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a field guide to Boll Weevil Identification

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A Field Guide to Boll Weevil Identification

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INTRODUCTION

Identification of boll weevils in both eradication and pest management programs is critical. Control decisions based on identification are major costs to the programs and to cotton growers. Treatments resulting from misidentified boll weevils are disruptive, unnecessary, and expensive. Failure to treat when boll weevils are not correctly identified could extend eradication program operations into extra years. Therefore, all identifications of weevils are critical. Second opinions should be encouraged. Specimens should be submitted to specialists for verification.

The use of boll weevil traps and the boll weevil aggregation pheromone (Grandlure) has become a major component of all boll weevil control programs. Grandlure-baited traps are at least eight times more efficient at detecting low-level populations of boll weevils than hand sampling (Hardee and Mitchell 1997).

Utilization of these traps makes it possible to control the boll weevil with less insecticide and ultimately makes eradication possible. Large geographical areas have traps placed around all cotton fields in Boll Weevil Eradication Programs. The reduction in the boll weevil population and the presence of large numbers of pheromone traps creates a new situation for even the most experienced field people. Now, boll weevil scouts are likely to find a variety of other snouted beetles – both in the traps and in the field – that were not commonly seen before. Additionally, differentiation in boll weevil punctures and the small bollworm and budworm damage can become more difficult and takes on new importance.

Boll weevil traps attract a large number of other insects and spiders. While the pheromone is specific for the boll weevil, it is similar to that of related weevils. The trap color alone attracts both boll weevils and other insects. The placement of the traps next to flowering shrubs often results in an increase of different insect species captured.

This publication is designed to help in the identification of boll weevil adults. Since most people do not have reference collections of insects to make identification comparisons, color photographs are included.

IDENTIFICATION

Figure 1

Boll weevils are 1/8 to 1/3 inch long, and their color varies by age. As boll weevils mature, they become a dark red-brown or mahogany. This figure shows a female boll weevil.

Figure 2

This figure shows a male boll weevil. Variations in the snout are the simplest means for distinguishing between the sexes.

Figure 3

The billbug varies from 1/5 to 3/4 inch in length, probably the largest weevil found in traps. Color varies by species including black individuals commonly found in traps.

Insects differ from other arthropods with their bodies consisting of head, a three-segmented thorax, and a segmented abdomen. The presence of wings signifies an adult insect. The prothorax – the first thoracic segment – holds the head and first pair of legs. The mesothorax, or middle segment, has the second pair of legs and the front pair of wings attached. The metathorax, or last segment, has the third pair of legs and second pair of wings.

Beetles' front wings are leathery or hardened covers. These wing covers, called the elytra, meet in a straight line on the abdomen. Structures used for beetle identification are the head, antennae, thoracic segments, legs, elytra, and abdomen. The weevils of the Family Curculionidae, including boll weevils, are called the snout beetles. Adult weevils have heads that extend into elongated snouts with chewing mouthparts at the distal end. The antennae arise on the sides of the snout with the long basal segment fitting into a groove on the snout. This long basal segment, with the attached smaller segments, has an elbowed appearance. The small segments increase in diameter near the end of the antenna, which gives it a club-like appearance.

There have been numerous species of weevils found in the boll weevil traps. Some representatives of common groups are described in the following sections.

THE BOLL WEEVIL

The boll weevil specimens (Figures 1, 2) pictured are among the larger of the species. Figure 1 is of a female, and Figure 2 is of a male – both collected in Webster County, Mississippi. For more detailed information on the boll weevil, see the "Boll Weevil Identification" section. Figures 1 through 9 are at the same magnification for comparison.

THE BILLBUGS

The billbug (Figure 3) is probably the largest weevil found in traps. Its snout is short and stout. The antennae arise from the snout close to the eyes but not next to them. The elytra do not cover as much of the sides of the abdomen and thorax and do not extend to cover the terminal abdominal segments. From the dorsal view, this weevil is wide at the middle of the body and much narrower at both ends. Billbugs often cover their bodies with a coating of mud. Size of the many species varies from 1/5 to 3/4 inch in length. Color varies by species including black individuals commonly found in traps.

THE BARIDINE WEEVILS

Baridine weevils (Figure 4) include 500 species in North America, all of which are about 1/5 inch long. Several species have been found in traps. Body shape is similar to that of the billbugs: widest in the middle when viewed from top and side. The elytra cover all segments of the abdomen but leave the sides exposed. The snout is longer than the billbug snout, and it is slender with a sharp bend close to the eyes. This shape gives the appearance of the snout always being bent back under the body. The body is covered by plate-like scales. There are more scales on the sides and under surface of the weevil. These generally white scales give a two-tone appearance to the weevil's body, dark top and light bottom. Color varies by species with some appearing blue, black, gray, and tan, but the body shape and size are generally consistent.

