PHOSPHOLIPIDS OF POMEGRANATE SEEDS

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The seeds were separated from the pulp after the production of pomegranate juice (Kuva Preserves Factory, Fergana Province, UzSSR). After the pomegranate oil had been obtained, the meal still contained phospholipids (PLs), and their study is important since they are physiologically active compounds.

The oil was extracted with hexane, and the phospholipids were extracted from the residue by the usual method [1, 2]. The total phospholipids so obtained, after being freed from accompanying substances, amounted to about 1% on the seeds.

With the aid of two-dimensional TLC [1st direction: chloroform–methanol–25% ammonia (70:3:5); 2nd direction: chloroform–methanol–acetic acid–water (14:5:1:1)] and qualitative reactions the phospholipids were identified: phosphatidylcholine (PC); phosphatidylethanolamine (PE); phosphatidylinositol (PI); phosphatidic acid (PA); lyso-PC; and lyso-PI.

All the phospholipids mentioned were isolated in homogeneous form by column and TLC chromatography. The position distributions of the fatty acid radicals in the PC, PE, and PI were determined by the action of phospholipase A_2 from *Vipera lebetina* L. (snake venom). The total fatty acid compositions were determined for the PA, lyso-PC, and lyso-PI (Table 1).

As in many plant phospholipids, the unsaturated fatty acids are esterified mainly in position 2. In the PI, PE, and PA, punicic acid (18:3) was detected; it makes up 60% of the oil [3]. The 20:0 acid was present in the lyso-PC and in the PE it was present only in position 1. Such a marked difference in the qualitative and quantitative composition of the fatty acids in the phospholipids as compared with the neutral lipids can be ascribed to the main acids – the amount of 16:0 acid had increased by a factor of 3-4 and that of the 18:2 acid by a factor of 4-5. In some phospholipids the 18:3 acid was completely absent, al-

TABLE 1. Composition and Position Distribution of the Fatty Acid Radicals in the Phospholipids of Pomegranate Seeds

Acid	10:0	12:0	14:0	16:0	16:1	17:0	18:0	18:1	18:2	18:3	20:0	ΣS	ΣU
Phosphatidylcholine													
Total	—	0,3	0,3	18,0	—	0,8	3,2	15,5	61,9	—	—	22,6	77,4
1	—	0,6	0,6	30,7	—	1,6	6,4	5,8	54,3	—	—	39,9	60,1
2	—	—	—	5,3	—	—	—	25,2	69,5	—	—	5,3	94,7
Phosphatidylethanolamine													
Total	—	0,5	0,5	18,4	0,8	0,9	4,0	12,4	59,1	1,8	1,6	25,9	74,1
1	—	0,5	0,3	29,7	0,5	—	5,6	11,4	45,2	3,6	3,2	39,2	60,8
2	—	0,5	0,7	7,1	1,1	1,8	2,4	13,4	73,0	—	—	12,5	87,5
Phosphatidylinositol													
Total	—	0,2	0,3	20,5	1,8	1,5	13,7	9,8	48,8	3,4	—	36,2	63,8
1	—	0,4	0,6	36,0	1,9	1,5	24,5	9,5	8,8	6,8	—	63,0	37,0
2	—	—	—	5,0	1,7	1,5	2,9	10,1	78,8	—	—	9,4	90,6
Phosphatidic acid													
Total	0,9	2,4	2,2	22,8	3,7	3,7	12,3	16,6	26,3	9,1	—	44,3	55,7
Lysophosphatidylinositol													
Total	—	2,7	2,3	27,4	6,4	2,7	11,4	15,1	32,0	—	—	46,5	53,5
Lysophosphatidylcholine													
Total	—	0,3	0,4	18,9	0,9	1,0	5,3	17,1	49,7	3,1	3,4	29,2	70,8

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though, as mentioned above, it is the dominating acid in the oil. This is probably due to the fact that in the biosynthesis of the phospholipids the inclusion of the 18:3 acid in the synthesis in hindered. We exclude the possibility of its decomposition in the production cycle, since in this case a high yield of lyso products would have been observed, which contradicts the results obtained for the total phospholipids.

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TERPENOID COUMARINS OF *Ferula aitchisonii*

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Ferula aitchisonii K.-Pol. is a narrowly endemic species of eastern Fergana which is found in thinned-out pistachio woodlands on the multicolored foothills of the Fergan range. The plant collected close to the classical site in the Kulagantau mountains near the town of Suzak (Oshhsk Province, Kirghiz SSR) was investigated. In the taxonomic respect this species is close to *F. karatavica* Regel et Schmalh.

Chromatography of an acetone extract of the roots on a column of silica gel L 40/100 in petroleum ether–ethyl acetate yielded four terpenoid coumarins: (I), $C_{24}H_{30}O_3$, mp 56-58°C, M^+ 366; (II), $C_{23}H_{26}O_4$, mp 143-144°C, M^+ 366; (III), $C_{24}H_{28}O_5$, mp 104-106°C, M^+ 396; and (IV), $C_{24}H_{32}O_5$, mp 74-76°C, M^+ 400. According to IR and PMR spectroscopy and their physicochemical constants, substances (I), (II), and (III) are umbelliprenin [1], tavicone [2], and karatavic acid [3, 4], respectively. The PMR spectrum of (IV) (Varian HA-100D, ppm, $CDCl_3$, O-TMS), also an umbelliferone derivative, shows the following main structural elements of the C_{15}-terpenoid moiety: $-CH_2-OAr$ (4.59 ppm, d, J = 7 Hz, 2 H); 4 $CH_2-C=C$ (2.09 ppm, u.s, 8 H); 2 CH=C (5.16 ppm, u.s, $W_{1/2}$ = 14 Hz, 1 H, and 5.45 ppm, t, J = 12 Hz, 1 H); $(CH_3)_2C-$ (1.18 ppm, s 3 H, and 1.14 ppm, s, 3 H); 2 $CH_3-C=C$ (1.6 ppm, s, 3 H, and 1.72 ppm, s, 3 H); H–C–OH (3.35 ppm, q, J_1 = 3 Hz, J_2 = 10 Hz, 1 H); and 2 OH (2.95 ppm u.s, $W_{1/2}$ = 10 Hz, 2 H). The presence of two hydroxy groups in the terpenoid moiety is also shown by the acetylation of (IV), leading to a monoacetate with the composition $C_{25}H_{34}O_6$, mp 72-74°C. PMR spectrum: CH_3COO- (1.90 ppm, s, 3 H); H–C–$OCOCH_3$ (4.82 ppm, q 1 H). IR spectrum: 3510 cm^{-1} (OH). These facts permit the suggestion for substance (IV) of the structure of karatavicinol. A comparison of the PMR spectrum of (IV) with that of karatavicinol showed their identity, but the melting point of substance (IV) (72-74°C, Kofler) differed from that given in the literature (52-53°C) [5].

To identify substance (IV) we obtained its acetonide, $C_{27}H_{36}O_5$, mp 53-55°C, the PMR spectrum of which was completely identical with that of karatavicinol acetonide kindly given to us by V. Yu. Bagirov. Thus *F. aitchisonii* contains the same main components as *F. karatavica*, which confirms the closeness of these species in the taxonomic respect.

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