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Roles of small regulatory RNAs in plant cellular development

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Abstract

MicroRNA (miRNA) and small interfering RNA (siRNA) are small regulatory RNAs, which control post-transcriptional gene silencing (PTGS) in plants. Despite exciting findings made in the past decade, the biological impacts of small RNAs in plant development remain to be further elucidated. We have developed genetic systems to investigate regulatory mechanisms and biological functions of plant small RNAs. First, we established a cell type-specific genetic system acting as a dual sensor for miRNA- and siRNA-mediated PTGS. Using this system, we uncovered a hidden mechanism of siRNA activity such that a proteasome subunit RPT2a coordinates PTGS and RNA quality control to regulate foreign RNAs. Second, we conducted miRNA profiling of stomatal lineage cells at the cellular level to identify miRNAs and their target genes modulating stomatal development. Stomatal development is not only critical for photosynthesis but also served as a model system to study cell lineage and patterning. We provide genetic evidences that miRNAs are dynamically expressed during stomatal lineage and play a crucial role in stomatal development. Together, our findings contribute to a better understanding of small regulatory RNA biology and provide a resource for guiding the study of small RNAs in plant development.

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