GMR Genetics and Molecular Research
Online Journal
ISSN:1676-5680

# *Phosphate-induced-1* gene from *Eucalyptus* (*EgPHI-1*) enhances osmotic stress tolerance in transgenic tobacco

**A.O. Sousa, E.T.C.M. Assis, C.P. Pirovani, F.C. Alvim and M.G.C. Costa**

Centro de Biotecnologia e Genética, Departamento de Ciências Biológicas, Universidade Estadual de Santa Cruz, Ilhéus, BA, Brasil

Corresponding author: M.G.C. Costa
E-mail: marciogc.costa@gmail.com

Genet. Mol. Res. 13 (1): 1579-1588 (2014)
Received January 21, 2013
Accepted June 29, 2013
Published March 12, 2014
DOI http://dx.doi.org/10.4238/2014.March.12.10

**ABSTRACT.** Environmental stresses such as drought, freezing, and high salinity induce osmotic stress in plant cells. The plant response to osmotic stress involves a number of physiological and developmental changes, which are made possible, in part, by the modulation of the expression of specific genes. *Phosphate-induced-1* gene (*PHI-1*) was first isolated from phosphate-treated phosphate-starved tobacco cell cultures as a stress-inducible gene, which is presumably related to intracellular pH maintenance; however, the role of the *PHI-1* gene product has not yet been clarified. A gene encoding a predicted protein with high similarity to tobacco PHI-1, named *EgPHI-1*, was previously identified in *Eucalyptus* by comparative transcriptome analysis of xylem cells from species of contrasting phenotypes for wood quality and growth traits. Here, we show that the overexpression of *EgPHI-1* in transgenic tobacco enhances tolerance to osmotic stress. In comparison with wild-type plants, *EgPHI-1* transgenic plants showed a significant increase in root length and biomass dry weight under NaCl-, polyethylene glycol, and mannitol-induced osmotic stresses. The enhanced stress tolerance of transgenic plants was correlated

 

with increased endogenous protein levels of the molecular chaperone binding protein BiP, which in turn was correlated with the *EgPHI-1* expression level in the different transgenic lines. These results provide evidence about the involvement of *EgPHI-1* in osmotic stress tolerance via modulation of BiP expression, and pave the way for its future use as a candidate gene for engineering tolerance to environmental stresses in crop plants.

**Key words:** Intracellular pH; Phosphorylation; Abiotic stress; Chaperone; Endoplasmic reticulum; Cell death

 