

INSECTS

There are many insects sunflowers are host to, however many of these insects are not a major concern. Although there are approximately 16 insects that can cause economic damage within a sunflower crop, only a few species will be present in a field in a given year. Population and severity of damage is dependent on weather, if the insect arrives in air streams from the United States and the stage of the crop when the insects populations are high.

Infestations of sunflower insects must be monitored regularly. During monitoring it is important to note the population of an insect, the growth stage of the insect and the crop, and the distribution of the insect ie. is the insect only present in isolated patches of the field. Monitoring the insects will determine if the insect has the ability to cause economic damage and if and when to apply an insecticide.

The following section provides information on the identification, life cycle, damage, scouting methods, economic threshold levels and management of some of the most common insect pests. If you remain unsure about identifying an insect or control options, contact a local agronomist or the provincial entomologist.

SEEDLING AND ROOT FEEDERS

WIREWORMS

Wireworm larvae feed on germinating seeds or young seedling. Infestations are more likely to develop where grasses, particularly perennial grasses, have been growing. Stems of young seedlings may emerge shredded. Damaged plants may wilt soon and die resulting in thin stands.

HOST CROPS

Grasses, corn, carrots, potatoes, wheat, barley, pulse crops, sunflowers, to name a few.

BIOLOGY

Wireworm larvae are slender, hard-bodied and smooth wire-like worms varying from 1.5 to 2 inches (38-50mm) in length when mature. They have 3 pairs of legs behind the head, and the last abdominal section is flattened and notched or forked. They are a yellowish white to coppery color.



Wireworms usually take 3 to 4 years to develop from the egg to an adult beetle. Most of this time is spent as a larva. Wireworm larvae and adults overwinter at least 9 to 24 inches (23cm to 61cm) deep in the soil. Adult beetles emerge from the soil in the spring. From late May through June, the female beetles lay 200 to 1400 eggs in loose or cracked soil and under lumps of soil. The young wireworms hatch and begin feeding on roots of germinating seeds.

Larvae move up and down in the soil profile in response to temperature and moisture. When soil temperatures reach 50 to 55°F (10 to 13°C) during the spring, larvae and adults move nearer the soil surface and larvae feed within 6 inches (15 cm) of the soil surface. When soil temperatures become too hot (>80°F, 27°C) or dry, larvae will move deeper into the soil to seek more favorable conditions. Due to this nature, wireworms inflict most of their damage in early spring when they are near the soil surface.

SCOUTING TECHNIQUES

Soil samples can be collected and sieved in the spring to find any wireworms present in the field. Soil should be sampled to a depth of 15 cm (6 inches) and repeated in different areas of the field to determine and average number of larvae per square meter. Baits can also be used to attract wireworms to an area for monitoring. The past history of a field is a good indicator, especially if wireworms have been a problem in previous seasons. Crop rotation may impact population levels.

CONTROL TIPS

If the risk of wireworm damage is high, seeds can be treated with an approved insecticide for protection of germinating seeds and seedlings. Consult the current *Guide to Crop Protection*. No rescue treatments are available for controlling wireworms after planting.

CUTWORMS

Cutworms can be a serious problem in many field crops. There are many different species involved, but the most common are the redbacked, darksided and dingy cutworms.

HOST CROPS

The redbacked cutworm feeds on practically all field crops, vegetables and home garden plants. It is best known for feeding on cereals, flax, canola and mustard.

BIOLOGY

Cutworm larvae have four sets of abdominal prolegs and curl up when disturbed. Redbacked cutworms have two broad red or reddish-brown top stripes that extend the entire length of the body. The top-stripes are divided by a dark line with white in the center and the head is yellowish-brown.

Dark sided cutworm larvae are white on the ventral sites and pale brown dorsally. They have numerous indistinct stripes.

Dingy cutworm larvae are dull brown, with a mottle cream color. The dorsal area is pale with traces of oblique shading.

Cutworm moths may lay several hundred eggs in or on the soil. After the eggs hatch, the larvae feed on the host plants. Larvae normally have 6 instar stages, moulting several times until eventually reaching five centimeters (2 inches) in length. The larvae tunnel into the soil to form earthen cells where they pupate, and the newly emerged moths exit using the old larval tunnels. Some species overwinter as eggs (e.g. the redbacked cutworm) or as larvae or pupae. Still others do not overwinter in the Prairies but rather re-invade annually from the U.S., aided by southerly winds. Most of our pest species have only one generation per year.



