

Know Nevada Insects

Common name: Sphinx moth
Scientific name: *Manduca sexta* and
Manduca quinquemaculata

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EXTENSION

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Fact Sheet 19-16

PEER
REVIEWED

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Perhaps two of the most striking moth caterpillars to be seen by the average Nevadan are those of the tomato and tobacco Sphinx moths, *Manduca quinquemaculata* and *Manduca sexta*, respectively. These distinctive caterpillars, often called hornworms as larvae, are best known as the ravenous pests of plants in the family Solanaceae, especially tomatoes, potatoes and tobacco. In most small-scale applications, the common caterpillars can be kept below economic thresholds by simply monitoring and hand removal. The moth, which is in the family Sphingidae (Sphinx moths), also contains many other beautiful caterpillars and adults that are not pests.

- <http://www.unce.unr.edu/programs/sites/ipm/>

Description and Life Cycle

Adults

Adult Sphinx moths are often seen hovering in front of flowers drinking using their long proboscis, or tongue, giving them the common name, hummingbird moths. While most moths fly at night, these moths can be seen in the afternoon or at dusk, making them some of the more commonly seen moths. Other notable Sphinx moths in Nevada include the white-lined Sphinx moth, *Hyles lineata*, and the Thetis clearwing or bee hawk moth *Hemaris thetis*, a conspicuous bumble bee mimic.

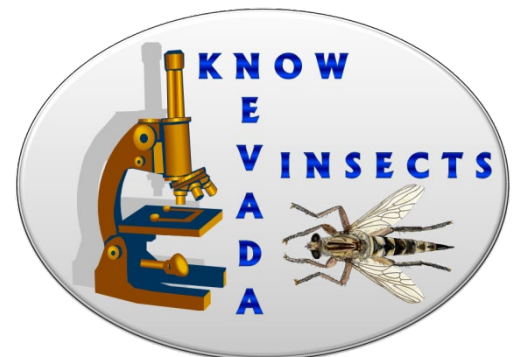
Adult moths may have a wing span from 4 to 5 inches, with a stout body and large eyes. Both species have yellow spots down both sides of the abdomen. The species name *quinquemaculata* is given for having five pairs of spots, while *sexta* is for the six rows of spots on that species. The wing color patterns of both species are variable and can be a mottled gray, black and white, or they can have more of a brownish pattern. The antennae are feathered, with male antennae being more feathered than female. Females release pheromones to attract potential mates. Adult lifespans are short, about seven to 10 days.



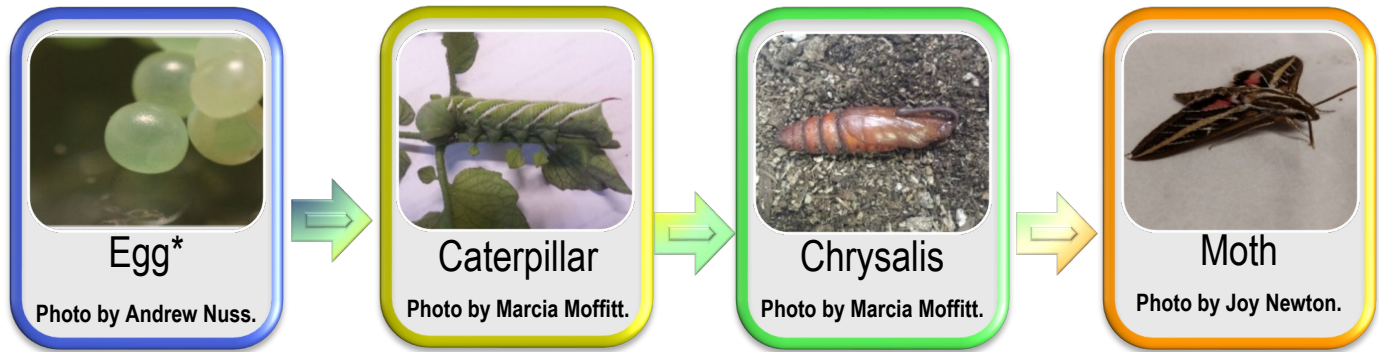
White-lined Sphinx moth
Photo by Joy Newton

Eggs and Caterpillars

Each adult female may lay up to 2,000 eggs. Adult females lay white to light-green eggs singly on the underside of host plant leaves, usually one to five eggs per plant. Eggs hatch after just a few days.



Caterpillars of both species are usually bright green, but there is also a dark-brown form as well. Both color types have white diagonal stripes along the body. *Manduca sexta* has seven single diagonal stripes, while *M. quinquemaculata* has eight chevron (V-shaped) stripes. In addition, both species



*Eggs are typically laid singly on leaves.

have a horn at the tail end of the body, giving the caterpillars their common larval name hornworm. In *M. sexta*, the horn is pink or red, whereas in *M. quinquemaculata* the horn is black. Both caterpillars can reach up to almost 4 inches long when fully grown. As with other caterpillars, only the front three sets of legs are true legs. The other structures it uses to walk are called “prolegs,” located on some abdominal segments and at the very tail end of the body.

