Chemistry of Natural Compounds, Vol. 32, No. 1, 1996

COMPOSITION OF THE ACYLGLYCEROLS OF THE WOODY VERDURE OF *Larix sibirica*. I

L. P. Rubchevskaya and S. M. Repyakh

UDC 634.0.813.2

The dynamics of the levels of mono-, di-, and triacylglycerols in Siberian larch needles during the vegetation period have been determined. The composition and structure of the triacylglycerols have been studied. It has been shown that in the triacylglycerol molecules the sn-2 position is predominantly acylated by unsaturated acids.

We have previously studied the acylglycerols of the cambial zone and phloem of the Siberian larch [1-3]. In order to elucidate the mechanism of their transformations in photosynthesizing tissue we have now investigated the levels and compositions of the acylglycerols of Siberian larch needles in the course of vegetation. The results of the investigations are given in Tables 1 and 2.

Below we report the levels of acylglycerols in Siberian larch needles (means of three-year investigations, % on the absolutely dry tissue):

	May	June	July	August	September
1(3)-Monoacylglycerols	0.007	0.005	0.007	0.004	0.002
2-Monoacylglycerols	0.002	0.005	0.007	0.006	0.001
1,2(2,3)-Diacylglycerols	0.004	0.006	0.007	0.009	0.002
1,3-Diacylglycerols	0.007	0.007	0.004	0.007	0.002
Triacylglycerols	0.030	0.045	0.048	0.032	0.005
Sum	0.050	0.068	0.073	0.058	0.012

The results obtained show that the acylglycerols of Siberian larch needles are represented by mono-, di-, and triacylglycerols (TAGs). The highest level of acylglycerols is present in the needles during the period of the maximum activity of the photosynthetic apparatus (July) — 0.073% — and the lowest in the period of needle shedding (September) — 0.012%.

The bulk of the acylglycerols consist of TAGs. Their proportion of the total acylglycerols in the needles amounts to more than 50% throughout the vegetation period.

The composition of the fatty acids acylating the sn-1, sn-2, and sn-3 positions in the TAG molecules was established by stereospecific analysis. The amounts of fatty acids were determined by gas-liquid chromatography.

The fatty acid composition of the TAGs is given in Table 1. Unsaturated fatty acids predominate. Their amounts in the sn-1, sn-2, and sn-3 positions of the needle TAG molecules change during the vegetation period. The unsaturated acids are the main acids of the TAGs.

In the molecules of the TAGs of Siberian larch needles, the sn-2 positions are predominantly acylated by unsaturated fatty acids. Their level changes in the course of vegetation from 61.51% (May) to 73.92% (July) of the total acids in the sn-2 position.

From the figures of Table 1, with the aid of a formula given in [2], we calculated the selectivity factors for the unsaturated acids — 18:1, 18:2, 18:3, and 16:1 — acylating the sn-2-position in the TAG molecules:

Month	Selectivity factor			
	18:3	18:2	18:1	16:1
May	0.60	1.23	1.02	0.58
June	0.71	1.01	1.02	1.07
July	0.87	1.21	0.98	0.94
August	0.92	1.32	1.05	0.46
September	1.07	1.29	0.99	0.77

Krasnoyarsk State Technological Academy, fax (3192) 27 44 40. Translated from Khimiya Prirodnykh Soedinenii, No. 1, pp. 15-18, January-February, 1996. Original article submitted June 19, 1995.

0009-3130/96/3201-0011$15.00

TABLE 1. Compositions of the Fatty Acids in the sn-1, sn-2, and sn-3 Positions of the Molecules of the Triacylglycerols of Siberian Larch Needles (% on the total acids)