SCOUTING TECHNIQUES

Cutworms are nocturnal, feeding at night and hiding during the day making them hard to detect. Once the crop has emerged, continue scouting on a weekly basis from mid-May to mid-June. Feeding by cutworms results in notched, wilted, dead and cut-off plants (weeds or crop seedlings). Plants may be missing from rows and bare patches may appear in fields as a result of cutworm feeding. Often cutworms are close to the base of the cut-off shriveled plants they have recently damaged. Using a small garden trowel and a soil sifter, they can often be found in the soil around these plants. Cutworms may be found down to about 5 cm (2 inches) below the soil surface. The small, worm-like larvae curl up or attempt to hide in the debris. Pupae may also be collected in this way.

ECONOMIC THRESHOLDS

Treatment is warranted when cutworm densities exceed 1 cutworm per square foot (30cmx 30cm) or if there is a 25 to 30% stand reduction.

CONTROL TIPS

Best results occur if insecticide applications are made in the evening. Sometimes it is most economical to just treat infested patches and not the entire field. Sometimes there are differences in susceptibility to insecticides between species of cutworms. Consult the current edition of *Guide to Crop Production* for registered insecticides.

Young cutworm larvae may be starved before spring seeding by allowing volunteer growth to reach 3 to 5 cm (1.2 to 2 inches), cultivating and then seeding 10 to 14 days later. Many predaceous insects, parasites and birds prey upon cutworms and reduce their populations

SUNFLOWER BEETLE

Feeding by adult beetles and larva may result in poor seed set, seed filling, reduced yields and delayed maturity.

HOST CROPS

Sunflower beetles feed on native and cultivated sunflowers.

BIOLOGY

Adult sunflower beetles are about 6 to 8 mm (1/4 to 3/8 inch) long and 2 to 4 mm (3/32 to 3/16 inch) wide. Adult sunflower beetles closely resemble adult Colorado potato beetles, however sunflower beetles are smaller. The head is reddish-brown and the thorax (area behind the head) is a pale cream-color at the top with a reddish-brown patch at the base. Each wing-cover has three dark-brown stripes that extend the length of the back. The fourth stripe ends at the middle of the wing in a small dot that resembles an exclamation point. Sunflower beetle larvae are yellowish green with a brown head capsule and humpbacked in appearance. Newly hatched larvae are about 1.5 to 1.75 mm (1/16 inch) long and will grow to about 8 to 10 mm (under half an inch) when fully developed.



Sunflower beetles overwinter as adults in the soil. Usually, their emergence from the soil coincides with seedling emergence in late May. The beetles feed throughout the day on the emerging seedlings. Eggs hatch about a week after they are laid and the young larvae feed on the leaves at night. They hide among the bracts of the flower bud and in the axils of the leaves during the day. The larvae feed for about two weeks but, because of the long egg laying period, larvae may be present in the field for about six weeks. The mature larvae drop to the ground, enter the soil, and pupate in earthen cells. The pupal stage lasts about two weeks. Adults of the new generation emerge and feed for a short period in late August and early September. They feed on the uppermost leaves or bracts of the plant before re-entering the soil to overwinter.

SCOUTING TECHNIQUES

Noticeable damage is often first seen on plants near the margins of sunflower fields. When plants are seedlings, scout to determine the average number of adult beetles per plant. For larger plants, determine the average number of larvae per plant and percent defoliation by sampling 20 plants at 5 sites along an X pattern for a total of 100 plants.

ECONOMIC THRESHOLDS

The threshold is one to two adult beetles per seedling at the two to six leaf stage or ten to 15 larvae per plant during the summer. Severe leaf damage may occur to plants in the two to six leaf stages when adult beetles are numerous. Control may be necessary if defoliation caused by either the adults or the larvae reaches 25 to 30 percent, especially if more defoliation is expected. If the majority of the larvae have reached maturity at about 25 percent defoliation, control should not be necessary.

