

Gene drive made in Göttingen

Risk of uncontrolled release of genetically engineered flies
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Testbiotech, the Gene-ethical Network and a German small farmers' organisation (Arbeitsgemeinschaft bäuerliche Landwirtschaft, AbL) have sent a joint letter to the German state government of Lower Saxony, calling for clarification and information on research into genetically engineered insects. The letter was sent after an interview with a biologist at the University of Göttingen was published in a German scientific journal. In the interview, Ernst Wimmer, from the Department of Developmental Biology, disclosed that experiments were being carried out with genetically engineered flies in a laboratory that apparently did not fulfil the necessary safety standards. The flies in question are genetically engineered in a way that means their artificial genes can spread rapidly throughout the populations. Experts call this a 'gene drive'. In this case, the mechanism is intended to make sure that the only male offspring are fertile. One of the consequences might be a complete decimation of the insect population.

A 'gene drive' is created using the CRISPR-Cas nuclease to insert DNA into the genome. The so-called 'DNA scissor' cuts into the genome at a defined site and thereby inserts its own DNA. Natural genetic information is destroyed at the site of insertion and, in this specific experiment, only the male offspring remain as being fertile. The process of genetic engineering is self-replicating in the following generations so that offspring homozygously inherit the new genetic condition, and the artificial genes can spread much quicker through populations than would naturally be the case. Many experts are warning against the release of such organisms into the environment.

In their experiments, the researchers at the University of Göttingen wanted to investigate the reliability of self-replication of the gene drive in following generations. They discovered that in following generations there was an increased frequency of unintended mutations at the site targeted for insertion in the genome with the gene scissors. These mutations rendered the gene-drive increasingly ineffective so that after several generations, fertile female offspring were starting to be born again. Consequently, if these flies escape, they will show unintended mutations, with some of them being able to reproduce and cross-breed, thereby producing offspring with largely unknown effects.

"These experiments show that new methods of genome editing based on tools such as CRISPR-Cas are not as predictable as they are often said to be. Obviously, in this case, we have seen an increasing number of unintended mutations," says Annemarie Volling for the small farmers organisation. "The agriculture and food production sectors might also have serious concerns if any of the insects escape. Therefore, we are demanding that the precautionary principle is strictly applied. Under no circumstances should native insect species that could cross-breed with genetically engineered insects and thereby spread into natural populations be used in these experiments."

Meanwhile the research carried out in Göttingen has been stopped. According to Wimmer, their laboratory safety standards were not sufficient to fulfil the official requirements. Wimmer's institution appears to have no adequate facility available at all. At the same time, he also seems to believe that the required standards are not necessary. Wimmer, who has also filed a patent on genetically engineered insects, claims that his flies would not be as dangerous as thought by most of experts. The organisations are warning about the dangers of downplaying the risks.

"The statement made by the researchers in Göttingen that their insects are not likely to harm the environment is not scientifically substantiated. Their experiments show that the gene drive does not work as they expected it to. Therefore, no conclusions can be drawn on the bio-safety of the flies," says Christoph Then for Testbiotech. "Research has to adhere to the rules and the precautionary principle if risk assessment suffers from too many unknown factors. Indeed, nobody can predict the consequences if those insects escaped."

Christoph Potthof states for the Gene-ethical Network: "Obviously, there are substantial risks, especially if the insects are able to spread into native populations. Even if the gene drive is no longer functional, the insects will still be genetically engineered. Further, some of the insects might show a higher stability in the heredity of the 'gene-drive' than others. No reliable conclusion on the environmental impacts could be drawn if these insects were to spread and persist in the environment. Therefore we have to make very sure that the flies can not escape."

The two organisations now aim to gather more information from the state authorities in Lower Saxony, who originally allowed these experiments. This includes information on which fly species was used, whether the experiments are really finished and if there are any plans for them to be recommenced.

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Further information: [Interview mit Prof. Wimmer, Laborjournal](#) [4]

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