Source : www.thehindu.com Date : 2023-09-14

# SPECIAL MOSQUITOES BEING BRED TO FIGHT DENGUE

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September 13, 2023 06:10 pm | Updated 06:10 pm IST - Tegucigalpa (Honduras)



A lab technician holds a strip of dried mosquito eggs inside a World Mosquito Program factory, in Medellin, Colombia on August 10, 2023. | Photo Credit: AP

A dozen people cheered last month as Tegucigalpa resident Hector Enriquez held a glass jar filled with mosquitoes above his head, and then freed the buzzing insects into the air. Enriquez, a 52-year-old mason, had volunteered to help publicise a plan to suppress dengue by releasing millions of special mosquitoes in the Honduran capital.

The mosquitoes Enriquez unleashed in his El Manchen neighbourhood — an area rife with dengue — were bred by scientists to carry bacteria called Wolbachia that interrupts transmission of the disease. When these mosquitoes reproduce, they pass the bacteria to their offspring, reducing future outbreaks.

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This emerging strategy for battling dengue was pioneered over the last decade by the non-profit World Mosquito Programme, and it is being tested in more than a dozen countries. With more than half the world's population at risk of contracting dengue, the World Health Organization (WHO) is paying close attention to the mosquito releases in Honduras.

In Honduras, where 10,000 people are known to be sickened by dengue each year, Doctors Without Borders is partnering with the mosquito programme over the next six months to release close to 9 million mosquitoes carrying the Wolbachia bacteria.

"There is a desperate need for new approaches," said Scott O'Neill, founder of the mosquito programme.

Models estimate that around 400 million people across some 130 countries are infected each year with dengue. Mortality rates from dengue are low – an estimated 40,000 people die each year from it – but outbreaks can overwhelm health systems and force many people to miss work or school.

The eggs come from the World Mosquito Program's bio factory in Colombia, where they are bred to carry bacteria that interrupt the transmission of dengue. | Photo Credit: AP

“When you come down with a case of dengue fever, it’s often akin to getting the worst case of influenza you can imagine,” said Conor McMeniman, a mosquito researcher at Johns Hopkins University. It’s commonly known as “breakbone fever” for a reason, McMeniman said.

The Aedes aegypti mosquitoes that most commonly spread dengue have been resistant to insecticides, which have fleeting results even in the best-case scenario. And because dengue virus comes in four different forms, it is harder to control through vaccines.

Aedes aegypti mosquitoes are also a challenging foe because they are most active during the day – meaning that’s when they bite – so bed nets aren’t much help against them.

Raman Velayudhan, a researcher from the WHO’s Global Neglected Tropical Diseases Programme, said, “Wolbachia is definitely a long-term, sustainable solution.”

Velayudhan and other experts from the WHO plan to publish a recommendation as early as this month to promote further testing of the Wolbachia strategy in other parts of the world.

The Wolbachia strategy has been decades in the making.

“We worked for years on this,” said Mr. O’Neill, 61, who with help from his students in Australia eventually figured out how to transfer the bacteria from fruit-flies into Aedes aegypti mosquito embryos by using microscopic glass needles.

The insects are bred to carry the bacteria Wolbachia, which interrupts the transmission of dengue. | Photo Credit: AP

Around 40 years ago, scientists aimed to use Wolbachia in a different way: to drive down mosquito populations. Because male mosquitoes carrying the bacteria only produce offspring with females that also have it, scientists would release infected male mosquitoes into the wild to breed with uninfected females, whose eggs would not hatch.

But along the way, Mr. O’Neill's team made a surprising discovery: Mosquitoes carrying Wolbachia didn’t spread dengue — or other related diseases, including yellow fever, Zika and chikungunya.

And since infected females pass Wolbachia to their offspring, they will eventually “replace” a local mosquito population with one that carries the virus-blocking bacteria.

The replacement strategy has required a major shift in thinking about mosquito control, said Oliver Brady, an epidemiologist at the London School of Hygiene and Tropical Medicine.

Since Mr. O’Neill’s lab first tested the replacement strategy in Australia in 2011, the World Mosquito Programme has run trials affecting 11 million people across 14 countries, including Brazil, Mexico, Colombia, Fiji and Vietnam.

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The results are promising. In 2019, a large-scale field trial in Indonesia showed a 76% drop in reported dengue cases after Wolbachia-infected mosquitoes were released.

Still, questions remain about whether the replacement strategy will be effective — and cost-effective — on a global scale, Mr. O’Neill said. The three-year Tegucigalpa trial will cost

$9,00,000, or roughly $10 per person that Doctors Without Borders expects it to protect.

Many of the world's mosquitoes infected with Wolbachia were hatched in a warehouse in Medellín, Colombia, where the World Mosquito Programme runs a factory that breeds 30 million of them per week.

The factory imports dried mosquito eggs from different parts of the world to ensure the specially bred mosquitoes it eventually releases will have similar qualities to local populations, including resistance to insecticides, said Edgard Boquín, one of the Honduras project leaders working for Doctors Without Borders.

The mosquitoes that hatch will carry bacteria called Wolbachia that interrupt the transmission of dengue. | Photo Credit: AP

The dried eggs are placed in water with powdered food. Once they hatch, they are allowed to breed with the "mother colony" — a lineage that carries Wolbachia and is made up of more females than males.

A constant buzz fills the room where the insects mate in cube-shaped cages made of mosquito nets. Caretakers ensure they have the best diet: Males get sugared water, while females "bite" into pouches of human blood kept at 97 degrees Fahrenheit (37 degrees Celsius).

"We have the perfect conditions," the factory's coordinator, Marlene Salazar, said.

Once workers confirm that the new mosquitoes carry Wolbachia, their eggs are dried and filled into pill-like capsules to be sent off to release sites.

The Doctors Without Borders team in Honduras recently went door-to-door around a hilly neighbourhood of Tegucigalpa to enlist residents' help in incubating mosquito eggs bred in the Medellin factory.

A constant buzz fills the room where the insects mate in cube-shaped cages made of mosquito nets. | Photo Credit: AP

At half a dozen houses, they received permission to hang from tree branches glass jars containing water and a mosquito egg-filled capsule. After about 10 days, the mosquitoes would hatch and fly off.

That same day, a dozen young workers from Doctors Without Borders fanned out across Northern Tegucigalpa on motorcycles carrying jars of the already hatched dengue-fighting mosquitoes and, at designated sites, released thousands of them into the breeze.

Because community engagement is the key to the programme's success, doctors and volunteers have spent the past six months educating neighbourhood leaders, including influential gang members, to get their permission to work in areas under their control.

Some of the most common questions from the community were about whether Wolbachia would harm people or the environment. Workers explained that any bites from the special mosquitoes or their offspring were harmless.

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