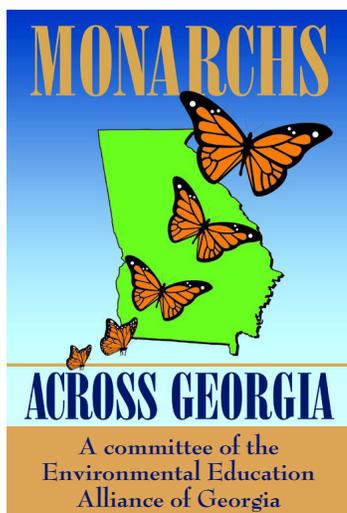


# The Chrysalis

Emerging news from *Monarchs Across Georgia*

Our mission is to inspire caretakers of the natural environment through monarch and pollinator education



## Upcoming Events

**SEEA Conference (virtual)**  
September 24-25, 2020  
\$25 - Register by September 15  
[Register Online](#)

**Pollinator Symposium (virtual)**  
Saturday & Sunday, October 3-4  
\$40 EEA; \$65 non-members  
Registration is limited.  
[Register Online](#)

**Symbolic Migration**  
Purchase your \$10 passenger tickets and submit butterflies by Friday, October 9.  
[Purchase Passenger Ticket](#)

**NAAEE Conference & Research Symposium (virtual)**  
October 13-17, 2020  
Various pricing  
Scholarships available  
[Register Online](#)

**Outdoor Learning Symposium (virtual)**  
[Stay tuned](#) for the announcement of the dates for this year's annual event.

**EEA 2021 Annual Conference (virtual)**  
[Stay tuned](#) for the announcement of the dates for next year's annual event.

## Butterfly Genomics

*Emory biologists show how monarchs fly differently, but meet up and mate*

By Carol Clark, Emory University

Each year, millions of monarch butterflies migrate across eastern North America to fly from as far north as the U.S.-Canadian border to overwinter in central Mexico — covering as much as 3,000 miles. Meanwhile, on the other side of the Rocky Mountains, western monarchs generally fly 300 miles down to the Pacific Coast to spend the winter in California. It was long believed that the eastern and western monarchs were genetically distinct populations.

A new study, however, confirms that while the eastern and western butterflies fly differently, they are genetically the same. The journal *Molecular Ecology* published the findings, led by evolutionary biologists at Emory University.

“It was surprising,” says Jaap de Roode, Emory professor of biology and senior author of the study. His lab is one of a handful in the world that studies monarch butterflies.

“You would expect that organisms with different behaviors and ecologies would show some genetic differences,” de Roode says. “But we found that you cannot distinguish genetically between the western and eastern butterflies.”

The current paper builds on previous work by the de Roode lab that found



*Monarchs congregating in Mexico. Photo by Jaap de Roode.*

similarities between 11 genetic markers of the eastern and western monarchs, as well as more limited genetic studies by others, and observational and tracking data.

“This is the first genome-wide comparison of eastern and western monarchs to try to understand their behavioral differences better,” says Venkat Talla, first author of the current study and an Emory post-doctoral fellow in the lab.

Talla analyzed more than 20 million DNA mutations in 43 monarch genomes and

*Continued on page 15*

# Georgia Pollinator Plants of the Year Program

By Lauren Muller, State Botanical Garden of Georgia

The State Botanical Garden of Georgia at UGA is excited to introduce the new Georgia Pollinator Plants of the Year program (GPPY). It's especially fitting that we do so during the garden's Year of the Pollinator. Modeled after the Georgia Gold Medal Program, GPPY recognizes and promotes four exceptional landscape plants that support pollinator biodiversity in our parks, home gardens, and commercial landscape plantings.

seeds for hard-to-source selections. We are developing eye-catching branding to help consumers easily identify these pollinator plants at the point of sale.

Collaboration is key to the success of the GPPY program. The selection committee includes experts at UGA and beyond in horticulture, entomology, botany, ecological restoration, and the green industry, ensuring that the



**Spring Bloomer** (left)  
*Conradina canescens*; photo  
by Shannah Montgomery.  
**Summer Bloomer** (above)  
*Clethra alnifolia*.



**Fall Bloomer** (left) *Solidago  
Petiolaris*; photo by Hugh and Carol  
Nourse. **Georgia Native** (above)  
*Asclepias tuberosa*; photo by Don  
Hunter.

The winning plants, chosen annually by a selection committee, are beautiful, easy to propagate, perform well in gardens across the state, and most importantly, provide valuable resources for insect pollinators such as forage, nesting sites, or larval food. The winners fall into the following categories: Spring Bloomer, Summer Bloomer, Fall Bloomer, and Georgia Native, which align with the gold medal standard for pollinator gardens – successional blooming. The selection committee has already chosen the winning plants for 2021, which provides interested growers a full year to increase their stock of these plants.

At UGA, we advocate for these ecologically valuable plants on all levels of the gardening supply chain, from growers, to retailers, to consumers. And we are building upon the work of existing programs, such as Georgia Grown, and UGA's Connect to Protect, with a focus on plant and pollinator conservation.

Our goals are simple: to increase availability of biodiversity-supporting landscape plants statewide and to provide the public with more opportunities to engage in pollinator conservation. In order to do this, the garden is strengthening the network of green industry and conservation partners by sharing propagation protocols for the winning plants while also providing access to

annual selection process is well informed ecologically and horticulturally. Partners work together to share horticultural knowledge and plant material and to encourage consumers to include pollinator-supporting plants in their gardens.

Concerns about pollinator declines and species extinctions continue to grow. The recently published "[Status of Pollinators in North America](#)" paints a grim picture. We are facing a loss of valuable insect species that are foundational to almost all ecosystems, including our food supply. The responsibility to conserve pollinators falls on all of us. Each and every one of us has a chance to contribute to pollinator conservation, and it can start in our gardens and home landscapes.

