AgriLIFE EXTENSION
Texas A&M System

Managing Insect Pests of Texas Sunflowers

E-579
7-09

Ed Bynum
Extension Entomologist
The Texas A&M System

Insect pests are often a major limiting factor in Texas sunflower production. Of the 50 insect species recorded on sunflower in Texas, about 15 are considered potentially major pests. The sunflower moth is the major common pest of sunflower. Stem weevils, seed weevils, the stalk girdlers, and thistle caterpillar are of secondary importance, although they can be quite serious when abundant.

Both oilseed and non-oilseed (confectionary) sunflowers are grown in Texas. The small, black seeds of oilseed sunflower contain 38 to 50 percent oil. They are processed into sunflower oil and also used as bird feed. Confectionary sunflower seeds are usually large with black and white stripes. They are used for human consumption in a variety of food products.

Because the sunflower has a relatively short growing season, it is suitable primarily as a spring-planted crop or as a second crop after wheat. Sunflower can be an alternative crop where plantings of other crops have been destroyed by wind, sand, rain or hail. Drought tolerance makes sunflower an attractive dryland crop and an alternative in areas with limited irrigation. Sunflower also responds well under full irrigation.

Cultural practices that help reduce insect problems include crop rotation, modified planting dates, weed control, volunteer and wild sunflower control and tillage. However, the judicious use of insecticides is often required for successful sunflower production in Texas. Producers should be able to identify the insect pests that reduce sunflower yield and know when those pests are most likely to occur during the growth of the plant. They should also understand pest biology and the control measures that are most effective.

Figure 1. Sunflower moths (photo by Scott Russell).

Figure 2. Sunflower moths (photo by Scott Russell).

Insect pests infesting the head

Sunflower moth

Lepidoptera: Pyralidae, *Homoesoma ellectellum* (Hulst)

The sunflower moth, also called the head moth, is the single most important sunflower pest in Texas. Sunflower moth infestations are usually heaviest early in the growing season, with another smaller moth flight possible later in the season. The adult is a small, slender, silver-to-buff gray moth about $\frac{1}{2}$ inch long. It is most often seen resting on sunflower heads during the blooming period, especially in early morning and early evening.

Moths are highly attracted to plants beginning to bloom. Nearly 80 percent of the eggs are laid on the plant within 4 to 7 days after buds begin to open (late R4 growth stage, see Fig. 6). Eggs hatch in 24 to 72 hours. Newly hatched larvae are yellowish. Mature larvae are brown with four yellowish-green to cream colored longitudinal stripes.

For the first 5 to 6 days after hatching, young larvae are relatively exposed as they feed on pollen and floral parts on the flower surface. Older larvae tunnel into the seeds and other head tissue. A single larva can destroy up to 12 seeds during the 15- to 19-day development period. Full-grown larvae are about ¾ inch long.

If larval feeding destroys florets before fertilization, seed will not develop and pops (empty seed hulls) may occur. A head infested with sunflower moth larvae looks trashy and has webbing across the face of the head. In addition to feeding damage, sunflower moth larvae predispose the sunflower head to *Rhizopus* head rot (Fig. 5). This disease can reduce yields up to 50 percent and lower seed oil content as well.

In Texas, insecticidal control is based on the percentage bloom and the presence of moths in the field. The window for treatment is very narrow because sunflowers finish blooming rapidly once they begin.

Figure 3. Sunflower moth larva (photo by Monti Vandiver).

Figure 4. Sunflower moth larva and damage (photo by Frank Peairs).

Table 1. Progression of sunflower bloom for typical oilseed and confectionary hybrids, Texas High Plains, 2007 and 2008. Sunflower bloom can quickly surpass suggested spray timing for controlling sunflower moth.

Location	Hybrid	Planning date	Percent plants in bloom @ date of record			
			8/13	8/15	8/17	8/19
Lubbock	Triumph 845HO	6/26/07	0	5	68	100
	Red River 2215	6/26/07	1	9	84	100
			7/11	7/13	7/15	7/17
Lubbock	Triumph 845HO	5/17/08	1	23	96	100
	Red River 2215	5/17/08	0	10	74	99
			8/22	8/25	8/27	8/29
Halfway	Triumph 845HO	7/3/08	0	51	89	100
	Red River 2215	7/3/08	3	54	79	95

Data from Texas AgriLife Research crop testing hybrid trials, courtesy Calvin Trostle, Extension agronomist.

Figure 5. Sunflower head rot disease symptoms as a result of sunflower moth larval damage (photo by Monti Vandiver).

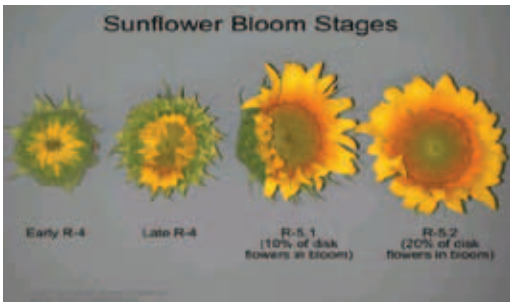


Figure 6. Blooming sunflowers (photo by Pat Porter).

