Common Insects of Field Crops in Oklahoma



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Common Insects of Field Crops in Oklahoma

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References to some pests not covered in this manual and other OSU publications
OSU Extension fact sheet EPP-7307 *Beneficial Insects.* For more information, visit extension.okstate.edu

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Introduction

This handbook was developed as a reference for the common insects and mites that damage field crops in Oklahoma. It does not cover every bug found in the state. The handbook is intended to be a resource for county Extension staff, crop consultants and students in plant sciences and entomology. It is intended to assist the user in identifying common arthropod pests and provide information on their life cycles, host plants, damage and management.

In this age of environmental awareness, the concept of routine, preventative treatments for pests is no longer acceptable. Insecticides and miticides should be used only when specific pests appear or where there is a historical basis for anticipating a pest. Every effort should be made to prevent the outbreak of insect/mite infestations through nonchemical means. When a pesticide can be justified, the least hazardous, most effective, most pest-specific product(s) should be used.

A well-designed Integrated Pest Management (IPM) plan encourages the use of suppression tactics that are: (1) most effective, (2) least expensive and (3) least detrimental to the environment. This can be achieved through the PAMS approach (i.e. Prevention, Avoidance, Monitoring and Suppression).

- **Prevention:** Examples include practices that keep pest populations from infesting a field. This includes using pest-free seeds, preventing weeds from reproducing, irrigating in a manner that minimizes development of plant diseases, cleaning equipment and field sanitation to minimize introduction of pests and pathogens.
- **Avoidance:** Examples include using crop rotation, selecting cultivars that are resistant to pests, trap cropping, selecting varieties with maturity dates that avoid pest infestations, proper fertilization and making sure soils are conducive to plant growth. Overreliance on chemical control can cause pests to become resistant to chemicals used, increase costs unnecessarily and contaminate the environment.
- **Monitoring:** Examples include surveying fields, properly identifying pests, weather monitoring, soil testing and record keeping.
- **Suppression:** Examples include:
  - **biological** (mating disruption, conserving natural enemies),
  - **cultural** (row spacing, alternative tillage including no-till, cover crops and crop rotation), physical (temperature management, flaming of weeds),
  - **mechanical** (mowing, cultivation) and chemical (herbicide, fungicide and insecticide) suppression tactics and
  - **chemical** controls should be used after the cost/benefit ratio has been confirmed, choosing pesticides with the least negative effects on the environment and human health and applied in a manner that is least disrupting to non-target organisms.

We have intentionally excluded specific chemical control suggestions for the pests listed in this handbook. This information is readily available in OSU Extension fact sheets, Current Reports, Circulars and in E-832, *Extension Agents' Handbook of Insect, Plant Disease and Weed Control*. These publications are updated frequently, so are a better source for that information.

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2016, Revised 2026

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Field Sampling Strategies

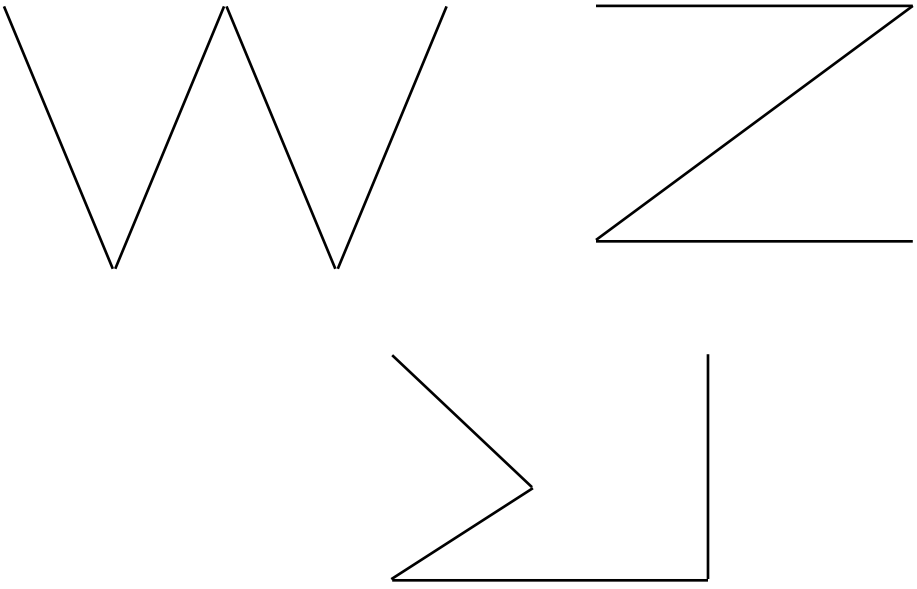
Crop scouting is a way to assess pest presence, pest abundance and crop damage. It can then be used to decide if a pest management action is needed or to evaluate its effectiveness. A field should be surveyed in a thorough, but efficient manner. Information should include the presence, number, type and severity of pests and crop problems (weeds, insects, disease, crop conditions, fertility, etc.).

A scout should be prepared with the proper equipment to sample and record observations. There are now many "scouting tool apps" for smart phones or tablets to collect and store data that can be used to refer back to a specific field. A form should include field history information such as the field location, the date and time of day the field(s) were sampled, the farmer's name and contact information, cropping history, crop variety, planting date, seeding rate/plant population, row width, tillage operations, names, rates and dates of pesticides and fertilizers applied, soil type and soil test records, weather information, stage of growth of the crop and major pest problems.

Take equipment, such as a pocket knife, magnifying glass, bags and vials to collect specimens, measuring tape, portable pH meter, ice cooler to keep specimens preserved, etc. Most smart phones now have very good cameras to take pictures; otherwise take a camera. Scouting frequency should be based on the crop life cycle, present and expected pests and environmental conditions. Sometimes the crop needs to be visited once per week or even more frequently, while other times, scouting frequency can be reduced.

Scouting should be representative of the field, but obviously, the whole field cannot be scouted in a reasonable time. Therefore, sampling patterns should be randomized to make sure the field is sampled in an efficient manner with no bias. Irregular-shaped fields may need to be sub-divided to ensure different areas of the field are visited. Don't oversample the edges of a field since they are more likely to overestimate the pest density. The most common scouting patterns are predetermined M-, Z- or W- shaped patterns for a rectangular field. Large fields should be broken down into 40- to 50-acre blocks, so the whole field is sampled.

Samples of insects, plant diseases and weeds can be collected and sent to the nearest diagnostic clinic, which is housed within the state Land Grant Institution, such as Oklahoma State University. The following page contains a sampling form used at the Plant Disease and Insect Diagnostic Laboratory at Oklahoma State to receive samples.



Insect Life Cycles

All insects and mites grow from newly hatched, immature life stages to adults through a process called **metamorphosis**. It literally means to "change in form." They do this by shedding their exoskeleton by a process called ecdysis, also referred to as molting.

There are different types of metamorphoses (shown below). **Ametabolous metamorphosis** means "without change." These insects typically have three life stages: the egg, a number of young (juveniles) and the male and female adult. The juvenile will undergo a series (often not a set number) of molts before becoming an adult. The juvenile stages look very similar to the adult. A common example of an insect that undergoes ametabolous metamorphosis is the silverfish.

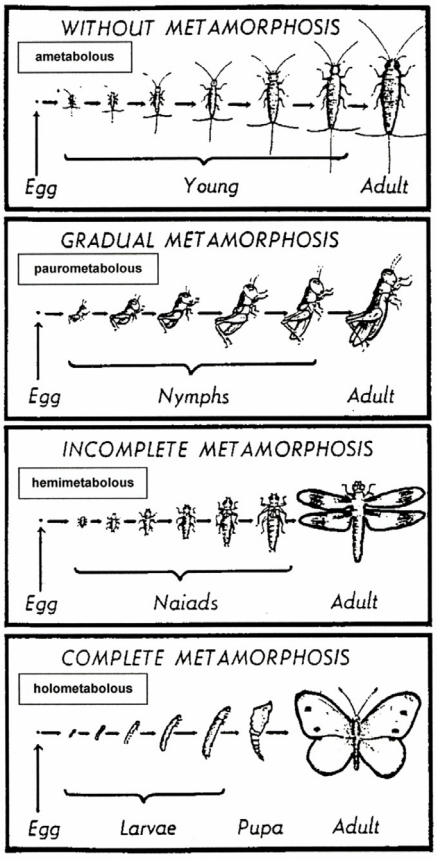
Gradual metamorphosis is also referred as **paurometabolous metamorphosis**. This type includes three distinct life stages: the egg, nymph and adult. Young nymphs resemble the adult, but will not have fully formed wings or reproductive organs. Nymphs will typically undergo a set number of molts before becoming adults. A common example of an insect that undergoes this type of metamorphosis is the grasshopper.

Incomplete metamorphosis is also referred to as **hemimetabolous metamorphosis**. In this type, the life stages include an egg, a naiad and an adult. Insects that undergo this type of metamorphosis are aquatic. A common example of an insect that undergoes this type of metamorphosis is the dragonfly.

Complete metamorphosis is also referred to as **holometabolous metamorphosis**. Insects that undergo this type of metamorphosis have four life stages: the egg, larva, pupa and adult. The immature larva has a very different appearance from the adult. The pupa is usually a quiescent life stage, and serves as the stage in which the larva completely changes form from the larva to the adult. A common example of an insect that undergoes this type of metamorphosis is the monarch butterfly.

Different insects and mites have different numbers of molts to become adults. For example, a fall armyworm caterpillar undergoes five molts after hatching before it becomes a pupa. A greenbug undergoes four molts to become an adult.

It is useful to have an understanding of how insects grow. Sometimes, the successful application of a control measure depends on which life stage or instar the pest insect is in.



Orders

	Zygentoma
Orthoptera	Phasmatodea
Blattodea	Dermaptera
Hemiptera	Mantodea
	Phthiraptera
Odonata	Ephemeroptera
	Plecoptera
Lepidoptera	Megaloptera
Coleoptera	Siphonaptera
Neuroptera	
Hymenoptera	
Diptera	

Types of insect metamorphosis and the insect orders associated with each type.

GENERAL INSECT PESTS

Notes

CUTWORMS

Order Lepidoptera: Family Noctuidae

Variegated cutworm *Peridroma saucia* (Hübner)



Army Cutworm *Euxoa auxiliaris* (Grote)



Black cutworm *Agrotis ipsilon* (Hufnagel)



Pale western cutworm *Agrotis orthogonia* Morrison

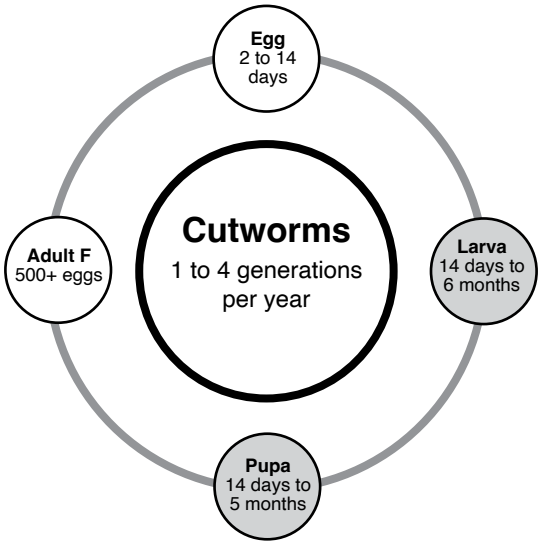


Description

Cutworms are caterpillars of moths that share a common characteristic; with their chewing mouthparts, they cut plants above, at or below the soil level and delay crop growth or cause stand loss. There are several species that are important crop pests, including the army, black, claybacked, dingy, pale western, variegated and western bean cutworm. Some will be discussed individually for a specific crop. Most cutworms, when disturbed, coil into a tight C shape. Mature cutworm caterpillars measure from 1 to 1.75 inches.

Life Cycle

Cutworms undergo complete metamorphosis. Cutworms are the larva stage of moths in the family Noctuidae. They can occur at various times during the growing season, but are typically thought of as pests in early spring or summer, but since most undergo several generations each year, they can cause problems in fall as well. Most undergo six to seven larval instars, and the later instars are the most damaging. Most overwinter as pupae in the soil, but some overwinter as larvae.



Shaded section indicates overwintering stage

Hosts

Cutworms are general plant feeders. They are known to feed on all of the crops listed in this publication.

Damage

The damaging stage is the larva. They feed on plants with their chewing mouthparts. There are four behavioral types of cutworms that are common field crop pests. **Climbing cutworms,** of which the variegated cutworm is an example, feed on plants above the soil surface and literally climb up to feed on the host plant. **Surface cutworms** feed on plants at the soil surface. A good example of a surface cutworm is the army cutworm. **Tunnel-dwelling cutworms** cut their food plant at the soil surface, but then pull it down into a tunnel and feed. The black cutworm is a good example of a tunnel dwelling cutworm. **Subterranean cutworms** feed almost entirely below the soil surface on roots and underground stems. The pale western cutworm is a good example of a subterranean cutworm.

Management

Fields need to be scouted soon after crop emergence. Look for evidence of feeding damage on the leaves and crop stand loss. Since stand loss can result from seedling diseases or herbicide injury, look for evidence of chewing and dig around the edges of the stand loss for resting cutworms to confirm that the loss is due to cutworms. For specific insecticide suggestions, E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control*

Notes

Notes

GRASSHOPPERS

Order Orthoptera: Family Acrididae

Differential grasshopper
Melanoplus differentialis **(Thomas)**



David Riley, University of Georgia, Bugwood.org

Twostriped grasshopper
Melanoplus bivittatus **(Say)**



Frank Peairs, Colo. State University, Bugwood.org

Redlegged grasshopper
Melanoplus femurrubrum **(De Geer)**



Russ Ottens, University of Georgia, Bugwood.org

Twostriped slantfaced grasshopper
Mermaria bivittata **(Servile)**



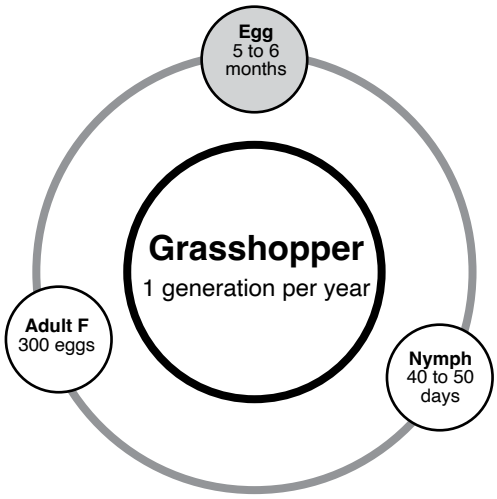
Kansas Dept. of Agriculture, Bugwood.org

Description

More than 130 species of grasshoppers call Oklahoma home. Four common species that damage field crops include the differential, redlegged, twostriped and twostriped slantfaced grasshoppers. All adult grasshoppers have leathery forewings and clear or colored membranous hindwings. They possess elongated legs designed for jumping. The differential grasshopper is yellow to brownish and possesses black inverted chevrons on the hind femurs. All legs are yellow or yellow-orange. The redlegged grasshopper is medium in size with a reddish-brown back with a yellow belly and bright red hind legs. The twostriped grasshopper is greenish yellow to nearly gray, with a pair of light stripes along each side of its back.

Life Cycle

Grasshoppers have three life stages: the egg, nymph and adult. Most grasshoppers produce one generation per year, and most overwinter as eggs in the soil. A few species overwinter as large nymphs. In late summer, female grasshoppers mate and deposit eggs in pods containing eight to 30 eggs. One female can lay up to 300 eggs. The embryos begin to develop, but become quiescent during the winter and resume development in the spring. Eggs hatch in spring, but hatching times vary by species and are triggered by weather and especially soil temperatures. Nymphs begin feeding within a day of hatching, and typically keep eating the plants they first start to eat throughout their life. Nymphs grow through five instars, shedding their exoskeleton each time. They become adults about 40 to 55 days after hatching and can live as adults for many weeks.



Shaded section indicates overwintering stage

Hosts

Grasshoppers are general feeders and attack a wide range of plants, from vegetables to most row-crops to many rangeland plants. They tend to feed more heavily on corn, soybean, wheat and canola and less so on sorghum or peanut.

Damage

Damaging stages are the nymph and adult. Grasshoppers damage plants with their chewing mouthparts. Grasshopper problems are sporadic but can occasionally become severe. They can damage crops anywhere in Oklahoma, but are more likely to become a threat in areas that receive less than 30 inches of annual rainfall. However, Oklahoma is subject to periods of drought, so other parts of the state may fall below that 30-inch threshold for several years. The timing of rainfall can alter survival of eggs and nymphs in a given area. Thus, grasshopper problems sometimes develop in isolated pockets across the state for a few years, then subside.

Grasshoppers can become a problem in row crops and small grains. They tend to injure canola, corn, soybean and wheat, and do not feed heavily on sorghum or peanuts. Corn and soybean are likely to suffer defoliation in late summer and fall, including damage to the ear of corn or the soybean seed pod. Alfalfa, winter wheat and double-cropped sorghum or soybeans are more vulnerable to damage in the summer or fall and can result in stand loss. More often than not, damage occurs in the first 50 to 100 feet on the field border as grasshoppers move in from roadside ditches.

Management

Grasshopper populations can be assessed through several methods. The square yard method requires the surveyor to walk in a straight line across an area, visually delineate an imaginary square yard area about nine to 12 feet in front of the surveyor, and simply count the number of grasshoppers seen jumping out of the space. About 30 samples should be taken, each spaced about 75 feet apart. Figure an average of the counts to determine grasshopper population densities.

With the square foot method, the surveyor counts grasshoppers from 18 different "square foot" areas in much the same manner as is done with the square yard method. After 18 samples have been taken, divide the total grasshoppers counted by two to come up with an average number of grasshoppers per square yard.

If the species of grasshoppers causing damage needs to be identified, collect some using a sweep net and sample several different 1-square-yard areas. Place the collected grasshoppers in a container and take them to someone familiar with grasshopper identification.

For more information, see EPP-7196 Grasshopper Management in Rangeland, Pastures and Crops. For specific insecticide suggestions, E-832, *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

There are no fixed thresholds for control, but the following guidelines were provided by the University of Nebraska:

Grasshopper population	Field: #yd^2	Field margin: #yd^2	Treatment necessary?
Non-economic	0 to 2	5 to 10	NO
Light	3 to 7	11 to 20	Depends on crop
Moderate	8 to 14	20 to 40	Probably
Abundant	15 or more	41 or more	YES

Notes

Notes

SPIDER MITE COMPLEX

Order Acari: Family Tetranychidae

Banks grass mite *Oligonychus pratensis* (Banks)



F.C. Schweissing, Bugwood.org

Twospotted spider mite *Tetranychus urticae* Koch



Frank Peairs Colo. State University, Bugwood.org

Twospotted spider mite damage to leaf



Whitney Cranshaw Colo. State University, Bugwood.org

Banks grass mite damage to corn



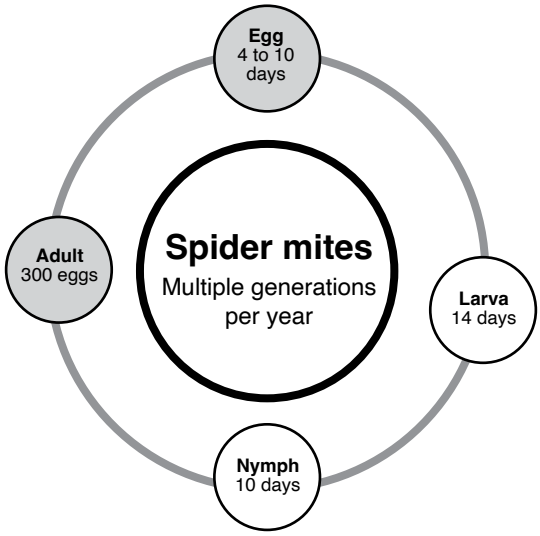
Frank Peairs Colo. State University, Bugwood.org

Description

Spider mites are related to spiders and ticks. Banks grass mites and twospotted spider mites are very small — barely visible to the naked eye. The newly hatched larva has six legs, but all other active stages have eight legs. Body color can range from red brown or pale greenish. Twospotted spider mites have darker spots on each side of their abdomen. They produce fine, irregular webs over the infested parts of plants.

Life Cycle

Spider mites have four life stages: the egg, larva (first instar), nymph (two instars) and adult. Some species overwinter as adults, others as eggs. They hatch or become active as the weather warms in the spring. Hot, dry weather is favorable for most spider mites and, during the summer months, they can complete a generation in seven to 14 days. Females lay as many as 300 eggs in their webs or on plants. Therefore, mite infestations can increase rapidly and cause extensive damage to plants in a short time. Infestations usually decline as the weather becomes cooler and wetter in the fall.



Shaded section indicates overwintering stage

Hosts

Some species of spider mites are restricted to one or a few kinds of host plants, while others feed on many different kinds of plants. Two spotted spider mites attack most field crops grown in Oklahoma, while the banks grass mite is more restricted to grass crops, such as corn and sorghum.

Damage

Damaging stages are the larva, nymph and adult. Damage occurs when the mites suck plant juices with their small, needle-like mouthparts called chelicerae. Light infestations leave a pattern of small, pale spots called stipples on the infested plant. With heavier infestations, the individual stipples run together and can cause the death of a leaf.

Management

Spider mites tend to prefer hot, dry conditions. Management of weeds in roadside ditches and field margins can help reduce spider mite infestations from starting. If no webbing is present, but light discoloration of leaves leads you to suspect spider mite infestations, double-check by holding a white sheet of paper under the foliage and jarring the leaves with your hand. Mites falling on the paper will appear as tiny specks, but generally start to move in a short period of time. For specific insecticide suggestions in various crops, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control*.

Notes

Notes

WHITE GRUBS

Order Coleoptera: Family Scarabaeidae

***Phyllophaga* adult**



Steven Katovich, USDA Forest Service, Bugwood.org

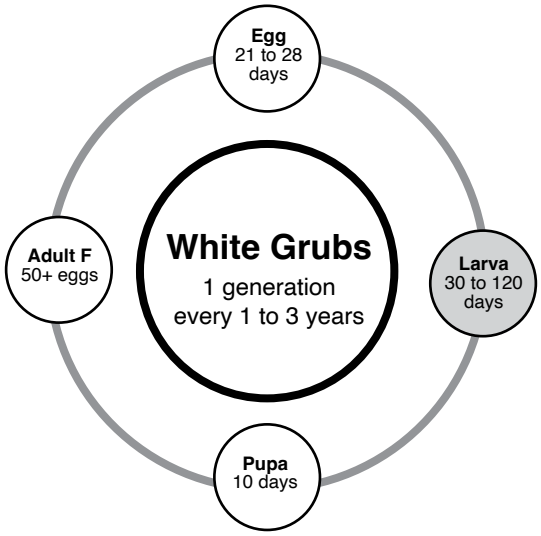
***Cyclocephala* adult**



Kansas Department of Agriculture, Bugwood.org



Tom A. Royer, Oklahoma State University



Shaded section indicates overwintering stage

Description

White grubs are the immature stage of May or June beetles (*Phyllophaga* spp.) and masked chafers (*Cyclocephala* spp.). The larvae are white, C-shaped grubs with distinct brown heads and three pairs of legs near the front end.

