Egyptian cotton worm

Spodoptera littoralis

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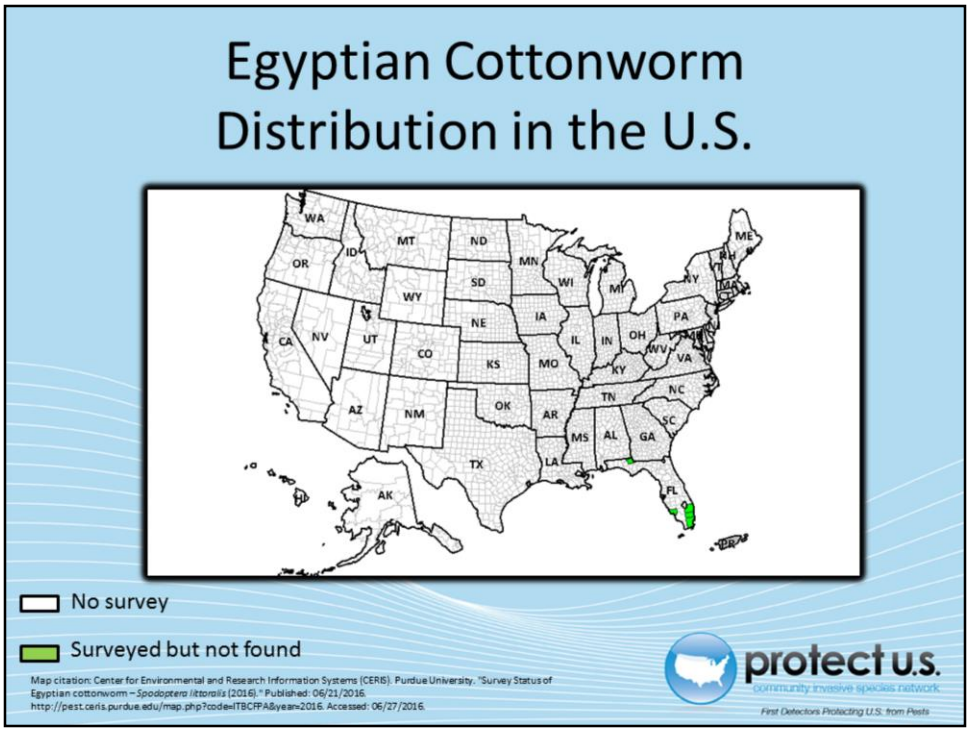
There are two species of cotton leaf worm that are geographically isolated; *S. litura and S. littoralis*. *S. litura* is found in Asia while *S. littoralis* is primarily in Africa. Some literature cites the two as the same species.

As far as *S. littoralis* is concerned, the distribution includes most parts of Africa, southern or mediterranean Europe and the middle east. Some of the locations include Greece, Italy, Malta, Portugal, Spain, Israel, Syria, and Turkey.

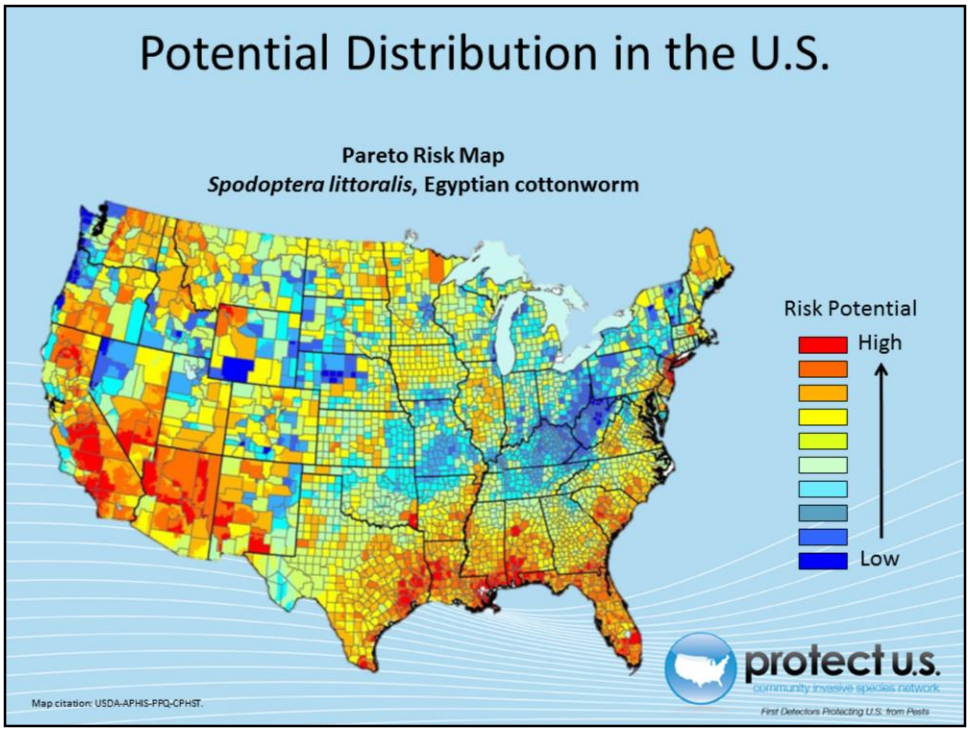
Spodoptera littoralis is native to Africa, the Middle East and the Mediterranean countries of Europe. This pest can be found in greenhouse crops including tomato, pepper and melon in Spain, Italy, and Greece. *S. littoralis* has not yet established in northern Europe due to the colder climate, but there is still a risk that it could eventually. Furthermore, there is a risk of introduction to other locations through shipments of plants.
box

Information sources: 3, 8, 16



In the U.S., this species has been intercepted over 170 times. Even so, it has yet to establish in North America. Nonetheless, *S. littoralis* is on the CAPS Priority Pest List for 2017 Commodity and Taxonomic Surveys for Oaks.