Figure 7. Banded sunflower moth (photo by Larry Charlet, J. Knodel and G. Brewer).

Count any head as blooming when any of the ray flowers are opening and disk flowers are exposed (Fig. 6. Note late R4 growth stage). The ray flowers are the yellow petals, while the disk flowers are the composite florets that produce seeds. Moths can lay eggs as soon as any part of the head is exposed.

Research has shown that insecticide should be applied when 15 to 25 percent of plants are blooming and sunflower moths are found in the field. Unfortunately, blooming can progress so rapidly that by the time the producer gets spray equipment or an airplane into the field, it may be too late for an application to be completely effective. Follow these suggestions for effective sunflower moth control.

- At planting time, ensure that field conditions are favorable for uniform emergence across the field (e.g., good soil moisture, proper and consistent planting depth, etc.). A field where emergence is not uniform will have an extended blooming period that causes problems in the timing of insecticide application. Irrigating fields to supply germination moisture can also cause up to a 2- to 3-day difference in blooming rate.
- At least 2 weeks before spraying, select and get a commitment from a custom applicator to be ready to spray; also decide which chemicals you will use so the applicator will have them on hand.
- Be ready to begin scouting as soon as you see the first blooming head in the field (late R4 stage). If you are a first-time grower, get assistance from those experienced in scouting for sunflower moth.

Besides the initial application, one to two additional insecticide applications at 5-day intervals may be needed when sunflower moth populations are moderate to heavy and moths are still active. In more northern states, pheromone trap sampling from growth stages R3 to R5.1 indicate that fields are at a high risk when more than four moths are captured per trap per night. However, treatment decisions should be made on the basis of scouting for adults at the time of bloom. Trap captures of fewer than four per night do not mean a field is safe from economic damage.

Banded sunflower moth

Lepidoptera: Tortricidae, *Cochylus hospes* Walsingham

The banded sunflower moth is about $\frac{1}{4}$ inch long and straw-colored with a brown triangular area near the middle of the forewing. At first, larvae are off-white, but as they grow to about $\frac{1}{2}$ inch they change to light pink, then to red or purple and finally green. Larvae feed on disk flowers until they reach the third instar (growth stage), when they begin feeding on seeds. The action threshold is one moth per two plants during the late bud (R4) to early bloom stage (R5.2). Scouting should be done in early morning or early evening.

Table 2. Insecticides commonly used to control sunflower moth and banded sunflower moth.

Insecticide	Rate/Acre	Remarks
Carbaryl (Sevin® XLR Plus, 4F, 80 WSP)	1 - 1 $^{1}/_{2}$ qt	12-hour restricted entry interval; 30-day pre-harvest interval for forage and 60 days for seed
Chlorpyrifos (Lorsban® 4E and other generic products)	1 - 1 $^{1}/_{2}$ pt	24-hour restricted entry interval; 42-day pre-harvest interval
Beta-cyfluthrin (Baythroid® XL)	2.0 - 2.8 fl oz	12-hour restricted entry interval; 30-day pre-harvest interval
Bacillus thuringiensis (Biobit® HP) (Dipel® DF) (Dipel® ES)	 0.5 - 1.0 lb 0.5 - 1.0 lb 1.5 - 2.5 pt	 4-hour restricted entry interval 4-hour restricted entry interval 4-hour restricted entry interval
Esfenvalerate (Asana® XL)	5.8 - 9.6 fl oz	12-hour restricted entry interval; 28-day pre-harvest interval
Lambda-cyhalothrin (Karate with Zeon) (Warrior II with Zeon)	1.28 – 1.92 fl oz	24-hour restricted entry interval; 45-day pre-harvest interval
Parathion, methyl	2 pt	96-hour restricted entry interval; 30-day pre-harvest interval
Zeta-cypermethrin (Mustang®) (Mustang Max EC®)	 2.72 - 4.3 fl oz 2.24 - 4.0 fl oz	 12-hour restricted entry interval; 30-day pre-harvest interval 12-hour restricted entry interval; 30-day pre-harvest interval

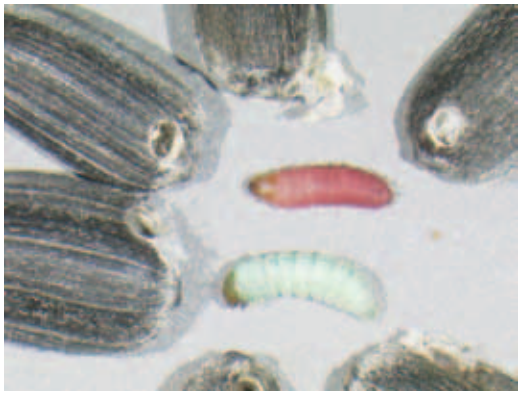


Figure 8. Banded sunflower moth larvae (photo by Larry Charlet, J. Knodel and G. Brewer).

