

Exogenous priming of chitosan induces resistance in Chinese prickly ash against stem canker caused by *Fusarium zanthoxyli*

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Abstract: Stem canker is a highly destructive disease that threatens prickly ash plantations in China. Synthetic fungicides are commonly used to manage stem canker in prickly ash. However, the indiscriminate use of these chemicals raises concerns regarding pesticide residues in crops. Therefore, the development of environment-friendly control measures against stem canker has become an urgent and important driving force for the sustainable development of the green prickly ash industry. This study demonstrated the effective control of stem canker in prickly ash using chitosan priming, significantly decreasing the infection incidence of *Fusarium zanthoxyli* and reducing the lesion areas of stem canker by 46.77 % to 75.13 % across all chitosan treatments. The mechanisms underlying chitosan-induced systemic acquired resistance (SAR) in prickly ash were further investigated. Chitosan treatment stimulated the prompt accumulation of H₂O₂ in prickly ash stems in a short period of time and then quickly returns to normal levels. During this period, there was no significant difference in MDA content, but peroxidase and catalase enzyme activities enhanced. A well-constructed regulatory network depicting the genes involved in the SAR and their corresponding expression levels in prickly ash plants primed with chitosan was established based on transcriptomic analysis. The key DEGs associated with CS-induced SAR in prickly ash stems were annotated, including *LYM2*, *CERK1*, *RLCK185*, *RLCK176*, *RbohD*, *CPKs*, *M3K3A*, *M3K5G*, *M2K5*, *MPK3*, *VIP1*, *EIN3*, *EIL*, *ERF1B*, *PR1*, *PR5*, *E13*, and *ChiB*. Additionally, 224 *ZbWRKYs* were identified based on the whole genome of prickly ash, and their phylogenetic evolution, conserved motifs, domains and expression patterns of *ZbWRKYs* were comprehensively illustrated. Among the 44 identified *ZbWRKY* DEGs, several WRKY TFs known to be involved in plant SAR were identified, including *WRKY22*, *WRKY29*, *WRKY33*, and *WRKY40*. The expression of 12 key genes related to the SAR was significantly increased by chitosan, including *LYM2*, *CERK1*, *RLCK176*, *MPK3*, *CPK4*, *RbohD*, *WRKY33*, *EIN3*, *PR1*, *PR5*, *E13*, and *ChiB*, as determined using reverse transcription-quantitative polymerase chain reaction. Furthermore, the activities of defensive enzymes (PAL, PPO, C4H, CHS, CAD and CHI) and the accumulation of lignin and flavonoids in prickly ash were significantly enhanced by chitosan treatment. Taken together, this study provides valuable insights into the chitosan-mediated activation of the immune system in prickly ash, offering a promising eco-friendly approach for forest stem canker control.