	Acid, %					
	18:1		18:2		18:3	
	% of acid in position 2	SF	% of acid in position 2	SF	% of acid in position 2	SF
Eremostachys hissarica	35	1,01	30	0,86	52	1,49
Marrubium alternidens	42	1,22	30	0,88	94	2,74
Phlomis salicifolia	31	0,89	39	1,14	100	3,96
Stachys betoniciflora	43	1,29	30	0,88	28	0,85
Stachyopsis sp.	35	1,02	31	0,92	47	1,37
Hyssopus officinalis	39	1,12	42	1,19	32	0,92
Lavandula vera (cult.)	59	1,81	57	1,75	26	0,80
Melissa officinalis	43	1,22	45	1,29	29	0,82
Mentha asiatica	67	2,11	35	1,09	25	0,80
Monarda didyma	71	2,09	50	1,46	27	0,78
Monarda fistulosa I	95	2,81	74	1,46	19	0,56
Monarda fistulosa II	62	1,83	45	1,32	27	0,81
Monarda rosea	88	2,60	49	1,44	25	0,73
Monarda sp.	56	1,67	52	1,55	27	0,82
Nepeta pannonica	94	2,98	48	1,52	23	0,72
Ocimum basilicum	45	1,29	54	1,55	28	0,79
Origanum tytthanthum	55	1,52	45	1,24	31	0,86
Salvia aethiopis	20	0,59	42	1,26	37	1,09
Salvia sclarea	43	1,21	40	1,13	31	0,88
Salvia sclarea (cult.)	49	1,43	47	1,37	27	0,78
Salvia sp.	49	1,44	39	1,16	25	0,74
Salvia virgata	34	0,95	38	1,06	35	0,98
Salvia splendens	33	0,92	34	0,96	38	1,07
Ziziphora pedicellata	52	1,46	47	1,31	31	0,86

(IR spectrum, TLC) [6], and in the mixture of acids from *Eremostachys hissarica* there were traces of the 17:0 and 20:0 acids (GLC).

A comparison of the results that we have obtained with information in the literature showed that the acids of the TAGs of species growing in Central Asia contained 3-6% more unsaturated components than the analogous species from other growth sites. It can also be seen from Table 1 that in the 2-MAGs of *Nepeta* the amount of 16:0 acid and in the 2-MAGs of *Mentha* and *Lavandula* the amount of 16:0 and 18:0 acids were greater than the amounts of these acids in the TAGs; in the 2-MAGs of *Salvia sp.* and *Salvia aethopis* the amounts of 16:0 and 18:0 acids were again high in comparison with the other oils. Consequently, the saturated acids in the TAGs of these species are distributed largely in the 2- positions, which is anomalous for plant oils. The reason for this anomaly is being investigated.

The amount of the 16:1 acid in the TAGs of 24 samples was small (about 1%), and therefore it is difficult to draw conclusions; nevertheless, the tendency to some increase in the amount of this acid in the 2-MAGs of individual species confirms the binding of the 16:1 acid with the secondary hydroxyl of the glycerol residue found previously [9].

The competition of the main unsaturated acids in the acylation of the secondary hydroxyl is well illustrated by the selectivity factor (SF), which is defined by the formula

$$([A_2]/[A]):(\sum[A_{II}]_2/\sum[A_{II}]),$$

where $[A_2]$ is the amount of an acid in the 2-MAGs; [A], amount of the same acid in the TAGs; $\sum[A_{II}]_2$, total amount of unsaturated acids in the 2-MAGs; and $\sum[A_{II}]$, total amount of unsaturated acids in the TAGs, mole % [9].

The selectivity factors for the 18:1, 18:2, and 18:3 acids in the samples that we studied are given in Table 2. Table 2 gives figures showing what proportion (as a percentage) of the total amount of acids in a TAG is esterified in position 2. The calculation was carried out by means of the formula

$$X\% = [A_2]\cdot 100/3\cdot[A].$$

TABLE 3. Position-Type Composition of the Triglycerides of Seeds of Species of the Family Labiatae

