

【Abstract】

ROLES OF ABSCISIC ACID IN THE MATURATION PROCESS OF GRAPE BERRIES

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SORAWEE THUNYAMADA

Graduate School of Horticulture
CHIBA UNIVERSITY

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Student name: Sorawee Thunyamada

Abstract

Abscisic acid (ABA) accumulates at the onset of grape ripening (véraison) and involves various metabolic processes and berry maturation, such as grape peel coloration and sugar accumulation. According to the complexity of the interactions between ABA and other plant hormones, further observations become essential to understand their functions on the physiological development of grapes. Therefore, this dissertation focused on the roles of plant hormone ABA on skin coloration, sugar distribution to the flesh, the self-defense system, and its interaction with the other plant hormones during grape berry maturation.

ABA and abscinazole-E3M (Abz), the ABA metabolism inhibitor, were applied to grape clusters. The anthocyanin concentration in ABA- and Abz-treated berry peels increased. ABA application significantly upregulated *MYB113*-like, *bZIP42*-like, and *UGT85A2*-like genes, while Abz application significantly induced *bZIP42*-like gene expression only. Additionally, significant induction of DNA methylation levels on the *MYB113*-like gene region was correlated with a high anthocyanin concentration in ABA-treated berry peels. ABA application decreased the chlorophyll a/b ratio and suppressed the expressions of photosynthesis system-related genes (*LHCA1*-like and *LHCB3*-like), while Abz application did not. Next, Abz application could increase endogenous ABA concentration through downregulation of ABA 8'-hydroxylase (*VvCYP707A1*) in grape flesh. Abz application also enhanced the expression of sucrose transporter genes (*VvSUC11* and *VvSUC12*), which led to sucrose accumulation. The increase of glucose and fructose concentration and the increased expression of hexose transporter gene (*VvHT2*) were observed in the Abz-treated berries. Abz increased the concentration of C₆ aldehyde, which is related to the self-defense system of plants via hydroperoxide lyase (*VvHPL*) upregulation. In contrast, Abz suppressed the expression of the pathogenesis-related (PR) gene (*VvPRI*) but positively induced the expression of chitinase genes (*VvChi26* and *VvChi31*). Next, the application of NDGA, which is the ABA biosynthesis inhibitor, to 'Shine muscat' grape berries enhanced *auxin-induced protein 6B* like gene and *gibberellin-regulated protein* gene expressions but suppress *ethylene-responsive transcription factor 2* gene and expression *abscisic-aldehyde oxidase-like%2C transcript variant XI* gene in the grape peel.

This study suggested that the ABA accumulation achieved by Abz application and ABA application could affect grape coloration differently. The increased ABA concentration also enhanced the sugar transporter activity and was involved in the plant self-defense system in grape berries. Moreover, ABA might suppress the auxin and GA activity and cooperate with ethylene on the process of grape ripening during berry maturation.