

Monarch Butterfly

The Monarch Life Cycle has four stages: **egg, larva, pupa, and adult**

Monarchs leave overwintering sites in February and March and typically reach the northern limit of their North American range in early to mid-June. Adult females lay eggs singly on milkweed species, which the caterpillars rely upon for energy and protective toxins called **cardenolides**. **Milkweeds** are critical for successful development of the caterpillar into an adult butterfly.

Once an egg is laid, the full cycle to adulthood may last **20 to 35 days**, and sometimes longer, depending on **temperature**. The caterpillars develop through five instars before forming a chrysalis and pupating into an adult butterfly. During the spring and summer, an adult monarch spends its **2–5 week lifespan** mating and nectaring on flowers, with females searching for milkweed upon which to lay their eggs. Multiple generations are produced during this time, with the final fall generation migrating to overwintering sites and living for **6–9 months**.

Egg

Eggs are **1.2 mm high and 0.9 mm wide**, have a cream or yellow color, and longitudinal ridges running from the tip to the base.

Eggs hatch about **4 days** after they are laid. Development is slower under cooler conditions.

Monarch females usually lay eggs singly on a milkweed plant, often on the bottom of a leaf near the top of the plant. Eggs can also be deposited on milkweed flower buds, stems, and the top sides of leaves. The dark head of the developing caterpillar can be seen near the top of the egg just prior to emergence.

Larva

Larvae molt as they grow and the stages between larval molts are called **instars**. Each new instar grows and expands until the outer skin splits, the head capsule falls off, and the new larva is able to crawl out of its skin. Monarchs go through **5 larval instars**, which are distinguished by the monarch's head size and presence and length of filaments on their thorax and abdomen.

Development time from egg through the 5th instar stage takes about **9-16 days**, depending on **temperature**. Size is **not a good** determinant of instar. In the larval stage, monarchs are constantly eating, growing up to **2,000 times** their original mass.

During the **1st instar stage**, newly hatched larvae are **2-6 mm long**. They have pale green or grayish-white, shiny, and almost translucent bodies and a **distinct black head**. The body does not get its characteristic white, yellow, and black stripes until after ingesting milkweed. It feeds in a circular motion, often leaving a characteristic, **arc-shaped** hole in the leaf. First and 2nd instar larvae often respond to disturbance by dropping off the leaf on a silk thread and hanging suspended in the air. Time in this larval stage is usually **1-3 days**, depending on **temperature**.

Monarch larvae continue to develop all the way through the **fifth instar**, where they have a vivid and distinct banding pattern. The black bands are wide and velvety, and the front legs look much smaller than the other two pairs. **Fifth instar** larvae move much farther and faster than other instars and can be found far from milkweed plants as they seek a site for pupating. Time in this larval stage is usually **3-5 days**, depending on **temperature**.

Pupa

Just before pupation, a monarch larva will spin a silk pad from spinnerets on the bottom of its head and clasp onto it with hooks from its hind prolegs. It can then hang upside down. After splitting its exoskeleton and wriggling around to remove its larval skin, a stem-like appendage called a **cremaster** appears. This is hooked into the silk pad and allows the pupa to safely hang until it emerges as an adult.

While the process of complete metamorphosis looks like **4 very distinct stages**, continuous changes occur within the larva. The wings and other adult organs develop from tiny clusters of cells already present in the larva, and by the time the larva pupates, the major changes to the adult form have already begun. During the pupal, or **chrysalis stage**, this transformation is **completed**.

Just before the monarchs emerge, their black, orange, and white wing patterns are visible through the pupa covering. This is not because the pupa becomes transparent; it is because the pigmentation on the scales only develops at the very end of the pupa stage. The pupal stage lasts about **8-15 days**.

Adult

Adult monarchs typically live **2-5 weeks** during their breeding season, except the migrating generation, which doesn't reach maturity until overwintering is complete, about **6-9 months**.

Adult monarchs emerge, or **eclose** after about **2 weeks** as a chrysalid. At eclosure, the abdomen contains most body fluids and wings are shrunken. The adult hangs upside-down and pumps fluids into wings until they expand and stiffen, then flies and feeds on nectar plants.

Adults reach sexual maturity in **3-8 days**. When mating, the male and female stay coupled from one afternoon until early the next morning, sometimes up to **16 hours**. Females begin laying eggs immediately after mating and both sexes can mate several times during their lives.

Monarchs sequester a **cardenolide toxin** acquired as larvae from their milkweed host plants. This toxin makes them **unpalatable** to some predators as larvae and adults. They advertise this toxin with their brightly colored wings and larval stripes.

