

Controlling the Pecan Weevil

*Bill Ree, Allen Knutson and Marvin Harris**

The pecan weevil (*Curculio caryae* [Horn]) is a key pest of pecan in the United States and portions of Texas. Pecan weevils, which also feed on all species of North American hickory, can be found from New York to Iowa, south to Oklahoma, and across the southeastern states from Florida to west Texas. As of 1999, pecan weevil had been found in 131 Texas counties (Fig. 1).

between August 20 and September 10 (Fig. 2). This emergence pattern is typical across the pecan belt. However, soils hardened by drought delay adult emergence. During drought conditions in 1977-78, almost 30 percent of the adult weevils emerged after an October 19 rain. Drought-delayed emergence can only be broken when the soil is softened by moisture, either from irrigation or rainfall.

Description

The adult is a brownish weevil about $\frac{3}{8}$ inch long. The female's snout is as long as its body; the male's snout is somewhat shorter (Fig. 4). The larvae are cream colored grubs with reddish heads. When fully grown, larvae reach a length of $\frac{3}{5}$ inch (Fig. 5).

Biology

Adult weevils, both males and females, damage pecans by feeding on and/or laying eggs in nuts. Even though damage can occur from the time of adult emergence to shuck split, the key to weevil control is to prevent egg lay or oviposition.

Pecan weevil activity starts in early August. Adults emerge from the soil where they have spent 2 or 3 years in soil cells located 4 to 12 inches beneath the soil surface. The emergence of adult pecan weevils is directly related to the type of soil and soil moisture conditions. Drought conditions and clay soils delay emergence of adults by a month or more.

