

BRIEF COMMUNICATIONS

PHOSPHOLIPIDS OF *Ferula tenuisecta* SEEDS

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The giant fennel *Ferula tenuisecta* Korov. is one of the 130 species of the genus *Ferula*, fam. Umbelliferae. About 100 species grow in Central Asia. Many *Ferula* species are resin- and essential-oil-bearing, medicinal, and fodder plants [1]. The fruit of *Ferula tenuisecta* contain carbohydrates, terpenoids, steroids, and coumarins. An extract of the fruit possesses antitumoral activity in vitro [2]. The total composition of the oil, and the fatty-acid and group compositions of the triglycerides of four *Ferula* species have been investigated previously [3, 4].

We have studied the phospholipids (PLs) of *Ferula tenuisecta*. On average, a pip weighed 0.031 g, with a moisture content of 10.9%. On the exhaustive treatment of ground seeds with gasoline (bp 40–60°C), 16.4% of substances, on the air-dry material, passed into the gasoline extract. The total yield of PLs amounted to 1.9% on the dry weight of the seeds. Table 1 gives the chromatographic mobilities and the qualitative and quantitative compositions of the PLs. In the total PLs we detected seven classes, which were identified by their chromatographic mobilities and qualitative reactions and by comparison with authentic specimens as phosphatidylinositol (PI), phosphatidylcholine (PC), phosphatidylethanolamine (PE), phosphatidic acid (PA), phosphatidylglycerol (PG), lyso-PC, and N-acyl-PE. The total content of the main PLs — PC, PE, and PI — amounted to more than 96%.

In all the PLs we determined the composition of the fatty acids (FAs) (Table 2). In them we detected 11 FAs, the main ones being palmitic, oleic, linoleic, and linolenic acids. In all the samples their amount exceeded 70%. The lowest level of palmitic acid was observed in the phosphatidylinositol and its levels in the PLs increased from PC to PE, where its amount was the highest, and since palmitic acid was the main saturated fatty acid the level of total saturated fatty acids increased correspondingly. The smallest amount of oleic acid was found in the PE and the largest amount in the PC. The linoleic acid content was about 10% in the PA and PG, about 20% in the lyso-PC, N-acyl-PE, and PE, 35.5% in the PI, and 45% in the PC. The total amount of unsaturated FAs decreased in the following sequence: PC — PI — lyso-PC — N-acyl-PE — PE — PA — PG.

TABLE 1. Chromatographic Mobilities and Composition of the Phospholipids of *Ferula tenuisecta* Seeds

Phospholipids	R _f		% as phosphorus
	syst. 1	syst. 2	
1. Phosphatidylinositol (PI)	0.25	0.22	19.8
2. Phosphatidylcholine (PC)	0.41	0.27	70.4
3. Phosphatidylglycerol (PG)	0.50	0.44	0.4
4. Phosphatidic acid (PA)	0.22	0.45	2.1
5. Phosphatidylethanolamine (PE)	0.53	0.53	6.4
6. Lysophosphatidylcholine (lysoPC)	0.25	0.10	0.5
7. N-Acylphosphatidylethanolamine	0.74	0.83	0.1

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TABLE 2. Composition and Positional Distribution of the Fatty Acids in the Phospholipids of *Ferula tenuisecta* Seeds

FAs	PC			PE			PI			PA	PG	Lyso-PC	N-Acyl-PE
	total	position		total	position		total	position					
		sn-1	sn-2		sn-1	sn-2		sn-1	sn-2				
12:0	0.4	0.8	-	2.9	2.1	3.7	0.4	-	0.8	1.4	2.1	1.6	1.5
14:0	1.3	2.6	-	2.0	1.5	2.5	0.3	-	0.6	1.0	1.8	-	0.9
16:0	20.9	37.3	4.5	43.4	53.5	33.3	17.9	24.1	11.7	32.3	39.4	33.3	35.0
17:0	0.5	1.0	-	-	-	-	3.7	7.4	-	1.2	1.3	2.5	1.6
18:0	1.5	3.0	-	5.1	7.3	2.9	11.6	23.2	-	6.3	6.9	7.1	7.0
18:1	24.0	20.7	27.3	10.1	10.1	10.1	23.7	23.8	23.6	16.5	15.4	18.7	17.5
18:2	45.0	21.8	68.2	23.7	6.6	40.8	35.5	9.1	61.9	9.2	11.6	21.1	20.3
18:3	2.3	4.6	-	6.6	6.5	6.7	4.2	7.0	1.4	13.8	12.0	12.0	10.1
Σ_{unident}	4.1	8.2	-	6.2	12.4	-	2.7	5.4	-	18.3	9.5	3.7	6.1
Σ_S	24.6	44.7	4.5	53.4	64.4	42.4	33.9	54.7	13.1	42.2	51.5	44.5	46.0
Σ_U	71.3	47.1	95.5	40.4	23.2	57.6	63.4	39.9	86.9	39.5	39.0	51.8	47.9

The positional distributions of the FAs in the PC, PE, and PI were established by enzymatic hydrolysis (Table 2). Asymmetry of the positional distribution of the saturated and unsaturated FAs appeared most clearly in the PI: the sn-1 position contained 54.6% of saturated acids, and the sn-2 position 86.9% of unsaturated FAs. In the PE 64.4% of the saturated FAs were localized in the sn-1 position and 57.6% of the unsaturated acids at sn-2. In the PC, 44.7% of saturated acids esterified the sn-1 position, while in the sn-2 position 95.5% consisted of unsaturated FAs.

Thus, of the seven classes of PLs detected in the seeds of *Ferula tenuisecta* the main ones were the PC, PI, and PE. In the main PLs, as in the PLs of the majority of organisms [4], we observed the traditional positional distribution of the FAs in which unsaturated FAs predominated in the sn-2 position and there was a considerably smaller amount of them in the sn-1 position.

The PLs were isolated and analyzed as described in [5, 6]. The quantitative determination of the composition of the PLs was made after two-dimensional TLC by the method of [7]. Systems for TLC: 1) $\text{CH}_3\text{Cl}-\text{MeOH}-\text{NH}_4\text{OH}$ (25%) (10:5:2); 2) $\text{CH}_3\text{Cl}-\text{MeOH}-\text{CH}_3\text{COOH}-\text{H}_2\text{O}$ (14:5:1:1). Analysis of the fatty acids, in the form of methyl esters, was conducted on a Chrom-4 gas-liquid chromatograph, steel column (4 mm \times 2 m), sorbent Reoplex-400, carrier gas nitrogen, column temperature 190°C, evaporator temperature 250°C, flame-ionization detector.

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