

Invasion of the body-snatching fungus

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The fungus infects the cicada and essentially hijacks their behavior. Credit: Yessenia Carrero/UConn

UConn researchers recently documented in *Nature Scientific Reports* a gory and fascinating relationship between periodical cicadas and a fungus that infects them, hijacks their behavior, and causes a scene straight out of a zombie movie.

"It's a fun story for us, not for the [cicadas](#)," says UConn ecology and evolutionary biology researcher and adjunct faculty member John Cooley.

Though researchers have known about the [fungus](#) for around 100 years, Cooley and his colleagues David Marshall, a postdoc, and lab technician Kathy Hill have published new findings about the [infection](#).

The story starts with the cicadas' emergence, when around 2 to 5 percent are infected with spores of a fungus called *Massospora cicadina*. Though the fungus infects both male and female cicadas, the researchers discovered that early in the emergence, the infection - at this point called a Stage I infection - causes curious behavioral changes in males where, in addition to their normal mating behaviors, they will exhibit wing flicking that is typically seen only in female cicadas.

The infected male cicadas put on a ruse, much like the Sirens of Greek myths; they flick their wings like a female, and lure in healthy unsuspecting males, who get close enough to be exposed to the spores, leading to their doom. The diseased males will also attempt to copulate with the uninfected females, exposing them to even more spores.

The infection results in the insect's abdomen becoming distended as it fills with powdery, white fungal spores eventually to the point of bursting open or falling off altogether. When the abdomen falls off, the genitalia are lost with it - but that doesn't stop the cicadas from their eager quest to copulate.

Cicadas infected by the spores passed around by the initially infected cicadas exhibit what is called a Stage II infection, following the same infection cycle as that seen in Stage I infections, in some cases acting normally despite the lack of genitalia and large portions of their abdomens, and spewing spores wherever they go.

The fungus's job is complete, the spores are spread and ready to infect future generations.

Growing body of research

Cooley says the research into similar infections by parasites or fungi has been observed in other species, for instance in beetles, fruit flies, and even mammals, and has led to a growing body of literature over the past 10 years or so.

Of the cicada infections, Cooley says, "This phenomenon is the ultimate evolutionary arms race, where the host loses because they are rendered sterile or evolutionarily irrelevant by the fungus in order to spread the [spores](#)."

He anticipates that this area of research will continue to heat up in coming years, as more details of these arms races are uncovered.

This type of research has to be performed in the field, and it's hard to predict where the fungus will be present. The best sites for studying these unfortunate cicadas have been almost stumbled upon. As Cooley explains, "I'd be driving along and say 'Holy smoke, there are a lot of dead cicadas in this spot. What's going on?'"

He says the findings on this hijacking fungus are an excellent example of the importance of basic scientific research and observation, and may ultimately lead to a scientific breakthrough.

"Basic research is sometimes not very exciting, it can be a lot of sitting around watching bugs," he observes. "You never really know in advance what the payoffs and applications will be. But basic research may lead to someone having an 'Aha' moment. Maybe this could lead to new biocontrol, maybe the fungus could secrete something to alter

metabolism or nervous behavior. We'll have to see where it goes."

More information: John R. Cooley et al, A specialized fungal parasite (*Massospora cicadina*) hijacks the sexual signals of periodical cicadas (Hemiptera: Cicadidae: *Magicicada*), *Scientific Reports* (2018). [DOI: 10.1038/s41598-018-19813-0](https://doi.org/10.1038/s41598-018-19813-0)

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