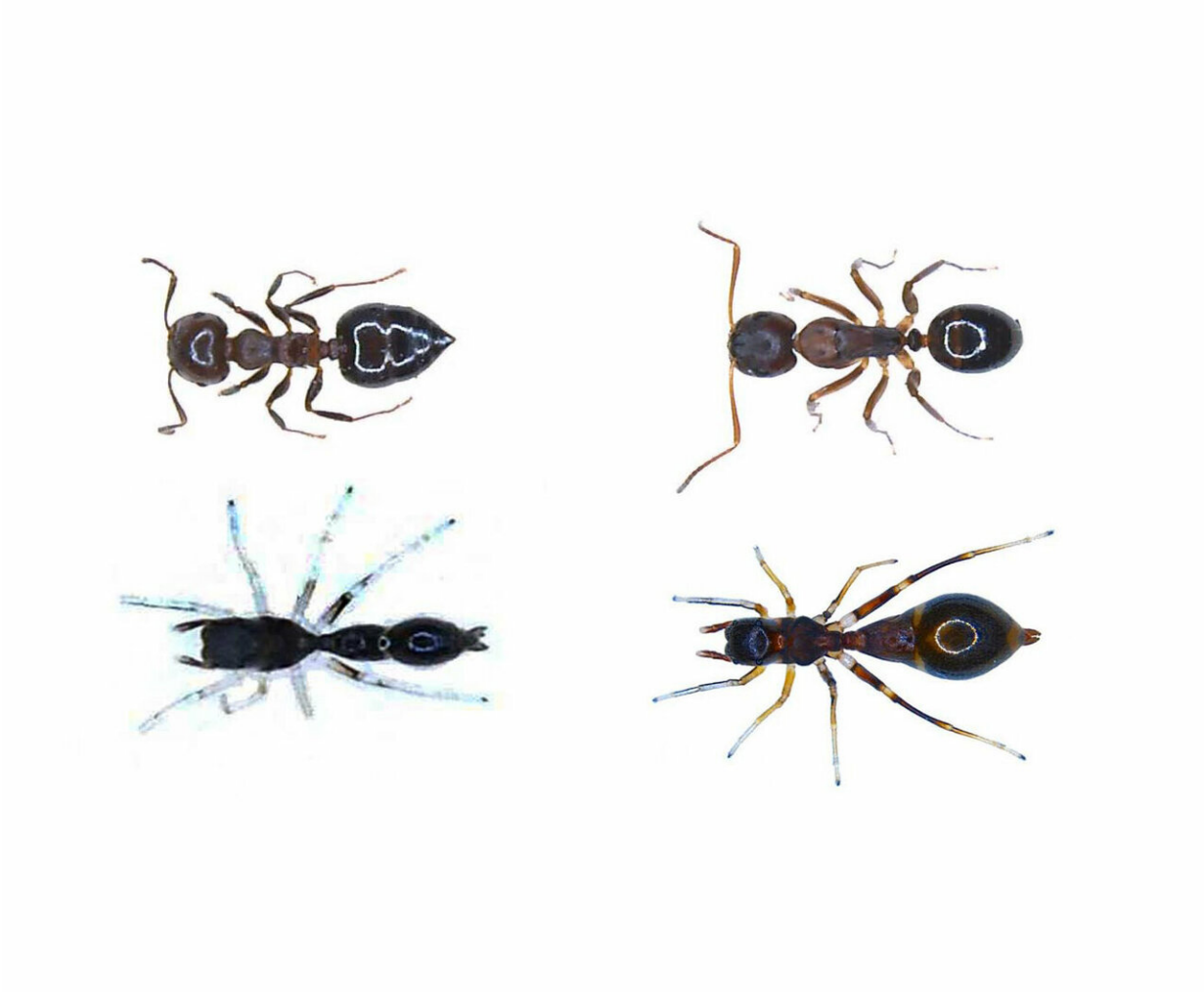
Spiders that pretend to be ants keep their spiderly proportions to attract mates

February 27 2019, by Michael Miller



Can you tell the spiders from the ants? UC researchers found that baby S. formica spiders, bottom left, closely resembled a tiny ant called Crematogaster, top left, while adult S. formica spiders, bottom right, mimicked a bigger species called Camponotus, top right. Credit: Alexis Dodson

Spiders that pretend to be ants to fool predators have an unusual problem when it comes to sex.

