Nature Reviews Genetics | AOP, published online
27 August 2014; doi:10.1038/nrg3818

PLANT GENETICS

Passing the message — mRNA transfer between plants

Extensive bidirectional transfer of mRNAs can occur between parasitic plant species and their hosts, according to the results of a new study published in *Science*. Although artificial constructs of inhibitory RNA in host plants have previously been shown to silence genes in their parasitic guests, this new work demonstrates, on a genome-wide scale, the extent to which RNA movement can occur between the parasitic plant *Cuscuta pentagona* and its host plants.

To facilitate the identification of parasite and host mRNA, the researchers grew *C. pentagona* on tomato and *Arabidopsis thaliana* host plants, as the genomes of these host plants have been sequenced previously. cDNA libraries were generated from tissue derived from the host stem above the region of *C. pentagona* attachment, the interface region where *C. pentagona* is attached to the host, and the *C. pentagona* stem. The team was then able to identify and compare host and parasite transcriptomes to determine whether mRNA transfer had occurred.

Analysis of the *C. pentagona* stems grown on *A. thaliana* hosts showed that they contained 1.1% *A. thaliana* transcriptome, whereas *C. pentagona* stems grown on tomato hosts contained 0.17% tomato transcriptome. Thus, mRNA from both host species was present in the parasite. Furthermore, *A. thaliana* and tomato host stems contained 0.6% and 0.38% *C. pentagona* transcriptome, respectively; thus, parasitic mRNA is also transmitted into both hosts. The interface region for *A. thaliana* contained half the parasite transcriptome and half the *A. thaliana* transcriptome, whereas the interface region for the tomato plants contained 86% tomato transcriptome and 14% *C. pentagona* transcriptome. Collectively, this work shows large-scale bidirectional transfer of mRNAs between the *C. pentagona* and two host plants. Moreover, the differences between the levels of transfer seen with tomato and *A. thaliana* indicate that mRNA mobility rates differ between different host species.

To further investigate differences in mRNA mobility, the researchers also examined the diversity of the mobile transcripts. Compared with 45% of expressed *A. thaliana* transcripts that were mobile, only 1.6% of expressed tomato transcripts were mobile. As the total number of genes in *C. pentagona* is unknown, the investigators used *de novo* transcriptome assembly to catalogue the number of expressed unique sequences ('unigenes') for transcripts derived from *C. pentagona*. A larger variety of *C. pentagona* unigenes (24% of all expressed *C. pentagona* unigenes) were found in *A. thaliana* than in tomato, where only 1% of expressed *C. pentagona* unigenes were detected. These data reinforce the idea that there are host-specific differences in mRNA transfer.

The function of the bidirectional mRNA transfer shown in this study is currently unclear, but the authors suggest that the parasite may use this approach to gather information regarding the health of the host, or to manipulate the host environment to create conditions that are favourable to parasitism.

Isabel Lokody

ORIGINAL RESEARCH PAPER Kim, G. *et al.* Genomic-scale exchange of mRNA between a parasitic plant and its hosts. *Science* **345,** 808–811 (2014)