The Caterpillar Lab

Educational Resources 2016

NEW ENGLAND BUCK MOTH PUPATION
DETAILED VIDEO NARATIVE

BACKGROUND INFORMATION

This document focuses specifically on the New England buck moth pupation video. For general information about pupation, check out the "Pupation FAQs and Teaching Guide" document at the top of our "Pupation" resource page.

In the wild, New England buck moth caterpillars (*Hemileuca lucina*) pupate at ground level or just beneath the soil. They do not build a complex cocoon, but instead rely on the soil and leaves to help shield them from predators. In our lab, we move prepupal caterpillars to a box of shredded paper towels to pupate.

The buck moth caterpillar's skin is adorned with stinging spines. Each of the caterpillar's branching spines has a sharp tip like a needle and contains venom. To a human, getting stung feels about as painful as a bee sting. When the caterpillar sheds into its pupa form, it sheds off its stinging spines. Coming in contact with the shed spines can cause mild to severe skin irritation, so The Caterpillar Lab staff members only touch buck moths' shed skins while wearing gloves or using tweezers.

Caterpillar Lab staff began filming this video a little late in the game. We noticed the caterpillar had already begun to shed into a pupa and decided to record the remainder of the process.

VIDEO NOTES

At the video's opening, observe differences between the creature shown and the still-growing buck moth caterpillar in the photograph here. In the video, notice that the creature's whole body doesn't look full—it tapers off, almost as if its rear end is empty. That's because it is! This creature's transition

to a pupa has already begun. If you look closely, you can see the newly formed pupa's body beginning to emerge out from under the old caterpillar skin. The pupa is yellow and visible between two tufts of the caterpillar's stinging spines.

As the video begins, watch the slow, undulating motion of the pupa wriggling out of its old caterpillar skin. Gradually, you can see the pupa emerging, cresting into view as its old caterpillar skin splits down the back and its old head capsule splits in two.

At 2:09, there is a more detailed shot of the pupa., which is positioned face down on the table.

Starting at 2:24, you can see some small, white, threadlike structures being pulled out near the creature's old retreating head capsule. The lines to the sides were the outer layers of the caterpillar's tracheal tubes, which are used for breathing. These tubes get pulled out from inside the new pupa's body through its spiracles, which are breathing holes located along the creature's sides. The middle white line is a layer of skin that covered the inside of the caterpillar's mouth and foregut.

At 2:29, the exposed pupa rolls on its side and you have an excellent view of its external anatomy. Press pause to observe. The pupa's head is at the thicker end of its body, on the right. Emerging from its head and pointing down towards its abdomen are two oblong, relatively crescent-shaped structures; these will become the moth's antennae.

It can a bit tricky to recognize at first, but you can see the pupa's wing structures from this view as well. Between the head / antennae and the ribbed segments of the abdomen, look for two wide structures that fold over the abdomen under the head. These will become the moth's forewings.

As the video ends, the pupa's body is still quite soft and delicate. Once it's exposed to air long enough, the pupa's outer layer of skin will darken to brown as it hardens and becomes more protective.

Hemileuca lucina

The New England buck moth is one of many buck moth species across North America. The heart of its range lies in New England, where its preferred habitat of Meadowsweet (Spirea) barrens occurs. Buck Moths are in the giant silk moth family, Saturniidae, but differ from other North American members of the family by flying in the fall and laying eggs that overwinter and hatch the following spring. Their caterpillars feed communally and can sting if touched.

GLOSSARY OF TERMS:

Cocoon: A shelter that some caterpillars construct and then pupate inside. Depending on caterpillar species, cocoons may range from a few leaves tied loosely together by silk, to complex and rugged silken structures. Not all caterpillars construct cocoons. It is important to distinguish the non-living cocoon from the living **pupa**.

Creature: During periods of transformation, it may be difficult to assign an organism to a well-defined life stage such as larva, pupa, or adult. There is technical vocabulary that deals with these in-between states, but for our purposes we will refer to the transforming insect simply as a "creature".

Head capsule: The caterpillar's hardened, **sclerotized** head exoskeleton, which contains the eyes, antennae, mandibles, and other sensory and feeding structures.

Prepupal: A caterpillar that has finished growing and feeding as a larva and is preparing to shed its skin and become a **pupa**, a transitional stage between its larva and adult forms.

Prolegs: The soft fleshy legs along a caterpillar's abdomen. These legs aid in a caterpillar's locomotion, are lost when caterpillars pupate, and are absent in the adult butterfly or moth. Prolegs are not to be confused with a caterpillar's six **true legs**, which are mounted under the caterpillar's thorax. True legs are hardened, pointed, and maintained through all stages of **metamorphosis**.

Pupa: The middle stage between the larva (such as a caterpillar) and adult (such as a moth or butterfly) forms of an insect. The pupa stage is the creature's body itself, not a case or covering. Pupae are not mobile and they do not eat. Many species overwinter or wait out inclement seasons as pupae. All insects that undergo complete metamorphosis have a pupa stage, including butterflies and moths, beetles, flies, wasps, bees, ants, and others.

Sclerotin/Sclerotized: A component of insects' skin that makes it more rigid and tough. The harder structures of a caterpillar's body are sclerotized, including the head capsule and true legs. Pupae are heavily sclerotized.

Shedding: The process of casting away an old exoskeleton to expose a newly grown exoskeleton beneath. All insects must shed their exoskeletons – including certain internal structures like the **tracheae,** foregut, and hindgut – as they grow. There are many vocabulary words associated with shedding that generally mean the same thing, including **shedding**, **moulting**, and **ecdysis**.

Shed Skin / Old Caterpillar Skin: The remains of an old layer of insect skin that has been replaced through the shedding process by a fresh, new layer. This discarded or soon-to-be discarded skin is called the **exuvia**.

Skin: There are many vocabulary words associated with an insect's skin, including **cuticle**, **integument**, **epidermis** and **exoskeleton**. These words may have subtle differences in when and how they are best used, but for our purposes here they may be considered synonymous.

Spiracles: The visible oval-shaped openings along an insect's body that allow it to breathe. Spiracles are attached to **tracheal tubes** or **tracheae**, which disperse atmospheric air to all parts of the body.

Tracheal tubes / Tracheae: A series of branching, hollow tubes that lead into an insect's body and deliver oxygen throughout. The lining of the tracheae must be shed each time an insect sheds its skin, to allow these tubes to grow with the insect.