

Butterflies, moths, and the Karner blue

What's a Butterfly?

Butterflies and moths are insects that belong to the animal order Lepidoptera.



Fig. 1 – Female Karner blue butterfly (photo courtesy of Donald J. Leopold)

Lepidoptera is a Greek word that means scaly wing (“Lepido-“ meaning scale and “pteron-“ meaning wing). The scales on a butterfly’s wing have spectacular color patterns. Butterflies constitute about 8% of all lepidopteran insects, with moths accounting for the other 92%. The name “butterfly” is thought to have originated with the early English, who called the yellow, spring Brimstone species “butter-fly” after the color of the butter they churned.

Is it a butterfly or a moth?

Telling butterflies and moths apart can be very confusing. Here are a few important characteristics that will help you tell them apart:

1. Butterflies fly are **diurnal** (active during the day), while most moths are **nocturnal** (active at night).
2. Butterflies always have knobbed **antenna**, while moths have feathery or straight antenna.
3. Butterflies are usually slim, and moths have plump, hairy bodies.
4. At rest, butterflies hold their wings together, vertically over their backs. Moths hold their wings out horizontally or fold them roof-like, over their backs.
5. Butterflies tend to be more brightly covered, to advertise their distaste to predators; moths are often dull colored and possess **cryptic coloration** to blend into the background colors of their native habitats.



Fig. 2 – Luna moth (photo courtesy of Troy Bartlett at <http://www.troyb.com/photo/gallery/section26.htm>).

- Both butterflies and moths have a well-developed coiled mouthpart called a **proboscis** that is used for probing and sucking the nectar from flowers. Some moths actually lack functional mouthparts as adults and only feed as larva.
- A butterfly **chrysalis** is naked, without a covering. Moths, however, spin silken **cocoons** or burrow underground to **pupate**.

Anatomy of an adult butterfly

Like all insects, the body of a butterfly contains three basic parts: **a head, thorax, and abdomen** (see Insect Characteristics module). The mouthparts on the butterfly or proboscis,

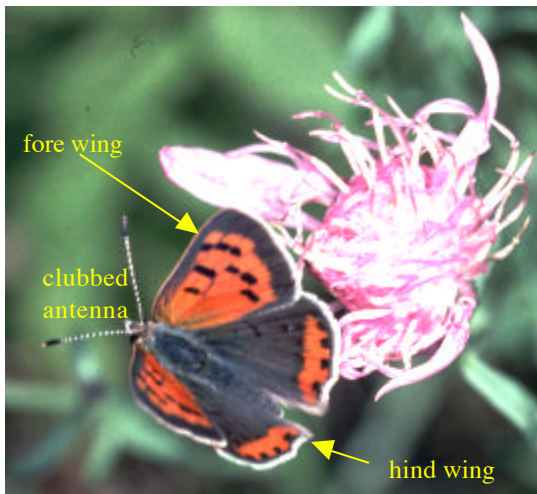


Fig. 3 - American Copper butterfly
(photo courtesy of Donald J. Leopold)

consists of a long coiled tube, which the butterfly can fill with blood, straighten out, and gather nectar from flowers. Butterflies also have two different wings used for flight, a hind wing and a larger fore wing attached further up on the thorax. With their large, compound eyes, butterflies can see in all directions without turning their heads. Since butterflies are nearsighted, they are

attracted to large stands of colored flowers as opposed to just individual flower stems. Butterflies do not see the “red” end of the visible light spectrum very well, but they do see polarized light (this indicates the direction the sun is shining) and ultraviolet light. Many flowers have ultraviolet light patterns that we can’t see, but insects use them as guides to various sources of nectar.

Second largest insect order

Lepidoptera is the second largest order of insects (Insecta) with over 100,000 species of butterflies and moths that have been collected and identified by researchers. New species are being discovered every day, especially in the rich tropical regions of the world (see Insect Characteristics module).

The Karner blue butterfly

The Karner blue butterfly is in the family Lycaenidae that includes most of the smaller butterflies - the blues, the coppers, and the hairstreaks. The Karner blue feeds solely on blue lupine during the larval stage. The Karner blue butterfly has a wingspan of about one inch and the

adults are sexually dimorphic (the male and female have different coloration). The male's inner wings are a purplish-blue color and lined with a black and white border around the edge. The female's inner forewings are blue in the center, fading into a blackish color with a white border around the edge.