Information sources: 10, 15, 16

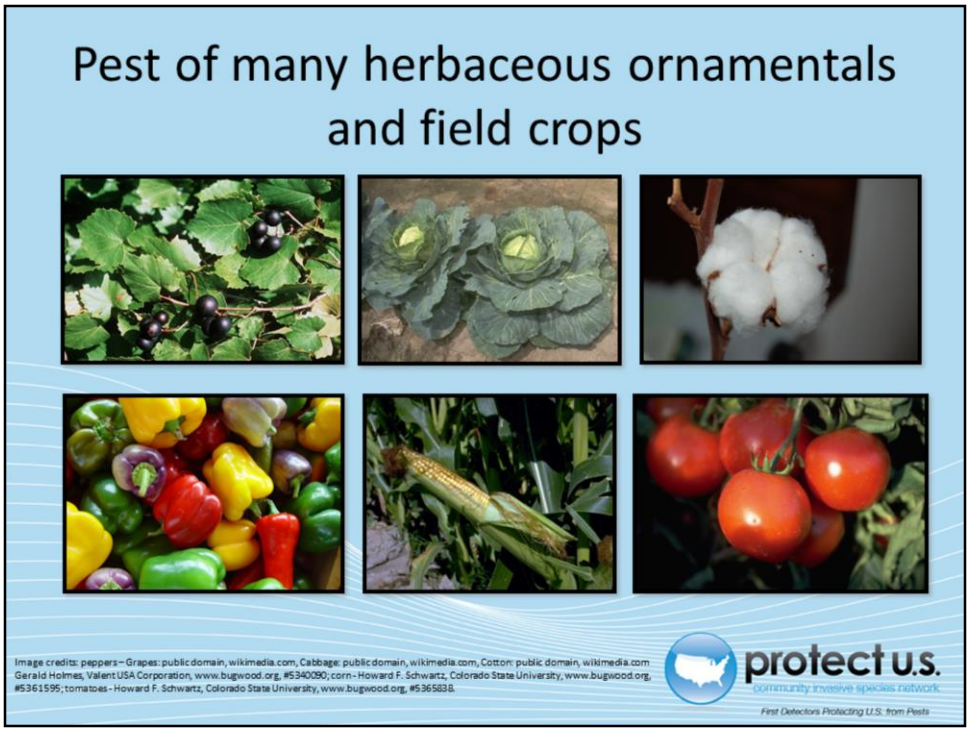


Higher values (red) indicate a higher risk for the establishment of this pest while lower (blue) values suggest a much lower risk.

This risk map developed by USDA-APHIS-PPQ-CPHST in 2011 shows that many parts of the United States have a high risk for the establishment of this pest based on host availability and climate. According to the USDA (1982) the potential range for this species may be limited to the west coast and the lower southwestern and southeastern United States. However, seasonal migrations could occur to other parts of the country.

Information sources: 16, 18

Map citation: USDA-APHIS-PPQ-CPHST.

