

TROPICAL MILKWEED & PARASITE INFECTIONS IN RESIDENT MONARCHS IN THE SOUTHERN U.S.: A RISK FOR MIGRATORY MONARCHS?

A fact sheet about a study published in Ecology Letters (Satterfield, Maerz, Hunter, Flockhart, Hobson, Norris, Streit, de Roode, & Altizer, 2018)

Like many migratory animals, monarch butterflies in North America are experiencing ecological changes from human activities.

- Migratory monarchs in eastern North America typically travel up to 3500 km (more than 2,000 miles) to Mexico each fall. Numbers of wintering monarchs in Mexico have plummeted by 84% in the last two decades.
- At the same time, some monarchs in the southern U.S. have given up migrating to Mexico. These resident monarchs breed year-round in patches of tropical milkweed along the Gulf and Atlantic coasts.
- Many other migratory bats, birds, and mammals are showing similar shifts from migratory to resident behaviors.



Migratory monarchs drinking nectar from native milkweed plants. Monarchs must lay eggs on milkweed, the only plant caterpillars can eat (photo provided by the USDA Forest Service).

Loss of migratory behavior can increase parasite transmission.

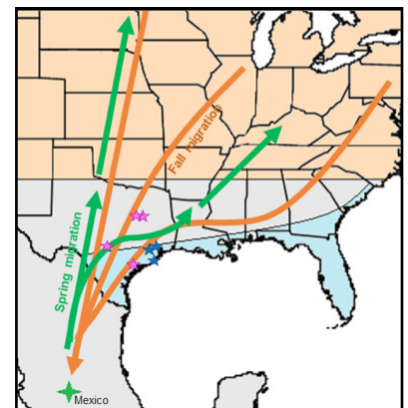
- Previous studies in monarchs showed that migration helps to reduce parasite infection by weeding out the sickest monarchs and allowing monarchs to leave contaminated areas for part of the year (Bartel et al. 2011; Altizer et al. 2011).
- Likely because of the loss of migration, year-round resident monarchs in the southern U.S. suffer high rates of infection from a protozoan called OE (Satterfield et al. 2015, 2016).
- In severe cases, monarchs infected with OE parasites get stuck when trying to emerge from the chrysalis and die. In mild infections, OE can shorten a monarch's lifespan or weaken their flight performance.
- Year-round monarch breeding occurs almost exclusively on an exotic species of milkweed commonly planted in gardens: tropical milkweed (*Asclepias curassavica*).
- Tropical milkweed often grows year-round in the southern U.S. and enables non-migratory monarch behaviors, unlike native milkweeds which typically die back in the fall and do not allow monarchs to continue breeding.



A monarch caterpillar eats tropical milkweed at a year-round breeding sites in Texas. Monarchs face extremely high infection risk for OE parasites (inset) at these locations, where prevalence can be 100% (photo by Dara Satterfield).

Resident behavior can have consequences for animals that continue to migrate.

- We studied whether infected resident monarchs might interact with migratory monarchs heading to or from Mexico.
- We observed monarchs in Texas in 2014-2015, with the help of dedicated citizen scientists.
- We sampled monarchs during and after the peak of migration, in both central Texas, at locations with only seasonal milkweed (not year-round milkweed) and in coastal Texas, at locations with year-round monarch breeding and tropical milkweed.
- Because monarch migrants and residents look the same, we used two chemical analyses to distinguish where the monarchs came from: stable isotopes, which retain the geographic signature of the place where those monarchs fed on milkweed as caterpillars, and host plant fingerprints (based on toxins in the wings called cardenolides) to test whether monarchs fed on tropical milkweed or native milkweed as caterpillars.



Our study showed that migratory monarchs flying both during fall (orange arrows) and the spring (green arrows) on the Texas coast encounter resident sites (blue stars). These migrants showed higher parasitism than migrants at sites without residents (pink stars) (photo by Dara Satterfield).

Resident behavior can have consequences for animals that continue to migrate.

First, we asked: *Do migratory monarchs encounter resident monarchs while traveling to and from overwintering sites?*

- In the fall: We found that monarchs migrating through central Texas (at sites without tropical milkweed) do not encounter residents, but monarchs migrating through coastal Texas do. We monitored sites with infected resident monarchs on the Gulf coast in Texas, and found a large influx of migrants during the fall.
- In the spring, some migratory monarchs share habitat with infected resident monarchs. Migrants and residents both laid eggs on tropical milkweed plants that often harbor high levels of parasites, and some infected residents moved into inland sites with native milkweeds.



Young monarch caterpillar at a resident site in Texas (photo by Dara Satterfield).

Second, we asked: *Do the migratory monarchs exposed to year-round breeding sites show differences in parasitism rates or reproductive behavior?*

- Migratory monarchs at resident sites had higher rates of OE parasitism and were more likely to be in a reproductive state (which is not conducive to migration), compared to other migratory monarchs.
- We cannot tell whether: (a) tropical milkweed sites attract migratory monarchs that are already infected or reproductive, or (b) these sites spread parasite spores to migratory monarchs and induce them into a reproductive state (which can make their successful migration less likely).
- This work predicts substantial pathogen transmission occurs from resident monarchs to the offspring of migratory monarchs.

Native milkweeds and nectar plants support monarch migration – and monarch health.

- We recommend that gardeners who want to help monarchs should plant and protect native milkweeds and nectar plants.
- Native milkweeds are typically synchronized with the monarch's natural migratory cycle and do not enable the overcrowding and year-round breeding that can lead to high parasitism rates and mortality from freezing.
- In places where tropical milkweed already occurs, it can be cut back during the fall and winter (monthly), and even better, replaced with native milkweeds.



Photos provided by Dara Satterfield.



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Odum School of Ecology
UNIVERSITY OF GEORGIA