

Arabidopsis seed coat mucilage is a secondary cell wall that can be used as a model for genetic analysis of plant cell wall structure and function

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Abstract

Arabidopsis seed coat epidermal cells produce a large quantity of mucilage that is extruded upon exposure to water. Chemical analyses and cell biological techniques suggest that this mucilage represents a specialized type of secondary cell wall composed primarily of pectin with lesser amounts of cellulose and xyloglucan. Once extruded, the mucilage capsule has a distinctive structure with an outer non-adherent layer that is easily removed by shaking in water, and an inner adherent layer that can only be removed with strong acid or base. Most of the cellulose in the mucilage is present in the inner layer and is responsible at least in part for its adherence to the seed. There are also differences in the pectin composition between the two layers that could contribute to the difference in adherence. The Arabidopsis seed coat epidermis and its mucilage are not essential for seed viability or germination. This dispensability, combined with the fact that the epidermal cells synthesize an accessible pectin-rich secondary cell wall at a specific time in development, makes them well suited as a genetic model for studying cell wall biogenesis, function and regulation. Mutants defective in seed mucilage identified by both forward and reverse genetic analyses are proving useful in establishing connections between carbohydrate structure and cell wall properties *in vivo*. In the future, genetic engineering of seed coat mucilage carbohydrates should prove useful for testing hypotheses concerning cell wall structure and function.