

Mosquitoes and the burden of disease they cause continue to weigh down many communities around the world. Despite their fragile appearance, mosquitoes continue to resist our best efforts to eliminate them. We've drained and polluted their wetland homes, and we've filled the skies with clouds of insecticides, but still they persist.

There is no reason why mosquito-borne disease won't continue to spread in the decades ahead. While [climate change, urbanisation and globalisation](#) will all influence future mosquito-borne disease risks, some of our current control products are also losing their potency.

In many ways, our efforts to control mosquitoes have also been our undoing. We constantly underestimate the resilience of mosquitoes. The more insecticides we use to try and kill mosquitoes, the greater the likelihood they will [develop resistance to these chemicals](#). We need to look at alternative ways to control mosquitoes, and a new project pitting mosquitoes against mosquitoes is being trialled in Australia.

Bugging the mosquito

While there are thousands of mosquito species worldwide ([over 300 in Australia alone](#)), the yellow fever mosquito (*Aedes aegypti*) is of greatest concern when it comes to outbreaks of dengue, chikungunya and Zika viruses. Second on the list is the Asian tiger mosquito (*Aedes albopictus*), a severe pest that also transmits these viruses. These [two exotic mosquitoes](#) have proven great at invading the world, spreading outwards to live with us in our cities. And they do love biting people.

It is important to remember that only female mosquitoes bite in pursuit of blood. Male mosquitoes do not, feeding only on nectar.

New approaches using an insect-specific bacteria have been developed that can sabotage mosquito populations. This works by either disrupting their reproduction or blocking their ability

Pitting mozzies against mozzies to stop the spread of disease

Written by Cameron Webb, Clinical Lecturer and Principal Hospital Scientist, University of Sydney

to transmit pathogens.

Scientists have concentrated their research on a naturally occurring insect bacteria, [Wolbachia](#).

Wolbachia doesn't naturally infect all mosquitoes. However, studies have shown female mosquitoes infected in a laboratory with *Wolbachia* pass the infection through to their eggs. Then when males infected with the bacteria mate with uninfected females, the female's eggs do not hatch. The reasons for this [are not yet fully understood](#) but is known as "cytoplasmic incompatibility".

Male *Wolbachia*-infected mosquitoes reared in the laboratory can be released into the field. As females only mate once, each successful mating results in no eggs hatching in the next generation. Therefore, the mosquito population shrinks over time.

Given these frisky male mosquitoes are better at finding female mosquitoes than we are with our insecticides, this approach could be a winner. It avoids increasing the risks of insecticide resistance and reduces the risks of other species in the area being [impacted by insecticides](#).

How would this beat disease?

Trials that use males carrying this bacteria to suppress mosquito populations of the Asian tiger mosquito are now occurring in the [USA](#) and [China](#). Singapore recently began its first trials [releasing bacteria-infected male yellow fever mosquitoes](#) throughout their high-rise apartments in an effort to study and remove mosquito populations that have proven tricky to control.

The [Eliminate Dengue](#) group from Monash University is also using this type of bacteria for population replacement of the yellow fever mosquito. In their novel approach, once the bacteria is established in the population of mosquitoes, dengue, Zika and chikungunya viruses cannot infect the mosquito, making the insect population resistant to transmission. Releases of these mosquitoes have been underway in northern Australia for more than five years, and the [results are very promising](#).

. There are plans to expand the approach to [South America](#)

.

Where to from here?

These new ways forward seem to offer a choice between using this common bacteria for either population suppression or replacement. The great benefit is that all these approaches use mosquitoes against mosquitoes.

While early successes of laboratory and field trials are already coming in, these small-scale and well-funded research projects may not reflect the reality of what is required in the long-term. How can we “scale up” these approaches to deploy them across the many major urban centres suffering from outbreaks of dengue and other mosquito-borne diseases?

This is where the [Debug Project](#) comes in. A newly announced partnership between Verily (formerly [Google Life Sciences](#)) and CSIRO, together with the University of Queensland and James Cook University, sets out to investigate how effective the release of *Wolbachia*-infected male mosquitoes is for mosquito control. Most importantly, the project will also be developing new technologies for the cost-effective mass rearing of mosquitoes. This is a critical step in being able to apply this approach to major cities impacted by mosquito-borne disease.

The early stages of the project will involve scientists releasing laboratory reared male mosquitoes and following them to see where and how far they fly, and how successfully they can track down and mate with local female mosquitoes. As well as demonstrating that this approach can actually reduce the overall mosquito population, the research will fill many of the gaps in our understanding of male mosquito biology.

The one thing we know is critical to upscaling any of these approaches is strong engagement with the local community. Without community support and participation, these projects are primed for failure. So, how would you feel about scientists releasing millions of “bacteria-infected male mosquitoes” in your neighbourhood? As the swathes of new non-biting males buzz around you and your house searching for females, please – don’t get out the bug spray.

.

Pitting mozzies against mozzies to stop the spread of disease

Written by Cameron Webb, Clinical Lecturer and Principal Hospital Scientist, University of Sydney

Cameron Webb and the Department of Medical Entomology, NSW Health Pathology, have been engaged by a wide range of insect repellent and insecticide manufacturers to provide testing of products and provide expert advice on mosquito biology. Cameron has also received funding from local, state and federal agencies to undertake research into mosquito-borne disease surveillance and management

Nigel Beebe works for University and the CSIRO and receives funding from state governments, (WA Health), national (NHMRC), and international (National Institutes of Health, USA and Verily) funding bodies to carry out research on mosquito biology and control.

Authors: Cameron Webb, Clinical Lecturer and Principal Hospital Scientist, University of Sydney

Read more <http://theconversation.com/pitting-mozzies-against-mozzies-to-stop-the-spread-of-disease-67447>