A transcriptional study of the effects of nitric oxide on rachis browning in table grapes cv. Thompson Seedless

Zhonghong Wu, Chenghu Dong, Jia Wei, Limin Guo, Yina Meng, Bin Wu and Jiluan Chen

Postharvest Biology and Technology, Volume 175, May 2021, 111471

Abstract

Rachis browning is an unfavorable trait of postharvest table grapes (*Vitis vinifera* L.) and considerably decreases the market value. In this study, we investigated how nitric oxide (NO) delayed the rachis browning progress during cold storage at 0 ± 0.5 °C and during shelf life at 8 ± 0.5 °C and 20 ± 0.5 °C, respectively. The role of NO was explored by changes of storage quality, enzyme activity, and related family gene expression in table grapes cv. Thompson Seedless. The results of transcriptome analysis showed that enzymatic browning might be a main reason for rachis turning brown. NO with 500 μL L^{-1} treatment was the most effective on inhibiting rachis browning. NO significantly prevented the browning by delaying water loss, reducing phenols accumulation, inhibiting PPO activity, and inducing POD activity. At transcription level, NO significantly down-regulated *PPO1*, up-regulated *POD3*, and affected the expression of *PAL2* and *PAL3* in grape rachis. The expressions of *PAL2* and *PAL3* showed a positive relation with phenols accumulation. Furthermore, Pearson correlation demonstrated very significant interaction between PPO activity and *PPO1* expression, suggesting that *PPO1* was the major gene contributing to the observed enzymatic activity. Extremely consistent with the corresponding enzymatic activity and the browning index, suggesting that *PPO1* might be crucial to code the enzyme PPO. Based on these findings, NO might be a promising strategy for improving the rachis freshness and extending the shelf life of postharvest table grapes.