

A Response to Tropical Milkweed and the injurious effects of well-meaning people by Jeffrey Glassberg article

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An article written by Jeff Glassberg last year about tropical milkweed for the NABA periodical *American Butterflies* has caused some confusion, and provides some misleading information regarding the planting of *Asclepias curassavica* for monarchs, which we address below.

*Yellow Highlights are the NABA article, and the response follows.*

*Recently, a number of people involved with Monarch research and conservation published opinion pieces in which they claimed that people who were planting Tropical Milkweeds might be harming Monarchs.*

The articles that Glassberg references were written by professionally trained scientists, and the papers were not opinion pieces, but were scientific articles with original data and careful analyses that were published in scholarly peer-reviewed journals. Peer-reviewed scholarly publications are those that have undergone a formal review process by other scientists (with formal scientific training and appointments at diverse international academic institutions). Their identity is typically not known to the authors, which is why this is often termed 'anonymous peer review.' Peer review subjects data to scrutiny by other scientists who approach the study critically, and the journal editors often require revisions of data analysis, data interpretation, and even the experimental work itself, before re-review occurs with possible additional critiques and corrections. Only papers that satisfy reviewer concerns appear in print. In contrast, the NABA magazine *American Butterflies*, in which the article by Glassberg was published, is not a peer reviewed scientific journal, and the statements published within *American Butterflies* are not subject to scientific scrutiny or expert review.

*If people believe these headlines and the statements of Lincoln Brower and others, that planting Tropical Milkweeds anywhere in the U.S. is actually absolutely definitively threatening the Monarchs, people will, of course, stop planting Tropical Milkweeds. This would be a shame, because there is little evidence to support the idea that planting Tropical Milkweeds will weaken Monarch populations and NO evidence to support the idea that Tropical Milkweeds are "trapping" Monarchs and stopping them from migrating to Mexico.*

This view ignores substantial data to the contrary.

<http://rspb.royalsocietypublishing.org/content/282/1801/20141734.full> is a link to the scientific article that publishes the data showing that infection rates by a debilitating protozoan *Ophryocystis elektroscirrha* (OE), which infects monarchs, reach very high levels when monarchs breed throughout the winter months on tropical milkweed. All of the winter breeding sites in the southern US monitored by citizen scientists had tropical milkweed; there was no winter reproduction of monarchs at sites without tropical milkweed, as native milkweeds in the eastern US were not available during the winter months. A comparison of OE infection rates on native vs tropical milkweed in California, published in a separate peer-reviewed journal, showed similar findings: <https://www.ncbi.nlm.nih.gov/pubmed/27252207>

The protozoan infection is harmful to monarchs – heavy infections prevent monarchs from emerging from their pupal cases, cause wing deformities, smaller adult body sizes, shorter life spans, poorer flight performance, and reduced mating success, as shown in other scientific analyses: <http://altizerlab.uga.edu/Publications/PDFs/DeRoodePNAS2008.pdf>  
<http://altizerlab.uga.edu/Publications/PDFs/BradleyAltizer2005.pdf>

*In addition, there is good reason to think that Tropical Milkweeds might increase the number of Monarchs and may become critical life-buoys, protecting migratory Monarchs from the projected loss of their overwintering grounds in Mexico.*

No scientific data are provided to support this assertion that tropical milkweed increases monarch numbers, and we are not aware of any observations to date showing that tropical milkweeds protect migratory monarchs from the loss of their wintering grounds.