Fig. 4 – A male Karner blue butterfly (photo courtesy of Donald J. Leopold)

The lower hind wings are also blue and lined with a white border, but they have orange spots

around the bottom edge of the wing. For both the male and female, the outer wings are a silvery-blue color with orange dots along the border of the both the fore wings and hind wings. The thorax and abdomen are a silvery-blue color.

The larva (or caterpillar) of the Karner blue butterfly is a bright green color with a dark green line running down the back. The



Fig. 5 – An ant tending a Karner blue larva (photo courtesy of Maija E. Benjamins)

coloration of the larva matches the color of the leaves of the blue lupine that they feed on. The larva is approximately one centimeter long, depending on the age. There are two nectaring bodies located at the hind end of the larva that release a sugary substance. Ants will often tend the larva by rubbing the nectaring bodies with their antennae. This stimulates the larva to release the substance that the ants use as food and, in turn,

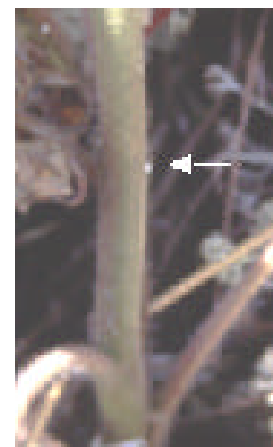


Fig. 6 – A Karner blue egg (photo courtesy of Maija E. Benjamins)

protect the larva from predators and parasites.

The eggs that the females lay are very tiny. If you're not careful, you'll miss the .35mm by .1mm egg. The Karner blue eggs are flattened with a slight depression in the center and are covered with miniscule bumps. They can be found on the stem of a blue lupine or blue stem grass approximately 3-15 cm from the ground.

The endangered species

Discovered in the 1860's, famed novelist/entomologist Vladimir Nabokov identified the species in 1944. The Karner Blue is a subspecies of the more common Melissa blue butterfly. In the early 1900s, the Karner blue butterfly was described as covering the fields of its habitat "in a sea of blue." In the past decade, the populations of this insect have declined by over 99% with only small remnants remaining. Since 1992, the Karner blue butterfly has been listed as a federally protected endangered species under the Endangered

Species Act of 1973 (see the Endangered Species module).

The Karner blue was once found along a narrow band ranging from Minnesota and southern Ontario to Maine. The range of this species is limited to the range of blue lupine and climatic variables. With habitat destruction and changing climatic conditions, the Karner blue now only exists in isolated populations in New Hampshire, New York, Michigan, Wisconsin, Indiana, and Minnesota. The remaining populations are very unstable and on the

brink of localized extinction.

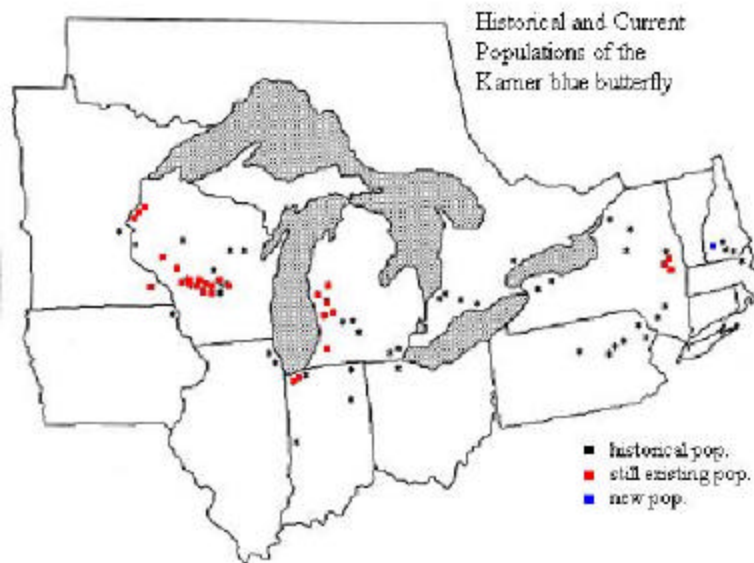


Fig. 7 – Historical and current populations of the Karner blue butterfly (modified from Anonymous 1992)

Karner blue habitat

The forever shrinking and fragmented habitat of the Karner blue butterfly is the oak-pine barrens and savannas. Glaciers that covered the northern half of North America during the Pleistocene glaciation formed most of these barrens (see the Geology module).

This glacier striped the area of any vegetation and left a sandy plain of land that extends from Maine to Minnesota and into Ontario (the habitat of the Karner blue butterfly and blue lupine). Sandy, nutrient poor soils, minimal water availability, and a mosaic of trees and low growing plants characterize the pine-oak barren habitat.

