A STUDY OF THE POLYSACCHARIDES OF *Eremurus robustus*

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A water-soluble polysaccharide (PS) has been isolated previously from the tuberous roots of Eremurus robustus Regel. [1]. Continuing an investigation of the polysaccharides of this raw material, we have isolated a glucofructan (GF) (8.9% of the weight of the raw material) from an aqueous extract.

The comminuted air-dry raw material (26.6 g), previously treated with ethanol, was extracted with water (2×530 ml) at room temperature with steeping for 3 h in each case. The extracts obtained were concentrated and poured into four volumes of ethanol, and the resulting precipitate of PS was separated by centrifuging. The supernatant liquid was treated with a solution of neutral lead acetate, the excess of which was eliminated by the addition of a saturated solution of Na_2SO_4. After concentration of the liquid to the state of a syrup, the GF was precipitated in a large volume of ethanol.

The polysaccharide consisted of a cream-colored amorphous powder soluble in water, $[\alpha]_D^{22}$ + 140° (c 0.5; H_2O) and giving no coloration with iodine. The PS was chromatographed on DEAE-cellulose. It consisted of neutral (7.5%) and acid (78%) fractions, which were subjected to hydrolysis with 2 N H_2SO_4 for 10 and 24 h, respectively. The hydrolyzate of the neutral fraction was found by paper chromatography to contain galactose, glucose, and traces of arabinose and xylose, and the hydrolyzate of the acid fraction contained galacturonic acid, galactose, arabinose, rhamnose, and traces of glucose and xylose.

The glucofructan was purified by reprecipitation with ethanol from aqueous solutions (eight precipitations). The product consisted of a snow-white hygroscopic powder readily soluble in water, $[\alpha]_D^{20}$ −34° (c 1.0; H_2O). The action of acetic anhydride in pyridine yielded an acetate, $[\alpha]_D^{20}$ −20° (c 1.0; $CHCl_3$). The IR spectrum of the GF had absorption bands at 830, 890, 935, 1650, and 3200-3600 cm^{-1}, which are close to the absorption bands of inulin.

The homogeneity of the PS was checked by paper electrophoresis in borate buffer and by gel chromatography on Sephadex G-50. A hydrolyzate of the glucofructan was shown by paper chromatography to contain fructofuranose and glucopyranose, their ratio as determined by GLC in the form of the trimethylsilyl derivative being 4 : 1. The fructose was identified in the form of the 2,3 : 4,5-di-O-isopropylidene derivative with mp 91-93°C $[\alpha]_D^{20}$ −25° (c 1.0; H_2O) [2].

The GF was subjected to periodate oxidation [3]. The consumption of periodate and the amount of formic acid liberated per mole of hexose unit amounted to 0.93 and 0.079 mole, respectively. A hydrolyzate of the oxidation products was shown by paper chromatography to contain glycerol, which was identified by the GLC method in the form of the polyol acetate. The ease of acid hydrolysis and the results of periodate oxidation permit the assumption of the presence of the furanose configuration of the fructose units connected with one another by a 1 → 2 or a 2 → 6 bond.

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POLYSACCHARIDES OF SOME SPECIES OF THE FAMILY LILIACEAE

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We have investigated the water-soluble polysaccharides (PSs) of the tuberous roots of some species of Eremurus, family Liliaceae [1-3].

To isolate the PSs from the tuberous roots, the bulbs, and the rhizomes, the air-dry raw material (20-50 g) was treated with ethanol (1 : 10) and extracted with water (three times at a ratio of 1 : 10–40 at room tem-