This is a call to action. As plant lovers, supporters of the botanical garden, and bird and butterfly watchers, we are asking for your contributions. Your involvement is invaluable to the success of this program. Take action by nominating your favorite pollinator plants, asking for your local garden center to carry the winning plants, and by infusing your home garden or landscape with biodiversity-supporting pollinator plants. Visit <https://botgarden.uga.edu/conservation-science/pollinator-plant-program/> for program updates, to learn about 2021's winning plants, and to find the nomination form.

**DEADLINE: OCTOBER 9, 2020**

# The Symbolic Migration is Going Virtual!

*The real monarchs will soon begin their annual migration to Mexico. Join the celebration by participating in the Symbolic Migration's 25th anniversary.*



The Symbolic Migration is an international project mirroring the annual migration of the Eastern population of the North American monarch butterfly. In the fall, students from across the U.S. and Canada will create paper Class Ambassador Butterflies and individual life-sized butterflies to send to Mexico.

These Ambassadors, along with an environmental lesson, will be delivered to students in schools surrounding the monarch sanctuaries in Mexico and will spend the winter there. In the spring, as real monarchs head north, participating schools will receive life-sized butterflies made by other students from across North America, along with a letter from a student in Mexico.

While schools are the main audience for Symbolic Migration, families, organizations, and other groups are welcome to participate. Adults can also participate; there is no age limit.

As the COVID-19 pandemic continues across the world, and schools are turning to virtual or hybrid learning, we

have opted to make this season's Symbolic Migration a virtual experience. For schools in the U.S. and Canada, this means that your Class Ambassador and life-sized butterflies must be scanned or photographed and shared with [symbolic-migration@eealliance.org](mailto:symbolic-migration@eealliance.org) through a Google Drive folder.

For the schools in Mexico, virtual participation is not a viable option as most schools and families do not have reliable internet service. We will send paper copies of your butterflies to our environmental educator and courier, Estela Romero, in Angangueo, Michoacán.

Currently, schools in Mexico will be closed this fall. We are hopeful that they will reopen in January 2021. In the interim, Estela will deliver your Ambassadors to the sanctuaries themselves and to local churches where small groups of students can retrieve them. You will be able to read about these deliveries and see photos on Estela's [Symbolic Migration blog](#) starting in mid-November.

*Continued on page 9*

## BACK-TO-SCHOOL REQUEST

# Donations Sought for Mexico Book Project

*All donors receive certificates that make great gifts for friends, family & teachers!*

As we headed back to school this fall, we took for granted that students in our community would have access to plenty of books and other learning resources. That is not the case, however, in the rural schools near the monarch butterfly's overwintering sites in Mexico.

To help those schools, Monarchs Across Georgia (MAG) created the [Mexico Book Project](#) in 2004. Every year, with donations from people like you, MAG is able to purchase children's books for 30 schools near the mountain town of Angangueo, Mexico.

Please consider making a difference in the lives of schoolchildren who don't have access to the same educational resources that we have in the U.S. Your donation can be an individual gift or the cumulative donations of a school fundraiser.



*Students help carry donated books into their school.*

[Make your online, tax-deductible contribution today.](#)

Thank you for your support.



# Notes from Monarch Watch

By Chip Taylor, reprinted with permission from the July 2020 Monarch Watch Update

## Monarch Population Status

There are a number of ways to assess the development of the summer monarch breeding population that lend some predictability to the size of the migratory population. One can use mid-summer numbers gleaned from surveys conducted by the North American Butterfly Association, or eggs per stem counts tallied by the Monarch Larval Monitoring Project, or simply follow the chatter about the numbers of adult monarchs and immatures reported on various social media sites and email lists like Dplex-L. All have merit and all have limitations.

I prefer to break down the numbers of first sightings north of 40N from 1 May to 14 June as reported to Journey North. I look for two things, the timing of arrival across the longitudes as well as the numbers arriving and I look at how those numbers might have been affected by the numbers of first sightings of returning monarchs from 1 March to 30 April. In addition, I ask how the weather might have affected recolonization. To that, I add the forecasts for the mean temperatures for the months of June–August. The result is a prediction each July that is correct more often than it is wrong, but there have been some misses and those are both instructive and humbling.

So, what do these metrics suggest for the coming migration? Actually, the prospects for a reasonably robust migratory population look quite good for the area from central Michigan to 100W in the Dakotas. The numbers from Michigan to the east coast are likely to be lower than for each of the last two years. In terms of the timing of arrivals in the northeast east of Toronto in Canada, and most of northern New England, the recolonization this year was the 6th lowest in the last 21 years. That said, this region has surprised me in the past by producing more monarchs than I expected.

Overall, there should be plenty of monarchs to tag this fall and there is a good likelihood that the numbers this winter in Mexico will be higher than in 2019.

## Western Monarchs

The big question for those interested in western monarchs is whether the population will increase

from the low numbers each of the last two years. The population in the east bounced back from a low of 0.67 hectares in the winter of 2013–2014 to 4.01 hectares in 2015–2016. That was a remarkable rebound and it's reasonable that the western population should be able to do the same, right? Maybe and maybe not.



The conditions in the west in terms of the weather extremes, the distribution of milkweeds, etc. are very different from those in the east. Here is what we can say about the west at this point: there is a mix of favorable and not so favorable reports for the west, but generally,

there are few reports and that is not a good sign. The good reports involve what appear to be good breeding populations in the vicinity of Prescott, Arizona, and in SE Arizona. Good numbers have also been reported in Salt Lake City and the surrounding area with some reports from Idaho. In contrast, Oregon and Washington have been relatively silent and that is not a good sign. Since a substantial number of the monarchs that arrive at the overwintering colonies along the west coast originate from the Northwest, low production there again this year could mean low numbers during this year's Thanksgiving Day Counts. Let's hope things pick up in the west over the next 6 weeks!

