Hallberg Butterfly Gardens 2020

Caterpillar Tending with Meghan Ashley

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Lepidoptera

Butterflies are apart of the scientific Order Lepidoptera. This order includes all moths and butterflies. There are roughly 17,500 known species of butterflies in the world and approximately 160,000 known species of moths.

Why are Lepidopterans important?

Butterflies and moths are essential to the survival of many habitats and are keystone species. Meaning they are so essential to their ecosystem that if they were to be removed would cause drastic changes. Through research and observation, Lepidoptera can notify us of changes in the environment and sometimes diagnose the cause of those changes. The environment directly affects ectothermic organisms (cold-blooded/rely on external heat). Insects often brief lifespan can show changes in communities, dispersion, development, and mortality rate in a relatively short period. Populations of Lepidoptera are dwindling across the board due to interacting stressors such as habitat loss, pesticide use, and invasive species.

Metamorphosis

(Ova) egg: is laid on a host plant either singularly or in small groupings. Egg hatches in roughly four days to a week after being laid. Eggs are not fertilized until laid and are often attached to stems or underside of leaves.

(Larva) Caterpillar: When a caterpillar hatches from its egg, it is in its 1st of 5 instars. Each time the caterpillar grows to its skins maximum capacity, it will split open and shed its skin to reveal its larger fresh layer of skin underneath. Each shed represents a new instar. Some caterpillars change color as they progress through instars. If a caterpillar is hosting on a toxic plant, the caterpillar's toxicity increases as it eats and grows. Another form of protection is called 'aposematism' (bright warning colors). Red, yellow, black, white is common. Caterpillars in the swallowtail family (Papilionidae) have an 'osmeterium,' which is an inflatable set of ‘horns' above the caterpillars head that inflate when threatened and exudes a foul odor.

(Pupa) Chrysalis: When a caterpillar is nearing the end of its 5th instar it will often leave the host plant to find a place to shed for the fifth time and reveal its chrysalis. Some caterpillars like horizontal surfaces like the Monarch butterfly. Others like vertical surfaces, like the anise swallowtail. While some use both vertical and horizontal surfaces like the pipevine swallowtail, they will often camouflage their chrysalis to the background it attaches. If the chrysalis is not going to overwinter (hibernate through winter), then it will eclose (emerge) in 10-14 days. Lepidoptera can

overwinter for long periods to wait for ideal conditions. The anise swallowtail has been observed to overwintering for up to 7yrs. The yucca moth has been recorded overwintering for up to 30 years!

(Imago) Butterfly: When a butterfly emerges, its wings are shriveled, and its abdomen is oversized and full of liquid. It immediately needs a place to hang upside down to excrete extra fluid and pump blood into its wings for them to expand correctly. Emerging can take about 20mns or less, while the wings take about an hour or more to harden. The typical lifespan of an adult butterfly is 2-4 weeks. Most insects spend the majority of their life as a larva or immature. The primary purpose of an adult butterfly is to mate and reproduce.

Caterpillar Care

Information to consider with the caterpillars' best interest in mind.

- **Caterpillars close to home**: Instead of purchasing caterpillars online, it is best to care for caterpillars near or in your yard for virus prevention. Releasing a butterfly from a different location can introduce diseases that were not previously in the area.
- **Less than 10**: The Xerces Society professional analysis states that raising caterpillars in chambers is not a viable form of conservation and is purely hobby/educational. Raising less than 10 caterpillars at a time is highly recommended. When raising and releasing large numbers of butterflies, many unknown variables can potentially harm wild populations. Such as introducing disease or less robust and slightly domesticated individuals.
- **Sync with the seasons:** Metamorphosis is a highly successful survival method partially due to the ability to adapt varying life cycle stages with the changing seasons. For example, depending on the duration of daylight, a caterpillar is exposed will determine if the caterpillar will emerge from its chrysalis the same season or if the daylight hours are getting shorter, informing the caterpillar winter is near. A chemical reaction signals the caterpillar into a hibernation-like state called overwintering, which means it will remain in its chrysalis over the winter and emerge next spring.
- **Keep your tools clean:** It is crucial to keep your devices clean. This includes washing your hands, and any netting or chambers your caterpillars are exposed to for prevention of outside contamination the caterpillar would not be introduced to if you were not handling their environment.

Tending the Lifecycle

Watching the butterfly lifecycle unfold in front of you can be very rewarding. There are many ways this can be done.

Tending the Wild: Complete metamorphosis is a highly successful adaptation that has evolved over millions over the years and is used by most insects alive today. Below are examples of different methods with varying levels of participation.

- **Plant and observe**: Plant the desired host and nectar plants of butterflies in an area. Sit back and enjoy watching the caterpillars that make their way to the buffet you have grown for them. It is recommended to plant broad groupings of plants and separate host plants

from nectar plants. The Xerces Society recommends at least a 4' x 4' grouping of each nectar source for pollinators. (Plant native when possible)

- **Lend a little hand**: For an added layer of protection, you can cover a host plant that is being eaten by desired caterpillars with a chamber made of hardware cloth or a 'caterpillar sleeve' made of nylon or vinyl screen. ** *Please note: once plant is covered, butterflies will no longer be able to lay eggs on this plant.***

- **Potted plants**: In a small to medium-sized potted host plant, insert a metal' tomato cage' into the soil and wrap screen around the tomato cage to create a safe chamber for caterpillars to munch leaves.

