POLYSACCHARIDES OF THE SEEDS OF CERTAIN PLANTS

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We have studied the carbohydrates of seeds of the following wild plants: *Haplophyllum latifolium* Ket. K. (Rutaceae) (I), *Soleananthus circinnatus* Ldb. (Boraginaceae) (II), *Crambe kotschyana* Boiss. (Cruciferae) (III) and *Amorphia fruticosa* L. (Leguminosae) (IV). From a single defatted sample of raw material we successively extracted with 82% ethanol the ethanol-soluble sugars (ESSs), with water the water-soluble polysaccharides (WSPSs), with a mixture of 0.5% solutions of oxalic acid and ammonium oxalate at 70°C the pectin substances (PSs), and with 7% and 14% solutions of caustic soda the alkali-soluble polysaccharides of the hemicellulose (HC).

The extract of the ESSs were freed from noncarbohydrate components with the aid of 10% lead acetate and sodium sulfate. After filtration and concentration they were precipitated from concentrated methanolic solution with acetone (1:5), and the precipitate was washed with anhydrous acetone and ether and was dried over P_2O_5 in a vacuum desiccator. In the extracts of the ESSs, free glucose, fructose, sucrose, and unidentified fructose-containing reducing and nonreducing oligosaccharides were detected by paper chromatography in the butan-1-ol—pyridine—water (6:4:3) system. The reducing sugars were revealed with aniline phthalate and the nonreducing ones with the Bonner reagent [1]. The amounts of the ESSs were 3.8% in I; 3.0% in II; 8.7% in III, and 12% in IV.

The WSPSs and PSs were dialyzed against mains water and then against distilled water, were freed from proteins by Sevag's method [2], and were precipitated with methanol (1:4). The HC was neutralized over acetic acid, dialyzed, and precipitated with methanol (1:4). The polysaccharides were also dried over P_2O_5. The yields of products were calculated on the absolutely dry weight of the raw material.

The monosaccharide compositions of the WSPSs, the PSs, and the HC were determined after acid hydrolysis (2 N H_2SO_4, 100°C, 14 h) by paper chromatography in the given system on

TABLE 1. Amounts of Carbohydrates and the Monosaccharide Compositions of the Seeds I-IV

Plant	Yields of product, % on the absolutely dry weight of the raw material				Ratio of monosaccharides, moles					
	WSPSs	PSs	HC		Glc	Gal	Man	Xyl	Ara	Rha
			7% KOH	14% KOH						
I	4.2	1.4	1.2	1.2	2,3	3,6	1.7	1.0	3,8	3,3
					4,3	2,3	1.0	—	4,3	3,9
					1,0	1,0	2.0	—	3,2	Tr.
					1.0	1,0	1,0	—	3,6	Tr.
II	8,0	2.9	3.8	2,0	3,1	,6	3,4	—	2,2	1,0
					1,0	1,0	—	1,0	—	1,3
					1.0	1.0	3,4	Tr.	9,6	1,0
					1.0	1,0	1,0	Tr.	8,7	Tr.
III	2,7	6.0	2,7	2,7	7,0	6,6	4,6	1,0	13,0	1,8
					1,4	1,0	Tr.	Tr.	6,9	2,8
					13,0	13,0	—	Tr.	7,8	1,0
					14,0	14,0	—	—	13,0	1,0
IV	3,0	2,5	8,4	2,0	31,0	38,0	67,0	1,0	8,0	2,2
					4,5	13,0	22,0	1,0	4,0	1,0
					3,8	5,4	15,0	5,6	3,0	1,0
					2,2	2,1	3,2	17,0	1,0	Tr.

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FN-3 and FN-11 papers. The quantitative ratios of the monosaccharides were determined by the GLC method using the acetates of the corresponding aldononitriles on a Tsvet-101 instrument with a flame-ionization detector, using a steel column (200 × 0.3 cm) filled with 5% of XE-60 on Chromaton N-AW, 0.200-0.20 mesh with helium as the carrier gas (55 ml/min) at a column temperature of 210°C. The results obtained are given in Table 1.

LITERATURE CITED

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CARBOHYDRATES OF *Allium*. III. CHARACTERISTICS OF THE POLYSACCHARIDES OF SPECIES OF *Allium*

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Continuing an investigation of the carbohydrates of plants of the family Alliaceae [1], we have made a comprehensive study of the amounts of all types of polysaccharides with the exception of cellulose in the bulbs of six species of *Allium* L. belonging to three botanical sections [2]. The plants of the section *Molium* Don (1, 2), those of the section *Haplostemon* Boiss (3) and those of the section *Rhiziridium* Don (4-6) were collected in 1981. From a single sample of the raw material previously treated with chloroform and 96% and 80% ethanols, we extracted successively the ethanol-soluble fraction (ES), the water-soluble polysaccharides (WSPSs), the pectin substances (PSs) [3], and the hemicelluloses A and B (HMCs) [4]. The results of the investigation are given in Table 1.

As can be seen from the table, the amounts of polysaccharides are different, the largest amounts being found in the plants of the section *Molium* Don.

In all the samples of ethanol-soluble fractions PC (water-saturated phenol, revealing agent, an ethanolic solution of urea system 1) showed the presence of fructose, glucose, sucrose, and oligosaccharides containing fructose.

The water-soluble fractions, after the elimination of protein by Sevag's method, consisted of cream-colored powders possessing no reducing capacity, giving no color reaction with iodine, readily soluble in cold water, and forming clear mobile solutions. The samples of WSPSs were subjected to complete acid hydrolysis with 0.5 N H_2SO_4 at 100°C for 2 h. In all the hydrolysates PC (system 1) showed the presence of fructose (main spot) and glucose (weak spot). Consequently, the water-soluble polysaccharides are glucofructans. The presence of glucofructans is characteristic for all the species of *Allium* studied.

Hydrolysis of the pectin substances and of the hemicelluloses was carried out with 2 N H_2SO_4 in sealed tubes at 100°C for 48 h. The hydrolysis products were identified by PC (butan-1-ol—pyridine—water (6:4:3); aniline phthalate) and quantitatively by GLC of the acetates of the corresponding aldonitriles [5] (Table 1).

Galacturonic acid was also detected by PC in all the samples of PSs.

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