

Oxitec's GMO mosquitoes spread their genes in the wild? Separating science from hype after controversial new study

In Florida and Texas, the invasive *Aedes aegypti* mosquito has posed a serious health threat, carrying the Zika and dengue virus into the state. Traditional insecticides have largely been useless against the mosquito. Outbreaks of Zika virus disease have been recorded in the Americas, Africa, Asia and the Pacific since the epidemic began in [2016](#), with more than a half million suspected cases and more than 2,700 congenital birth defects. Puerto Rico saw more than 36,000 cases and had 224, and it's now down to a yearly handful.



With the possibility of future epidemics, the biotech company

Oxitec has spent at least a decade testing a transgenic *A. aegypti* with a gene that kills off newly hatched mosquitos before adulthood. In a recent Brazilian field trial, second-generation GMO mosquitoes led to a reduction of Zika carriers by as much as 96%, Oxitec announced in June. Last week, the U.S. Environmental Protection opened a month-long window for public comments on the company's proposal for releases in Florida and Texas.

Plans for a widespread US release of the genetically altered mosquitoes has met with stiff resistance from anti-GMO organizations, which went door to door to stir up opposition four years ago in the Florida Keys when trials were first proposed. Since then, the fears have faded. There have been [split reactions](#) from local Floridians in two polls over the years, while other Florida surveys show [significant public support](#). A fiercely-contested referendum in 2016 found Monroe County residents [supportive of the releases](#), with 31 of 33 precincts and 58 percent of county residents voting in favor of the 1st Generation Oxitec mosquito project. Thousands of mosquitoes infected with the Wolbachia bacteria were later released in the Florida Keys as part of a 12-week trial. [screen shot at 4pm](#)

Activist environmental groups like [Friends of the Earth](#) and [Food and Water Watch](#), who have called the release plans “[dangerously short-sighted](#),” have spearheaded the opposition in Texas and Florida. Oxitec is [awaiting results from the comments and a subsequent ruling by the EPA in hopes](#) of securing permission to field test 20,000 male mosquitoes per acre per week in those two states. These mosquitoes have been engineered to express a protein called tTAV-OX5034. Female offspring are expected to die before reaching maturity, and thus the *A. aegypti* population should drop, hopefully significantly.

Did the mosquito experiment go wrong?

These carefully cultivated plans were thrown in disarray by population geneticist Jeffrey Powell and published on September 1, 2011.



stirred apocalyptic concerns: “Transgenic *Aedes aegypti*

Mosquitoes Transfer Genes into a Natural Population”.

Powell and researchers from Brazil monitored a release by Oxitec of 450,000 male *A. aegypti* mosquitoes in Jacobina, Brazil. The team genotyped the release strain and the population of *A. aegypti* for up to 30 months after release. They reported that some parts of the transgenic mosquito genome had been incorporated into the targeted Jacobina mosquito population.

Is that a concern or potential catastrophe? After all, Oxitec had always estimated that about 3 percent of the offspring of the engineered mosquitoes would survive, so the key finding was not surprising. But then the researchers went beyond the data to speculate as to potential causes and implications.

[E]vidently, rare viable hybrid offspring between the release strain and the Jacobina population are sufficiently robust to be able to reproduce in nature. ... The three populations forming the tri-hybrid population now in Jacobina (Cuba/Mexico/Brazil) are genetically quite distinct, very likely resulting in a more robust population than the pre-release population due to hybrid vigor.

The research team seemed to raise what many readers of the study thought was an apocalyptic take on the data: Had Oxitec just created a new “Franken-skeeter?” And it was this speculation that caught the attention of the media, anti-GMO groups and more than a few critical scientists.

Anti-GM group [GMWatch](#) announced that the mosquitoes in the experiment had “escaped human control,”

and were

now spreading in the environment. The mosquitoes used for the genetic manipulation are originally from Cuba and Mexico. These insects used in the laboratory have now mixed with the Brazilian insects to become a robust population which can persist in the environment over a longer period of time.

