ScienceWatch –Scent of a Roach

As cold war children constantly under the threat of nuclear attack, we often said that if an atomic attack occurred the roaches would still survive. In actual fact roaches can withstand ten times the dose of radiation that would readily kill humans. The cockroach *Blatella germanica*, also called the German cockroach or just plain roach is a worldwide household pest. It has so adapted to its human habitat that it no longer exists in the wild and has resisted all attempts to eradicate it. Lifespan is only about three months, but one female can yield 10,000 descendents in a year. Baits, traps, repellents, pesticides all do nothing better than to keep them at bay. As many as 100,000 can infest a home and once infested we can only hope to kill enough so they will go somewhere else. Not only are roaches carriers of disease, but also their excretions are allergens that greatly contribute to the rise of asthma in inner city settings.

Now a report in the February 18, 2005 issue of the journal *Science* provides some hope in controlling this pest that gives so many of us the willies. (Indeed if you have read this far you are braver than most.) The report by a team headed by Wendell Roelofs a biochemist at the Department of entomology, Cornell University, Geneva, NY, describes the isolation and synthesis of the roach sex pheromone. Pheromes are species-specific chemicals made by plants and animals to illicit a response in other individuals. Sex pheromones are more familiar to us as "sex attractants", which are widespread and especially potent in the insect world. For example, the antennae of a downwind male moth can detect just a few molecules coming from a female moth a mile away. Once he catches the scent the male flies upwind, following the concentration gradient, until he finds the female. The use of sex pheromones to control insect pests avoids environmentally damaging pesticides. For example, a synthetic version of the gypsy moth sex attractant (gyplure) used in traps has achieved some success in the past.

A decade ago researchers observed that virgin female roaches could attract males over some distance apparently by releasing a pheromone from the end of their abdomen while spreading their wings. Further study of roach extracts, however, was unsuccessful because the pheromone is thermally unstable and was destroyed by all attempts to isolate it. To avoid destroying the pheromone Roelofs' team used a specially designed gas chromatograph (GC) that could separate compounds from a roach extract at lower temperatures. As each separated roach compound flowed through the tubing of the GC it passed over the perfect biological detector, namely, the antennae of a live male roach attached to an electrode. Receptors on the roach's antennae sensed the attractant molecules and produced an electrical signal that could be detected. But the really hard work involved obtaining enough roach extract to study. This required dissecting and collecting the last abdominal segment from 1,500 virgin female roaches! Once the team had a pure, biologically active compound they identified it as gentisyl quinone isovalerate, otherwise dubbed "blattellaquinone".

Commercial producers are not about to dissect roaches so the team synthesized the active compound and showed it attracted males as well as the natural isolate did. They tested

this by placing male roaches at the downwind end of a straight plastic tube about two feet long and divided into two arms by a partition at the last six inches of the upwind end (olfactometer). A filter paper disc impregnated with dissolved synthetic blattellaquinone was placed at one arm of the olfactometer and a control lacking the pheromone at the other. By monitoring the choices made by males in response to various concentrations of attractant the team found that male roaches were able to detect as little as one-billionth of a gram, but were swamped by concentrations approaching one-millionth of a gram. This means that precise doses and formulation will be necessary for effective control in the field.

The team conducted a field test by setting traps with varying synthetic blattellaquinone concentrations at an infested pig farm. Immature nymphs and females were not attracted; however, the traps caught increasingly more males with concentrations up to one-millionth of a gram. You can bet pesticide manufacturers are clamoring for access to the attractant and one day we may see roach motels with little sex lights.

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