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A novel U-Box E3 ubiquitin ligase gene *GmPUB6* stimulates the expression by multiple stresses and plays a negative role in drought stress tolerance in transgenic *Arabidopsis thaliana*

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The plant U-box protein functions as an E3 ligase to poly-ubiquitinate a target protein for its degradation or post-translational modification. PUB play important roles in the regulation of gene expression and the subsequent control of a number of important biological processes, including those involved in the response to environmental stress, but only some of them have been investigated for effects on disease reaction in cereal crops. In this study, we report the identification and functional characterization of the *GmPUB6* gene, which functions in the adaptive response to abiotic stress. We found that *GmPUB6* expressed differentially in various soybean organs.

Otherwise, *GmPUB6* transcript accumulation was highly induced by abscisic acid, jasmonate, aluminum toxicity, cold, hot, high salinity and polyethylene glycol treatment in leaves and roots. In addition, GmPUB6 was localized to post-Golgi compartments, and showed E3 ubiquitin ligase activity by in vitro ubiquitination assay. For further functional analysis, we used *GmPUB6*-overexpressing transgenic *Arabidopsis* plants to show that the GmPUB6 protein regulates the osmotic stress response. *GmPUB6*-overexpressing transgenic *Arabidopsis* plants showed increased drought susceptibility, and this was accompanied by survive rate. *GmPUB6* transgenic plants displayed phenotypes that were hyposensitive to ABA and hypersensitive to osmotic stress, during the seed germination and seedling growth stages; and inhibited ABA-mediated stomatal closure. Together, these results demonstrate that *GmPUB6* plays a negative role in ABA and drought responses in *Arabidopsis thaliana* and could be a potent candidate gene for the genetic improvement of drought resistance in soybean.