[BIOINFO 2025]

Transcriptional Regulatory Effect of an Ion Transporter on the Defense-Growth Trade-Off in *Arabidopsis thaliana*

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In plants, cation regulation plays a crucial role in both immunity and growth. Therefore, understanding how plants utilize cations is of great importance. Among the various membrane transport proteins that control cation concentrations, it has been reported that knockout of gene A, which encodes a transporter, leads to hyperactivation of the salicylic acid (SA) response. SA, in turn, induces systemic acquired resistance (SAR), thereby activating a whole-plant defense mode. Observational studies have confirmed that the gene A mutant exhibits reduced growth compared to the wild type.

This study was designed to elucidate the relationship between defense–growth trade-offs in the gene A mutant line. To this end, RNA was extracted from the leave and shoot apex of wild-type and gene A mutant plants (three biological replicates each), followed by RNA-seq analysis. The results revealed that, in both leave and shoot apex, stress-related hormone responses involving not only salicylic acid but also jasmonic acid, ethylene, and abscisic acid were upregulated, along with enhanced defense responses and SAR. By contrast, in leaves, photosynthesis and energy metabolism were downregulated, indicating a reduction in growth-related functions.

Subsequently, to further investigate how the loss of gene A function induces defense responses and impacts growth, and to clarify whether defense and growth are indeed interconnected, we conducted additional molecular-level analyses. Through functional characterization of gene A, this study aims to elucidate how dynamic changes in cation regulation influence plant responses, thereby broadening our understanding of cation utilization and signaling in *Arabidopsis thaliana*.