

Hornworm

A CAROLINA™ CareSheet

The hornworm is the larval (caterpillar) stage of the sphinx moth, *Manduca sexta*. The moth's lifecycle can be completed in 30 days at 27° C (81° F) or 39 to 48 days at lower temperatures. For your first experience raising hornworms, we recommend our Hornworm Nursery Kit (item #143860) or our Hornworm BioKit® (item #[143870](#)). Hornworms are agricultural pests, so **do not release** any stage of the hornworm life cycle.

Immediate Care and Handling

We ship hornworms as eggs, larvae, or pupae. Open the shipping container and inspect the contents. Carefully locate the hornworm life stage that you ordered. Eggs are in a foam-plugged vial. Larvae arrive 1 per vial with enough food in each vial to grow them to maturity. Hornworm pupae come in a roll of packing material. Gently unwrap the pupae and handle them carefully. Do not break the tongue cases, or the pupae will die. Adults should begin to emerge from the pupae within 1 to 3 weeks.

Eggs

It is best to hatch eggs on an artificial diet, either our Ready-To-Use Hornworm Diet (item #143908) or our Dry Hornworm Medium (item #[143905](#)). Make a hatching chamber for a unit of 30 to 50 eggs using a clear 8-oz cup with lid. Either pour liquid diet into the bottom of the cup or use a spoon to add a layer of solid diet to the bottom of the cup. Tamp down the solid diet until it creates a good seal in cup's bottom. Whether liquid or solid, the layer of food should be no more than 7 to 10 mm (about ¼ to ⅜") deep. Place plastic netting such as our Drosophila Culture Netting (item #173090) in the cup with 1 end extended into the food. The netting will help support the food later when you invert the cup and will provide a surface for the larvae to climb onto the food. Allow the liquid diet to solidify before continuing.

Use a paper punch or other instrument and make 4 holes in the cup lid. Invert the lid and place it on a table, then line it with either filter paper, paper towel, or 2 sheets of tissue paper. Set the eggs on the paper and reposition the cup (containing the food) over the lid. Gently work the lid back onto the mouth of the cup, keeping everything inverted so the eggs remain on the paper. Place the completed hatching chamber, lid down, on a wire shelf or use spacers (pennies, etc.) to elevate the lid slightly above a solid

surface to allow air exchange through the holes. Incubate at 27° C (81° F). Use a lamp to provide heat and light. The eggs should hatch in about 3 days. Upon hatching, the larvae will climb up the netting and begin to feed. Leave the larvae in the hatching chamber until they are 5 days old, then transfer them to plants or a rearing chamber.

Eggs will also hatch on members of the Solanaceae (nightshade) family of plants, such as the tomato, tobacco, eggplant, and jimsonweed. **Note:** *Once larvae have fed on plants, few will accept an artificial diet.* Larvae also imprint on the first species of plant that they feed upon and are voracious eaters. A single larva can easily strip the leaves from a 45-cm-tall (18") plant. So, if you chose to hatch larvae on a suitable plant, you will need a plentiful supply of that plant before beginning. Place a leaf on damp filter paper in a petri dish and place the eggs on the leaf. Incubate as stated above, replacing the leaf if mold develops. Once the delicate larvae hatch and eat the leaf, use a small brush and carefully transfer them to additional leaves in petri dishes or onto plants.

Larvae

You can maintain larvae hatched on artificial diet on that diet or transfer them to plants, but larvae hatched on plants maintain best on plants. We ship individual larvae in 10 × 3-cm (4 × 1¼") vials (item #173076) containing 18 mL of artificial diet—enough to grow them to maturity. **Note:** *You can also make a rearing chamber for larvae that you hatched from eggs. Construction of a rearing chamber goes beyond the scope of this CareSheet, but you can find simple plans at www.manducaproject.com.*

Place a lamp with a 100-W bulb (or equivalent energy-saving bulb) about 25 cm above the larvae. Regulate the temperature by moving the lamp toward or away from the larvae. Monitor the temperature until it has stabilized around 27° C (81° F); thereafter, check it at least twice a day. Larvae must receive constant light to prevent their pupal stage from enduring for several months (diapause).