*Let's consider the claim that planting Tropical Milkweeds increases OE in Monarchs. Ophryocystis elektroscirrha (OE) is a protozoan parasite infecting Monarchs and their relatives. Caterpillars ingest the parasite when eating milkweed leaves and when the caterpillar becomes an adult butterfly, the adult is also infected. When infected, and especially when heavily infected, adult Monarchs' health is impaired, as is their ability to undertake the arduous migration from the northern United States to their overwintering sites in central Mexico (Bradley and Altizer, 2005). Recently, Satterfield et al. (2015) reported finding higher levels of OE infection in Monarchs during in the winter in the southern United States (52%) than they did in Monarchs during in late summer in the north (14%) or in winter at the Mexican overwintering sites (9%). From these data they concluded that populations of Monarchs that are nonmigratory are not able to cleanse themselves of OE.*

Dr. Satterfield found consistently higher protozoan parasite prevalence on monarchs sampled at sites with tropical milkweed available during the winter months. Past work by Dr. Sonia Altizer showed that OE spores can accumulate on milkweed leaves over time. Dr. Satterfield hypothesized that when native eastern milkweeds die back during the fall and winter, and monarchs leave an area, the OE spores that were there also die back, such that monarchs returning to the U.S. from Mexico in the spring to encounter parasite-free plants. By contrast, when the tropical milkweeds remain in flower and foliage year round, and when monarchs lay eggs on these plants year round, they are continually depositing parasite spores, which can remain viable for months unless they are exposed to extreme temperatures (such as freeze-thaw cycles).

Also, past work showed that the monarchs' annual migration 'weeds out' infected butterflies that are less able to migrate long distances to Mexico, thus lowering infection prevalence. For monarchs that breed year round and do not migrate, this weeding-out process is disrupted, thus allowing high parasite prevalence to persist in winter breeding populations.

*They also stated that "reports of monarchs breeding during the winter — rather than migrating or overwintering — have become common in the southern US.*

*These behaviours are almost exclusively restricted to sites where tropical milkweed is present [citing Howard et al. 2010].” The only mention of Tropical Milkweed in Howard et al. is “an observer reports that on January 8, 2009, monarch caterpillars were found on A. curassavica in its yard, and that no other milkweed species were present.” More importantly, the conclusion that Monarchs breeding in the winter are almost exclusively associated with Tropical Milkweed is not true, because Monarchs are known to breed on native milkweeds in Arizona (Morris, 2015) and in Texas (Wahl, 2015) during the winter (see photos, opposite page).*

The author appears to be confusing two different thoughts here. Yes, reports of monarchs breeding during the winter rather than migrating or overwintering have become common in the southern US. According to Citizen Science reports from Journey North concerning southern breeding in Georgia, an interesting pattern is present (<http://www.learner.org/jnorth/tm/monarch/MigrationMaps.html>). There is one report of an overwintering breeding population in 1998, and then we do not see another population again until 2003. There is another gap until 2006, then a gap until 2009 in north Georgia which coincides with breeding populations in South Carolina. This establishes a pattern for 2010, 2011, 2012, 2013, 2015, and 2016. Moreover, Satterfield et al. (2015) surveyed herbarium records of tropical milkweed to show that occurrences of tropical milkweed have increased over time in many locations. Here is a quote from Satterfield’s article: “Year-round breeding in the southern US may be relatively new as a widespread phenomenon. While records of winter-breeding occurred anecdotally in earlier decades (i.e. five reports from 1939 to 1960, excluding south Florida; electronic supplementary material), winter-breeding appears to have become more common in recent years (95 reports from 2002 to 2010 [39]).

In addition, Glassberg is comparing apples to oranges by bringing in the Arizona evergreen milkweed, and the Texas border milkweed. There are a very few native milkweeds that are considered to be ‘evergreen’ in the United States, whereas the vast majority of native milkweeds, including those in Texas, are seasonal. The distribution of native evergreen milkweeds and their importance for monarchs warrants further study, but it appears that the native evergreens are presently rare and have a restricted distribution.

