

# Butterflies and Moths



*Lake Shelbyville Eco-Meet*  
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## THE LIFE HISTORY OF MOTHS AND BUTTERFLIES

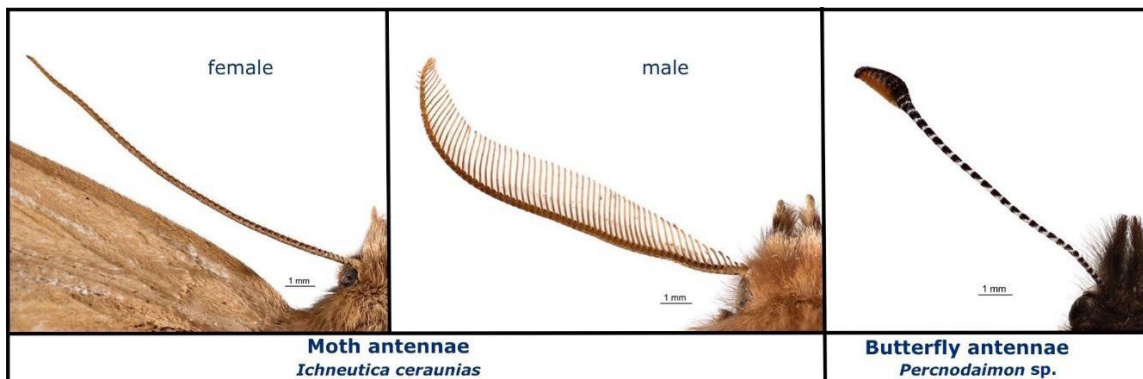
Both moths and butterflies belong to the insect order *Lepidoptera*, hence the study of these insects being called Lepidopterology. Members of this order have scales over most of their wings. The order *Lepidoptera* is estimated to contain nearly 160,000 species of moths and butterflies, more than 75% of this order are considered moths. While moths and butterflies have similarities in anatomy, life cycles, habitats, and appearance – there are key differences between their behavior to differentiate the two.

Butterflies are widely celebrated across the world for their beauty and valuable contribution to the ecosystem. The first known butterfly fossils are dated between 40-50 million years ago during the Eocene epoch. Scientists hypothesize that millions of years ago, the ancestor of the butterfly was the nocturnal (moth) and that over time several species became day flying. Butterflies and moths are insects that have 6 jointed legs, 3 body segments, 2 antennae, and 2 pair of wings.

## DIFFERENCES BETWEEN BUTTERFLIES AND MOTHS

### Wings

Typically, butterflies will have more bright and vibrant colors on their wings compared to moths. However, as you will find in this study guide, some moths can have spectacular colors and a few butterflies will have grey/brown dull colors. While color may not always be the best indicator, the position in which these two insects hold their wings can be a tell all sign. At rest, butterflies hold their wings vertically over their back and have knob-like clubs at the tips of their antennae. Moths, at rest, will hold their wings flat to the sides of their body and will have plumose or feather-like antennae. The antennae are used for smelling as well as for touching and orientation.



**Figure 1. Moth vs. Butterfly Antennae**

Moths will also have a small, bristle-like structure between their forewings and hind wings called a frenulum. The frenulum connects these wings and allows both sets of wings to move together during flight. Butterflies do not have a frenulum.

### **Diurnal vs. Nocturnal**

Butterflies are typically diurnal, meaning that they are most active during the day. Moths are typically nocturnal and active at night. There are exceptions to this – the Hummingbird Moth (named after the Hummingbird like the name suggests) are diurnal and can commonly be seen hovering over flowers and using their proboscis to take in nectar.

### **Difference in Life Cycle**

While the life cycles of moths and butterflies are very similar, the structures built to protect their young in the pupae stage is where they differ. Many moths spin silk thread to make cocoons. Cocoons can be formed many places. Butterfly caterpillars will not spin cocoons. Rather than a cocoon, butterflies will form a structure with a hard, smooth outer shell called a chrysalis. While both structures differ, both are used to protect the species during the pupae stage.

