



PLANT GENETICS

## Parasites plant microRNAs in the host

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Parasitic plants of the genus *Cuscuta* (dodders) can bidirectionally exchange proteins, mRNAs and viruses with their hosts through their feeding structures, the haustoria. A new study in *Nature* now provides evidence for the transfer of microRNAs (miRNAs) from *Cuscuta campestris* to infected *Arabidopsis thaliana* hosts, which may increase the virulence of the parasite.

To study the movement of miRNAs between host plant and parasitic plant, Shahid *et al.* performed small RNA sequencing of three tissues — the host stem, the interface (that is, the *C. campestris* haustorium and the *A. thaliana* stem) and the parasite stem — and compared the small non-coding RNA profiles. Despite the expression of the majority of *C. campestris* small RNAs being decreased at the interface when compared with the parasite stem, the expression of 76 small RNAs was upregulated; 42 of these were miRNAs.

A total of 26 miRNAs were 22 nucleotides in length, which is an unusual miRNA class in plants that is known to induce secondary small interfering RNA (siRNA) production from target mRNAs, followed by an increase in miRNA-mediated silencing of target gene expression. Indeed, six *A. thaliana* mRNAs were identified as plausible targets for the *C. campestris* miRNAs, and siRNAs sharing complementary sequences were found at the interface, suggesting secondary siRNA induction in the host. Accordingly, five of the six transcripts showed reduced expression in stems infected by the parasite compared with uninfected controls. These mRNAs had previously been associated with pathogen-induced signalling (*AFB2*, *AFB3*, *BIK1* and *TIR1*) and sugar content in detached leaves (*SEOR1*).

*A. thaliana* mutants of *seor1* and *afb3-4* showed increased parasite biomass, indicating a growth advantage for the parasite when the host was deficient in either gene product. Considering that the haustorium is used for nutrient acquisition, this suggests a role for *seor1* suppression as a means to increase sugar intake and, therefore, growth of the parasite.

Given that orthologues of the *A. thaliana* target mRNAs are found across a range of plants belonging to the eudicot clade, and some of them were predicted to also be targeted by *C. campestris* miRNAs, the authors repeated the small-RNA-sequencing screen with parasite-infected *Nicotiana benthamiana* and obtained similar results.

Together, the data presented in this study implicate *C. campestris* miRNA induction as a mechanism of trans-species regulation of mRNA expression in multiple hosts that might offer a virulence advantage to the parasite.

Michelle Trenkmann, Associate Editor,  
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**ORIGINAL ARTICLE** Shahid, S. *et al.* MicroRNAs from the parasitic plant *Cuscuta campestris* target host messenger RNAs. *Nature* **553**, 82–85 (2018)