The identification and functional verification of the cinnamate 4-hydroxylase gene from wax apple fruit and its role in lignin biosynthesis during nitric oxide-delayed postharvest cottony softening

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Abstract

Cottony softening of harvested wax apple fruit is characterized by lignin accumulation, and it involves the activity of cinnamate-4-hydroxylase (C4H) and its encoding gene. This work investigated the characteristics and function of the *C4H* gene of wax apple fruit and discussed its relationship with lignin biosynthesis during nitric oxide (NO)-delayed cottony softening of harvested wax apple fruit. The *C4H* gene cloned from wax apple fruit was named *SsC4H*, and it has a length of 1849 bp and a 1518 bp open reading frame encoding 505 amino acids. The sequence of *SsC4H*-encoded amino acids contained typical C4H domains and shared high sequence similarity and close evolutionary relationships with C4H from other plants; in vitro catalytic activity of C4H was observed in the expressed and purified recombined SsC4H protein. Moreover, the *SsC4H* expression and C4H activities were inhibited in NO-treated wax apple fruit compared with control fruit, with lower lignin content and cottony softening index. Therefore, *SsC4H* was confirmed as the *C4H* gene for wax apple fruit, and the NO-retarded cottony softening of harvested wax apple fruit may be attributed to inhibited expression of *SsC4H* and C4H activity, delaying lignin biosynthesis.