*Going further, based upon the reported higher infection rates in the southern United States during the winter, they, Satterfield and others, warn that planting Tropical Milkweeds will harm Monarchs.*

This is not an accurate representation of what Satterfield et al said: in fact, these authors’ statements exhibited a less histrionic reaction. They recommended that gardeners gradually replace tropical milkweed with native milkweed as it becomes available and prune back tropical milkweed from Nov-Feb so that it doesn’t support winter breeding monarchs. In a Q&A piece explaining the 2015 articles findings and implications (<https://monarchjointventure.org/news-events/news/qa-about-research-related-to-tropical-milkweed-and-monarch-parasites>), Satterfield, Altizer and Oberhauser write that: “Because the monarchs’ winter-breeding behavior is made possible by the presence of tropical milkweed, Satterfield recommended that gardeners gradually replace it with native milkweeds as they become available” Another quote from Satterfield’s 2015 paper on this topic states:

“Recent commercial demand for milkweed has stimulated tropical milkweed sales, often to the exclusion of native milkweeds [65]. To reduce monarch winter-breeding and its associated disease risk, gardeners and land managers need wider access to native milkweeds (which naturally senesce in the autumn), especially in coastal areas with mild winters.

*For example, OE levels in Monarchs breeding in winter in southeastern Arizona are reported to be very low (4.5%)(Morris, 2015).*

The Arizona breeding monarchs offered new information about migrating monarchs, and have been studied in particular by Gail Morris, a Monarch Watch Conservation Specialist who also coordinates the SouthWest Monarch Study. Much remains to be learned about the Arizona monarchs, and the SouthWest Monarch Study is making progress. A paper recently published showed that monarchs have a very complex migratory path and that they may come out of Mexico and go to California, or even migrate from California to the Rockies through Arizona. Gail Morris also reports that breeding in most locations in AZ is seasonal; in some areas the monarchs leave when temperatures become too hot: thus, monarchs are rarely in the same locations year-round. Their OE infection rate being low does not really prove or disprove anything; it just means we need to look at the Arizona population more carefully to determine whether or not tropical milkweed affects OE levels or the migratory path of monarchs. Here is a link to a paper that was recently published in the Journal of Lepidopterists’ Society that summarizes ten years of their findings:

<https://www.swmonarchs.org/images/2015-69-2-091.pdf>

*Similarly, OE infection rates among non-migratory Hawaiian Monarchs reportedly ranges from 4.5% to 85%, a range that is not known to be correlated with host plant species and appears to be affected by local environmental conditions, possibly including temperature (Pierce et al. 2014).*

Monarch ecology in Hawaii is quite different from that in North America. Neither monarchs nor their host plants are native to Hawaii, and monarchs use primarily *Callitropis* (crown flower), and to a lesser degree, old world and new world tropical milkweeds, as host plants. Monarchs in Hawaii do not appear to migrate long distances, are able to breed year-round in most locations, and their exposure to natural enemies other than birds and the protozoan OE is relatively unknown. What is known about OE in Hawaiian monarchs, however, shows that infection can and does reach high prevalence (up to 85% heavily infected) in some locations, which is consistent with patterns seen in winter breeding monarchs in the southern US and coastal California. It is possible that some local sites with low OE prevalence are those that are newly colonized by monarchs, and for which OE hasn’t yet reached high prevalence.

*In addition, about 60% of Monarchs overwintering on the California coast, an area without milkweeds, were found to be infected with OE (Leong et al., 1992.)*

The prevalence of heavy OE infection in west coast monarchs is closer to 30% historically, and has declined in recent years, in step with the decline in monarch numbers. An exception is that OE prevalence remains high for monarchs breeding on tropical milkweed during the winter months in CA. Here are the infection rates of OE from [monarchparasites.uqa.edu](http://monarchparasites.uqa.edu):

"OE infects monarchs in all three North American populations. The eastern migratory monarchs have the lowest infection rate. Less than 8% of these butterflies are heavily infected with OE. More monarchs have OE west of the Rocky Mountains. About 30% of the western migratory population is heavily infected with OE. The highest rate of OE in North America occurs in the nonmigratory monarchs of South Florida. More than 70% of these monarchs have OE infections. The infection rates for monarch populations in North America have been constant for many decades."