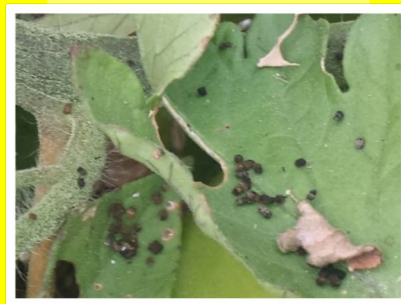
Caterpillars will eat whole leaves, green fruit and even stems of host plants. One or two individuals is enough to destroy an entire fully grown tomato plant. Larval development takes three to four weeks, followed by a “restless” stage when the caterpillar wanders off the host plant. Caterpillars then burrow into the soil and pupate. Pupae are light to dark brown and 2 to 3 inches long, with a long, thin, curved extension that will be the proboscis. In the summer generations, pupal development takes 14 to 18 days. As fall approaches, pupae will enter diapause, halting development to emerge the next summer. In warm climates, adults may reproduce all year long. In northern climates (where only *M. quinquemaculata* lives), there are likely two generations a year, with overwintering pupae emerging in June.

Caterpillar Host Plants and Damage

Both *M. sexta* and *M. quinquemaculata* can reach economic thresholds on crops of tomatoes (*Solanum lycopersicum*) as well as other solanaceous crops. Previous studies have shown that the use of integrated pest management strategies are effective in reducing pesticide use on eastern U.S. tobacco crops (Slone and Burrack 2016).



Tomato damage. Photo by Marcia Moffitt.



Hornworm frass on leaf. Photo by Marcia Moffitt.

Integrated Pest Management

Monitoring

For small-scale management, such as for home gardens or personal greenhouses, weekly inspection of plants for damage and presence of caterpillars is often enough to prevent excessive defoliation. Caterpillars are often found underneath leaves or at the base of plants during the day. Treatment other than hand removal should only be initiated if there are large larvae that are extensively defoliating plants or eating fruit. Spot-treating is also an option, as it is uncommon for whole fields to be infested. Adults can be monitored at night using light sources.

Cultural Control

Disking after harvest has been shown to destroy up to 90 percent of overwintering pupae. In addition, avoiding excessive nitrogen fertilization, avoiding early season pesticide sprays, and managing sucker control and stalk destruction are important to reducing larval populations during the growing season. Rotating crops with plants not in Solanaceae will also help avoid creating large inter-annual pest populations. In addition, creating border-strips of native flowering plants creates habitat for predators and parasitoids of these caterpillars (see Biological Control below). Yardim et al. (2006) found that the addition of vermicompost reduced field densities of *M. quinquemaculata* larvae and reduced short-term foliar damage by larvae in a greenhouse setting. Finally, while conventional wisdom suggests that unheated high tunnels, or hoopouses, may serve as a physical barrier to field pests such as *M. quinquemaculata*, other studies have found higher densities of pests under plastic, possibly due to a trapping effect in the summer, when high tunnel sides are open to regulate ambient temperatures (Ingwell et al. 2017)

Biological Control

M. sexta and *M. quinquemaculata* are both prey for a number of natural predators, perhaps most notably species of *Polistes* paper wasps. These predator populations can be encouraged using border strips, small plots around the edges of fields that serve as habitat. Hornworm eggs and caterpillars are also attacked by a variety of parasitoid wasps and flies—insects that lay their eggs on or in the caterpillar, and whose larvae kill the caterpillar during their development. One species in particular, *Cotesia congregata*, will lay dozens of eggs inside each caterpillar, emerging as cocoon-wrapped pupae that stick to the outside of the doomed caterpillar (Wagner 2005). Fascinatingly, this wasp carries with it a virus, and this virus suppresses the caterpillar's immune response, facilitating the growth of the wasp larva! These wasps can be encouraged by leaving any parasitized larvae that are found and allowing the wasps to emerge and reproduce. Parasitized larvae eat much less than healthy caterpillars. Wasps in the genus *Trichogramma* will also attack hornworm eggs and can be purchased for release. It is worth noting that many of these species are small (1/4 to 1/2 inch), and limited in their flight range, reinforcing the importance of spacing border strips throughout fields. Finally, *Bacillus thuringiensis* sprays can also be used.

Chemical Control

Hornworms should only be treated with insecticides if infestations exceed the economic threshold of five or more large (greater than 1 inch), unparasitized larvae found per 30 plants.

References

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Yardim, E.N., N.Q. Arancon, C.A. Edwards, T.J. Oliver, and R.J. Byrne. 2006. Suppression of tomato hornworm (*Manduca quinquemaculata*) and cucumber beetles (*Acalymma vittatum* and *Diabotrica undecimpunctata*) populations and damage by vermicomposts. Pedobiologica 50:23-29.

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