Sucrose metabolism and sensory evaluation in peach as influenced by β-aminobutyric acid (BABA)-induced disease resistance and the transcriptional mechanism involved

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Abstract

This study attempted to provide evidence for the inhibitory efficiency of β-aminobutyric acid (BABA) treatments on postharvest decay development, soluble sugar accumulation, and sensory profiles in peach fruit and to analyze the possible transcriptional regulation involved. Specifically, 100 mmol L^{-1} BABA directly induced resistance as manifested by suppression of postharvest decay progression in peaches, and this suppression was accompanied by the consistently upregulated expression of the WRKY transcription factor *PpWRKY40* and a battery of pathogenesis-related (*PR*) genes, such as *PpNPR1s*, *PpPR1s*, *PpPR2s* and *PpPR5s,* throughout the storage period. However, treatment with 10 mmol L^{-1} BABA ignited priming resistance in peaches that underwent hostile conditions of high pressure during the late monitoring period. The peaches elicited by 10 mmol L^{-1} BABA had higher expression levels of *PpSSs*, *PpSPSs* and *PpSPPs* as well as lower expression levels of *PpNIs* and *PpAIs* than those treated with 100 mmol L^{-1} BABA, thus resulting in increases in soluble sugar content and the sweetness score during storage. On the other hand, the direct interaction between persistently highly expressed *PpWRKY40* and the regulatory protein *PpNPR1* was detected *in vivo* and *in vitro* by Y2H and pull-down assays; in addition, Y1H and DLR assays demonstrated that *PpWRKY40* bound to the W-box motif in the promoter of sucrose-metabolizing enzyme genes, including *PpSS1* and *PpSPS3*, and activated their transcription. Hence, we deduced that the dual regulation of key genes associated with systemic acquired resistance (SAR) and sucrose metabolism by *PpWRKY40* might be conducive to the balance of fitness and defense in BABA-primed resistance by maintaining soluble sugar accumulation at an intermediate level and activating resistance against stress in harvested peaches.