- **Hand fed**: This refers to providing freshly cut plants for caterpillars in a caterpillar chamber. If choosing this method, please do comprehensive research beyond this paragraph (review resources page). This method takes the most work and caution. Recommend raising less than ten caterpillars per species. Unknown variables in mass rearing are potentially harmful to wild populations.
    - **Avoid domestication:** The goal is not to harm wild populations. Keep caterpillars exposed to outside weather conditions so that they can stay in sync with the seasons. Place your chamber in a location that is out the direct sun, rain, but is exposed to outside weather. If you are in an area with wildlife activity, it is recommended to have a reinforced cage with metal or vinyl screen to protect caterpillars from hungry predators (rats, birds) that will chew or peck through a chamber made of soft materials.
    - **Keep food fresh:** Every few days, depending on your plant variety, you will need to offer freshly cut leaves. Cut plants can be placed in a spice jar or small container with water. Make sure to cover any access to water as caterpillars will drown themselves. Please note some caterpillars will eat flowers/fruits, and various parts of their host plant at different instars for extra nutrients.
    - **Keep tools and chamber clean:** We can not avoid viruses and diseases that are found naturally in nature, but we can avoid introducing or contributing harmful stressors/viruses/bacteria by keeping our tools and chambers clean. This includes washing your hands when handing items your caterpillar will be exposed to. Caterpillar frass (poop) should be removed, and the cage wiped clean every few days. A dirty cage can become a cesspool for viruses and cause the caterpillars to become sick. Chambers should be cleaned and sanitized after each round of caterpillars that are raised. It is not recommended to raise multiple species in one chamber. Stress can cause caterpillars to become sick. If raising monarch caterpillars, the chrysalids should be removed from a chamber that contains caterpillars (How to move chrysalids video in resources). Butterfly emergence is the stage in which the OE virus spreads to other individuals. This virus is common, and the goal is not to cure the disease but simply to keep it from unnecessarily spreading to individuals that would not be exposed without our interaction.

Virus and Fatality Prevention

- Common Viruses, parasites, and predators -

- NPV (Nuclear Polyhedrosis): A virus commonly known as 'Black Death' causes caterpillars to liquify. Highly contagious.
- OE (Ophryocystis elecktroscirrha): This protozoan parasite affects over half the US Monarch populations and can weaken or cripple caterpillars. Rarely will OE kill the monarch as it needs the monarch to survive to an adult to spread to the next generation.
- Common parasitoids: wasps, Tachinid flies
- Common predators: Ants, wasps, spiders, assassin bugs and other predatory Hemipterans, birds, lizards, mice, praying mantis, toads
- BT (Bacillus thuringiensis): A naturally occurring bacteria used as an organic agent to protect food crops. Maybe present on organically grown host plants available in stores. Make sure to ask if it is present in the plant you are purchasing. Wash off the plant before offering it to your caterpillars for precaution.
- It is not recommended to raise too many caterpillars in one chamber or multiple species. Stress can cause caterpillars to become sick. Sickness can also happen in response to hunger. A caterpillar may seem to eat slowly for the first few instars, but their appetite grows with their size, becoming veracious by their fifth instar and increasing with warm weather. It can also be a good idea to know how your butterfly species likes to chrysalis and provide a mobile surface in which the chrysalis can be relocated if needed. Such as, the Monarch Chrysalids should be relocated, so the emerging butterflies do not spread OE to the caterpillars below.

Cleaning your chambers

- Chambers and reused caterpillar raising materials should be cleaned between every batch of caterpillars. Wash hands and materials used between handling each rearing chamber.

Bleach VS Borax

- **Bleach:** active and not to be mixed with other cleaning agents. Effective and most efficient sanitizer, but is **bio-accumulative** and **not environmentally friendly**. *Soak chamber and utensils in a 5% bleach 95% water solution for 15-minute minimum.*
- **Borax:** sodium tetraborate is a **boron mineral** found in nature and is not considered to be bio-accumulative or harmful to the environment. It can be mixed with cleaning against such as vinegar.

Cleaner Recipe:
Mix 2 teaspoons of borax, 4 tablespoons of vinegar, 4 tablespoons of hydrogen peroxide and 3 cups of Hot water. For more substantial cleaning power: add 1/4 teaspoon of liquid castle soap. Wipe on cages and tools with a dampened cloth or use a non-aerosol spray bottle.

Resources:

Organizations

- Lepidoptera Society
  https://www.lepsoc.org/
- Xerces Society (invertebrate conservation.'save the pollinators')
  xercessociety.org
- California Native Plant Society (research plants and butterflies of your area)
  calscape.org
- INaturalist (upload your sightings and view world wide observation data base)
  inaturalist.org

Butterfly Gardening

- **'**Gardening for Butterflies' (book)
  By The Xerces Society, published by Timber Press

- Xerces Society pollinator plant list
  https://xerces.org/pollinator-conservation/plant-lists/pollinator-plants-california/

- Butterflies and California native plants
  https://www.laspilitas.com/butterflylist.htm

- California Native Plant Society
  https://www.cnps.org/

Caterpillar Raising

- **Keep Monarchs wild** - https://xerces.org/blog/keep-monarchs-wild
- **Mass rearing Butterflies** - https://xerces.org/blog/rearing-and-releasing-monarch-butterflies-is-not-good-conservation-strategy
- **Monarch raising resource and citizen science** - http://www.monarchparasites.org/
- **Native VS Tropical Milkweed? Plant Native!** *(pod cast episode)*
  https://www.scientificamerican.com/podcast/episode/planting-milkweed-for-monarchs-make-sure-its-native/