Molecular cloning of a putative Acanthus ebracteatus- 9-cis-epoxycarotenoid deoxygenase (AeNCED) and its overexpression in rice

Abstract

9-Cis-epoxycarotenoid dioxygenase (NCED) is an important enzyme which catalyzes the oxidative cleavage of abscisic acid (ABA), a plant growth regulator which plays a vital role in stress tolerance. In this study, a cDNA sequence encoding NCED from a mangrove plant (Acanthus ebracteatus) was analyzed and overexpressed in rice. Analysis of the deduced amino acid sequence of AeNCED revealed an open reading frame of 1,638 bp encoding a protein of 545 amino acids, with a 123 bp 5'-untranslated region (UTR) and a 259 bp 3'-UTR. The deduced amino acid sequence of AeNCED is more than 80% identical to the amino acid sequences of carotenoid cleavage dioxygenase from carrot, tomato, and coffee. The RNA encoding AeNCED was detected in transgenic rice (Oryza sativa cv. BRRI dhan29) plants overexpressing this cDNA. These plants only showed significantly higher tolerance to salinity at germination and better performance at seedling stages. The levels of ABA in transgenic rice seedlings overexpressing AeNCED treated with 100 mM NaCl for 24 hours were higher than those of untransformed plants. However, a higher level of dihydrophaseic acid (DPA) and ABA glucose ester (ABA-GE) were also observed in these transgenic plants suggesting that rapid degradation of ABA through a self-regulation mechanism.

Keyword: 9-cis-epoxycarotenoid dioxygenase; Overexpression; Rice; Salt tolerance; Sequence analysis