

Capturing a lot more mosquitoes

Florian Muijres studies flight movement, including that of insects. He put this fundamental science to use for improving a mosquito trap. Henry Fairbairn helped work on those improvements as a student at Delft University of Technology and is now launching the resulting new trap on the African market. He hopes this will contribute to the fight against malaria.

TEXT KOEN JANSSEN

Near the shore of the vast Lake Victoria lies the Kenyan island of Rusinga, where Wageningen researchers have for many years done research on the effectiveness of mosquito traps that make use of aroma baits rather than chemical pesticides. The results were promising: in one and a half years, malaria infections went down by 30 per cent. But there was still room for improvement. Florian Muijres used high-speed cameras to study the movements of insects around the trap. He found out that the vast majority of the mosquitoes that approached the trap flew off again. Ultimately, only three per cent of the mosquitoes were lured into the trap.

Muijres works in Wageningen's Experimental Zoology chair group, and uses cameras to study the flight movements of mosquitoes, fruit flies, birds and bats. In 2020, the Dutch Research Council (NWO) awarded him a Vidi grant of 800,000 euros



for his research on two-winged insects. He gets three-dimensional footage of the flight movements of the insects using two sets of high-speed cameras, the more advanced of which can film 13,500 frames per second. This enables the research team to measure precisely how a wing moves. 'Mosquitoes create a kind of mini-tornado above their wing, which makes them fast and agile. In terms of aerodynamics, that wing movement is very interesting,' says Muijres. So this is fundamental research, but it is of importance for catching mosquitoes as well. 'How close do they get to the trap? And at what distance can they no longer escape? By understanding their flight mechanism, you can help in the effort to combat mosquitoes.'

THE SMELL OF SWEAT

With the camera images in mind, Muijres, PhD student Antoine Cribellier and other researchers from Wageningen and Delft

Universities set to work on improving the mosquito trap. In their search for victims, mosquitoes seek out the smell of sweat. Mosquito traps are geared to this and spread synthetic human aromas via a ventilator. As the insects get closer to their goal, however, they start to seek heat and humidity as well. So the researchers wondered if their trap would work better if it were able to generate more heat and moisture? 'We bumped up the temperature and humidity, and then we studied the effects,' says Muijres. 'That proved to be spot on.'

The MTego ('trap' in Swahili), as the trap is called, captured over four times more mosquitoes than the older model. Raising the temperature made the most difference: the camera images showed that the mosquitoes stayed in the vicinity for longer because of the heat, and came so close they could no longer get away and were sucked into the trap by a suction fan. The researchers published their findings in the *Malaria Journal* on 7 October 2020.

As a student on this project at Delft University, Henry Fairbairn worked on nine successive prototypes, and thought about how to make the trap accessible by making sure it was cheap and did not use too much electricity. This was where the combination of Wageningen entomological expertise and Fairbairn's technical know-how came into its own, says Muijres: 'Students of Industrial

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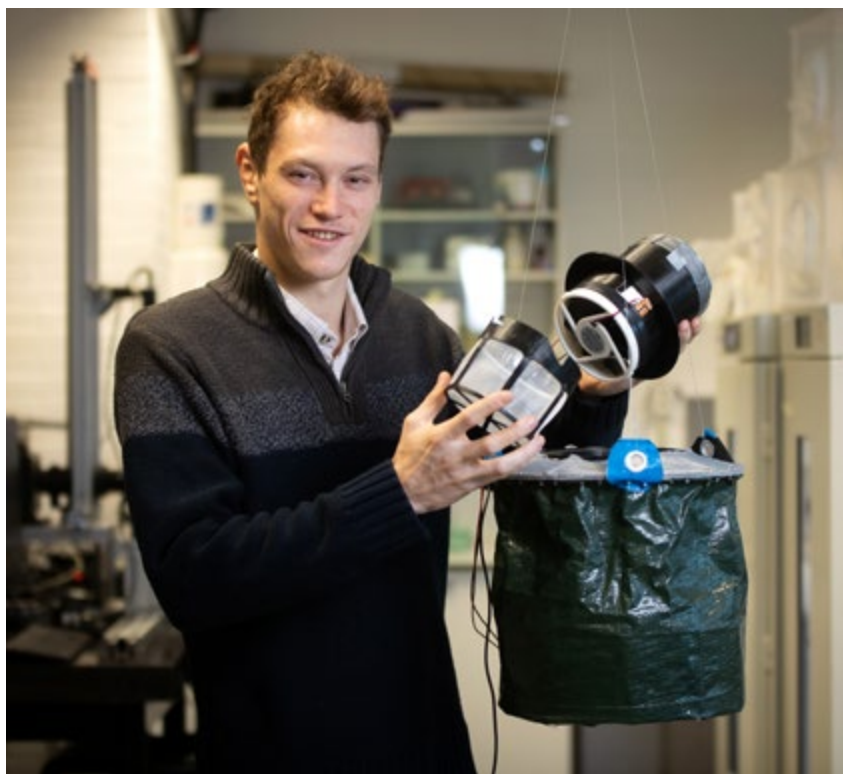


PHOTO SVEN MENSCHER

Henry Fairbairn worked on nine successive prototypes of the mosquito trap.

Design make actual products: water boilers, drills, cars. That's the kind of people you need.' Fairbairn: 'I hadn't done any biology since I was 17, and suddenly now I was surrounded by top scientists in that field. It was a mind-blowing experience.'

ON THE AFRICAN MARKET

Besides mosquitoes, the mosquito trap captured Fairbairn's interest too. After graduating, he decided to set up a startup to market the MTego in Africa. To that end, he links up with existing distribution channels for solar panels. There are advantages to that: sales of solar panels for domestic use have really taken off in Africa in recent years, and MTego needs electricity to keep the suction fan going. Fairbairn called his startup

PreMal, short for Preventing Malaria. Mosquito traps are an important weapon in the battle against malaria. This disease is a stealth killer: according to the World Health Organization, more than 400,000 people die of malaria every year. Florian Muijres: 'That figure is comparable with the number of Europeans who died of the coronavirus in 2020. And that goes on year in, year out, and it includes young children. Just imagine if the coronavirus killed children! The scale of the problem is still gigantic.' So he is delighted that his ex-student is applying his knowledge for practical purposes. 'This is actually quite fundamental research. How wonderful that it might well save lives.' ■

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