

Selection of reference genes for quantitative real-time PCR normalization in Ganoderma-infected oil palm (*Elaeis guineensis*) seedlings

ABSTRACT

African oil palm (*Elaeis guineensis*) is an important oil bearing tree commercially cultivated in Malaysia. Palm oil is an important product for local consumption, provides enormous socio-economic benefits of trade and employment opportunities, and fulfilling the growing global demand for vegetable oils. The monoculture system has fostered the outbreak of basal stem rot (BSR) disease caused by the fungus *Ganoderma boninense*. Quantitative real-time PCR (qRT-PCR) is a widely used molecular technique to examine the infection effect on gene expression in oil palm. The selection of appropriate reference genes is vital for accurate data normalization. In this study, the expression stability of six housekeeping genes- β -actin, cyclophilin, GAPDH, MSD, NAD and ubiquitin were validated in oil palm root tissue after fungal infection. NormFinder and BestKeeper algorithms were used to cross-validate the expression stability of the candidate reference genes. MSD, NAD and ubiquitin were shown to exhibit the highest expression stability. These genes were recommended as reference genes for gene expression studies of oil palm root tissue at early fungal infection stage.

Keyword: Reference genes; Gene expression; qRT-PCR; Oil palm; *Ganoderma boninense*