Suicide mosquitoes a gene-altered weapon in war against dengue fever

A Health Ministry worker fumigates in an area near the Panama Canal in July 2013. Mosquitoes can breed in stagnant water collected in parked or abandoned autos, barrels, flowerpots and tires. Photo: Tim Johnson/MCT

PANAMA CITY — They’ve attracted names like suicide mosquitoes, dead-end bugs and even Frankenskeeters.

They’re gene-altered mosquitoes and the list of countries that are testing to see whether they have a place in the public health arsenal in the war against mosquito-borne diseases such as dengue fever is growing. Panama is one of those countries.

Dengue is on the rise worldwide, with outbreaks reported this year in Texas and Florida. The mosquito that carries the dengue virus has spread to 100 countries and potentially exposes 2.5 billion people to the excruciating disease. Some 50 million to 100 million people contract dengue each year, of which about 25,000 die, the World Health Organization reports.

“A person with dengue will be prostrate for several days,” said Dr. Carlos Galvez, the head epidemiologist for Panama's Health Ministry. “They grow dehydrated very fast. In a matter of hours, the cases can grow more complicated.”
Call Them The Dead-End Bugs

This has been a particularly bad year for dengue in the Western Hemisphere, with the Pan American Health Organization reporting 1.4 million cases.

Panama has one of the most developed public-health systems in Latin America, a legacy of the U.S. military presence during much of the 20th century to oversee the operation of the Panama Canal. Yet even Panama struggles to cope with a type of mosquito known as Aedes aegypti. The aggressive city dweller that originally came from North Africa is the principal carrier of the dengue virus.

Teams patrol the streets fumigating with insecticide in a constant battle against the mosquito. Public service ads remind Panamanians to drain standing water in eaves, buckets, flowerpots and old tires, where mosquitoes breed.

Before long, public health officials may have a new tool — OX513A — a genetically modified mosquito from a British biotech company, Oxitec Ltd., that’s a spinoff from Oxford University.

Oxitec mosquitoes have been altered to contain a “lethality gene.” When the mosquitoes, all male, are released into the wild, they mate with females but the offspring don’t survive. That’s why they’re called dead-end bugs. Only if they’re exposed to tetracycline, an antibiotic, do the transgenic mosquitoes survive.

Flags Of Caution Raised

If Panama’s National Biosafety Commission gives the green light, sometime early next year technicians will release tens of thousands of gene-altered mosquitoes in Arraijan. The community is across the canal from Panama City at the canal’s Pacific end.

“We plan to do about 50,000 per week,” said Dr. Nestor Sosa, the head of the Gorgas Memorial Institute for Health Studies, a public research body. “You have to have a proportion of at least 10 to 1 (transgenic) mosquitoes to native mosquitoes. You have to overwhelm them.”

If all goes according to plan, the OX513A release will result in a drop in the mosquito population.

“If you lower the number of mosquitoes, you lower the possibility of infection with dengue,” Galvez said.

The transgenic mosquitoes have generated opposition, with complaints ranging from doubts about their effectiveness to concern about whether the impact on the ecosystem has been adequately studied.
“There are scenarios in which the dengue could worsen,” said Dr. Helen Wallace, a mathematician who is the executive director of GeneWatch UK, a British group that monitors genetic science. Wallace said that if the program succeeded in reducing the population of the Aedes aegypti mosquito, there was nothing that prevented some other type of mosquito from adapting to fill its niche and carry the virus.

“It could be harder to get rid of than the targeted mosquito,” she said.

**Even A Red Flag Hoisted, About Borders**

Another critic, Camilo Rodriguez-Beltran, a French-trained biosecurity expert working in Chile, said the gene-altered mosquitoes could cross international boundaries, violating international treaties on biosafety.

“All consequences that could occur are unforeseen,” Rodriguez said. “It’s been developed very rapidly.”

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Sosa, the health official, dismissed some of the criticism, especially about the transgenic mosquito’s potential impact on the ecosystem.

“The mosquito dies in a few days. So it’s very improbable that it will go into the environment or into another organism,” Sosa said. “It’s not that we are doing something that is environmentally unfriendly.”