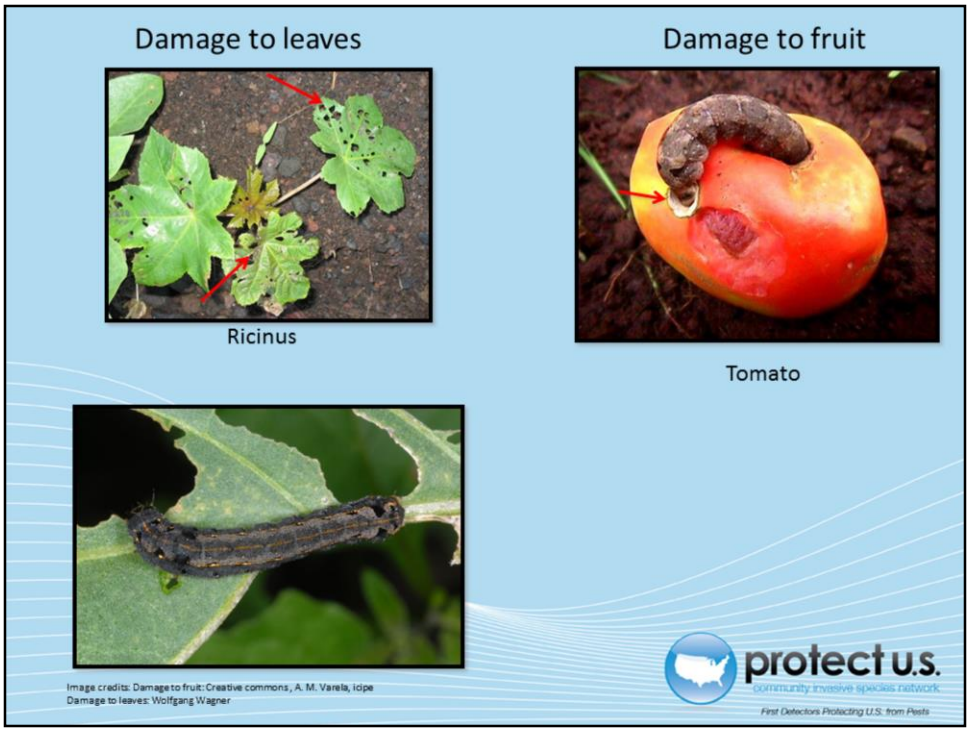


The pest has a wide host range and will feed on oaks as a secondary host (Salama et al., 1970).

Major Hosts
Abelmoschus esculentus (okra), *Allium spp.* (onion), *Amaranthus spp.* (pigweed, amaranthus), *Apios spp.* (groundnut), *Arachis hypogaea* (peanut), *Beta vulgaris* (beet), *Brassica oleracea* (cabbage, broccoli), *Brassica rapa* (turnip), *Brassica spp.* (mustards), *Camellia sinensis* (tea), *Capsicum annuum* (pepper), *Chrysanthemum spp.*, *Citrullus lanatus* (watermelon), *Citrus spp.*, *Coffea arabica* (coffee), *Colocasia esculenta* (taro), *Corchorus spp.* (jute), *Cucumis spp.* (squash, pumpkin), *Cynara cardunculus* (artichoke), *Daucus carota* (carrot), *Dianthus caryophyllus* (carnation), *Ficus spp.* (fig), *Glycine max* (soybean), *Gossypium spp.* (cotton), *Helianthus annuus* (sunflower), *Ipomoea batatas* (sweet potato), *Lactuca sativa* (lettuce), *Linum spp.* (flax), *Medicago sativa* (alfalfa), *Morus spp.* (mulberry), *Musa spp.* (banana, plantain), *Nicotiana tabacum* (tobacco), *Oryza sativa* (rice), *Pennisetum glaucum* (pearl millet), *Persea americana* (avocado), *Phaseolus spp.* (bean), *Pisum sativum* (pea), *Prunus domestica* (plum), *Psidium guajava* (guava), *Punica granatum* (pomegranate), *Raphanus sativus* (radish), *Rosa spp.* (rose), *Saccharum officinarum* (sugarcane), *Solanum lycopersicum* (tomato), *Solanum melongena* (eggplant), *Solanum tuberosum* (potato), *Sorghum bicolor* (sorghum), *Spinacia spp.* (spinach), *Theobroma cacao* (cacao), *Trifolium spp.* (clover), *Triticum aestivum* (wheat), *Vicia faba* (broad bean), *Vigna spp.* (cowpea, black-eyed pea), *Vitis vinifera (grape)*, and *Zea mays* (corn).

Minor hosts include but not limited to:
Casuarina equisetifolia (she-oak) *Quercus petraea* (durmast oak), and *Pinus* spp. (pine)

