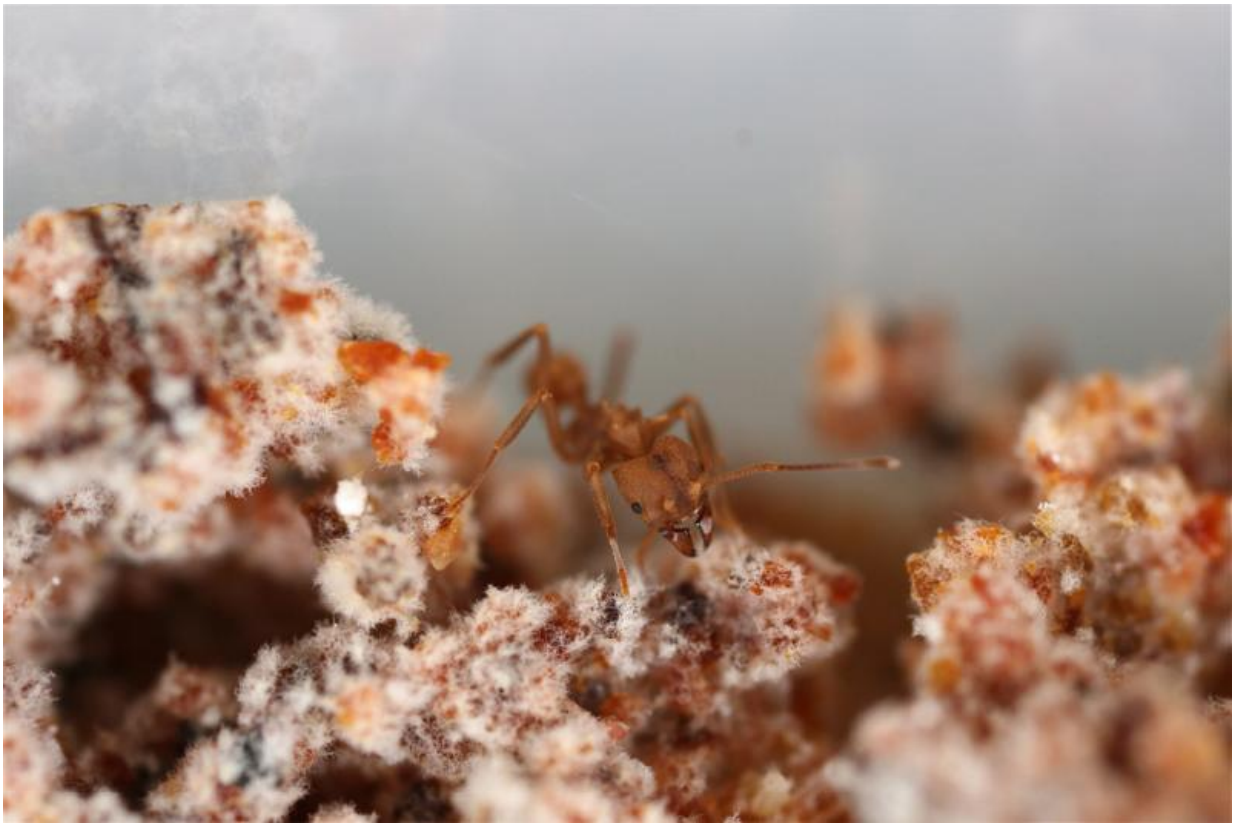
Research points to possible fungal control for leaf-cutter ants

October 7 2015



A fungus-growing ant from the genus *Trachymyrmex*, the closest living relatives of leaf-cutter ants, tending to a fungal garden. Both leaf-cutter ants and their *Trachymyrmex* relatives cultivate a specialized fungus (white) in subterranean farms. Researchers found that the same type of fungal parasites attack the farms of both *Trachymyrmex* and their leaf-cutter relatives. Credit: S. Solomon/Rice University

A 15-year study of leaf-cutter ants and their relatives across North and South America found that their nests are susceptible to infection by a diverse group of specialized fungal parasites. The discovery by biologists from Rice University, São Paulo State University in Rio Claro, Brazil, and the University of Texas at Austin could provide new clues for controlling the agricultural and garden pests.