Figure 9. Banded sunflower moth eggs (photo by Larry Charlet, J. Knodel and G. Brewer).

Figure 10. Sunflower headclipping weevil (photo by Whitney Cranshaw).

Figure 11. Sunflower headclipping weevil (photo by Whitney Cranshaw).

Figure 12. Sunflower headclipping weevil damage (photo by Whitney Cranshaw).

Sunflower bud moth

Lepidoptera: Tortricidae, *Suleima helianthana* (Riley)

The appearance of deformed heads and black frass on heads or stalks indicates the presence of sunflower bud moth. The adult is a gray-brown moth with two dark bands on the wings. One band is across the middle of the wing and the second is near the wing tip. The wing spread is about $^{2}/_{3}$ inch. Larvae are white with a dark head capsule and about $^{3}/_{8}$ inch long.

Two generations of sunflower bud moth are produced each year. Moths lay eggs in the terminals of immature sunflower, on the receptacle (underside) of mature sunflower heads, or in leaf axils. Black frass surrounds the holes where larvae enter the sunflower plant. In Texas, infestations have been light and feeding activity restricted to the fleshy part of the head and stalk. Yield losses have been minimal and have occurred only when larvae burrow into small, unopened buds, thus preventing head formation.

Sunflower headclipping weevil

Coleoptera: Curculionidae, *Haplorhynchites aeneus* (Boheman)

Sunflower plants that are girdled about 1 to 2 inches below the head are likely to be infested with the head clipping weevil. The adult is metallic black and about $^{1}/_{4}$ inch long with a long "snout." Females girdle just below the head and lay eggs in the girdled head. The head then falls to the ground, where larvae develop and overwinter. Economic infestations of this insect have not been noted in Texas, although 2 to 3 percent of a crop is occasionally damaged. In Kansas, insecticide application is considered when 10 percent or more of the flower heads have been clipped and weevils are still active.

Sunflower seed weevils

Coleoptera: *Curculionidae, Smicroynx* sp.

Two species of seed weevils have been detected in Texas. One is reddish brown and about $^{1}/_{8}$ inch long; the other is gray and about $^{1}/_{4}$ inch long. Adults may be present during the entire growing season. If adults emerge when sunflowers are in the bud stage they will begin feeding between the bracts. As the sunflower matures, weevils begin feeding on pollen and females deposit eggs individually into the developing seeds. Mature larvae drop to the ground and overwinter in the soil. There is a single generation per year.

Seed weevils have the greatest economic impact on confectionary and hybrid seed sunflower. Economic infestations most often occur when sunflowers are blooming. The action threshold for the red sunflower seed weevil (*Smicroynx fulvus*) is 14 per head for oilseed sunflower and one per head for confectionary. The gray sunflower seed weevil (*Smicroynx sordidus*) lays fewer eggs than the red sunflower seed weevil and probably has a higher action threshold; however, this has not been firmly established.

Figure 13. Red sunflower seed weevil (photo by Larry Charlet, J. Knodel and G. Brewer).

Figure 14. Gray sunflower seed weevil (photo by Larry Charlet, J. Knodel and G. Brewer).

Table 3. Insecticides commonly used to control seed weevils.

Insecticide	Rate/Acre	Remarks
Chlorpyrifos (Lorsban® 4E and other generic products)	1 - 1 $^1/_2$ pt	24-hour restricted entry interval; 42-day pre-harvest interval
Cyfluthrin (Baythroid 2)	2.0 - 2.8 fl oz	12-hour restricted entry interval; 30-day pre-harvest interval
Beta-cyfluthrin (Baythroid® XL)	2.0 - 2.8 fl oz	12-hour restricted entry interval; 30-day pre-harvest interval
Esfenvalerate (Asana® XL)	5.8 - 9.6 fl oz	12-hour restricted entry interval; 28-day pre-harvest interval
Lambda-cyhalothrin (Karate with Zeon)	1.28 – 1.92 fl oz	24-hour restricted entry interval; 45-day pre-harvest interval
Parathion, methyl	2 pt	96-hour restricted entry interval; 30-day pre-harvest interval

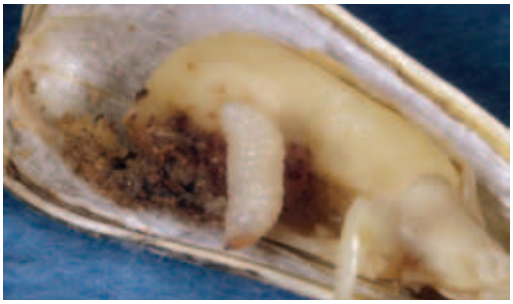


Figure 15. Gray sunflower seed weevil larva and damage to kernel (photo by Frank Peairs).