## Tagging: Then, Now and in the Future

Over the years, thousands of taggers have contributed to our tagging database. It is an enormous record and a veritable gold mine of information about how the migration functions. The record represents over 2 million tagged butterflies, and lists where, when, and by whom each butterfly was tagged. The sex of each butterfly and whether the butterfly was wild-caught or reared, tagged, and released is also recorded. The record also includes over 19,000 recoveries at the overwintering sites. We have spent the last several years closely examining these records and the data have been used as the basis for two publications. The first, "Is the Timing, Pace, and Success of the Monarch Migration Associated With Sun Angle?" was published in December 2019 and the second, "Evaluating the migration mortality hypothesis using monarch tagging data," should be published soon. Two additional papers are in preparation and more are planned.

*Continued on page 5*

# Notes from Monarch Watch

Continued from page 4

Briefly, the tagging data have revealed new information on the origins of monarchs that reach Mexico, the timing and pace of the migration, differences among regions due to recolonization and weather, the impact of drought years and many other factors. None of these insights into the dynamics of the migration and the monarch annual cycle would have been possible without the assistance of all those who have so generously donated their time and data to the Monarch Watch Tagging Database (which will ultimately be transferred to a national archive). Yet, in spite of these successes, we are not done; there is more to learn. The climate is changing and monarch habitats are continuing to decline, and for these reasons it is likely that the migration will change as well. Continued tagging should enable us to track these changes, and for that, we hope you will continue to tag, report your data, and generally support monarch conservation by creating habitats for monarchs or helping others do so. Thanks, and best of luck this tagging season. Please stay safe.

## Tagging Wild and Reared Monarchs

The following is an abbreviated version of "[Tagging Wild and Reared Monarchs: Best Practices](#)," posted to our Blog last year.

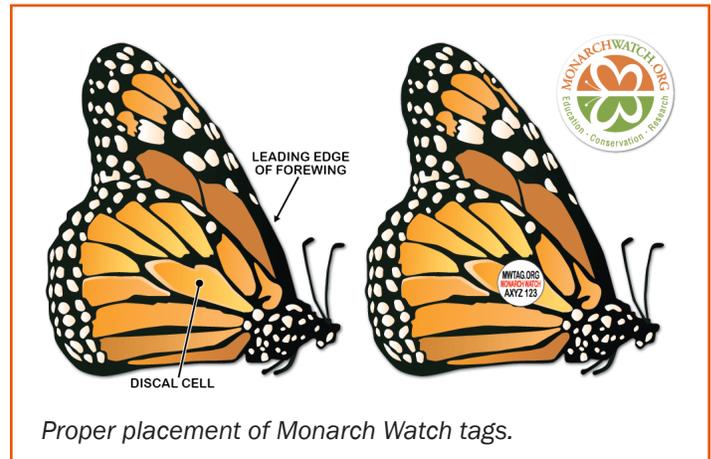
Diving into the data has revealed a number of surprises, such as the difference between the probability that a reared monarch will reach Mexico and the probability that a wild-tagged monarch will do so. The recovery rate is higher for wild-caught monarchs (0.9% vs 0.5%) and it is the data from the wild-caught butterflies that tell us the most about the migration. Frankly, for some analyses, we have to set the reared monarch data aside. That doesn't mean it is not valuable, but its uses are limited.

It should be noted that for tagging data purposes, monarchs captured as adult butterflies should be reported as WILD and adult monarchs reared from the egg, larva, or pupa stage should be considered REARED.

## Tagging Wild-caught Monarchs

For wild-caught monarchs we need to:

1. Increase the number of taggers from western Minnesota, and Iowa westward into Nebraska and the Dakotas to give us a more complete understanding of dynamics of the migration.
2. Increase the number of wild monarchs that are tagged since these provide the most valuable data.



3. Increase the number of taggers who tag from the beginning of the tagging season in early August until the migration ends. Tagging records for the entire season will help us establish the proportion of the late-season monarchs that reach the overwintering sites. When tagging wild-caught monarchs, many taggers run out of tags well before the season ends. That's great, but it would help us to know when all tags had been used by indicating this via the online tagging data submission form.

## Tagging Reared Monarchs

Reared butterflies tend to average smaller than wild migrants. That difference can be reduced significantly if careful attention is given to rearing larvae under the best possible conditions. Large monarchs have the best chance of reaching Mexico, surviving the winter and reproducing in Texas. There are several reasons for this: better glide ratio, better lift with cross or quartering winds, larger fat bodies, more resistance to stress, etc. There are very few small monarchs among those that return in the spring. For those of you who prefer to rear, tag and release, we have a few suggestions:

1. Rear larvae under the most natural conditions possible.
2. Provide an abundance of living or fresh-picked and sanitized foliage to larvae.
3. Provide clean rearing conditions.
4. Plan the rearing so that the newly-emerged monarchs can be tagged early in the migratory season (10 days before to 10 days after the expected date of arrival of the leading edge of the migration in your area).

Continued on page 16

OCTOBER 3-4, 2020

# Registration Open for Virtual Pollinator Symposium

Join Monarchs Across Georgia virtually for the [2020 Pollinator Symposium](#), a two-day pollinator-filled event where you will learn what is being done throughout the state to conserve, protect, and educate the public about important insect pollinators.

The Symposium will kick-off with a keynote address from Brannen Basham on “Restoring Pollinator Habitat.” Other topics on day one include: Project Monarch Health, Bee Smart Eat Smart, pocket pollinator gardens, and a children’s garden tour. Day two offers three virtual field trips with pollinator and plant conservation experts. Special thanks to The State Botanical Garden of Georgia for hosting the virtual presentation of this event.

The registration fee is \$40 for members of the Environmental Education Alliance and \$65 for non-members. Space is limited.

