In the products of partial acid hydrolysis (45% formic acid, 2.5 h), in addition to glucose and mannose a series of oligosaccharides was detected. Six of them (A-F) were isolated in the chromatographically and electrophoretically pure form by fractionation on a column (carbon–Celite 535) and by comparative paper chromatography (PC) in the butan-1-ol–pyridine–water (6:4:3) system. Paper electrophoresis (PE) was performed in a 0.05 M solution of $Na_2B_4O_7 \cdot 10H_2O$, pH 9.2, 400 V, and 4 h. The degree of polymerization (DP) of the oligosaccharides was determined by the method of Peat et al., (Table 1).

Thus, the results of periodate oxidation, methylation, and partial acid hydrolysis show that the glucomannan, which contains O–acetyl groups, consists mainly of β-1 → 4-linked aldohexopyranose residues of mannose and glucose having a very small degree of branching, both mannose and glucose being found at the reducing ends. The chain of the glucomannan possibly has alternating hexose sections: -[-Manp-Glcp-Manp-Manp-Manp-]$_n$-.

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THE POLYSACCHARIDES OF PLANTS OF THE GENUS *Eremurus*

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Continuing a study of the chemical composition of the polysaccharides (PSs) of *Eremurus* (desert candle) [1-3], we have investigated the amount of PSs in eight of its species.

The dried and comminuted tuberous roots (20-30 g) which had been treated with ethanol were extracted with water (1:40) for 3 h. The extract was poured into a double volume of ethanol, the precipitate that deposited was dissolved in water and dialyzed against distilled water, and the protein impurities were eliminated by Sevag's method [4]. The PSs were precipitated from the solution with ethanol, and the precipitate was dehydrated with acetone, washed with ether, and dried over P_2O_5. Information on the polysaccharide contents are given in Table 1.

Samples of the PSs consist of white fibrous powders with a creamy tinge containing no nitrogen. They are soluble in water, forming sticky highly opalescent solutions which give a cherry-red color coloration with a 0.1 N solution of iodine and are converted into gels on standing. To determine the qualitative carbohydrate composition, the PSs (0.05-0.1 g) were subjected to complete acid hydrolysis (2 N H_2SO_4 at 100°C for 8 h). The hydrolyzate was neutralized with $BaCO_3$. The precipitate was filtered off and washed with hot water until the washings gave a negative reaction for carbohydrates (phenol–sulfuric acid). The filtrate and the washing solutions were combined, treated with Amberlite IR-120 (H^+), and evaporated to 0.5-1 ml. This concentrate was studied by descending PC [butan-1-ol–pyridine–water (6:4:3)] and by paper electrophoresis (0.05 M $Na_2B_4O_7 \cdot 10\ H_2O$, 20-25 mA, 200 V). The chromogenic agent was aniline hydrogen phthalate. As a result, we identified glucose and mannose. Thus, the polysaccharides of the species that we studied are glucomannans, like those which we

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TABLE 1

Species of plant	Place and date of collection	Phase of development	Content, %	
			PSs on the weight of the air-dry raw material	O–Ac groups in the PSs
E. inderiensis (M. B.) Rgl.	Muyunkum, Suzanskii region, June 8, 1974	Fruit-bearing	18,2*	5,0
E. altaicus (Pall.) Stev.	Dzhungarian Ala-Tau, TadzhSSR, Aug. 1, 1972	Budding	22,3	4,4
E. hissaricus Vved.	Gorge of the R. Varzab, TadzhSSR, Aug 20, 1973	Green fruit	26,0	5,3
E. lactiflorus O. Fed.	Tashkent oblast, village of Khumsan, June 27, 1974.	"	12,7	4,1
E. luteus Bak.	Fergana valley, western part of the Alai range, May 10, 1974	Beginning of flowering	12,6*	9,1
E. regelii Vved.	Chimkent oblast, Koplanbek, June 27, 1974	Beginning of fruit bearing	18,8	6,16
E. tadshicorum Vved.	TadzhSSR, Sagirdash, July 15, 1974	Fruit-bearing	19,0	6,14
E. turkestanicus Rgl.	Western Tien Shan, Chimgan, June 22, 1972	Flowering	10,1	5,9

*The polysaccharides are not stained in the presence of iodine.

have described previously [5]. The initial PSs were purified via the copper complex, using Fehling's solution. The purified polysaccharide (PPS) was insoluble in water, swelled in 1 N NaOH, and was soluble in 99.7% HCOOH. We used IR spectroscopy to characterize the initial PSs and PPS. Their spectra were very similar, but the PPS lacked absorption bands at 1735 and 1250 cm^{-1} showing the presence of ester groups in the polysaccharides. To prove the presence of an ester bond, 1% solutions of the initial polysaccharides were heated with 0.5 N NaOH at 60°C for 2 h. Then the solutions were neutralized and the precipitate was separated off by centrifuging and dried. This treatment made the PSs soluble in water. On analysis of the polysaccharides treated with NaOH, no absorption at 1735 and 1250 cm^{-1} could be detected, as in the case of the PPS. The high water solubility of the natural acetylated PSs and the disappearance of solubility on deacetylation have been reported previously [6, 7].

The fractionation of the polysaccharides and the identification of the O–Ac groups were performed as described in the preceding paper [8] and the quantitative determination of O–Ac groups, by the method described by Obolenskaya et al., [9].

Thus, in the plant organism the glucomannans of Eremurus are present in partially acetylated form.

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