Under normal soil conditions, approximately 80 percent of adult weevils emerge

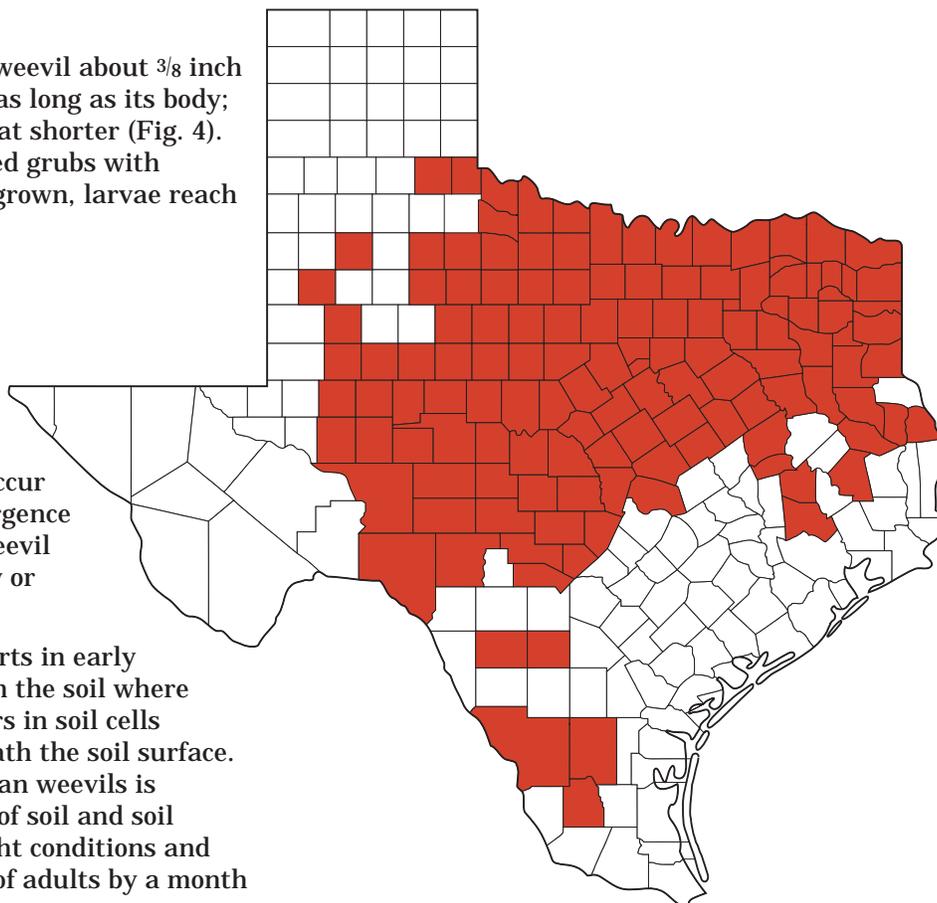


Figure 1. Pecan weevils are found in 131 counties in Texas.

Hard soil acts as a physical barrier to adults moving from their soil cells to the soil surface. Irrigation can be used to ensure adult weevils emerge at the normal time (Fig. 2). Application of 2 to 3 acre inches of water in

*Extension Agent-IPM(Pecans), Extension Entomologist and Entomology Professor, The Texas A&M University System.

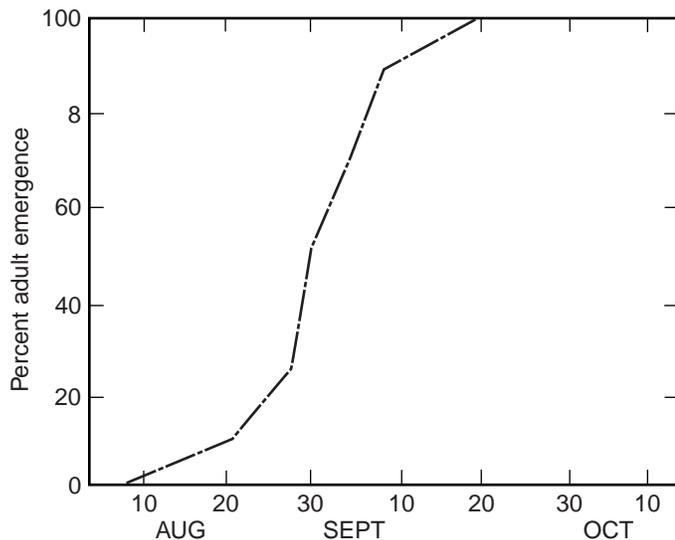


Figure 2. Cumulative percent of adult pecan weevil emergence when soil hardness is not a factor.

mid-August should prevent most soils from being drought-hardened during the critical August 20 to September 10 emergence period. Irrigation can prevent drought delay but will not accelerate weevil emergence earlier than normal. Schedule irrigation to ensure weevil emergence at the normal time, but allow time for soils to dry enough to allow pesticide sprayers access before emerging weevils can begin to lay eggs in nuts. Orchards under drip irrigation will have normal weevil emergence near water emitters but, under drought conditions, also will have delayed emergence from hard soils under the canopy but away from emitters.

Testing for Soil Hardness

Hard soils prevent weevils from emerging normally. Soil hardness can be measured by applying pressure to a dowel rod inserted into the soil. Soil hardness should be tested throughout an orchard.

Soils with a mechanical impedance equal to or greater than 60 kg/cm² in the top 5.5 inches (14 cm) of soil inhibit weevil emergence. To determine if your soil is that hard or harder, take an 8-inch length (20 cm) of 1/2-inch dowel rod fitted with a handle. Press the flat surface of the dowel rod (a 1/2-inch diameter dowel rod equals about a square centimeter of surface area) onto the soil surface and apply up to 132 pounds (60 kg) of force to the handle. If the dowel rod penetrates the soil to a depth of 6 inches (15 cm), weevils should emerge during the normal time (Figure 2). If the rod does not penetrate the soil, emergence of some weevils will be delayed until the soil becomes softer.

