

MU Guide

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The Boll Weevil in Missouri: History, Biology and Management

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Introduction

The cotton boll weevil, *Anthonomus grandis grandis*, is the most important pest of cotton in much of America's Cotton Belt. Its importance is due not only to the considerable damage it does but also to its disruption of management programs that target other pests.

High numbers of boll weevils can cause you to apply insecticide repeatedly during the growing season because the boll weevil goes through several overlapping generations during every crop season, reproduces quickly, moves often and can be controlled with insecticides only during its adult stage. Applying insecticides can reduce populations of organisms that regulate the populations of other cotton pests, such as aphids, plant bugs and the bollworm complex. The presence of significant boll weevil populations dictates, to some extent, the management of other pests.

History and distribution

The boll weevil is not native to the United States. It originated in Mexico and Central America where it fed on native tree cottons. It probably adapted to domesticated cottons in Central America in pre-Columbian times.

It was first detected in the United States in Texas, about 1892. The boll weevil spread across the Cotton Belt at an average rate of about 60 miles a year and made it to the Carolinas by 1922. It was first detected in Missouri about 1913.

Today, you can find the boll weevil in the mid-South cotton-production region, which is Arkansas, Louisiana, Missouri, Mississippi and Tennessee, and in Texas, New Mexico and parts of Alabama. States successfully eradicating the boll weevil are North Carolina, South Carolina, California, Florida, Georgia and parts of Alabama. Another subspecies of the boll weevil is found in Arizona, but it feeds predominantly on a wild relative of cotton.

The boll weevil is found throughout the Missouri cotton-production region, and cotton is the only host of the boll weevil in the state. It appears to be most abundant along Crowley's Ridge, a north-south ridge

extending from the Ozarks south into Arkansas, and in areas near major waterways (see Figure 1). Researchers are trying to definitively establish the distribution in the state.

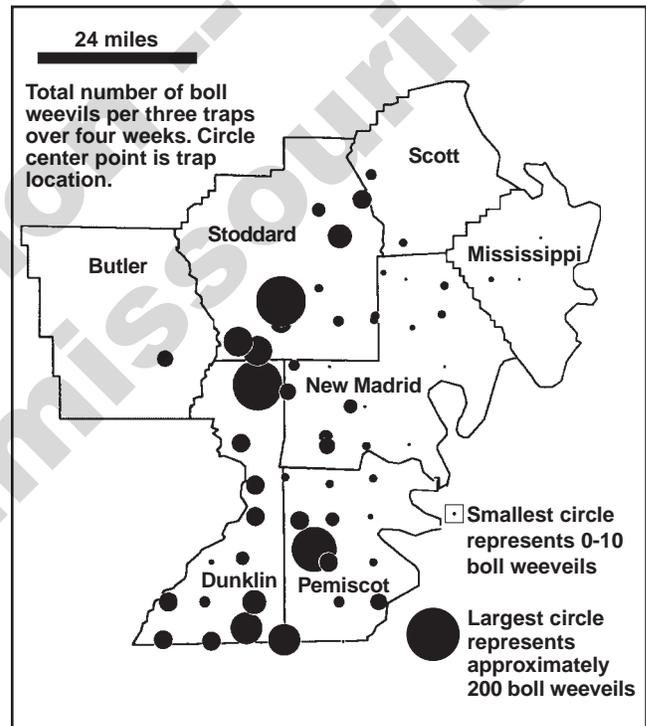


Figure 1. Distribution of boll weevils in southern Missouri,

The insect's life cycle

The boll weevil, like all beetles, undergoes complete metamorphosis. Female boll weevils deposit eggs in cotton flower buds, called squares, and in small bolls. Each female may produce as many as 200 eggs during her life span. The female seals the oviposition hole with frass, or droppings, leaving a characteristic brown, raised area at the site. The bracts of infested squares usually yellow, flare and the squares drop from the plant. Infested bolls may or may not drop.

