

Michigan Garden Clubs, Inc.
The Black Swallowtail Butterfly
Lesson Plan
Michigan K-12 Standards: Science

Key Concepts:

1. Definition –What makes a butterfly a butterfly?
2. Groups – What does the butterfly’s “family tree look like?”
3. Life Cycle – What are the stages of a butterfly’s life?
4. Anatomy - How is an adult butterfly’s body constructed?
5. Function - How is the butterfly important in our ecosystem?
6. Threats – What threats does the Black Swallowtail face?
7. Personal responsibility – What can we do to encourage more the Black Swallowtails?

Michigan Standards Science

Listed below are the *Michigan Science Standards* this lesson plan will meet at each grade level.

First Grade

Structure, Function, and Information Processing

1-LS1-2 Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.

Second Grade

Interdependent Relationships in Ecosystems

2-LS2-2 Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

Third Grade

Interdependent Relationships in Ecosystems

3-LS4-4 Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

Fourth Grade

Structure, Function, and Information Processing

4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Fifth Grade

Matter and Energy in Organisms and Ecosystems

5-PS3-1 Use models to describe that energy in animals’ food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.

Sixth-Eight Grade Middle School

Human Impacts

MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

MS-ESS3-4 Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth’s systems.

Definition: What is a butterfly?

- A butterfly is an adult flying insect that belongs to the group Lepidoptera, a Greek word that mean scaly wings. This name is a perfect fit because all the insects in this group have wings covered with thousands of scales in overlapping rows. Moths also belong to this same group. Lepidoptera is a very large group with more than 120,000 different kinds of butterflies and moths in 135 families. What makes the butterfly special is how the scales are arranged in colorful patterns.
- What makes a butterfly a butterfly? All butterflies have six legs, three main body parts, a head, thorax, (chest) and an abdomen (tail). They have wings, two antenna and an exoskeleton.

Classification of Butterflies: What does the butterfly’s family tree look like?

The butterfly belongs to the kingdom of animals, the phylum of arthropods, the class of insects, and the order of Lepidoptera.

Kingdom Animalia (animals)

Phylum Arthropoda (arthropods, invertebrate animals with exoskeleton, segmented body, and jointed legs)

Class Insecta (insects, arthropods with 6 legs, 2 antennae, and a 3-part body)

Order Lepidoptera (butterflies and moths)

Life Cycle

- Female lays an egg on a host plant.
- After 4-9 days the caterpillar will appear.
- Over the next three weeks they will grow two inches long.
- Each new skin has a different color.
- When grown, the caterpillar will crawl away from its host plant and attach to a branch.
- It sheds its skin many times until the last time it reveals a chrysalis, a hard outer shell.
- Inside the chrysalis, the caterpillar becomes a pupa.
- In about two weeks, it will slowly change into a butterfly.
- The chrysalis will crack open, and the young butterfly will come out.
- It hangs upside down for a few hours so its soft wings can harden to fly away.
- Adult butterflies live about two weeks, sipping nectar from only a few kinds of flowers.

Stages

- **Egg Stage** – Tiny yellow spheres on the leaves of dill, fennel, parsley and rue. Lasts 4-9 days.
- **First Instar Stage** - After a few days, a small black 1/16th of an inch creature appears, with a white or orange band in the middle. This is the first instar stage. It's eat all the time for several days.
- **Second Instar Stage** – The young larvae is mostly black with a white saddle. The white saddle is due to uric acid that protects this larvae from poison chemicals in the plants it eats. Size ranges from about 4.5 to 8 mm.
- **Third Instar Stage** – The third instar caterpillars look a lot like the second. Both are black with red/orange spikes, with the white band still around their middle. Size range from about 8mm to 13mm (1.3cm).
- **Fourth Instar Stage Full Grown Caterpillar** - Fourth instar caterpillars look very different from the 2nd and 3rd instar. It has black, white, and pale greenish stripes dotted with yellow all along its body. Early in the fourth instar, the middle white band can still be seen, but it fades away as the caterpillar grows and stretches its skin. Their size ranges from around 1.3 cm to 2.5 cm.
- **Fifth Instar Stage to the Pre-Pupa Stage** - Fifth instar caterpillars have green and black bands with yellow spots along the black bands. They grow to about 4 cm before pupating.
- **Early Pupa Stage** - Once they find a place to pupate, they will stay in that spot for a while without moving very much. Sometimes for as long as 24 hrs. Eventually they spin silk thread to attach themselves to the object they decided to pupate on, often a stick. Its feet are no longer touching the stick, except at its last segment. It spins a silk thread around its face and head.
- **Late Pupa Stage** - After another 24 hours, they molt one last time. After this molt they are no longer a caterpillar/larva, but a pupa that has formed a chrysalis. The Black Swallowtail chrysalis dark. That makes it look like part of a stick. Yet, some are green or light brown.
- **Recently Emerged Butterfly** - After pupating for around 9-11 days, the adult butterfly emerges from its chrysalis. After the butterfly emerges is hangs upside down beside its chrysalis shell for a couple hours to get fluids into its wings. The fluid hardens the wings and helps them fly.
- **Black Swallowtail Male and Female** - When comparing the male and female color, the male has more yellow and less blue. You can see some individual color pattern differences between the females too.



