

ARE MONARCH BUTTERFLIES DISAPPEARING DUE TO MILKWEED TOXICITY?

Lily Tatusko, Lucas Rousseau, Michael Salerno, Rubenstein School of Environment and Natural Resources, University of Vermont



Figure 1. Different varieties of milkweed. Photo: Sam Gardner, Jessica Walliser



Figure 6. Monarch butterfly caterpillar becoming a chrysalis, this is what users of a citizen science app would be looking for. From aercmn.com

Hypothesis

Monarch butterfly caterpillar populations are decreasing, despite the non-decreasing population of milkweed, their host plant. We believe that this may be due to the increase of invasive tropical milkweed plants (*A. curassavica*). We believe we will find less monarch chrysalis on the *A. curassavica* than the other species.



Figure 3. Monarch butterfly on a non-toxic milkweed plant, *Asclepias incarnata*. From News.wjct.org, Jim Hudgins.

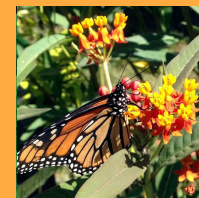


Figure 4. Monarch butterfly on a toxic milkweed plant, *A. curassavica*. From putnamhillnursery.com

Background

Monarch butterflies are in iconic species that can be recognized by ecologists and non-ecologists alike. Their caterpillars are a recognizable yellow and white striped pattern and can only be spotted on their host plant, milkweed, or *Asclepias*. They spend their lives as caterpillars dining on the leaves of the milkweed, where they eventually make their cocoons and transition into adulthood (Oberhauser and Solensky, 2004).

Different variations of milkweed, as shown above, contain different levels of toxicity, which has been proven to be affected by climate change. The species *Asclepias curassavica* is most susceptible to climate change resulting in dangerous toxicity levels to monarchs while other varieties see insignificant changes in toxin levels. *A. curassavica* has been labeled as invasive that also fares better in hotter climates meaning it can outcompete other milkweed which would reduce the food supply of monarchs. (Faldyn, Hunter, and Elder, 2018).

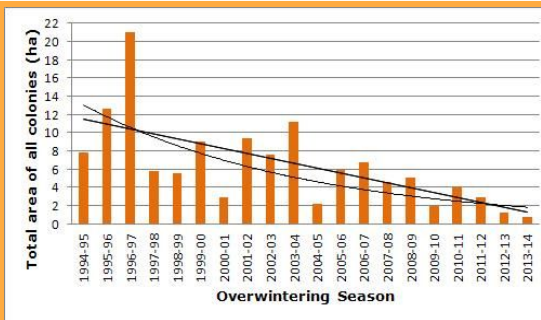


Figure 2. Decrease in monarch butterfly colonies from 1994-2013. Centerforfoodsafety.org, Larissa Walker

Predictions

We predict that more *A. curassavica* plants will be identified as compared to other milkweed species. We predict that citizen science will show us that caterpillars and chrysalis will be found on the other species as opposed to the *A. curassavica*, because caterpillars will not be able to survive the toxicity of *A. curassavica*. We also predict that this study will have a positive effect on the public and inspire people to plant non-toxic milkweed in their yards at home.

Motivation

Monarchs are an indicator species, indicating a healthy and diverse habitat for insects. Because they are so easily recognizable, they're a great ambassador species to get people interested in insects and pollination, and it also makes them an excellent candidate for citizen science projects. As pollinators, fully grown Monarch butterflies are essential to many ecosystems. However, despite the steady population of milkweed (Boyle, Dalgleish, and Puzey, 2018), Monarch butterflies are on the decline, as shown in the graph above (Walker, 2014)

Study Design

This study can utilize citizen science projects to draw data on whether caterpillars are observed and if chrysalises are formed on milkweed plants and what species of milkweed. Citizen citizens are already utilized for tagging monarch butterflies. One example of a possible citizen science project is the app iNaturalist, where users can submit plant and animal pictures and the app will log and identify them, and then they can be used for research. This study could use either an existing app like iNaturalist or a new app, where users would log when and where they saw Monarch Butterfly caterpillars or chrysalises, and it would identify what type of milkweed it was on.

Predicted Chrysalis Percentage Found on Species of Milkweed

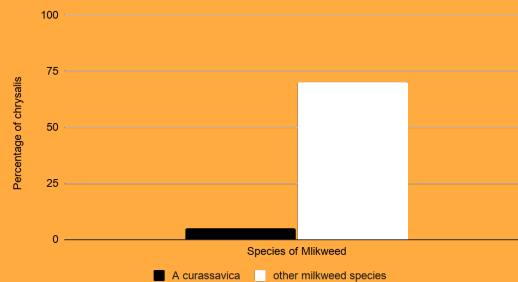


Figure 5. A graph showing possible, projected results from a citizen science project in which app users would log the butterfly's stage of life (caterpillar, chrysalis, adult) and what species of milkweed it would be on. We expect that more chrysalises would be identified on the native, non-toxic species of milkweed.

Intended Analysis

Given that the response variables (monarch chrysalis count) is continuous, and our independent variable, amount of a particular is also continuous (with different categories), we will analyze the data using regression (to analyze relationship between chrysalis count and number of species) and also a T-Test (comparing chrysalis count on what kind of milkweed). This analysis will identify if there is a difference between the habitat suitability of each species of milkweed and population of milkweed. Our study is limited by the accuracy of citizen scientists, since we will be relying on them for our data.

Literature cited

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