

Scaling up for rollout: rearing, transport, and release of mosquitoes

What does the project focus on?

The “scaling up for rollout” study is a four-year project that aims to inform Target Malaria’s work by improving our general knowledge of how to best rear, package and transport mosquitoes towards mosquito release studies and programmes.

Researchers focus on two areas:

- Identifying the insectary setting and conditions that enable mosquito larvae to best survive and grow and maximise the quality of adult mosquitoes produced,
- Understanding the key factors that improve the ability of such laboratory-grown male mosquitoes to compete with wild males for mating.

This is one of two projects set in Ghana that complement the overall research effort of Target Malaria. This project is led by medical entomologists, Prof. Frédéric Tripet and Dr. Fred Aboagye-Antwi. The research is being carried out at the School of Biological Sciences and the Noguchi Memorial Institute for Medical Research at the University of Ghana as well as at Keele University in the United Kingdom.

How is the research conducted?

The research is done using wild mosquitoes that are **collected locally and brought into the insectary** where they establish colonies for the studies. The work does not involve genetically modified mosquitoes.

The research focuses on male mosquitoes because it is through non-biting males that



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Target Malaria expects to implement its genetic technologies. Successful rearing and good mating competitiveness and reproductive fitness of the males is very important to the success of vector control interventions using genetic technologies.

The work is progressing through research activities conducted in the laboratory and insectaries and in large outdoor cage studies. Some of the most promising and important developments will also be validated through field **“Mark Release Recapture” studies**.

- Through this research the project seeks to develop and test larval rearing procedures that maximise the survival of mass-produced males. We are also developing rearing protocols that boost male mating competitiveness and maintain processes of mate choice.
- Another important component focuses on improving methods for packaging, transport and release of mass-produced males to minimise negative effects on male survival and mating competitiveness.
- Finally, we are developing new methods and markers for measuring mosquito longevity and mating competitiveness in semi-field cages and in the field.
- Mark Release Recapture (MRR) studies will be used to test some of our most important developments. In MRR studies, mosquitoes

are dusted with fluorescent powder(s) and released in a selected site, and then the research teams collect mosquitoes in that site to see how many they can recapture, where, and what proportion of the total mosquito population the marked ones represent. MRR provides data that can be used to estimate the number of mosquitoes in the location and it can give evidence on the survival, movement and mating success of released individuals. In this project, MRR studies will be used to test improvements in rearing, packaging and marking techniques towards future *An. gambiae* releases.

Why is this research important to Target Malaria?

Target Malaria is working to develop genetic technologies that will contribute to the elimination of malaria in Africa, by significantly reducing the population of malaria mosquitoes that are responsible for transmitting the disease. The project targets 3 mosquito species: *Anopheles gambiae*, *Anopheles coluzzii*, and *Anopheles arabiensis*.

Understanding the specific needs and constraints for the rearing, transport and release of these mosquitoes is much needed and will enable the project to prepare for potential larger scale releases of modified mosquitoes, as part of the Target Malaria's developmental pathway further down the line.

These studies will help maximize our chances that future potential applications of genetically modified mosquitoes will be successful.

What are the key aspects the project is looking at?

In terms of rearing: We are investigating the effects of food, light, ambient and water temperature, and humidity on the survival of mosquito larvae and the male mosquitoes' ability to mate and compete with wild males. This activity helps identify the best conditions for the development and longevity of lab-grown male mosquitoes.

In terms of packaging and transport: We are working on several interrelated aspects of the releases. For example, we are working on identifying the conditions and containers for short and long-distance transportation of large numbers of male mosquitoes. These need to minimize any negative impacts on the mosquitoes, and ultimately, will need to be compatible with automated packaging devices.

In terms of release: In the field, via MRR experiments, we are assessing different ways of doing releases to develop best practices that ensure released males can survive, compete and mate as successfully as possible, maximizing the efficiency of each release. This activity considers where, when, how often and how many male mosquitoes need to be released as well as methods for marking and tracking mosquitoes in the field.

Why is the research taking place in Ghana?

An. gambiae is one of the main vector species responsible for transmitting malaria in Africa. Our research needs to be done where *An. gambiae* is present and in a setting that is as 'typical' as possible of its habitat.

Researchers at the University of Ghana have strong expertise in vector ecology and entomology, and an interest in novel vector control approaches based on mosquito releases. Therefore, the University of Ghana can provide the necessary know-how and facilities required for this research project.

Who provides oversight for this research?

The research protocols are submitted to the University of Ghana, College of Basic and Applied Sciences Ethics Committee, that grants ethical clearance for the work to proceed.

A new insectary has been built on the campus of the University of Ghana to match the specific research needs. This work is subject to oversight by the Insectary Unit of the Parasitology

Department of the Noguchi Memorial Institute for Medical Research, University of Ghana.

As the work conducted in Ghana does not require the use of genetically modified mosquitoes, we do not anticipate we will require any additional permits from regulatory authorities beyond what is already in place. However, if new requirements are established, the project will seek the required permissions and take necessary steps to ensure compliance.



How are local communities engaged?

The project uses ethically designed engagement best practices to empower communities to make informed decisions about our work. There are three key locations to the project: we work in the insectary, in large outdoor cages and then conduct “Mark Release Recapture” in selected field sites. In the field sites, the project engages with the local communities to build a common understanding of the activities proposed and how they may affect the community. This dialogue supports our values of openness and co-development, and ensures that the community is informed and consulted before a decision is made.

Working closely with the field entomology team, the Stakeholder Engagement officer frequently engages these communities to ensure the project has their support before proceeding with the subsequent stages of the research.