

Study sheds new light on antibiotics produced by ants

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Foragers of the desert fire ant, *Solenopsis xyloni*, collecting flower nectar. A recent article by Penick, et al., found that ants in this genus produce some of the strongest antimicrobials measured in social insects. But contrary to popular theory, not all ants seem to invest in potent antimicrobials. Credit: Clint Penick

Ants, like humans, deal with disease. To deal with the bacteria that cause

some of these diseases, some ants produce their own antibiotics. A new comparative study identified some ant species that make use of powerful antimicrobial agents - but found that 40 percent of ant species tested didn't appear to produce antibiotics. The study has applications regarding the search for new antibiotics that can be used in humans.

"These findings suggest that [ants](#) could be a future source of [new antibiotics](#) to help fight human diseases," says Clint Penick, an assistant research professor at Arizona State University and former postdoctoral researcher at North Carolina State University who is lead author of the study.

"One [species](#) we looked at, the thief ant (*Solenopsis molesta*), had the most powerful antibiotic effect of any species we tested - and until now, no one had even shown that they made use of antimicrobials," says Adrian Smith, co-author of the paper, an assistant research professor of biological sciences at NC State and head of the NC Museum of Natural Sciences' Evolutionary Biology & Behavior Research Lab.

For this study, researchers tested the antimicrobial properties associated with 20 [ant species](#). They did this by using a solvent to remove all of the substances on the surface of each ant's body. The resulting solution was then introduced to a bacterial slurry. The growth of the [bacteria](#) in the slurry was then compared to the growth of bacteria in a [control group](#).

If bacteria in a slurry that contained ant solution grew less than the control group, that meant that an [antimicrobial agent](#) was at work. For example, the slurry containing thief ant compounds showed no bacterial growth at all.

The researchers found that 12 of the 20 ant species had some sort of antimicrobial agent on their exoskeletons - including some species, like the thief ant, that hadn't previously been shown to do so. But eight of the

ant species seemed not to make use of [antibiotics](#) at all. Or, at least, any antimicrobials on their exoskeletons were ineffective against the bacteria used in the study.

"Finding a species that carries a powerful antimicrobial agent is good news for those interested in finding new antibiotic agents that can help humans," Smith says. "But the fact that so many ant species appear to have little or no chemical defense against microbial pathogens is also important."

That's because the conventional wisdom has long been that most, if not all, ant species carry antimicrobial agents. But this work indicates that the conventional wisdom is wrong.



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In a recent study, the thief ant (*Solenopsis molesta*) -- shown here -- had the most powerful antibiotic effect of any ant species tested. The article, by Penick, et al.,

found that ants in this genus produce some of the strongest antimicrobials measured in social insects. But contrary to popular theory, not all ants seem to invest in potent antimicrobials. Credit: Magdalena Sorger

"We thought every ant species would produce at least some type of antimicrobial," Penick says. "Instead, it seems like many species have found alternative ways to prevent infection that do not rely on antimicrobial chemicals."

"The fact that not all ants use antimicrobials highlights the importance of refining our search for species that actually do hold promise for biomedical research," Smith says.

"For example, the thief ant is closely related to the red imported fire ant (*Solenopsis invicta*), which is well known for the [antimicrobial properties](#) of its venom. But in our study, we found that the thief ant was even more effective against bacteria than the fire ant. There may be other species in the same genus that are worth studying for their antimicrobial potency."

The researchers caution that this study is a first step, and that this study does have limitations. For example, the researchers used only one bacterial agent in their tests, meaning it is not clear how each species would fare against other bacteria.

"Next steps include testing ant species against other bacteria; determining what substances are producing the antibiotic effects - and whether ants produce them or obtain them elsewhere; and exploring what alternative strategies ants use to defend against bacterial pathogens," Smith says.

More information: External immunity in ant societies: Sociality and colony size do not predict investment in antimicrobials, *Royal Society Open Science*, [rsos.royalsocietypublishing.org ... /10.1098/rsos.171332](https://rsos.royalsocietypublishing.org/doi/10.1098/rsos.171332)

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