Life Cycle

May/June beetles have four life stages: the egg, larva (three instars), pupa and adult. May/June beetle life cycles range from one to three years, depending on species and location. Most species in Oklahoma have two-year life cycles. The adults emerge from the soil. While most species emerge in May and June, some species emerge in early April while others emerge in late summer though mid-September. After mating, the females enter the soil and deposit about 50 eggs in small, earthen cells during a one- to three-week period. Larvae hatch three to four weeks later and begin feeding on dead organic matter, later moving to the roots of plants. In the fall, the larvae move deeper into the soil and construct an overwintering cell to spend the winter. The following spring, they move back to the root zone to feed. Most of the damage is done during this time. At maturity, they move deeper into the soil to pupate.

Masked chafers have one-year life cycles and overwinter as third instar larvae deep in the soil. Larvae migrate upward during March and April and resume feeding until May, doing most of their damage during this period. They then move deeper in the soil for pupation. The adults emerge during June and July and mate. Females enter the soil and lay 10 to 30 eggs, which hatch two to three weeks later. Annual white grubs are more likely to feed on dead organic matter than May/June beetle larvae and can develop on this diet alone.

Hosts

Larvae of both types of white grubs feed on dead organic matter and on the roots of most grasses and many other types of plants. They damage crops by feeding on the roots of the infested crop.

Damage

The damaging stage is the larva. White grubs have chewing mouthparts as adults and larvae. Adults feed on the leaves of various trees, but are not considered pests of agronomic crops. Larvae feed on plant roots. Aboveground symptoms of white grub damage to plants include wilting, browning and dying of the plant in localized spots or in large irregular-shaped areas of a field.

Management

Dig plants and inspect for root injury from chewing. There is no rescue treatment for white grubs. Some at-planting insecticides are registered for control. Some seed treatments will deter white grub feeding and protect plants until they are large enough to withstand damage. In no-till or fallow ground, control summer weeds to make fields less attractive to beetles during egg laying. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

Notes

Notes

WIREWORM and FALSE WIREWORM

Order Coleoptera: Family Elateridae and Family Tenebrionidae

Click beetle



Joseph Berger, Bugwood.org

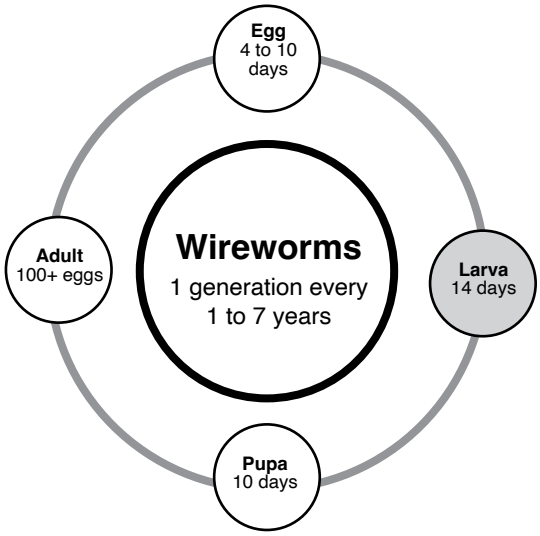


David Cappaert, Michigan State University, Bugwood.org

Darkling beetle



Whitney Cranshaw, Colorado State University, Bugwood.org



Shaded section indicates overwintering stage

Description

Wireworms are the larva of click beetles (Family Elateridae) and false wireworms are the larva of darkling beetles (Family Tenebrionidae). Adult click beetles are flattened, cigar shaped, with variable body colors and can snap their head downward, making a clicking sound, which helps them right themselves if they are turned on their back. Adult false wireworms are large (about 1 inch long) dark beetles with long legs and are often seen running as if they are trying to stand on their head. This posture allows them to emit a noxious odor that can repel predators or curious crop scouts. Both larvae have yellow/orange colored cylindrical bodies with a hardened head and tail and three pairs of very small legs.

Life Cycle

Wireworms can overwinter as adults or larvae; larvae can live for one to seven years in the soil, depending on the species. Females lay from 50 to 100 eggs in small batches usually during the spring. Wireworms are attracted to weedy fields during the summer, especially fields with grassy weeds. Often, various sizes of wireworms are found in the same field because generations overlap.

False wireworms produce one generation per year. They overwinter as adults or partially grown larvae, which mature in spring. Newly emerged adults and surviving overwintered adults lay eggs in the spring. Larvae hatch and mature by summer's end and a second egg-laying period occurs in late summer. These eggs are deposited on loose soil. Eggs hatch and the partially grown larvae, along with surviving adults will overwinter.

Hosts

Both false wireworms and wireworms feed on numerous plants and seeds. False wireworms are generally a pest of wheat in Oklahoma, while wireworms feed on numerous crops, such as corn, sorghum, cotton and soybean.

Damage

The damaging stage is the larva. The larvae feed on seeds, newly germinated seedlings and roots with their chewing mouthparts. If the seed has not germinated, they feed on the germ, killing the seed. This results in stand loss.

Management

Wireworms: Wireworms are more likely to be a pest in pasture or fallow ground that is planted to a crop. To determine if a field will have potential problems, collect 1-square-foot soil samples dug to a depth of 4 inches from five to 10 locations, and sift them through a piece of hardware cloth with ¼-inch mesh. An alternative is to construct bait stations in the field prior to planting. A bait station can be constructed by filling a nylon mesh bag with one cup of untreated and soaked wheat, corn or freshly cut potatoes. Bury the bag in a hole 6 inches wide by 3 to 4 inches deep. Mound the soil over the bait to prevent standing water. Return to inspect the station a few days before planting by sifting through the bag and surrounding soil. If an average of three to four larva are found per square foot, there will likely be an economically important infestation.

False Wireworms: High numbers of adult beetles in fields during late summer can indicate potential problems. Bait stations do not attract false wireworms as effectively as wireworms. The best method for evaluation is to collect 1 square foot soil samples dug to a depth of 4 inches from five to 10 locations, and sift them through a piece of hardware cloth with ¼-inch mesh. If an average of one larva per 3 square feet is found, there might be an economic infestation.

Seed treatments at planting have not been shown to adequately control false wireworms, but they do deter feeding by wireworms. False wireworms tend to build up in continuous wheat; therefore, crop rotation can be effective in reducing damage. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

Notes

Notes

ALFALFA INSECTS

ALFALFA GROWTH STAGES (REFERENCE)

Undersander, D., M.H. Hall, P. Vassalotti and D. Cosgrove. 2011. Alfalfa germination and growth. A3681. University of Wisconsin Cooperative Extension. Available at https://learningstore.uwex.edu/assets/pdfs/A3681.pdf (Accessed 1/21/2017)

ALFALFA INSECTS

Notes

ALFALFA CATERPILLAR: *Colias eurytheme* Boisduval

Order Lepidoptera: Family Pieridae



John Capinera, University of Florida, Bugwood.org



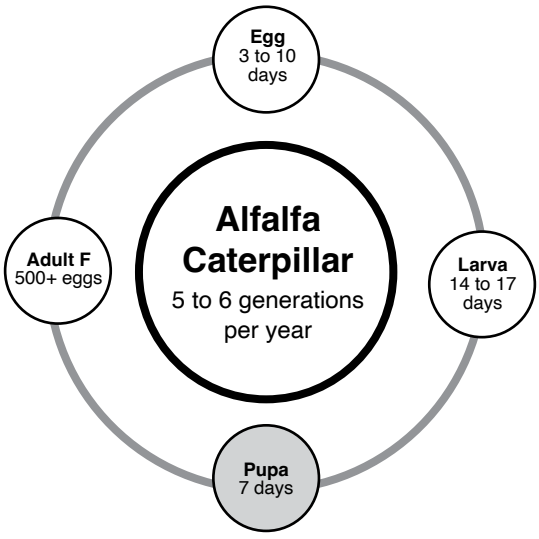
Charles T. and John R. Bryson, Bugwood.org

Description

Adult butterflies wing color ranges from white to yellow to yellow orange and is bordered by black margins. Males have solid wing margins, and females have yellow spots contained in the black wing boarders. Caterpillars are green with a velvet-like texture and a white stripe along the sides of the body. They possess four pairs of abdominal prolegs. When mature, caterpillars measure 1.5 inches.

Life Cycle

Alfalfa caterpillars have four life stages: the egg, larva (five instars), pupa and adult. Female butterflies can lay up to 500 eggs, singly on the underside of leaves. The eggs hatch in three to 10 days. Larvae feed voraciously and pupate in 14 to 17 days. Following pupation, they emerge as adults in about seven days. Oklahoma can experience five to six generations per year. Alfalfa caterpillars typically overwinter as pupa, but also are known to overwinter as adults in the southern U.S.



Shaded section indicates overwintering stage

Hosts

Besides alfalfa, alfalfa caterpillars will feed on soybean, clover and other members of the pea family.

Damage

The damaging stage is the larva. Newly hatched larvae feed with their chewing mouthparts and produce small shotholes. As they grow larger, they consume the entire leaf, including the leaf veins. This contrasts with other leaf-feeding caterpillars, which generally cause more skeletonization of leaves.

Management

Monitor using a sweep net, taking a minimum of 20 sweeps per 10 acres. Control options include early cutting or insecticides. Treatment thresholds are five to six larvae per sweep. For specific insecticide suggestions, see E-832 *OSU Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

ALFALFA SEED CHALCID: *Bruchophagus roddi* (Gussakovsky)

Order Hymenoptera: Family Eurytomidae



Oklahoma State University



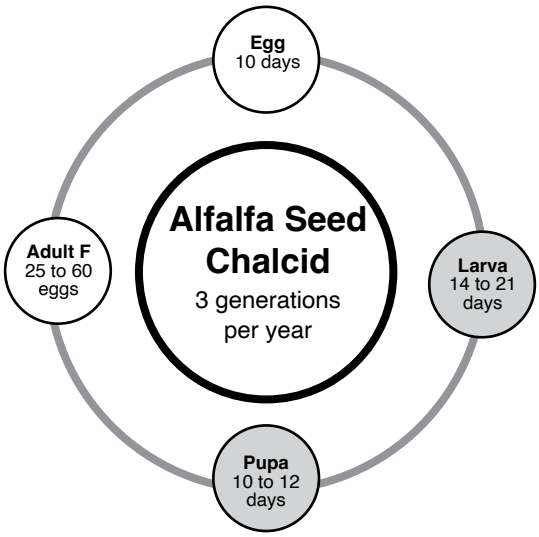
Ken Gray Image Courtesy of Oregon State University

Description

This insect pest is a tiny wasp measuring 2 millimeters. Larvae are white, C-shaped and legless. They feed singly inside an alfalfa seed.

Life Cycle

Seed chalcids have four life stages: the egg, larva (four instars), pupa and adult. Adult chalcids lay eggs singly within a green, developing seed. The larva develops within the seed, consuming the entire contents with its chewing mouthparts. There are several generations each year, and densities increase as summer progresses. They overwinter as larvae and pupae inside alfalfa seed.



Shaded section indicates overwintering stage

Hosts

Besides alfalfa, the alfalfa seed chalcid attacks oter species of Medicago, including spotted medic, small medic, bur clover, lucerne and yellow alfalfa.

Damage

The damaging stage is the larva. Seed chalcid infests seed and larvae completely consume the contents of their seed with their chewing mouthparts, reducing seed production. Up to 15 percent reduction in seed production has been observed.

Management

Chemical control is not effective, and can reduce pollinators, which are important for seed production. Elimination of volunteer alfalfa along fence rows and roadsides using an herbicide is the most effective means of reducing overwintering populations. Early harvest of seeds by mid-August will help avoid higher infested seed. Do not store uncleaned seed. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

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ALFALFA WEBWORM: *Loxostege cereralis* (Zeller)

Order Lepidoptera: Family Crambidae



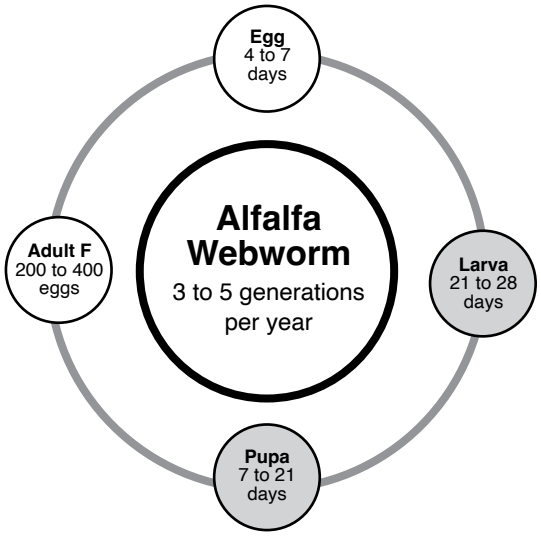
Mark Dreiling, Bugwood.org



Frank Peairs, Colorado State University, Bugwood.org

Description

There are several species of webworms that attack alfalfa, including the alfalfa webworm, garden webworm and beet webworm. They are all similar in appearance as caterpillars. The adult alfalfa webworm has a wingspan of about 1 inch. The forewing is tan with a wing pattern consisting of irregularly shaped white, brown and black lines with a yellow patch at the wing tips. Larvae are yellow to green with a yellow line along the back and each side and six black spots on each segment.



Shaded section indicates overwintering stage

Life Cycle

Alfalfa webworms have four life stages: egg, larva (six instars), pupa and adult. Alfalfa webworms complete their life cycle in five to six weeks on average. Adult females deposit eggs in masses of two to 50 eggs on a host plant. Eggs hatch within seven days, and the larvae will feed for three to four weeks. They pupate in the soil for one to three weeks, then emerge. They overwinter in Oklahoma as larvae or pupae, and produce three to five generations per year.

Hosts

This webworm complex feeds on numerous plants, including alfalfa, clover, cowpea, strawberry, corn, sunflower, ragweed, pigweed and soybean.

Damage

The damaging stage is the larva. Larvae consume foliage with their chewing mouthparts within their silk webbing. Caterpillars spin strands of silk which are used to connect foliage together and form a tube. Large populations can cause severe defoliations, but economic damage seldom occurs.

Management

Economic damage can occur when 25 to 30 percent of terminals are infested. Control can be obtained by cutting, followed by scouting the stubble. If webbing is formed on the stubble, consider applying an insecticide. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

ALFALFA WEEVIL: *Hypera postica* (Gyllenhal)

Order Coleoptera: Family Curculionidae



Richard Grantham, Oklahoma State University



Tom Royer, Oklahoma State University



Frank Peairs, Colorado State University, Bugwood.org

Hosts

Besides alfalfa, alfalfa weevils feed on white clover, red clover, yellow sweet clover and white sweet clover. However, alfalfa is the preferred host.

Damage

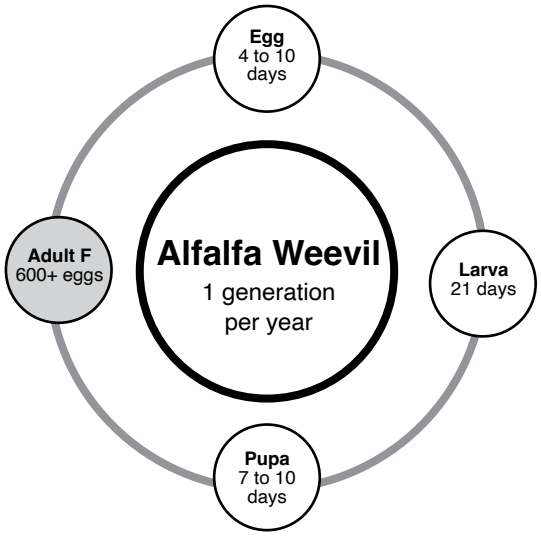
The damaging stages are the larva and adult. Both the adults and larvae alfalfa weevils feed on foliage with their chewing mouthparts. Larvae cause the most significant damage. Small larvae feed on terminal buds, but larger larvae feed on leaves, causing skeletonization and bronzing of leaves. Infested plants become ragged as the larvae chew small holes and patches on the leaves. This feeding can result in delayed regrowth of the first cutting, and over time, can reduce stand health. Typically, damage occurs on first cutting.

Description

The adult weevil measures 0.2 of an inch long and has an extended snout. Its thorax and body are brown with a wedge-shaped brown stripe that extends down the midline of its back, narrowing towards the posterior end. Larvae are green, with a black head capsule and a prominent white stripe along the center of its back.

Life Cycle

The alfalfa weevil goes through one generation per year. It has four life stages: egg, larva (four instars), pupa and adult. During fall, adults leave their summer sites and move into alfalfa fields, where they begin to deposit eggs in alfalfa stems. Egg-laying occurs from November through the following April anytime temperatures exceed 40 F. From February to April, eggs hatch and larvae begin to feed. Newly hatched larvae feed in plant terminals, but feed in more exposed locations as they grown. Larvae grow through four instars. Fully grown larvae measure 0.25 of an inch. When ready to pupate, larvae spin a loosely constructed silken cocoon usually found within the leaf litter.



Shaded section indicates overwintering stage

Notes

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Management

Control recommendations are based on the use of degree days to initiate scouting. An alfalfa weevil degree day calculator is available to assist in scouting initiation and threshold determination http://www.mesonet.org/index.php/agriculture/category/crop/alfalfa/weevil_heat_units. A total of 150 accumulated degree days above 50 F is needed to begin scouting. Thresholds are based on stem counts in relation to degree day accumulations. Fact Sheets providing more detailed information on alfalfa weevil biology are EPP-2097, *Alfalfa Weevil and Its Management in Oklahoma* and scouting CR-7177, *Scouting for the Alfalfa Weevil* are available. For specific insecticide suggestions, see E-832, *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

CLOVER LEAF WEEVIL: *Hypera zolius* (Scopoli)



Whitney Cranshaw, Colorado State University Bugwood.org



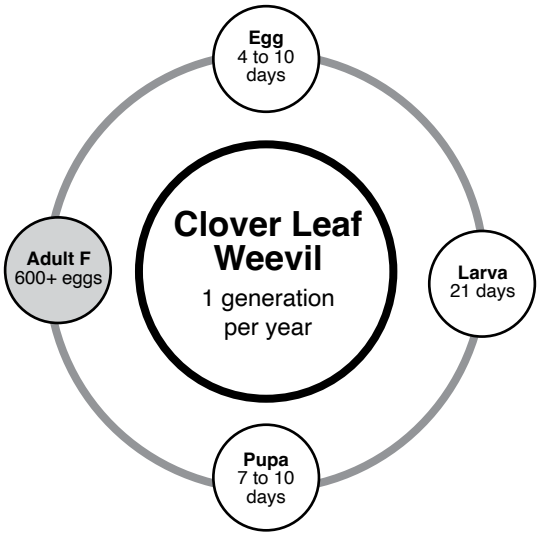
Ken Gray Courtesy of Oregon State University

Description

Adult clover leaf weevils are slightly larger than alfalfa weevils, measuring 0.4 of an inch long. It is brown with indistinct stripes down its back and also have an extended snout. Larvae are green with a white stripe down the middle of their back, but have a brown head capsule. Fully grown larvae reach 0.5 of an inch long. When ready to pupate, larvae spin a loosely constructed silken cocoon usually found within the leaf litter.

Life Cycle

Clover leaf weevils go through one generation per year. They have four life stages: egg, larva (four instars), pupa and adult. Adults lay eggs in fall, most of which hatch, and the larvae feed through the winter. They become fully grown in late March through early May. Larvae pupate, and adults emerge within a few days, feed for several days, then become inactive through the summer.



Shaded section indicates overwintering stage

Hosts

Clover leaf weevils feed on alfalfa and clovers with their chewing mouthparts, but will occasionally feed on snap bean, timothy grass, wheat, corn, Jerusalem artichoke and goldenrod.

Management

Clover leaf weevil is susceptible to fungal diseases and a parasitoid wasp, and is not considered to be a significant problem in alfalfa. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

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BLUE ALFALFA APHID: *Acyrthosiphon kondoi* Shinji

Order Hemiptera: Family Aphididae

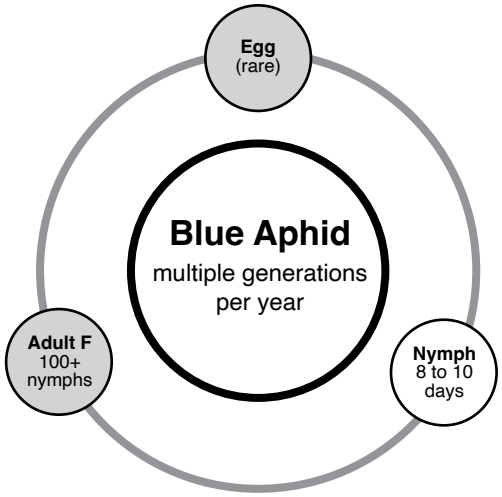


Description

Blue alfalfa aphid adults measure about 0.19 of an inch, and are dull or waxy. They are dark blue green in color. Antennae are lighter colored at the base, but gradually darken towards the tips. Their cornicles (tailpipe-like appendages) have black tips.

Life Cycle

Blue alfalfa aphids have two (or rarely three) life stages: egg (rare), nymph (four instars) and adult. Like other aphids, wingless females produce live young without mating through a process known as parthenogenesis. One female can produce up to 100 young. They can complete their life cycle in as little as eight to 10 days. They typically prefer cooler climate, and populations begin to decline when temperatures reach 90 F. They are not documented to overwinter in Oklahoma, but they will overwinter as eggs or adults in other parts of the U.S.



Shaded section indicates overwintering stage

Hosts

Besides alfalfa, blue alfalfa aphids feed on several other legumes, including *Astragalus* spp. (milkvetches), *Lotus* spp. (birds-foot trefoils), *Medicago* spp. (alfalfas and medics), *Melilotus* spp. (sweetclovers), *Trifolium* spp. (clovers) and *Vicia* spp. (vetches).

Damage

The damaging stages are the nymph and adult. Blue alfalfa aphids feed on plant sap with piercing/sucking mouthparts. Colonies tend to cluster around the newly expanding leaves, but if populations are dense, they will move down and feed on stems. As they feed, they cause leaf crinkling near plant terminals and stunting. Leaves take on a grayish hue. Stunted plants often have delayed regrowth.

Management

Sampling for blue alfalfa aphid can be accomplished by sweep net or pulling stems. Stem sampling will provide a more accurate estimate of aphid numbers. Thresholds are different, based on age of stand and growth stage. For seedling alfalfa, an average of one aphid per stem is threshold. For established alfalfa, less than 10 inches tall, the threshold is 10 per stem or 100 to 200 per sweep. For established alfalfa greater than 10 inches, threshold is 30 per stem or 300 per sweep. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

COWPEA APHID:
Aphis craccivora Koch

Order Hemiptera: Family Aphididae



Richard Grantham, Oklahoma State University



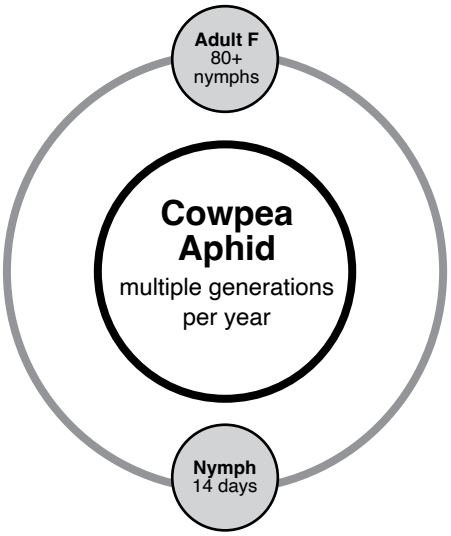
Whitney Cranshaw, Colorado State University Bugwood.org

Description

The cowpea aphid is a relatively small aphid, about 0.08 inch long. They are a glossy black as adults and slate gray as nymphs. Their legs are white with black tips and the first half of the antennae is white and the last half is black. Their cornicles (tailpipe-like appendages) have black tips.