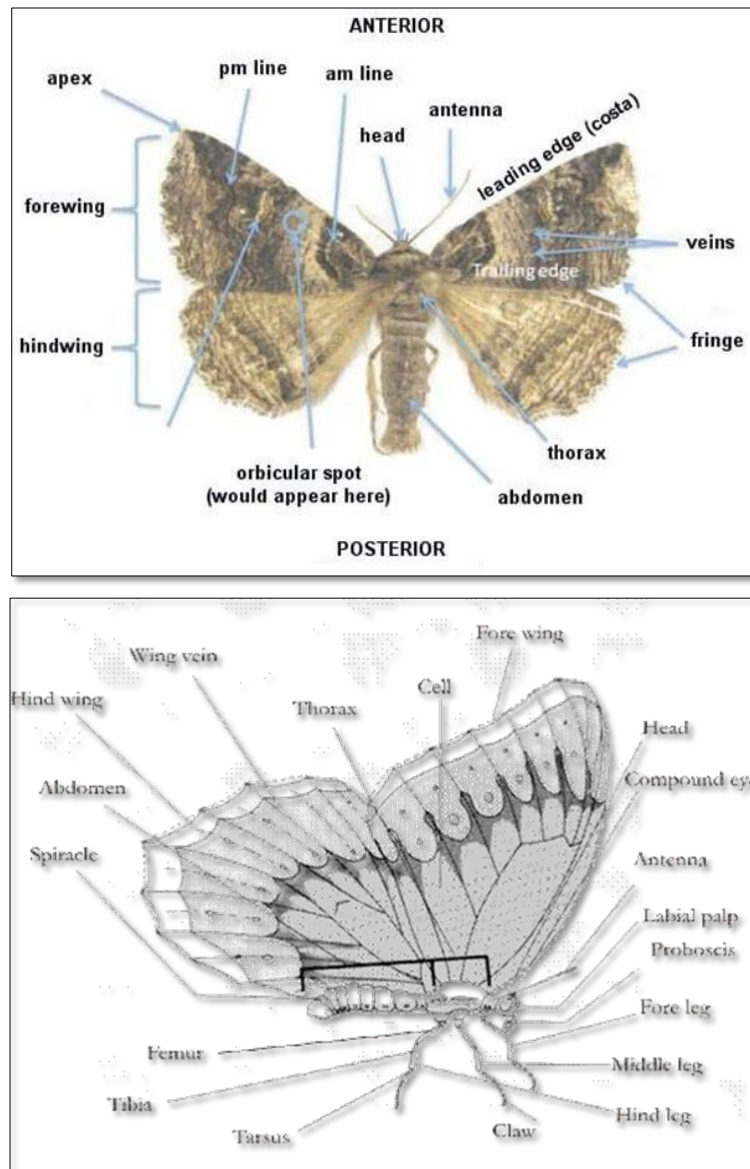


**Figure 2. Hummingbird Moth *Macroglossum stellatarum***

## ANATOMY

Butterflies and moths are insects that have 3 main body segments. These segments are the head, thorax, and abdomen. These insects have 6 jointed legs, 2 antennae, and 2 pairs of wings. Additionally, each insect has a pair of unique, powerful eyes at their head. Their eyes have hundreds of lenses, each focusing on a narrow area of the surrounding environment. The complete anatomy of both a moth and butterfly can be seen in Figure 4 and 5.

