

Title Effects of ethylene degreening on the transcriptome of mandarin flesh
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Abstract

The commercial practice of degreening citrus fruit by exposure to ethylene was developed to accelerate peel color development, but little is yet known about its putative effects on the edible flesh. To improve our understanding of the molecular mechanisms involved in the responses of mandarin flesh to ethylene degreening, we performed genome-wide transcriptional profiling analysis with the Affymetrix Citrus GeneChip[®]. Overall, out of 30,171 probe sets representing citrus transcripts on the microarray, we found that expression of 734 probe sets was significantly ($q \leq 0.01$) altered by factors of at least 3 by exposure to air or 4 $\mu\text{L L}^{-1}$ ethylene for 48 h at 20 °C. One-way ANOVA pair-wise comparisons revealed 163 probe sets that were affected by exposure both to air and to ethylene, 498 sets that were affected only by ethylene, and 73 that were affected only by air. Overall, keeping the fruit at 20 °C for 48 h without ethylene led to an arrest of general cellular and metabolic activity. In contrast, exposure to ethylene stimulated adaptation processes that involved induction of gene expression related to carbohydrate, amino acid, secondary and hormone metabolism, stress and defense, and activation of regulatory processes, including transcription regulation and protein posttranslational modifications. In light of these observations, we propose that ethylene degreening simultaneously stimulates two independent processes in mandarin flesh: on the one hand, storing the fruit at a relatively high temperature of 20 °C resulted in suppression of gene expression and overall metabolic arrest whereas, on the other hand, exposure to ethylene activated gene expression and stimulated various adaptation and metabolic processes, which might impact on fruit internal and nutritional quality.