TRANSPOSABLE ELEMENTS

MicroRNA sponge

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Transposable elements (TEs) have been known to regulate the expression of neighbouring genes in different ways, such as by interfering with promoters, affecting epigenetic regulation or providing enhancers. However, it is rarely reported that TEs regulate the expression of ectopic genes. Through rice transcriptome and genetic analyses, Jung-Nam Cho and Jerzy Paszkowski, from the Sainsbury Laboratory at the University of Cambridge, and colleagues showed that TEs can regulate ectopic gene expression by acting as miRNA sponges and thereby regulate plant development.

By examining publicly available transcriptome data for various rice tissues, the researchers found that TEs displayed tissue-specific expression, and the expression of many TE transcripts were correlated with co-expressed genes in the same tissue. A remarkable proportion (64%) of active TEs exhibited homology with co-expressed genes. Moreover, the co-expressed TEs were found to be enriched with microRNA binding sites, suggesting that they may regulate gene expression by miRNA sequestration.

MIKKI is one of the identified root-specific TEs. It contains an imperfect binding site for miR171, which targets mRNAs encoding root-specific SCARECROW-Like (SCL) transcription factors for cleavage. Over-expressing *MIKKI* in rice and *Arabidopsis* led to the downregulation of miR171 levels and upregulation of SCL expression, while *mikki* mutants exhibited increased miR171 levels and reduced SCL mRNAs, verifying that *MIKKI* acts as a target mimic of miR171. Similar to *scl* mutants in rice and Arabidopsis, the *mikki* mutants showed defective root development. Taken together, these data showed that the expression of *MIKKI* sequestrates miR171 in rice roots and consequently results in root-specific accumulation of *SCL* transcription factors, thereby regulating root development.

The conserved structure of *MIKKI* across multiple AA-genome rice species suggests a strong selective advantage of this microRNA sponge function through evolutionary history.

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