Title Inhibition of prolyl 4 hydroxylases delays senescence in cut carnation flowers through the suppression of climacteric ethylene production

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Abstract

Senescence of cut carnation flowers is accompanied by an increase in ethylene production and the sensitivity of the flower to ethylene. These changes in ethylene biosynthesis and signaling were attributed to an up-regulation of ACC synthase and ACC oxidase as well as the down-regulation of ethylene receptor genes. Use of pyridine 2,4-dicarboxylate (PDCA), a potent inhibitor of the in vitro enzymatic activity of two carnation petal prolyl 4 hydroxylases (P4Hs), resulted in alterations in the patterns of expression primarily of ethylene biosynthetic and secondary of ethylene perception genes in petals leading to a significant delay in senescence of cut flowers. A less potent inhibitor of the two carnation P4Hs was less efficient, however, in delaying senescence indicating a correlation between degree of inhibition of DcP4H1 and DcP4H2 enzymatic activity in vitro and degree of suppression of climacteric ethylene production and subsequently of senescence progression. These results suggest an involvement of proline hydroxylation in the regulation of senescence progression considering that P4Hs catalyze the formation of 4-hydroxyproline in hydroxyproline rich glycoproteins such as arabinogalactans (AGPs) and extensins. Although AGPs were shown to be involved in hormonal signaling, there are no reports implicating AGPs in ethylene production and perception in any plant species. The physiological significance of proline hydroxylation in ethylene signaling remains to be elucidated taking into consideration the fact that alterations in proline hydroxylation events lead to alterations in the structure and subsequently function of AGPs.