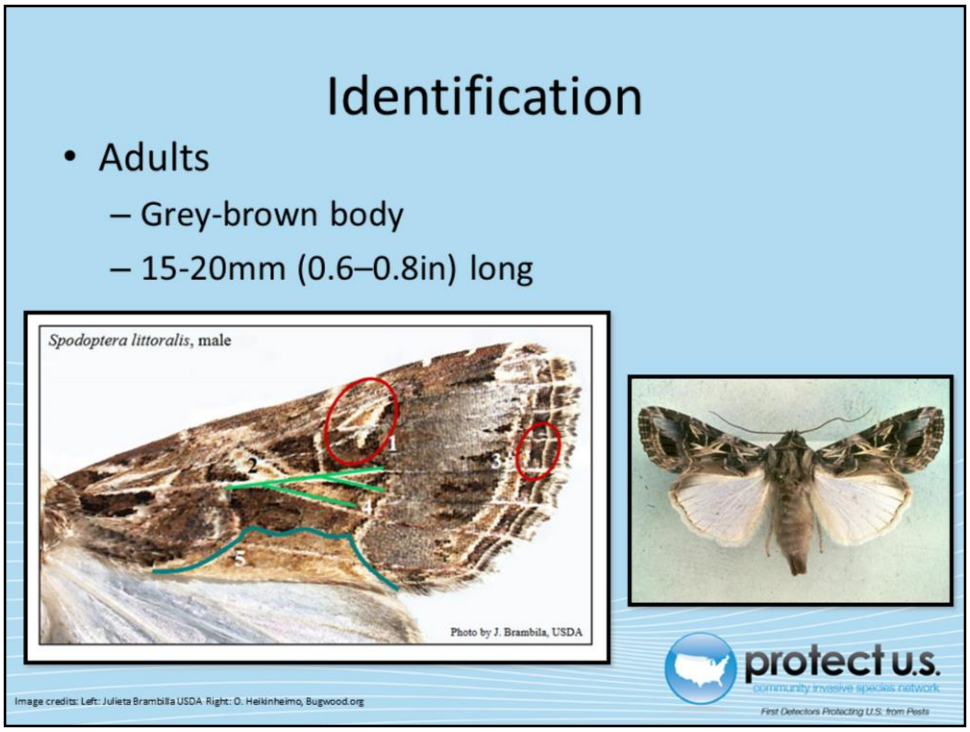
Information sources: 13, 16



Most damage occurs from larval feeding. Larvae prefer to feed on young leaves and shoots, but can also feed on stalks, bolls, buds and fruit. Larval gnawing can expose plant tissues making the host much more susceptible to disease. The Egyptian cotton worm can cause skeletonization and intense scaring of plant tissues. Older instars will chew large holes or completely defoliate plants.

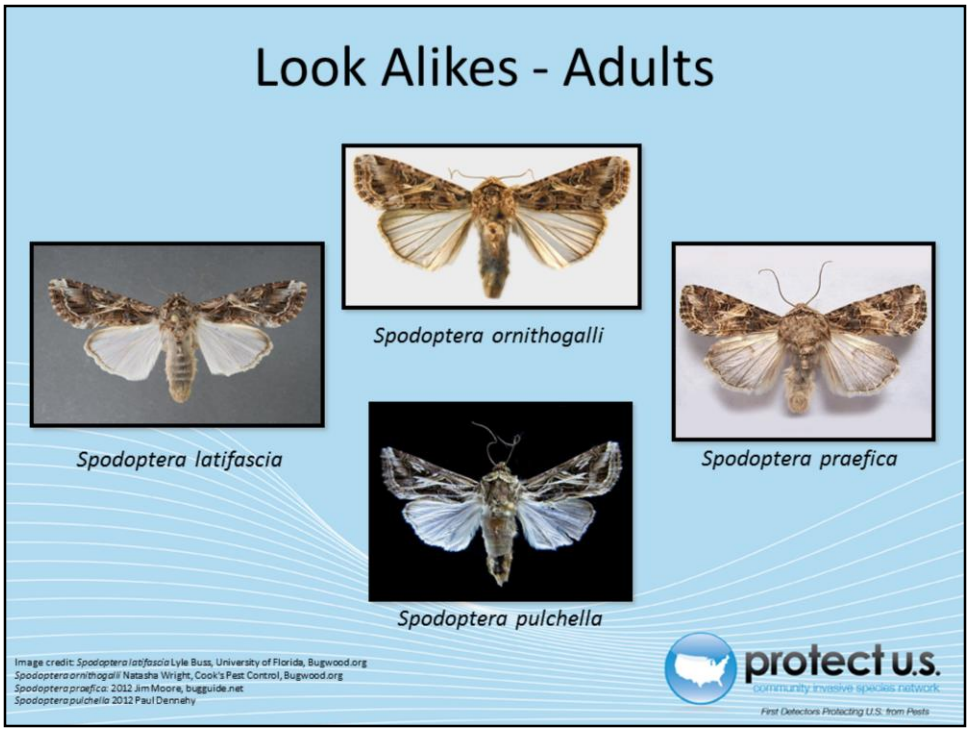
On cotton, leaves are heavily attacked and bolls have large holes in them from which yellowish-green to dark-green larval excrement protrudes.
On tobacco, leaves develop irregular, brownish-red patches and the stem base may be gnawed off.
On maize, the stems are often mined and young grains in the ear may be injured.

Information sources: 3, 16



Adult moths are difficult to distinguish visually from related species. The Egyptian cotton worm is a grey-brown moth with specific variegated patterns on the forewings. Hindwings are a pale white color. The body is 15-20mm (0.6–0.8in) long and the wingspan is 30-38mm (1.18 -1.5in).

Information sources: 7



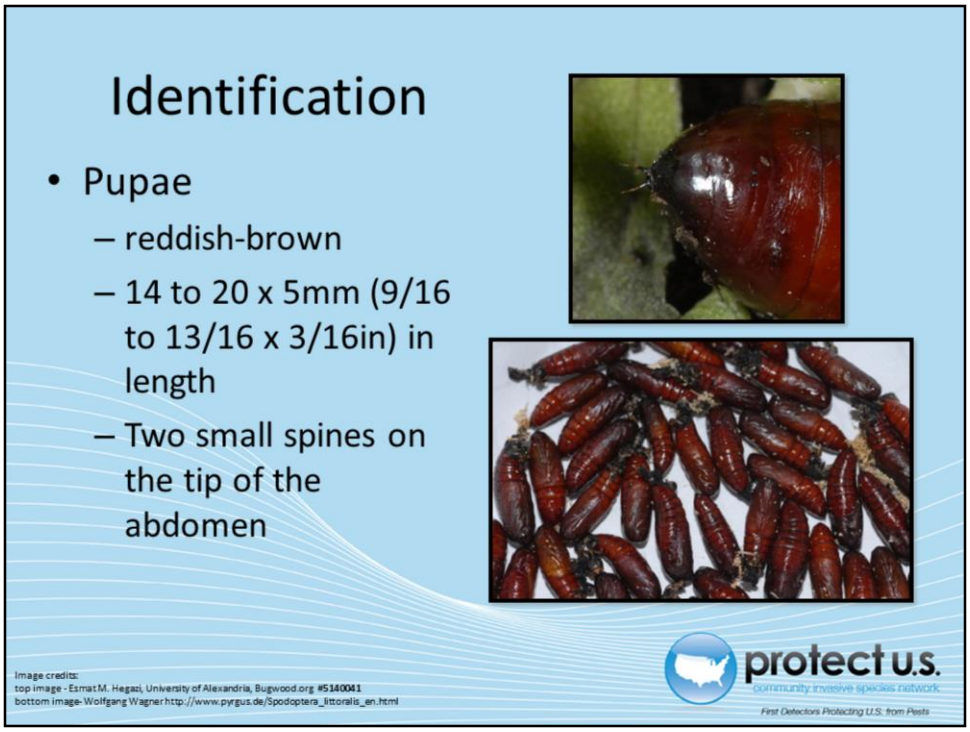
Many of the species of *Spodoptera* look very similar so identification is difficult. *S. littoralis* is often confused with *S. litura,* but both are not established in the continental United States. Dissection and examination of adult genitalia is the only method for identification. Other lookalikes include *S. dolichos, S. latifascia, S. ornithogalli,* and *S. pulchella*.