First Instar Stage



Second Instar Stage



Third Instar Stage



Full Grown Caterpillar



Pre-Pupa Stage



Early Pupa Stage



Late Pupa Stage



Recently Emerged Butterfly



Adult Butterfly with
Chrysalis Shell



Black Swallowtail-Male



Black Swallowtail-Female

<http://www.pbase.com/rcm1840/lifecycleofbls>

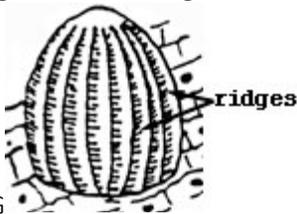
Anatomy – BUTTERFLY ANATOMY

ADULT

The body of an adult butterfly is divided into the same major parts as the larva: head, thorax. And abdomen. There are four main structures on the adult head: eyes, antennae, palpi and proboscis.

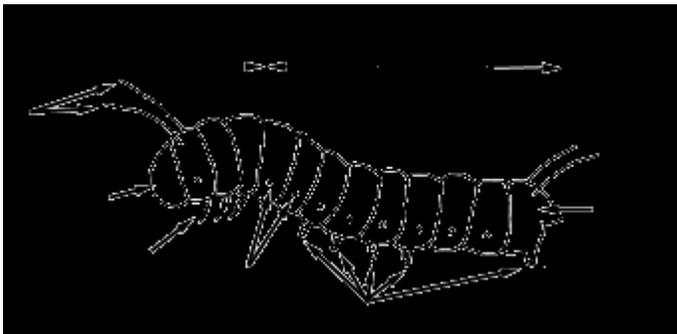


The two antennae and two palpi give butterflies a sense of smell. Organs on the back at bottom of legs, “taste” sweet liquids. The straw-like proboscis is the butterfly's tongue, through which it drinks nectar and water for nourishment. When not in use, the butterfly curls up its proboscis. All butterflies have four wings: two hindwings and two forewings. Veins give the wings structure, strength and support.



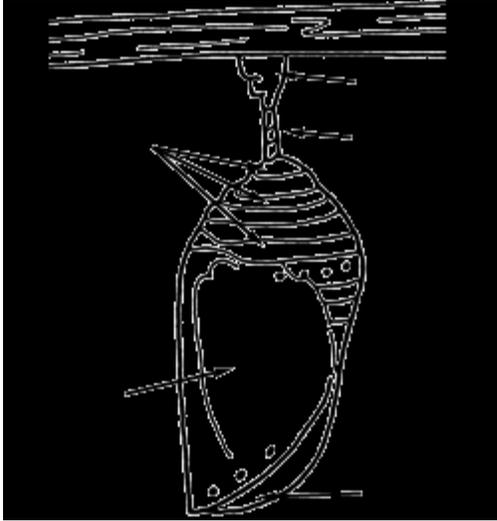
EGG

Each butterfly egg is surrounded by a hard outer shell to protect developing larva. The raised areas on an egg shell are called ridges. They are formed inside the female before she lays the egg. The male monarch butterfly pictured has a black spot on each hindwing that is made up of specialized scales. The female monarch's blackwebbing is thicker with spotless hindwings.