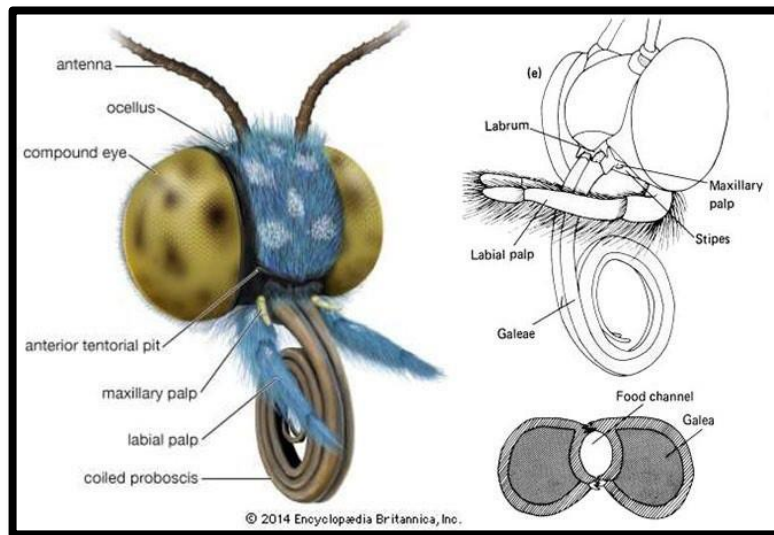
**Figure 3. Anatomy of a Moth**



**Figure 4. Anatomy of a Butterfly**

For most moths and butterflies, a properly functioning proboscis is essential to their existence. The proboscis is a coiled tongue-like, tubular, sucking organ that enables a moth or butterfly to extract nectar from any flower or blossom. When not in use, the proboscis rolls up and resembles a coil.

Unlike their larva, adults do not have any chewing mouthparts, so their straw-like tongues allow them to take in liquids. The proboscis is composed of 2 parallel linked tubes which operate like a pair of drinking straws when extended (see figure 5). Some adults, however, will not feed in the adult stage and do not use their proboscis.

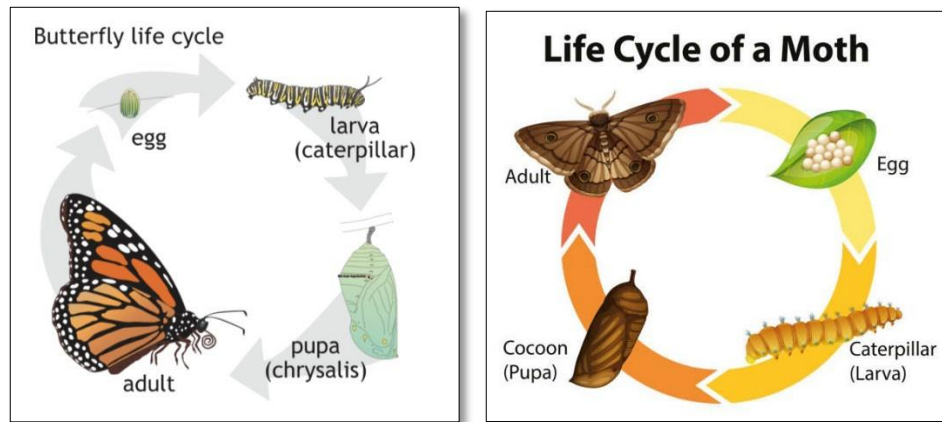


**Figure 5. Mouthparts and Proboscis Structure**

## LIFE CYCLE

The typical life history of a moth or butterfly consists of complete metamorphosis, which is characterized by four distinct stages. Because both insects go through complete metamorphosis, they are referred to as holometabolous. These are illustrated in the sketch. The egg hatches into a larva (caterpillar), which feeds, grows, and molts several times before transforming into a pupa. After a period of time, a winged adult emerges.





**Figure 6. Life Cycles of Moths and Butterflies**

After mating, the female lays eggs either singly, in rows, or clusters of a few to several hundred eggs. The egg shape and texture varies greatly among species. Some eggs do not hatch until the following spring, while others hatch before winter. The caterpillar or larvae spends its life feeding, the more it eats the larger it grows. Since its skin cannot stretch, the caterpillar grows by molting or shedding its skin several times. Each of these stages is called an **instar** and is larger than the previous one. The final molt produces the chrysalis or cocoon (pupa). The pupa is a resting stage and does not feed. As the adult begins to form inside the pupa, the shape of the wings and other body parts become visible. When the adult is fully formed the pupal skin splits open and the adult butterfly, or moth, crawls out. The newly emerged adult begins to pump fluids into its wings and soon is ready to fly. This transformation from egg to adult is called complete metamorphosis. Depending on the species, butterflies and moths can have one or multiple generations per year; a **generation** meaning the complete metamorphosis process that leads to an adult butterfly. The term **voltinism** refers the number of generations an organism has in a year. The Cecropia Moth, for example, is **univoltine** because it only completes one full generation per year as it spends up to 10 months inside the cocoon. The Monarch butterfly is **multivoltine**, meaning it will go through many generations in one year (4 generations).

