In Midwest, Flutters May Be Far Fewer

Rich Beauchesne/Portsmouth Herald, via Associated Press

HABITAT The use of a herbicide has taken away a home for monarchs.

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As recently as a decade ago, farms in the Midwest were commonly marred — at least as a farmer would view it — by unruly patches of milkweed amid the neat rows of emerging corn or soybeans.

Janet Jarman for The New York Times

WINTER HABITAT Pupils from Angangueo, a mountain town in Michoacan state in Mexico, during a celebration of migration of the monarch butterfly.

Not anymore. Fields are now planted with genetically modified corn and soybeans resistant to the herbicide Roundup, allowing farmers to spray the chemical to eradicate weeds, including milkweed.

And while that sounds like good news for the farmers, a growing number of scientists fear it is imperiling the monarch butterfly, whose spectacular migrations make it one of the most beloved of insects — "the Bambi of the insect world," as an entomologist once put it.

Monarchs lay their eggs on milkweed, and their larvae eat it. While the evidence is still preliminary and disputed, experts like Chip Taylor say the growing use of genetically modified crops is threatening the orange-and-black butterfly by depriving it of habitat.

"This milkweed has disappeared from at least 100 million acres of these row crops," said Dr. Taylor, an insect ecologist at the University of Kansas and director of the research and conservation program Monarch Watch. "Your milkweed is virtually gone."

The primary evidence that monarch populations are in decline comes from a new study showing a drop over the last 17 years of the area occupied by monarchs in central Mexico, where many of them spend the winter. The amount of land occupied by the monarchs is thought to be a proxy for their population size.

"This is the first time we have the data that we can analyze statistically that shows there's a downward trend," said Ernest H. Williams, a professor of biology at Hamilton College and an author of the study along with Dr. Taylor and others.

The paper, published online by the journal Insect Conservation and Diversity, attributes the decrease partly to the loss of milkweed from use of "Roundup Ready" crops. Other causes, it says, are the loss of milkweed to land development, illegal logging at the wintering sites in Mexico, and severe weather.

The study does not suggest the monarch will become extinct. But it questions whether the annual migration, the impetus for butterfly festivals around the United States and waves of tourism to Mexico, is sustainable.

Still, the paper does not present any data backing its contention that genetically engineered crops are reducing monarch populations. Some experts dispute that the monarch populations are declining at all, and say it is unclear whether the biotech crops are having an effect.

Andrew K. Davis, an assistant research scientist at the University of Georgia, said censuses of adult monarchs taken each fall at Cape May, N.J., and Peninsula Point, Mich., did not show any decline.

It could be that "even though the overwintering population is getting smaller and smaller, once they come northward in the spring they are able to recoup the numbers," Dr. Davis said. His paper disputing that there has been a decline in the monarch population was published online by the same journal.

Leslie Ries, a research professor at the University of Maryland, said other butterfly counts she had examined also did not show a decline, but rather year-to-year fluctuations. Since milkweed populations are not likely to fluctuate as much, the milkweed is probably not the major determinant of butterfly populations, she said.

But two other researchers, Karen Oberhauser of the University of Minnesota and John M. Pleasants of Iowa State, cite other evidence for a decline: the number of monarch eggs in the fields of the Midwest.

“Monarch production has decreased significantly” Dr. Pleasants said. “The reduction is caused by loss of milkweed resources available to them.”

The two scientists have submitted a paper to a scientific journal and said they did not want to discuss their data before publication.

Roundup Ready crops contain a bacterial gene that allows them to withstand Roundup or its generic equivalent, glyphosate, allowing farmers to kill the weeds without harming the crop.

Because they make weed control much easier, the crops have been widely adopted by farmers. This year, 94 percent of the soybeans and 72 percent of the corn being grown in the United States are herbicide-tolerant, according to the Department of Agriculture.

That in turn had led to an explosion in the use of glyphosate, according to the Environmental Protection Agency. About five times as much of the weed killer was used on farmland in 2007 as in 1997, a year after the Roundup Ready crops were introduced, and roughly 10 times as much as in 1993.

Farmers, of course, have always tried to eliminate weeds, by tilling or by spraying other herbicides. But while herbicides often had to be used before crops emerged from the ground, glyphosate can be sprayed later in the growing season because it won’t damage the resistant crops. That and the general effectiveness of glyphosate have led to greater weed control.

“It kills everything,” said Lincoln P. Brower, an entomologist at Sweet Briar College who is also an author of the paper documenting the decline of monarch winter populations in Mexico. “It’s like absolute Armageddon for biodiversity over a huge area.”

The amount of milkweed on farms in Iowa declined 90 percent from 1999 to 2009, according to Robert G. Hartzler, an agronomist at Iowa State. His study, published last year in the journal Crop Protection, found milkweed on only 8 percent of the corn and soybean fields surveyed in 2009, down from 51 percent in 1999.

Because of weed-control efforts, even before the advent of Roundup Ready crops, any one farm is not likely to harbor that much milkweed.

But the sheer amount of farmland in the Corn Belt has meant that farms, in aggregate, have accounted for a vast majority of monarch births, according to another study published by Dr. Oberhauser and colleagues in 2001. That study estimated that in Iowa, farms produced 78 times the number of monarchs as nonagricultural sites, and in Wisconsin and Minnesota, 73 times as much.

And while monarchs come from other parts of the country as well, the Midwest is widely believed to be where most of them are hatched.

Still, even Dr. Hartzler said in his paper that it was difficult to assess what impact the decline of Iowa milkweed was having on monarch populations.

A spokesman for Monsanto, the inventor of the Roundup Ready crops and the manufacturer of Roundup, agreed, saying “knowledge is still evolving about whether and how agriculture in Iowa affects monarch population biology.” And what is true of Iowa, he said, might not apply to other regions.

This is not the first time genetically modified crops have been thought to threaten the monarch.

In 1999, researchers at Cornell reported that monarch caterpillars could be killed if they ate milkweed onto which the researchers had dusted pollen from another type of engineered crop known as BT corn. That corn has a bacterial gene allowing it to produce a toxin that kills certain pests.

But subsequent research, financed in part by the biotechnology industry, found that caterpillars were not likely to be exposed to lethal amounts of BT corn pollen under actual field conditions. That concern has died down.

Scientists say it is not surprising that suppressing weeds would have an effect on insects, and probably not just the monarch.

The National Academy of Sciences discussed this in a 2007 report on bees and other animals that pollinate crops. The report cited a British study that found fewer butterflies in fields growing genetically engineered beets and canola than in fields growing nonengineered crops.

That raises the somewhat radical notion that perhaps weeds on farms should be protected. “There’s a change in agricultural thinking, because the weed-free field was the gold standard,” said May Berenbaum, head of entomology at the University of Illinois.

Still, she and other insect experts say it is unrealistic to expect farmers to give up the herbicide-tolerant crops — so efforts should be made to preserve or grow milkweed elsewhere, perhaps on farmland set aside for conservation. Monarch Watch is encouraging gardeners to grow milkweed.

Dr. Taylor of Monarch Watch offered a modest, possibly ironic proposal for biotechnology companies. “I would implore them to develop a Roundup-resistant milkweed,” he said.