Isolation of the 9-*cis*-epoxycarotenoid dioxygenase (*NCED*) gene from kiwifruit and its effects on postharvest softening and ripening

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Abstract

According to the general consensus, post-ripening effects of ABA on climacteric fruits accelerate the softening process, especially in kiwifruit. In order to further understand the mechanism of ABA action during postharvest ripening of kiwifruit, five ABA synthase genes related to 9-*cis*-epoxycarotenoid dioxygenase (NCED) were isolated from kiwifruit genome, namely, *AcNCED1*, *AcNCED1.1*, *AcNCED2*, *AcNCED3*, and *AcNCED3.1*. Gene expression analysis showed that the expression of *AcNCED1* peaked early during postharvest ripening, a finding that was consistent with the trend observed for the changes in ABA content. *AcNCED1* expression was induced by ABA and repressed by ABA synthesis inhibitor nordihydroguaiaretic acid. We found *cis*-elements related to fruit development and ripening in the *AcNCED1* promoter sequence. Analysis of *AcNCED1* promoter activity showed that ABA and ethylene significantly enhanced the expression of *AcNCED1*. Furthermore, *AcNCED1* silencing inhibited ABA synthesis and delayed kiwifruit softening, whereas transient overexpression of *AcNCED1* in tomato accelerated fruit color development relative to controls. These results indicated that *AcNCED1* encodes a key enzyme involved in ABA synthesis in kiwifruit, and that it may play an important role in the softening process of fruits early in postharvest.