CHEMICAL SYNTHESIS OF RHAMNOGALACTURONAN-I OLIGOSACCHARIDES AND THEIR ROLE IN PLANT IMMUNITY

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The plant cell wall not only serves as a physical barrier against pathogens but, when damaged, also functions as a source of cell wall-derived molecules that play crucial roles in plant immunity. These elicitors of pattern-triggered immunity in plants may be derived from cell wall polysaccharides such as cellulose, hemicellulose and pectin. Rhamnogalacturonan-I (RG-I) is a structurally diverse and functionally significant domain of pectin, predominantly found in the primary cell walls of terrestrial plants. Its backbone consists of alternating α-1,2-linked rhamnose and α-1,4-linked galacturonic acid residues, frequently substituted at the rhamnose positions with side chains rich in arabinose and galactose. Given the structural complexity of this polysaccharide, well-defined synthetic RG-I related oligosaccharides are necessary for investigating enzymes involved in pectin biosynthesis and degradation, as well as its role in plant immunity.

We present here chemical syntheses of oligosaccharides related to RG-I and their role in activating immune responses in plants. The synthetic strategy relies on assembling the RG-I backbone using galactose building blocks, which are oxidized to the corresponding galacturonic acids before side chain installation. A [3+4] glycosylation procures the protected backbone, which after oxidation can be deprotected or is functionalized with mono-, di-, and trigalactan side chains [1].

Using a glycan array equipped with synthetic and natural glycans, we discovered a group of plant receptor kinases named ARMs (AWARENESS of RG-I MAINTENANCES) that interact with RG-I. When plants were treated with RG-I, pattern-triggered immunity responses were induced. We identified RG-I oligosaccharide structures required for interaction with ARM receptors and immune activation and found that ARM receptors are redundantly involved in plant immunity. The application of synthetic carbohydrate chemistry for discovering glycan-receptor pairs in plants thus provides new opportunities in plant immunity research [2].

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References:

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