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Diversity in Regulation of Fruit Ripening

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Fruit ripening has received considerable attention because of the dramatic changes in a wide range of metabolic processes that occur before and after this event as well as due to its commercial importance. In climacteric fruit, such as tomatoes, melons, persimmons and kiwifruits, ethylene is known to trigger the onset of ripening and to be essential for the completion of the ripening process throughout the stages. Two systems, known as system 1 ethylene, representing basal ethylene in unripe fruit and system 2 ethylene, representing massive ethylene in ripening fruit ripening fruit, have been defined. In order to study on involvement of system 1 in induction of system 2 (ripening ethylene), transgenic tomatoes with *LeEILs* suppressed and 1-MCP, a potent inhibitor of ethylene perception, were employed. The transgenic tomato exhibited strong ethylene insensitivity and non-ripening phenotype. However, the transgenic fruit showed low but consistent increase in ethylene production and 1-MCP treatment failed to inhibit the limited increase in ethylene production. These observations suggest that initiation of ripening ethylene is less likely affected by system 1 ethylene and tightly regulated by developmental factors. Using macroarray of tomatoes, more than 400 genes, which were up- or down-regulated during ripening, were screened as ripening related gene. Both ethylene and MADS-RIN signalings controlled most of the ripening related genes, in which several transcription factors, annotated to TDR4, bZip and GRAS were included. Unlike tomatoes, persimmons decreased its potential of ethylene biosynthesis as fruit developed. After harvest of persimmon fruit, water stress in calyx induced ethylene biosynthesis and stimulated fruit ripening. In kiwifruits, presence of exogenous ethylene or disease stress induced fruit ripening as well as in tomatoes. In intact kiwifruit, however, ethylene production was not detected even after more than one-month storage at room temperature, suggesting that kiwifruit is unlikely to produce ethylene under natural condition. Surprisingly, chilling treatment to kiwifruit stimulated ripening without ethylene biosynthesis. These observations indicate wide diversity in regulation of ripening even in climacteric fruits.

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