**A Rifle, Not A Blunderbus**

Hadyn Parry, the chief executive of Oxitec, said in a telephone interview that his company thought its transgenic mosquito was safer than using insecticides, which he asserted “affect all insects in a given area.” Insecticides can also filter through the ecosystem and persist.

By using dead-end mosquitoes, only one species is affected, he said.

“It’s a highly targeted sniper’s rifle instead of a blunderbuss that takes out everything it finds,” Parry said.

Mosquitoes generally spend their three-week life spans in an area 200 yards from where they were born. The Oxitec mosquitoes, he said, can always be detected.

“You can actually look at any of our insects under a fluorescent light, and you’ll see a red color. This is so important when it comes to monitoring. We can tell how far our insects fly and where they are going,” Parry said.
Oxitec mosquitoes have been tested in the Cayman Islands, Malaysia and Brazil, Parry said, and he expects tests in India and in the Florida Keys, if the U.S. Food and Drug Administration and Florida authorities give final approval.

In tests earlier this year in the village of Mandacaru, in Brazil’s northeastern Bahia state, Oxitec reported 96 percent suppression of the dengue mosquito.

Health experts say they need additional tools to combat dengue, and they encourage the global pharmaceutical companies that are racing to create a vaccine. But research is costly and slow, partly because there are four virus types for dengue, each different.
Quiz

1. Select the paragraph from the section “Call Them Dead-End Bugs” that shows that mosquitos can live and thrive in many different settings.

2. Which of the following pairs of lines from the section “Flags of Caution Raised” include one reason why some people support the OX513A release and one reason others do not?
   
   (A) “You have to have a proportion of at least 10 to 1 (transgenic) mosquitoes to native mosquitoes. You have to overwhelm them.”; The transgenic mosquitoes have generated opposition, with complaints ranging from doubts about their effectiveness to concern about whether the impact on the ecosystem has been adequately studied.
   
   (B) “If you lower the number of mosquitoes, you lower the possibility of infection with dengue,” Galvez said.; “There are scenarios in which the dengue could worsen,” said Dr. Helen Wallace...”
   
   (C) “If you lower the number of mosquitoes, you lower the possibility of infection with dengue,” Galvez said.; “We plan to do about 50,000 per week,” said Dr. Nestor Sosa, the head of the Gorgas Memorial Institute for Health Studies, a public research body.
   
   (D) If Panama’s National Biosafety Commission gives the green light, sometime early next year technicians will release tens of thousands of gene-altered mosquitoes in Arraijan.; “We plan to do about 50,000 per week,” said Dr. Nestor Sosa, the head of the Gorgas Memorial Institute for Health Studies, a public research body.

3. Read the following from the introduction [paragraph 1-4].

   “A person with dengue will be prostrate for several days,” said Dr. Carlos Galvez, the head epidemiologist for Panama’s Health Ministry. “They grow dehydrated very fast. In a matter of hours, the cases can grow more complicated.”

Which of the following is the BEST synonym for “complicated” as it is used in this context?

   (A) confusing
   (B) interesting
   (C) dangerous
   (D) complex
A Panamanian environmental lawyer, Olmedo Carrasquilla, said his nation should use better techniques to educate the public on mosquito control.

"Why invest millions in methods and technology when there are no guarantees? When we know there are rudimentary methods that work?" he asked.

In this context, which of the following means the OPPOSITE of "rudimentary"?

(A) mosquito control
(B) methods that work
(C) millions in methods and technology
(D) better techniques to educate
Answer Key

1  Select the paragraph from the section "Call Them Dead-End Bugs" that shows that mosquitos can live and thrive in many different settings.

   **Paragraph 6:**
   Teams patrol the streets fumigating with insecticide in a constant battle against the mosquito. Public service ads remind Panamanians to drain standing water in eaves, buckets, flowerpots and old tires, where mosquitoes breed.

2  Which of the following pairs of lines from the section "Flags of Caution Raised" include one reason why some people support the OX513A release and one reason others do not?

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