Plant species	Amount of acylglycerols, % of the total				
	SSU*	SUS	USU	SUU	U_3
Eremostachys hissarica	0,2	0,6	2,0	14,2	83,0
Marrubium alternidens	0,2	0,3	1,2	11,0	87,3
Phlomis salicifolia	0,2	0,4	1,2	11,6	86,6
Stachys betoniciflora	—	—	0,6	4,5	94,8
Stachyopsis sp.	—	—	1,4	7,6	90,8
Hyssopus officinalis	0,2	0,7	0,9	15,2	83,0
Lavandula vera (cult.)	0,6	0,1	5,8	7,2	86,3
Melissa oficinalis	—	0,6	0,7	17,0	81,7
Mentha asiatica	0,7	0,2	10,1	9,2	79,8
Monarda didyma	0,1	0,1	1,2	8,5	90,1
Monarda fistulosa I	0,1	—	1,9	7,7	90,3
Monarda fistulosa II	0,1	0,2	2,1	7,9	89,7
Monarda rosea	0,2	0,6	1,6	8,3	89,3
Monarda sp.	0,1	—	1,7	7,0	91,2
Nepeta pannonica	0,1	0,2	6,2	1,6	91,9
Ocimum basilicum	0,2	0,9	2,0	17,4	79,5
Origanum tytthanthum	0,2	1,4	0,6	20,8	77,0
Salvia aethiopis	0,6	0,5	4,1	12,6	82,2
Salvia sclarea	0,3	1,6	2,2	21,4	74,5
Salvia sclarea (cult.)	0,2	0,7	2,3	16,0	80,8
Salvia sp.	0,8	0,5	4,7	12,4	81,6
Salvia virgata	—	0,9	0,7	18,4	80,0
Salvia splendens	0,4	1,2	1,3	21,8	75,3
Ziziphora pedicellata	—	1,0	0,5	19,0	79,5

*S) Sum of the saturated acids; U) sum of the unsaturated acids.

In the overwhelming majority of known plant TAGs the main unsaturated acids are arranged in decreasing magnitude of the selectivity factor in the sequence L > O > Le, showing that the 18:2 acid, as compared with the 18:1 and 18:3 acids, and regardless of its amount in the total, is esterified mainly in position 2 [9]. On comparing the SFs (Table 2) it may be noted that the sequence L > O > Le exists in the oils of only three plants: *Hyssopus*, *Melissa*, and *Ocimum*. In 14 samples, the acids form the sequence with respect to SFs O > L > Le; in species of *Stachyopsis*, *Marrubium*, and *Eremostachys* Le > O > L; in *Salvia aethiopis* and *Salvia virgata* L > Le > O; and in *Phlomis* and *Salvia splendens* Le > L > O. The proportion of 18:1 acid acylated at the secondary hydroxyl is greater than that of the 18:2 acid in the oils of 17 samples.

In those oils that contain a large amount of it (54-76%), linolenic acid predominantly occupies the 1,3- positions. However, in four out of the five oleic- and linoleic-containing TAGs (an exception being the Stachys species) with a content of the 18:3 acid ranging from traces to 4% and in the TAGs of *Salvia splendens* (37% of 18:3), this acid is esterified almost completely in position 2. Thus, in the majority of the species mentioned, including the seed oil of *Nepeta cataria* studied previously [10], oleic acid has the greater degree of affinity for the secondary hydroxyl of the TAGs than linoleic, and the distribution of the 18:3 acid between the 1,3- and 2- positions depends on the amount of this acid in the total.

In the calculation of the position-species composition of the TAGs, the acids were combined into the following groups: 18:0 with 16:0 (P), 16:1 with 18:1 (O), and, for the oils containing up to 4% of 18:3, 18:3 with 18:2 (L). The position-type compositions of the TAGs of the Labiatae species are shown in Table 3, and the position-type compositions of the main species of TAGs in Tables 4 and 5.

The type compositions of the TAGs of 22 species are similar to the known compositions of other plant oils having a similar set of fatty acids [11], with the exception of the absence of TAGs of the S_3 type in the 18:1- and 18:2-containing oils. If we bear in mind the fact that the amount of S in the initial total is small (Table 1), the absence of S_3 in these oils is normal.

