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In-silico investigation of the potential role of PBS3 gene in salicylic production in Cacao

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Abstract

Badnaviruses, especially Cacao swollen shoot virus (CSSV), is a major threat to cacao plants. Dispersed by insects, these DNA viruses cause swollen shoots, stunted growth, resulting in reduced yields, negatively impacting chocolate production worldwide. Salicylic Acid, A Plant's Built-in Alarm System Against Viruses, activate PR-genes in plants. Homology analysis with *Arabidopsis thaliana* suggests the potential involvement of PBS3 (avr-PphB Susceptible 3) gene family in salicylic acid (SA) biosynthesis. PBS3 protein attaches Glutamate to Isochorismic acid (ICA) to produce Isochorismate-9-Glutamate, then which produces salicylic acid. This study employed in-silico methods to identify and characterize PBS3 genes within the cocoa (*Theobroma cacao*) genome. This study analyzes gene structure, chromosomal location, protein motifs, phylogeny, synteny, transcriptome expression, and potential microRNA targets to elucidate the structural and functional characteristics of the PBS3 family in *T. cocoa*. Our findings revealed 24 *PBS3 genes* distributed across three chromosomes in *T. cocoa*. The abundance of *PBS3 genes* suggests extensive dispersion through segmental duplications (paralogous events) compared to tandem duplications (orthologous events). Transcriptomic analysis indicated high expression of *PBS3 genes* in response to Phytophthora megakarya inoculation, a fungal pathogen of *T. cocoa*. Additionally, Phylogenetic analysis with Arabidopsis thaliana identified five subfamilies within the GH3 family, encompassing both *T. cocoa* and Arabidopsis genes, sharing functional characteristics Further exploratory investigation of *PBS3 gene* and its underline mechanisms involved in SA production will enhance scientific knowledge of researchers in development of disease tolerance in cacao cultivars. However, further investigation is needed to validate the present results and to further understand the mechanisms controlling upregulation and downregulation of PBS3 and associated genes in plant stress tolerance.

Keywords: *Theobroma cacao, Disease resistance, Badnavirus, Salicylic acid, PBS3 gene family,*