Title Membrane lipid metabolism and oxidative stress involved in postharvest ripening, senescence, and storage disorders of fruits

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Citation ISHS ActaHorticulturae 945:269-282. 2012.

Keyword α-farnesene; apple; ethylene; lipoxygenase; melon; pear; phospholipase D; phospholipid catabolism; phytosterol conjugation; superficial scald; tomato

Abstract

Loss of membrane function resulting from lipid catabolism and peroxidation has long been associated with natural and stress-induced senescence of plant organs. Phospholipase D (PLD) and lipoxygenase (LOX) are two key enzymes in the proposed senescence cascade of phospholipid catabolism, the former initiating the process and the latter generating hydroperoxides from free di- and tri-enoic fatty acids. Aside from their deleterious effects on membrane structure, both PLD and LOX are now known to constitute large gene families that play an integral role in responses to biotic and abiotic stress via generation of lipid messengers and defense compounds. Another, less studied change in membrane structure associated with stress responses in plants is a redistribution of phytosterols among free and conjugated pools. Steryl glucosides (SG) and acylated steryl glucosides (ASG), in addition to free sterols (FS), are ubiquitous in plant tissues. Often a marked shift in the relative abundance of FS, SG, and ASG in cell membranes occurs in response to various types of stress, presumably altering physical properties and function. Undoubtedly the most important process contributing to membrane dysfunction and stress disorder development in stored produce is peroxidation of structural lipids by oxyradicals. Production of reactive oxygen species (ROS) is an inherent part of aerobic respiration and metabolism, and also plays a critical role in cell signaling cascades. Plant cells possess an array of antioxidant metabolites and antioxidative enzymes to keep ROS in check. However, under prolonged or severe oxidative stress these defenses are overwhelmed, allowing runaway free radical reactions and consequent degradation of lipids, proteins, and nucleic acids. Superficial scald of apple and pear fruits is a good example of a postharvest physiological disorder involving oxidative stress induced by long-term cold storage. The roles of PLD and LOX, sterol conjugation, and oxidative stress in the postharvest life of several fruits are discussed.