Title Hypoxia-induced biological changes indicate the presence of AC oxygen sensor in fruit and cut carnations

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Abstract

The most important aspect of hypoxia for prolonging storage life of certain detached plant organs in general and fruit in particular is retardation of the C_2H_4 climacteric onset. The length of the delay is saturable with respect to O_2 concentration. In apples the delay occurs at O_2 concentration below 6%. This is accompanied by suppression of the accumulation of ACS1 and ERS1 transcripts, both of which increase during the climacteric rise. Low O_2 decreases rate of fruit ripening when their C_2H_4 climacteric has been initiated. This too is saturable with respect to O_2 concentration since suppression of cellulases in climacteric avocado fruit is initiated when concentration of O_2 drops below 10%. Hypoxia induces and/or enhances activity of anoxic proteins and this increase is also O_2-dependent. In apples, the increase in accumulation of ADH transcripts is initiated at concentrations of O_2 below 6%. In carnation petals ADH activity does not increase at O_2 concentrations above 5-6%. Expression of the HMGR1 gene in apples increases with decreasing O_2 concentration in a way similar to that of ADH. Its promoter contains hypoxic-response elements. The collective data indicate the presence of an O_2 sensor that perceives the O_2 concentration and when its concentration drops below a certain level, on the one hand it suppresses the expression of developmentally regulated genes associated with tissue senescence, while on the other it enhances the expression of anoxic proteins. Indirect evidence indicates that the O_2-sensing protein contains Fe, since Co Ni, elements that can replace Fe, enhance ADH activity in air. MCP retards the C_2H_4 climacteric but has no effect on the expression of the ADH anoxic gene. Neither does it inhibit the rise in ADH expression when applied together with low O_2.