
Photodisc/Getty/Don Farrall

SMALL RNAS

RNAs attack!

By virtue of their short life cycles, many pathogens have the upper hand when it comes to the evolutionary arms race with their hosts. Until now, known pathogen effectors — molecules that facilitate successful host invasion — have included only proteins. However, Weiberg *et al.* have now shown that the grey mould-causing fungus *Botrytis cinerea*, which is an important plant pathogen, includes small RNAs (sRNAs) in its armoury.

B. cinerea infects almost all vegetable and fruit crops, which causes billions of US dollars of damage each year. To investigate a potential role for sRNAs in its pathogenicity, the authors first used RNA sequencing to reveal the transcriptional profiles of sRNAs in *Arabidopsis thaliana* and *Solanum lycopersicum* (tomato) plants that had been infected by *B. cinerea*. From these data they identified 73 *B. cinerea* sRNAs that were predicted to target host genes in both *A. thaliana* and *S. lycopersicum*. Many of these sRNAs had microRNA-like structures.

The authors predicted that these sRNAs could target genes with potential roles in host immunity, such as those encoding mitogen-activated protein kinases. Indeed, through *A. thaliana* infection assays, they showed that four of these immune-related putative target genes were suppressed after infection. Furthermore, they showed that these genes have a role in host immunity by ectopically expressing three of the *B. cinerea* sRNAs in *A. thaliana*. The resulting lines were more susceptible to infection, and this increased susceptibility was accompanied by decreased expression of the target genes. Furthermore, susceptibility was also increased when the target genes were mutated.

Importantly, the structures of 63 of the *B. cinerea* sRNAs that were predicted to silence host genes indicated that they are able to bind to plant ARGONAUTE 1 (AGO1). As AGO1 is a key effector protein in RNA-directed gene silencing, this finding suggested that *B. cinerea* might hijack the RNA-silencing machinery of host plants. This hypothesis was confirmed through the observation of reduced susceptibility to infection in *A. thaliana* strains in which AGO1 is mutated, and by the finding that *B. cinerea* sRNAs bind to AGO1 on infection.

Finally, the authors showed that the pathogenicity of *B. cinerea* depends on sRNAs. They did this by knocking out fungal genes that are involved in sRNA processing and by showing that the resulting strains were less infective.

This is the first example of sRNAs being involved in pathogenicity and it is intriguing to think about how this mechanism, which commandeers the host's own gene-silencing pathways, may have evolved.

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ORIGINAL RESEARCH PAPER Weiberg, A. *et al.* A fungal small RNAs suppress plant immunity by hijacking host RNA interference pathways. *Science* **342**, 118–123 (2013)