

Love Bugs: Breakthrough Study of Cockroach Sex

February 13 2007

Wanted: Mature males looking for a good time. Must have all six legs, strong antennae and love city life. Proclivity to procreate a must. Apply at crack in the bathroom wall, apartment 8B.

Female German cockroaches looking to attract male German cockroaches have much better ways of sending “come hither” signals than want ads.

Females raise their wings, lower their abdomen, stilt their legs and send chemical signals – sex pheromones – advertising their availability to adult males.

But prior to a discovery by NC State entomologists, scientists couldn’t figure out the chemical composition of these pheromones: the small 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 – kept this knowledge out of reach.

Research conducted by NC State’s Dr. Coby Schal and colleagues from 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 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, Schal says, 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 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.”

Source: NC State University, By Mick Kulikowski

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