Larvae hatching from the eggs feed on the square or boll tissue for approximately seven days to 14 days

(depending on temperature) and then pupate. The pupal stage lasts about five days, after which the new adult emerges. Newly emerged adults feed on squares, pollen or bolls. Females begin laying eggs three days to five days after they emerge. Generation time from egg to egg averages about 18 days to 21 days, although it can be shorter or longer depending on environmental conditions. Figure 2 illustrates the life cycle of the boll weevil.

Toward the end of summer, as cotton plants mature and days grow shorter, most emerging adult weevils enter a pre-diapause state. Diapause is a resting state comparable to hibernation that adult boll weevils enter to survive winter. Pre-diapause boll weevils typically don't mate but instead spend a great deal of time feeding to build up fat reserves for the winter. During this phase of the annual cycle, boll weevils travel great distances. Individual insects may move more than 30 miles in search of remaining food or wintering habitat.

Diapausing boll weevils generally spend the winter in leaf litter in wooded areas near cotton fields. However, a few overwinter in fence rows, grass banks and other sites. Survival is highest in hardwood litter sites. The boll weevils remain in these overwintering sites until warming temperatures, lengthening days and perhaps moisture trigger the break of diapause.

Abundance from year to year varies dramatically because of fluctuations in the severity of winters. Spring-emerging boll weevils search for the nearest cotton field and search for squares there. Those emerging before squares are available may feed on the terminal buds of cotton plants or on the pollen of flowering plants around the field. The boll weevil, however, must have cotton pollen available to successfully mate.

Once males feed on squares, they produce a pheromone, released in their frass, that is attractive to both females and males. Females are attracted because pheromone identifies not only an oviposition resource but a food source as well. Females know that males can't produce the pheromone until they find squares. Males are attracted to the pheromone because it identifies food and possible mates. Once females respond to the pheromone, the insects mate, and the annual cycle starts again. The insects may produce three generations to five generations a year in southeastern Missouri.

Mortality factors

Over the course of a year, many factors contribute to boll weevil mortality. These factors include predation, parasitism, disease, weather and others.

Predation is a relatively minor component in boll weevil population dynamics compared with other insect pests. Because most of the life cycle is spent inside the square, weevils tend to be safe from predators. However, studies have shown that some ants, especially fire ants, are effective predators of boll weevils. A number of insects, spiders, birds and other

animals eat adult boll weevils, but these predators only have a minor effect on infestations.

Parasites also have little effect on boll weevil populations. Several native parasitic wasps do attack weevil larvae but rarely in numbers high enough to reduce populations. An exotic parasitic wasp, *Catolaccus grandis*, is effective, but it cannot overwinter at these latitudes. It may be useful in release programs, though.

Disease organisms do kill some boll weevils, but again, normally not at levels that will control infestations.

Suicidal emergence can be a significant factor. In some years, many boll weevils come out of diapause long before cotton squares are available. Because most (but not all) emerging weevils will live for only about two weeks without cotton pollen, most of these early emergers die without reproducing.

Weather is probably the most important cause of boll weevil death in Missouri (and much of the rest of the Cotton Belt). Because the boll weevil is a tropical insect that traveled north, it is not well-adapted to the climate of much of the United States. Boll weevils start to die at about 23 degrees F; the percentage that dies increases as the temperature drops. Research we've conducted shows that most boll weevils don't survive after an hour at 5 degrees F. Because overwintering boll weevils are insulated by leaf litter, air temperatures usually have to drop lower than the values mentioned above. Snow or ice cover also insulate effectively and protect boll weevils from lethal temperatures.

In most years in Missouri, less than 10 percent of the boll weevils that enter wintering habitat survive to spring. A series of severe winters in the late 1970s virtually eradicated the weevil in Missouri; populations did not recover until the late 1980s. High heat, drought and cultivation may kill some larvae during the growing season. The impact of these factors has not been measured in the mid-South growing region.