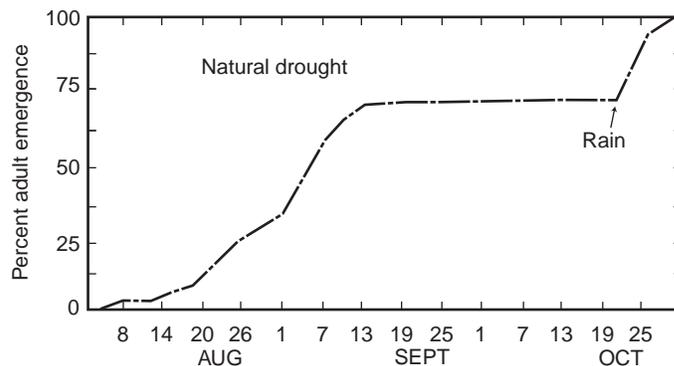


Figure 3. Cumulative percent of adult pecan weevil emergence from drought hardened soils and subsequent adult emergence after soils are sufficiently softened by rain. Graph reprinted from *The Pecan Quarterly*, Vol. 14, No. 2

As soon as they emerge from the soil cells, adult pecan weevils move to the nearest tree. Research indicates that 77 percent of adults fly to the tree trunk at a height of 6 to 8 feet, 5 percent walk to the tree trunk and 15 percent fly directly to the canopy. Once in the canopy, the tasks of feeding and finding a mate begin.

Feeding activity of adult weevils, both males and females, before nuts enter the gel stage can cause nut drop. After shell hardening, males only feed on the shuck and this will not cause nut drop. A close inspection of damaged pecans will reveal a puncture the size of a straight pin that can be traced through shuck and shell to the liquid endosperm area of the nut (Fig. 6). Often this feeding puncture or egg laying site will be surrounded by a circle of tracks created by the adult (Fig. 7). The presence of punctures and tracking confirm weevil presence.

Feeding rates for males and females prior to shell hardening are low. Most weevils emerge just at or shortly after gel stage, so nut losses caused by adult feeding are small compared to those caused by egg laying. The adult emergence period lasts for several weeks so time sprays to prevent oviposition rather than to protect a few nuts that will be lost to the small number of early emerging adults that feed during the water stage. The key to managing the pecan weevil is to prevent the laying of eggs.

Female weevils do not begin laying eggs until 5 days after they emerge from the soil. For egg lay to be successful, nuts must be in the gel stage or later. Nuts are susceptible to oviposition from the gel stage up to shuck split.

To deposit eggs in pecans, a female feeds through the shuck and shell to the kernel where she excavates a small cavity in the developing kernel. She turns around and, with her ovipositor, places three to four eggs per nut on the developing kernel (Fig. 8).

She will avoid any pecans in which eggs already have been laid by other females. A female will lay approximately 75 eggs in her life at a rate of 2.6 to 3.8 eggs per day. Each female will oviposit in approximately 30 nuts during her 3- to 4-week life. Female weevils cannot lay eggs in nuts after shuck split.

Larvae hatch and feed in the kernel. When fully developed, larvae chew a single hole, rarely two, through the shuck and shell (Fig. 9), exit the nut and drop to the ground. The time period from egg lay to larval emergence is approximately 42 days.

Once larvae have dropped to the ground, they burrow into the soil to a depth of 4 to 12 inches where they create a cell. A year later, about 90 percent of these larvae pupate during a 3-week period. After pupation, the adult pecan weevil remains in the soil for another year. These adults emerge the next year, resulting in a 2-year life cycle. The remaining 10 percent delay pupation until the second year. These adults remain in the soil for another year, which results in a 3-year life cycle.

Integrated Pest Management Practices

The objective in a pecan weevil integrated pest management (IPM) program is to prevent female weevils from laying eggs in nuts. Because the larvae, pupae and adults are covered with 4 to 12 inches of soil and pesticides cannot reach larvae inside the nuts, management of these life stages is not practical. The only possible time to manage infestations is after adults have emerged from the soil and before egg laying starts. To prevent weevils from laying eggs, pecan producers must do the following:

- monitor kernel development to determine when the earliest maturing cultivars reach a stage susceptible to oviposition;
- monitor adult emergence from the soil; and
- apply an effective insecticide at the proper time to prevent emerging weevils from laying eggs in susceptible nuts.

