Even ants suffer superpests in big farms

Ignoring a few difficulties with language, the ants that tend giant networks of fungus globs could swap horror stories about pests with any wheat farmer in Kansas.

The ant species with the biggest, fanciest farms in their nests—and with the least genetic diversity in their crops—attract more of the specialized pests than ant species with smaller, more diverse crops do, report Cameron R. Currie of the University of Toronto and his colleagues. Their weed analysis, the first detailed one for ant farms, appears in the July 6 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES. "This parallels human agriculture," Currie says.

The pest problems may soothe human egos ruffled by the knowledge that ants beat us to the invention of agriculture by about 50 million years (SN: 11/21/98, p. 334). A tribe of 200 some species, called attines, cultivate spongy masses of fungi for food.

For decades, these ants had a reputation as farmers of almost supernatural ability, managing farms with miraculously few weeds. Entomologists had proposed that ant glands secrete pesticides and that workers police intruding microbes before they take over. "People thought, 'Oh, they just weed out diseases,' and didn't really look for them," Currie remembers.

Ants do weed with amazing energy, he acknowledges. He's watched a stream of ants lug fungus debris some 4 feet up a vine and drop it, forming a perfect cone on the forest floor. "Their dumps are just beautiful," Currie says.

Only a few opportunistic weeds had been identified when Currie and his colleagues began their systematic 3-year search for intruders in 201 colonies from eight ant genera. The survey turned up what the scientists believe to be specialized foes of ant gardens, fungi of the genus *Escovopsis*. If they get out of control, they can reduce a healthy farm to dark goo in days. The most common pests in the survey, these fungi have not been detected anywhere except ant farms.

The ants aren't taking this assault lying down. Currie and other colleagues discovered that a farming ant's body carries patches of *Streptomyces* bacteria that produce a toxin for *Escovopsis* (SN: 4/24/99, p. 261).

The new paper describes evolutionary trends in the ancient clash between farmers and weeds. The bigger, more specialized ant farms, which tend to have less-diverse food fungi, were less likely to show weeds overall. Yet the dangerous *Escovopsis* represented around 70 percent of the pests that did attack the big gardens versus about 30 percent of weeds in smaller gardens. "As ants evolved to be better gardeners, the parasites evolved too," Currie says.

Jacobus J. Boomsma of the University of Copenhagen calls this "very exciting work." The findings mesh with what he sees as a growing appreciation of the role of parasites in evolution.

Ant specialist Ted R. Schultz of the Smithsonian Institution in Washington, D.C., welcomes the new study for its demonstration of the benefits of the small-farm lifestyle to ants. Its adherents seem to have either gone back to the wild and domesticated new forms of their food fungus many times in their history or snatched crops from their neighbors.

If such ants reduce their vulnerability to specialized parasites, "the question now becomes, What's the benefit of sticking with a clone?" he says. Fine-tuned cultivation, better harvests—the answers might be pretty much the same ones you'd hear in Kansas. —*S. Milius*

Before and after: The fungus Escovopsis *can ruin the fungal crops tended by ants.*

How dishwashers pollute the indoor air

Using an automatic dishwasher to clean up plates, glasses, and cutlery may dirty the kitchen's air, a new study finds.

Tap water contains trace quantities of potentially toxic organic chemicals, often a result of water-system chlorination. When such water is heated and sprayed, some of the waterborne pollutants enter the air.

Cynthia Howard-Reed of the Environmental Protection Agency in Reston, Va., and her colleagues now report that the heating and spraying actions of modern automatic dishwashers make these ubiquitous kitchen aids the home's most efficient means of releasing waterborne chemicals into indoor air.

The researchers conducted 29 experiments, running a residential dishwasher through its paces under a range of conditions—with varying cycles, temperatures, and numbers of dishes. Each time, they spiked the incoming water with four volatile organics. The researchers chose these chemicals to represent typical pollutants having different water solubilities. The more soluble a compound, the less likely it is to escape into the air.

Within a minute or two, the first cycle in the dishwasher stripped the water of 96 to 100 percent of toluene, ethylbenzene, and cyclohexane, the researchers report in the July 1 ENVIRONMENTAL SCIENCE & TECHNOLOGY. Because dishwashers continuously vent some 5 to 7 liters of air per minute into the kitchen, the volatilized pollutants almost immediately begin circulating within the house.

Acetone, the most volatile of the tested chemicals, is also the most soluble in water. That's why, depending on the conditions, dishwashers spewed into air just 18 to 55 percent of the waterborne acetone, explains coauthor Richard L. Corsi, a civil engineer at the University of Texas at Austin.

Per gallon, showers release only about three-quarters as much waterborne toluene as dishwashers; hot cycles in a clothes washer, only about half as much; and kitchen faucets and washing-machine cold cycles, a mere 20 percent. However, owing to the smaller volume of water used in dishwashers, Howard-Reed's team estimates that these devices contribute only about 10 percent of the waterborne pollution spewed into indoor air, while showers contribute about 45 percent.

The amount of contamination in the incoming water largely determines how much all this water use contributes to a home's indoor-air pollution. Under some conditions, however, Corsi's team has found that appliances can add troublesome chemicals to the water. Their washing-machine tests showed that chlorine bleach reacted with organic materials in dirty clothes to generate chlorinated organic chemicals.

Since many dish detergents contain chlorine, Corsi suspects that as they react with food scraps, they "will form some pretty nasty chlorinated organics in the dishwasher, and they will volatilize." This will add to whatever chemicals had been in the water, he says. —*J. Raloff*