Some news reports reported the study straightforwardly, but many others mixed the documentable scientific results (GM mosquitoes mixed with the wild-type mosquitoes and the population of *A. aegypti* appeared to rebound after an 18-month suppression) with what many considered wild speculation (that new hybrid mosquitoes could be more resistant to suppression and more likely to spread disease).

A [ScienceAlert story](#) (quoting a [New Atlas](#) article titled “Genetic engineering mosquito experiment goes wrong”), exemplified this speculative coverage:

The genetically-altered mosquitoes did mix with the wild population, and for a brief period the number of mosquitoes in Jacobino, Brazil did plummet, according to research published in Nature Scientific Reports last week. But 18 months later the population bounced right back up, New Atlas reports – and even worse, the new genetic hybrids may be even more resilient to future attempts to quell their numbers.

A story by the German Press Agency, DPA, quoted Christoph Then, head of the well-known European anti-GMO organization Testbiotech:

Oxitec’s trials have led to a largely uncontrollable situation. This incident must have consequences for the further employment of genetic engineering.

Scientists’ responded quickly and sharply to this speculation. Michigan State University plant geneticist Chad Niederhuth [tweeted](#), “Some of the claims made by this paper are completely unfounded and the title is downright irresponsible.” Despite the paper’s headline about transferring genes into a “natural population,” *Aedes aegypti* is native to Africa, and is an invasive species in all of the western hemisphere (including, naturally, Brazil).

Jason Rasgon, an entomologist and epidemiologist at Pennsylvania State University, dissected the paper’s problem in more detail. In a [series of tweets](#), as well as in a story in [Science magazine](#), Rasgon wrote:

- The experiment was not a failure, because *A. aegypti* did decline for 18 months, noting that “when you stop releases, the pop goes back to normal.”
- The population genetics methods used by Powell’s team showed some DNA from the release strain was transferred to the “wild” population. This might be of concern if *A. aegypti* were native to Brazil, which it is not. And, as former FDA official (and founding director of that agency’s biotech office)

Henry Miller [pointed out](#), the study showed that no part of the transgenic gene was transferred.

- The ability to transmit dengue virus was not changed (only the population of the mosquito), which was what Oxitec had intended (and previous studies had shown). “While there may be a potentially interesting population genetics story here, there is no epidemiological significance.”
- On the paper’s claim that the hybridization would result in “a more robust population than the pre-release population,” Rasgon pointed out (in all caps) that “they present absolutely no evidence or data supporting this statement.”

Follow the latest news and policy debates on sustainable agriculture, biomedicine, and other ‘disruptive’ innovations. Subscribe to our newsletter.

[SIGN UP](#)

Rasgon and other scientists have started asking why these speculative conclusions were in an otherwise solid paper on the population genetics of mosquitoes, why a notable group of researchers would make such statements and why *Scientific Reports* would publish them.

Shortly after the paper’s release, after a firestorm of criticism of the paper, the magazine (Nature Publishing) posted this:

[screen shot at pm](#)

Image not found or type unknown

In the [Talking Biotech](#) podcast by University of Florida Kevin Folta, Oxitec research and development and operations lead Kelly Matsen said that the Aedes mosquito is invasive worldwide, and has resisted other efforts. The company’s genetic-based sterile insect technique turns away from traditional x-ray/irradiation methods, to genetically modify insects so that they can “have the effect of reducing populations, and then remove the genes from the environment when we have done our work,” Matsen said.

However this is resolved, the paper and the reaction to it illustrate the structure of conflict over genetic modifications — some scientists who support the careful use of technology, others who fall victim to hype and speculation and non-government organizations (NGOs) which stringently oppose any such technology. As the GLP reported in a [previous article](#), this opposition “is based on speculative risks, those that have no established theory or evidence data,” according to Canadian researchers who surveyed experts on their views of genetic modification.

Andrew Porterfield is a writer and editor, and has worked with numerous academic institutions, companies and non-profits in the life sciences. [BIO](#). Follow him on Twitter [@AMPorfield](#)