CONTROL TIPS

Insecticides are available to control sunflower beetle. Consult the *Guide to Crop Protection* for product information. Natural controls usually keep sunflower beetle populations below damaging levels. Sunflower beetle eggs are eaten by the thirteen spotted lady beetle and the convergent lady beetle. Larvae of the common green lacewing consume both eggs and larvae. Damsel bugs and the two spotted stink bug may also prey on larvae of sunflower beetles. Parasitoids attack sunflower beetle eggs, larvae and adults.

THISTLE CATERPILLAR

Thistle caterpillar has been an occasional pest of sunflowers. Localized damage of sunflower crops has occurred during sporadic years of higher populations.

HOST CROPS

On Canada thistle, larvae feed selectively on foliage, leaving the stem and midrib. There are about 60 other hosts including sunflowers and canola.

BIOLOGY

Adults, commonly known as painted lady butterflies, arrive on the Prairies during early June, depending on speed and pattern of migration, from overwintering sites in tropical and subtropical areas. There is no evidence that they can survive our cold winters. This butterfly lays eggs on Canada thistle and a broad range of host plant. Larvae feed on the leaves producing loose webbing. The larvae are up to 30 mm (1.25 inches) long and dark purple to black in color. They have long spines on each segment of the abdomen.

SCOUTING TECHNIQUES

If populations seem heavy while scouting, sample about 100 scattered plants, noting the percent defoliation on each. Divide the total percent defoliation by the number of plants sampled to obtain an estimate of percent defoliation for the field.

ECONOMIC THRESHOLD

The threshold is 25 per cent defoliation provided that most of the larvae are still under about 3 centimeters (1 1/4 inches) long. If the majority of larvae are fully grown, most of the feeding damage will have already occurred.



larvae



adult



pupae

INSECTS IN THE STEM

SUNFLOWER BUD MOTH

High populations of this pest have been reported in the past. Despite high population, the sunflower bud moth may not cause high levels of economic loss.

BIOLOGY

Sunflower bud moths have a wingspread of about 16 to 18 millimeters (0.63 inches). Each gray-brown forewing has two dark transverse bands. One band extends across the middle of the wing, and the second band is located near the wing tip. The larva has a dark head capsule with a smooth, cream-colored body.

In Manitoba, two generations of sunflower bud moth are produced per year. Adults emerge from overwintering pupae during the last week of May to mid-June. A few days after adult emergence, eggs are deposited on the terminals of immature sunflowers or on the receptacle of mature sunflowers. Eggs also are deposited in leaf axils. The hatched larvae begin tunneling into the sunflower plant. The initial infestation in mid-June is characterized by an entrance hole surrounded by black frass (insect excrement). Mature larvae pupate within the sunflower plant.

Pupae move to the opening of the entrance holes formed in the stem or head tissue so that adults can emerge easily. The second generation adults appear in July and August. Infestations by the second generation larvae is not economically important.



In early planted sunflower, most of the infestations occur in the stalks, whereas in late planted sunflower, most infestations occur in the pith areas of the head. The only time yield loss is noticeable is when larvae burrow into unopened buds, preventing proper head development. The larvae normally do not feed on developing seeds, but confine feeding activities to the fleshy part of the head. Despite minimal economic losses, the larvae cause malformations in both the head and stalk.

SCOUTING TECHNIQUES

A field monitoring scheme for this insect has not been established since it is not of economic significance.

ECONOMIC THRESHOLD

None has been determined.

CONTROL TIPS

Insecticide use has not been warranted for control of sunflower bud moth.



adult



larvae

SUNFLOWER STEM WEEVIL

There are two main stem weevil species, the Spotted Sunflower Stem Weevil and the Black sunflower stem weevil.

BIOLOGY

The Spotted Stem Weevil adults are about 4 to 5 millimeters (3/16 inch) long and grayish brown with varying shaped white spots on the wing covers and between the head and abdomen. The snout, eyes and antennae are black. The larvae are 5 to 6 mm (1/4 inch) long at maturity and creamy white with a small, brown head capsule. The larvae will normally be in a curled or C-shape position when found in sunflower stalk tissue. The spotted stem weevil adults emerge in mid- to late- June and feed on the epidermal tissue of the sunflower foliage and stem. This feeding does not affect plant vigor. Mating occurs soon after emergence of adults. Just prior to egg laying, females descend to the lower portion of the plant to deposit eggs individually in the epidermal tissue of the stem. Eggs are very small (0.51mm long by 0.33mm wide). Upon hatching in early July, the first instar (larval growth stage) larvae feed on sub-epidermal and vascular tissue. Feeding is concentrated in the pith tissue as the larvae develop to third and fourth instars.