Life Cycle

Cowpea aphids have two life stages: nymph (four instars) and adult. Like other aphids, wingless females produce live young without mating through a process known as parthenogenesis. They are not known to undergo sexual reproduction in Oklahoma, but eggs can be produced that also overwinter. One female can produce up to 80 young. They go through four nymphal instars in as little as 14 days. Optimal temperature for their development is from 64 to 75 F.



Shaded section indicates overwintering stage

Hosts

In addition to alfalfa, cowpea aphids will infest cotton and other numerous plants including apple, carrot, cotton, cowpea, dandelion, dock, goldenrod, peanut, pepperweed, pigweed, red clover, shepherd's purse, vetch and sweet clover.

Damage

Damaging stages are the nymph and adult. Cowpea aphids feed on terminal growth, stems and blooms. In addition, they produce significant amounts of honeydew, which then gives rise to sooty mold. They are most likely to become a pest early, when alfalfa is breaking dormancy.

Management

Sampling for cowpea aphid can be accomplished by sweep net or pulling stems. Stem sampling will provide a more accurate estimate of aphid numbers. Thresholds are different, based on age of stand and growth stage. For seedling alfalfa, an average of five aphids per stem is threshold, unless the stand is water stressed, in which case, treatment should be made immediately when there is an average of one per stem. For established alfalfa less than 10 inches tall, threshold is 50 per stem or 400 per sweep. For established alfalfa greater than 10 inches, threshold is 100 per stem or 500 per sweep.

For specific insecticide suggestions, E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

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PEA APHID: *Acyrthosiphon pisum* (Harris)



Joseph Berger, Bugwood.org



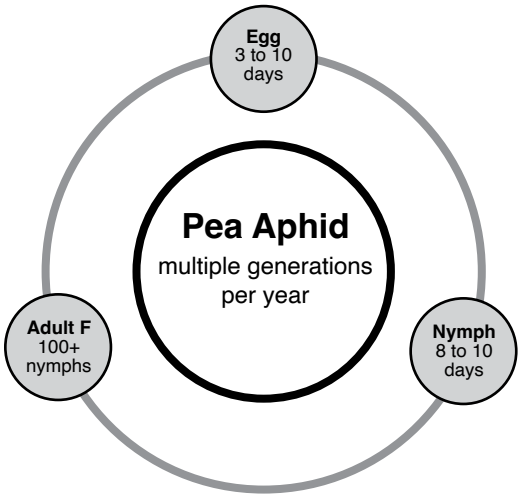
Whitney Cranshaw, Colorado State University, Bugwood.org

Description

Pea aphid adults measure about 0.25 of an inch. The body is shiny and typically green, but color can range from yellow to pale pink. Antennae possess a dark band at the tip of each antennal segment. Cornicles (tailpipe-like appendages) are long and black near their tips.

Life Cycle

Pea aphids have three life stages: egg, nymph (four instars) and adult. Like other aphids, wingless females produce live young without mating through a process known as parthenogenesis. One female can produce up to 100 young. They go through four nymphal instars in as little as eight to 10 days. They typically prefer cooler climate, and populations begin to decline when temperatures reach 90 F. They overwinter in many areas as eggs.



Shaded section indicates overwintering stage

Hosts

Besides alfalfa, pea aphid feeds on several other crop and weed legumes, including *Medicago* spp. (alfalfas and medics), *Pisum* spp. (pea), *Trifolium* spp. (clovers) and *Vicia* spp. (vetches).

Damage

Damaging stages are the nymph and adult. Pea aphids damage plants by sucking plant sap with their piercing/sucking mouthparts. Pea aphids prefer to feed on new, terminal growth, but will also feed on older leaves, stems and flower buds. They remove plant juices as they feed with their piercing/sucking mouthparts. Heavy feeding causes alfalfa to turn yellow and wilt. Since they prefer cooler weather, they are more likely found in spring and fall. Early infestations can delay plant growth, so first cutting is delayed.

Management

Sampling for pea aphid can be accomplished by sweep net or pulling stems. Stem sampling will provide a more accurate estimate of aphid numbers. Thresholds are different, based on age of stand and growth stage. For seedling alfalfa, an average of five aphids per stem is threshold. For established alfalfa less than 10 inches tall, threshold is 40 per stem or 300 per sweep. For established alfalfa greater than 10 inches, threshold is 75 per stem or 400 per sweep.

Growers starting a new alfalfa planting can select varieties with high levels of pea aphid resistance. Early cutting (if growth is close) can reduce populations. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

SPOTTED ALFALFA APHID: *Therioaphis trifolii forma maculata* (Buckton)



Kansas Dept. of Agriculture, Bugwood.org



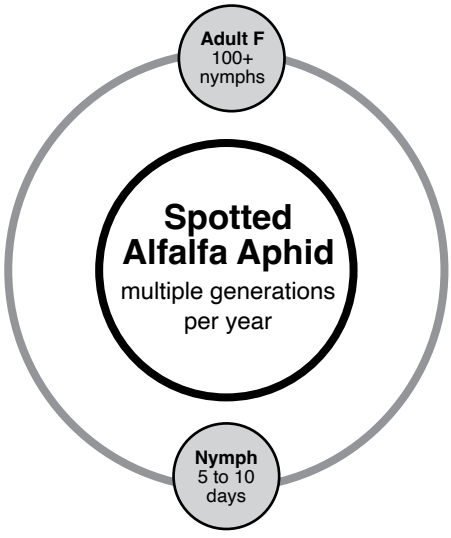
"Veinbanding" Queensland Dept. of Agriculture and Fisheries

Description

The spotted alfalfa aphid is a soft-bodied insect, usually wingless, measuring 0.08 of an inch long. The wingless form is pale yellow, and has four to six rows of dark spots on its back that are tipped with a short spine. It does not have prominent cornicles (tailpipe-like appendages).

Life Cycle

Spotted alfalfa aphids have two life stages: nymph (four instars) and adult. Like other aphids, wingless females produce live young without mating through a process known as parthenogenesis. One female can produce up to 100 young. They become adults in as little as five to 10 days. Spotted alfalfa aphid is not known to produce eggs in the U.S.



Shaded section indicates overwintering stage

Hosts

Besides alfalfa, this aphid feeds on clovers.

Damage

Damaging stages are the nymph and adult. Spotted alfalfa aphid prefers to feed with their piercing/sucking mouthparts on leaves in the lower canopy of the plant. They move upwards onto the leaves of the middle and upper canopy as lower leaves are damaged. Spotted alfalfa aphid feeding causes severe reaction to alfalfa plants. Symptoms include discoloration (yellowing) of leaves along the veins, creating a characteristic "veinbanding." Heavily infested plants turn yellow and some leaves may even take on a reddish cast. Heavily infested plants can be killed. Newly fall-planted fields may suffer severe winter kill due to infestations. Spotted alfalfa aphids also produce high levels of honeydew, which also gives rise to black sooty mold.

Management

Sampling for spotted alfalfa aphid is accomplished by sweep net or by pulling stems. Stem sampling provides a more accurate estimate of aphid numbers. Thresholds are based on age of stand and growth stage. For seedling alfalfa a threshold is an average of one aphid per stem. In established alfalfa less than 10 inches tall, threshold is 10 per stem or 100 to 200 per sweep. For alfalfa greater than 10 inches, threshold is 30 per stem or 300 per sweep. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

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BLISTER BEETLES:

Order Coleoptera: Family Meloidae

Ash-gray blister beetle, *Epicauta fabracii* (LaConte)



Tom A. Royer, Oklahoma State University, Stillwater.

Striped blister beetle, *Epicauta vittata* (Fabricius)



Tom A. Royer, Oklahoma State University, Stillwater.

Description

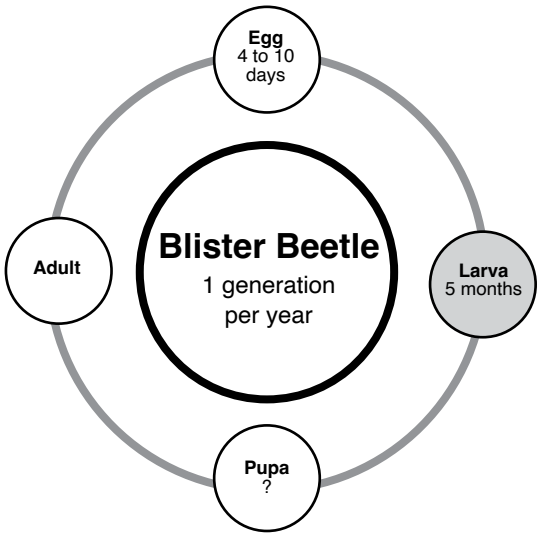
Blister beetles are common in the southern and eastern areas of the U.S. Several species are common to Oklahoma, including the black, ash-gray and striped blister beetles. These beetles range from 0.5 to 1 inch long and are readily recognized by their characteristic shape; narrow, cylindrical, soft body with a distinct "neck-like appearance" when viewed from above. The striped blister beetle, *Epicauta vittata*, is most frequently associated with sickness in Oklahoma livestock. It is black and yellow striped with three black stripes in the elytra.

Life Cycle

Blister beetles complete one generation per year. They have four life stages: egg, larva (six instars), pupa and adult. Adult beetles feed on plants, but larvae feed on grasshopper eggs. Adult beetles mate and the females lay eggs during the summer in shallow cavities in the soil. These eggs hatch in the fall and first instar larvae, called triungulins, immediately begin searching for grasshopper eggs to consume, which are typically laid in within 1 to 2 inches of the soil surface during the late summer and fall. Blister beetle larvae become less mobile with each molt, still devouring clusters of eggs. They overwinter in the soil and emerge as adults in late spring or early summer. Emergence of adult blister beetles typically occurs after the first cutting of alfalfa is completed (April or early May), but cutting before May 1 is not a guarantee of blister beetle-free hay.

Hosts

Pigweed, goldenrod, goathead, puncturevine, peanuts, soybeans and many other plants also serve as hosts for adult beetles.



Shaded section indicates overwintering stage

Damage

Damaging stage is the adult. Although blister beetles can cause some damage as they feed on alfalfa with their chewing mouthparts, they also contain a compound (cantharadin), which is poisonous to cattle and especially horses. Striped blister beetles especially are gregarious, and often congregate in small areas of an alfalfa field. The concern is that they are killed during the hay harvesting operation and remain in the hay as it is baled. Contaminated hay, when fed to livestock can cause illness or even death. A lethal dose of cantharadin in horses is 0.5 to 1 milligram per kilogram of body weight and would result in death within 24 hours. If smaller amounts are ingested, it can result in colic (pawing, looking to the side, stretching). There is no antidote for cantharadin poisoning, so horse owners are encouraged to purchase first-cutting alfalfa (cut before May 1) to ensure that the hay is blister beetle-free.

Management

Blister beetle-contaminated hay is almost always the result of beetles being crushed prior to baling. This usually happens when the swather goes through a swarm of beetles. Beetles are killed by the crimper rollers and trapped in the hay. Beetles are also crushed under the wheels of the harvester before the beetles have had time to escape. If left alone, the vast majority of blister beetles leave alfalfa shortly after cutting. Cutting without using crimpers and avoiding wheel traffic on freshly cut alfalfa are two of the best ways to avoid problems.

Striped blister beetles are gregarious, and will often congregate in small areas of fields. This habit makes them easier to see when harvesting, but it also increases the chance that they will contaminate hay during the harvesting process. Blister beetles do not normally migrate long distances. In alfalfa, they often are found within 50 yards of the field margin. Therefore, scouting for blister beetles should be concentrated along field borders. If insecticide applications are necessary, a producer has two choices:

1. spray entire field with a short-residual insecticide just before harvesting including the fence rows and field borders, or
2. inspect fields shortly before cutting and spray only the infested areas if any are found.

For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

Notes

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CLOVER ROOT CUCURLIO: *Sitona hispudulus* (Fabricius)

Order Coleoptera: Family Curculionidae



Pest and Diseases Image Library, Bugwood.org



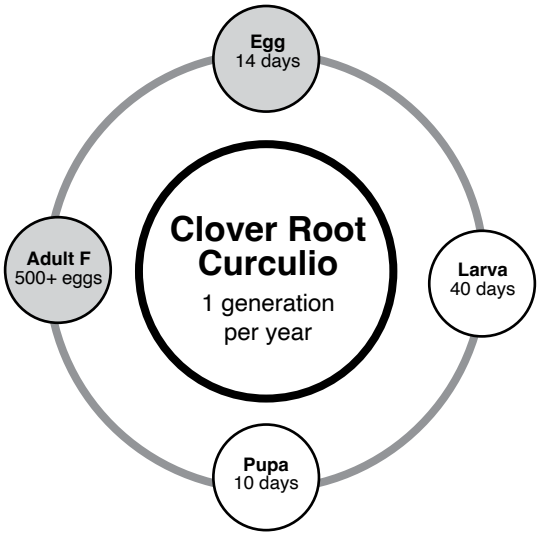
Bob Hammon Colorado State University, Bugwood.org

Description

Adult clover root curculio is brownish to black with a rounded short snout, and measures 0.2 of an inch long. Larva measure about 0.1 of an inch and are cream colored with a brown head capsule.

Life Cycle

Clover root curculio has four life stages: egg, larva (five instars), pupa and adult. The clover root curculio passes the winter as an egg or adult. Eggs (up to 500 per female) are deposited on the soil surface near the plant crown. Eggs hatch within 14 days and the larvae follow the soil cracks into the roots and nodules. They feed on roots from April through June and go through five larval instars. They pupate in the soil. Adults will emerge and aestivate through the hottest part of the summer. They move back into alfalfa in the fall and lay eggs, then become inactive.



Shaded section indicates overwintering stage

Hosts

Besides alfalfa, they feed on clover, soybean and a few other legumes.

Damage

Damaging stages are the larva and adult. Both adult and larvae feed on alfalfa with their chewing mouthparts, but larvae cause the greatest damage. Adults feed on foliage. Leaves that have ragged notches along their margins is evidence of adult feeding. Larvae feed on the fibrous roots. They scar the outside of larger roots, and tunnel through the lateral and taproots. Their feeding disrupts nutrient and water movement through the plant. High populations may girdle the crown. Over time, this feeding facilitates infection by other disease pathogens, such as those that cause verticillum, fusarium and bacterial wilt. Combined, direct feeding and associated diseases reduce stand life. This weevil can also attack newly seeded alfalfa, if planted next to an infested alfalfa stand.

Management

Spring planting of new alfalfa fields can reduce infestation from clover root curculio, allowing the stand to mature faster. Chemical control is not very effective for managing clover root curculio and may actually disrupt natural enemies for other important alfalfa pests.

POTATO LEAFHOPPER: *Empoasca fabae* (Harris)

Order Hemiptera: Family Cicadellidae



Flicker.com



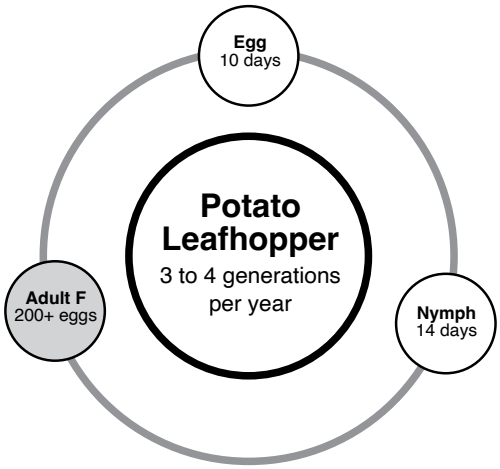
Hopper burn," Purdue University, West Lafayette, IN.

Description

The adult is small, green, wedge-shaped and measures about 0.125 of an inch long. There are a number of small, pale yellow or white spots on the body. The hind legs are long and enable the insect to jump a considerable distance. The nymphs (immature insects) are similar in shape to the adults, but lack wings and are pale green in color.

Life Cycle

Potato leafhoppers have three life stages: egg, nymph (five instars) and adult. This insect overwinters in the Gulf Coast states and migrates into Oklahoma in the spring, or more likely early summer. Large numbers of flying adults often appear suddenly in fields. Beginning three to 10 days after mating, females use their sharp ovipositors to insert eggs into the main veins or petioles of leaves. Each female lives a month or more and produces two or three eggs per day. Eggs hatch in about 10 days and the nymphs mature in about two weeks. Nymphs usually mature on the leaves where they hatched. Mating occurs about 48 hours after maturation and the life cycle is repeated. There are three or four generations per year.



Shaded section indicates overwintering stage

Hosts

Besides alfalfa, potato leafhoppers feed on more than 200 cultivated and wild plants, including peanut and soybean, on which they cause similar hopper burn symptoms.

Damage

Damaging stages are the nymph and adult. Both feed on the undersides of leaves, extracting plant juices with their piercing/sucking mouthparts. Their feeding causes stunting of plants, curling of leaf margins and crinkling of the upper surface of leaves. While feeding, leafhoppers also inject a toxic substance into plants which, in most hosts, causes a condition known as hopper burn. This condition is characterized by a yellowing of the tissue at tips and margins of leaves, which increases until the leaves die. Symptoms of leafhopper damage are sometimes confused with drought stress. They can severely stunt alfalfa and reduce forage production.

Management

Potato leafhoppers populations can be assessed with a sweep net. Thresholds are based on insect numbers and the height of the alfalfa. Collect 20 sweeps in five locations to obtain a representative sample. If the alfalfa is 3 inches tall, treat when an average of four leafhoppers per 20 sweeps are collected. The threshold increases to an average of 10 leafhoppers per 20 sweeps in 6-inch or higher alfalfa. If an insecticide application is warranted, suggestions can be found in E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control* and Extension Current Report CR-7150 *Alfalfa Forage Insect Control.*

Notes

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LYGUS BUG COMPLEX:

Alfalfa Plant Bug *Adelphocoris lineolatus* (Goeze)
Rapid Plant Bug *Adelphocoris rapidus* (Say)
Tarnished Plant Bug *Lygus lineolaris* (Palisot de Beauvois)

Order Hemiptera: Family Miridae

Stott Bauer, USDA Agricultural Research Service, Bugwood.org



Stott Bauer, USDA Agricultural Research Service, Bugwood.org

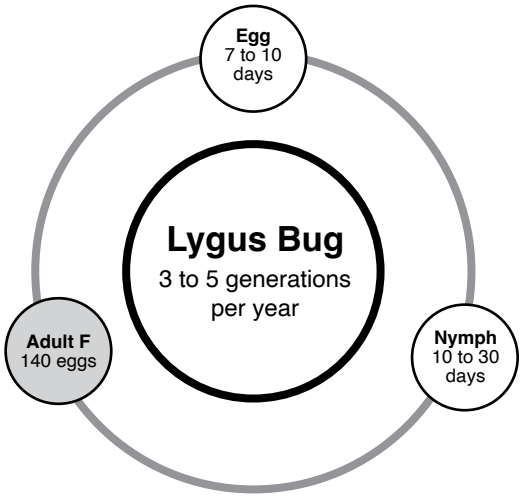


Description

The adults measure 0.2 to 0.24 of an inch long. The head and body are brown with yellowish and reddish markings. Typical is a V shape on the scutellum behind the head. The beak has four segments.

Life Cycle

Lygus bugs have three life stages: egg, nymph (five instars) and adult. Adults overwinter in vegetation in fields, timber margins and road ditches. They emerge in spring and lay eggs in the stems and leaf midribs of host plants. Eggs hatch in five to 17 days. Nymphs live from 15 to 30 days, molting five times before becoming adults. Oklahoma experiences three to five generations. They prefer to feed on plants that are about to flower.



Shaded section indicates overwintering stage

Hosts

Plant hosts are numerous, including hundreds of plant species. They feed on many vegetable and fruit crops including apple, blackberry grape, peach, pear, plum, strawberry, green pepper, lettuce and tomato. Crops include alfalfa, cotton and soybean. They will feed on many weed species including bitterweed, horseweed, smartweed, sunflower, vetch, pepperweed, wild mustard, wooly croton and henbit. They are also known to feed on other insects, including the alfalfa weevil, pea aphid, spotted alfalfa aphid and insect eggs.

Damage

Damaging stages are the nymph and adult. Lygus bugs feed on plants a with their piercing/sucking mouthparts, and are a major pest of alfalfa seed production, but not for forage production. They may injure alfalfa seedlings before it is established. In some cases, they can almost be considered a beneficial insect of alfalfa because they are known to feed on other insects, including the alfalfa weevil, pea aphid, spotted alfalfa aphid and insect eggs.

Management

Tarnished plant bug numbers vary from year to year. Often, their numbers are directly related to the presence of host plants that surround an alfalfa field. Weed control can be very beneficial for their control. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

VARIEGATED CUTWORM: *Peridroma saucia* (Hübner)

Order Lepidoptera: Family Noctuidae



Tom Royer, Oklahoma State University



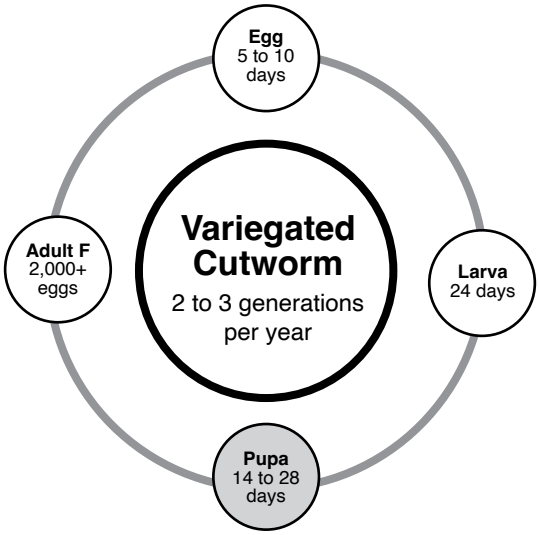
Ian Kimber, Bugwood.org

Description

Adult moths have wingspans from 1.5 to 2 inches. The forewings are mottled brown or yellow, with white hindwings, colored with brown lines and margins. Larvae are pale brown to gray, with mottled dark brown areas. The larvae have a distinct series of orange or yellow paired spots on the first of several segments. The eighth segment typically has a yellow and a black spot. Larvae may reach up to 1.5 inches. Pupae are brown and measure about 0.5 to 0.75 of an inch long. Eggs are laid in clusters and are white or yellow when newly laid, turning brown as hatching approaches. Eggs are minute (<0.04 inch) spheres.

