Abstract:

It has long been recognised that ethylene plays a major role in the ripening process of climacteric fruit. A more thorough analysis, however, has revealed that a number of biochemical and molecular processes associated with climacteric fruit ripening are ethylene-independent. One of the crucial steps of the onset of ripening is the induction of autocatalytic ethylene production. In ethylene-suppressed melons, ACC synthase activity is induced at the same time as in control melons, indicating that ACC biosynthesis during the early stages of ripening seems to be a developmentally-regulated (ethylene-independent) process. The various ripening events exhibit differential sensitivity to ethylene. For instance, the threshold level for degreening of the rind is 1ppm, while 2.5 ppm are required to trigger some components of the softening process. The saturating level of ethylene producing maximum effects is less than 5 ppm, which is by far lower than the internal ethylene concentrations found in the fruit at the climacteric peak (over 100 ppm). In many fruit chilling temperatures hasten ethylene production and ripening and in some late season pear varieties, exposure to chilling temperatures is even absolutely required for the attainment of the capacity to synthesize autocatalytic ethylene. This is correlated with the stimulation of expression of ACC oxidase and of members of the ACC synthase gene family. Ethylene operates via a perception and transduction pathway to induce the expression of genes responsible for the biochemical and physiological changes observed during ripening. However, only a few genes induced via the ethylene transduction pathway have been described so far. We have used a differential display method to isolate novel ethylene-reponsive (ER) cDNA clones of tomato that potentially play a role in propagating the ethylene response and in regulating fruit ripening. Collectively, these data permit a general scheme of the molecular mechanisms of fruit ripening to be proposed.