How do they get the attention of potential mates without breaking character to birds that want to eat them?

University of Cincinnati biologists say evolution might provide an elegant solution. Viewed from above, the mimics look like skinny, three-segmented ants to fool predators. But in profile, the adult mimics retain their more voluptuous and alluring spider figure to woo nearby mates.

UC researchers presented their findings in January at the Society for Integrative and Comparative Biology conference in Tampa, Fla.

Most birds avoid ants and their painful stingers, sharp mandibles and habit of showing up with lots of friends. Try to eat one and you're likely to get chewed on by 10 more. That's why nearly every insect family from beetles to mantises has species that mimic ants.

By comparison, spiders are delicious and nutritious, said Alexis Dodson, a UC doctoral student and lead author.

"That's what a lot of natural selection is all about—to convince other species not to eat you and convince members of your species to mate with you and to do so at the least cost possible," Dodson said.

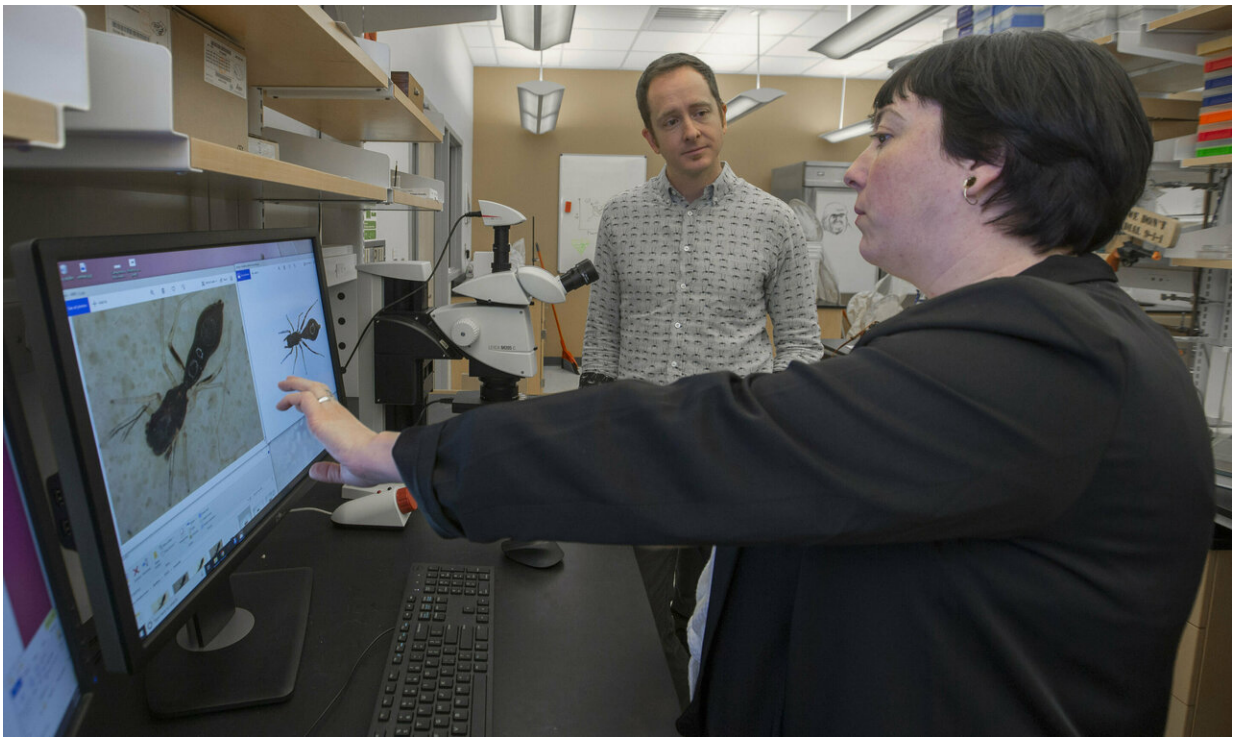
Lots of insects and arachnids mimic ants because they're so formidable. Some plants, too, have evolved a mutually beneficial relationship with aggressive ants to discourage hungry leaf-eaters.

