Title Inhibiting phospholipase A2 and D activities alters postharvest performance of citrus fruit

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Abstract

Phospholipases are enzymes with lipolytic activity that may trigger lipid signalling and/or phospholipid membrane degradation cascades in response to biotic and abiotic cues, including water stress and pathogen attack, two of the most important causes of losses during postharvest. Phospholipase A2 (PLA2) and D activities are induced during water stress in plants and are involved in loss of quality in certain crops following harvest stress and postharvest storage. The role of PLA2 and D as determinants of peel quality was investigated in Citrus fruit by using specific inhibitors, aristolochic acid (AT, a PLA2 inhibitor) and lysophosphatidyletanolamine (LPE, a PLD inhibitor) during postharvest storage. In some Citrus varieties, such as 'Fallglo' tangerines, PLA2 activity is induced under relative humidity (RH) conditions that promote postharvest peel pitting. Mature 'Navelate' fruit was stored at low RH (45%) conditions for 3 weeks at 20°C to promote a high rate of evapotranspiration. Periodically, peel quality determinants such as pitting index and Hunter L index were assessed, and flavedo (the outer colored part of the fruit peel) was sampled for analysis. Expression of genes encoding 5 PLD and 5 PLA2 enzymes was analyzed by real time RT-PCR in flavedo. Volatile emission of fruit was analyzed by GC-MS focusing on oxylipin-derived compounds. Prolonged dehydration promoted peel disorders and altered gene expression and volatile emission. Interestingly, inhibiting PLA2 activity induced a 40% increase in decay incidence, suggesting that suppression of oxylipin signalling may reduce immune response in Citrus fruit. Besides, PLD inhibition reduced epicuticular wax content in the fruit surface. Since waxes are composed by aliphatic compounds including long chain fatty acids, most of them product of phospholipase action, this observation suggests that wax deposition was altered when lipid metabolism was disturbed. In both cases, phospholipase inhibitors alleviated water stress-related disorders in peel. Taken together, data suggest that controlling or modulating phospholipase activities may be beneficial for preserving peel quality during postharvest handling of Citrus fruit.