Genome-wide molecular characterization of Phosphate Transporter 1 and Phosphate Starvation Response gene families in Elaeis guineensis Jacq. and their transcriptional response under different levels of phosphate starvation

ABSTRACT

Phosphate (Pi) fertilizer is applied in huge amount due to the poor absorption of Pi by crops especially in acidic tropical soil. As the major global source of oil and fats, the mechanism of Pi transport in oil palm needs to be studied to maintain good productivity for sustainable palm oil production. Ten Elaeis guineensis Phosphate Transporter1 (EgPHT1) and three Elaeis guineensis Phosphate Starvation Response (EgPHR) genes were identified in this study. All EgPHT1 proteins contain GGDYPLSATIxSE, the signature sequence of PHT1. All EgPHR have MYB-binding domain and coiled-coil domain characteristic of PHR at their C-terminal regions and one unique SOG2 domain for EgPHR1. The expression of four of the EgPHT1 and two of the EgPHR under low Pi (LP) and Pi starvation (-P) was studied by real-time quantitative PCR (qPCR). All genes showed enhanced expression in roots at −P compared to +P but no detectable change in the leaves. The expression profile of EgPHR2 which showed significant upregulation at LP compared to +P and further increase at −P correlated with EgPHT1;4 and EgPHT1;7 that possess P1BS motif in their promoter sequences, the binding site for PHR. PHR2, as a potential early transcriptional regulator for phosphate starvation was proven to be nuclear localized by subcellular localization experiment. Altogether, this study suggests all four analyzed EgPHT1 and two EgPHR play critical role in responding to Pi deprivation in oil palm. EgPHT1;4 and EgPHT1;7 which possess the P1BS motif are potentially upregulated by EgPHR2 as an early response mechanism against phosphate starvation.

Keyword: Transcriptional regulation; Transcription factors; Promoter motifs; PHT1; PHR; Pi starvation; Oil palm