COMPOSITION OF THE FATTY OILS OF THE BALSAMS OF VARIOUS CONIFERS

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We have studied the nature of the fatty acids obtained from the balsams of four species of spruce – Picea excelsa Link (Norway spruce), P. obovata Ledeb. (Siberian spruce), P. ajanensis Fisch. (Yeddo spruce), and P. tianschanica Rupr. (Tien Shan spruce): two species of the pine – Pinus silvestris L. subsp. sibirica Ledeb. (Scotch pine, Siberian subspecies), and Pinus pityusa Stev. and Larix dahurica Turcs. (Dahurian larch). There is no information whatsoever on this topic in the literature.

To isolate the fatty acids (FAs) from the balsams of the conifers, we used the property of the FAs of being readily esterified by methanol [1].

TABLE 1. Compositions (%) of the Fatty-Acid Fractions Isolated from Conifer Balsams

Acid	Code [5]	RRV	Composition of the mixture of fatty acids: Yeddo spruce	Tien Shan spruce	Norway spruce	Siberian spruce	Scotch pine, Siberian subsp.	Pinus pityusa	Dahurian larch
Undecenoic	11:1	0,126	0,4	0,5	0,6	0,2	1,1	1,3	1,0
Lauric	12:0	0,153	2,4	0,9	0,7	0,8	0,2	1,7	—
11-Methyldodecanoic	iso-13:0	0,182	0,2	—	0,2	Tr.	2,0	—	5,1
Tridecanoic	13:0	0,205	2,9	2,3	0,9	0,3	—	3,7	Tr.
12-Methyltridecanoic	iso-14,0	0,263	4,9	0,6	—	—	—	6,7	0,3
Physetenic	14:1[5]	0,316	Tr.	Tr.	3,1	0,5	3,1	—	—
13-Methyltetradecanoic	iso-15:0	0,336	7,8	8,8	—	Tr.	0,3	9,0	0,5
12-Methyltetradecanoic	anti-iso 15:0	0,370	—	—	0,7	0,6	—	—	7,1
Pentadecanoic	15:0	0,386	0,6	0,9	0,8	—	5,2	Tr.	—
13,13-Dimethyltetradecanoic	neo-16:0	0,419	—	—	0,7	0,9	—	0,4	2,2
14-Methylpentadecanoic	iso-16:0	0,460	11,3	9,4	—	—	1,3	10,0	8,4
Palmitic	16:0	0,550	0,3	3,0	8,4	7,5	3,3	0,5	1,6
Hexadec-7-enoic	16:1[7]	0,611	11,3	11,7	2,4	0,4	0,8	—	—
Palmitoleic	16:1[9]	0,623	—	—	—	—	—	13,0	10,8
14-Methylhexadecanoic	anti-iso 17:0	0,680	—	—	1,4	3,3	6,0	—	—
Margaric	17:0	0,730	1,4	0,6	0,6	0,5	—	—	Tr.
Hexadeca-4,7,10-trienoic	16:3[4, 7, 10]	0,840	10,8	9,5	1,1	0,5	Tr.	13,1	12,3
Hexadeca-6,9,12-trienoic	16:3[6, 9, 12]	0,908	—	0,8	—	—	6,4	—	—
Stearic	18:0	1,00	1,4	2,7	3,9	2,3	0,6	0,8	0,8
Oleic	18:1[9]	1,12	13,4	11,7	27,8	27,6	9,0	12,5	9,9
Isooleic or Isolinoleic	18:1 or 18:2	1,21	—	2,3	—	—	4,6	—	—

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TABLE 1 continued

Acid	Code[5]	RRV	Composition of the mixture of fatty acids						
			Yeddo spruce	Tien Shan spruce	Norway spruce	Siberian spruce	Scotch pine, Siberian subsp.	Pinus pityusa	Dahurian larch
Linoleic	$18:2^{9,12}$	1,33	0,9	0,7	24,9	31,0	17,4	1,4	1,6
Octadeca-5,9,12-trienoic	$18:3^{5,9,12}$	1,42	8,9	9,5	7,2	12,4	14,9	10,9	11,8
Linolenic	$18:3^{9,12,15}$	1,73	—	0,3	3,1	2,8	3,1	0,6	0,4
Arachidic	20:0	1,82	—	—	Tr.	1,3	0,4	—	Tr.
Octadeca-6,9,12,15-tetraenoic	$18:4^{6,9,12,15}$	1,96	8,1	8,3	1,1	—	Tr.	8,7	7,5
Eicos-11-enoic	$20:1^{11}$	2,10	0,2	1,8	0,5	—	4,4	—	0,9
Eicosa-8,11-dienoic	$20:2^{8,11}$	2,34	1,0	—	0,6	0,3	Tr.	Tr.	—
Eicosa-11,14-dienoic	$20:2^{11,14}$	2,50	8,2	8,8	2,6	4,0	1,4	3,8	7,3
Eicosa-8,11,14-trienoic	$20:3^{8,11,14}$	2,79	1,2	—	3,5	0,5	4,9	—	—
Behenic	22:0	3,24	1,7	0,9	0,5	1,0	0,8	—	—
Acids of undetermined structure									
X_1	—	0,105	—	2,3	0,9	0,4	0,8	0,1	—
X_2	—	0,165	—	—	—	0,7	—	—	—
X_3	—	0,237	—	—	0,5	Tr.	3,0	—	3,6
X_4	—	0,290	—	0,3	0,6	—	—	—	5,6
X_5	—	0,434	—	—	0,6	—	—	—	1,3
X_6	—	0,507	0,7	1,4	Tr.	0,2	4,9	1,7	—
Total amount of fatty acids in the balsams, %			0,4	0,4	0,7	0,6	0,5	0,3	0,4

The methyl esters of the FAs were analyzed at 200°C on a Khrom-2 chromatograph with a flame ionization detector. The column (3000 × 4 mm) was filled with Chromosorb W (60-80 mesh) impregnated with 20% of poly(ethylene adipate). The carrier gas was helium (60 ml/min). The components of the mixture were identified by known methods [2-5]. As can be seen from Table 1, the FA fractions isolated from the balsams that we investigated consisted mainly of unsaturated FAs. In the balsams of the Norway spruce and the Siberian spruce, the main components are oleic and linoleic acids, and the main saturated fatty acid is palmitic.

As compared with the balsams of these species of spruce, the balsams of the Yeddo spruce and of the Tien Shan spruce contain approximately half the amount of oleic acid and approximately 1/20th the amount of linoleic acid. But, in return, they contain more hexadeca-7-enoic,hexadeca-4,7,10-trienoic, octadeca-6,9,12,15-tetraenoic, and eicosa-11,14-dienoic acids.

Of the saturated fatty acids, 14-methylpentadecanoic and 13-methyltetradecanoic acids predominate in them, although these are not found in the balsams of the Norway and Siberian spruces.

The FA composition of the balsam of the Scotch pine, Siberian subspecies, is almost the same as the balsam of the ordinary Scotch pine [1]. Oleic, linoleic, and octadeca-5,9,12-trienoic acids predominate in it. The balsam of Pinus pityusa is distinguished by a high content of palmitoleic and hexadeca-4,7,10-trienoic acids which are practically absent from the balsam of the Scotch pine, Siberian subspecies. The predominant saturated acid in it is 14-methylpentadecanoic.

The FA composition of the balsam of the Dahurian larch is extremely close to that of P. pityusa.

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