Monitoring Kernel Development: Pecan kernel development must be in the gel or dough stage for oviposition, larval hatch and development to be successful. It is important to detect this early developmental stage so the onset of oviposition can be determined. To monitor kernel development, cut the distal or tip end of the nutlets of the earliest maturing varieties and check for the beginning of the gel stage. Pecans mature from the distal end to the stem end.

Monitoring Adult Emergence: There are several monitoring techniques to detect adult pecan weevil activity. They include inspecting dropped nuts for punctures and using knock down sprays, sticky bands, limb jarring and assorted traps. Of these techniques, the wire cone trap, pyramid or “Teddners” trap, and the Circle trap are commonly used.

Wire cone traps have been used for many years to monitor adult pecan weevil emergence. Wire cone traps are placed on the ground beneath pecan trees with a known history of pecan weevil infestations. These traps are durable and can be used for many years with limited maintenance. However, these traps are expensive, labor intensive and cannot be used with livestock unless the trap area is fenced.

The pyramid or “Teddners” trap is built of two triangular-shaped pieces of 1/2-inch hardboard. Each piece is slotted in the center so that one piece slips over the other at a 90-degree angle. The result is a 4-foot high vertical pyramid. The trap is painted a dark color and fitted with a boll weevil trap to collect adults. A single trap is placed beneath a tree canopy, approximately 8 to 10 feet from the trunk. It is recommended that one trap should be used per tree; no more than a total of 15 traps are needed for 100 acres. Since this trap works as a visual preference, the tree trunk next to the trap should be painted white to a height of 6 to 8 feet. Trap efficiency is enhanced by keeping grass and weeds mowed around the monitoring trees. These traps require little effort to put up and are relatively inexpensive. Like the wire cone traps, these traps cannot be used in conjunction with grazing unless the trap area is fenced.

A fairly recent trap that has only been tested for a couple of years in Texas is the Circle trap. This trap is a wire cone trap that is placed on the side of a tree. Trap placement on the tree allows use with grazing livestock.

Trap construction plans or sources for the purchase of traps can be obtained from your local county Extension office.

Regardless of the type of trap used, place traps on or under trees with known weevil infestations. If an orchard has several different soil types (sandy, loam, clay), place traps under infested trees growing on the different soils. Place traps in the orchard 1 to 2 weeks before the earliest maturing varieties reach the gel stage and monitor the traps every 2 to 3 days. Adult weevils collected in the traps should be counted and removed with each inspection.

Applying Insecticide: If adult pecan weevils are found in an orchard, economic damage will occur if the orchard is not treated. A treatment program for

the pecan weevil requires at least two properly timed insecticide applications. In some cases, three or four applications may be needed to prevent an economic loss.

Unlike treatment for the pecan nut casebearer, where infestations can vary from year to year by several weeks or more, the initial insecticide application for pecan weevil is applied around August 20 to 22. The initial treatment should be made when the earliest maturing nuts of the early varieties are in the gel stage at the distal end of the nut. Even in years where drought delays emergence and traps fail to collect adults, some pecan weevil adults will emerge through soil cracks before gel formation and this justifies the initial treatment.

The initial insecticide application should be effective for 5 days. Adult female pecan weevils do not begin to lay eggs until 5 days after emergence, so the earliest time to retreat will be 10 days after the initial application. If adult emergence traps are collecting adult weevils on or after the sixth day following the initial insecticide application, a second application is needed. The second application is needed no sooner than 10 days after the first treatment. If no adult weevils are trapped 6 days after the initial treatment, then the second application can be delayed until traps again detect adult activity. At least two sprays are needed to control established pecan weevil infestations. If drought has caused soil to become hard and adults continue to be trapped more than 5 days after the second application, a third insecticide application will be needed. Any pecan that has not reached shuck split will be susceptible to pecan weevil and should be protected with an insecticide application.