S. latifascia –In U.S. *S. latifascia* is distributed in the Southeast

S. ornithogalli – widely distributed across U.S.

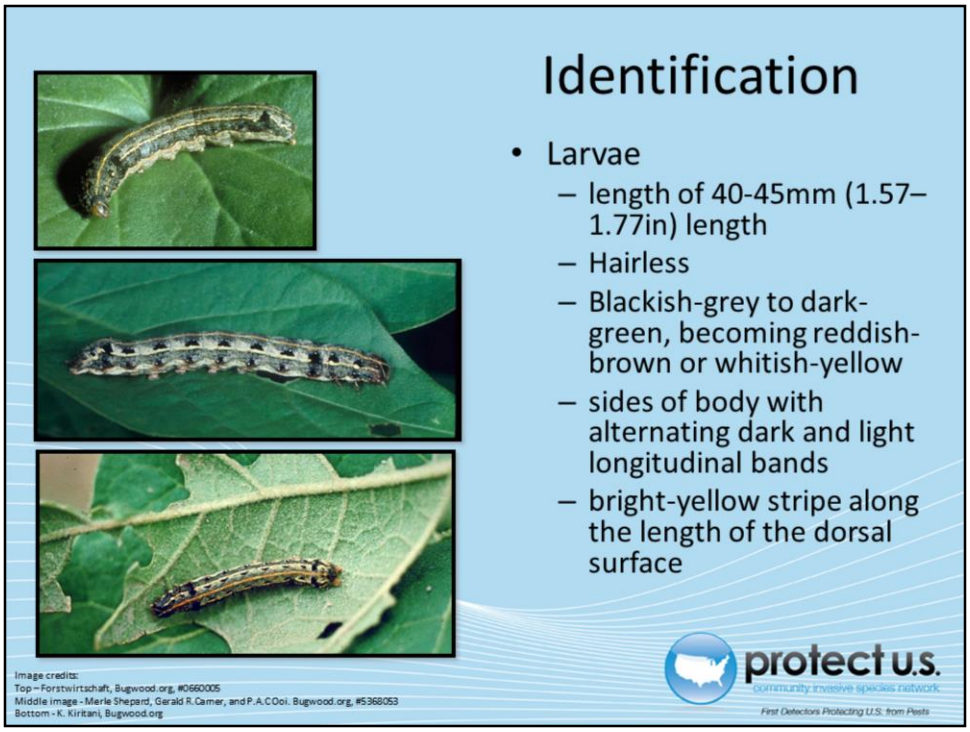
S. praefica – Distributed in western North America from Washington south to California and east to Kansas; also Alberta, Canada

