

 PATHOGENESIS

Buzzkill

In recent years there has been a devastating loss of bee colonies, mainly in the United States but also in European countries. Mites, viruses, genetically engineered crops or a combination of these factors have all been blamed for so-called honeybee colony collapse disorder. Now Higes and colleagues, reporting in *Environmental Microbiology*, show that the bee pathogen *Nosema ceranae*, which has only recently been detected in the honey producer *Apis mellifera*, can cause the collapse of a bee colony.

Bees are economically important as pollinators of fruits and vegetables, and so identifying the cause (or causes) of honeybee colony collapse disorder is imperative. Higes and colleagues report that the microsporidian bee pathogen *N. ceranae* can infect a bee colony and cause its collapse within 2 years. They followed an *A. mellifera* colony that had recently become infected with *N. ceranae* and tracked its health over 19 months until the population died. The infection had four stages: asymptomatic phase one; phase two, which featured unusual behaviour, including egg-laying by the queen in winter; phase three, named the false-recovery phase, in which the population increased to normal levels after winter, but the expected swarming never occurred; and phase four, which featured depopulation of the hive. The bees were active during depopulation, and food stores, capped brood cells and young bees were present, but the queen had died. By placing new bee colonies near the



infected colony, the authors showed that the infection could spread. These newly infected colonies also collapsed within 19 months.

Although no other pathogens seemed to be associated with the collapse of the colonies, including the Israeli acute paralysis virus, which had previously been implicated in bee colony collapse, the authors could not rule out a role for an unknown pathogen. Colony collapse could be prevented by treating infected colonies with the antiprotozoan drug fumagillin, which also decreased *N. ceranae* to undetectable levels, thereby supporting a role for

N. ceranae in colony collapse. However, treatment with fumagillin failed to prevent reinfection by *N. ceranae* 6 months after initial application of the drug.

This study provides experimental proof that *N. ceranae* can chronically infect and kill bees, which suggests that this pathogen might be an important factor in colony collapse disorder.

Christiaan van Ooij

ORIGINAL RESEARCH PAPER Higes, M. et al. How natural infection by *Nosema ceranae* causes honeybee colony collapse. *Environ. Microbiol.* 18 July 2008 (doi:10.1111/j.1462-2920.2008.01687.x)