PpCBF6 is a low-temperature-sensitive transcription factor that binds the *PpVIN2* promoter in peach fruit and regulates sucrose metabolism and chilling injury

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Abstract

PpVIN2 is the only vacuolar invertase (VIN) gene in peaches that is sensitive to cold. *PpVIN2* functions in sucrose decomposition and chilling injury (CI), but it is unknown how low temperatures induce *PpVIN2*. Here, we confirmed low-temperature activation of *PpVIN2* transcription from a *PpVIN2* promoter using a transgenic tobacco model. C-repeat binding factor (CBF) is a conserved cold-responsive gene in plants, and *PpCBF6* expression increases rapidly when peaches suffer from cold stress. We studied the interaction between PpCBF6 and *PpVIN2* both *in vivo* and *in vitro*. Using yeast one-hybrid assay and electrophoretic mobility shift assay, we confirmed that PpCBF6 binds to the promoter of *PpVIN2*, and results from a dual luciferase assay indicate that PpCBF6 inhibits the promoter activity of *PpVIN2*. *In vivo*, transient overexpression of *PpCBF6* decreases *PpVIN2* expression and VIN activity, and increases sucrose levels. In addition, when *PpCBF6* is targeted using virus-induced gene silencing (VIGS), *PpVIN2* expression and activity increase, accompanied by a decrease in sucrose content. Compared to the control group, exogenous methyl jasmonate (MeJA) treatment caused a higher expression of *PpCBF6*, and reduced the rapid rise of *PpVIN2* expression level. This resulted in the lower VIN activity and higher sucrose content in MeJA-treated peach fruit, thereby reducing the CI. In general, we proved that PpCBF6 retarded the degradation of sucrose by inhibiting the increased expression of *PpVIN2*, which improves the chilling resistance of peach fruit.