Figure 4

Baridine weevils are about 1/5 inch long. Color varies by species with some appearing blue, black, gray, and tan.

Figure 5

The cowpea curculio is a shiny black weevil, about 1/4 inch long.

Figure 6

The nut or pecan weevil looks like a boll weevil in shape, color, and size, but its snout is thinner and longer in proportion to its 3/8-inch body length.

Figure 7

The plum curculio has a rough, multicolored appearance and is about 1/4 inch long.

THE COWPEA CURCULIO

The cowpea curculio (Figure 5), a shiny black weevil, has no scales or hairlike setae. It has prominent round punctures on most of its body surface. The snout is slender – about a third the length of the 1/4-inch-long body. The elytra cover the entire top and most of the sides of the abdomen, the mesothorax, and the metathorax. This weevil does not fly. It is a pest of seedling cotton where cowpeas are present or used in rotation with cotton.

THE NUT OR PECAN WEEVIL

The nut weevil (Figure 6), when viewed from a top rear position in a trap, looks like a boll weevil in shape, color, and size. However, its snout is very thin and long in proportion to its 3/8-inch body length. The snout can range from half as long as the body to equal to the length of the body. The main part of the head appears spherical. The legs are long and slender with no spurs. As with the boll weevil, the nut weevil's elytra have a pattern of parallel grooves that run the length of the insect and curve to join at the end. The red-brown body is covered with white hairlike scales.

THE PLUM CURCULIO

The plum curculio (Figure 7) has a rough, multicolored appearance. The body is red-brown with black spots. There are patches of white and gold hairlike scales. This weevil's snout is stout and is a third as long as the 1/4-inch body. It has ridges running the length of the elytra with four prominent humps and a few lesser ones. This weevil is often seen in traps during

Figure 8

Rice water weevils are light tan with some darker spots.

Figure 9

Strawberry bud weevils are red-brown with dark markings and have bodies from 1/12 to 1/8 inch in length.

Figure 11

This enlarged top view of a boll weevil shows the insect's rounded "shoulders," which are sharp and distinct in the strawberry bud weevil (Figure 10).

Figure 12

Two small and two large adult boll weevils selected from a season-long collection trapped in a commercial cotton field at Eupora, Mississippi. Larger weevils were the norm for that collection.

the spring and is plentiful where wild plum and other stone fruit trees occur.

THE RICE WATER WEEVIL

The rice water weevil (Figure 8) is light tan with some darker spots on the prothorax and elytra. Its snout is short and very broad, and its body is covered with flat scales. There are no spurs or teeth on the femur of any of the legs. This is a major pest in commercial rice.

THE STRAWBERRY BUD WEEVIL

The strawberry bud weevil (Figure 9) is red-brown with dark markings on the elytra. It is from 1/12 to 1/8 inch in length and has a shape similar to the boll weevil. On the distal end of the femur is a single-toothed spur, as opposed to the double-toothed spur found on the boll weevil. The enlarged top view of this species (Figure 10) shows a triangular structure called the scutellum, which is covered by thickly clustered, white scales. This density of scales does not occur in the boll weevil (Figure 11). The strawberry bud weevil (Figure 10) has sharp, distinct "shoulders," which are more rounded in the boll weevil (Figure 11). Both are members of the genus *Anthonomus*, which includes about 100 species in North America. It is a pest of strawberries and has a wide host plant list, including wild blackberries.

Figure 10

This enlarged top view of a strawberry bud weevil shows a triangular structure called the scutellum, which is covered by thickly clustered, white scales. This density of scales does not occur in the boll weevil.

BOLL WEEVIL IDENTIFICATION

The shape of the boll weevil adult is consistent in several characteristics. The head has a long, slender, slightly curved snout about half the body length (Figures 1, 2). The overall body is a teardrop shape. It is somewhat elongated and appears generally smooth and rounded under lower magnification.

The size of the boll weevil is variable. Hunter and Pierce in 1912 recorded minimum and maximum lengths from their extensive studies to be 2.5 mm and 6.75 mm (Burke 1968). This is smaller than the 1/8 to 1/3 inch presented by Leigh et al. (1996). The snout length is not included, and standardized measurement is difficult in respect to positioning the head. Figure 12 shows two small and two large adult weevils. These were selected from a season-long collection trapped in 1997 from a commercial cotton field at Eupora, Mississippi. The larger weevils were the norm for the collection, and the small weevils were the smallest. Small weevils develop in small flower buds (squares), and large weevils develop in larger squares and bolls (Leigh et al. 1996). The small adult boll weevils have had their size reduced by environmental pressure. They are still fully functional in all other activities. Ecological studies on the boll weevil are described in detail by Rummel and Summy (1997).

