Bacteria deployed to destroy mosquito-borne dengue can't take the heat

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An Aedes aegypti mosquito during a blood feed. Credit: University of Melbourne

A promising strain of bacteria that stops dengue transmission in

mosquitoes struggles to survive hot conditions, new research from the University of Melbourne has revealed.

But there is a silver lining, because researchers now know which particular strains will survive the steamy tropics, where disease-bearing mosquitoes thrive.

Researchers say the discovery is vital, given it's only a matter of time before disease-spreading mosquitoes appear in southern-Australia. Dengue kills up to 20,000 people – many of them children – each year.

Scientists have recently discovered that a strain of bacteria, Wolbachia, can greatly reduce the ability of mosquitoes to transmit dengue. And it's also effective against Zika and chikungunya. Wolbachia spreads through mosquito populations quickly, making it an excellent alternative to pesticides.

Mosquitoes infected with Wolbachia have now replaced natural populations of mosquitoes in parts of Cairns. The Wolbachia technique is now being extended to other tropical regions around the world, but sometimes, Wolbachia mosquitoes fail to establish or the infection invades very slowly.

Perran Ross, a PhD student at the University of Melbourne, subjected Aedes aegypti mosquitoes to temperatures from 26 degrees to 37 degrees under controlled laboratory conditions to see how well the bacterium survives.

In research published today in *PLOS Pathogens*, the wMel Wolbachia strain, currently being used in many field trials around the world, survived in significantly lower numbers as the temperature rose. But other strains of Wolbachia were tested and some proved resistant to these higher temperatures.

"Although it was alarming to see that Wolbachia is vulnerable to high temperature, it is promising that other strains are more robust. These strains are also effective at blocking viruses" Mr Ross said.

"There is a great diversity of Wolbachia strains out there that we should be taking advantage of. We urgently need to consider alternative strains because wMel may not be as effective in hotter climates as we'd hoped."

Since 2011, researchers from the University of Melbourne have been collaborating with groups from Monash University, Glasgow University, Singapore and elsewhere to develop successful Wolbachia release strategies in Cairns, Singapore and Kuala Lumpur.

Professor Ary Hoffmann has been leading the group behind the research. He says the clock is ticking on the spread of vector-borne diseases in Australia.

"With climate change projections of increasing temperatures, we may see mosquitoes with dengue migrating from Queensland further down to southern Australia, particularly if another invasive species that transmits diseases, Aedes albopictus, enters mainland Australia. Also, we expect that higher temperatures will become more common," Professor Hoffmann said.

Mr Ross's findings may lead to the deployment of temperature-resistant strains of Wolbachia in Aedes aegypti and other mosquito species in the field.

More information: "Wolbachia Infections in Aedes aegypti Differ Markedly in Their Response to Cyclical Heat Stress," *PLOS Pathogens*. DOI: 10.1371/journal.ppat.1006006

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