PLANT PATHOGENS

Oozing protection

Although plants have evolved defences against microbial pathogens, it is still not clear why most plants are resistant to most pathogens. A paper published in *Nature* reports that *Arabidopsis thaliana* oozes antimicrobials from its roots to fend off potential bacterial pathogens in the rhizosphere.

Bais *et al.* investigated why only one pathovar, *Pseudomonas syringae* pv. *tomato* DC3000 (*Pst* DC3000), from a collection of eight different *P. syringae* strains, caused root disease in *A. thaliana*.

Using a root infection assay, Bais *et al.* showed that the non-pathogenic strains were poor root colonizers, unlike *Pst* DC3000. However, two of the same non-pathogenic strains caused disease in *A. thaliana* leaves. Members of the same research group, led by Jorge Vivanco, had previously shown that *A. thaliana* roots exude antimicrobial compounds. Here, they showed that the non-pathogenic strains caused disease in *A. thaliana* roots that had been treated with activated charcoal to soak up antimicrobial exudates. They also showed that the concentrations of antimicrobials were far higher during infection with non-pathogenic strains than in uninfected plants, but that plants infected with *Pst* DC3000 produced even less antimicrobials than uninfected plants.

Purified antimicrobial compounds were bacteriostatic against the non-pathogenic strains (but not *Pst* DC3000) *in vitro* at the same concentrations as those exuded by the roots. Mixed infections of *A. thaliana* with *Pst* DC3000 and non-pathogenic strains resulted in disease and failure to produce antimicrobials. As the growth rate of non-pathogenic strains was reduced *in vitro* by the antimicrobials, even when *Pst* DC3000 was present, *Pst* DC3000 did not degrade the antimicrobials.

Finally, mutants of *Pst* DC3000 in the type III secretion system (TTSS) genes *hrcC* (hypersensitive response) and *hrpL* (hypersensitive response and pathogenesis) elicited the same concentrations of antimicrobials from roots as the non-pathogenic strains. Therefore, the TTSS seems to be involved in suppression of this basic plant defence mechanism, presumably by translocating type III effectors into plant root cells. TTSS mutants were more susceptible to antimicrobials, so the TTSS might also be involved in resisting their effects.

Understanding mechanisms of plant resistance could be exploited to generate resistant crop plants and also to understand how bacteria and plants happily cohabit in the rhizosphere.

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References and links

ORIGINAL RESEARCH PAPER Bais, H. P. *et al.* Mediation of pathogen resistance by exudation of antimicrobials from roots. *Nature* **434**, 217–221 (2005)