The boll weevil's damage

Most damage to cotton by the boll weevil is caused by females laying eggs and larvae feeding. In heavy infestations, nearly every square receives an egg as soon as it is large enough to support the development of a larva (when squares are roughly the size of a pencil eraser); under these conditions, virtually no fruit may be set. The potential for damage is greater because of the boll weevil's short generation time. Two or more generations may occur during viable fruit set. You could lose more than 50 percent of your crop to boll weevils; complete crop failures have occurred.

Squares and small bolls fed on by adult boll weevils typically drop from the plant. Larger bolls may not drop but may be more susceptible to invasion by boll-rot organisms.

Adults feed on terminals of seedling cotton

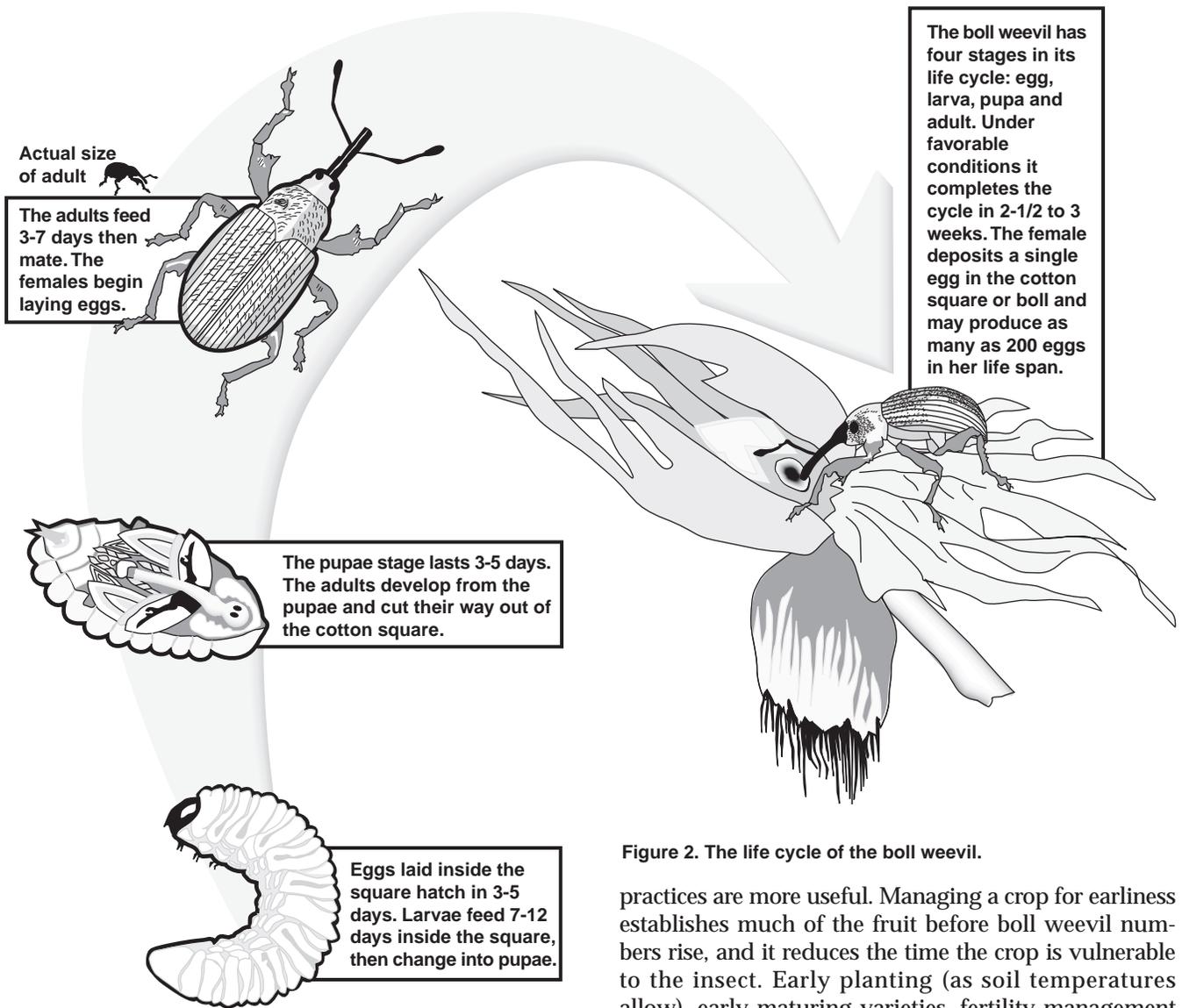


Figure 2. The life cycle of the boll weevil.

before squares are available. In rare instances, this feeding causes enough injury to reduce stand or retard plant growth.