Insect pests infesting the stalk

Sunflower stem weevil

Coleoptera: Curculionidae, *Cylindrocopturous adspersus* (LeConte)

The stem weevil occasionally causes losses in sunflower. Adults are brown and white mottled and about $^{3}/_{16}$ inch long. There is a single generation per year. Adults feed on leaves but cause no economic damage. Eggs are deposited in sunflower stalks during a 2- to 5-week period after adults emerge. Young larvae burrow into the stalk, destroying pith and making the plant highly susceptible to lodging. Larvae overwinter in chambers at the base of the stalk. As many as 100 $^{1}/_{4}$-inch, creamy-white larvae have been found in a single stalk. Stem weevil can reduce yields by 50 percent. Evidence indicates that stem weevil damage predisposes plants to charcoal rot. *In the Texas High Plains and Panhandle regions, crop rotation and delayed planting until after mid-June have prevented yield reduction from this pest.* Non-rotated, early-planted fields are most likely to be damaged. Double-crop sunflower or those planted late seldom develop severe stem weevil infestations.

Apply insecticide to control stem weevil when two or more adults are found per plant from the third alternate leaf stage to the early bud stage. An infestation level of one adult weevil per three plants is considered an economic threshold in North Dakota.

The black sunflower stem weevil (*Apion accidentale* Fall) is black and about $^{1}/_{10}$ inch long. Larvae are yellow and have been found among sunflower stem weevil larvae. This weevil causes very little damage.

Table 4. Insecticides commonly used to control stem weevils.

Insecticide	Rate/Acre	Remarks
Carbaryl (Sevin® XLR Plus, 4F, 80 WSP)	1 - 1 $^{1}/_{2}$ qt	12-hour re-entry interval; 30-day pre-harvest interval for forage and 60 days for seed
Chlorpyrifos (Lorsban® 4E and other generic products)	1 - 1 $^{1}/_{2}$ pt	24-hour re-entry interval; 42-day pre-harvest interval
Esfenvalerate (Asana® XL)	5.8 - 9.6 fl oz	12-hour re-entry interval; 28-day pre-harvest interval
Lambda-cyhalothrin (Karate with Zeon)	1.28 – 1.92 fl oz	24-hour re-entry interval; 45-day pre-harvest interval

Cocklebur weevil

Coleoptera: Curculionidae, *Rhdobaenus quinquedec impunctatus* (Say)

The adult weevil is 1/4 to 3/8 inch long and is red with black spots. The large larvae leave a 1/4-inch tunnel in the pith as they burrow down to the roots. Oval feeding scars on the stalk and rather large larvae in the pith indicate the presence of this pest. Destroying stalks helps reduce this pest.

Girdlers (Long-horned beetles)

Coleoptera: Cerambycidae, *Mecas* spp., *Ataxia* spp., *Dectes* spp.

Several species of girdlers attack sunflower. Adults of the *Mecas* spp. are 1/2 inch long and gray. The adult female makes two girdles about one-third of the way down the stalk, causing the upper stalk to die and fall to the ground. Eggs are deposited just beneath the stem surface and above the lower girdle. After hatching, the larvae, which are white and 1 inch long when mature, burrow down the pith to the roots, where they overwinter. Destroying stalks helps reduce this pest.

Another longhorned beetle, *Ataxia hubbardi*, does not overwinter in a dormant state. The larvae remain active and do not girdle the stalk. This species uses wild sunflower and cocklebur as alternate hosts. There is no evidence that it causes significant damage, but the larvae can be confused with *Dectes texanus*, a species that can be much more damaging to sunflower.

Dectes texanus is an important pest of both sunflowers and soybeans in the Texas High Plains. The adult beetle is pale gray and about 3/8 inch long with antennae longer than the body. Larvae are legless with a small brown head; they are 1/2 to 5/8 long when full-grown in the sunflower stem. The larva overwinters at the base of sunflower and soybean stalks and in some weeds such as wild sunflower, ragweed and cocklebur. Adults have an extended emergence period during the growing season and are long-lived. After emerging, females lay eggs in leaf petioles. Hatching larvae tunnel in the stem and down to the base of the stalk when they start preparing to overwinter. The larvae girdle the stalk at or just above ground level (1 to 2 inches). Tunneling causes some yield loss, but the greatest loss is from the lodging caused by girdling. No insecticide recommendations are currently available. If infestations are observed, harvest as early as possible to limit yield losses. Producers may consider spraying a plant desiccant on heavily infested fields to hasten harvest. Do not plant continuous sunflowers or rotate behind soybeans. Destroy sunflower and soybean stalks to reduce the overwintering larval population.

Figure 16. Cocklebur weevil (photo by Patrick Coin).

Figure 17. Cocklebur weevil (photo by Lynette Schimming).

Figure 18. (Left) Long-horned beetle, Dectes sp. (photo by J. P. Michaud).

Figure 19. (Right) Long-horned beetle tunneling damage (photo by Frank Peairs).

Figure 20. Long-horned beetle girdling damage (photo by J. P. Michaud).

Figure 21. Sunflower beetles and larva (photo by Frank Peairs).

