Canadian innovation for killing mosquito eggs could help Zika fight

April 7 2016

An 'ovillanta' is created from two 50 cm sections of an old car tire, fashioned into a mouth-like shape, with a fluid release valve at the bottom. Credit: Daniel Pinelo

With Canadian Government funding, a team of innovators from Canada and Mexico have successfully tested a low cost, environmentally-friendly way of destroying the eggs of the mosquito genus that spreads dengue, and likely spreading the Zika virus.

The 10-month study, conducted in a remote, urban area of Guatemala, documents a cheap, easy system to reduce virus-carrying *Aedesgenus* mosquitoes by capturing and destroying its eggs. The results appear today in the *F1000Research* Zika & Arbovirus Outbreaks channel.

The system includes an innovative Canadian-designed trap called an "ovillanta," created from two 50 cm sections of an old car tire, fashioned into a mouth-like shape, with a fluid release valve at the bottom.

Inside the lower tire cavity, a milk-based, non-toxic solution developed at Sudbury's Laurentian University lures mosquitoes. Inserted to float in the artificial pond is a wooden or paper strip on which the female insect lays her eggs. The strip is removed twice weekly, analyzed for monitoring purposes, and the eggs destroyed using fire or ethanol.

The solution, which now includes mosquito pheromone (the female insect's chemical perfume that helps others identify a safe breeding site), is then drained, filtered, and recycled back into the tire. The pheromone concentrates over time, making the ovillanta even more attractive for mosquitoes.

Said Dr. Ulibarri: 'We decided to use recycled tires - partly because tires already represent up to 29% of the breeding sites chosen by the *Aedes aegypti* mosquitoes, partly because tires are a universally affordable instrument in low-resource settings, and partly because giving old tires a new use creates an opportunity to clean up the local environment.' Credit: Daniel Pinelo

With a grant from Grand Challenges Canada, funded by the Government of Canada, the researchers, led by Gerardo Ulibarri of Laurentian University with collaborators Angel Betanzos and Mireya Betanzos of the National Institute of Public Health of Mexico, conducted the project in collaboration with Guatemala's Ministry of Health.

They found the rubber ovillanta significantly more effective at attracting the *Aedes* mosquito than standard traps made from 1-litre buckets.

During the 10-month study, the team collected and destroyed over 18,100 *Aedes* eggs per month using 84 ovillantas in seven neighbourhoods of the town of Sayaxche (population 15,000), almost seven times the roughly 2,700 eggs collected monthly using 84 standard traps in the same study areas.

A tantalizing but anecdotal observation was that there were no new cases of dengue reported as originating in the ovillanta study test area, a community that would normally anticipate two or three dozen cases in that timeframe.

Targeting mosquito eggs using the ovillanta, Dr. Ulibarri says, is one third as expensive as trying to destroy larvae in natural ponds and only 20% the cost of targeting adult insects with pesticides, which also harm bats, dragonflies and the mosquitoes' other natural predators.

The ovillanta was modelled after a mosquito trap developed at Laurentian University in response to the outbreak of West Nile virus in northern Ontario, which uses a modified solution to lure the Culex genus of mosquito, the West Nile carrier thought by some to be also the Zika carrier.

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Key to the overall system is an online training program to strengthen the mosquito control expertise of local health workers, coupled with a community engagement strategy that involves households in the regular maintenance of their ovillanta.

The community members collect the egg-laden strips of paper or wood from the ovillanta and pass them to the health workers, who conduct the monitoring and destruction using fire or ethanol.

The *Aedes* genus of mosquito - the principal genus that transmits Zika, dengue, chikungunya, and yellow fever viruses - has proven extremely difficult to control using other strategies, according to the World Health Organization.

A female, with a natural lifespan of up to three months, can start to reproduce in one week. Pesticide-resistance, dwindling resources, and an increase in mosquito-friendly environments have thwarted traditional methods of controlling the insect's rapid spread.

"Innovation is a key driver underlying the Government of Canada's approach to international development," said Canada's Minister of International Development and La Francophonie, the Honourable Marie-Claude Bibeau. "Innovative solutions that deliver improved global health outcomes - such as for the fight against the Zika virus - are needed."

"While in its early days, this integrated innovation of a mosquito trap coupled with training local health workers and engaging communities in vector control is a promising example of how Canada's leadership in development innovation can respond to public health emergencies such as Zika," said Dr. Peter A. Singer, Chief Executive Officer of Grand Challenges Canada.

More information: 'Control of Aedes aegypti in a remote Guatemala community,' *F1000Research*, 2016.

Provided by Grand Challenges Canada