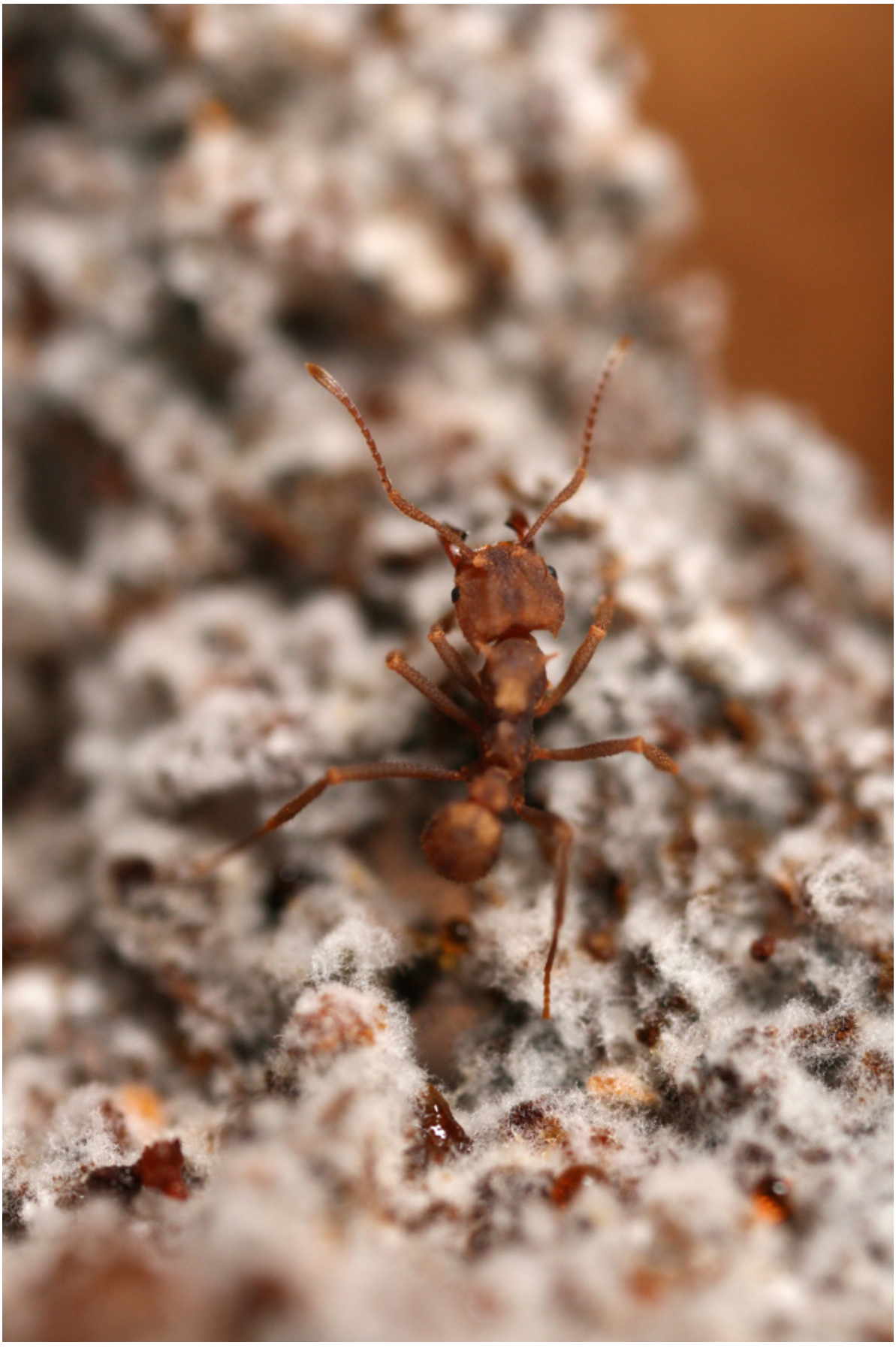
The study, which is available online in *Royal Society Open Science*, is one of the largest ever undertaken of parasites associated with leaf-cutter ants. It began in 2000 and involved collecting, cataloging and analyzing samples of parasitic fungi called *Escovopsis* from dozens of colonies of leaf-cutter ants and their relatives in Brazil, Argentina, Panama, Mexico and the Caribbean islands of Guadeloupe and Trinidad and Tobago. Researchers identified 61 new strains of the fungi, which attack the ants' food source.

