Downregulation of high-affinity potassium and sodium symporter gene, EcHKT1;1, in Eucalyptus roots enhances salt tolerance

BALASUBRAMANIAN Aiyar\textsuperscript{1}, Selvakesavan Rajendran kamalabai\textsuperscript{1}, Shamili Krishnaraj\textsuperscript{1}, Sandhya M C\textsuperscript{1}, Usha Jayachandran\textsuperscript{1}, Sudha Selvam\textsuperscript{1}, Siva kumar V\textsuperscript{1}, Sowmiya Kottaipalayam-Somasundaram\textsuperscript{1}, Suryaprabha A C\textsuperscript{1}, Vijaya Kumar Waman Bachpai\textsuperscript{1}, Hassen Gherbi\textsuperscript{2}, Claudine Franche\textsuperscript{2}, and Mathish Nambiar-Veetil\textsuperscript{1}

\textsuperscript{1}Institute of Forest Genetics and Tree Breeding
\textsuperscript{2}French National Research Institute for Sustainable Development

April 4, 2021

Abstract

Engineering for restricted root Na\textsuperscript{+} uptake could potentially enhance salt tolerance in Eucalyptus. High-affinity K\textsuperscript{+} transporters (HKTs) have been implicated in Na\textsuperscript{+} uptake from the external medium as in the case of TaHKT2;1 or in the unloading of Na\textsuperscript{+} from xylem like in AtHKT1;1. To rapidly determine the in planta role of EcHKT1:1, composite transgenics in which EcHKT1:1 was specifically downregulated via RNAi in the roots were generated. Compared to the controls that failed to survive at 350 mM NaCl, 33 \% of the composite transgenic plantlets generated using the EcHKT1;1 silencing construct were able to tolerate up to 400 mM NaCl. In these composite transgenics, EcHKT1:1 downregulation ranged from 37 \% to 74 \%. The average shoot to root ratio of sodium was 4.9 folds lower than the controls indicating restricted translocation of Na\textsuperscript{+} to the shoots. Relative expression analysis in the leaves of two non-transgenic genotypes contrasting for their salt tolerance also showed downregulated EcHKT1:1 expression in the tolerant clone. The study thus determined that EcHKT1:1 is a major gene determining Na\textsuperscript{+} transport from the roots to shoots. This study also demonstrated the utility of the composite transgenic approach for screening genes conferring salt tolerance in tree species.

Hosted file