Life Cycle

Variegated cutworms have four life stages: egg, larva (six instars), pupa and adult. High numbers of eggs are laid throughout the summer and typically hatch in less than a week. Larvae avoid direct sunlight, feeding on overcast days and during the night. They often are ready for pupation in the soil in less than a month. If there is sufficient time remaining in the growing season, pupae will hatch in two to four weeks. Several generations a year may be produced. Pupae are capable of overwintering, although they are highly vulnerable at this stage and suffer heavy losses before hatching in the spring. In climates with mild winters, the variegated cutworm may continue its life cycle and feeding uninterrupted.



Shaded section indicates overwintering stage

Hosts

Variegated cutworms attack alfalfa, canola and sweet clover and a large variety of plant species.

Damage

Damaging stage is the larva. Variegated cutworms feed with their chewing mouthparts. They cause damage by climbing to the top of the plant eating new regrowth, especially after first cutting. Older larvae may display the same behavior as other cutworms, mainly cutting plants at the soil line.

Management

No action threshold for alfalfa has been established, but an estimated measure, based upon similar species, recommends treatment when larvae exceed two per square foot after first cutting. Variegated cutworms are vulnerable to a wide variety of insecticides. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control* and Extension Current Report CR-7667 *Management of Insect and Mite Pests in Canola.*

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YELLOWSTRIPED ARMYWORM: *Spodoptera ornithogalli* (Guenée)

Order Lepidoptera: Family Noctuidae



Russ Ottens, University of Georgia, Bugwood.org



Natasha Wright, Cook;s Pest Control, Bugwood.org

Description

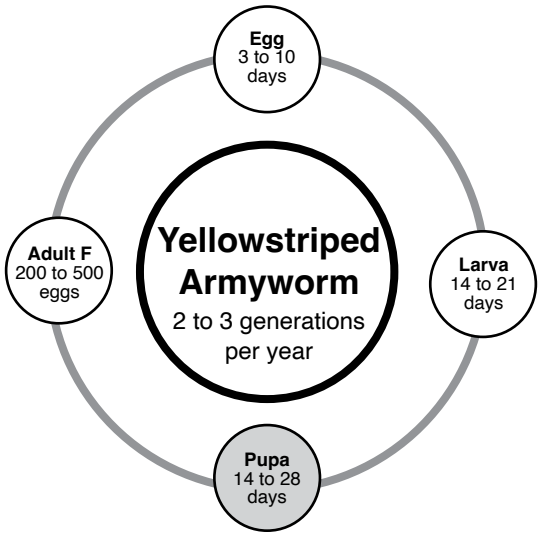
The moths body is brown and measures about 0.6 inch with a wingspan of 1.4 to 1.6 inches. Forewings are brownish gray, with an intricate pattern of light and dark markings. There is an asymmetrical set of whitish bands near the center of the wings. The hindwings are opaquely white with a narrow brown line along the outer margin of the wing. Mature larvae measure up to 2 inches. Body color varies from green when small to nearly black when large. They have two cream-yellow to orange stripes along the back, and a prominent dark spot on each side of the fourth abdominal segment. Partially grown larvae appear to have pairs of dark, triangular markings along the back of each body segment just above the light colored stripes.

Life Cycle

Yellowstriped armyworm has four life stages: egg, larva (six instars), pupa and adult. Oklahoma experiences two to three generations annually and they overwinter as pupae. A female lays eggs in cluster of 200 to 500 eggs on the underside of leaves. The female covers the eggs with body scales. Eggs hatch in three to 10 days. Larvae are initially gregarious, but disperse after a few days. They grow through six instars in 14 to 21 days. They pupate in the soil, where they remain for nine to 22 days.

Hosts

Yellowstriped armyworm is a general plant feeder. Its host plants include alfalfa, canola, corn, cotton, sorghum, soybean, sunflower, wheat and numerous vegetable crops. Weed hosts include dock (*Rumex* spp.), gumweed (*Grindelia* spp.), horse nettle (*Solanum* spp.), horseweed (*Erigeron* spp.), lambsquarters (*Chenopodium* spp.) and pigweed (*Amaranthus* spp.).



Shaded section indicates overwintering stage

Damage

Damaging stage is the larva. They feed on plants with their chewing mouthparts. Newly hatched larvae typically feed gregariously and skeletonize leaves. As they grow larger, they consume irregular patches of leafs.

Management

Scout using a standard 15-inch sweep net. Collect 20 sweeps per 10 acres. Treat when six or more caterpillars are found per sweep. If harvest time is near, simply harvest for hay. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

CANOLA INSECTS

CANOLA GROWTH STAGES

Pre-emergence

1. Seedling	Cotyledon completely unfolded
2. Rosette	
2.1-(n)	First true
2.2 -2.(n)	Second true leaf to nth true leaf expanded.
3. Bud	
3.2	Flower cluster visible at center of rosette
3.3	Lower buds yellowing
4. Flower	
4.1	First flower opening
4.2	Many flowers opened, lower pods elongating
4.3	Lower pods starting to fill
4.4	Flowering complete, seed enlarging in lower pods
5. Ripening	
5.1	Seeds in lower pods full size, translucent
5.2	Seeds in lower pods green
5.3	Seeds in lower pods green-brown or green-yellow mottled
5.4	Seeds in lower pods yellow or brown
5.5	Seeds in all pods brown, plant dead

CABBAGE APHID: *Brevicoryne brassicae* (L.)

Order Hemiptera: Family Aphididae



Richard Grantham, Oklahoma State University, Stillwater.



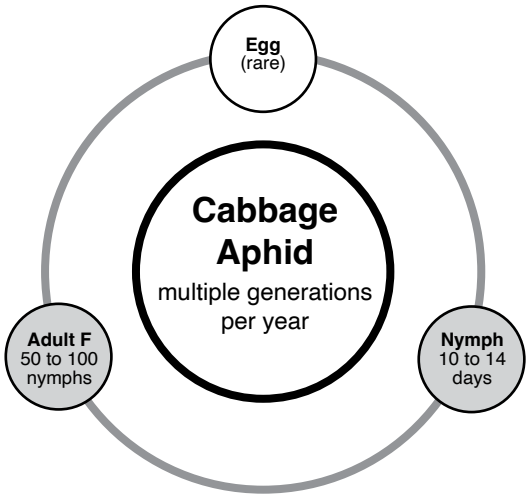
S. Micic and P. Mangano, www.wa.gov.au

Description

Cabbage aphids are pale gray to gray green and commonly wingless. They have a pair of short swollen cornicles (tailpipe-like appendages) on their abdomens. Adults are about 0.6 of an inch long. They are typically covered with a dense, white wax. The wingless nymphs resemble the adults in color and shape but are smaller.

Life Cycle

Cabbage aphids have two (or rarely three) life stages: egg (rare), nymph (four instars) and adult. They continue to feed and reproduce at reduced rates throughout the winter. Wild mustards and canola are important overwintering host plants. When temperatures warm in spring, aphid activity and reproduction increase. Wingless female adults produce large numbers of live nymphs (50 to 100) without mating. All develop into females through a process called parthenogenesis. Periodically, winged females develop and fly to new host plants. This aphid is favored by moderate temperatures and dry weather. The heaviest infestations occur in the spring (March to May) and fall (September into December). Many generations are produced each year.



Shaded section indicates overwintering stage

Hosts

Besides canola, cabbage aphids commonly feed on mustard, radish, turnip, shepherd's purse and watercress.

Damage

Damaging stages are adults and nymphs. Cabbage aphids feed on plant sap with their piercing/sucking mouthparts. Cabbage aphids typically cluster on the leaves and later on flowering panicles of canola during bloom and pod fill. Some infested plants are killed; others grow slowly. They also are found on growing tips and flowering spikes

Management

Natural control from parasites, especially *Diaeretiella rapae* (Hymenoptera: Braconidae), commonly attack cabbage aphids. Predators (such as lady beetles and lacewings) and environmental factors (such as heavy rainfall) can sometimes reduce cabbage aphid populations. Wild mustards serve as hosts for cabbage aphids and may speed the colonization of aphids into canola; therefore, the destruction of these weeds before planting and maintenance of field margins may reduce aphid problems.

An insecticide seed treatment with a neonicotinoid (imidacloprid, thiamethoxam or clothianidin) may reduce aphid colonization and establishment in the fall. Chemical control can be achieved with insecticides, provided care is taken to ensure good coverage. The problem of poor coverage is especially likely in late winter and spring when plants resume growth and produce overlapping and large clusters of leaves.

Economic thresholds for aphids are not well defined for Oklahoma canola production. Control procedures are usually warranted when aphids exceed 100 to 200 per plant. Fields should be monitored twice per week to obtain representative samples of each area of a field and quickly detect aphid immigrations. To protect pollinators, there are some restrictions on what insecticides can be used during bloom. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control* and Extension Current Report CR-7667 *Management of Insect and Mite Pests in Canola.*

Notes

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GREEN PEACH APHID: *Myzus persicae* (Sultzer)



Whitney Cranshaw, Colorado State University, Bugwood.org



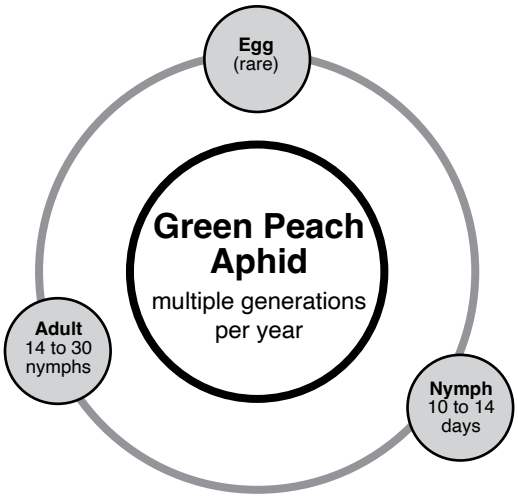
Richard Grantham, Oklahoma State University, Stillwater

Description

This soft bodied, pear-shaped insect is usually wingless and about 0.6 of an inch long. The wingless female is pale yellow green. The winged migrant form has a yellowish-green abdomen with a dark dorsal blotch. Both forms have a pair of tailpipe-like appendages known as cornicles. Nymphs are smaller than wingless adults, but similar in shape. They are pale yellow green with three dark lines on the abdomen. All stages can be recognized by the shape of the frontal tubercles (on the front of the head at the antennal bases). In dorsal view, these tubercles are strongly developed and come together anteriorly.

Life Cycle

Green peach aphids have two (or rarely three) life stages: egg (rare), nymph (four instars) and adult. Adults pass the winter on mustard greens such as spinach, collards, turnip and wild hosts such as wild mustard and dock. Winged forms migrate to other hosts in late spring. During these migratory flights, aphids may spread virus diseases from infected volunteer plants and weeds to healthy crop plants. Movement between host plants continues through summer and fall. Successive generations of mainly wingless females are produced throughout the year. Winged migrants develop whenever overcrowding occurs or food becomes scarce. Outdoor infestations are most common during the spring and fall and decline during the hottest months of the summer. This aphid is also a very common pest in greenhouses, where it breeds continuously. Many generations are produced each year.



Shaded section indicates overwintering stage

Hosts

Besides canola, the green peach aphid infests a very wide range of plants, including cabbage and related cole crops, dandelion, endive, mustard greens, parsley, turnip, tomato, tobacco, potato, spinach, pepper, beet, celery, lettuce and chard.

Damage

Damaging stages are adults and nymphs. Green peach aphids extract sap from plants with their piercing/sucking mouthparts and excrete a sweet, sticky substance known as honeydew as a waste product. Black sooty mold grows on honeydew and, though not directly harming the plants, may block out sufficient light to reduce yield. Weakened plants

become susceptible to other insects and diseases and may be inoculated with viruses carried by the aphids. Among the virus diseases transmitted by green peach aphids are potato leaf roll, potato virus Y, beet mosaic, beet yellows and lettuce mosaic.

Management

Insect predators, fungus diseases, high temperatures, damp weather and hard rains help reduce aphid populations. Cultural practices are helpful in avoiding aphid infestations. Wild mustards serve as hosts for green peach aphids and may speed the colonization of aphids into canola; therefore, the destruction of these weeds before planting and maintenance of field margins may reduce aphid problems.

Seed treated with a neonicotinoid insecticide may reduce aphid colonization and establishment in the fall. Control can be achieved with insecticides, provided care is taken to ensure good coverage. Economic thresholds for aphids are not well defined for Oklahoma production. Control procedures are usually warranted shortly after aphids initially colonize, and numbers should be kept below 5 percent of the leaves infested, if possible. Monitoring fields twice per week should be done to gain representative samples of each area of a field to quickly detect aphid immigrations. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control* and Extension Current Report CR-7667 *Management of Insect and Mite Pests in Canola.*

Notes

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TURNIP APHID: *Lipaphis pseudobrassicae* (Davis)



Richard Grantham, Oklahoma State University, Stillwater



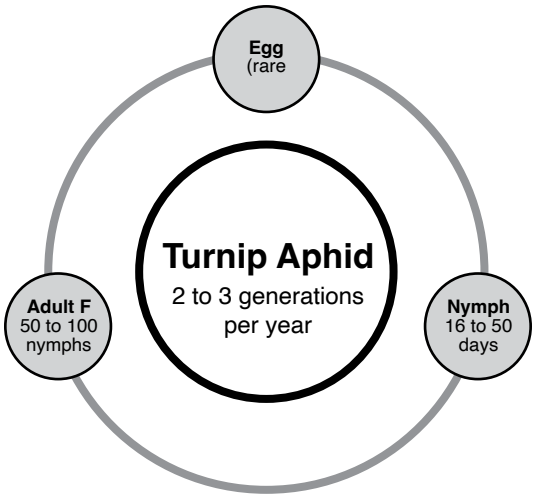
Tom A. Royer, Oklahoma State University, Stillwater

Description

Turnip aphids are pale gray green and, most commonly, wingless. They have a pair of short swollen cornicles (tailpipe-like appendages) on their abdomens. Adults are about 0.6 of an inch long. They have dark bars on their abdomen and a very light, waxy coating. Winged adults can be recognized by the presence of transverse dark bands on the last two abdominal segments. The wingless nymphs resemble the adults in color and shape, but are smaller.

Life Cycle

Turnip aphid has two (and rarely three) life stages: egg (rare), nymph (four instars) and adult. This aphid continues to feed and breed at reduced rates throughout the winter. Wild mustards and canola are important overwintering host plants. As warm weather returns, aphid activity increases. Wingless female adults produce large numbers of live nymphs (50 to 100) without mating, which all develop into females. Periodically, winged females develop and fly to new host plants. This aphid is favored by moderate temperatures and dry weather and heaviest infestations occur in the spring (March to May) and fall (September into December). Many generations are produced each year.



Shaded section indicates overwintering stage

Hosts

Besides canola, turnip aphids commonly feed on mustard, radish, turnip, shepherd's purse and watercress.

Damage

Damaging stages are adults and nymphs. Aphids cluster on the underside of leaves and suck sap with their piercing/sucking mouthparts, causing infested foliage to curl, wilt or become distorted. Some infested plants are killed; others grow slowly. They are also found on flowering spikes and seed pods, where they can cause flower abortion and pod curling.

Management

Natural control from parasites, predators (such as lady beetles and lacewings) and environmental factors (such as heavy rainfall) can sometimes reduce turnip aphid populations. Wild mustards serve as hosts for turnip aphids and may speed the colonization of aphids into canola; therefore, the destruction of these weeds before planting and maintenance of field margins may reduce aphid problems.

Seed treated with a neonicotinoid insecticide may reduce aphid colonization and establishment in the fall. Chemical control can be achieved with foliar-applied insecticides, provided care is taken to ensure good coverage. The problem of poor coverage is especially likely in late winter and spring when plants resume growth and produce overlapping and large clusters of leaves. To protect pollinators there are some restrictions on what products can be used during bloom. Economic thresholds for aphids are not well defined for Oklahoma production. Control procedures are usually warranted when aphids exceed 100 to 200 per plant. During bloom, the suggested threshold is 15 to 20 percent infested racemes. Monitoring of fields should be done twice per week to gain representative samples of each area of a field in order to quickly detect aphid immigrations. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control* and Extension Current Report CR-7667 *Management of Insect and Mite Pests in Canola*.

Notes

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ARMY CUTWORM: *Euxoa auxiliaris* (Grote)

Order Lepidoptera: Family Noctuidae



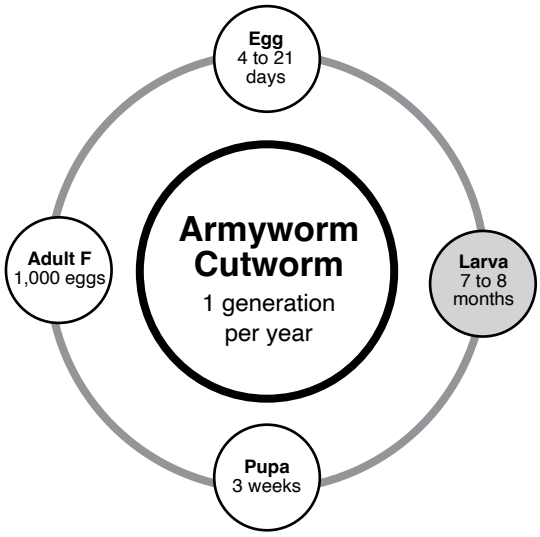
Frank Peairs, Colorado State University, Bugwood.org



Frank Peairs, Colorado State University, Bugwood.org



Tom A. Royer, Oklahoma State University



Shaded section indicates overwintering stage

Description

Adults are gray to light brown, with a wingspan of 1.5 to 2 inches. Forewings have a wavy pattern of alternating dark and light markings on their wings with one prominent kidney-shaped spot on each wing. The hind wings display a whitish fringe. Larvae are gray, or a mixture of brown and gray caterpillars. A light, broad stripe runs down the back, with blackish fringes giving way to darker sides. Larvae often curl into a C shape upon disturbance. Mature larvae are generally 1.5 to 2 inches long. Pupae are dark brown in color and are located in the soil.

Life Cycle

Army cutworm has four life stages: egg, larva (six instars) pupa and adult. Females lay eggs from late summer to early autumn. Weedy areas in crop fields and gardens are preferred deposition sites. One generation occurs each year. Eggs typically hatch from a few days to a few weeks after deposition. Newly hatched larvae begin feeding nocturnally, remaining in the soil during daylight hours. As fall advances and soil temperatures drop below freezing, immature larvae cease activity and overwinter. Larvae resume feeding and activity early in the year, typically when daytime temperatures rise above 32 F. Larvae pupate in the soil at a depth of 2 to 3 inches in late spring, with adults emerging in early summer. Adults migrate west to higher elevations for summer nectar-feeding, during which reproduction is suspended. In late summer and early fall, the moths return east to mate and lay eggs.

Hosts

Army cutworm is known to be a pest in oat, mustard, flax and sugar beet, but is of major significance in alfalfa, canola and winter wheat.

Damage

Damage is first detected as leaf defoliation, with holes chewed through leaves and semicircles cut from the edges. Larvae may cut plants down to the soil line, and during daylight hours feed on foliage pulled into soil cracks during the night. Younger plants are most vulnerable and may result in stand loss. Army cutworms will move en masse to new areas when local food sources are exhausted. Damage is generally greatest in early to mid-spring as larvae approach pupation.

Management

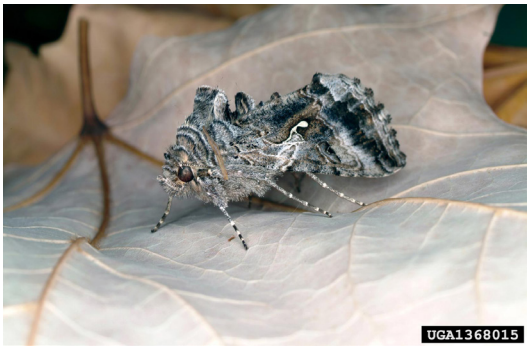
Inspection consists of checks for cut plants and larvae under rocks or clods of dirt in the top 3 to 4 inches of the soil. Larvae may also feed on overcast days and the late afternoon at the bases of plants. High levels of bird activity in a field are a possible indicator of army cutworm activity. Economic threshold is two larvae per foot of row. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control* and Extension Current Report CR-7667 *Management of Insect and Mite Pests in Canola.*

Notes

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CABBAGE LOOPER: *Trichoplusia ni* (Hübner)

Order Lepidoptera: Family Noctuidae



Joseph Berger, Bugwood.org



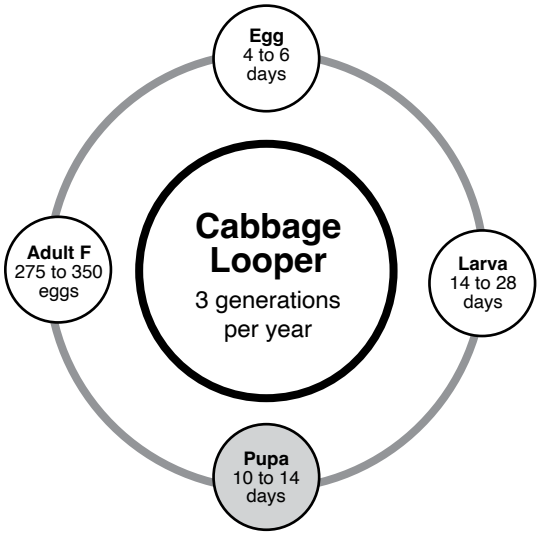
Alton N. Sparks Jr. Univ. of Georgia, Bugwood.org

Description

Adult moths have a wingspan of 1.5 inches. The forewings are gray brown with a silvery spot resembling a V or figure 8 near the center. The hindwings are pale, but become darker near the outer margin. Eggs are round, greenish white and slightly smaller than a pinhead. Newly hatched larvae are green. As they mature, they develop white stripes, two on top and two on each side. They have three pairs of prolegs, two pairs on the abdomen and one pair at the anal end. Larvae move in a characteristic "looping" motion. They reach about 1.2 inches long at maturity. The pupal stage is encased in a loosely woven, white cocoon on the host plant.

Life Cycle

Cabbage looper has four life stages: egg, larva (four to seven instars), pupa and adult. This species overwinters as pupae in the soil or in cocoons on host plants. Adults emerge in mid-spring and lay eggs. Larvae are present by April or May. The moths are active at night and each female may lay 275 to 350 eggs, singly on the upper surface of leaves. Larvae feed for two to four weeks before pupating. The pupal stage lasts for two weeks. With warm temperatures, development of cabbage loopers from egg to adult takes about 18 to 25 days.



Shaded section indicates overwintering stage

Hosts

Besides canola, cole crops such as cabbage, collards, broccoli, cauliflower and turnips are commonly infested. Cabbage loopers are also known to infest lettuce, spinach, celery, parsley, beets, peas, potatoes and tomatoes. Other hosts include alfalfa, soybeans and cotton.

Damage

Young larvae scarify the leaves, and older larvae with their chewing mouthparts. Older larvae chew irregular-shaped holes of various sizes as they get older. When caterpillars feed on the growing point, they can kill the plant or cause branching from auxiliary buds. They will also feed on developing seed pods.