[Register online today.](#)

## Agenda

### Saturday, October 3, 2020

9:00 - 9:15 a.m.	Welcome & Orientation
9:15 - 10:15 a.m.	Keynote Speaker
10:15 - 10:25 a.m.	Break
10:25 - 10:55 a.m.	Session 1
10:55 - 11:25 a.m.	Session 2
11:25 - 11:35 a.m.	Break
11:35 - 12:05 p.m.	Session 3
12:05 - 12:35 p.m.	Session 4
12:35 - 12:45 p.m.	Wrap-up

### Sunday, October 4, 2020

1:00 - 1:40 p.m.	Virtual Field Walk 1
1:40 - 1:50 p.m.	Break
1:50 - 2:30 p.m.	Virtual Field Walk 2
2:30 - 2:40 p.m.	Break
2:40 - 3:20 p.m.	Virtual Field Walk 3
3:20 - 3:30 p.m.	Wrap-up

## Saturday Sessions

### Project Monarch Health

Citizen science project working to track the prevalence of the protozoan parasite *Ophryocystis elektroscirrha* (OE) in monarch butterflies in North America. Learn how you can get involved.

*Paola Barriga, Postdoctoral Researcher and Teaching Associate, Odum School of Ecology, University of Georgia*

### Bee Smart Eat Smart

Curriculum to teach kids of all ages cooking techniques and the importance of pollinators in our food systems. Without a healthy pollinator population, we would not have these delicious, healthy recipes.

*Cora Keber, Director of Education, State Botanical Garden of Georgia*

### Pocket Pollinator Gardens

Even small spaces can host a delightful array of insect visitors. Explore techniques for creating your own potted prairie with Georgia native fillers, spillers, and thrillers!

*Lauren Muller, Conservation Outreach Coordinator, State Botanical Garden of Georgia*

### Children’s Garden Tour

Tour the Alice H. Richards Children’s Garden with a focus on pollination, education, and how each gallery helps teach about the natural environment.

*Katie McCollum, Children’s Garden Curator, State Botanical Garden of Georgia*

## Sunday Sessions

### Native Grasses Walk

Learn the benefits of native grasses in the Elaine Nash Prairie Restoration Project.

*Walter Bland, Managing Partner, Rock Spring Restorations*

### Pollinator Walk

Discover insect residents and learn about the different species that we find, while increasing your insect identification skills.

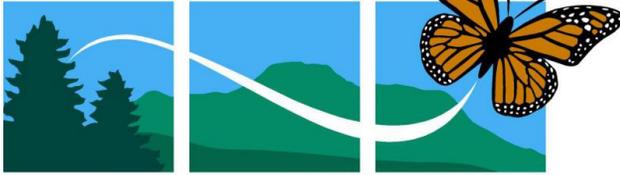
*Becky Griffin, Community and School Garden Coordinator, Georgia Certified Beekeeper and Pollinator Health Program Associate*

### Nature Photography Walk

Experience the natural areas and flora and fauna of The State Botanical Garden, while learning about the principles of nature photography.

*Don Hunter, Nature Rambler*

## Apply for a MAG Award



**MONARCH BUTTERFLY FUND**  
Conserving the Migration

Each year, [Monarchs Across Georgia](#) presents two awards: the Service Award and the Pollinator Habitat Award. A donation to the Monarch Butterfly Fund is made in the name of the award recipients. Nominations for both awards are due February 1, 2021. The awards will be presented at EEA's Annual Conference in March 2021.

### **MAG Service Award**

The MAG Service Award recognizes significant contributions to monarch education, conservation, and/or habitat restoration in the state of Georgia. Two awards are available: one for an individual engaged in formal or non-formal education and one for facility-level recognition.

[Submit a nomination.](#)

### **Pollinator Habitat Award**

The Pollinator Habitat Award recognizes a MAG-certified pollinator habitat that goes above and beyond the minimal certification criteria and has been established for at least three years.

[Submit a nomination.](#)

## Certify Your Pollinator Habitat

Do you enjoy watching and studying caterpillars on their host plants, searching for chrysalides hidden from predators, or observing butterflies and hummingbirds flitting from flower to flower?



Does your school, office, or backyard have bushes, trees and flowers that provide host plants, nectar, and protection for butterflies, bees, hummingbirds, and other pollinators? Is there a source of water or puddling areas for thirsty butterflies? Are there places for them to roost at night?

If so, register your habitat with Monarchs Across Georgia's Pollinator Habitat Program. No garden is too big or too small!

### **Latest MAG-certified Habitats**

- Karen, Ansley, and Julia Durden – Atlanta, GA
- Laura Hetherington Foster – Decatur, GA
- Renee L. Johnson – Lemay, MO
- Volha Dupuis – Decatur, GA
- Southern Conservation Trust Nature Center – Fayetteville, GA
- Jamey and Sam – Chickamauga, GA
- Jessica Dunne – Hiram, GA

## Volunteer for Monarchs Across Georgia

From writing articles, to staffing plant sales, to reviewing grant applications, Monarchs Across Georgia has a volunteer opportunity for you! Check out all the options below and then [visit our website](#) to learn more.

Here are a few ways that you could help:

- Write newsletter articles
- Become a MAG workshop facilitator and co-facilitate workshops
- Review grant applications
- Become part of our speakers bureau
- Post information on our website
- Gather news for our Facebook page
- Help with an event (children's craft or answering questions)

You could also coordinate or assist with:

- Grant administration
- Newsletter editing
- Symbolic Migration
- Mexico Book Project
- Plant sales
- Pollinator habitat certification
- Volunteer coordination
- E-blasts via email list



## Research Reports from the Field: Monarch Biology and Rearing

Monarch Joint Venture's webinar series brings you updates from monarch programs and scientists on a range of pollinator conservation topics, including monarch biology, monitoring, and conservation.

The May 2020 webinar on [Monarch Biology and Rearing](#) was presented by Dr. Sonia Altizer, Project Monarch Health - University of Georgia; Dr. Ania Majewska, Project Monarch Health - Emory University; Ayse Tenger-Trolander, University of Chicago; Dr. Marcus Kronforst, University of Chicago; and Dr. Karen Oberhauser, University of Wisconsin-Madison Arboretum. Dr. Oberhauser moderated questions for the presenters as they spoke about their recent research in monarch biology, ecology, and conservation, specifically as it relates to reared monarchs.

