An Analysis Examining the Phenotype in Chloroplast RNA Editing of the orrm1xorrm6 Double Mutants in Arabidopsis thaliana

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RNA editing acts as a critical component of plant biology because of its ability to generate RNA and protein diversity in eukaryotes, resulting in specific amino acid substitutions, insertions, and deletions. Plastid and mitochondrial RNAs in vascular plants are subjected to cytidine-to-uridine editing. The model plant species Arabidopsis thaliana (Arabidopsis) has two nuclear-encoded plastid-targeted Organelle RNA Recognition Motif (ORRM) proteins: ORRM1 and ORRM6. In the orrm1 mutant, many plastid RNA editing sites are affected but none are essential to photosynthesis. In the orrm6 mutants, two plastid RNA editing sites are affected: psbF-C77 and accD-C794. Because PsbF is essential to photosynthesis, the orrm6 mutants are smaller than the wild type. In addition, these mutants have pale green leaves and reduced photosynthetic efficiency. The purpose of this study was to determine whether the orrm1xorrm6 double mutants have an additive phenotype in reducing plastid RNA editing efficiency. To test this hypothesis, the orrm1 single mutants were crossed with orrm6 single mutants. The double mutants were compared with the wild type and single mutants in four areas: plant size, chlorophyll content, photosynthetic efficiency, and plastid RNA editing extent. Morphological and physiological analyses showed the double mutants have a smaller plant size, reduced chlorophyll content, and decreased photosynthetic efficiency compared to the orrm1 single mutants. The plastid RNA editing sites impacted in the single mutants are also significantly affected in double mutants. Therefore, loss-of-function mutations in the ORRM1 and ORRM6 genes have an additive effect in plant morphology, photosynthesis, and plastid RNA editing.

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