LARVA (Caterpillar) Larvae have three distinct body parts: head, thorax and abdomen. The head has a pair of very short antennae, mouthparts (upper lip, mandibles, and lower lip) and six pairs of very simple eyes, called ocelli. Even with all of these eyes, the caterpillar's vision is poor. The antennae help guide the weak-eyed caterpillar and the maxillary palps, which are sensory organs, direct food into the larva's jaws. Each thoracic segment has a pair of jointed, or true legs, while some of the abdominal segments have false legs, or prolegs. There are usually five

pairs of prolegs. The prolegs have tiny hooks on them that hold the larva onto its silk mat or leaf. The fleshy tentacles at the front and rear ends of Monarch larvae are not antennae, but they do function as sensory organs.



PUPA (Chrysalis). When it pupates, a butterfly larva splits its exoskeleton and wiggles out of its larval skin. When this skin moves far enough down the body, the cremaster appears. The cremaster is a spiny appendage at the end of the abdomen. The butterfly hooks its cremaster into a silk pad spun by the larva just before pupation; it will hang from this until it emerges as an adult. The freshly exposed pupa is very soft and delicate until it hardens. You can see many different body parts on the pupa, including the wings, abdomen, legs and eyes.

Resource: <http://www.monarchwatch.org/biology/index.htm>

Functions - How is the butterfly important in our ecosystem?

Butterflies are a part of the web of life. They support birds and amphibians, as well as insects. No matter what the stage of its life cycle (egg, caterpillar, chrysalis or adult), the butterfly is a source of food for some other creature. When you create a garden that attracts butterflies, you create a habitat for a variety of beneficial insects, birds, bees, and other wildlife.

The butterfly's primary contribution is to pollinate flowers, including fruit and vegetables blossoms that provide nectar for a variety of adults. Many species of native plants provide food and nectar for butterflies and their larvae.

Threats - What threats does the Black Swallowtail face?

Do you ever wonder, *Where have all the butterflies gone?* Butterfly populations are declining worldwide primarily due to loss of habitat. This is caused by modern agricultural and forestry practices, along with development and cropland conservation. All of this has contributed to the loss of food sources for the butterfly. Today butterflies are becoming increasingly scarce, with many endangered and some actually extinct. So great has been the decline in the number of some species in the last two decades that the U.S. Fish and Wildlife Service has launched a major campaign aimed at saving declining species.

A second factor affecting butterflies is the misuse and overuse of pesticides and herbicides. These types of lawn care and plant maintenance products contain chemicals that will kill butterflies and other beneficial insects in both their adult and larval phases of the life cycle. Systemic pesticides, as well as the use of *Bacillus thuringiensis* (BT) should also be avoided. In order to successfully invite butterflies into your

garden, you need to endure the caterpillars and the holes they chew in their host larval plants. By eliminating toxic chemicals from the butterfly area, you will enjoy your habitat garden's long season of bloom and find it alive with butterflies, beneficial insects, bees, birds, and other critters.

Personal Responsibility

One of the best ways to help butterflies survive is to provide adequate habitat in our own gardens and neighborhood communities. You too, can help conserve butterflies by planting the nectar and larval plants they need to survive during all stages of their life.

Which of the habitat essentials – food, water, and shelter – are you providing right now? What are you already attracting to your garden? Learn what local butterflies visit your area and their feeding habits. Visit your garden on a warm sunny day in the late morning or early afternoon to observe the butterflies feeding. Butterflies and plants along with the habitats they live in form one of the most intricate and balanced relationship known in nature.

Allow at least a small part of your garden to go 'wild' with minimal management. An example of this concept is to let your edibles, including herbs planted in the ground or in containers, blossom and go to seed. Emphasize caterpillar food plants that also perform double-duty as nectar plants, and plant them in an area that can grow undisturbed. Plant enough for the caterpillars to devour during their various instar stages. Many butterflies are plant specific. This means the female butterfly will only lay her eggs on one particular genus of plants.

Following are some healthy types of habitats:

Gardens – Butterfly gardens within developed areas (residential areas, parks, schools, and cultural institutions) provide much needed habitat for butterflies. These butterfly havens may be a few square feet within an urban backyard, or a larger managed garden attached to an educational institution, cultural center or a corporate office park. In addition to these butterfly habitats benefiting butterflies and other pollinators, they serve to educate children and adults on conservation activities, engage them in scientific inquiry and may lead to increased involvement in conservation activities.

