

Butterfly Gardener

Caterpillars to Butterflies



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Before Butterflies

Text and photos By Rita Venable

Note: Polyphemus moth used to illustrate some structures because of size.



A caterpillar's life appears deceptively inactive. In reality, hormones are raging, predators are more prevalent than the bad guys in a Bond movie and survivors are few. The caterpillars making it to the pupation stage have been plagued with splitting headaches, skin crawls and high blood pressure. They must find their own food at birth, and some build their own homes before they are a month old. How do they do it? Mostly by ingenious adaptations and specialized behavior.

C'mon Baby, Do The Locomotion

Caterpillars have three pair of segmented legs (true legs) at the thorax and five pair of grasping prolegs (false legs) along the abdomen. As the caterpillar moves it spins a silk pad, and little hooks called crochets on the bottom of each proleg grasp the pad. The prolegs prevent the caterpillar from plummeting to its death, even while resting. There are claws on each true leg for holding objects. The Black Swallowtail (left) illustrates the legs - both true (nearest the head) and false (four grasping the leaf edge plus the anal prolegs). A pair of anal prolegs on this *Cecropia* caterpillar grasp the food plant like tiny suction cups, anchoring the caterpillar firmly in place (left, inset).



Silk Production

Many caterpillars, especially skippers, such as this Silver-spotted Skipper (below, left), use silk to construct tent-like shelters (below, right). They stay in these protected shelters during the day, coming out to feed only at night. The silk-producing spinnerets located beneath a caterpillar's head provide silk for support pads, attachment points and girdles for chrysalids, pupation shelters or single or communal nests. The silk is composed of a hard inner protein which hardens and a softer outer protein which is pliable. The caterpillar, by moving its head from side to side, pulls the silk from the spinnerets. When the silk hardens, it also shrinks, pulling the leaves of the shelter over the caterpillar.





Breathing and Circulation

Caterpillars don't have lungs; they have spiracles that carry outside air directly to the tissues. Spiracles, which appear as tiny holes, are found on both the thorax and the abdomen of caterpillars, but are more obvious on some than others. Spiracles are also connected to tracheae inside the caterpillar which are interconnected in a network of tubes sort of like pipes in a house. Spiracles are evident on the Question Mark caterpillar (above).

Caterpillars have blood and a heart but no veins and arteries as humans do. The heart of a caterpillar looks like a long tube, and blood is pumped from the abdomen to the thorax to the head, then back again to the abdomen. Blood pools around the organs in a random fashion.

Growth and Sensory Perception

The weather affects the rate of development of caterpillars; the warmer the temperature, the faster the development (to a point). Most caterpillars go through four or five molts before pupating. Between molts are instars or stages of growth. As the caterpillar grows, stretch detectors between segments on the body cause hormone production that stimulates the old skin to fall off, starting at the head where it splits. The new skin is soft and needs several hours to "cure" before it can support body movement - a good reason not to move caterpillars at this stage. Outwardly, the caterpillar may change color, and other features such as spines may change length or shape. Inwardly, wing cells are already present, the antennae are folded inside the caterpillar head and compound eyes form underneath the caterpillar eye. As pupation draws near, changes inside the caterpillar continue, including the initial development of reproductive organs. The final molt is pupation.

Caterpillars see with ommatidia, six on each side of the head in a circle. They can distinguish color and ultraviolet light. They smell with odor detectors or pits located on the head, legs, body, antennae and mouthparts. They feel with setae which are all over their bodies in predictable and identifiable locations. (See Polyphemus caterpillar head, above.) They taste with taste organs in their mouths.

Food In, Garbage Out

As the Polyphemus moth (right) feeds on an oak leaf, frass, a waste product composed of uric acid, falls out the other side. As the caterpillar eats, the crop stores the incoming plant matter, the midgut extracts the nutrients, and the hindgut extracts the water producing the pellets, frass.

Don't let them fool you. Caterpillars may look like they are laying around a lot, but, in reality, they are little "Hulks." It's no wonder they have to rest up for a long time before they are ready to fly around.

