SYMBIOSIS

A helping hand

A new paper in the *ISME Journal* provides the first evidence for a role of a bacterial type III secretion system (T3SS) in an interaction between a bacterium and a fungus.

Bacterial symbionts have been found in a range of different hosts and confer many different metabolic benefits. One particularly intriguing relationship is that between the plant-pathogenic fungus *Rhizopus microsporus* and its bacterial endosymbiont, *Burkholderia rhizoxinica*. The bacteria supply their fungal host with a potent antimitotic polyketide macrolide called rhizoxin, which is used by the fungus as a virulence factor to attack its rice host. The persistence of the symbiosis is ensured by the fact that vegetative reproduction of *R. microsporus* is dependent on the presence of *B. rhizoxinica*, as the fungus cannot form endosymbiont-free spores.

Christian Hertweck and colleagues were interested in finding out which *B. rhizoxinica* factors are essential for *R. microsporus* development and sporulation. Using shotgun sequencing, a 22 kb T3SS gene cluster was identified in the *B. rhizoxinica* genome. To assess the impact of this T3SS on the symbiosis, the authors generated allelic replacement mutants for *sctC* and *sctT*, two genes in the cluster that are thought to encode functional homologues of two essential components of the *hrp* T3SS in the plant pathogen *Ralstonia solanacearum*. They then devised a bioassay based on the dependence of *R. microsporus* on *B. rhizoxinica* for sporulation and used this to monitor the effects of the mutations. When the T3SS mutants were used to infect cured fungi, sporulation was not triggered. Detailed microscopic analysis of the distribution of the bacteria in the fungal mycelia revealed that wild-type bacteria spread quickly throughout the mycelia, but the spread of the T3SS mutants was severely restricted. Quantitative real time PCR analysis showed that the expression of *sctC* and *sctT* is significantly upregulated during co-cultivation with a cured host. Taken together, these results indicate that the bacterial T3SS has a key role in the life cycle of the fungus.

The authors propose that *B. rhizoxinica* has acquired or can mimic a fungal factor that is required for vegetative reproduction and that this factor is secreted into the fungus by the T3SS.

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ORIGINAL RESEARCH PAPER Lackner, G., Moebius, N. & Hertweck, C. Endofungal bacterium controls its host by an *hrp* type III secretion system. *ISME J.* 19 Aug 2010 (doi:10.1038/ismej.2010.126)