Insect pests infesting foliage

Sunflower beetle

Coleoptera: Chrysomelidae, *Zygogramma exclamationis* (Fabricius)

The adult sunflower beetle resembles the Colorado potato beetle. About 1/4 inch long, it is yellow with brown stripes. It attacks early in the season, defoliating seedlings. The action threshold for seedling sunflowers is one adult per plant. On later growth stages, the yellowish, humped larvae hide in the bracts of the head during the day and feed on younger leaves at night, causing defoliation. The action threshold on later growth stages is 15 larvae per plant with about 25 percent defoliation.

Table 5. Insecticides commonly used to control sunflower beetle.

Insecticide	Rate/Acre	Remarks
Carbaryl (Sevin® XLR Plus, 4F, 80 WSP)	1 - 1 1/2 qt	12-hour re-entry interval; 30-day pre-harvest interval for forage and 60 days for seed
Chlorpyrifos (Lorsban® 4E and other generic products)	1 - 1 1/2 pt	24-hour re-entry interval; 42-day pre-harvest interval
Cyfluthrin (Baythroid® 2)	2.0 - 2.8 fl oz	12-hour restricted entry interval; 30-day pre-harvest interval
Beta-cyfluthrin (Baythroid® XL)	2.0 - 2.8 fl oz	12-hour restricted entry interval; 30-day pre-harvest interval
Esfenvalerate (Asana® XL)	5.8 - 9.6 fl oz	12-hour re-entry interval; 28-day pre-harvest interval
Lambda-cyhalothrin (Karate with Zeon)	1.28 – 1.92 fl oz	24-hour re-entry interval; 45-day pre-harvest interval

Thistle caterpillar (Painted lady butterfly)

Lepidoptera: Nymphalidae, *Vanessa cardui* (Linnaeus)

The butterfly has a wingspread of 2 inches. Its upper wing surface is brown with red and orange mottling and white and black spots. The thistle caterpillar, the larval stage of the painted lady butterfly, skeletonizes leaves and can cause significant defoliation. This colorful larva grows to 1 ¼ to 1 ½ inches long and has prominent spines on the body. Larvae feed under the webbing of a curled leaf in the plant's terminal area. The action threshold is 25 percent defoliation with most of the larvae less than 1 ¼ inches long.

Figure 22. Thistle caterpillar, larva of Painted lady butterfly (photo by Frank Peairs).

Saltmarsh caterpillar

Lepidoptera: Arctiidae, *Estigmene acrea* (Drury)

A late-season pest, the saltmarsh caterpillar occasionally damages late-planted sunflower. The very hairy caterpillar varies from yellow to brown to black and is often referred to as the "woolly bear." The caterpillar can be as long as 2 inches and can cause economic damage by severe defoliation. The adult moth is white with black spots and has a wingspan of 1 ½ to 2 inches. Keeping fields weed-free before and after planting will reduce problems with this pest.

Figure 23. Painted lady butterfly (photo by Scott Russell).

Beet armyworm

Lepidoptera: Noctuidae, *Spodoptera exigua* (Hübner)

Heavy infestation of beet armyworm can cause severe defoliation. The beet armyworm can grow to be 1 ½ inches long and is variable in color. The immature beet armyworm is light green with thin, white stripes; more mature worms have green and black stripes. These armyworms can best be identified by the black spot on the side of the larva above the second pair of true legs.

Pupation occurs in the soil. The adult moth has a wingspread of 1 inch. Forewings are grayish brown with a pale spot in the mid-front margin; hind wings are white with a dark anterior margin. Controlling pigweed in and around sunflower will reduce this pest.

Figure 24. Saltmarsh caterpillar (photo by Frank Peairs).

Figure 25. Saltmarsh caterpillar adult, Tiger moth (photo by Texas A&M University Department of Entomology).

Grasshopper (many species)

Orthoptera

Heavy infestations of grasshoppers develop periodically and cause economic damage to sunflower. These insects can attack sunflower any time during the growing season. Early in the season, check for immature grasshoppers in crop margins. Controlling grasshoppers in crop margins can often prevent their movement into the crop. The presence of 11 or more grasshoppers per square yard in crop margins is likely to cause economic damage. (See Extension publication E-209, "Grasshoppers and Their Control," for further information.)

Table 6. Insecticides commonly used to control grasshopper.

Insecticide	Rate/Acre	Remarks
Chlorpyrifos (Lorsban® 4E and other generic products)	1 - 1 $\frac{1}{2}$ pt	24-hour re-entry interval; 42-day pre-harvest interval
Cyfluthrin (Baythroid® 2)	2.0 - 2.8 fl oz	12-hour restricted entry interval; 30-day pre-harvest interval
Beta-cyfluthrin (Baythroid® XL)	2.0 - 2.8 fl oz	12-hour restricted entry interval; 30-day pre-harvest interval
Esfenvalerate (Asana® XL)	5.8 - 9.6 fl oz	12-hour re-entry interval; 28-day pre-harvest interval
Lambda-cyhalothrin (Karate with Zeon)	1.28 – 1.92 fl oz	24-hour re-entry interval; 45-day pre-harvest interval

Cutworms

Lepidoptera: Noctuidae, several species.