References: 1, 12



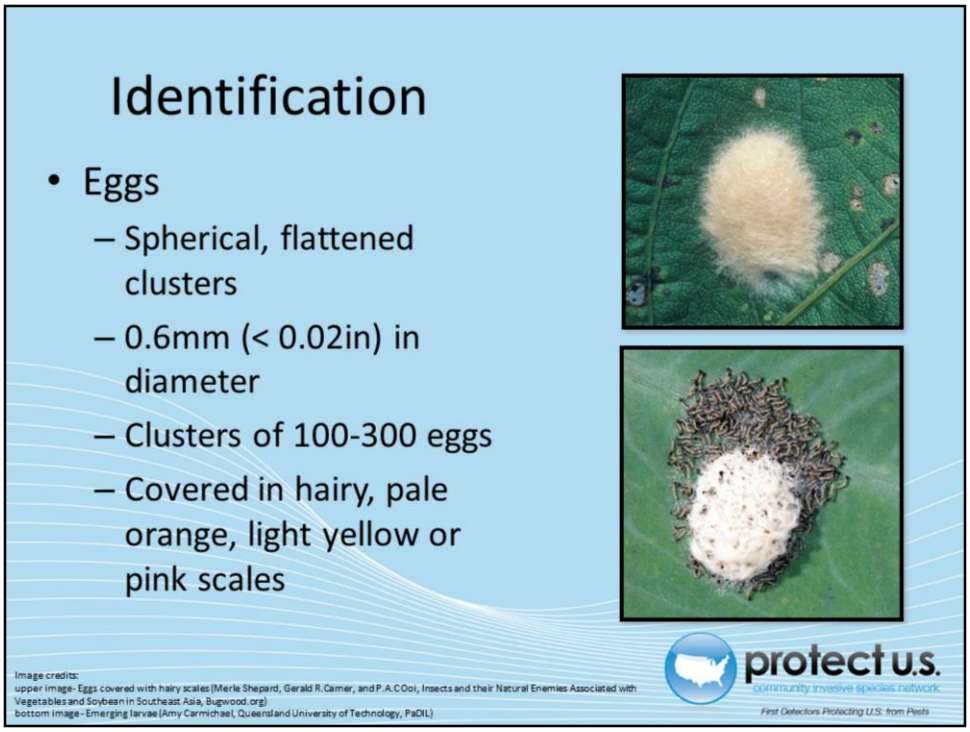
Initially, pupae are green with a reddish color, but quickly turn dark reddish brown. Pupae are cylindrical and 14 to 20 x 5mm (approx. 9/16 to 13/16 x 3/16in). The last segment has two strong spines as indicated by the lower images on the slide.

Information sources: 11, 16



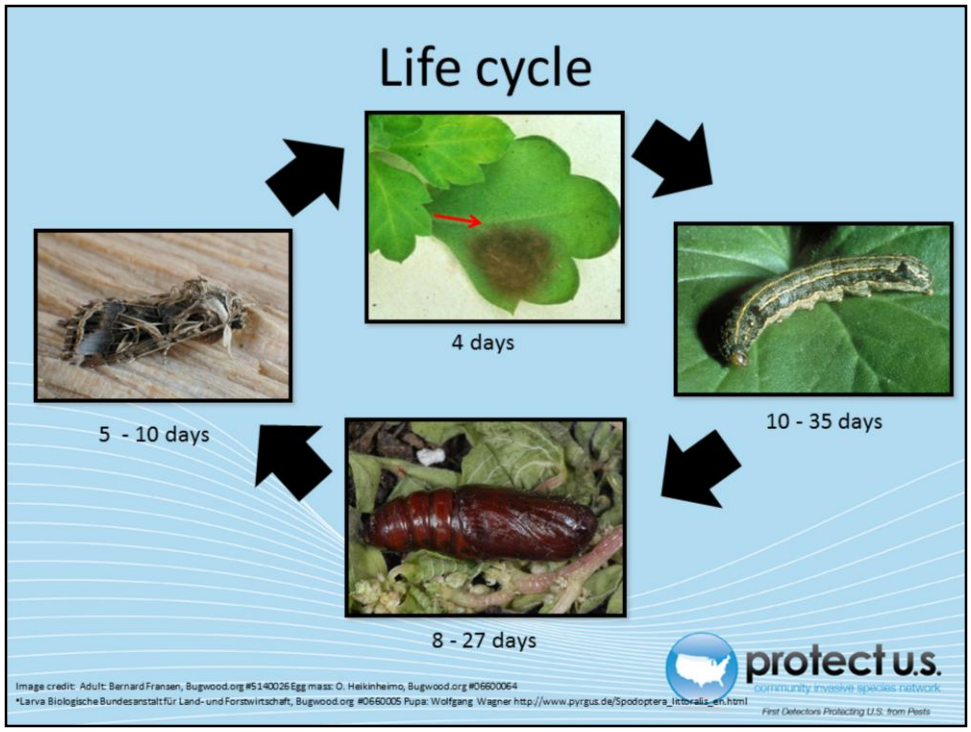
Larvae can grow up to 40-45mm (1.57-1.77in) in length. Younger larvae are blackish-grey to dark green while older larvae become reddish-brown or whitish-yellow. The sides of the body have dark and light bands along its length. On the dorsal side, larvae have two dark semilunar spots on each segment except for the prothorax. Bright yellow stripes also run along the length of the body.

Information sources: 6



Eggs are laid in spherical, flattened clusters. The females cover the egg clusters with hair-like scales that can be pale orange, light yellow, or pink. Clusters are roughly 0.4 to 0.7mm (<1/16in) in diameter.