By the last week in August, the larvae have descended while feeding to just above the soil surface. A rudimentary chamber is constructed in the stem, and the weevils overwinter in this chamber as fifth instar larvae. Pupation of the overwintering larva occurs the following year in early June. There is one generation per year.

The Black Stem Weevil adults are black and only 2.5 mm (0.1 inches) long from the tip of the snout to the tip of the abdomen. The snout is very narrow and protrudes forward from the head, which is small in relation to the rather large body. The larvae are very similar in appearance to the spotted stem weevil except they are only 2.5 to 3 mm (0.1 to 0.12 inches) long at maturity and yellowish in color.

The black stem weevil overwinters as an adult in soil, plant residue, sod or weed clusters, and begins to emerge and feed on volunteer sunflower as soon as the plants reach the early seedling stage. Adult feeding on cultivated sunflower begins at the two- to four-leaf stage. Females deposit eggs under the epidermis of the stem. Larvae emerging from these eggs tunnel in the pith area of the stem, pupate and emerge as adults in early August.

Little or no adult activity is observed for about two weeks in late July and early August. Apion adults emerging in August also feed on the leaves and stems of the plant, but as the plant matures and the leaves begin to die, the adults move under the bracts of the sunflower heads where they can be observed feeding until the plants are harvested.



These two species are highly suspected in vectoring Phoma black stem disease in sunflower fields. The only species of stem weevil larva that has been found to cause serious stalk breakage is the spotted stem weevil. When larval infestations of this species reach 25 to 30 or more per stalk, considerable weakening of stem tissue can result, especially when these larvae begin to create their overwintering cells in the base of the sunflower stalks. Breakage is most likely to occur when plants are under drought stress and/or during periods of high wind. The breakage typically occurs at or slightly above the soil surface in contrast to breakage attributed to stalk disease, which normally occurs farther up on the stalks.

SCOUTING TECHNIQUES

Look for stem weevils when scouting sunflower fields in late June and very early July using the X pattern and examining 5 plants per stop for a total of 25 plants at the 8 to 14 leaf stage. Sampling sites should be 23 to 31 meters (75 to 100 feet) in from the field margins. The average number of weevils per plant can then be calculated. When surveying for stem weevils, the scout must move through the field slowly to avoid having the adult stem weevils drop to the soil and 'play dead' as they typically will do if care is not taken during survey and counting efforts. Adult feeding by both stem weevil species is considered to cause insignificant mechanical injury.

ECONOMIC THRESHOLDS

The economic threshold for the spotted sunflower stem weevil is one adult per three plants.

CONTROL TIPS

No insecticides are currently registered for control of sunflower stem weevils in Manitoba. Delayed planting of sunflower until late May or early June has been effective in reducing densities of larvae in the stem. Fall tillage practices which either bury or break up sunflower stalks will help increase winter mortality of stem weevil larvae. Natural enemies of the stem weevil include three species of larval parasitoids and one egg parasitoid. These wasps have accounted for approximately 30 percent mortality of the stem weevils in the past.

SUNFLOWER MAGGOTS

There are three main species that have larval feeding stages that can cause seed sterility or stalk breakage under high populations. Damage is usually negligible.

BIOLOGY

The adult forms of all three sunflower maggots (flies) have wings with a distinct brown or yellowish-brown pattern. While all three fly species are similar in appearance, they do have distinguishing differences.

Sunflower Receptacle Maggot



This species is the largest of the three with a body about 10 mm (0.4 inches) long and a wing span of approximately 19 mm (0.75 inches). The eyes of this species are bright green and the wings have a yellowish-brown and somewhat mottled appearance. Sunflower receptacle maggot larvae attain a length of nearly eight mm (0.31 inches) at maturity. The larvae taper from the front to the rear and are yellowish-white in color.

Adults of the sunflower receptacle maggot emerge in late June to early July after sunflower buds reach five to 10 cm (2 to 4 inches) in diameter. Eggs are laid on the bracts of the developing sunflower heads. Egg laying occurs from mid-July through August. The hatched larvae tunnel into the spongy tissue of the receptacle. Damage to the head is negligible. After 30 days, the mature larvae cut a small emergence hole on the underside of the receptacle and drop into the soil to pupate. Overwintering pupae are found about 19 cm (7.5 inches) deep in the soil by August or early September. Some larvae will pupate in the sunflower head. There is only one generation per year in Manitoba.