The cutworms are stout-bodied, smooth caterpillars that can be 1 to 1 $\frac{1}{2}$ inches long. They vary in color from dull gray to black and have stripes or spots. Damage to sunflowers occurs early when plants are germinating and in the cotyledon growth stage. The feeding of older larvae will cut off plants at, below or above the ground level, causing skips in the plant stand. Most cutworms feed mostly at night. During the day larvae can be found at either end of the skip in the plant stand, resting under the soil surface near the base of a damaged plant. Treatment thresholds in Kansas are one or more larvae per square foot when most larvae are less than 1 $\frac{1}{4}$ inch long.

Insect pests infesting roots

Carrot beetle

Coleoptera: Scarabaeidae, *Ligyrus gibbosus* (De Geer)

The carrot beetle is occasionally very damaging to sunflower in sandy soils of the Texas Rolling Plains. The ½ inch long, brown "June bug" adult feeds on the sunflower roots, causing stunting, wilting and lodging. The larvae do not feed on sunflower roots. Carrot beetle infestations can often be detected by excavations near the base of the sunflower stalk. These excavations are made by skunks and other mammals foraging for the carrot beetles. Controlling pigweed in and around the sunflower field helps reduce this pest in the field.

Figure 26. Carrot beetle (photo by Billy Warrick).

Sunflower root weevil

Coleoptera: Curculionidae, *Baris strenua* (LeConte)

The sunflower root weevil is about 1 ¼ inch long and dull black with a short, downward-projecting snout. Adults first feed on foliage, causing little damage. They later congregate near the root zone of plants where they feed and lay eggs underneath the callus tissue that develops at adult feeding scars. Larvae feed near the area where they hatch, destroying root tissue and causing plants to wilt. Plants will lodge if infestations are severe. An economic threshold has not been established, and in North Dakota insecticide use has not been warranted for the control of this pest.

Figure 27. Sunflower root weevil (photo by J. P. Michaud).

Protecting bees and other pollinators from insecticides

Pollination is vital in producing many seed crops. Sunflower hybrids are self-fertile and depend less on insect pollination than earlier, self-incompatible varieties. However, studies show that even self-compatible hybrids benefit from insect pollination. Seed set, seed oil percentage, seed yields and oil yields increase when pollinators are present.

Many major insect pests attack sunflower crops during flowering. Applying insecticide to control pests may also harm pollinators. To minimize hazards to honey bees, communicate and cooperate with beekeepers, producers and pesticide applicators.

Figure 28. Sunflower root weevil larva (photo by Frank Peairs).

Follow these guidelines to reduce bee losses:

- If practical, apply insecticide before moving bees into fields for pollination.
- Where insecticides are needed, use materials least toxic to bees.
- Make all applications when bees are not visiting the field. Evening or early morning treatments, between 7 p.m. and 6 a.m., generally are most satisfactory. Evening applications, after bees have left the field, are less hazardous than early morning.
- Use spray or granular formulations rather than dusts.
- Where it is necessary to use one of the insecticides in Groups 1 and 2 in Table 7, notify the beekeeper so that arrangements can be made to protect the bees.
- Avoid drifting or spraying insecticide directly on bee colonies, which generally results in heavy losses. On hot evenings, bees often cluster on the fronts of the hives. Pesticide drift or direct spray at this time generally kills many bees.

Chemical use precautions

Select products that will give the safest and most effective and economical control. All suggested materials are poisonous, but proper handling reduces the hazards associated with their use. Comply with the manufacturer's label directions for handling all toxic chemicals.

Residues: The Environmental Protection Agency (EPA) has established pesticide residue tolerances on sunflowers. These regulations establish the amount of a specific chemical that can be present in or on sunflowers at harvest. Always consult the product label for specific restrictions, and be sure the pesticide is registered for use on sunflowers and is used only in accordance with specific application instructions.

Caution: All pesticides are potentially hazardous to humans, animals and nontarget crops. Use with caution. Store all pesticides out of reach of children, irresponsible people, livestock and household pets. Properly dispose of leftover spray materials and containers.

Pesticide drift: Avoid drift to nearby land and take precautions against contaminating ponds and streams.

Poisoning symptoms: Some symptoms of pesticide poisoning are headaches, nausea, cramps, diarrhea, weakness, blurred vision and muscular twitching. If you notice any of these symptoms during or after handling any pesticide, consult a physician immediately.

Policy statement concerning chemical use

Insecticides listed in Tables 2-6 have been tested in field trials and have proved to be effective. Table 8 lists all insecticides labeled for use on sunflowers.

The information and suggestions included in this publication reflect the opinions of Extension entomologists based on field tests and use experience. The management suggestions are a product of research and are believed to be reliable. However, it is impossible to eliminate all risk. Unforeseen or unexpected conditions or circumstances may result in less-than-satisfactory results even when these suggestions are used. Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied, of similar products not mentioned. The Texas AgriLife Extension Service assumes no responsibility for risks. Such risks shall be assumed by the user of this publication.

