

# NEWS RELEASE

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Feb. 17, 2005

## Scientists Discover Secret Behind Cockroaches' 'Come Hither' Call

EMBARGOED FOR RELEASE UNTIL 2 P.M. EST ON THURSDAY, FEB. 17

When female German cockroaches are ready to mate, they raise their wings, lower their abdomen, stilt their legs and send chemical signals – sex pheromones – advertising their availability to adult males.

But the infinitesimal amounts of pheromone emitted by each female cockroach and the pheromone's thermal instability – or propensity to fall apart at high temperatures that would normally allow intensive study – have kept an understanding of the pheromone's true chemical composition out of reach.

Now, research conducted by scientists at North Carolina State University, Cornell University and the State University of New York has ended more than a decade of uncertainty about the actual chemical composition of the pheromone.

In a study published in the Feb. 18 edition of the journal *Science*, the scientists characterized the pheromone – gentisyl quinone isovalerate, which they call blattellaquinone – for the first time, creating a synthetic version of the pheromone and then utilizing behavioral studies to show the synthetic version is just as effective as the natural version in getting adult male German cockroaches to “come hither.”

The study, says co-author Dr. Coby Schal, Blanton J. Whitmire Professor of Entomology at NC State, could have important pest control implications and advances the knowledge of fundamental biological and chemical properties of arguably the most important cockroach worldwide.

The researchers combined two study methods – gas chromatography, in which chemical compounds are studied in a controllable oven, and electroantennographic detection, which



An adult female German cockroach exhibits “calling behavior” during which she raises her wings and emits a volatile pheromone (blattellaquinone) from the last abdominal segment.

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records the electrical responses of the antenna, the cockroach's nose, to odors – to purify and identify the sex pheromone in female German cockroaches.

The researchers placed samples of complex extracts from the bodies of female cockroaches into the gas chromatograph, where the extracts were separated and then analyzed on a mass spectrometer, which tells the identity of each chemical compound. At the same time, the compounds were tested on the electroantennograph, a device that contained the extremely sensitive antennae of an adult male cockroach.

“We calculated that the antenna is about 100 to 1,000 times more sensitive to pheromones than the mass spectrometer,” Schal says. “So when the electroantennograph showed a response from the antenna, we knew we had a chemical that would cause a behavioral response in the male cockroach.”

To make sure it was female sex pheromone and not another attractant or possibly even a repellent, the researchers isolated the pure compound, identified and synthesized it, and did behavioral tests with male cockroaches to see if they'd approach the synthetic compound – that perhaps love was in the air – or stay away from it.

The research showed that the males were indeed attracted to blattellaquinone, with higher doses of the pheromone attracting more males. Also, when the sex pheromone was placed in traps, higher amounts trapped more males; females and sexually immature males were not caught in the traps.

Schal, who has studied the sex pheromone in his lab on and off since 1993, sees pest-control implications as the most important results of the research.

“The German cockroach is an important – arguably the most important – pest that is associated with allergic disease and asthma in children and the elderly, especially in the inner city,” Schal says. “The pheromone could offer novel approaches to controlling cockroaches by increasing the efficiency of traps in places like schools, hospitals and nursing homes, for instance, and of sprays and baits in homes and farm buildings.”

The research was funded by grants from the National Science Foundation and the U.S. Department of Agriculture, and supported by the Blanton J. Whitmire Endowment at NC State and the W.M. Keck Center for Behavioral Biology, an NC State research center.

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**Note to editors:** An abstract of the paper follows.

## **“Identification of the Sex Pheromone of the German Cockroach, *Blattella germanica*”**

*Authors:* Satoshi Nojima and Wendell I. Roelofs, Cornell University; Coby Schal and Richard G. Santangelo, North Carolina State University; Francis X. Webster, State University of New York  
*Published:* Feb. 18, 2005, in *Science*

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**Abstract:** The sex pheromone of the German cockroach, *Blattella germanica*, has been characterized as gentisyl quinine isovalerate. This cockroach is a major cause of allergic disease and serves as a mechanical vector of pathogens, making it one of the most important residential and food-associated pests worldwide. The sex pheromone-producing gland in adult females was identified in 1993, but thermal instability of the pheromone made characterization difficult. Now, using a new preparative gas chromatography approach coupled with electroantennographic detection, we have isolated and characterized the pheromone, which we term blattellaquinone, and confirmed the identification by chemical synthesis. The synthetic pheromone was active in behavioral assays and highly effective in field trapping tests, which suggest that it may provide a new tool in cockroach population detection, monitoring, and control.