

EgJUB1 and EgERF113 transcription factors as potential master regulators of defense response in *Elaeis guineensis* against the hemibiotrophic *Ganoderma boninense*

ABSTRACT

Background: Hemibiotrophic pathogen such as the fungal pathogen *Ganoderma boninense* that is destructive to oil palm, manipulates host defense mechanism by strategically switching from biotrophic to necrotrophic phase. Our previous study revealed two distinguishable expression profiles of oil palm genes that formed the basis in deducing biotrophic phase at early interaction which switched to necrotrophic phase at a later stage of infection. Results: The present report is a continuing study from our previous published transcriptomic profiling of oil palm seedlings against *G. boninense*. We focused on identifying differentially expressed genes (DEGs) encoding transcription factors (TFs) from the same RNA-seq data; resulting in 106 upregulated and 108 downregulated TFs being identified. The DEGs are involved in four established defense-related pathways responsible for cell wall modification, reactive oxygen species (ROS)-mediated signaling, programmed cell death (PCD) and plant innate immunity. We discovered upregulation of JUNGBRUNNEN 1 (EgJUB1) during the fungal biotrophic phase while Ethylene Responsive Factor 113 (EgERF113) demonstrated prominent upregulation when the palm switches to defense against necrotrophic phase. EgJUB1 was shown to have a binding activity to a 19 bp palindromic SNBE1 element, WNNYBTNNNNNNNAMGNHW found in the promoter region of co-expressing EgHSFC-2b. Further in silico analysis of promoter regions revealed co-expression of EgJUB1 with TFs containing SNBE1 element with single nucleotide change at either the 5th or 18th position. Meanwhile, EgERF113 binds to both GCC and DRE/CRT elements promoting plasticity in upregulating the downstream defense-related genes. Both TFs were proven to be nuclear-localized based on subcellular localization experiment using onion epidermal cells. Conclusion: Our findings demonstrated unprecedented transcriptional reprogramming of specific TFs potentially to enable regulation of a specific set of genes during different infection phases of this hemibiotrophic fungal pathogen. The results propose the intricacy of oil palm defense response in orchestrating EgJUB1 during biotrophic and EgERF113 during the subsequent transition to the necrotrophic phase. Binding of EgJUB1 to SNBE motif instead of NACBS while EgERF113 to GCC-box and DRE/CRT motifs is unconventional and not normally associated with pathogen infection. Identification of these phase-specific oil palm TFs is important in designing strategies to tackle or attenuate the progress of infection.

Keyword: JUNGBRUNNEN 1; ERF113; SNBE motif; GCC-box; DRE/CRT; Hemibiotrophic