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Constituents of the Seed of *Malva verticillata*. III. Characterization of the Major Pectic Peptidoglycan and Oligosaccharides*

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The major pectic peptidoglycan, designated as MVS-V, was isolated by chromatography of hot water extract with DEAE-Sephadex A-25 from the seeds of *Malva verticillata* L. Gel chromatography gave a value of 22000 for the molecular weight.

MVS-V is composed of 42.8% polysaccharide and 57.2% protein moieties. The polysaccharide contained L-arabinose, D-xylose, L-rhamnose, D-galactose, and D-galacturonic acid, and the molar ratio was 6 : 5 : 8 : 3 : 24. In adition, MVS-V contains 0.7% methoxyl and 1.4% *O*-acetyl groups. Thus one per six galacturonic acid residues in MVS-V exists as methyl esters.

Neither measurement of NMR spectrum nor methylation analysis of MVS-V gave good results. Thus, the carbohydrate moiety in MVS-V was isolated by treatment with a protease followed by gel chromatography. The polysaccharide fraction obtained was composed of 89.6% carbohydrate moiety having the same sugar composition as that of MVS-V, and 10.4% peptide. This fraction is tentatively designated as MVS-V-CH. Methylation analysis of the carboxyl-reduced derivative of MVS-V-CH, ^{13}C-NMR spectrum of MVS-V-CH, and periodate oxidation studies of MVS-V suggested that the minimal repeating unit of MVS-V-CH is composed of three terminal α-L-arabinofuranose, three 1,5-linked α-L-arabinofuranose, five 1,4-linked β-D-xylopyranose, one terminal β-D-galactopyranose, two 3,4-branched β-D-galactopyranose, six 1,2-linked α-L-rhamnopyranose, two 2,4-branched α-L-rhamnopyranose, and twenty-four 1,4-linked α-D-galacturonic acid residues. As a product of partial hydrolysis of MVS-V, 2-*O*-α-(D-galactopyranosyluronic acid)-L-rhamnopyranose was identified.

It can be concluded that the polysaccaride moiety of MVS-V resembles that of pectic substances. It has a main chain consisting of α-1,4-linked D-galacturonic acid residues which are interspersed with α-1,2-linked L-rhamnose residues, and a quarter of the rhamnose residues occupy branching points bearing arabinoxylogalactan side chains at position 4.

On the other hand, several oligosaccharides belonging to the "raffinose family" were isolated from the hot water extract of the material seeds. Stachyose, raffinose, sucrose, and in addition, D-fructose and D-glucitol were identified.

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