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Molecular mechanism underlying *Arabidopsis* root architecture changes in response to phosphate starvation

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Abstract

To cope with phosphate (Pi) deficient stress, plants modulate various physiological and developmental processes, such as gene expression, Pi uptake and translocation, and root architecture changes. Here, we report the identification and characterization of novel activation-tagged mutant involved in Pi starvation signaling in *Arabidopsis*. The *hpd* (hypersensitive to Pi deficiency) mutant exhibits enhanced phosphate uptake and altered root architectural change under Pi starvation compared to wild type. Expression analysis of auxin-responsive *DR5::GUS* reporter gene in *hpd* mutant indicated that auxin translocation in roots under Pi starvation are suppressed in *hpd* mutant plants. Impaired auxin translocation in roots of *hpd* mutant was attributable to abnormal root architecture changes in Pi starvation conditions. Our results indicated that abnormal auxin translocation in *hpd* mutant might be due to mis-regulation of auxin efflux carrier proteins, PIN-FORMED (PIN) 1, and 2 under Pi starvation conditions. Not only expression levels but also expression domains of PIN proteins were altered in *hpd* mutant in response to Pi starvation. Molecular genetic analysis of *hpd* mutant revealed that the mutant phenotype is caused by the lesion in *ENHANCED SILENCING PHENOTYPE4* (*ESP4*) gene whose function is proposed in mRNA 3'-end processing. The results suggest that mRNA processing plays crucial roles in Pi homeostasis as well as developmental reprograming in response to Pi deprivation in *Arabidopsis*.

Keyword: Phosphate starvation, Root architecture, PIN, *ESP4*

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