Management

While present in canola, cabbage loopers rarely cause economic damage. They are chiefly leaf feeders and are usually found on the undersides of leaves. Insecticide application decisions should be based primarily on the presence of larvae and presence of significant damage. There are no definitive economic thresholds developed for cabbage looper in winter canola. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control* and Extension Current Report CR-7667 *Management of Insect and Mite Pests in Canola.*

CABBAGE SEEDPOD WEEVIL: *Ceutorhynchus obstrictus* (Marsham)

Order Coleoptera: Family Curculionidae



Ken Gray Image Courtesy of Oregon State University



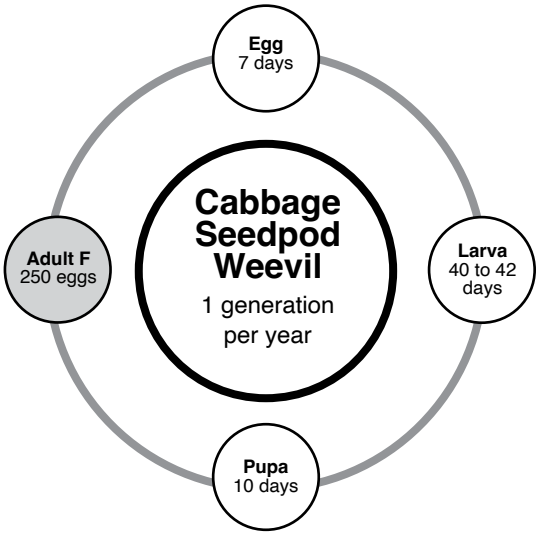
Courtesy of North Carolina State University

Description

The cabbage seedpod weevil is native to Europe. First discovered in British Columbia, it is believed to have established throughout much of North America. Its presence has been confirmed in Georgia and the Pacific Northwest. Adult weevils are ash gray and measure 0.12 to 0.16 of an inch. Adults are hard-bodied with a long, curved snout. The larvae are white, legless grubs that measure 0.17 inch when fully grown. The eggs are small, oval and white and usually laid singly.

Life Cycle

The cabbage seedpod weevil has four life stages: egg, larva (three instars), pupa and adult. Cabbage seedpod weevils grow through one generation per year that takes seven to eight weeks. They overwinter as adults, typically in tree shelterbelts and roadside ditches. Adults become active in spring. When soil temperatures exceed 55 F, they move into canola and feed on flower buds and blooming flowers. They mate after taking a pollen meal, and females attach a single egg in the pod cuticle next to a developing seed. Typically, they lay only one egg per pod. Eggs hatch in about seven days. Larvae grow through four instars. First instar larvae feed on the cuticle on the outside of the pod, second instars bore into the pod and second through fourth instars feed on developing seeds. Larval development requires about six weeks and each larva consumes an average of five seeds. When mature, the larva chews a small exit hole through the pod, then drops to the soil to pupate. New adults emerge, feed on green cruciferous plants/weeds or mature canola seeds, then migrate to overwintering sites.



Shaded section indicates overwintering stage

Hosts

Cabbage seedpod weevils will feed on various cruciferous weeds, such as hoary cress, flixweed and wild mustard) and cruciferous vegetables such as cabbage, broccoli, cauliflower, collards, kale, Brussels sprout, kohlrabi, turnip, radish, mustard and watercress.

Damage

Both adults and larvae damage canola with their chewing mouthparts, although larval feeding on seeds is much more damaging. Adults feed on flower buds, and if the canola is stressed, some yield reduction can occur. Larva-infested pods are often misshapen, and contain fewer seeds. Research in Georgia indicated that pods infested with one larva per pod on average reduced seed yield and weight by 20 percent.

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Management

Cabbage seedpod weevil has not been documented in Oklahoma as of 2016. Scouting procedures suggest that scouting should start when canola is in the bud stage. Sweep net samples should be taken at 10 locations, 10 sweeps per location. Sample the field perimeter and within the field. Thresholds suggested when sweep counts average three to four weevils per sweep. Timing for control is suggested when the crop is in 10 to 20 percent bloom. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control* and Extension Current Report CR-7667 *Management of Insect and Mite Pests in Canola.*

DIAMONDBACK MOTH: *Plutella xylostella* (L.)

Order Lepidoptera: Family Plutellidae



Tom A. Royer, Oklahoma State University



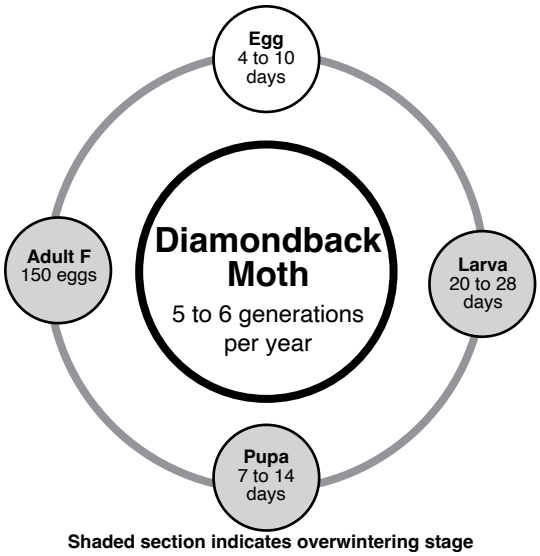
Whitney Cranshaw, Colorado State University, Bugwood.org

Description

This small, grayish-brown moth has narrow front wings, conspicuously fringed hind wings and a wingspread of 0.75 of an inch. When at rest, the wings come together to form a line of white or pale yellow diamonds down the middle of the back. The minute, round eggs are pale yellow. The larvae are slightly tapered at each end and pale green in color. They have black heads and scattered black hairs on the body. At the rear end of the larva, the prolegs on the last segment are spread apart, forming a characteristic V shape. They are slightly more than 0.25 of an inch long at maturity and wiggle rapidly if disturbed. The yellowish pupae are enclosed in loosely spun, gauze-like cocoons.

Life Cycle

The diamondback moth has four life stages: egg, larva (four instars), pupa and adult. Diamondback moths overwinter as adults among field debris of canola or within the crowns of dormant canola. Active adults may be seen during warm periods throughout the winter. In spring, eggs are laid on foliage, singly or in groups of two or three. Larvae hatch a few days later, usually by early April in Oklahoma. Larvae feed for about 10 days during warm weather or for as much as a month during cool seasons. First instar larvae mine the tissue within a leaf, but soon emerge and infest the undersides of the leaves. When mature, larvae spin loose cocoons, which remain attached to lower leaf surfaces. After a two week pupal period, a new generation of moths emerges. Total development from egg to adult averages 25 to 30 days. Activity can continue through October and even into mid-November. There are as many as five or six generations per year in Oklahoma.



Shaded section indicates overwintering stage

Hosts

The diamondback moth is a pest of practically all crucifers, including canola, cabbage, broccoli, cauliflower, collards, kale, Brussels sprout, kohlrabi, turnip, radish, mustard and watercress. They also feed on several weeds, including wild mustards and yellow rocketcress.

Damage

Larvae are the damaging stage with their chewing mouthparts. When they first hatch, larvae feed by leaf mining. As they grow, they begin to feed on the outside of the leaves. Small larvae chew small, irregular windowpane areas on a leaf. As they get larger, they chew entire leaves leaving only the veins. Leaf feeding doesn't result in significant yield loss. As winter approaches, larvae move into

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the growing point of canola where they continue to feed on the growing point when temperatures are favorable. There is no information regarding the extent or impact of such injury, but it is believed that such plant injury may cause plants be more susceptible to winter kill, or cause damage to the plant and reduce yield potential. Yield loss is also associated with flower and seed pod injury. When larvae feed on flowers, they cause them to abort. Pod feeding results in lower seed production. Feeding associated with flowers and pods can also cause a delay in plant maturity.

Management

Destruction of crop residue and weeds that serve as alternate hosts for this pest is an important form of cultural control through the reduction of source populations. Diamondback moths are attacked by a number of natural enemies.

Insecticide application decisions should be based primarily on the presence of larvae. Research has shown that the action threshold for diamondback moth caterpillars on canola varies. Scout for diamondback moth by pulling plants from a 1-square-foot area, beat the collected plants into a white bucket and count larvae. Count larvae that are dangling on the plant from silk threads as well. Take counts in at least five locations to get an average number of larvae per square foot. Larvae tend to cluster at the edges of fields, so a larger representative sample may be necessary.

Thresholds are:

- 10 to 15 larvae per square foot during early flowering.
- 20 to 30 per foot during pod stage.

Diamondback moths are notorious for developing resistance to insecticides, particularly pyrethroids, which are the primary registered insecticides for use in canola. Consider rotating insecticide modes of action as a way to inhibit development of resistance to insecticide control. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control* and Extension Current Report CR-7667 *Management of Insect and Mite Pests in Canola.*

FALSE CHINCH BUG: *Nysius raphanus* Howard

Order Hemiptera: Family Lygaeidae



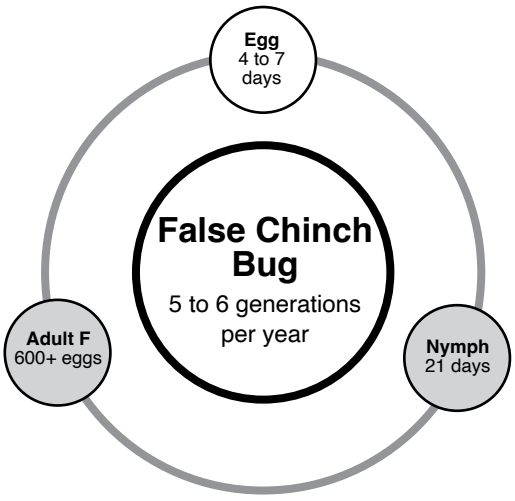
Tom A. Royer, Oklahoma State University

Description

Adult false chinch bugs are grayish-brown and measure 0.125 to 0.17 of an inch long. Adults possess hemelytra (partly hardened and partly membranous wings), displaying a characteristic wedge-shape at the top of the abdomen. Nymphs are wingless, with red-orange coloration on the abdomen. False chinch bugs feed with piercing-sucking mouthparts.

Life Cycle

False chinch bugs have three life stages: egg, nymph (six instars) and adult. Eggs are both laid and hatch throughout the growing season in the soil surrounding plants. Nymphs molt three times to reach adulthood, generally within three weeks. Both nymphs and adults are capable of overwintering in the plant residue that remains following harvest and in areas with weedy host plants. Multiple generations per growing season are common.



Shaded section indicates overwintering stage



Tom A. Royer, Oklahoma State University

Hosts

False chinch bugs feed predominantly on cruciferous plants (canola, mustards, radishes, turnips, kale, cabbage, broccoli, etc.) as well as purslane and mustard weeds.

Damage

False chinch bugs utilize their piercing-sucking mouthparts to feed on sap. Small numbers are typically not injurious. Large numbers on a single plant, sometimes numbering in the thousands, are capable of reducing turgor pressure and causing plants to wilt. Water stress makes plants particularly vulnerable to this type of damage; fortunately the largest false chinch bug populations are found in wet years. Seedlings are the most vulnerable stage, although the largest groups are usually found on sexually mature flowering plants.

Management

There is no established threshold for false chinch bug. Chemical control is difficult for false chinch bugs because even when large numbers are detected, they usually migrate too rapidly for effective control. If necessary, pyrethroid sprays may be effective in spot application. Spray coverage is critical; use a high gallonage of water for best control. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control* and Extension Current Report CR-7667 *Management of Insect and Mite Pests in Canola.*

Notes

FLEA BEETLES: *Phyllotreta* spp.

Order Coleoptera: Family Chrysomelidae



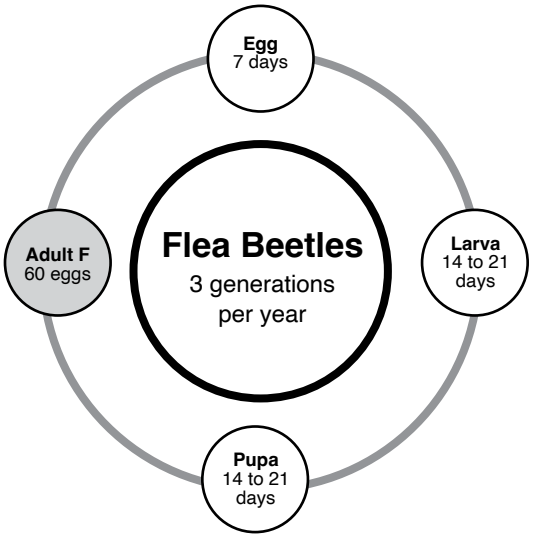
Whitney Cranshaw, Colorado State University, Bugwood.org

Description

Flea beetles are small, oval insects that vary from 0.125 to 0.17 of an inch in length. Several species attack canola, and their body color ranges from blue black, brown or yellow brown. The hind legs are distinctly enlarged and thickened, and these beetles jump readily when disturbed. The larvae live in the soil and are small (0.12 to 0.33 inch), white, elongated and have three pairs of thoracic legs and brown or red heads.

Life Cycle

Flea beetles have four life stages: egg, larva (three instars), pupa and adult. Life cycles of flea beetles vary with the species. Generally, they overwinter as adults in dead leaves, grass or rubbish. They resume activity in the spring and feed on weed hosts until cultivated plants are available. Eggs are deposited in the soil near the bases of host plants and may require a week or more to hatch. Larvae feed on or in roots, tubers or lower stems for two to four weeks before pupating. After a pupal period of seven to 10 days, a new generation of beetles emerges. Some species have only one generation per year, while others may have three or four generations per year.



Shaded section indicates overwintering stage

Hosts

Nearly all kinds of plants are attacked by flea beetles. Some species are rather host specific, but others will attack a wide variety of plants.

The vegetables most commonly damaged in Oklahoma are radishes, corn, eggplant and potatoes.

Damage

The adults chew small, round holes in the leaves of plants. Damage is most serious early in the growing season and this injury eventually kills infested leaves. In addition, some species can transmit plant diseases. The root-feeding larvae cause little significant injury to most host plants with their chewing mouthparts.

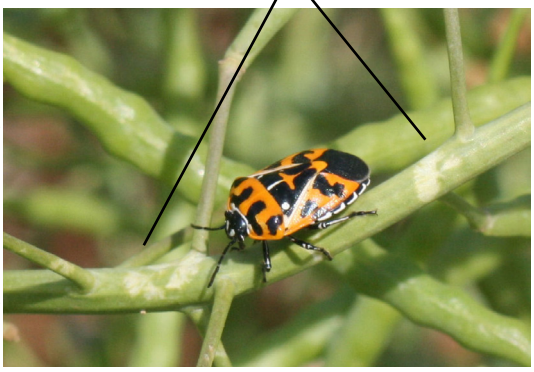
Management

Flea beetles are rarely a problem in winter canola. If seedlings are significantly damaged, there are a number of insecticides available to control adult flea beetles. Plants should be treated when adults and damage (small, round holes in the cotyledons) appear. Treatment can be repeated as needed. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control* and Extension Current Report CR-7667 *Management of Insect and Mite Pests in Canola.*

HARLEQUIN BUG:
Murgantia histrionica (Hahn)

Order Hemiptera: Family Pentatomidae

Harlequin bug and typical feeding damage



Tom A. Royer, Oklahoma State University

Harlequin bug eggs



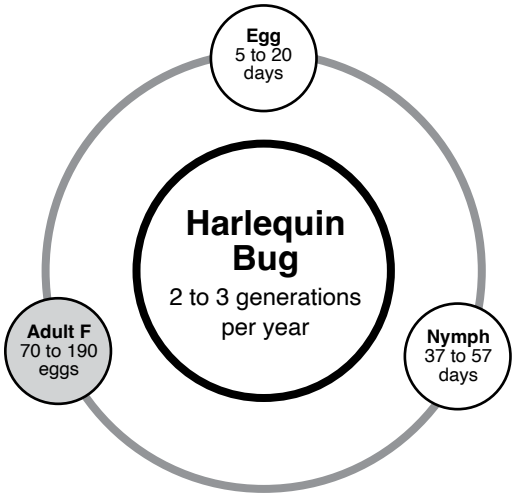
Richard Grantham, Oklahoma State University

Description

This black, shield-shaped stink bug is brightly colored with orange, red and yellow markings. It is about 0.4 of an inch long. The eggs are barrel-shaped, less than 0.12 of an inch long and are laid in clusters. Each egg is light gray to pale yellow with two black bands, one at the top and the other near the bottom and a black spot just above the lower band. Immature bugs are similar to the adult in coloration, but are smaller and lack wings.

Life Cycle

Harlequin bugs have three life stages: egg, nymph (five instars) and adult. Harlequin bugs overwinter among plant debris as adults. Adults usually emerge mid- to late April in Oklahoma. About two weeks after resuming activity, females begin depositing eggs on the undersides of leaves. Eggs are laid in double-row clusters of 10 to 13 until each female has deposited about 155 eggs. Eggs hatch in five to 20 days, depending on temperatures. Nymphs feed for six to eight weeks before becoming adults. There are three or four generations per year.



Shaded section indicates overwintering stage

Hosts

Besides canola, the harlequin bug will attack nearly all crucifers, including common weeds of the mustard family such as wild mustard, shepherds purse and peppergrass. If their preferred food becomes scarce, they will also feed on squash, corn, beans, asparagus, okra, tomato and many other plants.

Damage

Adults and nymphs pierce stalks, leaves and pods with their needlelike piercing/sucking mouthparts and extract plant juices. Stems, leaves and pods injured in this manner develop irregular cloudy spots around the puncture wound. Young plants are likely to wilt, turn brown and eventually die, while older plants are only stunted. They will also feed on pods and can damage developing seeds.

Management

Destruction of weeds (especially those in the mustard family) within fields and along fence rows limits overwintering sites. Economic thresholds are not established for this pest. Perimeter sprays around the edge of a field may be appropriate if scouting indicates that the harlequin bugs are numerous. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control* and Extension Current Report CR-7667 *Management of Insect and Mite Pests in Canola.*

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IMPORTED CABBAGEWORM: *Pieris rapae* (L.)

Order Lepidoptera: Family Pieridae



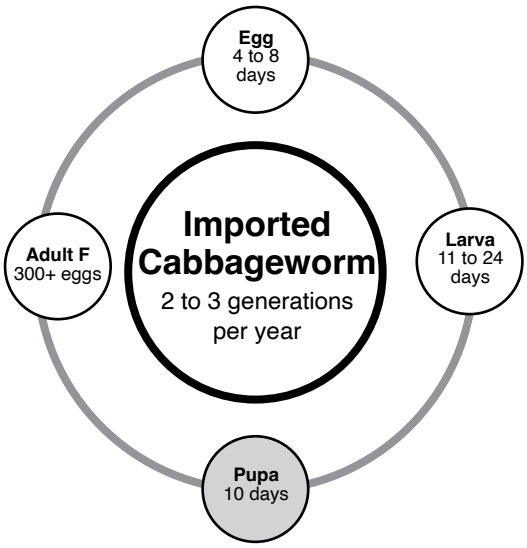


Description

The adult is a white butterfly with a black area near the tip of each forewing and a black spot on the front edge of each hindwing. The female has two other black spots on each forewing, whereas the male has one spot. Eggs are pale yellow, bullet shaped, ribbed lengthwise and crosswise and laid on end on the leaf surface. Larvae are green with a faint yellow stripe down the back and a row of faint yellow spots in each side. They have a velvety appearance because of numerous short hairs on the body. Five pairs of prolegs are present on the abdomen and larvae measure about 1.55 inches at maturity.

Life Cycle

Imported cabbageworm has four life stages: egg, larva (five instars), pupa and adult. Imported cabbageworm overwinters as a pupa attached to the host plant debris. Butterflies emerge in early spring. Each female deposits several hundred eggs, one at a time on the leaves of a host plant. Eggs hatch in four to eight days and larvae feed for 10 to 14 days before pupating.



Shaded section indicates overwintering stage

Hosts

Besides canola, imported cabbageworm prefers cabbage, broccoli and cauliflower.

Damage

Larva is the damaging stage. Imported cabbageworm is not considered a pest of canola. They occasionally may be found in the fall. They are a typical foliage-feeding caterpillar, preferring the new, more succulent leaves to eat with their chewing mouthparts.

Management

No action threshold for canola has been established, but an estimated measure based upon similar species recommends treatment when larvae exceed one per square foot. Imported cabbageworms are vulnerable to a wide variety of insecticides. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control* and Extension Current Report CR-7667 *Management of Insect and Mite Pests in Canola.*

VARIEGATED CUTWORM: *Peridroma saucia* (Hübner)

Order Lepidoptera: Family Noctuidae



Tom A. Royer, Oklahoma State University



Tom A. Royer, Oklahoma State University



Ian Kimber, Bugwood.org

Description

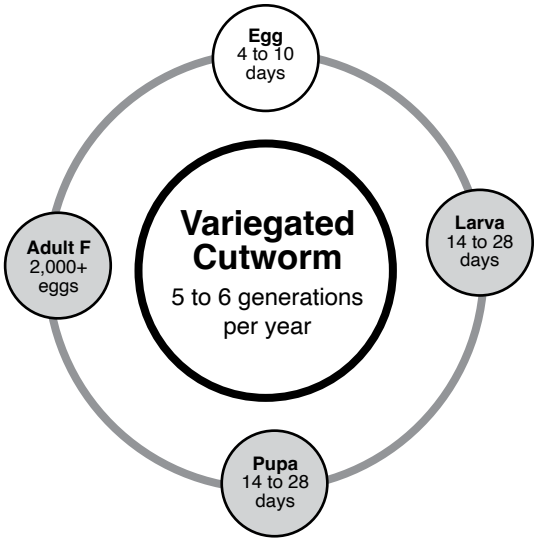
Adult moths have wingspans from 1.5 to 2 inches. The forewings are mottled brown or yellow, with white hindwings colored with brown lines and margins. Larvae are pale brown to gray with mottled dark brown areas. The larvae have a distinct series of orange or yellow paired spots on the first several segments. The eighth segment typically has a yellow and a black spot. Larvae may reach up to 1.5 inches. Brown pupae are about 0.5 to 0.75 of an inch long. Eggs are laid in clusters and are white or yellow when newly laid, turning brown as hatching approaches. Eggs are minute (less than 1 millimeters) spheres.

Life Cycle

Variegated cutworms have four life stages: egg, larva (six instars), pupa and adult. High numbers of eggs are laid throughout the summer and typically hatch in less than a week. Larvae avoid direct sunlight, feeding on overcast days and during the night and are often ready for pupation in the soil in less than a month. If there is sufficient time remaining in the growing season, pupae will hatch in two to four weeks. Several generations a year may be produced. Pupae are capable of overwintering, although they are highly vulnerable at this stage and suffer heavy losses before hatching in the spring. In climates with mild winters, the variegated cutworm may continue its life cycle and feeding uninterrupted.

Hosts

Variegated cutworms are becoming increasingly important as pests of canola. Other affected crops include alfalfa and sweet clover, however the variegated cutworm can feed on a large variety of plant species.



Shaded section indicates overwintering stage

Notes

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Damage

Larva is the damaging stage. Variegated cutworms feed with their chewing mouthparts. They often climb to the top of the plant and consume reproductive material. They damage pods and seeds as well as foliage. Older larvae may display the same behavior as other cutworms, mainly cutting plants at the soil line.

