

Termite queen, king recognition pheromone identified

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NC State researchers identify the termite royal recognition pheromone emitted by queens, like the one pictured, and kings. Credit: Matt Bertone, NC State University

Researchers at North Carolina State University have for the first time identified a specific chemical used by the higher termite castes—the queens and the kings—to communicate their royal status with worker termites. The findings could advance knowledge of termite evolution,

behavior and control.

A study published in *Proceedings of the National Academy of Sciences* shows that a wax-like hydrocarbon—a chemical consisting of only carbon and hydrogen atoms called heneicosane—on the body surface of subterranean royal [termites](#) is used to enable worker termites to recognize and care for them. Termites live mostly underground or in wood and are generally blind, necessitating the use of chemical signals to communicate.

"This is the first report of a queen recognition pheromone in termites and the first report of a king recognition pheromone in insects," said Coby Schal, Blanton J. Whitmire Distinguished Professor of Entomology at NC State.

Schal and NC State Ph.D. graduate Colin Funaro, the paper's co-corresponding authors, used gas chromatography to isolate specific chemicals from the exoskeletons of royal and worker *Reticulitermes flavipes* termites and found heneicosane on the royal termites, but not on workers.

When heneicosane was placed on glass dummies serving as royal termite proxies, workers did not bow or curtsy, but instead started shaking—an action that seemed to reflect the termite version of royal recognition. Workers shook even more when the royal pheromone was blended with other hydrocarbons from the colony's workers that represent the colony's odor.

"Termites use a two-step recognition process - the colony's odor gives workers a 'home' context and heneicosane within this context denotes 'royals are in the home,'" Schal said.

"The royal-recognition pheromone lets workers know that there is a

queen or a king present and that everything is stable in the colony," Funaro said. "Worker termites shook more when realizing that the royals were also nest mates."

Schal said that the study upends the commonly held belief that queens of the insect order Hymenoptera - ants, bees and wasps - were the first to use these wax-like hydrocarbon pheromones for royal recognition.

"Termites appeared some 150 million years ago while the social Hymenoptera appeared about 100 million years ago, so this discovery of a hydrocarbon as a royal-recognition [pheromone](#) in termites appears to predate its use in social insects," Schal said.

R. flavipes termites are major pests in North Carolina and the Southeast, causing billions in damage, Schal added. In recent years they have spread to the west coast of the U.S., and into Canada, South America, Europe, and Asia.

More information: Colin F. Funaro et al., "Identification of a queen and king recognition pheromone in the subterranean termite *Reticulitermes flavipes*," *PNAS* (2018).

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Provided by North Carolina State University

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