

Alteration in the Defense Network Involved in Mitigating the Oxidative Burst of C3 and C4 Plants Exposed to Heat Stress

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Abstract—Heat stress is one of the major abiotic stresses that limit the plant growth, development and productivity worldwide. Several molecular and biochemical reactions are altered due to elevation in temperature. Plant response to heat stress varies with the degree and duration of heat stress. Wheat (C3) and Maize (C4) are two important staple food grain crops after rice. Heat is an important constraint to the crop productivity in both the crops affecting the reproductive stage. Here, we have compared the different genotypes of wheat and maize for their thermotolerance associated biochemical responses towards heat stress. We observed very high level of lipid peroxidation (component of oxidative stress) in leaves of different genotypes of wheat, as compared to maize under HS. Activity profiling of antioxidant enzymes like superoxide dismutase and catalase showed very high activity in C4 compared to C3 plants under HS. We also observed very high accumulation of osmolyte, especially proline in C4 plants under HS, as compared to C3. Stage specific analysis showed very efficient scavenging mechanism of C4 plants, especially high antioxidant enzyme activity, high accumulation of Osmolyte and high total antioxidant potential under HS. These findings suggest that maize, being C4, has very responsive antioxidant enzymes network for augmenting the thermotolerance mechanism under HS compared to C3 plants like wheat. These biochemical parameters can be used as potential markers for screening wheat germplasm for thermotolerance. Selection of genotypes based on these criteria may help in the development of varieties tolerant to heat stress.

Keywords: Heat stress, wheat, maize, C3 Plants, C4 plants, Proline, Antioxidant enzymes, Catalase, SOD.