More recent data on OE in California monarchs is provided in this newer paper, which shows that monarchs breeding year-round on tropical milkweed in California show extremely high parasite infection prevalence, relative to migratory monarchs wintering along the California coast: <https://www.ncbi.nlm.nih.gov/pubmed/27252207>

*These three examples strongly suggest that the level of OE infection might not be as highly correlated with non-migratory behavior and that the presence of an evergreen supply of milkweeds doesn't necessarily mean that OE levels will be high. as Satterfield et al. conclude. Perhaps the higher levels of infection that Satterfield et al. found to be associated with Tropical Milkweeds were due to temperature effects or other factors not intrinsic to Tropical Milkweed (see below). Let's, for argument's sake, say that we accept the conclusion of Satterfield et al., that planting Tropical Milkweeds might increase OE infection in Monarchs. Even if this was true (but see prior discussion), there would be simple ways for butterfly gardeners to effectively remove any risk. For example, treating Tropical Milkweeds as annuals in the northern states and uprooting them in Sept. would not increase OE levels and would create more habitat for Monarchs.*

This is, in fact, one of the recommendations of the authors of the cited work: if gardeners choose to plant tropical milkweed, they should prune the plants back or otherwise make them unavailable to monarchs during the fall and winter, so that the plants do not attract monarchs to reproduce on during the time that they should be migrating or overwintering in Mexico.

*In peninsula Florida, planting Tropical Milkweed does not appear to threaten migratory populations at all, since Monarchs don't migrate through peninsula Florida to Mexico.*

Monarchs have long been known to migrate through Florida during fall and spring. One of the most famous sites to see monarchs during the fall migration in the southern U.S. is at St Marks Wildlife Refuge in the Florida panhandle. Studies showing migrating monarchs in Florida during spring and fall have been published by Lincoln Brower and his students and colleagues. For more information, see the following articles:

[http://www.floridawildlifeviewing.com/florida\\_wildlife\\_hotspots/migrating\\_monarchs.htm](http://www.floridawildlifeviewing.com/florida_wildlife_hotspots/migrating_monarchs.htm)  
<https://www.ncbi.nlm.nih.gov/pubmed/19579046>

*Tropical Milkweed has been present in extreme southern Florida for at least 100 years and, as Dr. William Grant posted to NABA-Chat "In Dr. Fred A. Urquhart's book The Monarch Butterfly: International Traveler page 98, he states that in 1951 he traveled to the peninsula of Florida and found Monarchs there in winter, he also found them in California and Mexico and concluded "that not all monarch butterflies migrated."*

There is now a very permanent tropical milkweed population in Florida, and the genie is already out of the bottle, in that tropical milkweed is prevalent in the southern part of Florida. According to Journey North's Citizen Science data, which began appearing in 1998, there have been permanent populations of monarchs in Florida since their first year of reporting. An influx of fall migrant monarchs does enter Florida each year, likely moving into the Caribbean, as shown by prior work by Lincoln Brower's students Amy Knight and Christina Dockx in several papers published in the past 10 years. However, where these monarchs continue on to is presently unknown, and many of them might break migration to join the resident breeding populations.

*On the other hand, removal of Tropical Milkweed from Florida would probably wipe out, the non-migratory Monarchs present, along with Queens and Soldiers.*

This is a "straw man", as no one, including Satterfield, has made the case for removing tropical milkweed from Florida. Dara A. Satterfield, John C. Maerz, and Sonia Altizer instead recommend leaving tropical milkweed alone in central and south Florida. What *has* been suggested is cutting tropical milkweed back farther north in the fall when migration begins, and replacing it as much as possible with native milkweeds.

