Gene Expression Analysis of Barley Genotypes Contrasting for their Tolerance to Salinity Stress

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Abstract - **Salinity is one of the most severe environmental stresses affecting plant productivity worldwide. Studies of the physiological and molecular mechanisms involved in tolerance to salinity indicate that to prevent the accumulation and toxicity of sodium in leaf cytoplasm, plants have developed at least four mechanisms that function in a cooperative manner, i.e., restriction of Na^+ influx, active Na^+ extrusion at the root-soil interface, controlled translocation of Na^+ to the shoots, and compartmentalization of Na^+ into the vacuole. Ten barley genotypes showing contrasting phenotypes, selected from the USDA barley core collection (2750 lines) (accessions with high relative biomass under saline stress that have relatively high flag leaf Na+/K+ content, versus accessions with high relative biomass under saline stress that have low flag leaf Na+/K+ content) were cultivated in pots in hydroponic system under greenhouse conditions. Two salt stress treatments were applied to seedlings (7dsm-1 and 15dsm-1) along with control (0dsm-1). All treatments were made in triplicate. The salinity was maintained for the rest of the growth cycle. Primers to amplify the barley candidate genes (HKT1;5, HKT1;4, NHX1, and V-H+-PPase) and to monitor their expression profile by semi-quantitative RT-PCR, were synthesized. This study will contribute to understanding the mechanism of salt tolerance in barley and provide alternative barley genotypes that are tolerant to salinity.**

Keywords: Barley; ion homeostasis; Sodium/ Potassium transporters; gene expression; Salinity tolerance

4th Annual International Conference on Advances in Biotechnology (BioTech 2014)

ISSN 2251-2489
doi: 10.5176/2251-2489_ BioTech14.44

I. INTRODUCTION

Saline soils are widespread in arid and semi arid regions of the world. Soil salinity has an impact on the plant growth and its physiology.[19] Environmental factors are the primary cause of average yield losses of crop. [2] Plants differ greatly in the tolerance of salinity as reflected in their growth response.[20]

Barley is a model cereal crop to study salinity tolerance.[19] Barley is one of the most ancient cultivated crops. Barley is the 4th most important cereal grain and is used for livestock feed, malt, malt beverage and food. During the process of domestication, barley has gradually accumulated traits that facilitated agricultural production. [1]

Environmental clues trigger physiological and molecular responses that enable the plant to prevent or minimize exposure to stressful situation, or to adapt and prevail over the unavoidable difficulty [2] Salt tolerance of the plants depends on many genes which mediates sodium specific transport or Sodium-Potassium co-transport.[20] The variations in the gene expression in different accession is very helpful in screening and selection of salt tolerant varieties.

Sodium and potassium are alkali metals and both are highly important for the cell function and survival in all living organisms.[19] Both will form mono-valent cations by losing one electron. Sodium is toxic to the cell since it disrupts and denatures macromolecules such as proteins and nucleic acid and it produces strong electric field. [9]. Hence it is a chaotropic.[18]

Potassium ion is comparatively larger and produces weaker electric field. Potassium