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POLYSACCHARIDES OF SAPONIN-BEARING PLANTS
XI. AN INVESTIGATION OF THE POLYSACCHARIDES OF *Acanthophyllum knorringianum*

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Polysaccharides have been isolated from the epigeal organs and roots of Acanthophyllum knorringianum *and their quantitative levels and qualitative compositions have been established. A neutral polysaccharide of the epigeal organs belongs to the mannoarabinoglucogalactan type, and a neutral polysaccharide from the roots, to the arabinoglucogalactans.*

An investigation of the polysaccharides of the plant *Acanthophyllum pungens* Boiss, fam. Caryophyllaceae has been reported previously [1]. Continuing the study of the polysaccharides of saponin-bearing plants, in the present paper we give the results of an analysis of the polysaccharides isolated from the epigeal and hypogeal organs of *Acanthophyllum knorringianum.*

From the air-dry raw material (roots and epigeal organs separately), after its treatment with chloroform to eliminate noncarbohydrate substances, by extraction with water we isolated the water-soluble polysaccharides (WSPSs), then, by extraction with a 0.5% solution of oxalic acid and ammonium oxalate, the pectin substances (PcSs), and, finally, by extraction with 10% caustic soda, the hemicelluloses (HCs).

The characteristics of the polysaccharides, as determined by PC and GLC analysis, are given in Table 1. In addition to neutral monosaccharides, all the plant polysaccharides contained uronic acids (PC). In terms of quantitative levels, the WSPSs predominated in the roots, and the PcSs in the epigeal organs. In the PcSs of the roots the predominating monosaccharide was arabinose. In the WSPSs of the roots the main monosaccharides were galactose and glucose, while in the WSPSs of the epigeal organs they wer *Chemistry of Natural Compounds, Vol. 35, No. 2, 1999* e galactose, rhamnose, glucose, and arabinose.

The presence of uronic acids in the WSPSs showed that they contained acidic polysaccharides. By separating an aqueous solution of the WSPSs of the roots on a column of DEAE-cellulose (acetate form) we obtained a neutral polysaccharide (NPS) consisting of galactose, glucose, and arabinose residues in a ratio of 35.0:17.0:1.0, which permitted the NPS to assigned to the polysaccharides of the arabinoglucogalactan type [2]. By elution with a 1 M solution of sodium acetate we isolated an acid polysaccharide (APS) consisting of galactose, glucose, mannose, xylose, arabinose, and rhamnose resides in a ratio of 18.7:8.5:1.6:1.0:6.7:2.3, together with galacturonic acid.

By separating the WSPSs from the epigeal organs, and also those from the roots, we obtained a NPS consisting of residues of galactose, glucose, mannose, arabinose, and rhamnose in a ratio of 15.8:16.8:2.0:1.0 and belonging to polysaccharides of the mannoarabinoglucogalactan type. An acid polysaccharide (APS) consisted of the same monosaccharides as the NPS but in a ratio of 9.5:9.6:1.0:2.6, and galacturonic acid.

The amount of HCs in the roots was greater than in the epigeal organs. The HCs consisted of a cream-colored powder readily soluble in alkaline solutions. The predominating monosaccharide of the HCs both of the roots and of the epigeal organs was xylose, and for this reason they were assigned to the xylan type of polysaccharides.

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TABLE 1. Characteristics of the Polysaccharides of *A. knorringianum*

Plant organ; type of PS	Yield of PS, % on the air-dry weight	Monosaccharide composition					
		Gal	Glc	Man	Xyl	Ara	Rha
Roots							
WSPSs	5.7	87.0	38.4	21.0	2.0	8.16	10.25
PcSs	2.2	1.0	2.1	Tr.	Tr.	9.4	2.5
HCs	3.7	1.0	2.3	1.2	14.6	-	-
Epigeal organs							
WSPSs	3.2	8.6	5.0	Tr.	1.0	4.3	5.9
PcSs	5.4	1.0	1.2	Tr.	1.3	1.4	1.2
HCs	2.8	5.1	1.0	5.4	28.0	1.0	1.3

Analysis showed that in the roots the predominating polysaccharides were the WSPSs and the HCs, while in the epigeal organs they were the PcSs and the WSPSs. The neutral polysaccharide of the roots was of the arabinoglucogalactan type, while the neutral polysaccharide of the epigeal organs was a mannoarabinoglucogalactan.

EXPERIMENTAL

Solutions were evaporated in a rotary evaporator at 40°C. Monosaccharides were chromatographed on FN 11,12 paper (Germany) by the descending method in butan-1-ol—pyridine—water (6:4:3, by volume) and the spots were revealed with acid aniline phthalate.

As in [3], the GLC of the samples in the form of aldononitrile acetates and polyols was conducted on a Chrom-5 instrument with a flame-ionization detector; the steel column (0.3 × 200 cm) was filled with 5% of XE-60 on Chromaton N-AW 0.200—0.250 mm, and the carrier gas was nitrogen, 60 ml/min, 220°C.

Samples of the polysaccharides were hydrolyzed with 2 N H_2SO_4 for 8 h (PcSs and HCs — 48 h) at 100°C.

Inactivation of the Plant. Separately, the comminuted air-dry roots (58.5 g) and the epigeal organs (104.1 g) were inactivated three times with chloroform in a ratio of 1:12 for 2 h in the boiling water bath and were then filtered off and dried, and the chloroform extracts were evaporated. The WSPSs, PcSs, and HCs were extracted successively from the air-dry raw material.

Isolation of the WSPSs. By the method of [1] the air-dry roots yielded 3.3 g, and the epigeal organs 3.4 g, of WSPSs.

Isolation of the PcSs. The PcSs were obtained from the residual raw material after the isolation of the WSPSs [1]: 1.4 g from the roots and 5.72 g from the epigeal organs.

Isolation of the HCs. The HCs were isolated by the method of [1]: 2.24 g from the roots and 3.0 g from the epigeal organs.

Separation of the WSPSs on DEAE-Cellulose. As in [1], on a column of DEAE-cellulose the WSPSs were separated into NPSs and APSs. Elution with water yielded 1.83 g of NPSs and 0.62 g of APSs from the roots, and 1.2 g of NPSs and 0.41 g of APSs from the epigeal organs.

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