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Genomic analysis, evolution, and expression profiling of the BPC genes family revealed their conserved role in regulating abiotic stress in Tomato

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Abstract

Global crop yield and sustainable agriculture are seriously threatened by the combined effects of heat and drought stress, with tomato plants being especially vulnerable to these environmental conditions. Plant development and responses to abiotic stressors are known to be significantly regulated by the BASIC PENTACYSTEINE (*BPC*) gene. Its precise role and the biological mechanisms underlying it in tomato are still unclear. This study aimed to evaluate the *SlBPC* gene's function in providing tomato plants with abiotic stress tolerance. Five potential *SlBPC* gene family members were found that were consistently positioned onto five chromosomes. The *SlBPC* genes were divided into three subgroups employing phylogenetic studies by incorporating *BPC* members from Arabidopsis, rice, wheat, soybean, and tomato. A comprehensive analysis of *SlBPCs* revealed that individuals belonging to the same subgroup shared similar patterns, gene structures, and cis-regulatory regions. Several members have components linked to hormones, stress reactions, and developmental processes. Using data from the NCBI database, the expression patterns of *SlBPC* genes in seedlings and leaves under heat and drought stress conditions were analyzed. Under heat stress, expression levels peaked after 12 hours, and during the first day of the drought, *SlBPC* genes reached their maximum. RNA-seq analysis showed significant differential expression in the vein and intervein during drought (T1). In the vein, *SlBPC1* and *SlBPC4* were upregulated, while *SlBPC2* and *SlBPC5* were downregulated, and in the intervein. The implication is that *SlBPCs* play a role in facilitating plant adaptation to abiotic stress conditions by responding to abiotic stressors. The findings, taken together, provide a framework for functional research of *SlBPCs* in tomato, particularly for controlling heat and drought stress.

Key Words: *Genome-wide, BASIC PENTACYSTEINE, Tomato, Heat, Drought*