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ecology: Ants are voracious weeders

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Feed it or weed it: leaf-cutting ants know which fungus is good for them

If disease takes hold, the entire farm can be devastated. Farmers must be ever-vigilant and cut out any signs of infection immediately. This is not a description of human farmers battling potato blight or foot-and-mouth disease, but of ants tending their fungal gardens, as new research reveals.

Leaf-cutting ants (Attini) cannot digest the vegetation they gather. Their vast nests — containing up to eight million individuals — have chambers where the ants feed a fungus with collected leaves. Ants eat the fruits of this fungus.

Intensive weeding is the ants' first line of defence against unwanted fungi that can invade their fungus farms and smother their crops, Cameron Currie of the University of Texas, Austin, and Alison Stuart of the University of Toronto have found[1].

The duo sprayed fungal gardens of the leaf-cutting ant *Atta colombica* with spores of two pest fungi: *Trichoderma viride* and *Escovopsis*. In the wild, a quarter to two-thirds of nests have chronic *Escovopsis* infections. It stunts a colony's growth, and can devastate a fungus garden such that ants abandon it.

Currie and Stuart found that worker ants patrolled their gardens constantly, checking them with their antennae. When the ants found rogue fungal spores, they gathered them up in their mouthparts and carted them off to the colony's dump — the researchers call this behaviour grooming. Within a few hours of fungus application, large numbers of ants had moved to the infected site.

The ants also weeded out small chunks of the garden — leaf, crop fungus and all. This could involve several ants cooperating: different types of workers groom, cut and carry. "Grooming occurs first," says Currie. "Once the spores germinate, the ants start to weed."

The ants seem to be able to tell the difference between the two invading fungi. The specialist pathogen *Escovopsis* triggered more ants to take up cleaning duties, and their efforts went on for much longer than those directed against *Trichoderma*.

Trichoderma was eliminated rapidly, but *Escovopsis* hung on in the nests, suggesting that it has evolved some counteradaptation to the ants' attentions; it is not known what this might be. *Escovopsis* may grow too quickly for the ants to keep up, or, Currie says, "the spores are really sticky — the ants may have a difficult time getting them out of the nest".

It's an arms race, says Ted Schultz of the Smithsonian Institution in Washington DC, who also studies fungus-farming in ants. "The ants are evolving better and better ways of detecting *Escovopsis*, and *Escovopsis* is evolving better and better ways of avoiding detection."

Weeding and grooming are just two weapons in leaf-cutting ants' antifungal arsenal. An earlier study by Currie and his co-workers found that the ants carry a bacterium that protects it from *Escovopsis*[2]. They also keep their nest clean by licking its surfaces and those of new plant matter as they add it to the garden.

And every few years, the ants up sticks and move to a new nest site — "a mammoth undertaking", says Schultz, and presumably a way to escape disease. "Whether it's human agriculture or ant agriculture," says Schultz, "pathogens are one of the major things driving the system."

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1. Currie, C. R. & Stuart, A. E. Weeding and grooming of pathogens in agriculture by ants. *Proceedings of the Royal Society B* **268,** 1033–1039 (2001).

2. Currie, C. R., Scott, J. A., Summerbell, R. C. & Malloch, D. Fungus-growing ants use antibiotic-producing bacteria to control garden parasites. *Nature* **398,** 701–704 (1999).