



Pattern of *CsICE1* expression under cold or drought treatment and functional verification through analysis of transgenic *Arabidopsis*

Z.T. Ding, C. Li, H. Shi, H. Wang and Y. Wang

Tea Research Institute, Qingdao Agricultural University, Qingdao, Shandong, China

Corresponding author: Y. Wang

E-mail: wangyutea@163.com

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ABSTRACT. *CsICE1* is thought to be involved in hardiness resistance of tea plants. Using seedling cuttings of biennial Wuniuzao in this study, the pattern of *CsICE1* expression under cold temperature (4°, -5°C), drought [20% polyethylene glycol 6000 (PEG-6000)], and plant hormone [200 mg/L abscisic acid (ABA), 1 mg/L brassinolide (BR)] treatment was studied by real-time quantitative PCR. Additionally, stress resistance, such as the freezing resistance of *CsICE1*, was studied using *Arabidopsis* lines transformed with sense or anti-sense *CsICE1* via *Agrobacterium tumefaciens* infection. Our results showed that *CsICE1* mRNA could be induced under -5°C, PEG, ABA, or BR treatment, although the pattern of expression differed for all treatments. Compared to wild type (WT) and anti-sense *ICE1* transgenic lines, sense lines displayed higher relative germination rates under salt and drought stress. After freezing treatment, the sense transgenic lines over-expressing *CsICE1* showed a higher survival rate, increased levels of proline, and decreased levels of malonaldehyde. Conversely, compared with WT, anti-sense *ICE1* transgenic lines had lower proline levels and higher malonaldehyde levels under freezing conditions. Our study

indicates that *CsICE1* is an important anti-freezing gene and that over-expression of *CsICE1* can improve cold resistance and enhance salt and drought tolerance of transgenic lines.

Key words: *CsICE1*; Expression pattern; Real-time quantitative PCR; Tea plant