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MICROBIAL ECOLOGY

Bacteria reinforce plant defences

Plants growing in soils with disease-suppressive qualities resist infection by specific soil-borne pathogens much better than plants growing in similar soils that lack these qualities. This protection seems to be provided by the resident soil microbiota, but little is known about the precise microorganisms and mechanisms involved. Now, Raaijmakers and colleagues report that specific bacterial groups, such as certain pseudomonads, and their metabolites have a key role in the control of a fungal root-pathogen of crop plants.

The authors analysed the disease-suppressive properties of a soil that protected sugar beet plants from infection by the fungus *Rhizoctonia solani*. The disease-suppressive activity was destroyed by heat treatment or γ-irradiation, and was partially transferred to a similar but non-suppressive soil by adding a small amount of the suppressive soil, which suggested that protection against *R. solani* was due to the action of resident microorganisms. The authors isolated metagenomic DNA from the rhizosphere of plants grown in various mixtures of suppressive and non-suppressive soils. A higher abundance of certain bacteria belonging to the Pseudomonadaceae, Burkholderiaceae and Lactobacillaceae families, the order Xanthomonadales and the class Actinobacteria was associated with plant protection from *R. solani*. As previous work has shown that pseudomonads can contribute to protection against plant-pathogenic fungi, the authors then isolated >100 pseudomonad strains that were active against *R. solani* from the rhizosphere of plants grown in disease-suppressive soil. Most of the strains were grouped by DNA fingerprinting into three haplotypes, which corresponded to the most abundant pseudomonads detected by the metagenomic analysis, but only one of the haplotypes protected plant seedlings from *R. solani* infection. Random transposon mutagenesis of a representative strain of this haplotype resulted in a mutant that lacked *in vitro* activity against the fungus and did not protect the plants from fungal infection, although it colonized the rhizosphere as well as its parental strain. The mutation was mapped to a gene encoding a non-ribosomal peptide synthetase for the synthesis of a putative nine-amino acid chlorinated lipopeptide.

Thus, the production of a particular metabolite by a specific group of pseudomonads seems to be important for protection of sugar beet plants from infection by *R. solani*. However, other bacterial groups were also associated with protection against the pathogen and therefore may play a part in disease suppression. It remains to be seen whether and how the plants recruit the beneficial soil bacteria.

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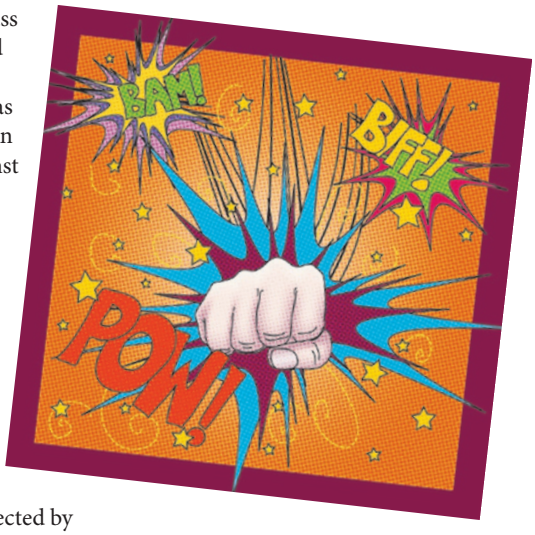

> “pseudomonads … have a key role in the control of a fungal root-pathogen of crop plants”

ORIGINAL RESEARCH PAPER Mendes, R. *et al.* Deciphering the rhizosphere microbiome for disease-suppressive bacteria. *Science* 5 May 2011 (doi: 10.1126/science.1203980)
FURTHER READING Haas, D. & Défago, G. Biological control of soil-borne pathogens by fluorescent pseudomonads. *Nature Rev. Microbiol.* **3**, 307–319 (2005)