Involvement of miRNA-mediated anthocyanin and energy metabolism in the storability of litchi fruit

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Postharvest Biology and Technology, Volume 165, July 2020, 111200

Abstract

Litchi (*Litchi chinensis* Sonn.) has a short shelf life and its storability varies greatly among different cultivars. In this study, four litchi cultivars of different storability were used to investigate the possible roles of microRNAs and their targets in litchi fruit senescence. Slower pericarp browning in 'Jingganghongnuo' and 'Huaizhi' was observed compared with that in 'Guiwei' and 'Nuomici', which was correlated with higher levels of ATP, energy charge, and anthocyanin but lower activity of anthocyanase that oxidizes anthocyanin. A phylogenic analysis of *Arabidopsis*, tomato (*Solanum lycopersicum*), and litchi, using totally 40 *LcMYB*s, categorized certain *LcMYB*s into the anthocyanin biosynthesis-related R2R3 MYB subfamilies as previously described in *Arabidopsis*. In addition, the expression of a group of litchi miRNAs, including miR159/319, miR828 and miR858 that jointly target multiple *LcMYB* genes, was found to decrease fast in 'Jingganghongnuo' and 'Huaizhi'. A group of R2R3-type *LcMYB*s was validated as authentic targets of these miRNAs. Accordingly, these *MYB*s were induced in 'Jingganghongnuo' and 'Huaizhi' whereas largely suppressed in 'Guiwei' and 'Nuomici'. Moreover, litchi miR2118 targeting energy-related genes displayed a similar expression pattern to those of the *MYB*-targeting miRNAs in the different cultivars, and two of the miR2118 targets exhibited opposite expression pattern with miR2118. Finally, a miRNA-mediated anthocyanin and energy metabolism network underlying the regulation of cultivar-specific fruit senescence in litchi is proposed. We conclude that miRNA-mediated regulation can account for the differential storability of specific litchi cultivars.