Male mosquitoes lured to traps by sounds of female wing-beats

October 26 2015

Anopheles gambiae mosquito, feeding on blood. Credit: James Gathany, Centers for Disease Control and Prevention

Like mariners lured on to the rocks by the siren songs of legend, male mosquitoes have been found to zero in on inexpensive traps that

broadcast sound that is similar in frequency to the sound that is produced by the wing-beats of female mosquitoes—a discovery that may lead to better mosquito control in developing countries.

Experiments by two Australian scientists show that sound-baited traps using cheap batteries can capture up to 95 percent of male mosquitoes exposed to them. Since only females bite, the purpose of the traps is not to eliminate mosquitoes. Instead, the traps can be used to monitor their populations and to capture males that can be sterilized and then later released to mate - unsuccessfully - with females.

Their research is presented in an article appearing in the *Journal of Medical Entomology* called "The Siren's Song: Exploitation of Female Flight Tones to Passively Capture Male *Aedes aegypti* (Diptera: Culicidae)."

Males snub females at rest but swarm those in flight. Experiments show, on the other hand, that females could not care less about the sound of male wing-beats. Several recent studies suggest that there is little biological evidence for the worth of commercially marketed traps that purport to repel gravid females because once inseminated they supposedly shun reproduced male flight sounds.

"Males of most mosquito species of medical importance use their superb auditory sense to detect and locate female mosquitoes by recognizing the female's unique flight tone," said co-authors Brian Johnson and Scott Ritchie.

For their experiments, Johnson and Ritchie selected a $20 device called a GAT (Gravid *Aedes* Trap) to capture gravid females by luring them to lay eggs in a mixture of hay and water. Normally only five percent of the mosquitoes collected in this type of trap are males.

The researchers rigged their GATs for sound with a basic M3 player and a speaker, knowing that the female of each mosquito species usually has its own trademark frequency. That of *Aedes aegypti*—the species responsible for yellow fever, dengue, and chikungunya, and the one used in the tests—averages about 484 Hz. The researchers also broadcast control frequencies—a female tone of 560 Hz, which had been detected in a 2011 study, and a male tone of 715 Hz.

During one experiment, four GATs with the hay-water mix were placed within four small nylon tents located inside a large cage. Three traps emitted a single tone each: 484 Hz, 560 Hz, or 715 Hz. The fourth trap was silent.During the course of the experiment, traps were rotated among tents, operators, and positions to eliminate prejudicial variables.

Thirty virgin males were released in one test, and 30 gravid females in another. After two hours, the capture rate for males in the 484 Hz trap was more than 95 percent. The capture rate for those in the 560 Hz trap was about half of that, and was only about five percent in the silent trap .

Taking their experiments one step further, the researchers tested how the traps worked among large numbers of free-flying males and females. The site was a large cage that housed about 1,000 individuals of both sexes. The rules of the experiment were similar to those of tests carried on in tents except that traps were checked every half hour.

The 484 Hz frequency again proved the best bet for attracting males and gravid females. Not a single non-gravid female was found in the traps. Tests in the open outdoors and inside a house also produced similar findings: a 484Hz tone is music to the ears of a male *Aedes aegypti* mosquito, except instead of ears they sense sound waves with a structure in the second segment of the antennae. Sound waves vibrate the antennae and are picked up by the so-called Johnston's organ, commonly used by male insects to locate mates.

While the antennae of male mosquitoes are attuned to the frequency of wing-beats by females of the same species, the opposite does not occur. Female antennae are not tuned to detect wing-beats of either sex. During mating, however, it appears that females match their flight tone to that of the male.

The ability of a reliable, inexpensive sound-trap to collect male mosquitoes could greatly enhance studies of mosquitoes and the release of sterile males in much of the developing world. Many existing traps need electricity from the grid or from large, rechargeable batteries, but the logistics of supplying power in remote, impoverished regions is uncertain, and expensive batteries are often targeted by thieves.

The GAT traps are five to ten times cheaper than many others, and GAT traps made for use in the field will be eventually be powered by watch batteries.

More information: *Journal of Medical Entomology*, jme.oxfordjournals.org/lookup/ … i/10.1093/jme/tjv165

Provided by Entomological Society of America

Citation: Male mosquitoes lured to traps by sounds of female wing-beats (2015, October 26) retrieved 26 April 2024 from https://phys.org/news/2015-10-male-mosquitoes-lured-female-wing-beats.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.