Management

No action threshold for canola has been established, but an estimated measure based upon similar species recommends treatment when larvae exceed one per square foot. Variegated cutworms are vulnerable to a wide variety of insecticides. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control* and OSU Extension Current Report CR-7667 *Management of Insect and Mite Pests in Canola.*

CORN/SORGHUM INSECTS

CORN GROWTH

Growth stage	Code	Description
0: Germination		
	00	Dry seed (caryopsis)
	01	Beginning of seed imbibition
	03	Seed imbibition complete
	05	Radicle emerged from caryopsis
	06	Radicle elongated, root hairs and/or side roots visible
	07	Coleptile emerged from caryopsis
	09	Emergence: coleoptile penetrates soil surface (cracking stage)
1: Leaf development[1, 2]		
	10	First leaf through coleoptile (V1)
	11	First leaf unfolded (V2)
	12	Two leaves unfolded (V3)
	13	Three leaves unfolded
	1.	Stages continuous till...
	19	Nine or more leaves unfolded
3: Stem elongation		
	30	Beginning of stem elongation
	31	First node detectable
	32	Two nodes detectable
	33	Three nodes detectable
	3.	Stages continuous till...
	39	Nine or more nodes detectable[3]
5: Inflorescence emergence, heading		
	51	Beginning of tassel emergence: tassel detectable at top of stem
	53	Tip of tassel visible
	55	Middle of tassel emergence: middle of tassel begins to separate
	59	End of tassel emergence: tassel fully emerged and separated (VT)
6: Flowering, anthesis		
	61	Male: stamens in middle of tassel visible Female: tip of ear emerging from leaf sheath
	63	Male: beginning of pollen shedding Female: tips of stigmata visible (R1)
	65	Male: upper and lower parts of tassel in flower Female: stigmata fully emerged
	67	Male: flowering completed Female: stigmata drying
	69	End of flowering: stigmata completely dry

7: Development of fruit

71	Beginning of grain development: kernels at blister stage, about 16 percent dry matter (R2)
73	Early milk (R3)
75	Kernels in middle of cob yellowish-white (variety-dependent), content milky, about 40 percent dry matter
79	Nearly all kernels have reached final size

8: Ripening

83	Early dough: kernel content soft, about 45 percent dry matter
85	Dough stage: kernels yellowish to yellow (variety dependent), about 55 percent dry matter
87	Physiological maturity: black dot/layer visible at base of kernels, about 60 percent dry matter
89	Fully ripe: kernels hard and shiny, about 65 percent dry matter

9: Senescence

97	Plant dead and collapsing
99	Harvested product

[1] A leaf may be described as unfolded when its ligule is visible or the tip of next leaf is visible
[2] Tillering or stem elongation may occur earlier than stage 19; in this case continue with principal growth stage three.
[3] In maize, tassel emergence may occur earlier, in this case continue with principal growth stage five

Lancashire, P.D.; H. Bleiholder; P. Langeluddecke; R. Stauss; T. van den Boom; E. Weber; A. Witzen-Berger (1991). "An uniform decimal code for growth stages of crops and weeds." *Ann. Appl. Biol.* 119 (3): 561–601. doi:10.1111/j.1744-7348.1991.tb04895.x.

SORGHUM GROWTH

Growth stage Code Description

0: Germination

00	Dry seed (caryopsis)
01	Beginning of seed imbibition
03	Seed imbibition complete
05	Radicle emerged from caryopsis
06	Radicle elongated, root hairs and/or side roots visible
07	Coleoptile emerged from caryopsis
09	Emergence: coleoptile penetrates soil surface (cracking stage)

1: Leaf development[1, 2]

10	First leaf through coleoptile
11	First leaf unfolded
12	Two leaves unfolded
13	Three leaves unfolded
1.	Stages continuous till...
19	Nine or more leaves unfolded

2: Tillering[3]

20	No tillers
21	Beginning of tillering: first tiller detectable
22	Two tillers detectable
23	Three tillers detectable
2.	Stages continuous till...
29	End of tillering. Maximum number of tillers detectable

3: Stem elongation

30	Beginning of stem elongation: pseudostem and tillers erect, first internode begins to elongate, top of inflorescence at least 1 centimeter above tillering node
31	First node at least 1 centimeter above tillering node
32	Node 2 at least 2 centimeters above node one
33	Node 3 at least 2 centimeters above node two
3.	Stages continuous till...
37	Flag leaf just visible, still rolled
39	Flag leaf stage: flag leaf fully unrolled, ligule just visible

4: Booting

41	Early boot stage: flag leaf sheath extending
43	Mid boot stage: flag leaf sheath just visibly swollen
45	Late boot stage: flag leaf sheath swollen
47	Flag leaf sheath opening
49	First awns visible (in awned forms only)

5: Inflorescence emergence, heading

51	Beginning of heading: tip of inflorescence emerged from sheath, first spikelet just visible
52	20 percent of inflorescence emerged
53	30 percent of inflorescence emerged
54	40 percent of inflorescence emerged
55	Middle of heading: half of inflorescence emerged
56	60 percent of inflorescence emerged
57	70 percent of inflorescence emerged
58	80 percent of inflorescence emerged
59	End of heading: inflorescence fully emerged

6: Flowering, anthesis

61	Beginning of flowering: first anthers visible
65	Full flowering: 50 percent of anthers mature
69	End of flowering: all spikelets have completed flowering but some dehydrated anthers may remain

7: Development of fruit

71	Watery ripe: first grains have reached half their final size
73	Early milk
75	Medium milk: grain content milky, grains reached final size, still green
77	Late milk

8: Ripening

83	Early dough
85	Soft dough: grain content soft but dry. Fingernail impression not held
87	Hard dough: grain content solid. Fingernail impression held
89	Fully ripe: grain hard, difficult to divide with thumbnail

9: Senescence

92	Over-ripe: grain very hard, cannot be dented by thumbnail
93	Grains loosening in day-time
97	Plant dead and collapsing
99	Harvested product

[1] A leaf is unfolded when its ligule is visible or the tip of the next leaf is visible
[2] Tillering or stem elongation may occur earlier than stage 13; in this case continue with stages 21
[3] If stem elongation begins before the end of tillering continue with stage 30

Lancashire, P.D.; H. Bleiholder; P. Langeluddecke; R. Stauss; T. van den Boom; E. Weber; A. Witzen-Berger (1991). "An uniform decimal code for growth stages of crops and weeds." *Ann. Appl. Biol.* 119 (3): 561–601. doi:10.1111/j.1744-7348.1991.tb04895.x.

Notes

CORN LEAF APHID
Rhopalosiphum maidis (Fitch)

Order Hemiptera: Family Aphididae



Richard Grantham, Oklahoma State University



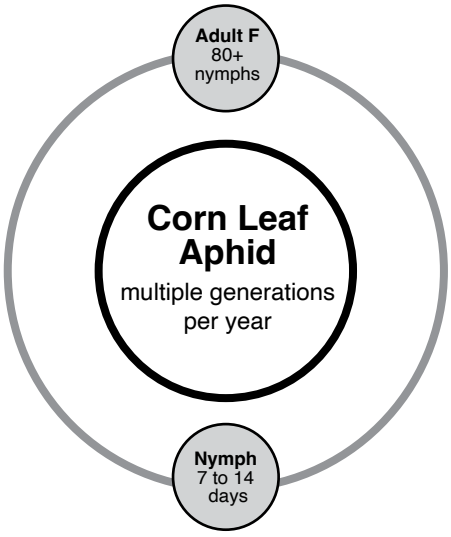
Tom Harey, Kansas State University

Description

Corn leaf aphids are comprised of winged and wingless forms, but are most commonly wingless. Adults measure 0.03 to 0.06 of an inch long. Body color is blue-green with black legs and a pair of short swollen cornicles (tailpipe-like appendages) that also are black. Winged forms measure 0.06 of an inch long and are clear. They have black eyes, thorax and legs. The abdomen is blue-green. Nymphs are similar in body color, but are smaller.

Life Cycle

Corn leaf aphids have two life stages: nymph (four instars) and adult. They reproduce primarily by parthogenesis, giving birth to live young that are all females. Nymphs grow through four instars in seven to 14 days and can complete up to 10 generations per year in Oklahoma. They are not thought to overwinter north of Texas, but winged forms migrate each spring, extending their range into Canada. They do overwinter in Texas on Johnsongrass and other grasses. They seem to favor by dry conditions which impede development of fungal pathogens that help keep them under control.



Shaded section indicates overwintering stage

Hosts

Corn leaf aphids prefer corn, but will also feed on barley, green beans, Johnsongrass, millets potato, rice, sorghum, sugarcane, tobacco and wheat, as well as other grasses.

Damage

Adult and nymph are the damaging stages. This aphid feeds primarily in the whorl of corn and sorghum with their piercing/sucking mouthparts. They do not possess toxins in their saliva, but remove plant sap from their host plant. They also produce copious amounts of honeydew, and ants will attend them. The honeydew also serves as a substrate for sooty mold to grow, which can impede photosynthesis. If numerous, these aphids can reduce yield and impede tassel emergence, obstructing pollination. Besides the direct damage they can cause, they are also vectors of several plant viruses including barley yellow dwarf, maize leaf fleck and millet red leaf viruses. They can also serve as vectors for the non-persistent maize dwarf mosaic and sugarcane mosaic viruses.

Management

Corn leaf aphid infestations that occur on seedling plants occasionally cause stand loss, but otherwise rarely require control unless the plants are under other stresses. For specific chemicals, see the E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control*.

GREENBUG:
Schizaphis graminum (Rondani)



Richard Grantham, Oklahoma State University



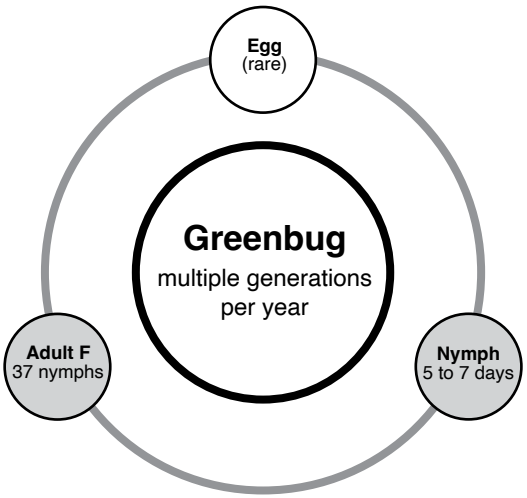
Phil Sloderbeck, Kansas State University

Description

A mature greenbug measures 0.06 of an inch with an oval-shaped, light-green body and a darker green stripe down its back. It possesses two cornicles (tailpipe-like appendages) with dark tips on the posterior end of the abdomen, green legs with dark tarsi and antennae. Winged forms are similar in body color with a brownish head and thorax.

Life Cycle

Greenbugs have three life stages: egg, nymph (four instars) and adult. Eggs are typically not produced in the southern U.S. Generally, they reproduce primarily by parthenogenesis, giving birth to live young (which are all females). They can become adults within one to two weeks of birth. Greenbugs are present throughout the year. In winter, they can be found on winter wheat and wild grass hosts, but optimal growth and reproduction occurs at temperatures between 50 and 85 F. Winged forms migrate to sorghum as it emerges in late spring and summer. Adult greenbugs are winged or wingless, and both forms often occur in the same colony. Wingless forms are more commonly seen since all immature greenbugs are wingless. Winged aphids are a main source of new infestations.



Shaded section indicates overwintering stage

Hosts

More than 70 grass species have been identified as host for greenbug, including species in the genera *Agropyron, Avena, Bromus, Dactylis, Festuca, Horedum, Lolium, Oryza, Panicum, Paspalum, Poa, Sorghum, Triticum* and *Zea*. In Oklahoma, they are a pest of wheat and sorghum. They are also a pest of Kentucky bluegrass in more northern states.

Damage

Adult and nymph are the damaging stages. The greenbug, like other aphids, feeds on plant sap through its straw-like piercing/sucking mouthparts. As they feed, they inject chemicals that injure the sorghum plant. Injury from greenbug feeding first appears as tiny reddish- or copper-colored spots on leaves. While greenbugs typically feed on the underside of the leaf, the injury is also visible on the upper side of an infested leaf. As greenbugs continue to feed and reproduce, the infested leaf becomes yellowed, and finally dies.

Notes

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Management

Sampling for greenbug can be accomplished by using the greenbug Glance-N-GoTM sampling app for smartphones. The sampling app calculates a treatment threshold based on user inputs, then provides a presence/absence sampling program that will reach a decision when the program determines that the threshold limits (to treat or not treat) have been reached, instead of requiring a fixed number of samples. The app is available for iOS or Android systems.

Alternatively, without the app, inspect 25 to 50 plants in a representative W or U pattern. Thresholds from Texas are based on plant damage and aphid presence, while thresholds from Kansas are based on aphid counts per plant. Note that if 20 percent of greenbugs are mummies (brown and swollen), the parasitic wasp, *Lysiphlebus testaceipes* may have provided enough control that a spray would not be necessary. Recheck the field in two to three days to see if treatment is needed.

Treatment Thresholds* For Greenbugs On Sorghum

Plant size	When to treat	
	Texas Thresholds	**Kansas Thresholds**
0 to 1 leaf stage	20% of plants visibly damaged	25–50 greenbugs per plant
3 leaf stage	20% of plants visibly damaged	50–100 greenbugs per plant
5 leaf stage	Visible damage on leaves (red spots, yellow leaves), but before any entire leaves are killed on 20% of plants	150–300 greenbugs per plant
Mid-whorl stage	Visible damage on leaves (red spots, yellow leaves), but before any entire leaves are killed on 20% of plants	300–600 greenbugs per plant
Boot to heading	Death of one functional leaf	700–1,000 greenbugs per plant
Heading through soft dough	Death of two functional leaves	700–1,000 greenbugs per plant

For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

SORGHUM (SUGARCANE) APHID: *Melanaphis sorghi* (Theobald)



Richard Grantham, Oklahoma State University



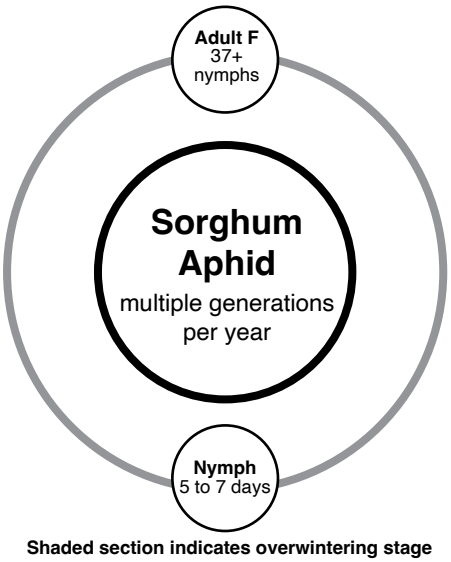
Ali Zarrabi, Oklahoma State University

Description

The sorghum aphid is also referred to as the sugarcane aphid, *Melanaphis sacchari*, but has since been shown that the sugarcane aphid and sorghum aphid are two distinct species, with the sugarcane aphid occurring mostly in sugarcane and the sorghum aphid occurring mostly in sorghum. A mature sorghum aphid measures 0.06 of an inch with an oval-shaped, light yellow to tan body. It possesses two dark cornicles (tailpipe-like appendages) on the posterior end of the abdomen, yellow legs with dark tarsi and antennae.

Life Cycle

Sorghum aphids have two life stages: nymph (four instars) and adult. They reproduce by parthenogenesis, giving birth to live young (which are all females) and can become adults within four to 12 days from birth. One female can produce up to 96 nymphs within 37 days. Newly born sorghum aphids molt (shed their skin) three times before becoming an adult. Adult sorghum aphids are winged or wingless, and both forms often occur in the same colony. Sorghum aphids do not overwinter in Oklahoma. Winged forms migrate to sorghum as it emerges in late spring and summer. Winged aphids are a main source of new infestations.



Shaded section indicates overwintering stage

Hosts

Besides sorghum, the sorghum aphid has been documented to feed on Johnsongrass (*Sorghum halepense*), sorghum/sudangrass (*Sorghum drummondii*) wild sudangrass (Sorghum verticillforum), sugarcane (*Saccharum officinarum*) and corn (*Zea mays*). Plant host ranges are continuing to be studied.

Damage

Adult and nymph are the damaging stages. Damage by sorghum aphid in sorghum is dependent on the growth stage of the sorghum. They directly remove sap from the plant with their piercing/sucking mouthparts, which removes sugars and nutrients and increases water stress. They produce copious amounts of honeydew (a liquid waste product) which is a substrate for sooty mold. Sooty mold can reduce photosynthesis. Heavy infestations can kill leaves, and weaken plants. Heavy infestations can kill leaves, weaken plants, reduce seed development and delay maturity. The excess honeydew prior to harvest can cause harvest inefficiency due to clogging of the combine head.

Notes

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Management

There are sorghum hybrids that are known to be somewhat resistant to sorghum aphid. Planting early will help reduce aphid pressure. The use of insecticide seed treatments can delay aphid buildup early.

This aphid can build numbers quickly, especially from boot stage until plant maturity. Sorghum aphids prefer to feed underneath leaves, but they drop honeydew on the leaf just below, so a visible sign that they are infesting is the appearance of shiny leaves. Scout fields regularly. Sampling for sorghum aphid can be accomplished by using the sugarcane aphid Glance-N-Go™ sampling app for smartphones. The sampling app calculates a treatment threshold based on user inputs, then provides a presence/absence sampling program that will reach a decision when the program determines that the threshold limits (to treat or not treat) have been reached, instead of requiring a fixed number of samples.

The app is available for iOS or Android systems. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

YELLOW SUGARCANE APHID: *Sipha flava* (Forbes)



Richard Grantham, Oklahoma State University



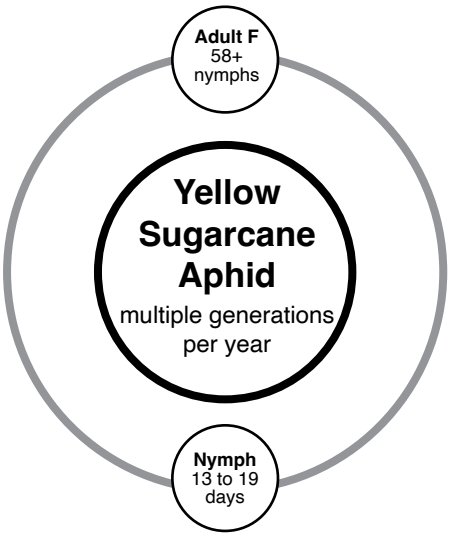
Greg Cronholm, Texas A&M University

Description

A mature yellow sugarcane aphid measures 0.06 inch with an oval-shaped, lemon-yellow body. It is covered with short black spines and has two double rows of darker spots on its back. Cornicles (tailpipe-like appendages) are very short.

Life Cycle

Yellow sugarcane aphids have two life stages: nymph (four instars) and adult. They reproduce by parthenogenesis, giving birth to live young (which are all females). They can become adults within 13 to 19 days from birth. One female can produce up to 48 nymphs during a 28-day period. Adult yellow sugarcane aphids are winged or wingless, and both forms often occur in the same colony. Wingless forms are more commonly seen since all immature yellow sugarcane aphids are wingless. Winged aphids are a main source of new infestations.



Shaded section indicates overwintering stage

Hosts

Besides sorghum, the yellow sugarcane aphid has been documented to feed on numerous species of grasses, including bromegrasses (*Bromus* spp.) sugarcane (*Saccharum officinarum*), foxtail barley (*Hordeum jubatum*), wheatgrass (*Agropyron* spp.) orchardgrass (*Dactylus glomerata*), millets (*Panicum* spp.), Johnsongrass (*Sorghum halepense*) and big blustem (*Andropogon gerardii*).

Damage

Adult and nymph are the damaging stages. Yellow sugarcane aphids feed on the underside of lower sorghum leaves with their piercing/sucking mouthparts. Their saliva has toxins that initiates a visible reaction from the sorghum plant. Even low numbers of aphids cause leaves to become purple (on seedlings) or yellow (on more mature plants). Plants may be killed outright, stunted with delayed maturity or stalk lodging coupled with associated stalk rots. Research shows that severe damage has already occurred by the time the plant exhibits visible injury symptoms.

Management

Fortunately, Oklahoma sorghum rarely experiences economic levels of yellow sugarcane aphid infestations. Treatment thresholds are based on infestations that occur from the one- to three-leaf stage. Insecticide seed treatments should minimize the risk from yellow sugarcane aphids. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

Notes

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ARMYWORM
Mythimna unipuncta (Haworth)

Order Lepidoptera: Family Noctuidae



Mark Dreiling, Bugwood.org



Roger Schmidt, University of Wisconsin-Madison, Bugwood.org

Description

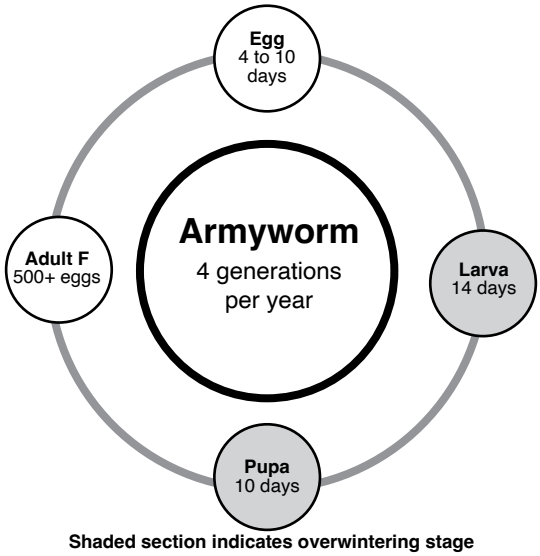
The adult moth is uniformly pale brown to grayish brown in color, with a wingspread of about 1.5 inches and a characteristic small, white spot near the center of each front wing. The spherical eggs are greenish white and are laid in masses. Mature larvae measure 1.5 inches long with a yellowish or grayish ground color, more or less tinged with pink. The top of the back is greenish brown to black with a narrow, broken, light median stripe. A dark stripe on each side includes the black spiracles in its lower edge. The subspiracular stripe is pale orange, mottled and edged with white.

Life Cycle

The armyworm has four life stages: egg, larva (six instars), pupa and adult. Armyworms overwinter as pupae or as mature larvae which pupate in the spring. Moths emerge in the spring, mate and lay eggs in masses on host plants (mostly in the grass family). Larvae feed for about four weeks but do most of their damage during the last 10 days before pupation. They then pupate in cells in the soil. A new generation of moths emerges about one week later. There are four generations per year in Oklahoma.

Hosts

Small grains, corn, timothy grass, millet and some legumes and turf grasses.



Shaded section indicates overwintering stage

Damage

Larva is the damaging stage. Young caterpillars skeletonize the surface of leaf blades and the inner surface of the sheaths with their chewing mouthparts. Older larvae begin feeding from the leaf edges and consume entire leaves. This species is a true armyworm; the larvae may migrate en masse from wheat and enter a corn field that has newly emerged corn. They are more likely to enter a corn field that is planted late. In years when wheat is infested over a wide area, homeowners often will find the adult moths ("millers") in large numbers hiding in shrubs and trees in early summer.

