ScienceWatch – Biotechnology and the Butterfly

"This is the first time we have the data that we can analyze statistically that shows there's a downward trend." – E. Williams

Biotechnology can be defined as any product or process that uses a living thing or its components. Older examples of biotechnology are bread and wine, the production of which depends on yeast. Newer examples are detergents containing bacterial enzymes to remove stains, human insulin made by a genetically engineered bacterium, and genetically engineered (transgenic) plants that make toxins to kill insects or are resistant to herbicides.

Transgenic corn and soybeans resistant to the herbicide Roundup allow farmers to spray these crops with chemicals to eradicate weeds, including milkweed, the principal food plant for larvae of the monarch butterfly (*Danaus plexippus*). The decline in milkweed, which grows across most of North America, may, in part, be responsible for a decline in the eastern North American population of the "Bambi of the insect world".

According to a study published in the March 2011 online issue of *Insect Conservation and Diversity*, there has been a decline in the size of the winter colony in Mexico over a 17-year period. The research team led by Lincoln Brower, an entomologist at Sweet Briar College, Sweet Briar, VA, also included Ernest Williams, a conservation biologist at Hamilton College, Clinton, NY. They analyzed data showing the area occupied annually by the overwintering butterflies. The trend line they obtained shows a decline from 1994 to 2011 of over 60%, which they say portends a major population crash.

While other factors, such as illegal logging in the overwintering Mexican forest and breeding habitat destruction in the US play a role in the decline, the researchers say a major cause is the killing of milkweed from herbicide sprayed in fields of genetically-engineered-resistant crops. They cite unpublished results, which claim that upwards of 90% of milkweed has disappeared from agricultural fields sprayed with Roundup.

The herbicide can be used on corn and soybeans because these crops have been genetically engineered to contain a bacterial gene that produces resistance to glyphosate, the active ingredient in Roundup. Both the herbicide and the resistant seeds were patented by Monsanto. Since the advent of these crops in the late 90's, Roundup usage has greatly increased, yielding herbicide-resistant "superweeds". But it has also decreased the use of another herbicide, atrazine, which readily contaminates water supplies and causes birth defects.

Whether or not monarchs are in trouble is open to question. Another study published in the June issue of the same journal refutes the conclusions of Brower, *et al*. Andrew Davis, a research scientist at the University of Georgia, has collected data on butterflies present during migration and counted at Cape May, NJ for 15 years and Peninsula Point, MI for 19 years. He says his numbers show no such decline in the eastern population. He suggests that even when winter numbers are small, the population can rebound due to its high fecundity during the summer.

Genetic engineering of food has been controversial from its inception. Supporters say it lets farmers produce more food by targeting specific insect pests and uses fewer harmful chemicals. Opponents say the chemicals made by the transgenic plants still pollute the environment, creating resistant insect pests and super weeds. Moreover, many people refuse to eat a plant that produces a toxin or is genetically engineered in any manner.

This is not the first time genetically-engineered crops have been thought to threaten the monarch. Transgenic corn also makes a toxin that kills the corn borer. The toxin gene comes from a bacterium, *Bacillus thuringiensis*, hence, "Bt" corn. Ten years ago Cornell researchers found that milkweed artificially dusted with pollen from Bt corn killed monarch butterflies. The finding created a stir until it was shown that under natural conditions the effect was insignificant.

The same may be true for this latest threat to the winged Bambi.

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