

Melatonin enhances the hemiparasite *Santalum album* Linn. tolerance to low nitrogen stress via accelerated N metabolism and haustoria development

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Abstract

Santalum album is a hemiparasitic plant that obtains some of its water and nutritional requirements by parasitizing the roots of neighboring plants. As a hemiparasite, *S. album* can obtain organic N from parasitizing host roots as well as inorganic N by absorption thru its roots. In this current study, we evaluated changes in the physiology, transcriptional profiles and chromatin accessibility in *S. album* seedlings exposed to low N conditions with and without supplemental melatonin. We employed two complementary assays, global transcriptome analysis (RNA-seq) and assay for transposase-accessible chromatin with high throughput sequencing (ATAC-seq) to identify genes and genic regions differentially regulated in *S. album* roots under these conditions. Low N conditions disturbed the homeostasis of N metabolism, reducing both N uptake and assimilation. The inclusion of melatonin enabled *S. album* seedlings in low N conditions to achieve significantly higher levels of N uptake and assimilation compared to plants without melatonin. Interestingly, melatonin treatment also enhanced haustorium development through a mechanism associated with auxin accumulation. These results suggest that the application of supplemental melatonin may accelerate N metabolism and haustorium formation of *S. album* in low N conditions.

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