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Investigating the function of Arabidopsis HISTONE DEACETYLASE 14 in chloroplasts

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Lysine acetylation is a crucial post-translational modification involved in plant development and responses to environmental stimuli. While much attention has been focused on the role of HDACs in histone acetylation, their involvement in deacetylating non-histone proteins remains less explored. Among the 18 HDACs in Arabidopsis, HDA14 stands out for its dual localization in plastids and mitochondria. To investigate the role of HDA14, we used quantitative mass spectrometry and identified 1509 acetylation sites on 881 protein groups, with 56 sites deregulated in a hda14 mutant compared to WT. Most of the upregulated acetylation sites are associated with chloroplast proteins. Based on these results, proteins known for their substantial position in regulating organellar metabolic processes were chosen to perform interaction studies via enzymatic activity assays, BIFC and phenotyping. Moreover, HDA14 activity was further characterized upon changes in the amino acid code. The findings underline the importance of HDA14 in modulating lysine acetylation dynamics in Arabidopsis, revealing not only its influence on other proteins but also that it is modified itself by N-terminal acetylation through GNAT2, which is one of the N-acetyltransferases in chloroplasts. The function of the N-terminal acetylation of HDA14 is still unknown and requires further investigation.

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