Sunflower Maggot

Adults of this species have a wing spread of about 13 mm (0.5 inches) and a body 6 mm (0.25 inches) long. The wings bear broad dark bands that form a fairly distinct F-shaped mark near the tips. The larvae of sunflower maggot are creamy white, headless and legless, as are the other two species. They taper slightly at both ends and attain a length of about 7 mm (0.28 inches) at maturity.

Sunflower maggots have one generation per year. This insect overwinters as larvae in plant debris in the soil. Pupation and adult emergence are completed in early June. Females lay eggs in stem tissue of young sunflower, and larvae feed in the pith tissue for much of the growing season.



Sunflower Seed Maggot



This sunflower maggot is the smallest of the three species with the adult having a body length of about 6 mm (0.25 inches) and a wing span of approximately 7 mm (0.28 inches). The wings have a brown lace-like appearance. *N. finalis* larvae attain a length of 4.5 mm (0.19 inches) at maturity. Unlike the other two species of sunflower maggots, sunflower seed maggots complete two generations per year. The first generation pupates in the head; the second generation overwinters in the soil as pupae.

SCOUTING TECHNIQUES

Scouting techniques have not been developed for sunflower maggots because they cause negligible damage.

ECONOMIC THRESHOLD

None established.

INSECTS ON THE HEADS

SUNFLOWER MIDGE

Midge larvae can affect the growth of sunflower heads. Heavily-damaged heads become gnarled and cupped inwardly, producing few seeds.

HOST CROPS

Sunflowers

BIOLOGY

The tiny, tan-colored, adult sunflower midge is only about 2 mm (1/8 in) long with a wingspan of about 4mm (0.07 inch). The wings are transparent and void of markings except for the veins. The first peak of first-generation adult emergence occurs in early- to mid-July. A second peak occurs about 7 to 10 days later. The adults prefer to lay their eggs on sunflower buds with a diameter greater than 1 inch. Eggs are laid individually or in groups in depressions between the bracts of the sunflower bud. The midge larva is tiny, being only 3 mm (1/8 in.) long when fully grown and cream to yellowish orange. The newly emerged larvae move to the bases of developing seeds or bracts. Presence of the larvae is frequently determined by necrotic areas at the base of, or between, bracts. They use their rasping mouthparts to feed on the plant tissues in these locations. Mature larvae drop from the head and burrow into the soil. If conditions are favorable, they pupate and emerge the same season. Otherwise, they remain in the soil and overwinter as larvae in cocoons or, in some cases, as pupae. The second generation adults lay their eggs among the seeds. Usually, the larvae pupate in the spring. The adults start to emerge in late June. The adult midges only live for two to three days and are difficult to find in the field.

May	June	July	August	September
Overwintering larvae pupate	Adult midges emerge, egg laying begins	Larval feeding	Larvae move into soil	Overwinter as larvae or pupae

SCOUTING TECHNIQUES

Although damage may be severe, it is usually sporadic and localized. Damage to heads is usually restricted to field margins but, in severe infestations, damage is present throughout the field. When monitoring sunflower heads, look for midge larvae in the flower head, scarred bracts, and twisted or gnarled flowers. The larvae may be found at the base of the bracts or feeding in the flower at the base of the florets. A 10X magnifier helps in locating the tiny larvae.

ECONOMIC THRESHOLD

No threshold has been established for this pest in either oil type or confection sunflowers.

CONTROL TIPS

Delayed planting (until late May) may avoid the first major emergence of the overwintering population. However, later infestations can still be severe. Some commercial hybrids are tolerant or resistant to the sunflower midge. Consult your provincial agricultural representative for information on the most resistant varieties.

Insecticides do not work well against this pest. They provide inconsistent and inadequate control of the adults and larvae. Because the larvae crawl into the bud soon after hatching, they are protected from foliar applications. Insecticides can control the sunflower midge only if they are applied to the foliage just before the adults emerge. However, because this emergence cannot be accurately predicted, insecticide applications are ineffective

SUNFLOWER SEED WEEVILS

Larvae feed on kernels, causing reduced seed weight and oil content. Often the kernels are only partially fed upon, making it difficult to separate healthy from weevil-damaged seed. This causes downgrading of confectionary sunflower seed.