"Leaf-cutter ants are difficult to control with ordinary means, partly because they're farmers," said Scott Solomon, an evolutionary biologist at Rice University. "They don't respond to most baits and poisons because they grow their own food, a specialized fungus that's co-evolved with them in a symbiotic relationship for the last 50 million years."

Leaf-cutter ants inhabit areas from the southern United States to Argentina, and there are at least 40 species, including the Texas native Atta texana, which is found only in Texas and Louisiana. Ecologists call the ants "mutualists" because they cooperate with another species for mutual benefit. Each leaf-cutter species has its own mutualist partner, a fungus that it grows and cultivates for food and that in turn depends on the ants for food and shelter.

The leaf-cutter name comes from the ants' farming style. Worker ants range widely, cutting and gathering leaves, which are brought underground into climate-controlled chambers where the fungal gardens

are kept. A leaf-cutter colony, which can be more than 60 feet deep and hundreds of feet wide, often contains dozens of farming chambers and millions of worker ants.



A fungus-growing ant from the genus *Trachymyrmex*, the closest living relatives of leaf-cutter ants, tending to a fungal garden. Both leaf-cutter ants and their *Trachymyrmex* relatives cultivate a specialized fungus (white) in subterranean farms. Researchers found that the same type of fungal parasites attack the farms of both *Trachymyrmex* and their leaf-cutter relatives. Credit: S. Solomon/Rice University

In Texas, the ants are known to damage citrus, plum, peach and other fruit trees, nut and ornamental plants as well as some forage crops. They can also decimate pine seedlings in parts of the East Texas and Louisiana, making it difficult for foresters to establish new crops.

"They've evolved one of the most complex and fascinating symbiotic relationships in nature," said Solomon, a professor in the practice of ecology and evolutionary biology in Rice's Department of BioSciences. "We study that relationship, partly to learn about the process of evolution but also to see if we can find new ways to control the ants."

Escovopsis is a fungal parasite that attacks the ants' fungal crops. *Escovopsis* was first identified about 25 years ago, and earlier studies suggested that it is highly specialized and found only in association with fungus-growing ants. Evolutionary analyses suggested that *Escovopsis* co-evolved along with the ants and their fungal crops, since a different strain infects the fungal partners of each of the major groups of fungus-growing ants.

Solomon began collecting leaf-cutting ants and their fungi in Central America in 2002 as a graduate student working with UT-Austin's Ulrich Mueller, a co-author on the study. In 2007 they expanded their work,

thanks to a National Science Foundation international postdoctoral fellowship that allowed Solomon to spend a year working with study co-authors Andre Rodrigues and Mauricio Bacci at São Paulo State in Rio Claro, Brazil.

"Expanding the collections into Brazil was very important for this study because that is where many of the leaf-cutter ants and their fungal-farming relatives live, including many species that we knew very little about," Solomon said.

To collect samples, the team traveled across much of Brazil in search of leaf-cutter ants and their relatives. When they found a colony, they would dig up a farming chamber and then use sterile instruments and containers to collect a palm-sized fragment of fungal garden. At the lab, the fungi from these fragments were isolated and studied, both via DNA sequencing and with traditional microscopy.

The research revealed 61 new strains of *Escovopsis*, more than three times the number that had been cataloged in all previous studies. It also found that *Escovopsis* is more of a generalist than was previously thought; the same genetic variant was found invading the farms of distantly related fungus-growing ant species, and as many as three different forms of *Escovopsis* were found in the same ant colony.

"That could be significant because the more general and broadly applicable a control strategy is, the more economical it is to develop and test," Solomon said. "Based on what we know so far, it could be possible to develop an *Escovopsis*-based control strategy in which a single form of the parasite could be used to target several different species of ant."

Solomon said a significant amount of research still needs to be done before such a strategy could be developed. For example, biologists have yet to document the complete life cycle of *Escovopsis*. Such studies

would be needed to fully understand how the parasite undermines a colony's health and how broadly it might be used against leaf-cutter species.

More information: Lucas A. Meirelles et al. Shared parasites between leaf-cutting and non-leaf-cutting ants in the higher attine fungus-growing ant symbiosis, *Royal Society Open Science* (2015). DOI: 10.1098/rsos.150257

Provided by Rice University