



Genetic and hormonal regulation of grape berry cuticle formation

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Abstract

The plant surface typically comprises of various epidermal cell types which synthesise and deposit a protective waxy layer known as the cuticle. The cuticle is a significant contributor to important crop traits related to drought tolerance, biotic stress, postharvest fruit quality as well as providing structural support. In this work we have investigated grape berry cuticle formation in the context of the accumulation of anti-fungal specialised metabolites and the ability of the cuticle to structurally cope with the rapid expansion of ripening berries. Metabolic QTL analysis was performed in a grapevine cross population, using chemical profiling data collected via GC-MS analysis for cuticular waxes. QTLs were identified for individual as well as classes of waxes, and a significant QTL associated with triterpenoid formation further characterised through the implementation of gene co-expression analysis. *In vivo* characterisation of a candidate *triterpene synthase* gene confirmed its role as a key gene for grapevine triterpene biosynthesis. Additionally, the hormonal regulation of berry cuticle formation was studied via chemical analysis of berry cuticles after application of various phytohormones. Application of cytokinin modulated the accumulation of berry surface waxes, leading to changes in the tensile properties of the berry skins, and a subsequent reduction in fruit cracking. These results highlighted the strong genetic association with cuticle formation and properties, but also the ability for growers to modulate this important physiological trait, and will potentially allow for optimised crop improvement strategies in the future.

Keywords: Cuticle, Fruit surface, Metabolic regulation, Triterpenoids, cracking