

AT U-M, WHERE IT'S M FOR MONARCHS, MILKWEED AND MICROBES!

The Yak used to see Monarchs all the time, but now we rarely do. Until recently, the last time we saw North America's best-loved butterfly was in September 2012, outside Detroit's Renaissance Center. It was part of the species' awe-inspiring fall migration, making its way to Mexico to overwinter with millions of other Monarchs from the U.S. and Canada.

So it felt like a gift to finally see a Monarch in mid-August at the University of Michigan Matthaei Botanical Gardens, in Ann Arbor. The Monarch has been in trouble for years, with fewer and fewer butterflies arriving in Mexico to cluster together for warmth in a remote mountaintop forest. The reasons for the crash are complex, but a food shortage tops the list: Many butterflies starve on their long journey south.

The good news is that a growing number of concerned scientists are trying to help, including Amanda Meier, 24, a U-M graduate student. The butterfly we saw at Matthaei lucked out. The woods that surround the Gardens' conservatory, formal gardens, campus farm, and public garden are crammed with naturally occurring milkweed, the Monarch's favorite food. And Amanda is growing another 360 milkweed plants in an experimental field.

She's trying to learn how a "good" microbe commonly found in soil affects Monarchs and other milkweed-eating insects. The project began last year with 700 plants grown indoors with varying amounts of the microbe, mycorrhizal (MY-core-high-zull) fungi.

"We grew about 240 Monarchs in a lab, and then we'd take eggs or caterpillars, put them on a plant and let them eat for six days," said Amanda, who is working on a doctorate degree in Ecology and Evolutionary Biology.

"And then we'd weigh them at the end to get an exact measurement. In the field, we don't pull the caterpillars off (the plants) to weigh them because we want to see if they'll crawl to another plant and start eating."

In her outdoor field, Amanda has seen mostly milkweed-loving aphids, from one to 300 on "quite a few" of her plants. But by early September, she also had seen "at least three" Monarch butterflies and "15 to 20" caterpillars. The green caterpillars are so small when they emerge that when Amanda showed us one, we could barely see it against the milkweed's green leaves.

"Basically, they eat their way out (of the egg)," Amanda said. "Then they eat the egg before they eat any leaves, first shaving all the hairs off the leaf with their mouths....And then they eat the leaf and that's the tricky part: When the leaf is ripped a gummy, milky sap oozes out – it's called latex – and if the caterpillar isn't careful it will gum up its mouth parts and can't eat and will starve to death."

But you'd have to be a very foolish bird, snake or other predator to munch a Monarch. Most milkweed species contain cardenolides (CAR-deh-NO-lides), a compound that is highly poisonous.

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Photo by Pat Chargot

Researcher Amanda Meier, 24, examines one of her 360 milkweed plants at the University of Michigan Matthaei Botanical Gardens. The findings from her outdoor experiment could boost milkweed restoration efforts and help save the Monarch butterfly.



Photo by Austin Thomason/University of Michigan

These two beautiful Monarch butterflies were born in the lab of University of Michigan ecologist Mark Hunter. Several of his students are involved in Monarch research.

