Getting mosquitoes to kill their own

July 9 2009

(PhysOrg.com) -- It's about mosquitoes killing mosquitoes.

The day-biting mosquito Aedes aegypti takes a blood meal and then rests in a dark place before heading for water to deposit her eggs. Her eggs will develop into larvae, pupae and adults -- adults capable of transmitting the killer disease, dengue.

But maybe not, thanks to a six-member team led by British researcher Gregor Devine, a team that includes epidemiologist and dengue mosquito researcher Amy Morrison of the University of California.

Unbeknownst to the mosquito, a deadly insecticide in her resting place will kill her future generations. Her resting area contains a cloth impregnated with a powdered larval insecticide, which will stick to her body when she buzzes off to an aquatic habitat to lay her eggs. There the larvicide will kill not only her offspring but other immature mosquitoes at this and other breeding sites.

Getting mosquitoes to spread insecticides is the gist behind the research, "Using Adult Mosquitoes to Transfer Insecticides to Aedes aegypti Larval Habitats," published June 29 in the Proceedings of the National Academy of Sciences *(PNAS)*.

Devine, with Rothamsted Research, Hertfordshire, United Kingdom, and Morrison, with the UC Mosquito Research Laboratory, directed by Thomas Scott of the UC Davis Department of Entomology, have been working together on a variety of field experiments on mosquitoes,

including the use of adult mosquitoes to kill their young via a larvicide.

"A major barrier to mosquito control for dengue has been treating all of the infested containers," said Scott. "This is a creative way to exploit the ecology of the system by using the mosquitoes themselves to treat all containers, including the ones that are most difficult for humans to find. This is an exciting new development with important public health implications."

The field work took place in the Amazon city of Iquitos, Peru, where Morrison has studied dengue since 1999. Iquitos, endemic to dengue, is the most populous city in the world that cannot be reached by road.

The researchers placed the insecticide, a juvenile hormone analogue (JHA), at dissemination stations in a cemetery in Iquitos. Although they placed the JHA in just 3 to 5 percent of a resting area, that placement resulted in a 42 to 98 percent reduction of emergent adult mosquitoes at each breeding site.

The JHA used was pyriproxyfen, which the authors said "does not interfere with the fundamental behaviors (of mosquitoes) that we are exploiting because it is neither lethal nor repellent to adults.

"It is the act of oviposition (egg-laying) that contaminates the aquatic habitat, so the technique explicitly and precisely targets the mosquitoes' preferred breeding sites," the authors wrote. "This process may help overcome one of the most important constraints on the successful application of larvicidal or pupacidal interventions: the inefficient waste of expense insecticides and human resources on treating inappropriate or cryptic oviposition sites."

The insecticide kills larvae, but does not harm people-or adult mosquitoes. Pyriproxyfen is registered for public health use. The World

Health Organization declared it safe for drinking at 300 parts per billion, which is 1000 times the dose needed to control Aedes aegypti.

When humans treat aquatic habitats with insecticides, the process can be difficult, time-consuming and expensive. When mosquitoes apply insecticides, this targets the exact breeding site (from a discarded tin can to flower vase saucer to sewage seeps) and amplifies the effect because every adult mosquito completes several resting and egg-laying cycles during its lifetime, Devine said.

Devine lived in Iquitos in 2006-2008 while working with the U.S. Navy and UC Davis on the research project.

Morrison and Jeff Stancil, a U.S. Navy entomologist from the Naval Medical Research Center Detachment in Peru, were co-applicants on the grant.

Some 2.5 to 3 billion people, primarily in tropical and sub-tropical countries, are at risk to dengue, caused by any one of four serotypes or closely related viruses known as DEN-1, DEN-2, DEN-3, or DEN-4. Nicknamed "break bone fever," classic dengue is characterized by high fever, headaches, muscle and joint pain, nausea, vomiting and a rash.

Some 50 to 100 million cases of debilitating dengue fever occur annually. The most severe form of the disease, dengue haemorrhagic fever (DHF), strikes a half million people a year, according to the Centers for Disease Control and Prevention. Some 22,000 die of DHF.

Provided by UC Davis (news : web)

https://phys.org/news/2009-07-mosquitoes.html