*Thus, we are left with the Gulf Coast, southern Texas and southern Arizona as the only areas where there MIGHT be an issue. Tropical Milkweed is, according to the US Dept. of Agriculture-Agricultural Research Service, native to Nuevo Leon and Tamaulipas, the two Mexican states bordering southern Texas, and I have encountered Tropical Milkweed growing in these areas.*

*Lincoln Brower has stated that "curassavica likely would not normally have entered Texas from Mexico in the past or future even with global warming. It does not tolerate desert conditions in its natural geographic distribution." (Maেকে, 2015) however, Nuevo Leon and Tamaulipas are not deserts, nor is southern Texas,*

This means that tropical milkweed would not have made it into the USA without human help, as climate warming results from human activities, as does the intentional planting of tropical milkweed, which is probably much more common than natural migration of seeds from Mexico.

*In addition, some native milkweed family plants that serve as Monarch caterpillar foodplants, including Fringed Twinevine, are evergreen in southern Texas. On page 7 you can see a photo of a Queen nectaring at a Fringed Twinevine flowerhead growing wild at the National Butterfly Center, on Jan. 22, 2015. In southern Arizona, a number of different native milkweeds are evergreen. So, are all of these native milkweeds in southern Arizona and southern Texas (and northern Mexico) a direct threat to Monarchs? Should we remove them? I don't think so.*

The geographic ranges of native evergreen milkweeds are narrow and they appear to be quite rare, and are largely absent from the eastern U.S. More data on the extent to which they are used by monarchs, and when, and OE infection rates on these plants, would be useful.

*As mentioned earlier, it has been said that Tropical milkweed is “trapping the butterflies” and “absolutely definitively” that tropical milkweed is threatening the monarchs and their migration. These statements are unsupported by data.*

Nowhere in Satterfield’s scientific article (<http://rspb.royalsocietypublishing.org/content/282/1801/20141734.full> ) does a statement appear that says tropical milkweed is “trapping the butterflies” and the only statement that present in the article regarding a threat is this one: “Shifts towards year-round breeding on tropical milkweed, resulting in high rates of OE infection, could pose an additional emerging threat to the long-term viability of migratory monarchs.”

*Journey North, a fine organization, has, for quite a few years, asked people to report Monarchs that they see in December, January and February. Elizabeth Howard, of Journey North, kindly sent me their data related to winter sightings of Monarchs. In 2002, the first year of data availability, people at 18 locations outside of peninsula Florida reported seeing Monarchs. In 2014, the year with the most recent data, people at 13 locations outside of peninsula Florida reported seeing Monarchs. Not exactly an exponentially increasing epidemic. And, of those who reported seeing Monarchs, 94% of the 294 reports over 13 years, were of fewer than 10 Monarchs. So, something like 400 Monarchs, or about 30/ year, were reported during the winter.*

When someone uses citizen science data to make a scientific point, one must be very careful. Citizen Science data result from people’s observations and reports, and the number of observers varies from year to year. When scientists use such data in a paper, they use specific statistical formulas to deal with variation in participant numbers. Therefore, one must be careful when comparing one year to another using raw data. Also, the correct comparison is not between two isolated years, but, rather, among long-term general trends over time, especially because monarch abundance is known to fluctuate from year to year, and 2014 saw relatively few monarchs across North America. See [https://www.learner.org/jnorth/tm/monarch/conservation\\_overview.html](https://www.learner.org/jnorth/tm/monarch/conservation_overview.html) for an interesting discussion about why the numbers were so low in 2014.