Host Crops
Sunflowers

BIOLOGY

There are two species of Seed Weevils that can cause damage in sunflowers in Canada; the Red Sunflower Seed Weevil and the Gray Sunflower Seed Weevil. The red sunflower seed weevil is the most common of the two species on the Prairies. The adults are 2.5 to 3.06 mm (1/10 to 1/8 in.), long and are covered with reddish-orange, oval scales. The adults appear during late June on volunteer sunflowers and feed on the bracts where they form pinpoint holes. As the bud develops and opens, adults move to the inflorescence and feed on pollen produced by the disk flowers. Females lay their eggs inside the seed coat of developing seeds. Populations are highest on plants at 50% flowering. The egg laying pattern follows seed filling which progresses from the outside to the center of the head. Usually, an infested seed contains a single larva. The larvae are small, cream colored, legless and C-shaped.



Sunflower seed weevil on top. Do not confuse with the much smaller minute pirate bug nymphs.

In late August, the mature larva chews an exit hole in the seed, drops to the ground directly beneath the sunflower head, and overwinters in the soil. Pupation occurs in the soil during early June through early July.

The gray sunflower seed weevil is not as common and is slightly larger (3 to 3.5 mm or 1/8 in. long) than the red seed weevil larvae. Seeds infested by the larvae enlarge, protruding above the surrounding seeds, and lack a kernel. The damage caused by a single larva of this species exceeds that of the red seed weevil because of the loss of the entire kernel. However, it usually does not cause economic damage to sunflowers used for oil because of its low population level and low reproductive rate.

May	June	July	August	September
Larvae overwinter in soil	Larvae pupate, new adults feed on volunteer sunflowers	Females lay eggs in developing seeds, eggs hatch	Larval feeding, larvae move into soil	Larvae overwinter in soil

SCOUTING TECHNIQUES

Begin scouting for seed weevils as soon as the yellow ray petals appear. Continue counts until the economic threshold level has been reached or most plants have reached 70% pollen shed at which time very few seeds are suitable for egg laying.

When sampling, follow an X or Z pattern in the field. Initiate counts more than 30 meters (100 feet) into the field as counts taken along the field margin will lead to abnormally high weevil counts that will not be representative of the field. Count the number of weevils on 5 plants at each site for a total of 25 plants. Brush the face of the heads vigorously to bring the weevils to the surface or spray mosquito repellent containing DEET on the head. This will force the weevils to move out of their hiding spots. Care should be taken to not confuse other insects which may be present on sunflower heads, such as minute pirate bugs for seed weevils.

ECONOMIC THRESHOLD

Insecticides are available to control sunflower seed weevil. Consult the *Guide to Crop Protection* for product information. In oilseed sunflowers, the threshold is 10 to 12 weevils per plant. In confection sunflowers the threshold is 1 to 2 weevils per plant.

CONTROL TIPS

Early planting helps to reduce seed damage because early planted sunflowers complete flowering and are no longer susceptible to egg laying at the time of peak weevil populations. Fall or spring disking can reduce adult emergence.

Insecticides, sometimes in combination with trap-cropping, remain the major management tool to reduce damage. Determine the sunflower plant growth stage before applying an insecticide. The weevil does not begin to lay its eggs on sunflower heads before heads reach 40% bloom (the outer 40% of the florets have opened).

If treatment is necessary, insecticides should be applied before three out of ten plants reach 40% bloom. Remember that 40% bloom does not mean that 40% of the plants in the field are blooming. To minimize harm to bees, apply insecticide in the late evening or early morning. Check fields in 2 to 3 days to determine control levels. Natural enemies of larvae in the seed include several species of parasitic wasps and flies and a fungus found in the soil.

BANDED SUNFLOWER MOTH

Larvae feed on sunflower florets and seeds.

HOST CROPS

Commercial sunflowers. Several species of wild sunflowers are also known hosts of banded sunflower moth.

BIOLOGY

The banded sunflower moth is a small, straw-colored moth about 7mm (0.3 in) long with a brown triangular area in the middle portion of the front wings. Newly hatched larvae are off-white with a dark-brown head capsule and about 1.5 mm (0.06) long. As the larvae grow, there is a gradual color change to light pink or yellow, then to reddish or purplish and finally to green at maturity. Full-grown larvae are about 10mm (0.4 in) long.