In Texas, the recommended insecticide for pecan weevil control is carbaryl (Sevin® 80S) at a rate of 1.25 to 3.0 pounds per 100 gallons. Do not use spreader stickers with the treatment. Other formulations of carbaryl also can be used. Read and follow label directions.

The pecan weevil is an insidious pest that infests nuts that could otherwise be harvested and used as food. Routine management of the weevil calls for two or three well-timed, late-season applications of insecticide. This prevents weevils that live in the infested orchard from causing economic damage. Adults do not fly far and natural spread of infestations occurs over distances of a mile or less. Movement over longer distances results from transport of infested nuts by humans.

Pecan Weevil Eradication

Integrated pest management (IPM) practices in pecan are designed to keep pecan weevil populations below economic levels. The goal of eradication, however, is to eliminate a pest species from an area. Occasionally, efforts to eradicate pecan weevil are attempted when isolated populations are detected. An eradication program is typically conducted under the regulatory authority of the Texas Department of Agriculture. Eradication efforts include an intensive insecticide treatment program, destruction of infested nuts and discarded trash, and strict quarantines to prevent movement of infested nuts into the eradication area.

To eradicate pecan weevil, insecticides are applied just before gel stage and continue at 7- to 10-day intervals. Several applications that blanket the presumed adult emergence period are made in an effort to kill every emerging weevil. This eradication program requires a minimum 3-year period when no larval infestations appear in the harvests. The program probably should be conducted for a fourth season to ensure eradication success. Eradication is considered complete when no pecan weevil larvae are found for four consecutive seasons.

Additional Information

These publications are available at the Texas Cooperative Extension Bookstore, <http://tcebookstore.org>.

E-215, *Managing Insect and Mite Pests of Commercial Pecans in Texas*.

E-341, *Field Guide to the Insects and Mites Associated With Pecans*.

CD-ROM, Pecan Pest Management. Available from the Texas Pecan Growers Association. Send check for \$30.00 plus \$3.00 shipping (Texas residents add \$4.95 [8.25 percent sales tax]) to: Olde Pecan Book Store, P.O. Drawer CC, College Station, TX 77841.



Figure 4. Pecan weevil adults (male, left; female, right).



Figure 5. Pecan weevil larvae.



Figure 6. Pecan weevil puncture of pecan shell.

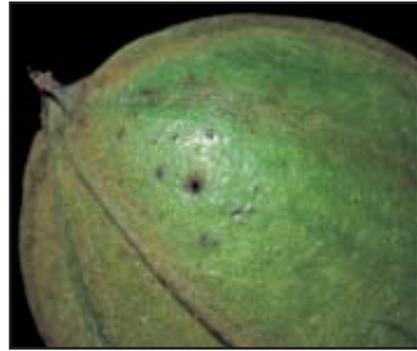


Figure 7. Pecan weevil circular tracking pattern around puncture.



Figure 8. Female pecan weevil ovipositing eggs in pecan. Courtesy of Oklahoma State University Entomology Department.

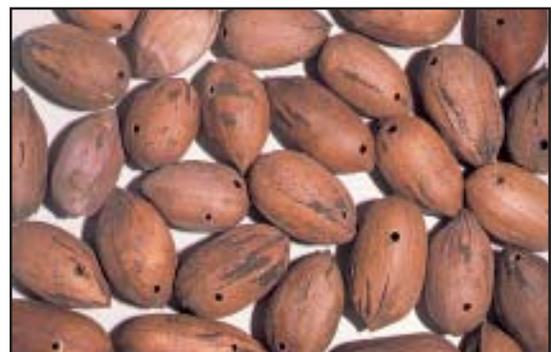


Figure 9. Pecan weevil larvae emergence holes.

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