(05-1-72)

Arabidopsis trehalase *AtTRE1* controls the level of endogenous trehalose and involves in plant growth and development

Hwa-Jee Chung, Ju Young Park, Sung Ran Min, Jang Ryol Liu*

Laboratory of Environmental Biotechnology, Korea Research Institute of Bioscience and Biotechnology (KRIBB), Daejeon 305-806, Korea

Objectives

Many organisms have developed mechanisms to sense and respond to internal or external soluble sugars for maintenance of growth and metabolism. In higher plants, the soluble sugars act as important signaling molecules that affect a wide range of biological functions, including flowering time, cell cycle control, leaf senescence, seed development and germination, and early seedling development. Although the sugars act in concert with various cellular components, only a few are currently known. Trehalose, a nonreducing disaccharide of two glucose units, is present in many prokaryotic and eukaryotic organisms. Its function as an energy source or cellular protectant under stress conditions has been well studied in yeast and *E. coli*. However, in plants there is only limited knowledge of the functions of endogenous trehalose and its hydrolysis enzyme trehalase. To understand the function of endogenous trehalose and its hydrolyzing enzyme trehalase in plants, we isolated AtTRE1 T-DNA knockout mutant.

Materials and Methods

1. *Attre1* mutant was isolated by reverse genetics using gene-specific and T-DNA left border primers.
2. Promoter of AtTRE1 was PCR amplified and fused to GUS reporter genes, and subsequently introduced into Arabidopsis.
3. Total carbohydrates were determined by H+-NMR and HPLC analysis.

Results

We isolated a T-DNA knockout plant, *Attre*, that has impaired trehalase activity. The *Attre* mutant contained elevated levels of endogenous trehalose and T6P, and exhibited phenotypic abnormalities in both vegetative and reproductive organ development, including growth retardation, abnormal leaf and flower morphologies, and impaired pollen production. Interestingly, a disruption of *AtTRE* resulted in alterations in trehalose synthesis and expression of stress responsive genes together with components of the abscisic acid (ABA)- and glucose-signaling pathways. Therefore, our results indicate that endogenous trehalose acts as a signaling molecule, and that *AtTRE* functions in growth and development by controlling the cellular level of endogenous trehalose.

* *Corresponding author* : Jang Ryol Liu Tel: 042-860-4430, E-mail: jrliu@kribb.re.kr