[View Archived Webinars or Register for Upcoming Webinars](#)

## Creating Pollinator Pathways in the Built Environment

In this webinar from July 2020, Dr. Jaret Daniels explains how every landscape, large or small, is now critical to support pollinators. He shares the important role that our growing human-dominated spaces can play in sustaining native wildlife populations.

These spaces include urban parks and neighborhoods, utility and transportation corridors, as well as home gardens and yards. Such landscapes can contain rich flora that contribute significantly to biodiversity. This is of extreme importance in trying to reverse insect declines of the recent times. Deteriorating insect

populations has garnered substantial media attention due to the potential impacts on people, agriculture, and ecological systems.

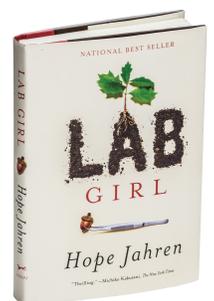
Learn how minor changes in built landscapes help support wildlife, where changes are needed most, and what actions are most beneficial.

Dr. Daniels is associate professor of entomology at the University of Florida and director of the McGuire Center for Lepidoptera and Biodiversity at the Florida Museum of Natural History. His research focuses on insect ecology, population biology and conservation, with particular emphasis on butterflies and other native pollinators. He also serves on the Florida Wildflower Foundation board of directors.

[View the Webinar](#)

## Lab Girl

As a geobiologist, Hope Jahren has studied trees, flowers, seeds, and soil. *Lab Girl*, while being her treatise on plant life, also celebrates the lifelong curiosity, humility, and passion of scientists. Hope takes us back to her childhood in Minnesota, where she spent hours in her father's college laboratory. She tells us how she found a sanctuary in science, learning to perform lab work "with both the heart and the hands."



She extends the mantle of scientist to each one of her readers, inviting us to join her in observing and protecting our environment. Warm, luminous, compulsively readable, *Lab Girl* vividly demonstrates the mountains that we can move when love and work come together.

## GARDEN SPOTLIGHT

# Regal Moth or Royal Walnut Moth

The regal or royal walnut moth (*Citheronia regalis*) is one of the largest and most remarkable moths in the U.S.

**Geographic Distribution.** It is found throughout the deciduous forest areas of the eastern United States, from New Jersey to Missouri, and southward to eastern Texas and central Florida.

**Appearance.** It has a wingspan of 9.5 to 15.5 cm, and females are larger than males. The forewings are gray to gray-green in color, with red-orange veins and creamy yellow spots. Hindwings are orange with creamy yellow spots at the costal and inner margins.

**Lifecycle.** One brood occurs every year. They have been observed from May through mid-September. A second brood may be possible in the deep southern regions, as suggested by a few records. Regal moths have vestigial mouths; i.e., their mouth parts have been reduced and are not functional. They live for about a week as adults, mating the second evening after emergence, and females ovipositing at dusk on the third evening.

Eggs are laid in groups of 1 to 3 on both sides of host plant leaves. They hatch in 6 to 10 days into the famed hickory horned devil caterpillars, which feed alone. Young caterpillars resemble bird droppings and can be found resting on the top of leaves. Older caterpillars look menacing, earning the name “Hickory Horned Devil” due to their large size, bright colors, and red “horns” near the head. Duration of the larval stage is about 35 days, with five instars. The caterpillars then pupate in a burrow in the soil. The pupa is the overwintering stage.

**Host Plants.** The larvae are commonly found on species of the family Juglandaceae, including walnut (*Juglans nigra*), butternut or white walnut (*Juglans cinerea*), and a variety of hickories (*Carya* spp.), including pecan.



Top: Adult regal moth. Above: Caterpillar stage. Photos by Patrick Coin. Source: [https://commons.wikimedia.org/wiki/Citheronia\\_regalis](https://commons.wikimedia.org/wiki/Citheronia_regalis).

Other hosts are sweet gum (*Liquidambar styraciflua*), persimmon (*Diospyros virginiana*), sumacs (*Rhus* spp.), and cultivated cotton (*Gossypium*).

**Natural Enemies.** At least six species of tachinid flies, one species of sarcophagid fly, and one species of braconid wasp have been reported as parasitoids of the regal moth.

## Symbolic Migration

*Continued from page 3*

The cost is a \$10 Passenger Ticket per classroom, which supports the visits in Mexico to deliver printed copies of your electronic butterflies and provide conservation education. The deadline to purchase Passenger Tickets and submit butterflies is October 9, 2020. See the [Symbolic Migration Teacher Packet](#) for details.

Symbolic Migration is a partnership between Journey North, a program of the University of Wisconsin-Madison Arboretum, and Monarchs Across Georgia, a committee of The Environmental Education Alliance of Georgia, a 501(c)(3) organization. [Journey North](#) manages the interactive Symbolic Migration Participant Maps and hosts all educational materials. [Monarchs Across Georgia](#) administers the program and is responsible for all fundraising.

# Protecting Pollinators at Home - Part 2

Reprinted with permission from the Xerces Society for Invertebrate Conservation; part 1 appeared in the Spring 2020 issue.