The adult moths start emerging from the soil in mid-July and are present through to mid-August. Moths fly from last year's sunflower fields to the current year's sunflower fields. Adults moths rest in vegetation along field margins during the day and at twilight females move into the field to lay eggs. They lay eggs on the bracts of sunflower heads, which hatch in 5 to 8 days. Larvae can be present in sunflower heads from about mid-July to mid-September. Mature larvae drop to the ground and spin cocoons in the soil where winter is passed. Pupation takes place in late June or early July the following year.



Newly hatched larvae move from the bracts to the florets of the sunflower head, where they enter open florets to feed. If eggs hatch prior to the opening of the florets, larvae will feed on bract tissue before moving to the florets. Larvae continue to feed in the florets until the third instar, reducing the total number of mature seeds produced. During later stages of development, the larvae tunnel through developing seeds, usually entering at the top and leaving after the contents are eaten. Each larva may destroy 6 to 7 mature seeds in addition to the florets eaten by the earlier instar larvae. Since the seed kernel is entirely consumed by the larva, the seed will normally pass

through the combine. The greatest damage by banded sunflower moth larvae has been shown to occur at the edge of the field.

SCOUTING TECHNIQUES

Fields should be monitored when plants are in the late bud (R-4) to early bloom stage (R-5.1) of development. Monitor for adult moths in early evening or early morning when the moths are most active. Sampling sites should be at least 75 to 100 feet (23 to 30 m) from the field margin. Count moths on 20 plants from 5 different sites for a total of 100 plants. Sampling strategies based on scouting for adult moths during daylight hours and for eggs have also been developed.



ECONOMIC THRESHOLD

If monitoring in the early evening or early morning, one banded sunflower moth per two plants is a reasonable economic threshold.

CONTROL TIPS

If treatment is warranted, it should be applied at the R5.1 sunflower plant growth stage. Insecticides should be applied early in the morning or late in the day to minimize the adverse effect on bees and other pollinators.

Parasitic wasps attack both the eggs and larvae and general predators in the sunflower field also consume both larvae and eggs. Minute pirate bugs feed on the eggs and young larvae. Ground beetles can destroy about 40% of overwintering larvae and pupae. At least 4 different species of parasites attack the larvae of the banded sunflower moth.



NOTE: The Arthur's sunflower moth (*Cochylis arthuri*) is very similar to the banded sunflower moth. The Arthur's sunflower moth larvae also feed on developing seeds in the sunflower head causing similar damage to that of the banded sunflower moth. The adults also have dark banding across the wings, although they can be distinguished from banded sunflower moth. Young larvae are cream colored, mid-instar larvae are light to dark pink, and last- (fifth-) instar larvae are light to dark green.

LYGUS BUG

Feeding by lygus bugs on developing seeds can cause kernel brown spot, small brown to black spots on the blunt or distal end of sunflower seeds.

HOST CROPS

Lygus bugs have been recorded on over 385 crop plants and weeds.

BIOLOGY

Adult lygus bugs are about 5 mm (0.2 in) long and 2.5 mm (0.1 in) wide. They vary in color from pale green to reddish-brown and have a distinct triangle or “V” mark on the wings. First stage nymphs are very small, wingless and bright green. Nymphs may look similar to aphids but are much more mobile.



Lygus bugs feed on plants by injecting plant tissue with digestive enzymes, and then extracting nutrients with their needle-like mouthparts. Lygus bug feeding on developing sunflower seeds can cause scarring on the seeds, known as kernel brown spot. While brown spot is not known to affect yield, this quality issue can be significant in confection sunflowers because processors are only allowed 0.5% damage in the finished product. Lygus bug feeding can also result in a bitter taste to the seeds. While brown spot is visible on dehulled kernels, there is usually no sign on the exterior of the hull that the kernel has brown spot.



Nymph lygus bug

Lygus bugs are mobile and can be found on many crops. Lygus bugs probably move to sunflowers from alfalfa, canola or other host crops when those crops have either been harvested or senesced.

SCOUTING TECHNIQUES

Scout for adults or nymphs on the sunflower heads or foliage.

