Title Molecular and physiological study of postharvest rachis browning of table grape cv Red Globe

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Abstract

Red Globe is one of the most important varieties of table grapes (*Vitis vinifera* L.) grown for export. Rachis browning is a common problem that affects the quality and marketing of table grape clusters. In general, this process has been associated with water loss, but senescence has also been proposed as additional component in the process. Until now, there has been no evidence clarifying the cellular mechanism underlying this process in rachis. Thus, we conducted a transcriptional analysis using quantitative reverse transcription polymerase chain reaction (qRT-PCR) of 30 putative senescence-associated genes (SAGs). The expression of these genes in rachis was evaluated at harvest and after 90 days at 0 °C and under air or controlled atmosphere (CA) conditions. Additionally, the effect of applying cytokinin (Ck) one day before harvest to retard senescence was evaluated. After cold storage, CA and Ck had a significant effect on delaying development of browning. However, following the refrigerated period plus 2 days at 20 °C (shelf-life), only the Ck treatment had a significantly lower percentage of browning compared to the control. The analysis of the relative mRNA levels of the candidate genes suggests an important anti-senescent effect of cold storage, as 13 genes showed a down-regulated profile compared to the corresponding expression profile at harvest. Combined with cold storage, the Ck treatment after shelf-life provided additional protection and affected the expression profiles of 3 genes: *TL1*, *CBS* and *ERF*. This response suggests a putative cellular regulatory mechanism of water loss and senescence in rachis that most likely involves ethylene and oxidative stress metabolism. Additionally, the short-term storage experiments indicated an up-regulation of chlorophyll breakdown-related genes after storage for 2 days at 20 °C but not at 0 °C. This finding suggests an early postharvest involvement of the chlorophyll degradation process at high temperatures.