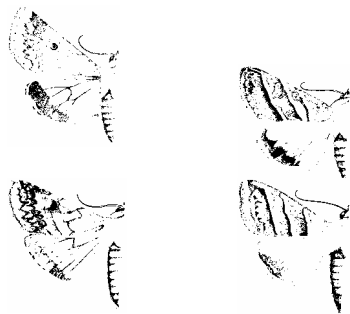


Identification of *Bollworms* and *Tobacco Budworms* in Cotton

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The cotton bollworm (*Helicoverpa zea*) and the tobacco budworm (*Heliothis virescens*) are major pests in Tennessee cotton production. Both species are very similar in general appearance. To the untrained observer, they are misidentified, especially in the larval stage. Due to pyrethroid resistance development within tobacco budworm and variable efficacy of transgenic Bt toxin against bollworm, proper identification has become vital. Selection of control methods and strategy can have a positive or negative economic impact. B. varieties have performed well controlling tobacco budworm infestations but sometimes require supplemental insecticide applications for acceptable control of bollworms.



Bollworm moth
(female & male)

Budworm moth
(female & male)

Both species have complete life cycles consisting of egg, larvae, pupae and adult. Moths (adult stage) average laying 1000 eggs in 8-10 days deposited singly within plant terminals, on leaves, square bracts and stems. Normally, eggs are placed on the upper surface of a leaf vs. the lower surface. As plant size increases, eggs are laid within the plant on squares, blooms, bloom tags and bolls. The number of eggs deposited depends on the general health and vigor of the female moth. Moths are nocturnal and most of their activity including egg lay occurs at night.

Bollworm egg



Budworm egg



Newly laid eggs (within 24 hours) of both species are whitish and flattened at the poles with “ribs” or raised vertical ridges running from pole to pole. These ribs are classified as long or primary and short or secondary. Eleven to 17 (average 12.9) primary ribs occur on bollworm eggs. Eight to 12 (average 10) primary ribs occur on tobacco budworm eggs. Bollworm eggs average 25 total ribs (21 to 31) while tobacco budworm eggs average 21 total ribs (18 to 25). The number of ribs varies from egg to egg.

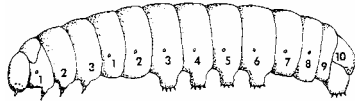
Within 48 hours, the eggs darken and the embryo appears as a reddish ring. On the third day and prior to hatch, eggs have a light brown to grayish appearance. Eggs hatch in 3-4 days depending on temperature. Newly hatched larvae feed on the “egg shell” before moving to various plant parts.

Another characteristic used to distinguish bollworm and budworm is the mandibles or teeth. Budworms have the extra tooth (retinaculum) on the inside of the mandible of the third to last instar larvae. Occasionally, the extra tooth can be lost, leaving a “scar” which appears as a thin, whitish, non-sclerotized area.



Bollworm mandible

Budworm mandible



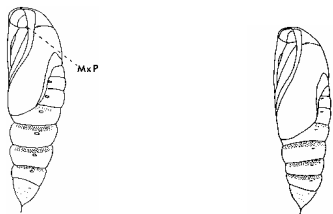
The presence or absence of microspines (spinules) around setae on abdominal segments 1, 2, and 8 can assist in determining species. The amount of pigmentation and size of the insect within each instar affects the ease of determining the distribution of the spinules.



Setae with Microspines
Bollworm Budworm

Larvae of both species undergo six instar stages or the periods between molts. Color is variable and not a reliable distinguishing character to determine species, especially in third through last instar larvae. Pigmentation and color are determined by environment (exposure to light, temperature, food) and heredity. Larvae in concealed feeding sites or on dark substrates are darker in appearance.

Larval feeding and damage can occur for 14 to 16 days. A single larva may damage 3-6 squares, 1-2 bloom, and 1-2 bolls. At the end of this feeding period, larvae burrow into the top 2-3 inches of soil around the base of the plant to form the pupae stage.



Bollworm pupa Budworm pupa

Pupae of bollworms and tobacco budworms are shiny, reddish-brown before turning dark brown due to adult pigmentation just before emergence. Bollworm pupae average 21.6 mm in length and 6.0 mm in width across the thorax. Tobacco budworm pupae are smaller and average 18.2 mm in length and 4.7 mm in width. Bollworm pupae also have larger spinules and maxillary palpi that are absent in budworms. In July and August, moths emerge from pupae in 10-12 days. This completes the life cycle.

Scouting

In conventional cotton varieties, the normal sequence of larval feeding is from terminal to small squares, larger squares, blooms and bolls. This sequence can change with hot, humid temperatures that cause moths to seek refuge deeper within the plant canopy to lay eggs. This sequence also appears to be changing with the advent of Bt cotton varieties. Bollworm larvae which survive in Bt cotton are commonly found in white blooms or penetrate bloom tags after hatch to enter the top of small bolls. Both scenarios require close observation and whole plant exams.

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