

Ultrastructural responses of plant zygotic embryo cell walls to desiccation – a case study of three gymnosperm species differing in their sensitivity to drying

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Abstract

Plant cell walls are dynamic in that they can change conformation during ontogeny and in response to various stresses. These changes have been characterised for vegetative tissues; however, even though seeds are the primary propagatory units in most plants, little is known about the conformational responses of zygotic embryo cell walls to desiccation, which is a common abiotic stress. This motivated the present study, which investigates the effect of drying on the gross morphology of the zygotic embryo cell walls of three gymnosperm species: *Podocarpus henkelii*, which produces desiccation-sensitive seeds; *Pinus elliottii*, the seeds of which are desiccation-tolerant; and *Podocarpus falcatus*, which produces seeds that appear to be intermediate. Cryo-scanning electron microscopy was used to observe the responses of embryo cell walls to desiccation. Hydrated embryos of all three species displayed polyhedral cells with relatively straight walls. Upon desiccation to c. 0.05 g g⁻¹ (dry mass basis), cell walls assumed an undulated conformation, the severity of which appeared to be limited by the subcellular accumulation of carbohydrate-containing amyloplasts in *P. henkelii*, lipid bodies in *P. falcatus*, and protein and lipid in *P. elliottii*. Intercellular spaces between cortical cells were also observed to enlarge upon desiccation, suggesting that components and/or processes at these junctions may be affected by desiccation. When dried embryos were rehydrated, embryo cell walls of *P. henkelii* remained moderately undulated, while those of *P. falcatus* and *P. elliottii* returned to their original straight conformation. Cell-cell connectivity and hence, communication (via the plasmalemma) is dependent on cell wall conformation. The results obtained here suggest that seed desiccation sensitivity may in part be based on the inability of dried-rehydrated embryo cell walls, such as those of *P. henkelii*, to regain their original straight conformation which can compromise cell-cell communication needed for growth.

Biography

Wynston Woodenberg is a postdoctoral fellow at the University of KwaZulu-Natal, Durban, South Africa, who has over ten years' experience with microscopy of gymnosperm seeds.

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