## When and How to Respond to Garden Pests

- ⇒ **Reconsider your tolerance for pest damage.** A few holes in the leaves of garden plants can indicate a thriving ecosystem and generally, are not cause for concern. Sometimes insects feeding on plants can cause leaves to turn yellow or brown, but infestations rarely kill the plants. For example, lace bugs feeding on asters can have this effect, but the asters typically survive. Small populations of some pests can be a good thing, as they provide food for beneficial species. Also, many beneficial insects eat or otherwise use plants; holes in the leaves of your plants might be a sign of butterfly caterpillar activity or native bee presence.
- ⇒ **Identify the pest and manage it accordingly.** It is important to know which pest you are dealing with to determine how best to manage it. A pest's food and shelter requirements and life cycle often dictate your response. A call to your local extension service can help you identify potential pests, and provide good management suggestions. Make sure to tell your extension service that you are most interested in management options that do not require pesticides. An online search can also provide good management suggestions. You may need to start by searching for the plant species and damage or injury symptoms to figure out the likely pest or disease. Once you know the name of the pest, search by the pest name plus "IPM" (which stands for *integrated pest management*).
- ⇒ **Address the underlying cause of the pest problem.** Your plants might be succumbing to pests because they are unhealthy. Plants become stressed for a number of reasons including whether they get too much or too little water or sunlight, are planted too densely inhibiting proper airflow or if the soil pH doesn't match their needs. While applying a pesticide might kill a pest, it will not address underlying issues that allow pests to thrive. Pests can re-establish on vulnerable plants despite pesticide application(s).
- ⇒ **Physically remove the pest.** If you find diseased or infested plant parts, prune away the damaged areas and dispose of them off-site. With small insect infestations, picking off the pests or spraying them off with a hose can be effective.
- ⇒ **Replace unhealthy plants.** When a plant is perennially prone to pests, and efforts to improve its health have failed, sometimes the right course of action is to remove the plant and replace it with something better suited to the landscape.



Adding pollinator habitat to your garden can also attract other "beneficial insects" that are natural enemies of common pests and can help keep pest populations in check. (Photo: Justin Wheeler.)

## Mitigating Risks of Pesticides

While we urge home gardeners to forgo pesticide use, if you do choose to use pesticides, please use them judiciously and carefully, to limit harm to pollinators and other beneficial insects such as lady beetles that eat garden pests. Take all precautions to avoid exposing bees and other beneficial insects to pesticides. You can limit exposure by making targeted applications directly to the pest or affected plant and never making applications immediately before or during bloom. Before you use a pesticide, take the time to read the label and follow any advisory language to limit harm.

If you are considering use of a pesticide, please consider the following guidelines:

1. **Try to go pesticide free.** A home garden can thrive without pesticides. If you do decide to use pesticides, use them only when you have found a pest that can compromise the health of your plants, rather than nuisance pests. Never use pesticides for cosmetic reasons.

# Protecting Pollinators at Home - Part 2

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2. If you do decide to use a pesticide, **choose the most targeted, reduced-risk product available.** Start with organic options, but keep in mind that some organic pesticides are toxic to pollinators and other beneficial insects. Avoid multi-use products for disease, insects, and/or weeds. These combination products can be very toxic to beneficial insects. They are also contrary to the concept of using a pesticide for a specific target pest. Some lower-toxicity options for home gardens include insecticidal soap, horticultural oils, and kaolin clay. You can learn more about organic pesticides in the Xerces report, *Organic Pesticides: Minimizing Risks to Bees and Other Agriculturally Beneficial Insects*. You can also compare the toxicity of different pesticides to bees using the online Bee Precaution tool developed by University of California Agriculture and Natural Resources (available at [www2.ipm.ucanr.edu](http://www2.ipm.ucanr.edu)). Before you treat for a suspected pest, be sure that you have identified it properly, and determined if it is likely to cause harm.
3. **Avoid applications where bees are present.** In an effort to avoid direct exposure of bees, pesticides should never be applied when bees are foraging. Since pesticide residues can stay active on plants causing harm hours to days after an application, it is best to avoid any applications during bloom. Some plants, such as apple trees, attract pollinators even before they bloom. If you notice pollinators visiting a plant, even one that is not in bloom, forego any pesticide application.
4. **If you use a landscaping company, learn about their practices.** Do they use any products to manage weeds, disease, or insects? If so, ask them to discuss options with you before making any applications.

## Managing Weeds in Your Yard and Garden

While many “weedy” species can actually provide pollinator resources, you will want to have a strategy to address unwanted and problematic plants. We suggest the following.

1. **Accept some weeds in your yard.** If you have an unwanted, native weed, you may want to allow some of it to persist in confined areas since native plants tend to provide native pollinators with nectar and pollen and serve as larval host plants for moths and butterflies. If you have invasive weeds, it is best to remove them. Check the web site of the USDA National Invasive Species Information Center or give a call to your local extension service to determine whether a species is invasive. If you appreciate a more manicured aesthetic, consider strategically setting aside areas of your yard to be more wild. You might spend more time managing weeds next to your front door or patio while leaving areas such as a side yard untamed. The less-managed areas can provide nesting habitat for pollinators.
2. **Weed by hand or with hand tools.** Advancements in weeding tools have made hand weeding efficient, easy, and comfortable. Many stores now carry effective tools that can be used without bending over.
3. **Time your weeding for early in the plant’s growth cycle.** It is best to remove weeds before they go to seed. Weed removal is also most



Above: Signs can go a long way toward acceptance of an “untidy” yard. (Photo: Elizabeth Henkel.)

Below: Weeding can be a relaxing activity, giving you time to de-stress from daily life and the chance to carefully observe and appreciate the diversity of wildlife your garden supports. (Photo: Debbie Roos.)



# Protecting Pollinators at Home - Part 2

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effective when root systems are less developed.

4. **Use mulches wisely.** Mulching, including leaf mulch, can be an effective way to control weeds and retain moisture in topsoil during dry spells. Still, heavy mulch can block access to the ground for soil nesting bees and certain mulches (e.g., cedar mulch) can be toxic to bees and ants. We recommend mulching sparingly, and choosing organic untreated mulches rather than colored or rubber mulch.
5. **Solarization, heavily seeded cover cropping, and sheet mulching are effective weed management techniques** if you are preparing larger areas for planting. The Xerces Society guidelines *Organic Site Preparation for Wildflower Establishment* (available from [xerces.org](http://xerces.org)) provide more information about these and other techniques.
6. **After weeding, replant with desirable species** so weeds don't re-establish.