Larvae raised on plants will also require constant light to avoid diapause in the pupal stage. Their food consumption increases rapidly as they grow.

At maturity, larvae are often over 7 cm (2¾") in length and will show a dark, pulsating line with nodes on the dorsal surface. This is the dorsal aorta. The larva is then ready to pupate. **Note:** *Mature larvae raised on plants will burrow into soil to pupate if not removed from the plants.*

Pupae

Every day, examine each larva for the appearance of the dorsal aorta, which often initially appears just anterior to the horn. Prepare the larvae for pupation when the line becomes visible. Delay at this point may result in the death of the larvae.

If you are growing larvae in vials, remove each mature larva from its vial and wash any remaining culture medium from the vial with a jet of water. **Note:** *Do not use soap or detergent.* Replace the larva in the vial and cover it with dry inert material (shredded paper, sawdust, potting soil, etc.) until the vial is about half full, and then recap the vial. Do not overfill or pack the vial; the larva needs appropriate space to pupate. It also needs darkness, so wrap the vial in newspaper or foil and secure with rubber bands. If you are growing larvae in a rearing chamber, proceed as above except procure bottles or vials to use as pupating chambers. Pupation should be complete in 7 days. You can then examine the pupae if you like; but be careful, as they damage easily. No later than 14 days after preparing the larvae to pupate, ready them for adult emergence.

Moths (adults)

In preparation for the moths' emergence, transfer pupae to a cage such as the Carolina™ Butterfly Sanctuary (item #674291) or other container. Cover the cage bottom with paper towel and lay the pupae on the towel. Maintain the pupae at room temperature while exposed to a normal day/night cycle. If you use a hard-sided cage, cover at least one wall with paper towel or newspaper. The emerged moths can climb and cling to this vertical surface, without which their wings will crumple instead of unfolding properly, and they will be unable to fly.

FAQs

Why are larvae called hornworms?

Because they have a tapered projection (horn) on the dorsal posterior of the abdomen. Although it may look like a stinging spine, this horn is harmless. Under crowded conditions, the horn is often missing, possibly from being broken or bitten off.

What are some plants that hornworm larvae like to eat?

The larva eats the leaves of a wide range of solanaceous plants including jimsonweed (*Datura*), ground cherry (*Physalis*), tomato (*Lycopersicon esculentum*), eggplant (*Solanum melongena*), Jerusalem cherry

(*Solanum pseudocapsicum*), potato (*Solanum tuberosum*), pepper (*Capsicum annuum*), and tobacco (*Nicotiana tabacum*).

Since hornworms are a crop pest, how should I dispose of them?

If it is necessary to dispose of any life stage, freeze it in a plastic bag and dispose of in the trash.

After emerging from the pupal case, how long until the adult females begin to lay eggs?

The female moth usually begins depositing eggs on the third night after emergence.

Where does an adult female moth typically place an egg?

The female hovers around and then approaches a host plant, touching a leaf's upper surface (near the margin) with her leg. She quickly flexes her abdomen until she contacts the edge of the leaf's undersurface. There she deposits a single egg extruded from her ovipositor before flying away.

Is there a way to tell when the eggs are about to hatch?

The smooth, pale-green egg is about 1 mm in diameter and almost spherical. The color fades, becoming almost white before hatching in 3 to 8 days depending primarily on the temperature.

How do I know if my pupa is still alive?

If your larvae pupate during the fall, they may enter diapause until the spring or summer (when conditions are more favorable). However, if you keep a light on the larvae, diapause will not occur. You will know your pupa is dead if it does not move and squirm. Dead pupae are dry, hard, and very dark. Maintain adequate humidity to prevent your pupae from drying out.

Can hornworms be sexed?

Hornworm pupae can be. Examine the ventral tip of the abdomen with a hand lens. Males exhibit 2 small bumps on segment 9, the next to last segment. Segment 9 is smooth on females, and there is a thin groove on segment 8.

Problems? We hope not, but if so contact us. We want you to have a good experience.

Orders and replacements: 1-800-334-5551, then select Customer Service.

Technical Support and Questions: caresheets@carolina.com



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