Management

Armyworms are not easily seen because they hide in the soil during the day and feed on the leaves and heads at night. Heaviest infestations will more likely occur near field margins. Look for this insect in and under debris at the base of plants. The presence of frass (feces) and dropped plant material indicates ongoing feeding activity. When scouting, examine several locations within the field and take an average of caterpillar counts.

Generally, if corn is past the seedling stage, control is not warranted unless significant leaf removal can be seen and caterpillars are still present and feeding. The treatment threshold is 25 percent seedling corn plants are damaged and unparasitized armyworm larvae are still present. Pay attention to evidence of natural enemy activity. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

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CHINCH BUG:
Blissus leucopterus (Say)

Order Hemiptera: Family Blissidae



Bob Wright, University of Nebraska



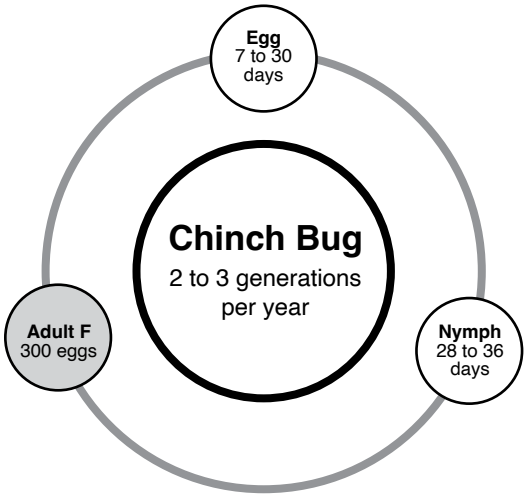
Bob Wright, University of Nebraska

Description

Adult chinch bugs are small, oval bugs that measure about 0.2 of an inch long and 0.06 of an inch wide. They are black with white forewings, that create a distinct white patch on their back that is bordered marginally in the middle by two black triangles, giving them an X pattern. Newly hatched nymphs are small and bright red with a transverse white band in the middle of their abdomen. As they grow and shed their exoskeleton, they become darker brown, then black. The last (fifth) instar has wing pads that cover most of the white band, so they appear to have a white spot.

Life Cycle

Chinch bugs have three life stages: egg, nymph (five instars) and adult. They can grow two to three generations each year. Typically, they overwinter in bunch grasses in the genus *Andropogon*.



Shaded section indicates overwintering stage

Hosts

Chinch bugs are primarily grass feeders. Besides wheat, barley, corn and sorghum, they will feed on other warm-season grasses including bermudagrass. Even though they feed on wheat in early spring, they rarely cause any damage, but thin wheat stands may suffer yield loss. In sorghum, if conditions are favorable, they can build and feed on maturing sorghum and cause some yield loss.

Damage

Adult and nymph are the damaging stages. Chinch bugs feed with piercing/sucking mouthparts and suck plant sap. They secrete digestive enzymes that help break down plant tissues. As they feed, they can cause severe chlorosis, stunting and plant death in smaller plants. In Oklahoma, adults will migrate to wheat in April and lay eggs. The eggs hatch, and nymphs feed on wheat until it matures. They typically cannot complete their life cycle in wheat, so older nymphs will migrate en masse to newly planted wheat or corn, where they can mature and cause serious injury if populations are numerous. They prefer sorghum, and because it is typically planted later than corn in the spring, they can cause more serious injury to sorghum.

Management

Management options include planting a 30-foot wide, thickly planted "trap crop" of forage sorghum or sorghum/sudangrass between the maturing wheat field and sorghum field. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

CORN EARWORM:
Helicoverpa zea (Boddie)

Order Lepidoptera: Family Noctuidae



Sturgis McKeever, Georgia Southern University



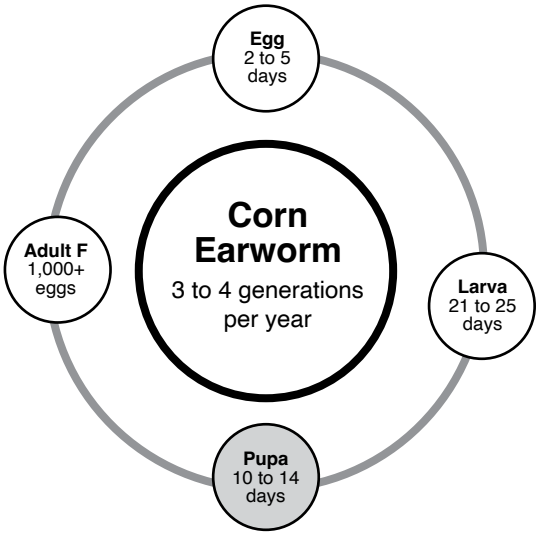
Steve Brown, University of Georgia, Bugwood.org

Description

The adult moth is usually light yellowish olive with a single dark spot near the center of each front wing, but some adults have vague darker markings on the wings. The wingspread is about 1.5 inches. The eggs are almost spherical with a flattened base and white or cream in color. The larvae vary in color, ranging from shades of pink, yellow, green, brown and black. The color depends to some extent on the host plant. They usually have darker or lighter stripes running lengthwise on the body. They can be positively identified by the presence of short, sharp microspines between the hairs on the body, but magnification of 7 to 10X is necessary to see these spines.

Life Cycle

Corn earworm has four life stages: egg, larva (five to six instars), pupa and adult. Earworms overwinter as pupae in the top inch or two of the soil. Adults begin to emerge in early spring. Moths also migrate north from Texas, augmenting the population that overwinters in Oklahoma. Eggs are laid on the buds or fruit of host plants. Larvae feed for 21 to 25 days before entering the soil to pupate. They prefer buds or fruit, but will also feed on the leaves of many different plants. There are three to four generations per year. First- generation larvae are found mostly in alfalfa and seldom cause problems summer crops. Second- generation larvae commonly damage corn, beginning in mid-May. Third-generation moths attack sorghum heads.



Shaded section indicates overwintering stage

Hosts

Corn earworm can feed on more than 300 different plants. Its common name is often based on the host plant it is attacking, e.g. corn earworm, tomato fruitworm, cotton bollworm, soybean podworm or sorghum headworm. The vegetables most commonly damaged are corn and tomatoes, but earworms will also feed on several other vegetables, some field crops, some ornamentals and a wide variety of wild plants.

Damage

Larva is the damaging stage. Damage to corn is by feeding on the terminals of young plants and the ears (on the kernels) of older plants with their chewing mouthparts. Corn earworms will also feed in corn and sorghum whorls and on the panicles of sorghum, eating developing seed.

Notes

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Management

Generally, corn earworm control is not warranted for ear feeding in corn or whorl feeding in corn and sorghum. Sampling for corn earworm in sorghum can be accomplished by using the sorghum headworm Glance-N-Go sampling app for smartphones. The sampling app calculates a treatment threshold based on user inputs of plant population, crop value and caterpillar size, then provides a sequential sampling program for bucket samples that will reach a decision when the program determines that the threshold limits (to treat or not treat) have been reached, instead of requiring a fixed number of samples.

The app is available for iOS or Android systems. See the E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control* for specific insecticide suggestions.

CORN LEAFHOPPER:
Dalbulus maidis (DeLong & Wolcott)

Order Hemiptera: Family Cicadellidae

Ashleigh M. Faris, Oklahoma State University Extension



Ashleigh M. Faris, Oklahoma State University Extension

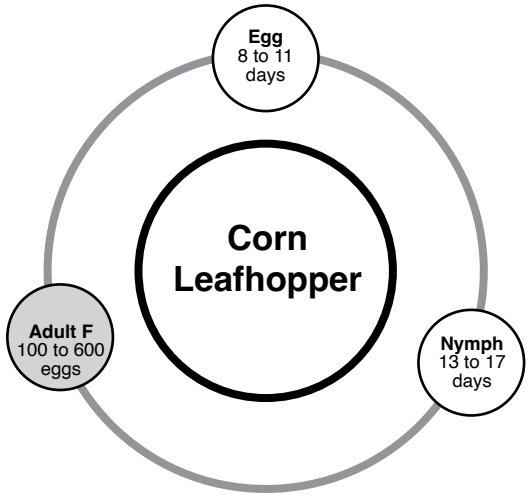


Description

Adult corn leafhoppers are yellow to tan, have two black dots surrounded by light colored halos located between their eyes and have no additional markings on their head or face. Corn leafhoppers are cigar-shaped insects; adults have two pairs of wings with light wing venation and nymphs are wingless. Corn leafhopper nymphs may lack the two black dots located between the eyes and can be green or yellow in color. Adults measure one-eighth inch in length.

Life Cycle

Corn leafhoppers have three life stages: the egg, nymph (five instars) and adult. Female corn leafhoppers can lay between 100–600 eggs; eggs are inserted into corn leaf tissue along the midrib and are not visible. The eggs hatch in eight to 11 days and nymphs feed over 13–17 days before becoming adults. Adult longevity ranges from 18–85 days. The critical thermal minimum temperature for the corn leafhopper is 23 F. Corn leafhoppers do not overwinter. In years of recent corn leafhopper outbreaks, the insect moves into Oklahoma from Texas during summer months.



Shaded section indicates overwintering stage

Hosts

Besides corn, corn leafhoppers can be found on incidental hosts such as native grasses, Johnsongrass, weeds, sorghum, wheat, alfalfa and other green foliage. Corn leafhoppers are not known to reproduce outside of corn, nor is there any evidence of the insect transmitting pathogens to these incidental hosts.

Notes

Notes

Damage

Corn leafhoppers can cause damage through direct feeding when populations are extremely high. In high numbers, black sooty mold may be observed on corn plants due to the honeydew that corn leafhoppers excrete when feeding. They are most damaging when carrying pathogens that cause corn stunt disease. Symptoms of corn stunt disease include reddening of leaf tips, shortening of internodes, chlorosis, adventitious brace roots, proliferation of ears and reduced corn cob and kernel size. Double-crop and late planted corn are most at risk for corn stunt infection.

Management

When corn is in the vegetative stages, monitor using a leaf vacuum equipped with nylon thigh-highs so that insects are suctioned into the nylon tube. During reproductive growth stages, a sweep net can be used to monitor for corn leafhoppers. Sample a minimum of 25 plants by placing the vacuum over the whorl of vegetative corn, or by sweep netting up and down the sides of reproductive corn. There is no economic threshold for corn leafhoppers as not all corn leafhoppers are infective. The insect must acquire the corn stunt pathogens by feeding on an infected corn plant. Infection can only be confirmed through molecular testing of the insect or corn plant tissue. Decision to treat should be based on pathogen presence in the insect population or approaching corn stunt disease incidence. In a low-risk season, where corn leafhopper numbers are low and pathogen presence is low, treatment may not result in an economic return on investment. In high-risk seasons where the corn leafhopper abundance is high and pathogen presence is high treatment is warranted to reduce economic loss. Managing volunteer corn will reduce out of corn growing season populations and will remove the off-season corn stunt pathogen reservoir. For specific insecticide suggestions, see *E-832 OSU Extension Agents' Handbook of Insect, Plant Disease and Weed Control*.

CORN ROOTWORM COMPLEX: *Diabrotica* spp.

Order Coleoptera: Family Chrysomelidae

Notes



Joseph Berger, Bugwood.org



Winston Beck, Iowa State University, Bugwood.org



Scott Bauer, USDA Agricultural Research Service, Bugwood.org



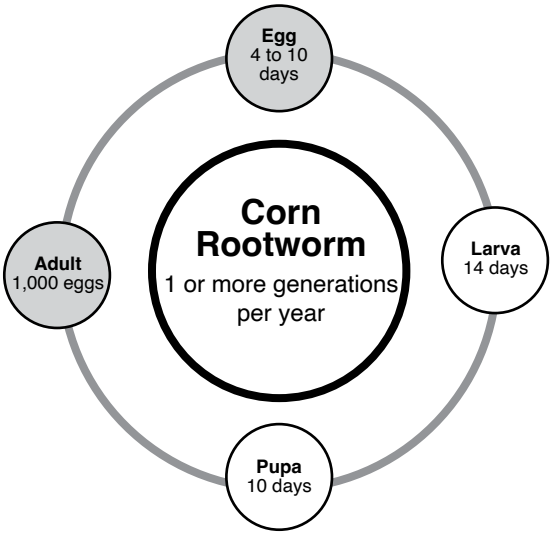
R.L. Croissant, Bugwood.org

Description

While there are four species of corn rootworms (the northern, Mexican, western and southern) the southern and western corn rootworms will be discussed here. Both adult beetles are oblong-oval in shape and about 0.25 of an inch long with a black head, legs and antennae. The southern corn rootworm (also known as the spotted cucumber beetle) has wing covers marked with 12 black spots. The western corn rootworm has wing covers marked with two longitudinal black stripes. The larvae are slender and yellow white. The head and a plate at the rear of the body are brown. There are two short, sharp projections on the anal plate.

Life Cycle

Corn rootworms have four life stages: egg, larva (three instars), pupa and adult. **Southern corn rootworms** overwinter as adults in protected locations. They may be active during the winter any time the temperature is over 65 F. Mating occurs in the early spring, and each female will lay 500 or more eggs in cracks in the soil, often as corn is just emerging. Eggs hatch in five to 11 days. Larvae grow through three instars, feeding on plant roots for two to four weeks before pupating in earthen cells about 1 inch below the soil surface. There are two or three generations per year and adults are active at least into November.



Shaded section indicates overwintering stage

Notes

Western corn rootworms overwinter as eggs in the soil. They hatch in late May through mid-June. Larvae grow through three instars, feeding on corn roots for about four to five weeks, then they pupate in the soil. There is one generation per year.

Hosts

Corn is the preferred host for both species, but the southern corn rootworm is known to feed on more than 100 different plants including most vegetables and field crops, many flowers, weeds and grasses. The larvae develop on the roots of a wide variety of plants.

Damage

Adult and larva are the damaging stages. Adults are sometimes numerous enough to interfere with pollination by feeding on corn silks. Damage to corn is caused mostly by the larvae as they feed with their chewing mouthparts. They bore into the stalk just above the roots and kill the growing point of young plants. They also feed on the roots, which can cause lodging and yield reduction. Damage from southern corn rootworm typically occurs before corn puts out brace roots, whereas western corn rootworms feed on crown roots and brace roots. Damage is more likely in cool, wet springs, in low, wet areas and where only corn has been grown for several years.

Southern corn rootworms are a minor pest of corn except for areas of coastal Texas and Louisiana. Western corn rootworms are a pest of corn throughout the corn belt. Recently, a western corn rootworm variant will lay eggs in soybean, rendering the corn/soybean crop rotation ineffective in parts of Iowa, Illinois, Indiana, Michigan and Ohio.

Management

For specific insecticide suggestions, see E-832, *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

EUROPEAN CORN BORER: *Ostrina nubilalis* (Hübner)

Order Lepidoptera: Family Crambidae

Adam Sisson, Iowa State University



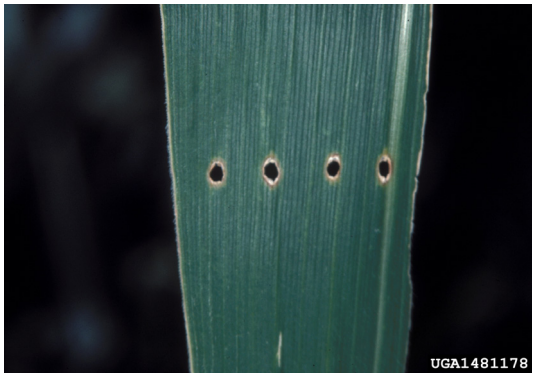
Frank Peairs, Colorado State University, Bugwood.org



Clemson University- US Cooperative Extension Slide Series, Bugwood.org



Frank Peairs, Colorado State University, Bugwood.org

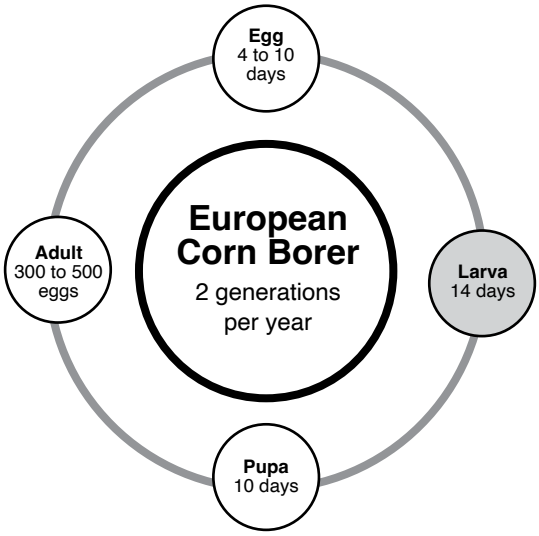


Description

The European corn borer is an introduced species, but is now widely distributed throughout the U.S. The adult female is about 1 inch long with a wing pattern of alternating yellow-brown and medium brown wavy lines. Males have a darker wing pattern with brown and yellow bands. Mature larvae are 0.75 to 1 inch with a brown head capsule, creamy pinkish to light gray body with light spots containing dark tubercles.

Life Cycle

European corn borer has four life stages: the egg, larva (six instars), pupa and adult. They overwinter as larvae in the corn stalk and pupate in spring when temperatures reach 50 F. Adults emerge about seven to 10 days later, mate and begin laying eggs. Female moths lay egg clusters (two per night) of 15 to 20 eggs on the underside of corn leaves. When eggs are about to hatch, they are termed “blackhead” stage because the black head capsules of the larvae are visible through the egg case. There are usually two generations per year in most of the southern corn belt areas.



Shaded section indicates overwintering stage

Notes

Notes

Hosts

European corn borer prefers corn, but has a wide host range, including potato, snap and lima beans, pepper, barnyardgrass, cocklebur, dock, panic grass, pigweed and smartweed.

Damage

Larva is the damaging stage. Caterpillars cause damage from stalk tunneling using their chewing mouthparts during the vegetative growth stage, which can result is stalk lodging. They also tunnel into the ear shanks, causing ear drop. Early evidence of an infestation is the visible "window panes" and "shot holes" on leaves that occur when larvae feed on leaves within the whorl. Their feeding can result in indirect yield loss from disruption of water and sap movement due to their tunneling. They can cause direct yield loss when stalks break or ears drop from shank tunneling. European corn borer was considered to be a serious pest of corn before transgenic corn varieties containing the *Bacillus thuringiensis* gene became widely used.

Management

European corn borer is not a common pest in Oklahoma. Monitoring is commonly done with pheromone traps, so flights can be predicted. Most corn hybrids are now genetically modified with *Bacillus thuringiensis (Bt)* genes that resist European corn borer infestation. Growers must follow all requirements for establishing a non-*Bt* refuge. For specific insecticide suggestions, see E-832 *OSU Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

FALL ARMYWORM
Spodoptera frugiperda (J. E. Smith)

Order Lepidoptera: Family Noctuidae



Frank Peairs, Colorado State University, Bugwood.org



Lyle Buss, University of Florida, Bugwood.org

Description

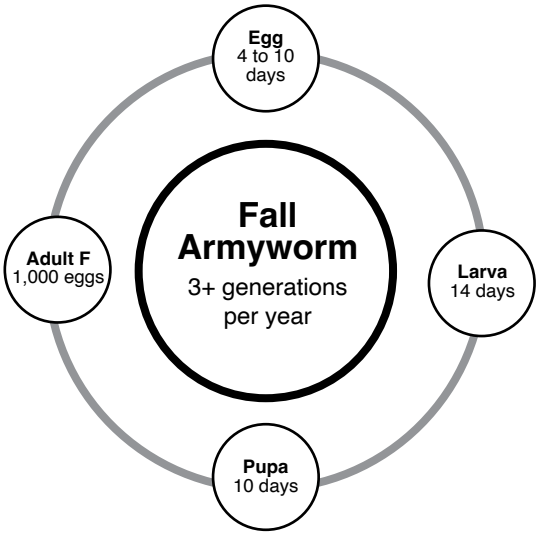
Male moths have dark gray front wings, mottled with darker and lighter splotches. There is a prominent pale, diagonal marking near the center of the front half of each wing and a prominent white spot at the extreme tip. The front wings of female moths are dull gray brown with only small, inconspicuous markings. The hindwings of both sexes are white with a slight purplish sheen. The wingspan is about 1.5 inches. Eggs are pale gray, laid in masses and covered with grayish, fuzzy scales from the body of the female. Larvae have five pairs of abdominal prolegs and measure 1.5 inches when fully grown. Body color may be green, brown or almost black with black and reddish brown stripes on each side of the body and four small black spots on the dorsal side of each abdominal segment. The head capsule is mostly black and is marked with a pale, inverted Y on the front (see page 118).

Life Cycle

The fall armyworm has four life stages: egg, larva (six instars) pupa and adult. It does not overwinter in Oklahoma. Moths migrate northward from Texas or Mexico, causing infestations each year. They usually reach the state by late June. Each female lays about 1,000 eggs in masses of 50 to several hundred. Larvae are present by early July. After feeding for two to three weeks, the larvae dig into the soil to pupate. A new generation of moths emerges about two weeks later. There are several overlapping generations extending into October or even November in some years.

Hosts

This species will feed on a very wide variety of plants but prefers plants in the grass family. Corn, sorghum and wheat are subject to infestation.



Shaded section indicates overwintering stage

Damage

Fall armyworms damage plants with their chewing mouthparts. They are potential crop pests in late summer and fall. Large numbers can consume all aboveground plant parts, and they are capable of killing or severely retarding the growth of plants. This species may migrate in large numbers in search of new areas in which to feed.

Management

No detailed thresholds have been developed for fall armyworm in corn or sorghum for whorl feeding. An economic threshold that is based on plant population and crop value and control costs as well as an efficient sampling plan can be accessed using the sorghum headworm calculator http://entoplp.okstate.edu/shwweb/index.htm See E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control* for specific insecticide suggestions.

Notes

Notes

LEAF-FOOTED BUG: *Leptoglossus phyllopus* (L.)

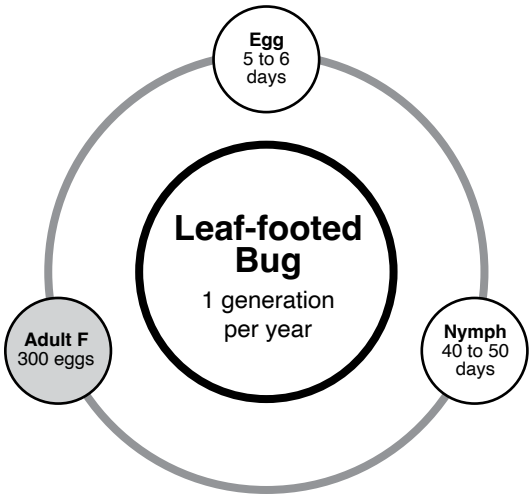
Order Hemiptera: Family Coreidae

Description

The leaf-footed bug is also a true bug measuring from 0.75 to 1.25 inches in length and about 0.5 of an inch wide. Leaf-footed bugs do not vary much in color and exhibit a dull brown background color. They also possess a characteristic shape and leg pattern. The tibial section of the hindleg is flattened and greatly expanded, so it appears somewhat leaf-like, hence the common name. They often possess a white or yellow stripe running across the wing covers. The leaf-footed bug has characteristic slender mouthparts containing stylets that function to suction plant juices from the tissue once the mouthparts have pierced the surface. The nymphal stages are similar to the adults but lack wings. They may range in size from about 0.125 inch long to nearly 0.75 inch long when mature.

