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Pearl Millet WRKY Transcription Factor PgWRKY60 Can Retard Growth under Both Unstressed and Abiotically Stressed Conditions in Genetically Modified Arabidopsis

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Extended Abstract

Pearl millet (Pennisetum glaucum) is a cereal crop that can tolerate high temperatures, drought, and low-fertility conditions where other crops lose productivity. However, genes regulating this ability are largely unknown. Transcription factors (TFs) regulate transcription of their target genes, regulate downstream biological processes, and thus are candidates for regulators of pearl millet tolerance to the adverse conditions. PgWRKY60 is a pearl millet gene encoding a group III WRKY TF, and its expression is stronger in salinity-stressed ICMB081 shoots than salinity-stressed ICMB01222 shoots and unstressed ICMB081 and ICMB01222 shoots (Shinde et al., 2018). These findings tempted us to further characterize its functions as a TF potentially regulating plant responses to drought and salinity stress. Group III WRKYs in pearl millet have not been characterized thus far and their roles in abiotic stress mediation is unknown. This particular gene has nuclear localization potential (Fig. 1A). A construct with PgWRKY60 enabled yeast reporter cells to survive on test media in the yeast one-hybrid assays indicating the gene is capable of activation transcriptional function (Fig. 1B). Transgenic Arabidopsis thaliana plants overexpressing PgWRKY74-GFP fusion protein were generated and tested for growth and stress-responsive gene expression under mannitol and NaCl-stressed conditions (Fig. 2). Most PgWRKY60-ox lines exhibited smaller rosette areas and smaller root length than did the wild type under unstressed, mannitol-stressed and salinity-stressed condition. Only line #3 exhibited smaller rosette areas than did the wild type under mannitol stress. Lines #3, #4 and #5 had smaller root lengths than wild type under salt stress. This indicates that PgWRKY60 negatively regulates shoot and root growth even under an unstressed condition. These findings provide evidence for its possible roles in response to stress and provide ideas for future research to develop stress resistant cultivars.

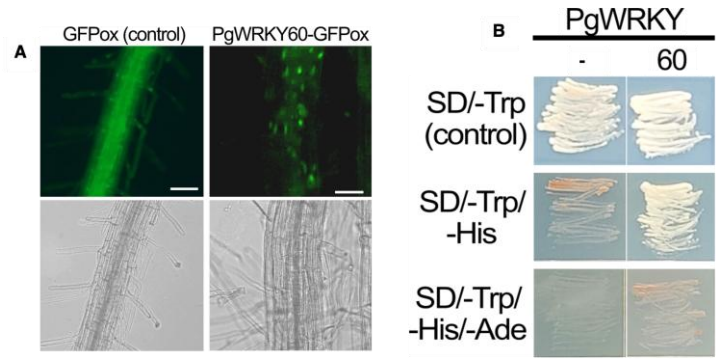

Figure 1: (A) PgWRKY60 is localized in the nucleus, (B) PgWRKY60 can activate reporter genes in a yeast one-hybrid.

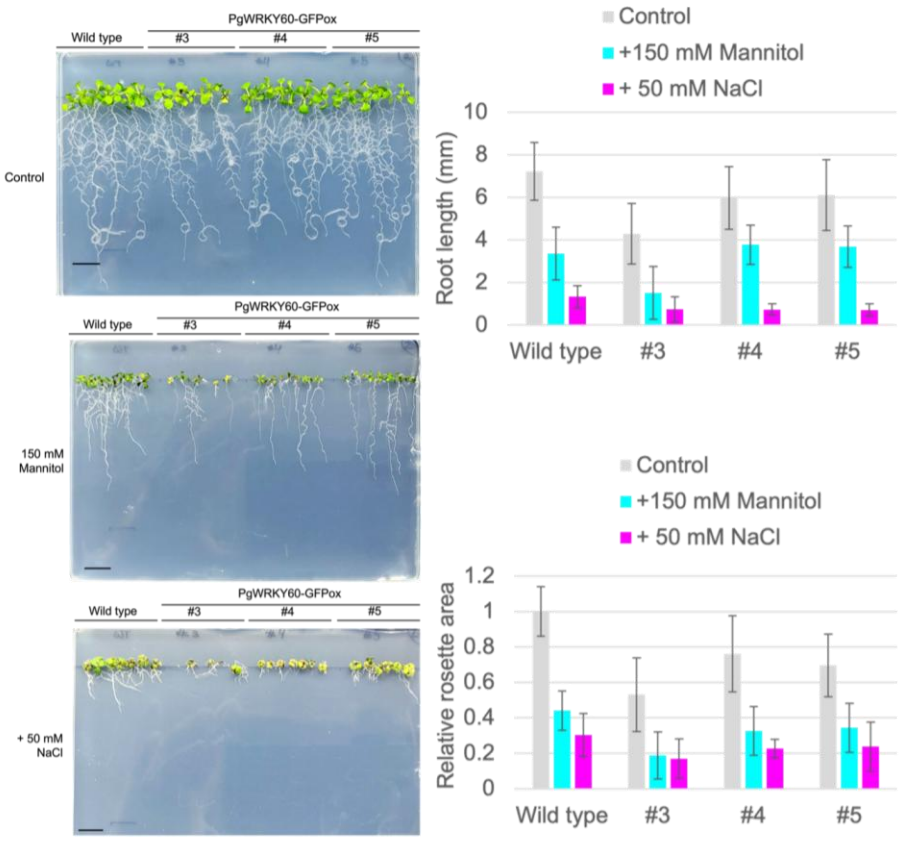

Figure 2: PgWRKY60-GFP-overexpressing (PgWRKY60-GFPox) plants exhibit rosette growth retardation under mannitol- and NaCl-stressed conditions.

References

[1].Shinde H, Tanaka K, Dudhate A, Tsugama D, Mine Y, Kamiya T, Gupta SK, Liu S, and Takano T, Comparative de novo transcriptomic profiling of the salinity stress responsiveness in contrasting pearl millet lines, Environmental and Experimental Botany 155, 619-627, 2018.