On comparing the position-species composition of the 18:1- and 18:2-containing oils it can be seen that the amount of single-acid species OOO and LLL amounts to one third (32-35%) of the total composition of the TAGs. Another third (about 37%) in the 18:1-containing TAGs consists of the sum of OOL and OLO (in the TAGs of Eremostachys, also POO). In the linoleic-containing TAGs, 37-40% of the composition is due to the sum of the species OLL and LOL. The species of TAGs in the seeds of *Stachyopsis* have a different relationship. The fatty

TABLE 4. Position-Species Composition of the Triglycerides of the 18:1- and 18:2-Containing Oils of the Family Labiatae, mole %

Species of TAG	Eremostachys hissarica	Marrubium alternidens	Phlomis salicifolia	Stachys betoniciflora	Stachyopsis sp.
OOO	35,0	1,6	32,6	2,1	26,7
OOL	20,8	10,2	20,0	12,6	27,4
OLO	8,4	3,1	18,1	3,5	11,6
OLL	5,0	20,0	11,2	21,2	12,0
POO	8,2	1,0	5,6	0,4	3,4
LOL	3,1	16,8	3,0	19,1	7,1
OLeO	2,8	0,2	—	0,1	0,6
OOLe	2,8	—	—	0,2	0,6
POL	2,4	2,8	1,8	1,2	1,8
PLO	1,8	1,6	3,2	0,6	1,6
OLeL	1,8	1,2	—	0,4	0,6
OPO	1,1	0,1	0,7	—	0,6
LOLe	0,8	—	—	0,8	0,4
LLL	0,7	32,2	1,7	32,3	3,1
OPL	0,6	0,4	0,4	0,2	0,6
OLLe	0,6	—	—	0,4	0,4
PLL	0,6	5,4	1,0	2,2	0,8
POP	0,5	0,1	0,3	—	0,1
LLeL	0,3	1,8	—	—	0,2
LLLe	0,2	—	—	1,4	0,2
LPL	0,2	0,7	0,1	0,4	0,2
PLP	0,1	0,2	0,1	—	0,1

acid composition of this oil is similar to the composition of the oil of *Phlomis* and corresponds to oleic-containing oils (18:1, 64%; see Table 1), although the amount of OOO is less than 30%, and 54% of the total species composition of the TAGs is distributed uniformly between the species OOO and OOL. In botanical systematics, differences of opinion exist in relation to the position of the genus *Stachyopsis* in the family Labiatae. Its species are frequently transferred from one genus to another and have been described as species of the genus *Phlomis* or of *Stachys*. On the basis of a number of morphological characteristics, Dyugaeva [12] has proposed to isolate *Stachyopsis* into a separate genus. The information that we have obtained on the chemical composition of the seed oil of *Stachyopsis sp.* indirectly confirms its isolation into an independent genus.

In the group of 18:3-containing oils (Table 5), the amount of the single-acid species LeLeLe varies over wider limits — from 15% in the TAGs of *Salvia sp.* to 43% in the oil of *Lavandula*. They differ still more in their contents of individual position species such as OLeLe (0.4-18%), PLeLe (0.4-9%), and others.

In all species of *Monarda*, of the two-acyl TAGs LeLLe and LeOLe predominate. The species *M. Fistulosa* from collections I and II differ little in their total set of acids, but in the position-species composition of the TAGs the differences are more substantial. Thus, in *M. fistulosa* II there is 10% more of the species LeLeLe, and 10 times more of the species OLeLe and LLL. The same differences are observed for the wild and cultivated varieties of the species *Salvia sclarea*. As compared with linseed oil, which is close to it in acid composition [13], the oil of *S. sclarea* (cultivated variety) possesses a larger set of TAG species — in particular, the species LeLLe and LeOLe, which are absent from linseed oil, make up 21% of the TAGs of *S. sclarea*.

Thus, the results obtained indicate that the oils of the family Labiatae differ from known plant oils by the nature of the distribution of the 18:1, 18:2, and 18:3 acyls between the 1,3- and 2-positions of the TAGs and by a larger species diversity of the acylglycerols.

EXPERIMENTAL

We have previously described the isolation of the oils, their fractionation by column chromatography, and enzymatic hydrolysis [14], and the conditions of gas-chromatographic analysis [10].

TABLE 5. Position-Species Composition of the Triacylglycerols of the 18:3-Containing Oils of the Family Labiatae, mole %