*Keep in mind that even with the greatly reduced number of Monarchs, it is estimated that more than 50 million Monarchs make it the Mexican overwintering sites each year (Monarch Joint Venture, 2015).*

*This is a somewhat misleading statement regarding monarch numbers. Historically, monarch numbers migrating to the Mexican colonies are measured in units of hectares of forest occupied by wintering monarchs. Scientists have measured fifty million monarchs in one hectare. The historical average of monarch butterflies is 300 million monarchs. This means that Glassberg’s statement that 50 million monarchs make it to Mexico would still reflect a reduction, with only 16% of the normal population ([https://www.learner.org/jnorth/tm/monarch/pop\\_millions.html](https://www.learner.org/jnorth/tm/monarch/pop_millions.html))*

*Are we to believe that the very small number of Monarchs that are seen at a few locations in winter are telling us that Tropical Milkweeds are threatening the successful migration of 50*

million Monarchs? In most years tens of thousands of Monarchs migrate through the National Butterfly Center (NBC), which is located in the Lower Rio Grande Valley of Texas but is somewhat to the east of the main migratory flight corridor. The NBC has Tropical Milkweed patches that support large populations of Queens and Soldiers. I can report that when the Monarchs move through the NBC, essentially all of them continue to fly south. In most years, none stay at the NBC during the winter. This year, which was abnormally warm in the Lower Rio Grande Valley of Texas, one or two did. The Tropical Milkweeds are not “trapping” Monarchs.

There are other reasons besides trapping monarchs that are valid for not planting tropical milkweed. Recall that Satterfield et al. (2015) show that allowing tropical milkweed to survive allows the protozoan parasite loads to build up to much higher levels than would normally be found on native milkweeds. This becomes particularly problematic in a place like the National Butterfly Center because large swathes of monarchs return north in the spring and lay their eggs. This can allow for a high reinfection rate that would not normally be seen on native milkweeds just emerging from the ground. Following are quotes from Satterfield’s paper: “During the autumn, migratory monarchs probably pass through locations inhabited by winter-breeding monarchs [59]. Moreover, migratory monarchs might lay eggs at winter-breeding sites in the spring when they travel north from Mexico to reproduce in the Gulf coast states [60]. If migrants oviposit on milkweed previously visited by winter-breeding butterflies, their progeny would be exposed to the same parasite strains as winter-breeding monarchs. [Incidentally, Satterfield and colleagues now have data on spring and fall mixing of migrant and resident monarchs, presented in a paper currently under review at a journal called “Ecology Letters”, which should appear in 2018.]

Importantly, even leaving aside infectious disease, winter-breeding monarchs could represent a reserve population to augment the numbers of eastern migratory monarchs in the face of steep declines. However, because these same winter-breeding monarchs support high parasite transmission, their potential role as a source of infection for migratory monarchs during seasonal periods of mixing is cause for concern. The widespread decline of migratory monarchs in North America has been widely publicized [33], with most attention focused on habitat loss as a major cause [35,36]. Shifts towards year-round breeding on tropical milkweed, resulting in high rates of OE infection, could pose an additional emerging threat to the long-term viability of migratory monarchs.”

The reason that some Monarchs are now found in winter along the Gulf Coast and in southern Texas is that increased temperatures due to global warming now allow Monarchs to often survive in more northerly locations than was possible years ago.

No data are provided to support this statement. Moreover, without the year-round availability of tropical milkweed, monarch adults might be present, but year-round breeding, and the high OE transmission that results from it, would not occur.

The summer 2012 issue of American Butterflies was devoted to Monarchs. In it, Mexican researchers Cuauhtémoc SáenzRomero and Roberto Lindiz-Cisneros explained how computer models predict that the oyamel forests that currently support Are Tropical

Milkweeds “trapping” Monarchs and preventing them from migrating to Mexico? The Mexican overwintering Monarchs will succumb to global warming, leaving Monarchs with no overwintering grounds. If, and when, this happens, wouldn't it be a good thing for there to be extensive areas in the southern United States that might serve as reservoirs for Monarchs that would then be able to repopulate more northern areas, much as Painted Ladies and American Ladies do now?

Yes, it would be a good idea for there to be extensive habitat for monarchs in the southern US planted for monarchs. With over 100 native species of milkweeds available to choose from, we should concentrate on using the native species that are available to us. It makes more sense to concentrate our efforts on rebuilding our habitats to support native plants that will rebuild our ecosystems and support all of our native wildlife, than to put our effort into this one tropical milkweed species that we now have scientific evidence that can cause harm.