Managed Corridors – The US Department of Transportation indicates there are almost 9 million miles of highways in the US. In addition, there are more than 5 million acres of land within utility right-of-way. When managed properly, these easements can provide critical habitat for pollinators. Begin by removing invasive species and replace with a mix of milkweed and native flowers with overlapping bloom times. Mowing should be limited to when plants have died back. Keep in mind that mowing at any time, even in the winter, kills insects. In the summer some insects cannot get away from the mower, especially eggs and caterpillars. In winter, insects may be dormant in leaf litter or plant stems. Mowing in patches ensures that pollinators can recolonize the mowed areas. Since roadways and utility corridors are highly visible, consider adding a sign or informational brochures in highly frequented areas, such as rest stops, to educate the public about your conservation efforts.

Agricultural Areas: Agricultural fields used to be an important source of milkweed for monarch caterpillars. Milkweed historically grew alongside crops, and provided abundant food for monarch caterpillars. With the introduction of herbicide tolerant crops, management shifted from a till-based approach to the widespread use of herbicides. This practice has diminished much of the native milkweed growing in agricultural areas, since milkweed can survive some tilling, but cannot survive herbicides. Farmers have an important role to play in the conservation of monarchs and pollinators in general. Native flowers, including milkweed planted in fallow fields, hedgerows and farm field margins, provide food for butterflies. Use of low-till and no-till farming techniques allow more milkweed to grow alongside crops. Avoidance of pesticides and minimal, well-timed herbicide applications is a must for pollinator-friendly farming.

Natural and Restored Areas: Nature preserves, parks or areas not actively being used for another

purpose may be ideal as a butterfly habitat. Restored areas are lands that have been specifically replanted or re-purposed for conservation. Audubon Preserves or Wildlife Refuges are excellent examples of habitat for a variety of wildlife including butterflies. Natural areas may also be located in high traffic areas. Trail margins in prairies, campsites and picnic areas present opportunities to enhance butterfly habitat. Minimal management and disturbance, including the avoiding of mowing until butterflies have migrated from the area, is essential. Mowing kills insects any time of the year. Mowing in patches ensures that pollinators always have access to undisturbed patches of habitat, and that surviving insects can recolonize the mowed area. Avoid using pesticides and herbicides both.

By including various native milkweed species in urban backyard gardens or larger gardens in the community, managed highway and utility corridors, agricultural areas as well as nature preserves, parks and restored areas, you will discover the joys of helping other pollinators too. Please plant milkweed to support a variety of beneficial insects, bees, butterflies and other pollinators who use it as a valuable nectar resource. <http://www.xerces.org/milkweed-seed-finder/>

From: Inviting Butterflies Into Your Garden: An Educational Publication of *National Garden Clubs, Inc.*

Activities

Activity 1- Identify Characteristics of the Black Swallowtail Butterfly.

1. Use overlapped shingles (like on a roof) to demonstrate the structure of butterfly wings.
2. Read text and use its pictures to determine the behavior patterns in the parents that helps offspring survive. (State Standard Grade 1)
3. Develop a simple model that mimics the function of an animal pollinating plants. (State Standard Grade 2)
4. Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun. (State Standard Grade 5)

Activity 2 – Explore Life Cycle of a Black Swallowtail Butterfly

1. Use pictures, worksheets and color to show the stages of the circular lifecycle.
2. Have students label a life cycle diagram.
3. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. (State Standard Grade 4)

Activity 3 – The Black Swallowtail Butterfly and the Environment

1. Read stories about other animals that have become extinct.
2. Make a list with the students of the reason butterflies are important to our environment.
3. Formulate a letter to a Congressman listing the benefits of a student-lead solution to a problem caused by the changing environment, mentioning how the types of plants and animals that live there may be affected. (State Standard Grade 3)
4. Work out a maze that shows how a caterpillar can become a butterfly if he avoids the troubles on the maze.
5. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. (State Standard Gr. 6-8 Middle School)
6. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. (State Standard Grade 6-8 Middle School).