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RESEARCH PAPER

Copy number variation of a gene cluster encoding endopolygalacturonase mediates flesh texture and stone adhesion in peach

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Abstract

Texture is an important attribute affecting consumer perception of fruit quality. Peach melting flesh and flesh adhesion to stone (endocarp) are simply inherited and controlled by the *F-M* locus on linkage group (LG) 4. Here, we report that two genes encoding endopolygalacturonase (endoPG) in the *F-M* locus, designated *PpendoPGF* and *PpendoPGM*, are associated with the melting flesh and stone adhesion traits. *PpendoPGM* controls melting flesh while *PpendoPGF* has pleiotropic effects on both melting flesh and stone adhesion. The *F-M* locus has three allelic copy number variants of *endoPG*, H_1 (*PpendoPGF* and *PpendoPGM*), H_2 (*PpendoPGM*), and H_3 (null). The H_2 haplotype represents the ancestral one while the H_1 and H_3 haplotypes are two variants due to duplication and deletion of *PpendoPGM*, respectively. Accessions with H_1H_1, H_1H_2, or H_1H_3 genotypes show the freestone or semi-freestone and melting flesh phenotype, while both H_2H_2 and H_2H_3 accessions have the clingstone and melting flesh phenotype. The H_3H_3 accessions have the clingstone and non-melting flesh phenotype. Our study not only demonstrates a driving role of gene copy number variations in flesh texture diversification in fruit trees, but also provides a useful diagnostic tool for early seedling selection in peach breeding programmes.

Key words: Copy number variation, flesh texture, melting flesh, peach, polygalacturonase, stone adhesion.

Introduction

Texture is a sensory property that involves a variety of traits such as crispness, firmness, meltiness, and juiciness, therefore, it has an important direct influence on the consumer's perception of fruit quality (Brookfield *et al.*, 2011). Major changes in fruit texture occur during ripening and are usually associated with softening. Fruit softening is primarily a result of the decline in cell wall strength and cell-to-cell adhesion. Numerous hydrolases have been suggested as being