A024 AGSC

Small Signaling Peptides Mediate Nodulation and Nitrogen Acquisition

Abstract

Plant roots are responsible for essential functions like nutrient uptake, anchorage, and storage. Nitrogen is one of the major limiting nutrients in plant productivity and development. Study of root uptake mechanisms for macro nutrients like nitrogen is vital to our understanding of their role in plant growth and development. To augment the supply of nitrogen, plants belonging to the Fabaceae family establish symbiotic relationship with nitrogen fixing bacteria called rhizobia and form specialized structures known as root nodules. Small signaling peptides (SSPs), are hormones which regulate diverse plant developmental processes including root growth and nodule formation. However, their involvement in regulation of nutrient uptake by roots is poorly understood. Utilizing exogenous application of synthetic peptides, we investigated the role of two SSP families, CAP-derived peptides (CAPEs) and Inflorescence Deficient in Abscission (IDAs) in the model legume *Medicago truncatula* roots. We screened the gene expression profile of 63 peptide coding genes under nutrient deficient conditions using publicly available data. The gene encoding *MtCAPE16* in particular, was identified to be transcriptionally responsive to both nitrogen deficiency and nodulation. Exogenous application of synthetic MtCAPE16 reduced production of lateral roots by 50-60% under low (0.02 mM N) and sufficient (6 mM N) Nitrogen treatment. Similarly, exogenous application of the synthetic peptides corresponding to the nodulation responsive *MtIDA5*, *MtIDA10*, *MtIDA15* genes suppressed formation of nodule number. Interestingly, these effects were abolished in the hypernodulating mutant *sunn*. Our study suggests a role for the peptides in maintaining plant nutrient homeostasis. Further investigation using CRISPR/Cas9 mutants and overexpression lines of these signaling peptide will be used to understand their function *in planta*. This study will help uncover novel functions of these SSPs and contribute towards their possible application for enhanced nutrient uptake.