Species of TAG	Hyssopus officinalis	Lavandula vera	Melissa officinalis	Mentha asiatica	Monarda didyma	Monarda fistulosa I	Monarda fistulosa II	Monarda rosea	Monarda sp.	Nepeta pannonica	Ocimum basilicum	Origanum tytthanthum	Salvia aethiopis	Salvia sclarea	Salvia sclarea (cult.)	Salvia sp.	Salvia virgata	Salvia splendens	Ziziphora pedicellata
LeLeLe	24,7	42,8	17,6	16,4	39,5	28,5	37,8	37,1	41,0	33,9	24,9	26,3	17,5	15,6	21,4	14,8	19,3	4,9	30,7
LLeLe	11,6	6,6	14,4	15,2	9,6	6,6	9,3	10,2	7,4	12,2	9,7	13,1	8,4	8,2	8,4	6,6	15,6	11,6	11,2
OLeLe	9,8	4,8	3,6	2,0	3,9	0,5	6,4	1,1	7,7	0,4	5,7	4,2	17,8	9,8	7,8	9,0	7,2	3,6	5,8
LeLLe	8,8	12,5	14,8	11,9	13,0	13,8	9,9	15,1	10,7	18,7	15,1	11,8	5,3	6,1	10,3	6,7	8,8	5,0	11,1
LeOLe	6,7	11,6	3,4	5,9	13,3	27,8	13,8	14,9	13,1	10,8	6,2	5,6	3,9	8,2	10,6	13,4	3,3	1,4	6,9
PLeLe	5,8	4,0	5,0	2,8	3,4	2,7	3,0	3,4	3,0	0,4	7,0	8,2	4,6	6,2	5,4	3,4	6,2	3,6	8,6
LLLe	4,2	2,0	12,2	11,0	3,2	3,2	2,4	4,2	1,9	6,6	5,8	5,3	2,6	3,2	4,2	3,0	7,2	12,0	4,0
OLLe	3,6	1,4	3,2	1,4	1,3	0,2	1,7	0,4	2,0	0,4	3,4	1,8	5,4	3,8	4,0	4,0	3,2	3,8	2,0
LOLe	3,2	1,8	2,8	5,6	3,2	6,5	3,4	4,1	2,4	3,8	2,4	2,8	1,8	4,4	4,2	6,2	2,8	3,4	2,6
OOLe	2,6	1,4	0,8	0,8	1,3	0,5	2,3	0,5	2,5	0,2	1,4	1,0	4,2	5,2	3,8	8,0	1,2	1,0	1,4
OLeL	2,4	0,4	1,6	1,0	0,5	0,1	0,8	0,1	0,7	—	1,0	1,0	4,4	2,6	1,6	2,0	3,0	4,4	1,0
PLLe	2,4	1,2	4,4	2,2	1,5	1,6	1,1	1,7	1,0	0,4	4,6	4,2	1,4	2,8	2,8	1,6	3,2	3,8	3,4
LLeL	1,4	0,3	3,0	3,5	0,6	0,4	0,6	0,7	0,3	1,1	0,9	1,6	1,0	1,1	0,8	0,8	3,2	7,0	1,0
POLe	1,8	1,2	1,0	1,0	1,5	1,6	1,5	1,6	1,2	0,2	2,0	2,0	1,0	3,8	3,0	3,0	1,2	1,0	2,2
PLeL	1,6	0,4	2,2	1,4	0,5	0,5	0,5	0,5	0,4	0,2	0,6	2,4	1,2	1,8	1,2	0,8	2,8	4,4	1,6
PLeO	1,2	0,2	0,6	0,2	0,2	—	0,3	—	0,4	—	1,0	0,8	2,4	2,2	1,0	1,0	1,4	1,4	1,0
OLeO	1,0	0,1	0,2	0,1	0,1	—	0,3	—	0,4	0,4	0,3	0,2	4,6	1,5	0,7	1,4	0,7	0,7	0,3
OLL	0,8	0,2	1,2	0,6	0,1	—	0,2	0,1	0,2	—	0,6	0,4	1,4	1,0	0,8	1,0	1,4	4,4	0,4
OOL	0,6	0,2	0,2	0,4	0,2	—	0,3	0,1	0,2	—	0,2	0,2	1,0	1,4	0,8	1,8	0,6	1,4	0,2
LePLe	0,5	4,7	0,4	4,3	0,9	1,5	1,5	1,2	1,1	6,0	1,1	0,4	1,3	0,9	1,4	1,2	0,3	0,3	0,3
LLL	0,5	0,1	2,5	2,6	0,2	0,2	2,4	0,3	0,1	0,7	0,6	0,7	0,3	3,2	0,4	0,4	1,5	7,1	0,4
POL	0,4	—	0,6	0,4	0,2	0,5	0,2	0,3	0,1	—	0,2	0,6	0,2	0,8	0,6	0,8	0,6	1,4	0,3
LOL	0,4	0,1	0,6	1,3	0,2	0,4	0,2	0,2	0,1	0,3	0,2	0,4	0,2	0,6	0,4	0,7	0,6	2,1	0,2
PLO	0,5	—	0,6	0,2	—	—	0,1	—	0,1	—	0,4	0,2	0,8	0,8	0,5	0,4	0,6	1,4	0,2
PLL	0,5	0,2	1,8	1,0	0,2	0,3	0,1	0,2	0,1	—	1,0	1,0	0,4	0,8	0,5	0,4	1,4	4,4	0,7
OLO	0,4	—	0,2	—	—	—	0,1	0,3	0,1	—	0,2	0,1	1,4	0,6	0,3	0,6	0,3	0,7	0,1
PLeP	0,5	0,1	0,4	0,1	0,1	—	0,1	0,6	—	—	0,6	0,9	0,3	0,7	0,5	0,2	0,6	0,6	0,7
OOO	0,3	—	—	—	—	—	0,1	—	0,1	—	0,1	—	1,0	0,8	0,3	1,2	0,1	0,2	0,1
PPLe	0,2	0,6	—	0,5	0,1	0,1	0,1	0,1	0,1	0,1	0,2	0,2	0,4	0,3	0,2	0,4	—	0,2	—
OPLe	0,2	0,6	—	0,6	0,1	—	0,2	—	0,3	—	0,2	—	1,4	0,6	0,4	1,2	0,2	0,2	—
LPLe	0,2	0,5	0,2	4,0	0,2	0,4	0,4	0,4	0,2	—	0,6	0,2	0,6	0,4	0,4	1,0	0,2	0,8	0,2
POO	0,2	—	—	—	—	—	0,1	—	0,1	—	0,2	0,2	0,6	1,2	0,6	1,0	0,2	0,4	0,2