## Managing Mosquitoes and Ticks in and Around the Home

Mosquitoes and ticks are not garden pests but because of their potential health concerns, many people seek to manage them in their yards. Managing these public health pests is most effective at the community level but there are actions you can take at home to limit their presence without harming the pollinators you have welcomed into your yard.

The most effective way to limit mosquitoes in your yard is to first prevent them from breeding and second to take steps to avoid being bitten by mosquitoes. Dumping standing water at least once a week eliminates mosquito

## Bee-Friendly Lawns

Lawns are the single largest irrigated crop in America; we have well over 40 million acres of lawn. "Bee lawns" incorporate low-growing flowering plants into traditional grass, providing valuable forage and the benefits of a home lawn.

If your lawn is already established, you can re-seed with pollinator-friendly lawn mixes that include plants such as clover or creeping thyme. You also can simply accept some flowering weeds. Beyond increasing the number of flowering plants in your lawn, also limit the number of times you mow or only mow a section of your lawn at a time. Xerces' blog "Bee Friendlier With Your Lawn Care" (access via [xerces.org](http://xerces.org)) has many tips for lawn management. The University of Minnesota's Bee Lab also provides tips on how to create and manage bee lawns in a fact sheet, *Flowering Bee Lawns for Pollinators*.



Although white Dutch clover is most obvious, the bee-friendly lawn on left has eight flowers that bloom through the spring and summer. In contrast, the lawn on the right offers little to support pollinators. (Photos: (l) Matthew Shepherd; (r) heipei, Flickr.)

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breeding grounds. Common places where you'll find mosquitoes breeding are in bird baths, backyard pools, flower pots, and gutters. These efforts are most effective if you can also convince your neighbors to remove breeding habitat. Placing screens in your windows and wearing long pants and shirts at times when mosquitoes are most active are valuable ways to avoid mosquito bites. Also, for those evenings when you are sitting outside, set up a box fan to keep mosquitoes away. **Do not use backyard products such as mosquito misters or vaporizers which emit insecticides. These products may also kill pollinators and other beneficial insects and they only kill the mosquitoes that come in contact with the poisons rather than eliminating the source of the mosquitoes.**

It is important to keep in mind that most mosquitoes don't carry disease. Your county health department, as well as online tracking by the Centers for Disease Control and Prevention, can keep you informed as to whether the mosquitoes in your area pose a health risk or are simply a nuisance. More information can be found in the Xerces Society publication *How to Help Your Community Create an Effective Mosquito Management Plan*.

Some ticks also transmit disease. Ticks are most often found in grassy, brushy, or wooded areas. To avoid ticks latching on to you, walk in the middle of trails, wear light-colored clothing, and check your clothing and body for ticks once you come indoors. While we recommend mowing grass less often to sustain pollinators, keeping the grass in frequently used areas (such as where children or pets play) shorter can help reduce contact with ticks. Creating a wood chip or gravel strip between your yard and wooded areas limits tick presence in your yard. Removing leaf litter in frequently used areas also reduces tick habitat. You can learn more in the *Tick Management Handbook* prepared by the Connecticut Agricultural Experiment Station.

### Conclusion

As pollinators move through the landscape they encounter many hazards, including disease, pesticides, and lack of forage and nesting sites. By creating a pollinator garden, you are providing them a safe oasis. Pollinator-friendly yards also inspire curiosity and foster awareness. Once your neighbors see yours, they might decide to add a few pollinator plants in their yard. In some communities, neighbors have combined their efforts to purposefully expand habitats to create corridors that help expand the range of these beneficial species. In this digital age, you can even inspire people far away by sharing your garden through the Xerces Society's Bring Back the Pollinators campaign, a forum celebrating pollinator gardens across the country. And, of course, be sure to take a few moments every day to marvel at the diversity of insects right under your nose.



The most effective way to reduce the number of mosquitoes is to remove potential breeding places. Any object in which water can puddle, including old tires, buckets, and flower pots, may be used by mosquitoes. Dump water from these places at least once a week. (Photo: Pan American Health Organization.)

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## Websites Referenced

### Xerces Society Resources

Bring Back the Pollinators campaign: [bringbackthepollinators.org](http://bringbackthepollinators.org)

*How to Help Your Community Create an Effective Mosquito Management Plan*: [xerces.org/how-to-help-your-community-create-an-effective-mosquito-management-plan-a-xerces-society-guide/](http://xerces.org/how-to-help-your-community-create-an-effective-mosquito-management-plan-a-xerces-society-guide/)

*Organic Pesticides: Minimizing Risks to Bees and Other Agriculturally Beneficial Insects*: [xerces.org/pollinator-conservation/organic-farms/organic-approved-pesticides/](http://xerces.org/pollinator-conservation/organic-farms/organic-approved-pesticides/)

*Organic Site Preparation for Wildflower Establishment*: [xerces.org/guidelines-organic-site-preparation/](http://xerces.org/guidelines-organic-site-preparation/)

Regional pollinator plant lists: [xerces.org/pollinator-conservation/plant-lists/](http://xerces.org/pollinator-conservation/plant-lists/)

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USDA National Invasive Species Information Center: [invasivespeciesinfo.gov](http://invasivespeciesinfo.gov)

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# Butterfly Genomics

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found no evidence for genomic differentiation between eastern and western monarchs. Instead, he found identical levels of genetic diversity.

“Our work shows that the eastern and western monarchs are mating together and exchanging genetic material to a much greater extent than was previously realized,” Talla says. “And it adds to the evidence that it is likely differences in their environments that shapes the differences in their patterns of migration.”

Co-author Amanda Pierce, who led the earlier study on 11 genetic markers, launched the project while she was a graduate student in the De Roode Lab.