## CONSERVATION

Lepidoptera play a huge role in our environment as pollinators, prey, herbivores, environmental indicators and serve as top models for research in mimicry and genetics.

Butterfly and moth habitats must be protected to ensure future generations the opportunity to view these fascinating and colorful animals. Both adults and caterpillars require specific kinds of plants and habitats. For this reason, they are especially susceptible to land development. The widespread use of pesticides and

herbicides further reduces their populations. Many species are declining in range and numbers and have been listed as endangered or threatened species. Butterflies and moths are significant plant pollinators and are excellent indicators of environmental quality. They have important roles in food chains and few species compete for plants that people value. By cultivating particular nectar flowers and host plants, it is possible to attract many species of butterflies and moths. Specific plants are listed below which attract butterflies and moths. This is just a partial list.

<b>Butterflies</b>	<b>Larval Food Plants</b>
Black Swallowtail	Carrots, Parsley, Dill
Giant Swallowtail	Prickly ash, Citrus Trees
Tiger Swallowtail	Wild Cherry, Birch, Poplar, Ash, Apple Trees, Tulip Tree
Zebra Swallowtail	Pawpaw
Monarch Butterfly	Milkweed
Comma Butterfly	Hops
Painted Lady	Thistles
Red Admiral	Nettles
Viceroy	Pussy Willow, Plums, Cherries

<b>Moths</b>	<b>Larval Food Plants</b>
Tomato Hornworm Moth	Tomato and Tobacco Plants
Luna Moth	Hickory, Walnut, Sweet Gum, Persimmon, Birch
Imperial Moth	Red and Silver Maple
IO Moth	Wild Cherry
Polyphemus Moth	Alder, Basswood, Birch, Chestnut, Elm, Hickory, Maple, Ash
Cecropia Moth	Bird, Alder, Elm, Maple, Wild Cherry, Willow, Lilac



Butterfly Nectar Sources		
Cultivated Flowers	Wildflowers	Shrubs and Trees
Daisies	Blazing Stars, Clover	Buckeye, Hawthorns
Marigolds	Black-eyed Susan, Ironweed, Phlox	Butterfly Bush, Fruit Trees
Pink Live Forever	Thistles, Butterfly Weed	Lilac
Zinnias	Goldenrods, New England	Spirea
Purple Aster	Aster, Coneflowers	Blueberries
Pink Phlox	Dogbane, Milkweed, Wild Bergamot	Redbud, Sumacs

\*You will be responsible for the identification and characteristics of the butterflies and moths included in this study guide. Pictures of the species are included in this study guide. It is highly recommended for the identification portion of the test that you study the characteristics using a source such as a field guide.\*

## BUTTERFLIES

### GIANT SWALLOWTAIL *Papilio cresphontes*



**Wingspan:** Up to 6.9" for females and 7.4" for males

**Color:** A large brown butterfly with yellow band across uppers, female larger, and series of yellow spots, round wings, yellow on tail and toward tip of forewing, underside very pale yellow throughout.

**Habitat:** Butterfly gardens, open woodlands and nearby fields, suburban areas, marshes, bogs, and citrus groves of the South.

**Range:** Common in eastern North America, from southern Canada to Costa Rica.

**Lifecycle:** 2 generations per year.

EASTERN TIGER SWALLOWTAIL *Papilio glaucus*



**Wingspan:** 3 1/10 – 5 1/2”

**Color:** Yellow with four black bands on the front wings. The innermost band lines up with the median band of the hind wing. The wing margins are black with a row of yellow spots. Black tiger stripes cross fore and hindwings in both sexes, black tails, light underside with black highlighted veins, females sometimes occur as a black form, variable as subspecies and forms.

**Habitat:** Deciduous woods along streams, rivers, and swamps.

**Range:** Widely distributed from New England west through the southern Great Lakes area of the U.S. and into most of the Great Plains states and south to Texas. Southern Canada.

**Lifecycle:** Between 2 and 3 generations per year depending on the region.

PAINTED LADY *Vanessa cardui*



**Wingspan:** 2 – 2 1/2”

**Color:** Orange and black butterfly with white spots on the dark forewing tips and white cobwebbing on the brown undersides of the hindwings. 4 small eyespots on the underside of the hindwing. Wide dark median forewing band, which is broken into two parts. Spots on the hindwings are well separated and all about the same size.

