



FACT SHEET – GM MOSQUITOES (2011)

Current Activities with GM Mosquitoes

The past three years have seen a dramatic increase in activities beyond laboratory evaluation for the research and development of genetically modified mosquitoes for disease vector control.

Sterile insect trials

The first open release trial was conducted using the RIDL® platform, produced by Oxitec Ltd, in *Aedes aegypti* (the primary vector of dengue in humans) on the Caribbean island of Grand Cayman in late 2009. This is a non-self-sustaining autocidal technology, so continual release is required for transgenic insect populations to persist in the environment to control natural populations. It follows the historic concept of sterile insect technique successfully employed against many important agricultural pests. Subsequently further open releases of the same GM mosquito technology have taken place in Malaysia and Brazil. At least two other countries are planning open releases before the end of 2011.

The first step outside containment was to determine if RIDL® males could mate with wild females in the open environment. Following the successful outcome of this experiment, further releases were conducted on Grand Cayman in 2010 with the aim of suppressing a population of *Aedes aegypti* in the open environment. Preliminary analysis indicates a reduction in the ovitrap index – a measure of mosquito population density – by 80% in the release area compared to the untreated control area.

Another approach to genetically-induced male sterility developed in *Anopheles gambiae*, the primary vector for human malaria, has involved insertion of homing endonuclease genes (HEGs) to create various constructs, including sterile male lines. This technology, developed largely with support from the Grand Challenges in Global Health (GCGH) programme, moved into larger laboratory cage trials in 2010.

Self-sustaining (replacement) trials

Attempts are being made to develop HEGs as self-sustaining control agents to deplete or eliminate *Anopheles* populations. Some of the pre-requisites for HEG-based self-sustaining approaches have now been demonstrated in the lab, though no complete system has yet been constructed. The fact that some HEG technologies are self-sustaining in the environment implies much greater scrutiny for risk, public acceptance, efficacy – as a new paradigm for mosquito control – and cost effectiveness, which is where this technology could excel in comparison to existing malaria controls.

Although *not* based on genetic modification, the 2011 open field release of *Wolbachia* infected *Aedes aegypti* in Northern Queensland, Australia, shows the fast pace of regulatory and public adjustment and approval for use of an innovative technology in the face of the rising impact of dengue. Such a self-sustaining technology intentionally alters the native vector population, albeit using an agent that is “natural” rather than through genetic manipulation. This technology is aimed at reducing the dengue vector capacity to transmit pathogens.

This rapid progress is beyond what was envisaged at the start of the MosqGuide project (mid 2008) and gives the project substantial additional material to enhance the best practice guidance with case studies and “real world” results.

Vector control strategies using GM insects

Genetically modified insects can be used to reduce the number of vector insects using either of the following strategies:

POPULATION SUPPRESSION

Goal: reduce numerical size of the vector population

POPULATION REPLACEMENT or “REFRACTORY INSECT STRATEGY”

Goal: change vector population to less a harmful form

Resources for support of decision making around use of GM mosquitoes

National governments and regional bodies evaluating the option of GM mosquitoes for disease vector control will be making a range of decisions regarding: the safety and efficacy of these technologies, the appropriate approach to stakeholder consultation regarding their use in the socio-cultural context, and the suitability of innovations within the existing disease control programmes and strategies (outlined in MosqGuide Module 3). MosqGuide is proposing a harmonised approach to key considerations (Module 1) and data requirements (Module 4) for decision making, whilst conclusions about acceptable risk for the predicted benefits should be determined case by case. Capacity building materials on risk assessment in particular have been provided through MosqGuide to regional biosafety training courses (comprising Module 6), also funded by the TDR.

MosqGuide, as a project and a group of individual researchers, has observed or participated in recent and imminent activities with GM mosquitoes noted above. For example, members of the project team have led activities including community engagement for the release of sterile male mosquitoes in Bahia, Brazil. The project brought expertise and experience from Mexico, Brazil, Thailand and the UK as resource experts for the first consultation amongst the scientific, regulatory and vector control communities in Panama (to complement actions by the research institution planning GM mosquito trials) in 2009. Further technical and ethical/social/regulatory support will be provided by the project team as the consultation moves to public interest groups, environmentalists and other stakeholders in 2011.

At the 11th International Symposium on Biosafety of Genetically Modified Organisms (ISBGMO) in 2010, the MosqGuide project organised and led a workshop on 'National decision making on use of GM mosquitoes' (Module 3), in addition to significant participation in the plenary and poster sessions on GM insects. The ISBGMO brings together regulators, academics and industry to discuss emerging issues in evaluation, monitoring and release of GMOs. This meeting gave MosqGuide an opportunity to have direct discussions with global GMO regulators and also served as a validation step for Module 3 on national decision making. Individual discussions with donor groups about their requirements to fund innovations in control methods are proceeding in 2011.

The project also has participated in the site selection process for disease endemic country research by the GCGH project mentioned above. This included review of the regulatory and ethics review framework, technical capacity, disease incidence and entomological factors for potential African countries and target research institutions. The GCGH project has now selected five institutions in East and West Africa for further collaboration in the next phase of semi-field testing. General guidance for researchers is available as MosqGuide Module 2, as posted on the MosqGuide project website.

Numerous research projects on related technologies are proceeding at a rapid pace around the world. The regular MosqGuide e-newsletter of news and events has become a popular and effective way to keep abreast of these developments. The pace of progress with these technologies is likely to challenge the social, ethical and regulatory frameworks, and institutional capacity to address them.

Additional funding for the MosqGuide team to continue its activities past mid 2011 is needed to support countries making decisions about these new technologies, in the face of a rising threat from mosquito vectored diseases.

Funding

This project is funded by the World Health Organization (WHO) Special Programme for Research and Training in Tropical Diseases (TDR)



Contact

Please visit our website for FAQs and contact details
www.mossguide.org.uk