TABLE 1

Plant	Growth site, phase of development, and time of collection	Amount of polysaccharides, % of the weight of the air-dry raw material	Monosaccharide composition and number of carbohydrate residues					
			Ara	Gal	Glc	Man	Rha	Xyl
Eremurus aitchisonii Baker	Fergana valley, Bauoshata flowering, May 26, 1975	0,4	2	3	2	2	1	—
E. altaicus (Pall) Stev.	Dzhungarian Ala-Tau, Koyandisai, flowering, July 1, 1975	22,0	—	—	1	2,6	—	—
E. anisopterus (K. et K) Regel.	Bukhara oblast, Sarmysh, flowering, May 6, 1975	0,7	3	14	8	26	1	—
E. bucharicus Regel.	TadzhSSR, Kulyab oblast, environs of the village of Alamtai, flowering, June 9, 1975	0,14	2	5	4	—	1	—
E. inderiensis (Stev.) Regel.	Muyunukmi, Suzak region, fruit-bearing, June 8, 1974	18,2	—	—	1	3,5	—	—
E. lactiflorus O. Fedtsch.	Chatkal territory, environs of Chimgan, flowering, May 21, 1975	13,6	—	—	1	5	—	—
E. olgae Regel	Alai range, environs of Gul'che, flowering, July 6, 1974	0,2	3	11	—	—	1	—
E. robustus Regel.	KazSSR, Boroldai, flowering, May 19, 1973	0,24						
E. roseolus Vved.	Daryaza range, environs of the village of Sagirdasht, flowering, June 20, 1972	0,42	2	110	—	—	1	—
E. stenophyllus (Boiss. et Buhse). Khokhr.	Sagirdasht, green fruit, June 30, 1973	0,4	7	20	—	2	4	1
E. tianshanicus Rarjj et Vved.	TadzSSR, gorge of the R. Kafirnigan, flowering, July 21, 1974	0,66	1	6	7	30	1	—
Korolkowia severzowii Regel.	Chimkent oblast, Kaplanbek, flowering, April 5, 1974	0,6	2	2	1	—	1	1
Petilium raddeana (Regel.) Vved	Kopet Dagh range, environs of Karakala, end of vegetation, June 3, 1975	0,4	3	5	2	1	1	1
Phenopetalum stenanteruin Regel.	Chimkent oblast, Kaplanbek, flowering, March 20, 1975	0,48						
Polygonatum sewerzowii Regel	Tashkent oblast, R. Galvasai, Bostandykskii region, vegetation before budding, April 19, 1976	8,7						
Veratrum Lobelianum Bernh.	KirgSSR, R. Tyup, withering of the epigeal parts, September 19, 1975	0,56	6	10	4	11	1	—

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perature for 3 h). The extracts obtained were evaporated, and the proteins were eliminated by two treatments by Sevag's method [4]. The PSs were precipitated from the aqueous solution with four volumes of ethanol, and were washed with acetone and ether and dried over P_2O_5. Information on the amounts of PSs in the various species is given in Table 1.

The representatives of the various genera differed in the amounts and compositions of the PSs they contained. To determine the qualitative carbohydrate compositions, samples of the PSs (0.05-0.1 g) were hydrolyzed with 2 N H_2SO_4 on the boiling-water bath for 8-24 h. The hydrolyzates were neutralized with $BaCO_3$, evaporated to 1-2 ml, and treated with 15-30 ml of ethanol to precipitate the uronic acid salts, which were separated by centrifuging. The centrifugates were evaporated to dryness (neutral fraction) and used to obtain the aldononitrile acetates [5] for GLC analysis [Tsvet-100 instrument with a flame-ionization detector, steel columns (200 × 0.3 cm) filled with 5% of XE-60 on Chromaton N-AW 0.200-0.250 mm, carrier gas helium (55 ml/min), column temperature 210°C].

The barium salts of the uronic acids were dissolved in water and the solution was treated with KU-2 resin (H^+), evaporated to dryness (acid fraction), and investigated by PC and electrophoresis.

Galacturonic acid was present in the polysaccharides of the species of plants investigated, but its amount was lower than the amount of neutral monosaccharides. Starch was extracted by hot water from the bulbs of K. sewerzowii, P. raddeana, and R. stenanterum.

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THE OIL FROM THE PULP RESIDUES OF Hippophae rhamnoides

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Sea buckthorn oil has been used successfully in medical practice for the treatment of various diseases [1]. We give the results of an investigation of the oil from the pulp residues of Hippophae rhamnoides L. (common sea buckthorn) collected in October, 1974, in the Vartashen region of the Azerbaidzhan SSR.

To extract the oil, the green fruit was pressed and separated from the juice, and pulp residues were dried at 50-60°C and extracted with petroleum ether (40-60°C), and the solvent was distilled off. This gave 22.6% of oil on the absolutely dry matter. Its main physicochemical indices were determined by standard methods [2].

Index	Oil
Density, g/cm^3	0.9217-0.9231
Refractive index, n_D^{20}	1.4590-1.4660
Acid No., mg KOH/g	9-12
Saponification No., mg KOH/g	200
Iodine No., % I_2	112.5
Thiocyanogen No., % I_2	86.6
Phospholipids content, %	0.89
Unsaponifiables, %	3.3
Neutralization No., mg KOH/g	211.7
Total fatty-acid content, %	95.6

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