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"Filling gaps and removing traps
for sustainable resource management"

The *CEP1* Peptide Modulates Cluster Root Morphology in P-Deficient *Lupinus albus*

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Abstract

White lupin (*Lupinus albus*) has an adaptive mechanism to aid the acquisition of phosphorous from the soil. In phosphorous stress condition, white lupin forms proteiod (cluster roots) roots which mediate the secretion of citric acids, malic acids, protons, phenolics and acid phosphatases which influence releasing of phosphorous. *CEP1* is a member of *CEP* signaling peptide that has a short, conserved 15-amino-acids domain near the C terminus, a feature that has common to several post-translationally modified small signal peptides in plants. *CEP1* was investigated to reduce the lateral root formation and slow down the primary root growth in *Arabidopsis* and *Medicago*. However, it has a positive correlation with nodules formation in *Medicago*. In this study, the effect of *CEP1* gene on cluster roots morphology changes in white lupin plants was examined by *CEP1* gene overexpression via *A. rhizogenes* transformation. These transgenic plants were initially grown in agar plates and transferred into hydroponics without phosphorus supply after the formation of hairy roots. Five-weeks old plants were harvested and changes in root morphology were observed, such as number of cluster roots, rootlet density, rootlet length, root hair length and the number of root primordia of the first lateral root. Number of cluster roots and number of root primordia were documented throughout the culture period. Compared with the control plants (*agrobacterium* control *A. rhizogenes* infected plant without construct) and vector control (empty vector transformed), no significant difference in the number of cluster root and root primordia was found in *CEP1* overexpressed plants. However, *CEP1* overexpressed plants always showed a trend of reduction of cluster roots number in the entire cultural period. On the other hand, a significant reduction in root length and root hair length were observed in *CEP1* overexpressed plants compared to control plants. Taken together, our data suggested that the *CEP1* overexpression has a decreased trend on cluster root formation, and decrease in rootlet length and root hair length was observed in Pi-deficient white lupin plants. Hence, *CEP1* act as a negative growth regulator in cluster roots growth and development under phosphorus deprived condition via a direct or indirect way.

Keywords: *CEP1* overexpression, cluster roots, negative plant growth regulator, P deficiency

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