Most people know that many of the Monarchs born in the American West overwinter on the California coast. But was this always so? The overwhelming number of overwintering sites are in groves of nonnative blue eucalyptus (from Australia) and the earliest record of Monarchs overwintering in California is from 1864. If the current crop of tropical milkweed doom-sayers were present when Monarchs shifted to overwintering on the California coast on non-native trees, one can imagine them springing into action to protect the purity of the Monarch migration. Would the Monarchs (not to mention the Californians) now be better off?

The source of Glassberg's data concerning the overwhelming number of overwintering sites of the monarch butterfly in groves of nonnative blue eucalyptus trees is not clear. Perhaps he is confusing the numbers of sites the monarchs choose (400 historic and current sites, Xerces) with the number of monarch butterflies (Western population equals 292,674 in 2015) identified at those sites. The eastern population of migratory butterflies uses 12 different overwintering sites and in 2015, was recorded as 56,500,000 monarchs. This example seems unrelated to the subject at hand. If the author's point is that California monarchs now use a non-native tree species, in contrast to an earlier time when they used native tree species, for overwintering, the argument for the continued proliferation of non-native trees is unsound.

*NABA has always encouraged the use of native plants. For example, an article by Ann Swengel, in the very first volume of American Butterflies (Summer, 1993) detailed all of the native milkweeds of the Midwest and how to propagate them. And, the National Butterfly Center in Mission, Texas, a major project of NABA, is now the largest botanical garden in the United States that focuses on the use of native plants in a garden setting. However, despite NABA's overwhelming preference for, and love of, native plants, there are instances where nonnative plants fill a butterfly need and that demonizing non-native plants is a misguided strategy that antagonizes many people who would be natural allies in our mission to conserve butterflies. Encouraging people to use plants native to their region is a good idea; calling people bad names because they have planted the usual, commercially available, garden plants is counterproductive.*

The use of the term “demonized” seems inflammatory and counterproductive to a discussion that should revolve around points documented in articles published in peer-reviewed journals.

In summary, the article in American Butterflies, by Jeffrey Glassberg is an opinion piece that is not supported by previously published evidence, and has spread misinformation that could be confusing to well-intended gardeners that want to help monarch butterflies.

What the facts have shown are this:

- 1) tropical milkweed produces flowers and foliage at times of year outside the range of native milkweeds, allowing monarchs to breed during the migration and wintering periods;
- 2) because tropical milkweed allows for winter breeding, OE loads build to higher levels on the plant and on monarch populations using tropical milkweed;
- 3) infection by OE is harmful to monarchs – it prevents some infected monarchs from emerging from their pupal cases, causes wing deformities, smaller adult body sizes, shorter life spans, poorer flight performance, and reduced mating success.
- 4) long distance migration lowers the rate of OE infection in the population on monarchs (Altizer, et al, 2011). Therefore, it would seem that encouraging such migration would be the best path to helping both the Eastern and the Western populations of monarchs stay as healthy as possible, so that they can continue their migration which occurs only here in North America.

When these facts are presented, it is clear that the recommendations that were suggested by Satterfield et al. (2015), namely cutting back tropical milkweed in the fall and winter, and gradually replacing this with native milkweeds, have merit. Following are several links that could be helpful with additional scientific information that has been published on this topic:

[https://monarchjointventure.org/images/uploads/documents/Oe\\_fact\\_sheet.pdf](https://monarchjointventure.org/images/uploads/documents/Oe_fact_sheet.pdf)

<https://monarchjointventure.org/news-events/news/qa-about-research-related-to-tropical-milkweed-and-monarch-parasites>

<http://www.eealliance.org/assets/Documents/MAG/notallmilkweediscreatedequal%20revised%202017.pdf>

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