

# 'Gene drive tech is viable way to combat malaria'

Across Africa, scientists are exploring new tools to reduce the scourge of malaria. *Daily Monitor's Gillian Nantume* spoke with Krystal Birungi, an entomologist and research and outreach associate at Target Malaria Uganda about the new tool - Gene drive technology being researched to reduce malaria.

**G**ene drive is being researched as a complementary tool in the fight against malaria alongside bed nets, insecticides, drugs, and vaccines. Tell us more about it.

The 2025 Africa Malaria Progress Report indicates that the continent accounted for approximately 270 million malaria cases in 2024, representing about 96 percent of the global total. In response to these challenges, African researchers, including those at the Uganda Virus Research Institute (UVRI), are studying complementary and innovative approaches to strengthen malaria control.

Our main methods in Uganda are spraying and insecticide-treated nets. Overtime, these have had a huge impact on malaria rates. At one point, we had 100,000 children dying of malaria every year, which has reduced to 16,000. However, this number has remained constant for the last 10 years.

The challenge is that resistance to insecticide and drugs has made it impossible to reach elimination. Therefore, we have to consider new tools. So we thought of reducing the number of mosquitoes that spread malaria by using genetic modification to reduce the numbers of eggs it lays. One mosquito lays up to 300 eggs after biting a person. The blood they take after a bite is meant to develop the eggs.

**What potential does gene drive have?**

Previously the challenge we faced was that genes are only passed down half the time, like 50 percent. For instance, if you have a tall man and a short woman, the children will either be tall or short or medium. There is no assurance that they will have only tall children.

So, we added a gene drive to the mosquito to ensure that the gene modification to reduce the number of eggs is passed down to every single offspring. If you have a gene drive, you can release a few mosquitoes and every mosquito that they mate with will lay less eggs.

**How are the modifications introduced to the mosquitoes?**

They are introduced at the egg stage using very special, tiny injections. However, at the moment, Uganda Virus Research Institute imports mosquito eggs that have already been modified. We are not yet injecting the eggs from here. We have an insectary from which mosquitoes cannot escape. That is where the eggs are hatched and reared to adult mosquitoes.

The modified adult mosquitoes are then mated with wild mosquitoes to produce a mosquito background. The Insectary is an Arthropod Containment Level Two (ACL-2)



A mother and her child sleep under a mosquito net. Research shows that more must be done to reduce malaria deaths. PHOTO/FILE

building, recommended by the World Health Organisation (Who) to contain modified organisms, and it is regulated by the National Biosafety Committee, other ethical committees, and the National Environment Management Authority (Nema).

**Have the genetically modified mosquitoes been introduced to the environment? If so, how many have been released?**

We have never released the modified mosquitoes and indeed, this is not something you can do without regulatory approval. We have modified mosquitoes in the insectary that have a paternal male bias. These are mosquitoes that have been modified to the extent that 90 percent of their offspring are male. Male mosquitoes do not bite and therefore cannot spread malaria. Also, if you have more male mosquitoes you have fewer mosquitoes laying eggs.

**Some people are critical of anything to do with genetic modification. How do you plan to bring them on board?**

I think it is natural that people worry about things they do not understand or that are new. However, I would like to assure the public that this kind of technology is heavily regulated. There are experts whose job it is to issue permits and approvals, to study proposals, and follow up and monitor progress.

I would like people to know that genetic modification as a whole is not necessarily a bad thing. For instance, people with diabetes take insulin every day. That insulin is genetically modified,

and those people have not died because someone studied it, regulated it, and only released it when it was safe.

The mosquito has naturally evolved to be resistant to insecticides. Now we want it to evolve to a level where it lays fewer eggs, which is helpful to us for malaria reduction.

**We rarely hear about malaria in developed countries, and most of what they did was spraying. Why can't we do the same here?**

One major thing you will find in countries with the highest malaria rate is that they are in the equatorial belt. The top three countries for malaria infections are Nigeria, the Democratic Republic of Congo (DRC), and Uganda, in that order. And all these countries have beautiful tropical weather which mosquitoes enjoy.

Methods like large-scale spraying of insecticides worked well in countries that have seasons that are unfavourable to mosquitoes. For instance, South Africa has a winter season. At that point, mosquitoes are few, and when you attack, you can get almost every mosquito. That is not a possibility in Uganda, and that is why we need integrated tools to fight malaria in some of these tropical countries.

Krystal Birungi. PHOTO/ARNOLD SSEREMBA

## TARGET MALARIA

Globally, Target Malaria began in 2005, before Uganda was brought on board. It began as an idea, a question posed by experts from all over the world. Uganda joined in 2013. Currently, we have proven, in small cages, that it is possible to reduce mosquito numbers using this modification. So, in five years, we hope to carry out field trials, but that is subject to regulatory approval. Populations may reduce in a cage, but that may not be the case outside. In the cage, the mosquitoes have no choice but to mate with the available mosquitoes. But what if we release them and the wild mosquitoes reject them as infertile? So, we still have more tests to perform. The end goal is to have a tool that the Ministry of Health can deploy with other malaria control tools, especially in regions where there is insecticide resistance.

**What drew you to this kind of research?**

It was growing up in a community where malaria was a scourge. As children, we got sick almost every holiday. We could not avoid it because mosquito nets were expensive. I am sure several Ugandans can relate to that. Sometimes, our parents were unable to afford the medication. That was my life growing up. And really, no one is more motivated to find a solution to a problem than the affected people.

**Can you tell us about the role you see women playing in malaria elimination and why you say more women need to be involved?**

It is really important that women are represented in research in science, but especially in research like this, because malaria disproportionately affects them. As primary caregivers, women and girls are missing work and school to take care of sick children and siblings. Besides, most adults who are affected are pregnant women.

When you are the most affected from a disease, you should be part of the demographic that is talking about solving the problem. So, I encourage any woman who is interested in science that this is a very viable field for you because it is saving future generations of Uganda.

There are two gene drive strategies currently under investigation among various research teams in the world: either to reduce the number of malaria-carrying mosquitoes or to stop the parasite from infecting the mosquitoes.

At Target Malaria Uganda, the focus is on the first approach, targeting the four Anopheles mosquito species that are the main malaria vectors in Africa.

Krystal Birungi, an entomologist, holds a Double Major in Zoology and Botany from Makerere University and has been working with Target Malaria for the past decade. Birungi is also a malaria advocate. In 2021, she was nominated by The Global Fund Advocates Network (GFAN) as part of their speakers' bureau. She is one of the 10 Goalkeepers Champions for her work in advancing health policy across Africa through scientific innovation and leadership. She is also a 2025-2026 Obama Foundation Africa Leader.