The Stress of Suicide: Temporal and Spatial Expression of Putative Heat Shock Protein 70 Protect the Cells from Heat Injury in Wheat (*Triticum aestivum*)

Ranjeet R. Kumar[1*], Suneha Goswami[1], Gyanendra K. Rai[2], Pooja Verma[1], Kavita Dubey[1], Khushboo Singh[1], Sweta Singh[1], Sadhana Maruya[1], Yugal K. Kala[3], Gyanendra P. Singh[3], Sushil K. Sharma[1], Himanshu Pathak[4], Raj D. Rai[1]

[1]Division of Biochemistry, [3]Division of Genetic, [4]Center for Environment Science and Climate Resilient Agriculture, Indian Agricultural Research Institute, New Delhi, India Pin 110012
[2]Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu

Abstract—*Heat stress adversely affects growth, development and yield of winter wheat (Triticum aestivum). Plants have, however, evolved mechanisms to adapt to such conditions mainly by the expression of stress-associated chaperones, the heat shock proteins (HSPs), for modulating the tolerance level. Here, we report cloning of cytosolic putative HSP70 of 1678 bp from a thermotolerant cultivar (C306) of wheat (T. aestivum). BLASTn search showed maximum homology with predicted HSP70 protein reported from Hordeum vulgare (accession no AK354795.1). In silico characterisation showed presence of nucleotide-binding domainof the sugar kinase/HSP70/actin superfamily in the sequence. Putative HSP70 showed temporal and spatial variations in the expression under the heat stress (HS). We observed abundance of HSP70 protein, H_2O_2, proline, and guaiacol peroxidase activity during the seed-hardening stage under HS; accumulation was, however, more in the thermotolerant C306 than in thermosusceptible HD2329 cultivar. Gradual decrease in the cell membrane stability (CMS) and increase in the total antioxidant capacity (TAC) were observed in both the cultivars at the different stages of growth. The expression of HSP70 showed negative correlation with CMS and positive with TAC under HS; changes were less pronounced in C306 than in HD2329 at all the stages of growth studied. HSP70 seems to play diverse roles associated with the thermotolerance, and partially protect the wheat from the terminal HS. Being the important member of family of the HSPs, HSP70 needs to be studied in detail, to be used for developing climate-smart wheat crop, through genetic engineering / breeding approaches.*

Keywords*: Wheat;Lipid peroxidation; Heat stress; H_2O_2; Wheat; HSP70; Osmolyte; ROS; Transcript; qRT-PCR; Proline*