Month	Position	12:0	14:0	16:0	16:1	18:3	18:2	18:1	18:0	20:0	22:0	24:0
	sn-1	10.32	3.00	14.22	6.70	4.12	6.00	30.66	10.45	4.85	6.82	2.86
May	sn-2	0.60	2.16	16.76	5.60	3.22	7.85	49.77	8.88	3.90	0.83	0.43
	sn-3	4.00	8.33	8.76	13.40	5.88	2.10	41.20	7.45	2.88	4.30	1.70
	sn-1	7.00	7.00	13.80	4.41	5.85	5.10	32.80	9.66	6.00	4.17	4.21
June	sn-2	1.00	1.00	13.88	5.34	4.13	6.40	52.60	9.73	5.46	0.26	0.20
	sn-3	3.30	10.29	8.60	3.00	4.98	4.80	46.70	5.44	7.96	2.80	2.13
	sn-1	10.20	2.00	15.20	3.49	5.10	6.33	36.80	2.22	8.45	5.11	5.10
July	sn-2	1.85	0.83	16.11	5.00	6.12	9.80	53.00	2.74	3.32	0.43	0.80
	sn-3	5.90	8.00	11.10	4.70	6.17	3.03	45.20	3.96	5.28	3.41	3.25
	sn-1	11.68	6.00	13.12	5.44	4.11	4.68	29.28	5.76	8.27	5.89	5.77
August	sn-2	2.40	4.00	15.42	3.46	5.92	7.44	48.62	7.89	4.00	0.44	0.41
	sn-3	7.77	10.00	7.33	9.70	6.13	2.00	37.77	6.12	6.08	3.00	4.10
	sn-1	12.10	5.45	14.33	2.11	3.10	3.50	33.46	6.10	9.18	3.25	7.42
September	sn-2	4.70	4.00	14.45	3.76	4.98	5.12	47.65	10.10	4.33	0.35	0.66
	sn-3	8.10	7.07	18.88	6.00	3.30	1.10	36.65	3.89	7.12	2.67	5.32

TABLE 2. Main Molecular Forms of the Triacylglycerols of Siberian Larch Needles, % on the Total Triacylglycerols

Name	May	June	July	August	September
OOO	6.28	8.05	8.82	5.38	5.84
LOO	1.23	1.25	1.52	0.85	0.61
OOL	0.32	0.82	0.59	0.28	0.16
OOLe	0.90	0.86	1.20	0.87	0.53
OOP	1.34	1.48	2.16	1.04	3.00
POO	2.92	3.39	3.64	2.41	2.50
POP	0.62	0.62	0.89	0.47	1.29
OPO	2.12	2.13	2.68	1.71	1.77
PPO	0.98	0.90	1.11	0.76	0.76
PPP	0.21	1.65	0.27	0.15	0.39
LaOO	2.12	1.72	2.44	2.14	2.11
SOO	2.14	2.37	0.53	1.05	1.06
OSO	1.12	1.49	0.46	0.87	1.22
OOPo	2.04	0.52	0.92	1.38	0.96

*O, L, Le, P, La, S, and Po represent the acyls of the 18:1, 18:2, 18:3, 16:0, 12:0, 18:0, and 16:4 acids.

The results obtained show that, with respect to their capacity for acylating the sn-2 positions in the TAG molecules, the unsaturated acids of the C_{18} series form the following sequence of decreasing selectivity factors: 18:2 > 18:1 > 18:3; i.e., the sequence of the majority of plant acylglycerols is followed. It must be mentioned that in its capacity for acylating the sn-2 position, the 16:1 acid competes with the 18:1 species.

In the needle TAG molecules the fatty acids are distributed nonuniformly between the sn-1 and sn-3 positions — i.e., the TAGs have asymmetric structures. The stereospecific composition of the TAGs of Siberian larch needles and its change in the course of vegetation were determined from the experimental results. The main molecular forms of the TAGs are shown in Table 2.

As can be seen from Table 2, the bulk of the needle TAGs consist of acylglycerols in which the sn-2 positions are acylated by unsaturated acids, especially the 18:1 acid. Among such acylglycerols sn-glycerol 1,2,3-trioleate (OOO) predominates. In the course of vegetation their amount changes from 5.84 to 8.82%, with a maximum in July and a minimum in September. Among the TAGs having saturated acids in the sn-2 positions the main ones are those with acyls of the 16:0 acid. In the course of vegetation a definite tendency to a change in the stereospecific composition of the needle TAGs can be traced. It consists in the accumulation until July — the period of the maximum photosynthetic activity — of TAG molecules in which the sn-2 position is acylated by unsaturated acids, and a gradual fall in their level up until September.

EXPERIMENTAL

The acylglycerols were isolated from the total lipid fraction by column and thin-layer chromatographies on silica gel, as described in [2]. The total lipids were obtained by the method of Bligh and Dyer [4]. Needles were gathered from Siberian larch trees from May to September in the second decade of each month for three years [1]. Needles were taken from each third crown and were averaged, the number of trees ensuring the necessary reliability of the samples. Stereospecific analysis of the triacylglycerols was carried out by the method of [5]. Fatty acid compositions were determined by GLC as described in [2].

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