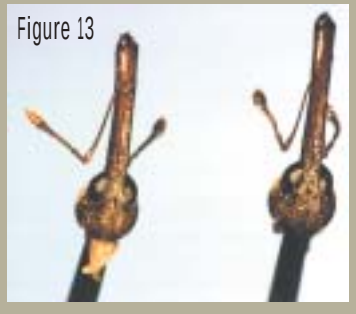
The snout of the boll weevil differs between the male and female. This sexual variation is the simplest means for distinguishing between the sexes. The female in

Figure 1 has a more slender snout with an appearance of being longer than the male in Figure 2. In cross section, it would be round in the female and ovoid in the male. The male has more of a bend near the end of the snout. In Figure 13, the female's snout is longer from the base of the antennae to the end than the male's snout. In Figure 14, the female has a shinier, smooth-appearing snout especially under low magnification and bright intense light. The male snout has a coarser appearance with more pits, pores, and scales. These characteristics are best viewed from the antennal base to the end of the snouts. Other sex structures are more difficult to distinguish or require dissection and a microscope.

Hardee et al. (1969, 1997) found that in early season or before cotton fruited, the pheromone (Grandlure) attracted more males (53.4%) than females (46.6%) to the traps. In late season (during migration), more females (62.4%) than males (37.6%) were captured. During midseason (the main fruiting period), 90% or more of the few boll weevil adults captured were females. Thus, sexing trapped boll weevils can have some importance if trap tampering is suspected.

The femur of the boll weevil is the largest leg segment. It is expanded or swollen in the middle (Figure 15). The boll weevil front femur is compared in Figure 16 to the front femur of the Thurberia weevil and *Anthonomus peninsularis*. At the distal end of the boll weevil femur is a stout spur with double-pointed teeth (Figure 15).

Figure 13



The female boll weevil's snout (right) is longer from the base of the antennae to the end than the male's snout (left).

Figure 14

The female boll weevil (top) has a shinier, smooth-appearing snout. The male snout (bottom) has a coarser appearance with more pits, pores, and scales.

Figure 15

The femur of the boll weevil is the largest leg segment. It is expanded in the middle. At the top of this figure is a front view of the femur; at the bottom, a rear view.

Figure 16

This figure compares three weevil front femurs: Thurberia weevil (top), *Anthonomus peninsularis* (center), and the boll weevil (bottom). At the distal end of the boll weevil femur is a stout spur with double-pointed teeth.

Figure 17

This figure shows the outside view of a boll weevil's elytra with grooves.

Figure 18

This figure shows the inside view of a boll weevil's elytra, which are hardened wings that cover an insect's more delicate second set of wings.

A. peninsularis has a more slender femur with two very sharp, smaller spurs. Boll weevils and Thurberia weevils have similar legs; experts separate them based on a width-to-length ratio of the femur (Burke et al. 1986).

The boll weevil has spurs on the femora of all legs. The middle pair of legs has a smaller spur with one large tooth and a second remnant of a tooth or rounded area on the spur. The femora of the back legs have a single, sharp-toothed spur. The tibia or second long leg segment has a sharp spur on its far end pointed almost perpendicular to the tibia. The tibial spurs are on the first and second pairs of legs. The third pair of legs has bristles that appear as spurs.

The elytra have parallel grooves that join at the distal end (Figure 17). Within these grooves are pits that display the same parallel pattern from the inside view (Figure 18).

The color of the boll weevil varies by age of the adult. Before emergence, the new adult is a translucent yellow or straw color. Young adults in the flower gradually change to become more red (Figure 12, second from left). As the weevil matures, it becomes a dark red-brown or mahogany (Figure 18). White scales give the body a gray color or a variable color (Figures 1, 2, 11, 12, 17). These elongated scales are tapered at both ends and are more robust on the sides and lower surfaces of the body. On the upper surfaces, these scales are more hairlike and are in clusters, as opposed to a consistent covering. The main cluster of scales on the dorsal median of the prothorax appears as a white stripe from the head to the elytra. This characteristic is not present in all boll weevils. In Figure 17, the bottom elytrum is black. By viewing the elytra from the inside, the body color is more obvious (Figure 18). This exception to color is the ebony boll weevil (Bartlett 1967). Exception to the scales was the discovery of scaleless and dark-scaled boll weevils by Villavaso (1986).

In the literature, there is a boll weevil referred to as the "Gast Ebony" from the laboratory rearing colony at the Gast Rearing Facility, a USDA-ARS facility at Mississippi State. Specimens with this black body color have been collected in program traps in North Carolina, South Carolina, and Mississippi and verified by these authors. Whether it occurs rarely in nature or is a product of past research releases from the USDA-ARS rearing facilities is not known (Terranova et al. 1990, 1991).