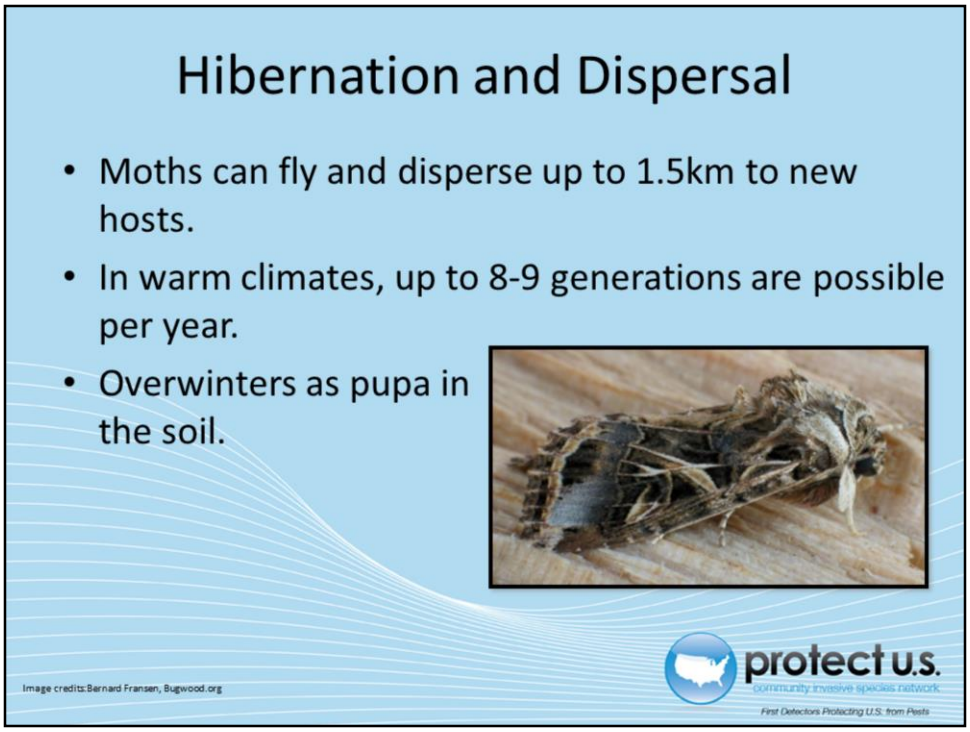
Information sources: 3



Females lay clusters of eggs on the under sides of leaves. The eggs will hatch in around 4 days depending on the temperature. Larval soon begin feeding on plant tissues and causing extensive damage to the host. The Egyptian cotton worm larvae will complete six instars over a three week period in most warmer climates. Cooler regions require additional development time. Larvae will push downward in the soil and pupate where there is solid ground 3 to 5cm (approx. 1 3/16 to 2in) deep. The larvae will form a clay "cell" or cocoon and pupates within 5-6 hours. In the winter, pupae can overwinter in the ground. Adults will emerge at night and live for 5-10 days and typically lay eggs during their first night. In warmer climates, it is estimated that the Egyptian cotton worm completes anywhere between 2 and 9 generations annually.

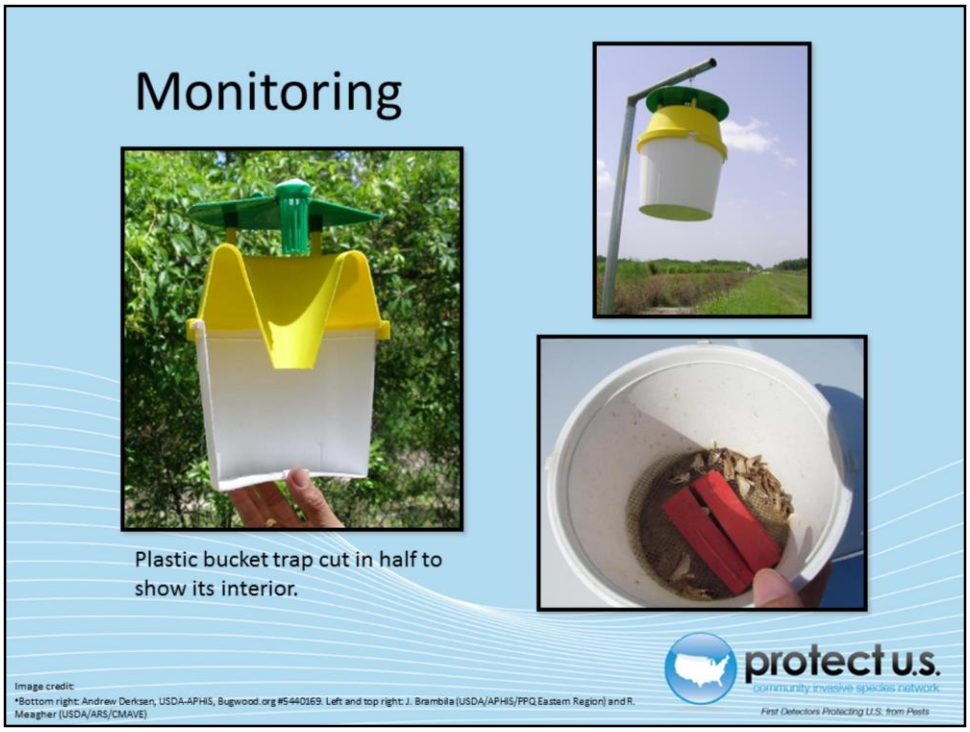
At temperatures of 18° C (64° F) and 36° C (97° F), eggs can hatch at 2 and 9 days respectively. In the same temperatures, the larval stage lasted on average 10 and 35 days, and the pupal stage required 8 and 27 days, respectively (Ocete Rubio, 1984).

