Scientists identify nature's insect repellents

July 16 2010

In the battle between insect predators and their prey, chemical signals called kairomones serve as an early-warning system. Pervasively emitted by the predators, the compounds are detected by their prey, and can even trigger adaptations, such a change in body size or armor, that help protect the prey. But as widespread as kairomones are in the insect world, their chemical identity has remained largely unknown. New research by Rockefeller University's Joel E. Cohen and colleagues at the University of Haifa in Israel has identified two compounds emitted by mosquito predators that make the mosquitoes less inclined to lay eggs in pools of water. The findings, published in the July issue of *Ecology Letters*, may provide new environmentally friendly tactics for repelling and controlling disease-carrying insects.

Many animals use chemicals to communicate with each other. Pheromones, which influence social and reproductive behaviors within a particular species, are probably the best known and studied. Kairomones are produced by an individual of one species and received by an individual of a different species, with the receiving species often benefiting at the expense of the donor.

Cohen and his Israeli colleagues focused on the interaction between two insect species found in temporary pools of the Mediterranean and the Middle East: larvae of the mosquito C. longiareolata and its predator, the backswimmer N. maculata. When the arriving female mosquitoes detect a chemical emitted by the backswimmer, they are less likely to lay eggs in that pool.

To reproduce conditions of temporary pools in the field, the researchers used aged tap water with fish food added as a source of nutrients. Individual backswimmers were then placed in vials containing samples of the temporary pools, and air samples were collected from the headspace within the vials. The researchers used gas chromatography-mass spectrometry to analyze the chemicals emitted by the backswimmers.

Cohen and his colleagues identified two chemicals, hydrocarbons called n-heneicosane and n-tricosane, which repelled egg-laying by mosquitoes at the concentrations of those compounds found in nature. Together, the two chemicals had an additive effect.

Since the mosquitoes can detect the backswimmer's kairomones from above the water's surface, predator-released kairomones can reduce the mosquito's immediate risk of predation, says Cohen. But they also increase the female mosquito's chance of dying from other causes before she finds a pool safe for her to lay her eggs in.

"That's why we think these chemicals could be a useful part of a strategy to control the population size of mosquitoes," says Cohen, who is the Abby Mauzé Rockefeller Professor and head of the Laboratory of Populations. "We started this work from very basic curiosity about how food webs and predator-prey interactions work, but we now see unexpected practical applications. These newly identified compounds, and others that remain to be discovered, might be effective in controlling populations of disease-carrying insects. It's far too soon to say, but there's the possibility of an advance in the battle against infectious disease."

Provided by Rockefeller University