Burke (1968) listed three forms or subspecies of *Anthonomous grandis*. These are the Mexican Boll Weevil, the Southeastern Boll Weevil, and the Thurberia Boll Weevil. The Southeastern Boll Weevil is the species of concern in the southern United States, including south Texas. The Mexican Boll Weevil is nearly identical and can be distinguished only by a few experts. Both are identical in status as cotton pests. The Thurberia Boll Weevil is of concern in Arizona and in Sonora, Mexico, when it leaves its wild cotton host (*Gossypium thurberi*) and moves into commercial cotton. It does not cause major damage, and misidentification could lead to unnecessary insecticide treatments.

CLOSEST BOLL WEEVIL RELATIVES

Five similar *Anthonomous* species have been compared and described by Burke and Cate (1979) and Clark and Burke (1986). The sister species to the boll weevil is *A. hunteri* from southern Mexico. Its host plant is *Hampea trilobata* in the Family Malvaceae. *A. hunteri* has a body that is more strongly convex in side view, its snout is longer and more strongly curved, and its front femur is more slender than the boll weevil (Burke and Cate 1979). The other four species are *A. fulvus*, the mallow weevil, from Texas, Oklahoma, and Kansas; *A. peninsularis*, from Arizona, California, and Nevada; *A. texanus*, from Texas, New Mexico, Arizona, and Mexico; and *A. cognatus*, from California. The globe mallows are listed as their host plants. *A. peninsularis* and *A. texanus* have been found in boll weevil traps. These four species all have the same dense white scale covering of the scutellum as the strawberry weevil (Figure 10). Clark and Burke (1986) state that the scales on the prothorax and elytra are uniformly distributed on *A. peninsularis*, *A. texanus*, and *A. cognatus*, as opposed to the tendency for scale clumping in the boll weevil. The scales on the elytra form a distinct pattern on the mallow weevil similar to that of the strawberry bud weevil (Figure 10). These scale characteristics easily separate these species from the boll weevil, but other characteristics and pictures are available in Clark and Burke (1986).

FIELD EVIDENCE

Cotton square damage by the boll weevil comes from feeding and egg-laying punctures. Both male and female adults feed on squares by chewing through the surface and feeding on the developing pollen and seeds. The penetration holes are no larger than the boll weevil snout. Usually, there is a feeding puncture on each square, and near each is a small pile of frass (fecal material). When there is an extreme shortage of squares, numerous feeding punctures can be found on each square. Usually, there is only one egg puncture per square (Figure 19), but multiple punctures can occur. The puncture has a plug placed in it to seal the hole and protect the egg [photos in Leigh et al. (1996) and Extension Service Cotton Insect Scouting Manuals]. The feeding punctures of small budworms and bollworms can sometimes be mistaken for boll weevil punctures. If the small larvae do not do much damage, the plant will seal the wound with a sap plug. This has been mistaken for boll weevil damage but can be identified with a low-power lens. Worm feeding is accompanied by small fecal pellets on the square surface. These pellets are usually in a single line held together by silk strands.

This figure shows different types of boll weevil damage on cotton squares (from left): (1) egg puncture marks; (2) a grub developing within a square; (3) a pupa growing inside a square; and (4) adult weevils feeding on a square.

Figure 20

These illustrations show four stages of cotton development (from top): (1) cotyledon; (2) five-leaf, first square; (3) first bloom; and (4) first open boll.

SUMMARY

This is a field guide to boll weevil identification. Photographs of other species of weevils are included to help distinguish characteristics not found in the boll weevil. The adult boll weevil can usually be field identified by considering the sum total of its physical characteristics:

1. the BODY SHAPE is an elongated teardrop, ranging from 1/8 to 1/3 inch in LENGTH.
2. the SNOUT is slightly curved and about half the body length.
3. the ELBOWED ANTENNAE with terminal clubs arise on the snout closer to the distal end than to the eyes.
4. the PROTHORAX usually has clumped hairlike scales on its dorsal median, giving the appearance of a white stripe.
5. the SCUTELLUM does not appear white but has a sparser covering of scales with the body wall being visible.
6. the ELYTRA have a series of parallel grooves that curve and join at the distal end.
7. the FRONT LEG has a stout FEMUR with a large double-toothed spur at the distal end and a slender TIBIA with a single sharp spur on its distal end. These characteristics are similar on the second pair of legs.
8. the hairlike SCALES are grouped in clusters on the top of the body, and the thicker scales are more dense in coverage on the sides and bottom of the body. All scales are elongated and taper to points at each end.

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