SUMMARY

1. The composition of the fatty acids of the seed oils of five species and the position-species composition of the triacylglycerols of 22 species of the family Labiatae have been determined for the first time.

2. It has been established that in the oils studied the main types of acylglycerols are U_3 and SU_2, while the type S_2U does not exceed 2% and S_3 is absent.

3. It has been found that in the majority of the species studied position 2 of the acylglycerols is enriched with oleic acid, and the nature of the distribution of linolenic acid is determined by its amount in the total material.

LITERATURE CITED

1. C. Litchfield, Fette, Seifen, Anstrichmittel, 4, 223 (1973).
2. C. D. Evans, D. G. McConnell, G. R. List, and C. R. Scholfield, J. Am. Oil Chemists' Soc., 46, 421 (1969).
3. S. D. Gusakova, A. U. Umarov, and A. L. Markman, Khim. Prir. Soedin., 315 (1968).
4. S. D. Gusakova and A. U. Umarov, Khim. Prir. Soedin., 324 (1975).
5. S. D. Gusakova, Kh. K. Kholmatov, and A. U. Umarov, Khim. Prir. Soedin., 149 (1976).
6. J. M. Hagemann, F. R. Earle, A. A. Wolff, and A. S. Barclay, Lipids, 2, 371 (1967).
7. A. V. Patudin, I. U. Yusupova, and L. A. Voloshina, Rast. Res., 12, No. 2, 272 (1976); G. V. Novitskaya and V. I. Mal'tseva, Rast. Res., 3, No. 3, 438 (1967).
8. M. N. Coleman, J. Am. Oil Chemists' Soc., 38, 685 (1961).
9. F. D. Gunstone, R. J. Hamilton, F. B. Padley, and M. J. Qureshi, J. Am. Oil Chemists' Soc., 42, 965 (1965); F. D. Gunstone and F. B. Padley, Chem. Phys. Lipids, 1, 110 (1967).
10. T. V. Panekina, S. D. Gusakova, and A. U. Umarov, Khim. Prir. Soedin., 174 (1978).
11. A. G. Vereshchagin, The Biochemistry of the Triglycerides [in Russian], Moscow (1972), pp. 188-191.
12. T. M. Dyugaeva, in: The Systematics, Anatomy, and Ecology of Plants of the Asiatic Part of the USSR [in Russian], Leningrad (1976), p. 52.
13. F. D. Gunstone and F. B. Padley, J. Am. Oil Chemists' Soc., 42, 957 (1965).
14. T. V. Panekina, S. D. Gusakova, M. Ya. Tabak, and A. U. Umarov, Khim. Prir. Soedin., 44 (1978).