Information sources: 5, 14, 16



The moths can disperse over a long distance (1.5km during a period of 4 hours overnight) in search of new host plants. In warm climates, up to 8-9 generations are possible and the pest can overwinter as pupae in the soil. *S. littoralis* has been noted outside its normal range in Europe, but this is likely due to movement of plant materials.

Information sources: 3, 4, 17



The Cooperative Agricultural Pest Survey (CAPS) approved method is a trap and lure. A plastic bucket trap [unitrap] with dry kill strip is the approved trap. It is reccomended that the lure be changes every 84 days (12 weeks).

Information sources: 1

Chemical Control

- Many populations of *S. littoralis* are extremely resistant to pesticides
- Insect growth regulators are used against *Spodoptera* spp.

Image credits: Todd Gilligan, LepIntercept, USDA APHIS ITP, Bugwood.org

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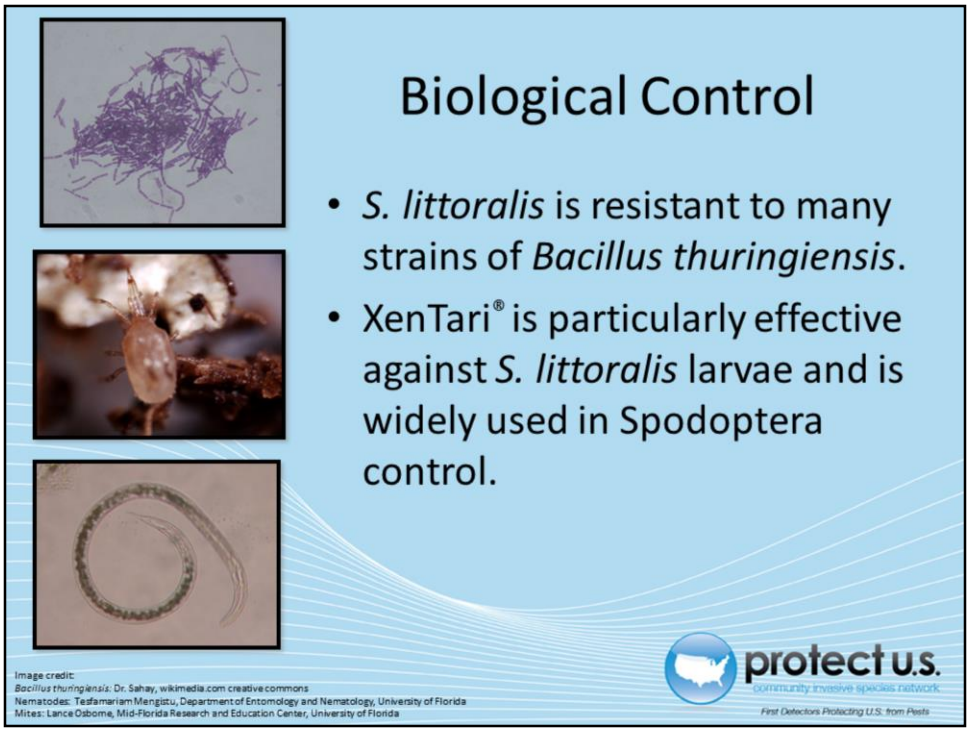
S. littoralis was previously treated with methyl-parathion in Egypt, but resistance has developed since 1968. Since then, organophosphates, synthetic pyrethroids, and other insecticides have been used but resistances has recently occurred in these as well. Limitation of synthetic pyrethroids to one applications per year on cotton in Egypt and as a result, resistance has significantly slowed.

Chemicals used against *Spodoptera* spp. also include insect growth regulators. In India, research has begun on various antifeedant compounds or extracts such as need extract and azadirachtin.

Since resistance to pesticides is very common in this pest species, establishment in the U.S. could be devastating and very difficult to control.

Be sure to check with your local county extension agent regarding any restrictions on use of these pesticides as some may require an applicator's license!

Information sources: 3



Many studies on possible biological control of the two species of *Spodoptera* have occurred. Parasites (braconids, encyrtids, tachinids, ichneumonids) and predators have shown some success. It has also been noted that nuclear polyhedosis, fungi, and microsporidia have proven effective. Furthermore, parasitic nematodes such as *Neoaplectana carpocapsae* have been tested but not shown successful results in practice. In the past, *Bacillus thuringiensis* has been used on Egyptian cotton worm, but resistance to many strains has occurred.

One strain, XenTari® is effective with little resistance thus far against *S. littoralis* larvae and is widely used in Spodoptera control. This strain of *Bacillus thuringiensis aizawai* (ABTS-1857) contains two additional toxin proteins that make it more effective on Egyptian cotton worm. As with most caterpillars, earlier larvae are more susceptible to control and as a result, early treatment is the most effective. As a whole, integrated pest management techniques are recommended for control and limitation of resistance.

Information sources: 3, 17

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- United States Department of Agriculture, National Institute of Food and Agriculture (USDA NIFA)
- United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine (USDA APHIS PPQ)
- Cooperative Agriculture Pest Survey (CAPS) Program
- National Plant Board (NPB)
- States Department of Agriculture
- Extension Disaster Education Network (EDEN)
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- National Plant Diagnostic Network (NPDN)
- U.S. Department of Homeland Security (DHS)
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