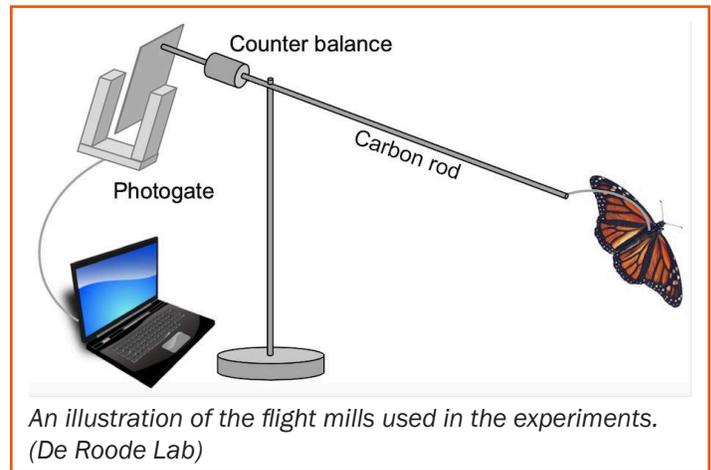
“Monarch butterflies are so fragile and so lightweight, and yet they are able to travel thousands of miles,” Pierce says. “They are beautiful creatures and a great model system to understand unique, innate behaviors. We know that migration is ingrained in their genetic wiring in some way.”

After monarchs leave their overwintering sites, they fly north and lay eggs. The caterpillars turn into butterflies and then fly further, mating and laying another generation of eggs. The process repeats for several generations until finally, as the days grow shorter and the temperatures cooler, monarchs emerge from their chrysalises and start to fly south. This migratory generation does not expend any energy on breeding or laying eggs, saving it all for the long journey.

“For every butterfly that makes it to California or to Mexico, that’s its first journey there,” Pierce marvels.

Previous work had identified a propensity for the eastern and western monarchs to have slight differences in their wing shapes. For the current paper, the researchers wanted to identify any variations in their flight styles.

They collected eastern monarchs from a migratory stopover site in Saint Marks, Florida, and western monarchs from one of their overwintering sites near Oceano, California. Pierce ran flight trials with the butterflies by tethering them to a mill that restricted their flight patterns to circles with a circumference of about 25 feet. The trials were performed in a laboratory under controlled light and temperature conditions that mimicked overwintering sites. Artificial flowers were arranged around the circumference of the flight mills.



“The idea was to try to give them some semblance of a ‘natural’ environment to help motivate them and to orient them,” Pierce explains.

Butterflies were released unharmed from the flight mills after performing short trials.

The results showed that the eastern monarchs would choose to fly for longer distances while the western monarchs flew shorter distances but with stronger bursts of speed. “The more powerful flight trait of the western monarch is like a sprinter, essentially,” Pierce says, “while the eastern monarchs show a flight trait more like marathoners.”

Pierce has since graduated from Emory and now works as a geneticist for the Environmental Protection Agency in Washington, D.C.

Talla, who specializes in bioinformatics, grew up in India where the rich diversity of wildlife inspired him to become an evolutionary biologist. He moved to Sweden to get his PhD, where he studied the genomics of the European wood white butterfly. Although all wood whites appear identical visually, they are actually three different species.

“One of the big questions I’m interested in answering is how does an individual species wind up becoming multiple species?” Talla says. “I want to understand all the processes involved in that evolution.”

He jumped at the chance to join the De Roode Lab. “Monarchs have always been at the top of my list of butterflies I wanted to study because of their incredible migrations,” Talla says. “They are a fascinating species.”

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# Butterfly Genomics

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Last November, he joined de Roode on a lab field trip to the eastern monarch overwintering site, inside and adjacent to the Monarch Butterfly Biosphere Reserve in central Mexico. Tens to hundreds of millions of monarchs blanket the trees and landscape through the winter. “It’s a mind-blowing sight,” Talla says. “It makes you wonder how they all know how to get there.”

Previous tracking and observational studies had shown that at least some western monarchs fly south to Mexico instead of west to California. The full-genome analysis suggests that more than just a few of the western monarchs may be making the trip to Mexico where they mix with the eastern monarchs. And when the butterflies depart Mexico, some may fly west instead of east.

“Evidence from multiple directions is coming together to support the same view,” de Roode says.

The findings may help in the conservation of monarchs. Due to a combination of habitat loss, climate change and lack of nectaring flowers, numbers of both eastern and western monarchs have declined in recent decades, with the western ones showing the most precipitous drop. The U.S. Fish and Wildlife Service is currently considering whether the butterflies need special protections. “If environmental factors are all that drives the differences between the eastern and western monarchs, it’s possible that we could help the western population by transplanting some of the eastern ones to the west,” de Roode says.

The De Roode lab now plans to investigate what exactly in the environments of the butterflies triggers different expressions of their genes.

Co-authors of the current paper include Emory post-doctoral fellow Kandis Adams; Emory visiting student Tom de Man; Sumitha Nallu and Marcus Kronforst, both from the University of Chicago; and Francis Villablanca from Polytechnic State University in Obispo, California.

The work was funded by Emory University, the National Science Foundation and the National Institutes of Health. Learn more about the [De Roode Lab](#) at the [Emory University Department of Biology](#).

## Pollinator Habitat Award Winner

Rose Barton displays her certificate



## Notes from Monarch Watch

*Continued from page 5*

5. Tag the butterflies once the wings have hardened and release them the day after emergence if possible.
6. When it comes to tagging, tag only the largest and most-fit monarchs (see complete article for some guidelines). Records of tags applied to monarchs that have little chance of reaching Mexico add to the mass of tagging data, but do not help us learn which monarchs reach Mexico – unless the measurements, weight and condition of every monarch tagged and released is recorded. There are a few taggers who keep such detailed records and those data can be very informative. If you collect such data and are willing to share it, please contact us. Do not add this information to the standard tagging data sheet.

As a final note, this text is not a directive. We are not telling you what to do; rather, we are simply providing suggestions that may lead to more successful rearing and tagging efforts.