"Ants are distasteful," said Nathan Morehouse, assistant professor of

biological sciences in UC's McMicken College of Arts and Sciences.

"They're well-defended and they come in big numbers. So a lot of animals avoid them," Morehouse said. "Unless you're a specialist like an anteater, they're just not a good meal."

Spiders occupy a three-dimensional world. But whether they're on the ground or climbing a tree, potential predators are likely to get a dorsal view, he said.



UC student Alexis Dodson discusses her morphometric comparison of a spider and an ant with UC assistant professor Nathan Morehouse. Credit: Joseph Fuqua II/UC Creative Services

"Thinking of vantage point is essential," Morehouse said. "From the top, juveniles and adults both look like ants. And juvenile spiders look very much like ants from the side. But adult spiders shift away from the ant profile toward a more traditional spider-like profile."

But it's not enough to look like an ant, Morehouse said. To fool clever predators, you have to act like one, too. The spiders have enormous back legs like ants. Spiders have an extra pair of legs compared to ants and no antennae. But ant mimics will wave their small forelegs in the air like ant antennae.

"The level of mimicry we encounter in jumping spiders is incredibly detailed," he said. "When ants follow a trail, they weave their heads back and forth. The ant is trying to cast back and forth over a chemical trail that's hard to find.

"Remarkably, jumping spiders also perform this weaving behavior even though it has no functional significance for them," Morehouse said. "They're trying to be convincing actors. They're trying to look like an ant."

UC researchers studied a jumping spider called Synemosyna formica found in Ohio and across eastern North America.

Jumping spiders are so named because they jump. Some can leap more than 50 times their body length. But ants don't jump. And neither do the spiders who pretend to be ants.

In fact, it's likely the mimics can't jump because their antlike frame won't allow it. Amazingly, Morehouse said, the ant mimics seem to have lost the ability to jump by copying ant locomotion so well.

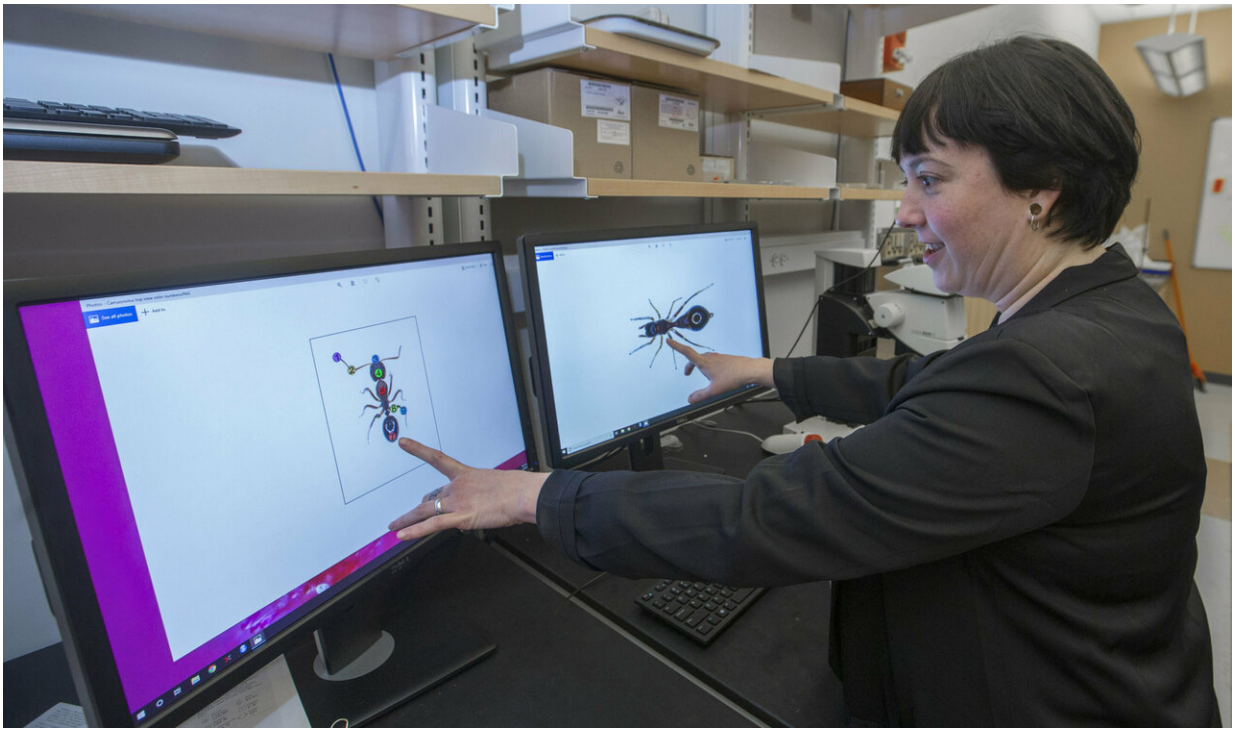
"Some of it is biomechanics. They're constrained by the loading of their