Management

Winter is probably the most effective killer of boll weevils each year in Missouri. Unfortunately, you can't modify the weather or wintering habitat in this area. However, you can manage boll weevil populations through a combination of cultural and chemical control strategies.

An important tool for boll weevil management is the pheromone trap. This trap uses a synthetic version of the pheromone produced by male boll weevils to attract weevils of both sexes. These traps give good information on the activity and the number of weevils in a cotton field.

Cultural control: Cultivation destroys some of the larvae in squares that have fallen off the plant, but other

practices are more useful. Managing a crop for earliness establishes much of the fruit before boll weevil numbers rise, and it reduces the time the crop is vulnerable to the insect. Early planting (as soil temperatures allow), early maturing varieties, fertility management to prevent lush, late-season growth, using growth regulators such as Pix (mepiquat chloride) and other earliness practices help reduce boll weevil impact.

In some years, a substantial number of weevils can develop in a field after harvest, particularly if harvest was early and regrowth occurs. Destroy crop residues as soon as possible after harvest to reduce overwintering populations. Mowing with a flail or rotary mower is preferable to disking or otherwise trying to bury the residue. To be effective, destroy residue on an area-wide basis. If only a few growers leave residue standing through the fall, enough boll weevils can be produced to infest neighboring growers' acreage the following spring.

Chemical control: You can use three types of insecticide applications during the cotton-growing season to reduce boll weevil populations. The first two types reduce populations during the growing season; the third reduces populations going into wintering habitat.

The first kind of boll weevil insecticide treatment

frequently is called a “pin-head square” application. Time the application to coincide with the appearance of the first squares, when they are about the size of a kitchen matchhead. A well-timed pin-head square application can greatly reduce the number of boll weevil colonizers in a field and may eliminate the need for more insecticide treatments later in the season. Pin-head applications are, therefore, the most important chemical “tools” available for boll weevil management. Base your decision to make a pin-head application on pheromone-trap captures. Place pheromone traps when plants emerge at a rate of one trap per 10 acres to 20 acres. You should treat your crop if, during a two-week period prior to the appearance of the first square, you capture one weevil to two weevils in each trap each week.

The second type of boll weevil insecticide application is an “in-season,” threshold-based treatment. These are directed at populations that have exceeded the economic threshold and that will cause economic loss if left unchecked.

Missouri’s threshold is 10 percent to 15 percent squares with boll weevil punctures. Examine a minimum of 100 randomly selected squares before you decide whether to treat. Begin scouting when the first squares are one-third grown (about the size of a pencil eraser), and continue weekly until cutout (when square production drops off). You may need to repeat in-season treatments at four-day to five-day intervals until the population is reduced. Late in the season (during and after cutout), raise the threshold to reflect the increasing scarcity of squares. At this time the threshold should be between 20 percent to 30 percent punctured squares, and you should examine small bolls for signs of adult feeding and egg laying.

The third type of insecticide treatment option to use against boll weevils is the “diapause-control” spray. Its goal is to reduce the number of boll weevils entering wintering habitat. If you want the diapause-control treatment to be effective, make it part of an area-wide program. Diapause-control sprays are applied to cotton fields after the crop is made but before boll weevils move to wintering habitat (in Missouri this would be about the beginning of September). You may spray several times prior to harvest at 10-day to 14-day intervals. Discontinue when the crop residue is destroyed or killing frost occurs. The need for diapause treatments is based on damage rates in the field and pheromone trap captures.

You can find recommended insecticides in MU Publication M146 or at your local University

Extension center.



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