Resources

All of Nature (Blog with monarch lifecycle)

Monarch Butterfly Eggs (June 6, 2023)

<https://allofnature.blogspot.com/2013/06/monarch-butterfly-eggs.html>

Monarch Butterfly Egg Hatching (June 10, 2013)

<https://allofnature.blogspot.com/2013/06/monarch-butterfly-egg-hatching.html>

Monarch Caterpillar Growth (June 23, 2013)

<https://allofnature.blogspot.com/2013/06/monarch-caterpillar-growth.html>

Monarch Caterpillar Prepares to Become Chrysalis (June 23, 2013)

<https://allofnature.blogspot.com/2013/06/monarch-caterpillar-prepares-to-become.html>

Monarch Caterpillar Changes to Chrysalis (June 24, 2013)

<https://allofnature.blogspot.com/2013/06/monarch-caterpillar-changes-to-chrysalis.html>

Monarch Butterfly Emerging From Chrysalis (July 6, 2013)

<https://allofnature.blogspot.com/2013/07/monarch-butterfly-emerging-from.html>

Webinars and Podcasts

In the Life of Monarchs East of the Rockies: Biology and the Great Migration (December 8, 2023)

<https://youtu.be/0BfZsM0Dr-4?si=Ebuz8jVx1nhgupdl>

Episode 6: A Monarch's Life: Migration, Survival, and Barfing Blue Jays (December 5, 2023)

https://youtu.be/rInVvPP01SM?si=SBRIM3nGRy9WfO_9

In the Life of Western Monarchs: A Community Science Approach to Conservation (November 17, 2023)

https://youtu.be/Tgmz8JhnXuY?si=Qk_tIsV_037EFt8d

Episode 4: Potato Chips, Leaves, or Butterflies? The Art and Importance of Counting Western Monarchs (November 7, 2023)

<https://youtu.be/Xmg6Nc1ZYuQ?si=F8aW2zs8oCPQiTQI>

Monarchs in a Web of Life - Predators, Parasites, and Disease (March 26, 2019)

<https://monarchjointventure.org/resources/monarch-webinar-series/background-on-monarchs/monarchs-in-a-web-of-life-predators-parasites-and-disease>

Journal articles

Rethinking Monarchs: Does the Beloved Butterfly Need Our Help? (January 15, 2024)

<https://e360.yale.edu/features/monarch-butterflies-milkweed-home-breeders?fbclid=IwAR1RtGIJfcNhE1BauRq5bDbJ2PP-tDuxbyQZX2UNkScAp179pbInTBroCuM>

Overwintering and breeding patterns of monarch butterflies (*Danaus plexippus*) in coastal plain habitats of the southeastern USA (June 27, 2023)

<https://www.nature.com/articles/s41598-023-37225-7>

Migration of Eastern North American monarch butterflies via the South-east and the Atlantic: evidence from stable isotopes, thin layer chromatography, DNA and phenotype (June 16, 2023)

<https://academic.oup.com/biolinnean/article-abstract/139/3/294/7199707?redirectedFrom=fulltext&login=false>

Area of forest occupied by the colonies of monarch butterflies in Mexico during the 2022-2023 overwintering period (March 21, 2023)

https://files.worldwildlife.org/wwfcmssprod/files/Publication/file/3oj167d505_WWF_Monarch_Butterfly_Report_2022_2023_FINAL.pdf

Oriented migratory flight at night: Consequences of nighttime light pollution for monarch butterflies (April 27, 2022)

<https://www.cell.com/iscience/fulltext/S2589-0042%2822%2900581-8>

Do North American Monarch Butterflies Travel to Cuba? Stable Isotope and Chemical Tracer Techniques (August 2004)

https://www.academia.edu/19139948/DO_NORTH_AMERICAN_MONARCH_BUTTERFLIES_TRAVEL_TO_CUBA_STABLE_ISOTOPE_AND_CHEMICAL_TRACER_TECHNIQUES

In the News

Western Monarch Count Tallies 233,394 Butterflies (January 30, 2024)

<https://xerces.org/blog/western-monarch-count-tallies-233394-butterflies?fbclid=IwAR3fmiFN7XE-e4TqUIU9guNbDO6hwNjTe-DtTgKP43d42GL9wGcAJLSO3wI>

Troubling news for monarch butterfly populations (March 21, 2023)

<https://www.worldwildlife.org/stories/troubling-news-for-monarch-butterfly-populations>

Monarch “Super Generation” in Our Own Backyard (Winter 2022, pages 19-21).

https://extension.umd.edu/sites/extension.umd.edu/files/2022-11/Fall_2022_final.pdf

Monarch Larvae Attaching to its Silk Pad (September 21, 2020)

<https://monarchbutterflyusa.com/monarch-larvae-silk-pad/>

Online Resources

Xerces - Monarch Butterfly Conservation

<https://xerces.org/monarchs>

Monarch Watch - strives to understand and conserve the monarch migration by enlisting volunteers to set up waystations and tag monarchs during the fall migration.

<https://www.monarchwatch.org/>

Monarch Joint Venture - a nonprofit organization building a national partnership of federal and state agencies, other nonprofits, community groups, businesses, and academic programs working together to conserve monarch butterflies and other pollinators.

<https://monarchjointventure.org/>

Journey North - This website provides information on tagging and monitoring monarch butterflies as they migrate in the eastern U.S.

<https://journeynorth.org/monarchs>

Project Monarch Health - Project Monarch Health is a community science project working to track the prevalence of the protozoan parasite *Ophryocystis elektroscirrha* (OE) in monarch butterflies in North America.

<https://www.monarchparasites.org/about>

Monarch Larva Monitoring Project - involves citizens in collecting data on larval monarch populations and milkweed habitat.that will help to explain the distribution and abundance patterns of monarch butterflies in North America.

<https://mlmp.org/>

iNaturalist - iNaturalist helps you identify the plants and animals around you while generating data for science and conservation.

<https://www.inaturalist.org/projects/monarch-butterflies>