body weight," he said. "So they just sort of lurch. They're becoming more like ants in all kinds of ways. It's pretty neat."

UC researchers examined how close the spiders resemble ants using an elliptical Fourier analysis, a mathematical approach that compares complex shapes. It's an anatomical study called morphometrics.

S. formica is unusual for another reason: It mimics two different species of ants during its lifetime. To make the illusion more convincing, adult spiders will mimic Camponotus, a bigger kind of ant than the tinier black ants called Crematogaster the young spiderlings copy.

"I think that's the most surprising finding," UC postdoctoral researcher and study co-author David Outomuro said. "It makes a lot of sense to mimic something that matches your size."



UC student Alexis Dodson is examining whether spiders that mimic ants engage in overt courtship behaviors like other jumping spiders. Credit: Joseph Fuqua II/UC Creative Services

Now UC researchers are studying how ant mimics communicate with each other without blowing their cover. Jumping spiders are renowned for their larger-than-life courtship rituals. Many such as the peacock jumping spider have flashy colors—iridescent blues, greens and reds—and perform showstopper courtship dances like some kind of arachnid vaudevillian.

"This is my passion project," Dodson said. "Do they have mating rituals like other jumping spiders?"

So far Dodson has only observed what she calls "handshake" behaviors, or spiders seeming to acknowledge each other from a distance.

"It's as if one says, 'Hi, I'm not an ant.' And the other says, 'I am also not an ant,'" Dodson said. "It's definitely there. It's distinct from just walking around. And it's not something I've seen an ant do."

But do the mimics retain their distinctive courtship ritual like other jumping spiders? Some spiders will take these intimate encounters below ground where it's safer, Outomuro said.

"If you do courtship outside, predators might perceive you as potential prey and the mimicry stops working," Outomuro said.

Morehouse said the possibilities are intriguing. Perhaps, spiders behave more like ants during courtship because their antlike bodies demand it. Or maybe they borrow cues from ant behavior to maintain their

protective ruse during courtship.

"Or it's possible there are no antlike motions. When they court, they completely break character and behave like other jumping spiders," Morehouse said. "That's something Alexis is just beginning to understand."

Animal mimicry has been studied extensively in many other species but not this particular jumping spider. That makes the research particularly exciting, Morehouse said.

"Alexis was first to recognize that the ant mimics look like spiders in profile. We're really breaking new ground here," Morehouse said. "We have to figure out how these animals can be obvious to each other but not obvious to other species."

Provided by University of Cincinnati

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