ECONOMIC THRESHOLD











Lygus bugs are capable of damaging 30 to 35 seeds per head per adult. With the industry standard allowing for a maximum of 0.5% kernel brown spot, the economic threshold for lygus bugs on sunflowers is likely about 1 lygus bug per 9 heads.

In research trials damage to sunflower heads was approximately twice as severe when infestations occurred at late bud and early bloom compared to stages when heads had completed flowering. Thus, lygus bug management should be initiated prior to or at the beginning of the bloom stage if adult densities approach the economic threshold. Fields should be monitored for lygus bugs until flowering is completed to reduce incidence of kernel brown spot damage to confection sunflowers.

CONTROL TIPS

Insecticide application is most beneficial when applied during early flowering at the R5.1 stage. Consult the current *Guide to Crop Protection* for registered insecticides.

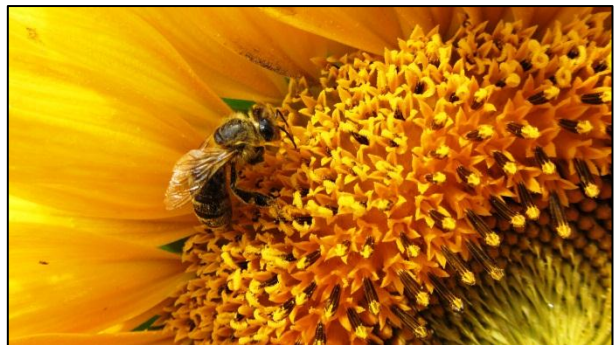
BENEFICIAL INSECTS

					
Dr. J. Gavloski	Dr. Charlet	Dr. J. Gavloski	Dr. J. Gavloski	Dr. J. Gavloski	Dr. J. Gavloski
DAMSEL BUGS Prey on sunflower beetle larvae, and banded sunflower moth eggs and larvae	TWO SPOTTED STINK BUG Prey on sunflower beetle larvae	PARASITIC WASPS Attack both the eggs and young larvae of banded sunflower moth, sunflower seed weevils and sunflower stem weevils	GROUND BEETLES (CARABID BEETLES) Can destroy 40 percent of overwintering larvae and pupae of sunflower beetles	HOVER FLY Increases crop yield by enhancing pollination. Feeds on aphids	HONEY BEE Increase yield in sunflower by enhancing pollination
					
Dr. J. Gavloski	Dr. J. Gavloski	Dr. J. Gavloski	Dr. J. Gavloski	Dr. J. Gavloski	
LADY BEETLES Consume sunflower beetle eggs, aphids, and banded sunflower moth eggs and larvae		GREEN LACEWING Predators to a variety of sunflower pests including aphids, sunflower beetle eggs and larvae, and banded sunflower moth eggs and larvae.		MINUTE PIRATE BUG Both immature stages (nymphs) and adults feed on a variety of sunflower pests including aphids, eggs and larvae of banded sunflower moth. Both adults and nymphs feed by sucking juices from their prey through a sharp needle-like beak.	

POLLINATION

Unlike native sunflowers, current hybrids have been selected for and possess high levels of self-compatibility. Although self-compatible sunflower hybrids usually out-produce self-incompatible cultivars, modern hybrids continue to benefit from insect pollination. Studies have shown that in most sunflower hybrids seed set, yield and oil quantity is increased when pollinators (such as bees) are present.

To achieve maximum yields and quality, often the use of insecticide is required to protect the crop from insect competitors. Unfortunately, many of the major insect pests of sunflower attack the crop during flowering and insecticide applications harm the pollinating bees. Below are some key strategies that can help protect the pollinators.



KEY STRATEGIES:

Scout fields and apply insecticide only when needed

Apply Insecticide in the evening - Honey bees are foraging when the sun is up and during the warmer parts of the day and return to the hive at night. When the bees return to the field the next day, the effect on the bees will be significantly reduced.

Less harmful to bees does not necessarily mean less harmful to pests – This is due to the repellent effect on bees from the residue of some insecticides. Select insecticides that provide effective control of the targeted pests while minimizing impact on bees.

Communicate with beekeepers – Contacting the beekeeper about an insecticide application, the insecticide chosen, and the steps taken to reduce harm to pollinators, helps the beekeeper to decide if additional measures should be taken to minimize bee damage.