

Vacuolar Phosphate Transporter1 (VvVPT1) positively regulates grape berry soluble sugar accumulation and ripening

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Abstract

Vacuolar Phosphate Transporter1 (VPT1)-mediated phosphate uptake in the vacuoles is essential to plant development and fruit ripening. Interestingly, in this study, we find that the VvVPT1 protein positively regulates grape berry soluble sugar accumulation, potentially associated to its sugar transport activity. The *VvVPT1* is isolated from grape (*Vitis vinifera*) berries, which mainly accumulated glucose and fructose. This tonoplast-localized VvVPT1 contains SPX (Syg1/Pho81/XPR1) and MFS (major facilitator superfamily) domains and its mRNA expression could be induced by sucrose. Using transient transgenic systems in grape berry, we found that the downregulation and upregulation of *VvVPT1* expression inhibited and promoted ripening and affected hexose contents, fruit firmness, and ripening-related gene expression. The VvVPT1 protein has low affinity for Pi, while possesses high affinity for hexose absorption in yeast system, dependent on its SPX domain. In comparison to the VPT1 available (only strawberry FaVPT1 and Arabidopsis AtVPT1), as expected, the three proteins all have low-affinity Pi transport activity, strikingly, they appear different sugar transport capacity, in consistent with their soluble sugar status. Together, these data first demonstrate that VvVPT1 can promote grape berry hexose accumulation and ripening, associated to its SPX and MFS domains in direct transport of hexose into the vacuole. Finally, vacuolar phosphate transporter1 (VPT1)-mediated alternative accumulation of soluble sugar varies with fruit types is discussed.

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