

LIPIDS FROM SEEDS OF *Abies nordmanniana*

N. S. Khatiashvili, L. N. Gogilashvili,
and E. P. Kemertelidze

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Abies nordmanniana (Stev.) Spach. or Caucasian fir (Pinaceae L/ND) is an evergreen conifer up to 50 m in height that is widely distributed in the Caucasus and occupies approximately 6% of its forested area. In Turkey, it grows on slopes of the Pontic mountains [1, 2]. Fir oil obtained from the seeds is used in perfume and cosmetic formulations and in medical practice.

Neutral lipids (NL) were extracted from air-dried ground seeds by *n*-hexane and hot pressing. The yield of total NL was 15-20% as a yellow oily liquid with the following limiting properties: acid number, <43 mg/KOH/g; d_4^{20} 0.960; n_D^{20} 1.475-1.498; moisture and volatile substances, <16.5%; saponification number, 90-220 mg/KOH/g; iodine number, 115-190% I_2 .

TLC was performed on Silufol plates and silica gel (L 100/160) using hexane:diethylether:acetic acid (87:14:1). Total NL gave bands corresponding [3] to hydrocarbons (HC), sterol esters (SE), methyl esters of fatty acids (MEFA), triacylglycerides (TAG), free fatty acids (FFA), free sterols (FS), 1,3-diacylglycerides and 1,2-diacylglycerides (DAG), monoacylglycerides (MAG), and phospholipids (PL). The ratios of separate NL classes were typical for oils from higher plants. The dominant class was TAG.

All separate classes were isolated from the crude fractions during a study of the NL composition using column chromatography (CC) and preparative TLC (PTLC). Alkaline hydrolysis of the principal acyl-containing lipids isolated fatty acids (FA). Their composition was determined by GC of the methyl esters [3-5].

Table 1 shows that NL from seeds of *A. nordmanniana* contained eight FA, the principal mass of which was unsaturated FA, in particular, oleic acid (18:1) and linoleic acid (18:2), which dominated all classes. The exception was SE from lipids isolated by direct pressing of seeds, where 97.7% was palmitic acid (16:0); the remaining 2.3%, lauric acid. Mainly this distinguished NL obtained by *n*-hexane extraction and direct pressing of seeds from each other. The presence of isopalmitic acid in the FFA is also interesting.

The polar fraction was extracted by the Folch method [6] in order to investigate PL from defatted *A. nordmanniana* seeds. The yield of total PL purified of ballast substances [3] was 0.045% of the raw material mass. PL were identified by two-dimensional TLC on silica gel using $CHCl_3:CH_3OH:NH_4OH$ (25%) (65:30:5) and $CHCl_3:CH_3OH:CH_3CO_2H$ (glacial): H_2O (170:25:25:6).

PL were identified by spraying with Vaskovsky and Dragendorff's solutions and ninhydrin. Pure PL were determined quantitatively by spectrophotometry [7].

Total PL from *A. nordmanniana* seeds contained (%): phosphatidylcholine (PC), 46.7; phosphatidylinositol (PI), 21.9; phosphatidylethanolamine (PE), 18.7; and lysophosphatidylcholine (l-PC), 12.5. The results showed that the dominant component of total PL was PC. A regular distribution $PC > PI > PE$ was observed. The qualitative and quantitative compositions of PL obtained from the raw material were identical after extraction by *n*-hexane and by direct pressing.

GC was performed on a Chrom-4 instrument with a flame-ionization detector using a stainless-steel column (2.5 m \times 3 mm) packed with Reoplex (15%) on Chromaton NAW (0.160-0.200 mm), thermostat temperature 210-220°C, He carrier gas flow rate 40 mL/min.

TABLE 1. Fatty Acid Composition of Total and Separate Classes of Neutral Lipids from Seeds of *Abies nordmanniana*, %, GC

Acid	Total		TAG		FFA		SE	
	a	b	a	b	a	b	a	b
12:0	1.47	0.50	-	-	1.31	1.1	-	2.31
14:0	Tr.	Tr.	-	Tr.	-	-	Tr.	-
<i>iso</i> -16:0	Tr.	0.30	-	-	0.10	0.15	-	-
16:0	3.41	3.84	2.5	3.5	2.02	2.1	1.95	97.69
16:1	Tr.	0.69	-	-	0.18	0.31	-	-
18:0	Tr.	Tr.	Tr.	-	Tr.	-	-	Tr.
18:1	37.86	26.47	35.5	40.5	40.04	34.71	49.76	Tr.
18:2	57.26	68.20	62.0	56.0	56.35	61.63	48.29	Tr.
$\Sigma_{\text{sat.}}$	4.88	4.65	2.5	3.5	3.43	3.35	1.95	100.0
$\Sigma_{\text{unsat.}}$	95.12	95.36	97.5	96.5	96.57	96.65	98.05	-

a, extraction; b, pressing.

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