This habitat is referred to as high disturbance ecosystem because it is subjected to alteration by seasonal fires (fires lit by



Fig. 8 – Blue lupine (photo courtesy of Maija E. Benjamins)

lightening in the springtime) (see the Climate module). The characteristic plant and animals of this ecosystem are adapted to the nutrient poor soils, low water availability, and the seasonal fire regime (see the Plant Adaptations and Insect Characteristics modules).

Karner blue life cycle

The Karner blue butterfly is **bivoltine** (having two generations per year) and a **holometabolist** (see the Insect Characteristics module). Their life cycle begins each year in mid-April as the Karner blue butterfly eggs emerge from diapause. At this time, the blue lupine is beginning to grow. The larvae feed, growing from a 1 mm to 1 cm, until the end of May. The larva then crawls off of the lupine plant and pupates on a nearby plant or in leaf litter.

In the beginning of June, the first male hatches, hangs from the plant to dry out his wings, and begins to fly around and feed. Some **entomologists** believe that the male Karner blues will establish small territories before mating. These territories probably attract females with the amount of lupine and egg laying habitat within them. The better areas will attract more females ensuring the particular male in that territory will have a higher frequency of mating.

The females will hatch in the next few days and will begin feeding, mating, and laying eggs immediately. A single Karner blue female can lay up to eighty eggs. The adults

