Molecular Cloning and Characterization of a Vacuolar Na^+/H^+ Antiporter Gene from the Succulent Xerophyte *Zygophyllum xanthoxylum*

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Molecular cloning and characterization of a vacuolar Na^+/H^+ antiporter gene from the succulent xerophyte *Zygophyllum xanthoxylum*

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Introduction Salinity is an environment factor that adversely affects plant growth and development . High salinity causes osmotic and oxidative stresses , and the damage in ion homeostasis . To cope with salt stress , plants have developed a variety of adaptation mechanisms . One of them is to compartmentalize Na^+ into the vacuole through the operation of a vacuolar Na^+/H^+ antiporter (NHX) (Apse *et al* ., 1999) . So far , NHX genes have been isolated from the glycophytes , such as *AtNHX1* in *Arabidopsis thaliana* ,*OsNHX1* in rice and *GhNHX1* in cotton , and the halophytes , such as *SsNHX* in *Suaeda salsa* and *SeNHX1* in *Salicornia europaea* . However , NHX genes from the xerophytes have been not reported . In this study , a homologous gene (*ZxNHX*) of vacuolar Na^+/H^+ antiporter was cloned and characterized from a typically succulent xerophyte , *Zygophyllum xanthoxylum* .

Materials and methods The core fragment of *ZxNHX* was cloned by RT-PCR . The full-length cDNA ends of *ZxNHX* were isolated by RACE system . Sequence analysis was run on the software DNAstar . Homology comparison was analyzed using DNAMAN software .

Results The full-length cDNA of vacuolar Na^+/H^+ antiporter gene from *Z . xanthoxylum* was obtained by assembling the core cDNA fragment (Figure 1 a) , 5 -RACE fragment (Figure 1 b) and 3 -RACE fragment (Figure 1 c) . This cDNA consists of 2127 bp with a 5 -untranslated region of 213 bp , an open reading frame of 1558 bp that encodes a protein of 532 amino acids with a calculated molecular weight of 58 .8 KDa , and a 3 -untranslated region of 315 bp containing a ploy (A) tail . It was named as *ZxNHX* and deposited in the GenBank database (accession no . EU103624) . The deduced amino acid sequence of *ZxNHX* shares a high homology with those of the vacuolar Na^+/H^+ antiporters of higher plants , ranging from 80 .7% homology with that of *Populus euphratica PeNHX2* to 72 .7% with that of *Oryza sativa OsNHX1* , and contains the consensus amiloride-binding domain . Semi-quantitative RT-PCR analysis showed that the expression of *ZxNHX* in *Z . xanthoxylum* was induced and regulated by salt stress .

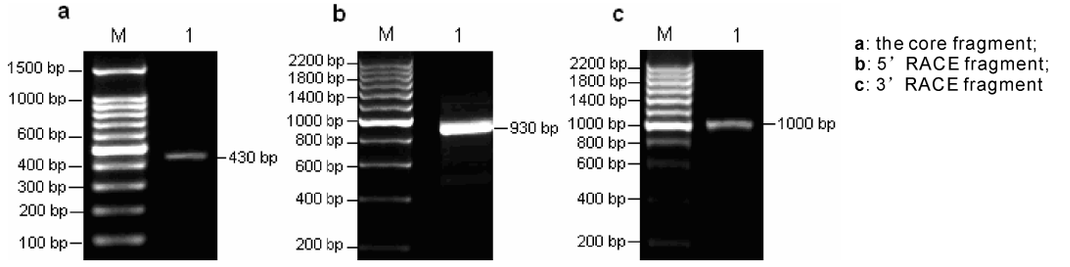

Figure 2 *Agarose gel electrophoresis of the core fragment and RACE fragments of ZxNHX .*

Conclusions The results indicated that the gene *ZxNHX* isolated from *Z . xanthoxylum* is a vacuolar type Na^+/H^+ antiporters . This gene may play important roles in the drought tolerance , its mechanism is under further investigation .

Reference

Apse MP , Aharon , GS , Snedden WA , Blumwald E . 1999 . Salt tolerance conferred by overexpression of a vacuolar Na^+/H^+ antiporter in *Arabidopsis* .*Science* . 285 : 1256-1258 .