Pesticides must be registered and labeled for use by the Environmental Protection Agency and the Texas Department of Agriculture. The status of pesticide label clearances is subject to change and may have changed since this publication was printed. County Extension agents and appropriate specialists are advised of changes as they occur.

The USERS are always responsible for the effects of pesticide residues on their livestock and crops, as well as for problems that could arise from drift or movement of the pesticides from their property to that of others. Always read and follow carefully the instructions on the product label.

For further information about Texas sunflower production, consult educational resources from Texas A&M AgriLife at *http://lubbock.tamu.edu/sunflower* and from the National Sunflower Association at *http://www.sunflowernsa.com*.

Table 7. Insecticides grouped according to their relative hazards to honey bees.

Insecticides	Remarks
Group 1 - Highly toxic Carbaryl Chlorpyrifos Cyfluthrin *Beta*-cyfluthrin Deltamethrin Esfenvalerate *Gamma*-cyhalothrin *Lambda*-cyhalothrin Methidathion Parathion, methyl Pyrethrum *Zeta*-cypermethrin	This group includes materials that kill bees on contact during application or for several days afterward. With some exceptions, remove bees from the area if these are used on plants the bees visit.
Group 2 - Moderately toxic None	Do not apply these products when bees are working in the field. Apply in late evening.
Group 3 - Relatively nontoxic *Bacillus thuringiensis*	Apply in late evening or early morning when bees are not foraging.

Table 8. Toxicity rating, purchase restrictions, and re-entry, grazing and harvest restrictions for insecticides registered for sunflowers.

Chemical name	Trade name[1]	Signal word[2]	Restricted use pesticide[3]	Class[4]	Re-entry[5] (hours)	Grazing (days)	PHI[6] (days)
Bacillus thuringiensis	Biobit® HP, Dipel® DF, Dipel® ES and others	Caution	No	B	4		None
Carbaryl	Sevin® (All)	Caution	No	C	12	30	30 - forage 60 - seed
Chlorpyrifos	Lorsban® 4E, 75WG, and generics Lorsban® 15G	Warning Caution	Yes Yes	OP OP	24 24	Do not graze Do not graze	42 42
Chlorpyrifos + *Gamma*-cyhalothrin	Cobalt®	Danger	Yes	OP & PY	24	Do not graze	45
Cyfluthrin	Tombstone®	Danger	Yes	PY	12	30	30
Beta-cyfluthrin	Baythroid® XL	Warning	Yes	PY	12	30	30
Deltamethrin	Delta Gold®, Battalion®	Danger	Yes	PY	12	Do not graze or feed treated foliage	21
Esfenvalerate	Asana® XL and generics	Warning	Yes	PY	12		28
Gamma-cyhalothrin	Proaxis®	Caution	Yes	PY	24		45
Lambda-cyhalothrin	Karate®, Karate® with Zeon, and other products with and without Zeon Technology	Warning	Yes	PY	24		45
Zeta-cypermethrin	Mustang®, Mustang Max ® EC, EW	Warning Caution	Yes Yes	PY	12	Do not graze or feed treated foliage	30
Methidathion	Supracide® 2E	Danger	Yes	OP	3 days	Do not graze or feed treated foliage	50
Parathion, methyl	Cheminova Methyl® 4EC	Danger	Yes	OP	4-5 days		30
Pyrethrum	PyGanic® EC, Evergreen® EC	Caution	No	B	12		None
Thiamethoxam	Cruiser® – Seed Treatment Insecticide	Caution	No	N	12		

[1] Always refer to the insecticide label for all application instructions and specific use directions.
[2] Danger means highly toxic. Warning means moderately toxic. Caution means low order of toxicity.
[3] Restricted use pesticides are available only to certified applicators or people under their direct supervision.
[4] Pyrethroid = PY, Carbamate = C, Organophosphate = OP, Neonicotinoid = N, Biological Pesticide = B.
[5] Re-entry time is the length of time from application until workers can re-enter the area without protective clothing.
[6] PHI – preharvest interval from last insecticide application.

