Mosquito discovery sheds light on how malaria is spread in South Africa

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A second Malaria causing mosquito has been discovered in South Africa. Credit: Flickr

Across the world there are limited tools available for controlling mosquitoes. The two most successful and widely used initiatives are indoor house spraying and the use of insecticide treated bed nets. These target mosquitoes that feed on humans inside their homes and then rest indoors. Hundreds of millions of bed nets have been distributed across Africa in the last 15 years.

But there are no methods that control mosquitoes that operate outdoors. This is a major challenge across the continent. It poses a particular problem for South Africa which has set itself the goal of eliminating malaria by 2018.

The reason is the variable behaviour of the main malaria carrying mosquito in the country, *Anopheles arabiensis*. Although it prefers to feed on people inside their houses – and rest there while its eggs develop – it's not averse to doing so outside. This makes it less amenable to house spraying which means that it's never completely eradicated from an area.

Our research has uncovered that another mosquito vector, *Anopheles vaneedeni*, also carries the parasite and is also amenable to biting and breeding outside. *Anopheles vaneedeni* has been known about since 1977, it has never – before now – been identified as a malaria carrying vector in nature.

Our discovery is a step in the right direction. It gives weight to the view that until effective methods are developed for controlling outdoor mosquitoes, eliminating local malaria transmission in southern Africa will be extremely difficult. The fact that we now know about *Anopheles vaneedeni* means that we can target our research towards knowing more about this vector's behaviour. This, in turn, can open the door to finding solutions.

South Africa's history with malaria

Historically there were cases of malaria throughout the north-eastern areas of the country which have subtropical climates: Limpopo, Gauteng, Mpumalanga and KwaZulu-Natal. There have been epidemics around Pretoria and as far south as Port St Johns on the south east coast. In 1932, for example, there were over 22,000 deaths from malaria in northern Kwazulu-Natal.

South Africa adopted malaria intervention strategies as early as the 1950s. As a result, the burden was reduced and areas affected by the disease shrank. Now only the far north-eastern part of Limpopo Province, eastern Mpumalanga and far northern Kwazulu-Natal, bordering Mozambique, continue to be affected.

South Africa has a long history of intense malaria control activities. Entomologists in the country have been studying malaria mosquitoes for close to 100 years.

South Africa was a pioneer in one of the early methods adopted by the World Health Organisation (WHO) to fight malaria. Extensive surveys conducted in parts of the country showed how effective it was to spray insecticides indoors to protect people from mosquito bites. This method was adopted by the WHO in the 1950s for their global malaria eradication programme.

As part of our research we assist the provincial malaria control programmes by collecting mosquitoes and doing the necessary laboratory analysis to identify the species and detect malaria parasites in these mosquitoes.

What we found, and the significance

We carried out an extensive collection of mosquitoes in outdoor resting

places such as clay pots and modified plastic buckets. Using these methods, we found that *Anopheles vaneedeni* was indeed carrying the parasite.

This species was shown to be capable of transmitting malaria parasites in laboratory experiments in 1977, but has not, until now, been implicated in transmission in the field. It will happily feed on humans outdoors, and definitely liked our outdoor clay pots as resting sites.

We also found specimens of both *Anopheles arabiensis* in the clay pots. Until now it was thought that only this species was responsible for ongoing malaria transmission in South Africa. We now know that this situation is more complex because other Anopheles species is also responsible for the ongoing transmission.

The trouble with outdoor vectors

It's now clear that the drivers of malaria in South Africa are more complicated than previously believed. Methods that target the immature stages of the mosquito's life cycle – such as when the larvae breed in rain pools, ponds, swamps, streams, rice paddies – are generally only applicable in very specific situations. It would be impossible to treat every rain puddle on the continent.

Another intervention being explored is the use of sterile male mosquitoes – female mosquitoes mate only once in their lifetime and if the male is sterile, she will not produce viable eggs.

We are also testing novel compounds that might disrupt the parasite development inside the mosquito or kill mosquitoes that feed on cattle.

A lot of research, internationally, is going on into novel traps and control methods and we are collaborating with groups in the UK, US and

Tanzania who want to test these methods.

The first step towards a successful malaria control or elimination programme, is "knowing the vector". That means understanding the behaviour of the mosquitoes – their feeding and resting patterns, the mating behaviour of the males and females, the preferred aquatic habitat of the immature stages, their geographic distribution, and what their response is to insecticides. The Anopheles vaneedeni can now also be studied in this light.

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