**Habitat:** Occurs in nearly any kind of habitat.

**Range:** Found nearly worldwide except South America and Antarctica.

**Lifecycle:** Approximately 6 generations.

ZEBRA SWALLOWTAIL *Eurytides marcellus*



**Wingspan:** 2 ½ – 4”

**Color:** Long hindwing tails, wings are pale green-white with black stripes (hence the name “Zebra”). Two blue spots appear at the end of the wings, and red spots appear on the wings near the lower part of the body.

**Habitat:** Moist, forested areas. Bottomland forests.

**Range:** Eastern U.S. and southeast Canada.

**Lifecycle:** 2 generations per year, Florida and far southern portions of their range may have 3 generations.

EASTERN COMMA BUTTERFLY *Polygonia comma*



**Wingspan:** 1 ¾ - 2 ½”

**Color:** Scalloped, irregular edges with pronounced indentations along the margins. Cryptic coloring allows hibernating adults to camouflage amongst dead leaves. The forewings are orange with dark brown patches, while the hindwings are mostly black in the summer, but orange with yellow spots in the spring and fall. The lower side of the hindwing has a small, white or silver comma shape that is enlarged at both ends.

**Habitat:** Open woodland and wood edges are the main breeding and hibernating habitats.

**Range:** Found throughout most of the eastern U.S. south to north central Florida and the northern Gulf states, and west to eastern Wyoming and Colorado.

**Lifecycle:** 2 generations per year.



RED ADMIRAL *Vanessa Atalanta*



**Wingspan:** 2 ¾ - 3"

**Color:** Scalloped black to brown wings on its upperside with reddish-orange bands and white spots on its wingtips. Its underside is a mottled blue, brown, and black.

**Habitat:** Found in moist woods and forests, yards, parks, meadows, marshes, and fields.

**Range:** Found from northern Canada south to Guatemala. Also found in Hawaii, the Caribbean, New Zealand, Europe, Northern Africa, and Asia.

**Lifecycle:** 1-3 generations.

MONARCH *Danaus Plexippus*



**Wingspan:** 3 3/8 – 4 7/8"

**Color:** Reddish-orange with black vein markings. Black boarder around wings with white spots. Wings look similar to stained glass windows. Female Monarchs have thicker black veins on their wings and the males have small pouches on its hind wings where it stores pheromones. Their bright orange color is their defense, as orange is a warning color for predators.

**Habitat:** In spring and summer, their habitat is open fields and meadows with milkweed. In the winter, it is the coast of southern California and at high altitudes in central Mexico.

**Range:** North America from southern Canada to South America and the Caribbean. Most common east of the Rocky Mountains. Those that live east of this mountain range overwinter in Mexico, while those living west of the Rocky Mountains may overwinter in southern California. Monarchs have also been established in Australia.

**Lifecycle:** Tied to their migratory patterns. Four generations of Monarchs per year.

**Table 1: Summary of Monarch Annual Life Cycle**

Generation #	Timing of immature stages*	Timing of adult stages*	Migrates?	Overwinter?
1	March-May	April-June	Yes, north in spring	No
2	May-July	June-July	North, through early June	No
3	July-August	July-August	Some movement south	Some
4	July-October	August-April	Yes, south in fall and north in spring	Yes

Table 1: Taken from monarchjointventure.org.

Remarks: Well known for its long migration to and from central Mexico and for its role as a distasteful and emetic model for the edible Viceroy Butterfly. The Monarch is Illinois' state insect.

### VICEROY *Limenitis Archippus*



**Wingspan:** 2 5/8 – 3 5/16"

**Color:** Brush-footed butterfly meaning their forelegs are hairy and are not used for walking. It is dark orange with black veins with row of white spots edge their wings. It mimics the Monarch, except for the black horizontal stripe that crosses the bottom on its back wings.