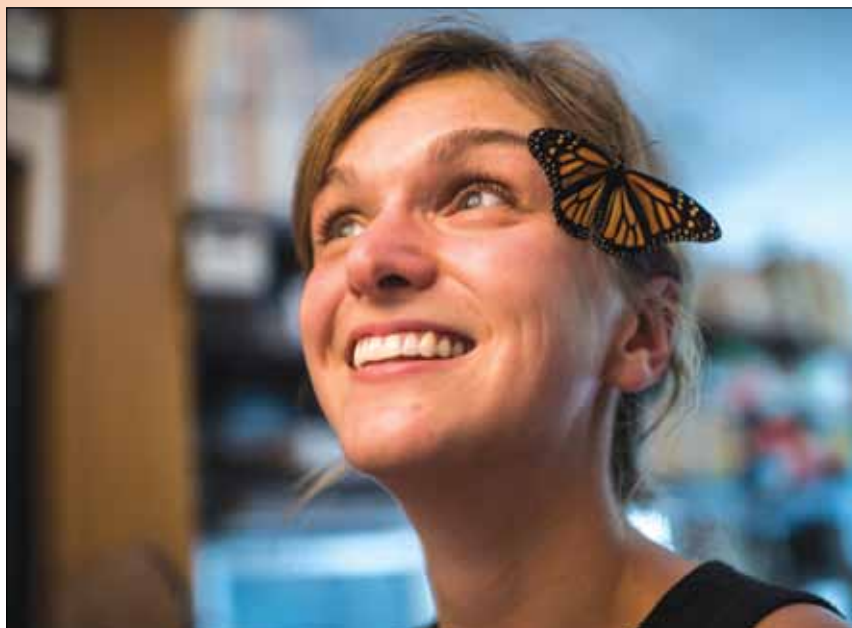


Photo by Austin Thomason/University of Michigan
Leslie Decker is a University of Michigan doctoral student in Ecology and Evolutionary Biology. She is investigating how Monarch butterflies will respond to increasing levels of carbon dioxide in the atmosphere. That's not a barrette in her hair; it's a live monarch.



Photo by Austin Thomason/University of Michigan
This hungry Monarch is munching milkweed. It will munch for about two weeks before beginning the magical process of becoming a floppy butterfly inside a hardened, transparent little house, called a pupa, or chrysalis. About two weeks after that, an adult butterfly will emerge to hang upside down and dry out, then fly.

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Monarchs, aphids and a few other insects are resistant, absorbing the toxin and storing it. It's probably why Monarchs are so brightly colored: to advertise their threat, as if they were wearing tiny T-shirts that read, "Don't eat me. I can stop your heart."

FUN FUNGI

Mycorrhizal fungi are a fascinating group of organisms, Amanda said. "It colonizes the roots. What happens is – it's very cool – it acts almost like a fertilizer. It will grab phosphorous as well as extra water and other nutrients from the soil and give it to the plants.

"In exchange for getting the nutrients from the soil, the plant will actually give its own sugars to the fungus. It's kind of like a little intimate friendship that's going on below ground that we never see."

Amanda's plants are suspended above ground to prevent them from forming friendships with any mycorrhizal fungi in the ground. She inoculated each plant with a commercial mix of four fungi species. A third of the plants were fed no fungi; another third were fed a small amount and the rest were fed a lot. Amanda is still analyzing her data to determine how much of the fungi mix is best for six different species of milkweed as well as the insects that feed on them. Her findings could boost milkweed restoration efforts in Michigan and other states.

"Often when we restore an area we put a lot of plants into the soil and we just hope they grow," Amanda said. "But we never consider what's actually in the soil that could be affecting them. My hope is that by doing this basic research, we might ultimately want to put these fungi into the soil (in the right amounts) when we plant milkweed."

Other U-M students are studying a parasite that can infect Monarchs, shortening their lives and making flying difficult.

"The parasite puts spores onto the little hairs on the abdomen

of the butterfly," Amanda said. "When the butterflies lay their eggs they end up dropping some of these spores onto the (milkweed) plant. And when the caterpillar comes out of its little egg and shaves the leaves and starts to eat it will actually eat the spores. It doesn't realize it should avoid them."

But some milkweed plants contain higher amounts of cardenolides than others, making them better at killing spores. And sick moms can somehow sense which plants provide the best medicine.

"The mother butterfly can tell the difference between a plant that's more medicinal and one that's not, and if it's sick, it will lay more eggs on the medicinal plant," Amanda said. "If the mother isn't sick, (she) doesn't differentiate."

The egg is infected, but the caterpillar survives. "It's very neat because it's actually those first bites of the plant once the caterpillar ingests them that help to kill off that parasite inside of it," Amanda said, adding: "There are other insects that can medicate themselves, too. And we never really give them credit. I often think of insects as kind of like a zoo that we never look at. They all have these crazy adaptations. They look really cool. I think they're fascinating. I'm lucky to just be able to go and stare at insects all day."

For more, visit www.journenorth.org.

By Patricia Chargot



In the late 1990s, more than a billion Monarchs made it to Mexico. By 2013, only about 33 million did. The total was up last year to about 65 million, but scientists consider that only a slight increase.