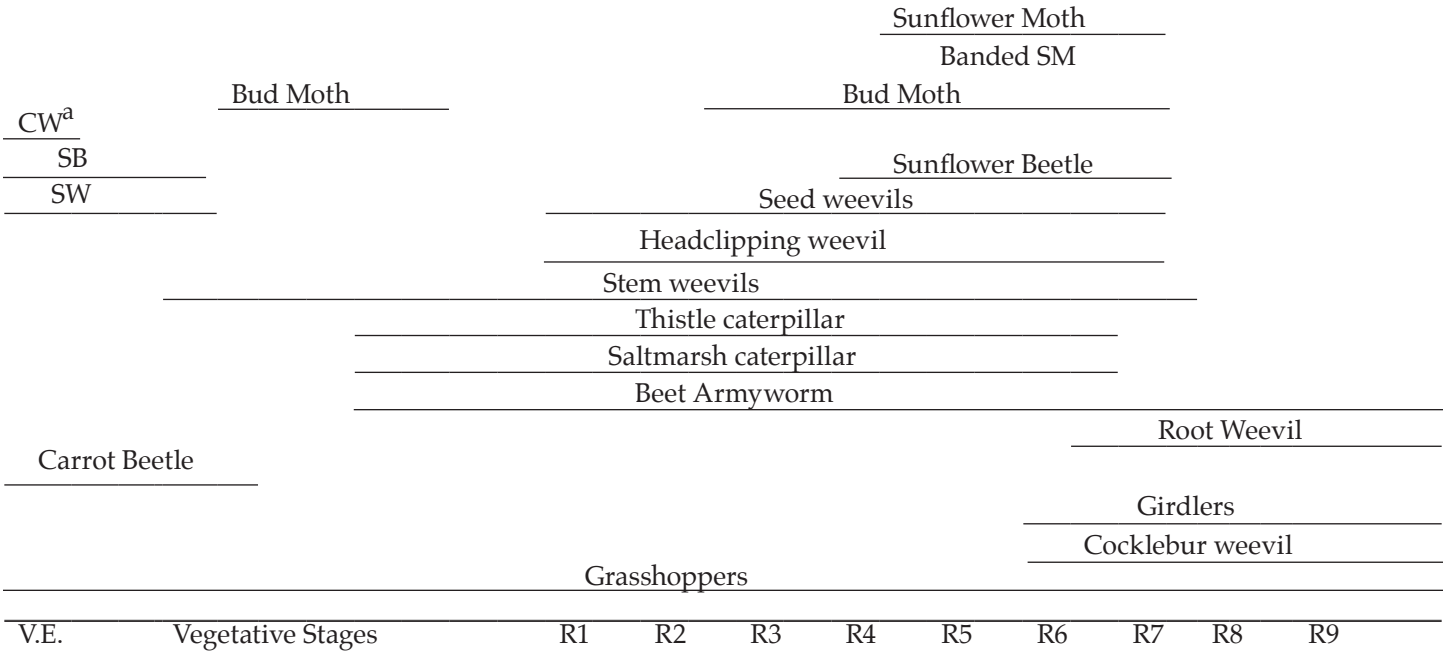
Stages of Sunflower Development

Stage	Description
VE Vegetative Emergence	Seedling has emerged and the first leaf beyond the cotyledons is less than 4 cm long.
V (number) Vegetative Stages V1 V2 V3 etc.	These are determined by counting the number of true leaves at least 4 cm in length beginning as V1, V2, V3, V4, etc. If senescence of the lower leaves has occurred, count leaf scars (excluding those where the cotyledons were attached) to determine the proper stage.
R1 Reproductive Stages	The terminal bud forms a miniature floral head rather than a cluster of leaves. When viewed from directly above, the immature bracts have a many-pointed star-like appearance.
R2	The immature bud elongates 0.5 to 2.0 cm above the nearest leaf attached to the stem. Disregard leaves attached directly to the back of the bud.
R3	The immature bud elongates more than 2.0 cm above the nearest leaf.
R4	The inflorescence begins to open. When viewed from above, immature ray flowers are visible.
R5 (decimal) R5.1 R5.2 R5.3 etc.	This stage is the beginning of flowering. The stage can be divided into substages depending on the percent of the head area (disk flowers) that has completed or is in flowering. Ex. R5.3 (30%), R5.8 (80%) etc.
R6	Flowering is complete and the ray flowers are wilting.
R7	The back of the head has started to turn pale yellow.
R8	The back of the head is yellow but the bracts remain green.
R9	The bracts become yellow and brown. This stage is regarded as physiological maturity.

From Schneiter, A. A. and J. F. Miller, 1981. "Description of Sunflower Growth Stages." Crop Science *21: 901-903. A pictorial reference to developmental growth stages for sunflower is available at the national sunflower association Web site, http://www.sunflowernsa.com/growers/default.asp?contentID=302.*

Seasonal Sunflower Pest Profile

The development of various sunflower pests is usually closely related to the seasonal development of the sunflower. Although the severity of insect problems cannot be predicted on a seasonal basis, producers should frequently determine plant development to aid them in predicting insect problems associated with various developmental stages of the sunflower.



[a] Cutworm

Acknowledgment

The author acknowledges the work of Carl Patrick, former Extension Entomologist, in developing the original version of this publication. Additional thanks are extended to Pat Porter, Chris Sansone, Calvin Trostle and others for assistance in preparing this publication, and to the photographers who provided the photographs.

Produced by AgriLife Communications and Marketing, The Texas A&M University System

Extension publications can be found on the Web at: *http://AgriLifebookstore.org*.

Visit Texas AgriLife Extension Service at *http://AgriLifeExtension.tamu.edu*.

Issued in furtherance of Cooperative Extension Work in Agriculture and Home Economics, Acts of Congress of May 8, 1914, as amended, and June 30, 1914, in cooperation with the United States Department of Agriculture.
Edward G. Smith, Director, Texas AgriLife Extension Service, The Texas A&M University System.
Revision.