Small regulatory RNAs as signaling factors during leaf patterning

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Patterning and outgrowth of lateral organs in plants depend on the specification and maintenance of adaxial/abaxial (dorsoventral) polarity in developing leaves. Members of the classes of microRNAs (miRNAs) and trans-acting short interfering RNAs (ta-siRNAs) have crucial roles in these developmental processes. The *AUXIN RESPONSE FACTOR* (*ARF*) family members *ARF3* and *ARF4* are together necessary to establish abaxial (ventral) fate in leaves. *ARF3* and *ARF4* are targets of ta-siRNAs that are termed "tasiR-ARFs." The biogenesis of the tasiR-ARFs, in turn, requires the activity of a microRNA, miR390. To begin to understand the possible role of tasiR-ARFs in leaf polarity, we have localized the biogenesis components of the tasiR-ARF pathway, including miR390, the activity of the ARGONAUTE gene required for miR390 activity (AGO7), and the activity of tasiR-ARFs themselves. We provide evidence that the tasiR-ARF pathway in *Arabidopsis* acts non cell autonomously to maintain the polarized accumulation of *ARF3* in leaf primordia. Small RNAs (tasiR-ARFs) in this specialized RNAi pathway may contribute to its non-cell autonomous activity, as they accumulate outside their discrete regions of biogenesis. It is also possible that miR390 acts non-autonomously, although our results suggest that there is a combination of tissue-specific differential miRNA precursor processing and movement. We propose that small RNAs can possibly function as mobile inductive signals to direct patterning events during development.

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