



GE DIAMONDBACK MOTHS (GDM) IN NEW YORK STATE

- The world's first trials for a Genetically Engineered Diamondback moth (GDM) began in 2015 under netted cages at Cornell University's Geneva Experiment Station.
- The permit granted by USDA/APHIS² allows for 3 years of open (non-netted) trials, releasing up to 1.44 million male GDM per year.
- Diamondback moths are a serious pest to Brassica family³ of plants in the southern US, UK, parts of Europe, South and Southeast Asia, Australia, New Zealand and Africa although not particularly in New York State.
- The purpose of this new GE insect is to reduce pest populations of Diamondback moths through engineering a new female lethality trait (female larvae die, and males go on to reproduce until the population is destroyed) into male GDM.⁴
- Concerns include the contamination of crops with female GE larvae, which die while feeding on the crop, and impacts of this single-species approach on other pests which could cause increases in their numbers.

HOW IS IT SUPPOSED TO WORK?

Male GDM are produced in the laboratory with fluorescence and 'female lethality' traits. The lethality trait is turned off by a tetracycline switch, so the insects can be bred to adulthood by feeding them on this antibiotic. Multiple thousands of male GDM are repeatedly released into the field and mate with wild females who produce eggs which are laid on the brassica. Larvae develop and the GDM female larvae die. The GDM male pupate to continue the cycle and surviving GDM males, along with repeated additional releases of GDM males, suppress the numbers of wild Diamondback moths. This takes six weeks or more in laboratory experiments.

In order to significantly affect the moth lifecycle, up to 100,000 male GDM will be released from the lab weekly for up to 4 months. There may also be a release of non-GE moths if there are not enough naturally existing. The release of male GDM must be in numbers an order of magnitude greater than wild moths in order for the GDM to overtake the wild ones. The release rate is unknown at this time, but numbers from 4X to 50X have been used in trials of other GE insects.

¹ Oxitec Ltd. (UK) developed a Genetically Engineered Diamondback moth (GDM) to reduce the population of this species which is a pest to Brassica family plants. In 2014 they received a permit from USDA APHIS to allow the first world-wide efficacy trials of this moth in New York State by Dr. Anthony Shelton, Cornell University.

² For more information, see the complete [USDA/APHIS permit](#), [The Environmental Assessment \(EA\)](#), and [GeneWatchUK Briefing on GM Moths](#) [<http://www.genewatch.org/pub.shtml?als%5bcid%5d=576071>]

³ Brassica family of plants includes cabbage, cauliflower, broccoli, Brussels sprouts, canola oil, and some seeds.

⁴ Two traits are bred in to the GDM: fluorescence to identify the GE moths from non-GE moths, and female lethality, which causes the female larvae to die. Male Sterility or SIT is not one of the traits in the GDM.

QUESTIONS AND UNKNOWNNS ABOUT GDM

1. IMPACT ON HUMAN AND ENVIRONMENTAL HEALTH

What are the specific human and animal health and environmental impacts of GDM on Target and Non-target species?

- A. What are the impacts on **Non-target** species that might eat the GDM larvae such as:
 - **Farmworkers** who may breathe or ingest large amounts of dead larvae debris or live adults?
 - Vegetable **consumers** who may eat dead GDM larvae remaining on the vegetable?
 - Other **birds and animals** that may eat the plant, larvae, or debris?
 - Non-target species in the **soil** that might eat or come in contact with dead GDM larvae that drop to the ground?
- B. Does the use of a tetracycline antibiotic to breed the GDM mean that antibiotic resistant bacteria can develop in their guts and be spread into the environment and food chain?

2. IMPACT ON BRASSICA FARMING IN NEW YORK STATE

Will this create a problem that doesn't exist today, with negative consequences to the vital brassica farming business and farm economy in NYS?

- A. Are Diamondback Moths a serious agronomic threat in New York, or will this trial introduce a bigger problem? The permit allows that non-GE moths may be released if there aren't enough naturally. GDM need to be repeatedly released at many times greater-than-natural numbers in order to overcome the wild population, what is the multiplier? Ratios of 10 to 1 and 40 to 1 GDM to wild moths have been used in caged experiments to date, taking repeated releases over six weeks to begin to suppress the wild moth population.ⁱ
- B. In real world use, will large releases of GDM make it economically and agronomically challenging to grow brassicas in NYS for both conventional and organic farmers?
 - Will farmers need to use additional amounts of pesticide to protect the crop against the infestation? What effect will this additional pesticide use have on future generations of GDM in the fields? Will it create a cycle of release/spray that will require ever greater releases?
 - Will organic farms and organic methods of control be overwhelmed in the face of the infestation created, making organic brassicas a thing of the past in NYS? What are the impacts of this single-species approach on other pests which could cause increases in their numbers?
- C. Since GDM female larvae die (presumably on the plant), will the farmer (conventional or organic) experience extraordinary amounts of dead larvae on the plants? What if the marketplace is not willing to purchase foods which may have GE insect residue in them? Will this create issues for farmers at the point of sale (wholesale, restaurant, or direct), making NY grown brassicas undesirable? Will export markets require such foods to be labeled as GE?

3. POTENTIAL FOR CONTAMINATION AND OTHER UNINTENDED CONSEQUENCES

Are there appropriate bio-security measures in place and how do they assure those who do not wish exposure to GDM (farmers and consumers) are protected from contamination? Windblown moths can be dispersed hundreds/thousands of miles from where they emerge.

- A. What will happen when male GDM spread outside the trial site? Could breeding and release of large numbers lead to a resistance to the female lethality trait? Could the GDM encounter sufficient tetracycline in the environment to allow them to survive and breed?
- B. In what ways do developers expect the insects to mutate and evolve as releases continue? How will organic farmers and other farmers who do not wish to have GDM on their crops be protected from spread of GDM to their fields? Who will be liable and responsible for contamination by GDM?

ⁱ Harvey-Samuel, T., Morrison, N. I., Walker, A. S., Marubbi, T., Yao, J., Collins, H. L., ... Alpey, L. (2015). Pest control and resistance management through release of insects carrying a male-selecting transgene. BMC Biology, 13, 49.
<http://doi.org/doi:10.1186/s12915-015-0161-1>