

Scientists zero in on how termites coordinate mating behavior for colony success

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Credit: University of Florida

By utilizing two of the most invasive termite species in Florida, scientists have gained insights at how animals living in groups—termites particularly—coordinate their leader-follower behaviors to thrive.

Thomas Chouvenc, an assistant professor of urban entomology at the UF/IFAS Fort Lauderdale Research and Education Center (REC), collaborated with colleagues at Arizona State University on new research. In the study, scientists used Formosan subterranean [termites](#) and Asian subterranean termites—two of the most [invasive species](#) in Florida.

A new paper "Coordination of movement via complementary interactions of leaders and followers in termite mating pairs" in the *Proceedings of the Royal Society B* explores the hidden relationship in termite species behind the behavioral traits of leaders and followers.

As social insects, termite queen and king wannabes directly influence their respective movement for mating success and survival. The key is in the female's pheromones. In termites, during the mating season, winged individuals fly from their colonies to find a mate and create a new colony. The female produces a pheromone that allows a male to find her. In this interaction, the female is the leader, while the male is the follower, as both partners look for a place to start a colony.

The rules of engagement guiding the behavior of leader-follower are often species-specific. Also, they are believed to result from the fine-tuning of the two opposite behavioral traits—leading and following—through [natural selection](#).

South Florida presented a unique opportunity to further test that hypothesis, which is why researchers turned to the termite lab at UF/IFAS Fort Lauderdale REC where Chouvenc specializes in termite biology. Studies on the biology of termites yield insights into pest management strategies, but also provide novel understanding of complex [evolutionary processes](#).

"In South Florida, we have these two established invasive termite species that cause a lot of damage to structures and trees," said Chouvenc. "They sometimes engage in interspecific mating activity, with a potential for hybridization, which gave us the ideal opportunity to test this hypothesis."

"It is challenging to test the hypothesis that the leader-follower behavioral rules are finely co-evolved in an animal species. Such two

behavioral traits are inherently linked and difficult to dissect," said Nobuaki Mizumoto, who led the study as a postdoctoral researcher at Arizona State University and is now at Okinawa Institute of Science and Technology.

This new study revealed that both the leader and follower have evolved to expect a set of cues from their partner, and if these expectations are not met, then the coordination falls apart, said Mizumoto,

"Our results have implications on how large groups of animals came to coordinate their efforts through natural selection, or how sexual selection has shaped sex-specific traits to meet a differential expectation between partners," concluded Mizumoto.

Because the two invasive termite species have evolved separately for about 18 million years, the leader-follow rule in the two species can be slightly different, explains Chouvenc.

"Despite sharing the same pheromone, Formosan subterranean termite females produce much more pheromone than the Asian subterranean termite females," he said. "We, therefore, hypothesized that the leader-follower rule discrepancies between the two species would reveal a lack of optimization through evolutionary fine-tuning."

This unique approach allowed the team of researchers to show that males of Formosan subterranean termites cannot properly follow females of the Asian subterranean termite. Meanwhile, males of the Asian subterranean termite are fully capable of following Formosan subterranean termite females.

"This asymmetric result was remarkable because it indicated that male Formosan subterranean termites were not capable or were not motivated to follow females of a species that produce little pheromones. On the

other hand, males of Asian subterranean termites were perfectly able to follow females of the Formosan subterranean termites, which produces far more pheromone than these males evolved to track," added Chouvenc.

"In a previous collaborative study, we were able to show that males optimize their movement to keep up with females, while the [females](#) adapt her movements depending on the feedback from the male following her," Mizumoto said. The current study highlighted that such optimization was the result of evolutionary processes

While the discovery of the two termite [species](#) finding love in Florida remains a concern for their potential impact on our houses, it provides opportunities to test a unique hypothesis, that helps understand how coordination behaviors of animals have evolved, Chouvenc explains.

More information: Nobuaki Mizumoto et al, Coordination of movement via complementary interactions of leaders and followers in termite mating pairs, *Proceedings of the Royal Society B: Biological Sciences* (2021). [DOI: 10.1098/rspb.2021.0998](https://doi.org/10.1098/rspb.2021.0998)

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