FUNGAL PATHOGENESIS

Fungal communication gets volatile

The antagonistic effects between some non-pathogenic and pathogenic strains of the fungus *Fusarium oxysporum,* a major cause of wilt in more than 100 species of plant, have long been clear, but are poorly understood. Reporting in *Environmental Microbiology*, Minerdi and colleagues now propose that this antagonism occurs through the direct, long-distance transport of volatile organic compounds (VOCs) between the antagonistic strains.

Previous studies of a strain of *F. oxysporum* isolated from soils in north-western Italy that naturally limit the incidence of *Fusarium* wilts established that its antagonistic effects depend on its association with a range of ectosymbiotic bacteria. In this follow-up study, the authors sought to identify the method of communication between different fungal strains and determine the role of VOCs in this interaction.

The authors first compared the VOC profiles of the wild-type antagonistic strain and a pathogenic strain ('cured' of its bacteria) of *F. oxysporum* using static headspace solid-phase microextraction assays, and found that they were substantially different. The sesquiterpenes are a class of VOC that have previously been associated with plant–fungus communication and antifungal activity. It was not surprising, therefore, that sesquiterpenes predominated in the volatiles of the wild-type, but not the cured, strain. Minerdi and colleagues then investigated the effect of VOCs on pathogenic strains by co-cultivating wild-type and cured isolates and comparing radial growth after 4 and 5 days, and found that VOCs from the wild-type strain reduced the mycelial growth of both the cured strain and other pathogenic strains. In hydrophobicity tests, the surfaces of hyphae grown in the presence of VOCs were found to be hydrophilic, which is a characteristic of non-pathogenicity. Together, these observations indicate that VOCs, and in particular sesquiterpenes, are responsible for *F. oxysporum* antagonism.

To confirm the role of VOCs in the antagonism between *F. oxysporum* strains, Minerdi and colleagues used semi-quantitative PCR to look for transcripts of two putative virulence genes, *mk* and *chs*, in mycelium grown in the presence or absence of VOCs. They found that the presence of VOCs repressed expression of these two pathogenicity genes. Analyses of mycelium grown in the presence of various sesquiterpenes indicated that α-humulene is the VOC responsible for this repression.

The potential use of antagonistic *F. oxysporum* for the biocontrol of *Fusarium* wilt is clear, but knowledge of the mechanisms at work is essential. In this study, Minerdi and colleagues have shown, for the first time, that antagonistic strains of *F. oxysporum* produce VOCs and that these chemicals are responsible for the observed antagonistic effects, causing inhibition of both mycelial growth and virulence gene expression.

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ORIGINAL RESEARCH PAPER Minerdi, D., Bossi, S., Gullino, M. L. & Garibaldi, A. Volatile organic compounds: a potential direct long-distance mechanism for antagonistic action of *Fusarium oxysporum* strain MSA. *Environ. Microbiol.* 12 Nov 2008 (doi:10.1111/j.1462-2920.2008.01805.x)