**Habitat:** Meadows, marshes, swamps, and other wet areas with willow, aspen, and poplar trees.

**Range:** Found in most of the continental U.S. and in southern Canada and northern Mexico.

**Lifecycle:** 2-3 generations per year.



## BLACK SWALLOWTAIL *Papilio polyxenes*



**Wingspan:** 3 1/8 - 4 1/2 ”

**Color:** Uppersides of wings are dark blue to black with rows of yellow spots along the edges of its hindwings and forewings. Blue band of spots and reddish-orange eyespots on its hindwings. Undersides of its wings are black with two rows of orange spots. Blue suffusion around hindwings more pronounced in female and have smaller, lighter yellow spots. Orange background in east of range, yellow in west, variable as subspecies.

**Habitat:** Flowery open areas including fields, parks, meadows, and garden.

**Range:** Southern Canada to northern Mexico. Found in most of the eastern U.S. and some parts of the western U.S.

**Lifecycle:** 2 generations per year. The first generation emerges between late April – early June after staying the winter in their chrysalis. The second generation emerges in late summer and their eggs become the first generation.

## MOTHS

### TOMATO HORNWORM MOTH *Manduca quinquemaculata*



**Wingspan:** 3 1/2 - 4 3/8”

**Color:** : Wings are mouse-gray, streaked with black and brown. Hind wings are strong and pointed. Forewings are paler with 2 zigzag dark lines crossing the middle of the wing. Body is heavy, torpedo shaped. Abdomen has 5 pairs of yellow spots on upper surface.

**Habitat:** Open areas, particularly those that have been cultivated.

**Range:** Northern Mexico to southern Canada. Not evenly distributed through this area as it is uncommon in the Southeast and Great Plains.

**Lifecycle:** 1-2 generations per year depending on region.



### LUNA MOTH *Actias luna*



**Wingspan:** 3 1/8 – 4 1/2”

**Color:** Wings are pale green; forewings have purple front margins; hindwings have long tails. Discal eyespots on both the fore and hind wings.

**Habitat:** Deciduous forests.

**Range:** Eastern North America, as far west as Texas, large portion of southeastern Canada.

**Lifecycle:** In northern regions, only 1 generation per year. In warmer climate, the Luna Moth can have 2-3 generations per year.

### IMPERIAL MOTH *Eacles imperialis*



**Wingspan:** 1 1/8 – 2”

**Color:** Wings and body pale sulfur-yellow; forewings pastel pink at base and along outer margin.

**Habitat:** Deciduous forests and mixed forests.

**Range:** from Argentina to Canada and from the Rocky Mountains to the Atlantic coast.

**Lifecycle:** Like the Luna Moth, the number of generations is dependent on climate. Northern regions will see one generation per year while southern regions will see 1-2.

IO MOTH *Automeris io*



**Wingspan:** 2 3/8 – 2 3/4”

**Color:** Male’s forewings yellow; female’s reddish brown. Hindwings of both sexes are yellow with reddish-orange submarginal band, reddish-orange shading near margin, and central black eyespot ringed with black. Thorax is yellow.

**Habitat:** Open woods and meadows.

**Range:** Canada and the U.S.

**Lifecycle:** One generation per year in northern part of range, 1-2 generations in southern regions.

POLYPHEMUS MOTH *Antheraea polyphemus*



**Wingspan:** 3 1/2 - 5 1/2”

**Color:** Wings are brownish yellow with a black and white irregular line parallel to the paler outer border. Forewings have eyespots edged in yellow and surrounded by black and blue.

**Habitat:** Deciduous forests, urban areas, wetlands

**Range:** Most of Canada and most of the U.S. Southern Mexico

**Lifecycle:** Dependent on climate. One generation per year in most northern parts of range, up to four in the most southern parts of range.



CECROPIA MOTH *Hyalophora cecropia*



**Wingspan:** 4  $\frac{3}{4}$  - 5  $\frac{7}{8}$ "

**Color:** Wings are speckled gray-brown with rusty shading, especially near body, and have white crescents, white and red crossbands, tawny outer margin, and pale lilac tip with eyespots. Body dull red-orange with white collar and white rings on abdomen.

**Habitat:** Hardwood forests east of the Rocky Mountains in the U.S. and Canada

**Lifecycle:** One generation per year, univoltine. (meaning produces one brood per year.)