Title Aroma biology of harvested fruit: Recent advances and lingering questions

Author Randolph M. Beaudry

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Abstract

Many plant species have evolved fruit-specific biochemical pathways that yield volatile, odor-active compounds to attract herbivores and assist in seed dispersion. The temperate and tropical fruit we eat are no exceptions. Endogenous, spontaneous aroma formation by fruit includes the production of complex cocktails of esters, alcohols, acids, terpenes, thiols, and other compounds. These aroma compounds require no interaction from the consumer of the product apart from using their olfactory sense. Several aroma compounds are also induced or their emission enhanced by the process of mastication even as the fruit are consumed. Cellular disruption of fresh fruit during mastication causes the mixing of cellular contents and induction of numerous chemical and enzymatic reactions not normally present in the intact tissue. The mixture of induced and autonomously-produced aroma compounds changes continuously for climacteric and nonclimacteric fruit alike, as they proceed from 'immature' to 'ripe' to 'overripe'. For the most part, these changes reflect developmentally-driven alterations in the synthesis and availability of aroma compound precursors and the activity of specialized enzymes. Unfortunately, postharvest treatments can often compromise aroma formation by altering fruit development. This fact provides us with the impetus to learn more about the biology of aroma formation - and there is reason to believe there is much to be discovered. In apple, for instance, a newly described 'citramalate' pathway has been shown to contribute to the synthesis of precursors for both straight and branched-chain esters. The existence of this pathway calls into question the commonly held belief that many of the ester precursors are products of degradative processes and instead supports the notion that de novo synthesis of new precursors contributes significantly to the formation of important aroma compounds. Conversely, degradative, lipoxygenase-dependent reactions are essential for the formation of several important aldehydes during the process of eating fresh fruit. Interestingly, we have found the capacity of these 'in-mouth' processes is also under strict developmental control by the fruit. Recent findings aside, the biology of aroma formation still holds many unknowns, however, and perhaps chief among them is whether our knowledge of this biology can be used to preserve aroma while making gains in fruit storability.