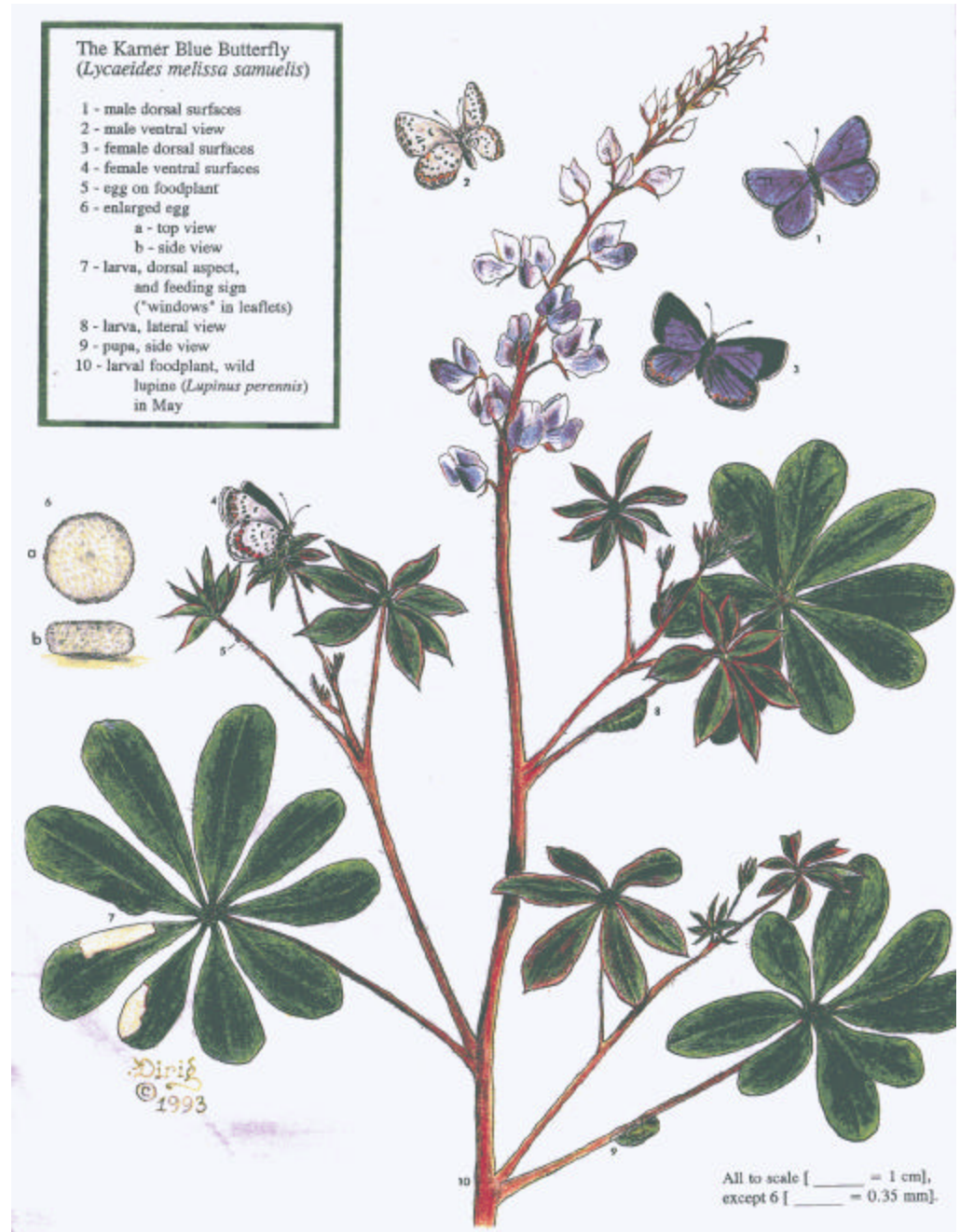


Fig. 9 – Life stages of the Karner blue butterfly (modified from Andow *et al.* 1994)

live for about two weeks and nectar on a sea of blue lupine, New Jersey tea, wild strawberry, black berry, dewberry, and hawkweed. The females will lay eggs on the blue lupine in the area. These eggs will then hatch in mid-June repeating the cycle of larva, pupa, and butterflies.

The second generation of Karner blue butterflies will fly in mid July and nectar on butterfly weed, horsemint, and spreading dogbain. The females of this generation will lay their eggs in blue stem grass and senescent lupine. These eggs will not hatch until the next April, beginning the entire life cycle again.

Experiment – Inspect an insect

Objectives:

To be able to identify the basic parts of an insect, and differentiate butterfly structures from those of moths.

Identify distinguishing characteristics of the Karner Blue Butterfly.

Describe the life cycle of the Karner Blue Butterfly.

Materials:

- illustrations of insect anatomy and the life cycle of a butterfly
- pictures, slides, and/or other teaching materials from nature magazines
- hand lens

Methods:

This activity can be done with preserved samples or illustrations that can be obtained from a biological supply company such as Ward's or Carolina Biological Supply.

1. Locate a field with variety of flowering plant species that butterflies may like to nectar on.
2. Form groups of 2 to 4 people and find the various stages of butterfly metamorphosis (egg, larval, pupation, and adult stage) in the field. Take pictures or make drawings of each stage in the life cycle. Be sure to share your finding with other groups!
3. When the sun sets, watch for moths at a light and compare the features to the butterflies seen during the day.
4. Have each group exchange their pictures and illustrations of the life cycle. With these pictures or illustrations, have each group prepare a poster illustrating the complete life cycle

of butterflies and moths. Be sure to include the basic anatomical and behavioral differences between butterflies and moths.

5. Display each poster and have a discussion about what features the Karner blue butterfly has that allow it to survive.

Extra credit:

Adopt a local lot or conservation area, and plant a “Butterfly Garden” to attract several species of butterflies (see Vegetation Management module and Plant Adaptations module). For additional information, see your local nature center or county cooperative extension agent.

Websites:

<http://www.troyb.com/photo/index.htm>
<http://www.npsc.nbs.gov/resource/distr/lepid/moths/mothsusa.htm>
<http://pooh.unl.edu/~scotth/samantha/moths-butterflies.html>
<http://animaldiversity.ummz.umich.edu/arthropoda/insecta/lepidoptera.html>
<http://www.ecosurvival.com/main/kbb/>
http://www.savethepinebush.org/KB/KB_Index.html
<http://www.wbu.com/chipperwoods/photos/karner.htm>
<http://hometown.aol.com/karnerblues/>
<http://www.nwf.org/wildalive/butterfly/>
<http://www.dec.state.ny.us/website/dfwmr/wildlife/endspec/kbbufs.html>

Key Words: complete metamorphosis, Lepidoptera, diurnal, nocturnal, cryptic coloration, proboscis, chrysalis, protective coloration, pupate, head, thorax, abdomen, ecosystem.

Resources:

Anonymous. 1992. Karner blue butterfly Population and Habitat Viability Assessment (PHVA) Workshop Briefing Book. CBSG, The Wilds, Zanesville, OH

Dirig, R. 1994. Karner Blue Butterfly, A Symbol of a Vanishing Landscape. Ed. D.A. Androw, R.J. Baker, C.P. Lane, Minnesota Agricultural Experiment Station, University of Minnesota, St. Paul, MN

Woodford, A.O. 1965. Historical Geology. W.H. Freeman and Com. San Francisco, CA 440-441.

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