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PLANT POLYSACCHARIDES. XVI. MANNAN FROM *Ungernia ferganica* AND ITS BIOLOGICAL ACTIVITY

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A mannan has been isolated from the bulbs of Ungernia ferganica *Vved., and its qualitative chemical composition, the nature of the bond between the hexose residues, and the form of the molecule have been determined. It has been established that the mannan is a relatively nontoxic compound and exhibits a pronounced hypolipidemic activity both in intact animals and in animals with experimental hyperlipidemia.*

Of the eight species of *Ungernia* Bunge growing on the territory of Uzbekistan, three are a source of nongalenical and galenical drugs [1] that are being used successfully for the treatment of bronchitides, bronchoectopic states, and the residual effects of poliomyelitis and radiculitis and are employed in the functional x-ray diagnostics of diseases of the stomach and intestine [2], and also in homeopathy [3].

Natively acetylated mannans specific for the vegetative organs have been found in the bulbs of plants of the *Ungernia* genus [4]. In the present paper we give information on a method of obtaining a mannan from *U. ferganica.* Vved and the results of an investigation of its biological activity.

The isolated mannan consisted of a white free-flowing amorphous powder soluble in water and practically insoluble in organic solvents (acetone, alcohol, chloroform, ether). The quantitative composition of the mannan was represented mainly by mannose, with traces of glucose and arabinose, which were identified by PC and GLC (in the form of aldonitrile acetates) with markers. The molecular mass of the mannan was 10,000-35,000, $[\alpha]^{20}$ −42° (*c* 2.5; water). It melted with decomposition at 222-226°C and contained 3.4% of O-Ac groups. The IR spectrum of the mannan showed the absorption bands characteristic for ester groups, which disappeared on purification through the copper complex [5].

In the products of Smith degradation we detected mainly erythritol, and traces of glycerol and mannose. The formation of a considerable amount of erythritol showed the presence of 1→4 bonds between the mannose residues.

Methylation of the mannan by the Hakomori method gave a permethylate, which was subjected to formolysis and hydrolysis. In the products of the latter, by TLC on Silufol with authentic specimens we identified 2,3,6-tri-O-methyl-*D*-mannose as the main product, which showed the linear structure of the polysaccharide: Man_p (β-1→4) Man_p (β-1→4)Man_p.

The β-configuration of the glycosidic bonds followed from the negative specific rotation of the mannan and from its IR spectrum [5].

The presence of a small amount of acetyl groups lowers the solubility of native mannans: on purification and the loss of irregularly arranged acetyl groups the aggregation of the molecules takes place more readily, and mannans purified via their copper complexes are insoluble in water. The solubility of the native mannans is of great biological importance, and, moreover, judging from the literature, acetyl groups in polysaccharides increase their immunospecificity [6].

The intravenous administration of the mannan to white mice in doses of 50-1000 mg/kg caused no changes whatever in the behavior of the experimental animals (observation was continued for a week). In acute experiments, administration of the mannan to cats in doses of 10-100 mg/kg lowered the arterial pressure by 10-15% for a short time (5-15 min).

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TABLE 1. Influence of the Mannan from *Ungernia ferganica* on the Levels of Cholesterol, β-Lipoproteins, and Triglycerides in the Blood Sera of Intact Rats and Rats with Experimental Hyperlipidemia ($M \pm m$; n = 6-8)

Experimental conditions	Intact animals		Endogenous hyperlipidemia		Triton hyperlipidemia	
	Cholesterol, mg-%	β-Lipoproteins, mg-%	Cholesterol, mg-%	β-Lipoproteins, mg-%	Cholesterol, mg-%	Triglycerides, mg-%
Intact animals	73.8±5.0	69.9±5.0	73.8±5.0	69.9±5.0	72.7±4.6	42±2.72
Control	–	–	99.3±4.2*	85.5±4.2*	258.8±18.6	
Mannan, 50 mg/kg	56±3.9*	38.3±4.4*	71.8±4.5*	68.1±3.6*	167±6.3*	572±20.1*
Mannan, 100 mg/kg	58.6±3.6*	46.2±4.8*	–	–	–	–

*Significant changes with respect to the corresponding control.

In view of the fact that a mannan isolated from *Amorphophallus konjac* Koch. K. is close in chemical composition to the mannan from *U. ferganica* and possesses a hypotensive and a pronounced hypocholesteremic action [7], we studied the influence of the preparation under investigation on a number of indices characterizing the state of the lipid metabolism. Thus, the seven-day administration of the mannan to intact rats in doses of 50-100 mg/kg led to a 20-24% fall in the level of cholesterol and a 33-44% fall in the level of β-lipoproteins in the blood serum, the effect of the mannan in a dose of 50 mg/kg being more pronounced (Table 1). The administration of the mannan to animals under conditions of hyperlipidemia with increased levels of endogenous cholesterol and β-lipoproteins led to normalization of the cholesterol and β-lipoprotein levels. Pronounced hyperlipidic effect of the mannan was also observed when it was administered to animals with Triton hyperlipidemia (see Table 1).

Analysis of the results presented shows that the water-soluble polysaccharide that we had obtained from *Ungernia ferganica* is a relatively nontoxic compound exhibiting a brief hypotensive and pronounced hypolipidemic action.

EXPERIMENTAL

Isolation of the Mannan. The air-dry comminuted raw material (100 g) was extracted with water (1.5 liter) at room temperature for 4 h. The extract was filtered and precipitated with ethanol (1:2.5). The precipitate was separated off and dissolved in 1 liter of water, and the solution was acidified with conc. HCl to pH 1.4 and hydrolyzed at 85 ± 2°C for 45 min. The hydrolyzate was poured into ethanol (1:2.5). The partially hydrolyzed polysaccharide was separated off and washed with ethanol of increasing concentration (70-96%), dried, and ground. The yield was 8.1% on the weight of the air-dry raw material.

The structure of the mannan was established by the same methods (PC, GLC, hydrolysis, methylation, periodate oxidation, IR spectroscopy) as in the case of ungeromannan-V [5].

Endogenous and Tritone hyperlipidemias in rats were produced as in [8] and [9], and the levels of cholesterol, β-lipoproteins, and triglycerides in the blood sera were determined by the methods of [10-12].

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