Life Cycle

Leaf-footed bugs have three life stages: egg, nymph (five instars) and adult. This insect overwinters as an adult in protected areas such as fence rows, grassy field borders, under stones or bark of trees. They become active during the first warm days of spring (usually around May). Egg laying can occur anytime from May through July and August. Eggs are cylindrical with a flattened bottom and flattened sides and laid end to end in clusters of 15 to 35 in a single row. Nymphs are bright red, and grow through five instars, becoming adults in about 50 days. Female bugs may move readily between weeds and other alternate hosts.



Shaded section indicates overwintering stage



Hosts

Leaf-footed bugs feed on a variety of plants, including bean, cowpea, sorghum, eggplant, potato, tomato, peach, strawberry, okra and watermelon. They are typically not numerous enough to cause problems, but occasionally reach pest status in sorghum and corn. They also will occasionally congregate into large colonies, and this “crowd feeding” can cause damage.

Damage

Damage from stink bugs and leaf-footed bugs are similar, therefore, they will be considered together in relation to their effects on sorghum. They injure sorghum by feeding on seeds in the panicle with their piercing/sucking mouthparts. Sorghum is most susceptible during the milk to soft-dough stage.

Management

Weed management can help with suppressing infestations. Current treatment thresholds are five per leaf at milk stage and nine per leaf at soft-dough. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

LESSER CORNSTALK BORER: *Elasmopalpus lignosellus* (Zeller)

Order Lepidoptera: Family Pyralidae

Richard Sprenkel, University of Florida, Bugwood.org



Mark Dreiling, Bugwood.org

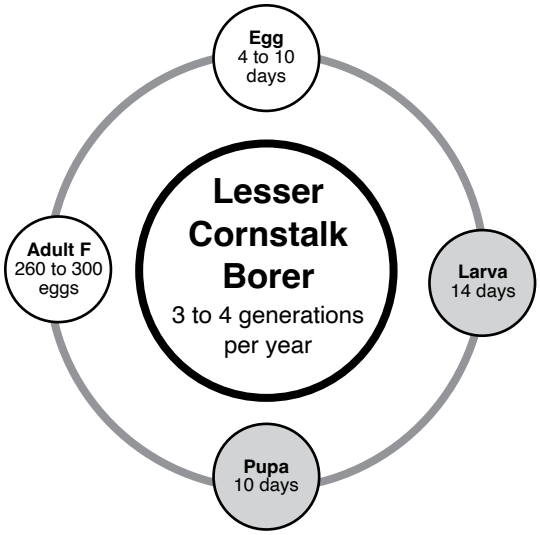


Description

The male moth has brownish yellow front wings with gray margins and several dark spots. The female's front wings are nearly black. The wing spread is about 1 inch. The larvae are slender, blue green, brown-striped caterpillars about 0.75 of an inch long when mature. Larvae are very active and thrash about violently when disturbed.

Life Cycle

Lesser stalk borer has four life stages: egg, larva (five to nine instars), pupa and adult. This insect can overwinter as larvae or pupae, but they usually spend most of the winter as larvae, then pupate in late winter or early spring. Moths emerge early in the spring and lay eggs on or near the hosts leaves or stems. The eggs hatch in two to seven days. Larvae may first feed on leaves or roots or tunnel up the main stem of a plant. They later construct underground silken tubes or burrows from which they bore into plants near the ground line. Larvae typically undergo six instars, but can range from five to nine. With ideal conditions, they become fully grown in three weeks, leave their burrows and spin silken cocoons under trash on the surface of the ground. In these cocoons, they change to pupae from which moths emerge in two to three weeks. There appears to be three to four generations per year in Oklahoma.



Shaded section indicates overwintering stage

Hosts

The lesser cornstalk borer is known to feed on corn, beans, cowpeas, peas, peanuts, sorghum, soybeans and wheat. Weed hosts include crabgrass, nutsedges, watercress, wild oats, bermudagrass, Johnsongrass, wiregrass and goosegrass.

Damage

Injury is caused when a larva bores into the stalk of a host plant, thereby disrupting the growing point. This results in a condition called deadheart. Damage can be slight, or it can kill the plant. Stalks on larger plants can break off when infested. Damage is most prevalent in crops grown on sandy soils during dry conditions.

Management

Cultural practices include tillage and early planting. For fields with a history of lesser cornstalk borer, a registered granular insecticide applied in-furrow or banded at planting can reduce damage. Post-emergence control is difficult because they are protected from contact with an insecticide. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

Notes

Notes

SORGHUM MIDGE: *Contarinia sorghicola* (Coquillett)

Order Diptera: Family Cecidomyiidae

Sorghum midge adult head



Phil Sloderbeck, Kansas State University

Sorghum midge pupal cases



Phil Sloderbeck, Kansas State University

Blasted sorghum



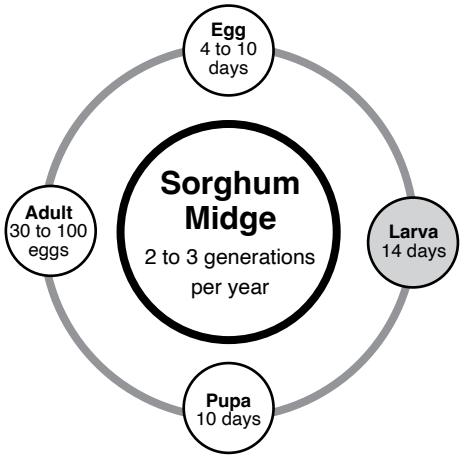
Phil Sloderbeck, Kansas State University

Description

The sorghum midge is widely distributed throughout the U.S., and is a very damaging pest of sorghum in the southern U.S. Adult sorghum midge measures 0.04 of an inch long, with an orange-red body and gray membranous wings.

Life Cycle

Sorghum midge has four life stages: egg, larva (two or three instars), pupa and adult. They overwinter as larvae in spikelets of their host. Adult females lay a yellowish-white egg (about 50 per day) between the glumes of a flowering spikelet. The eggs hatch in two to three days, and the larva feeds inside the developing seed. Larvae complete their development in about nine days, and move upward in the spikelet to pupate. About three-fourths of the pupa protrude between the glumes at the spikelet tip. The adult fly emerges in about one to three days, completing a life cycle in about 14 to 16 days. There are probably two to three generations per year in Oklahoma.



Shaded section indicates overwintering stage

Hosts

Sorghum and Johnsongrass are the primary hosts, but they have been reported to use 14 other species of grasses.

Damage

Damage is caused by larvae that consume the inside of developing seeds with their chewing mouthparts. If enough numbers are present, they can destroy an entire sorghum head. Symptoms of sorghum midge damage to a sorghum head is termed blasting.

Management

Choose resistant varieties if available. Planting early can help avoid infestations. Avoid planting successive plantings of sorghum near each other. Scout for midge by placing a 1-gallon plastic bag over each head, and thump it. The midges will fly upward. Remove the bag and contents and look for midges inside the plastic bag. Check 25 to 40 flowering heads per field. Without disturbing the plant, look for small gnat-sized flies that are moving about the head or are laying eggs on flowers with extended anthers. The best time to scout for sorghum midge is when they are most active (9:00 to 11:00 am). Begin scouting when the heads first emerged heads begin pollinating and continue every three days until the bloom is finished. The economic threshold is one midge per head for susceptible varieties or five midges per head for resistant varieties. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

SOUTHWESTERN CORN BORER:
Diatraea grandiosella Dyar

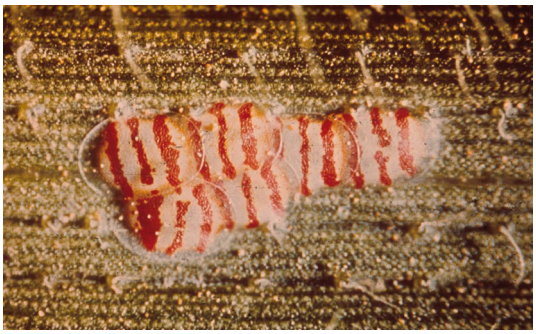
Order Lepidoptera: Family Crambidae:



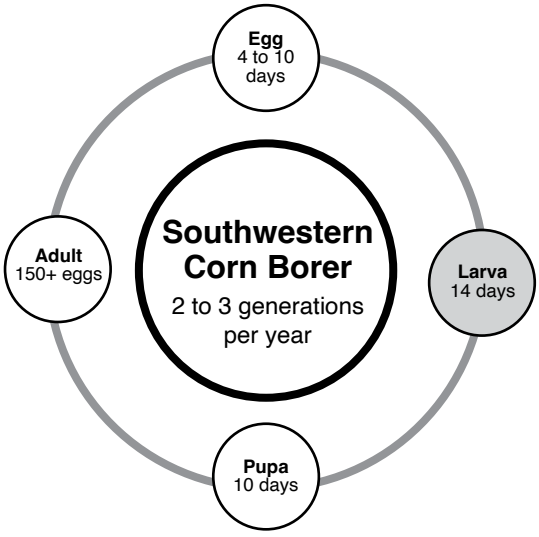
Frank Pears, Colorado State University, Bugwood.org



Frank Pears, Colorado State University, Bugwood.org



Texas A & M University



Shaded section indicates overwintering stage

Description

Adult southwestern corn borers are dull white with a wingspan of 0.75 to 1.2 inches. The mouthparts extend forward, giving it the appearance of a snout. Larvae are white with a pattern of large, black spots on each body segment. Overwintering larvae lose their spots. The head capsule is black for first through third instars; brown for fourth through sixth instars. Mature larvae measure 1.25 inches. Eggs are white and laid in a group resembling fish scales. About 36 hours before hatching, they show three broken red lines across each egg.

Life Cycle

Southwestern corn borer has four life stages: egg, larva (six instars) pupa and adult. Eggs are deposited in masses on the upper and lower surfaces of leaves. It completes two to three generations in Oklahoma. Southwestern corn borer overwinters as a larva in the corn root crown. It pupates in late May through June. About 10 days after pupation, adults emerge, mate and begin to lay eggs. Eggs are laid from mid-June through early July. Larvae hatch, feed on the inner whorl leaves of the corn plant producing shot holes. Older larvae move into the stalk and tunnel in the inner plant tissue of the stalk. Second generation eggs are laid near the ear. Newly hatched larvae feed on the ear husks, ear cob and ear shank. Later, they move in and tunnel into the stalk. Mature second generation caterpillars tunnel down to the base of the ear stalk just below the soil line, and hollow out a cell and line it with silk. The final molt produces a white caterpillar with no visible spots. They remain in their hibernation cell and overwinter.

Hosts

Corn is the primary host, but southwestern corn borers also can be found in sorghum and Johnsongrass.

Notes

Notes

Damage

Southwestern corn borers damage corn in several ways. Their tunneling in small corn can kill the growing point, causing a condition called dead heart. Tunneling and girdling in the stalk can result in stalk breakage. They can cause ear drop from shank tunneling. Direct feeding on the ear can reduce grain. They cause indirect yield loss by tunneling into the stalk and interfering with water and nutrient flow in the plant.

Management

Reduced tillage can favor survival of overwintering larvae. Most corn hybrids are now genetically modified with *Bacillus thuringiensis (Bt)* genes that resist southwestern corn borer infestation. Growers must follow all requirements for establishing a non-*Bt* refuge. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

WESTERN BEAN CUTWORM: *Striacosta albicosta* (Smith)

Order Lepidoptera: Family Noctuidae:



Frank Peairs, Colorado State University, Bugwood.org



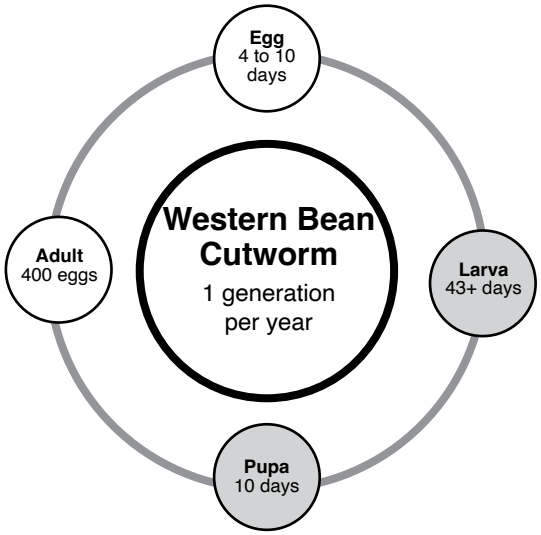
Adam Sisson, Iowa State University, Bugwood.org

Description

Adult western bean cutworm is grayish-brown with a wingspan of 1.5 inches. They have a whitish stripe along the margin of each forewing with two bands extending perpendicular to the stripe. Newly hatched larvae are brown with two rows of faint diamond-shaped markings on their back. As they grow, they lighten to a pale tan or gray-brown color with two black rectangle-shaped markings just behind their head. Eggs are white, barrel-shaped and change color from white when first deposited to gray just before hatching.

Life Cycle

Western bean cutworm has four life stages: egg, larva (six instars), pupa and adult. They produce one generation per year. Moth flights typically begin in mid-summer. Eggs are deposited in masses consisting of 20 to 200 eggs. Larvae hatch and eat their egg shells before moving to protected areas of the corn plant to feed on leaf material, fallen anthers and silks. Their final destination is the ear, where they feed on developing kernels. When mature, they overwinter as prepupae in the soil, and change to pupae in late spring.



Shaded section indicates overwintering stage

Hosts

Western bean cutworms prefer corn and beans as host plants.

Damage

Larva is the damaging stage. It damages corn by feeding on the ear with its chewing mouthparts. Research from Iowa and Nebraska indicate that an average of one larva per ear can cause a 4-bushel-per-acre reduction in yield. In addition, damaged ears and kernels are more susceptible to ear molds and aflatoxin.

Management

Management consists of monitoring flights with pheromone traps, coupled with scouting. Scouting should begin when traps catch multiple moths. Corn that is most susceptible are fields where the corn is just beginning to shed pollen. Scouting consists of examining the upper surfaces of new leaves and newly emerged tassels. Larvae are capable of moving from plant to plant, so recommendations are to scout 20 consecutive plants in five locations. Fields should be scouted for several weeks. The threshold is to treat if 8 percent of the tassels have larvae and the field is 95 percent tasseled. Larvae are susceptible to insecticide control until they move into the ear husk. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

Notes

Notes

COTTON INSECTS

COTTON GROWTH STAGES (BBCH-SCALE)

0: Germination

00	Dry seed
01	Beginning of seed imbibition
03	Seed imbibition complete
05	Radicle emerged from seed
06	Elongation of radicle
07	Hypocotyl with cotyledons breaking through seed coat
08	Hypocotyl with cotyledons growing towards soil surface
09	Emergence: hypocotyl with cotyledons breaking through soil surface (crook stage)

1: Leaf development (Main shoot)

10	Cotyledons completely unfolded[1]
11	First true leaf unfolded[1]
12	Second true leaf unfolded[1]
13	Third true leaf unfolded[1]
1.	Stages continuous till...
19	Nine or more true leaves unfolded;[1] no side shoots visible[2]

2: Formation of side shoots[3]

21	First vegetative side shoot (2nd order) visible
22	Two vegetative side shoots (2nd order) visible
23	Three vegetative side shoots (2nd order) visible
2.	Stages continuous till...
29	Nine or more vegetative side shoots (2nd order) visible

3: Main stem elongation (Crop cover)

31	Beginning of crop cover: 10 percent of plants meet between rows
32	20 percent of plants meet between rows
33	30 percent of plants meet between rows
34	40 percent of plants meet between rows
35	50 percent of plants meet between rows
36	60 percent of plants meet between rows
37	70 percent of plants meet between rows
38	80 percent of plants meet between rows
39	Canopy closure: 90 percent of the plants meet between rows

5: Inflorescence emergence (Main shoot)

51	First floral buds detectable (“pin-head square”)[4]
52	First floral buds visible (“match-head square”)[4]
55	Floral buds distinctly enlarged
59	Petals visible: floral buds still closed

6: Flowering

60	First flowers opened (sporadically within the population)
61	Beginning of flowering (“Early bloom”): 5 to 6 blooms per 25 feet of row (5 to 6 blooms per 7.5 meter of row)
65	Full flowering: (“Mid bloom”): 11 and more blooms per 25 feet of row
67	Flowering finishing: majority of flowers faded (Late bloom)
69	End of flowering

7: Development of fruits and seeds

71	About 10 percent of bolls have attained their final size
72	About 20 percent of bolls have attained their final size
73	About 30 percent of bolls have attained their final size
74	About 40 percent of bolls have attained their final size
75	About 50 percent of bolls have attained their final size
76	About 60 percent of bolls have attained their final size
77	About 70 percent of bolls have attained their final size
78	About 80 percent of bolls have attained their final size
79	About 90 percent of bolls have attained their final size

8: Ripening of fruits and seeds

80	First open bolls on the first fruiting branches
81	Beginning of boll opening: about 10 percent of bolls open. Nodes Above White Flower (NAWF)
82	About 20 percent of bolls open
83	About 30 percent of bolls open. Nodes Above Cracked Boll (NACB)
84	About 40 percent of bolls open
85	About 50 percent of bolls open
86	About 60 percent of bolls open
87	About 70 percent of bolls open
88	About 80 percent of bolls open
89	About 90 percent of bolls open

9: Senescence

91	About 10 percent of leaves discolored or fallen
92	About 20 percent of leaves discolored or fallen
93	About 30 percent of leaves discolored or fallen
94	About 40 percent of leaves discolored or fallen
95	About 50 percent of leaves discolored or fallen
96	About 60 percent of leaves discolored or fallen
97	Above ground parts of plant dead; plant dormant
99	Harvested product (bolls and seeds)

[1] Leaves are counted from the cotyledon node (= node 0)
[2] Side shoot development may occur earlier, if there is a vegetative side shoot continue with principal growth stage 2. If there is a reproductive side shoot (fruiting branch) continue with the principal growth stage 5
[3] Vegetative side shoots are counted from the cotyledon node
[4] “Pin-head square” or “match-head square” is the first square which forms at the first fruiting

BEET ARMYWORM: *Spodoptera exigua* (Hübner)

Order Lepidoptera: Family Noctuidae



Richard Grantham, Oklahoma State University



Robert Baurenfeind, Kansas State University, Bugwood.org

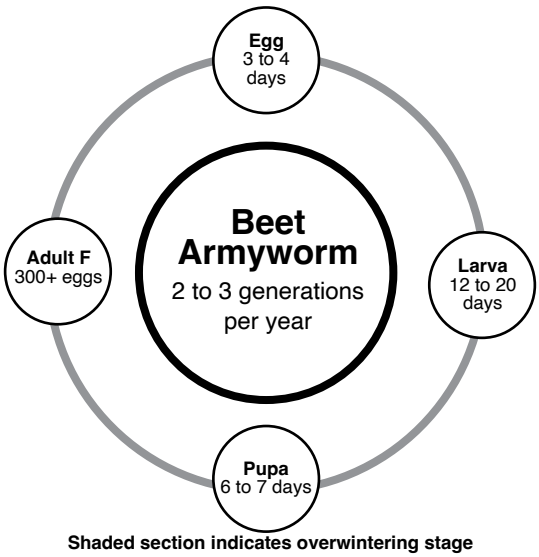
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Description

Adult beet armyworms are light colored, forewings have irregular banding and hindwings are grayish white with a darker line along the outer wing margin. Wingspan is about 1 to 1.4 inches. Larvae are pale green to yellow when young, but fully grown larvae measures about 1 inch, and has a green body (sometimes dark) with a pink or yellow stripe that is bordered with a thin white line along each side. They have five pairs of abdominal prolegs and often have a black spot along the second thoracic segment. Eggs are laid in clusters of 50 to 150 and often are covered with a layer of whitish scales from the female body that give them a fuzzy appearance.

Life Cycle

Beet armyworm has four life stages: egg, larva (five instars), pupa and adult. Eggs typically hatch in three to four days in warm weather. Larvae can complete their growth in 12 to 20 days. They pupate in the soil for about six to seven days. Total time from egg to adult can occur in as little as 25 to 40 days. Beet armyworm does not overwinter in Oklahoma, but they can complete two or more generations in a growing season.



Shaded section indicates overwintering stage

Hosts

Beet armyworm infests numerous plants from grasses to broadleaves. They are a pest of cotton, corn, soybean, alfalfa, pepper, tomato and potato. They also use weedy plants such as plantain, lambsquarters and redroot pigweed.

Damage

Beet armyworm caterpillars are foliage feeders, but will also feed on squares, blooms or bolls. They normally feed in a group for the first two instars and skeletonize cotyledons or leaves. When they reach third instar, they become solitary feeders. In pre-bloom cotton, they tend to feed on leaves but will also eat a terminal, which results in extensive lateral branching. While they are a pest, they are not normally considered to be a major pest of cotton. With the development of transgenic cotton varieties that have the *Bacillus thuringiensis (Bt)* gene, they have even become less of a problem. They may sometimes feed on blooms, which do not express the *Bt* toxin, but flower feeding does not typically result in yield loss.

Management

Beet armyworms often have effective natural enemies including several parasitoids. Scouting before treatment is important to avoid flairing aphids or other major pests. Treatment with a registered insecticide should begin when 10 percent of plants are infested or when the field average is one beet armyworm per plant. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

Notes

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BOLL WEEVIL: *Anthonomus grandis grandis* Boheman

Order Coleoptera: Family Curculionidae



F. Benci, Boll Weevil Research Laboratory, Bugwood.org



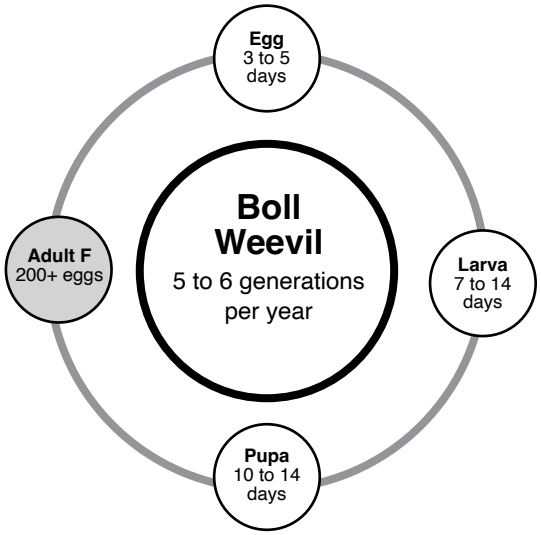
Ronald Smith, Augum University, Bugwood.org

Description

Boll weevil adults measure 0.1 to 0.33 of an inch from the tip of its proboscis to the tip of its abdomen. Body color can vary from yellowish brown to reddish brown to grayish brown. Its proboscis is about half the length of its body. Mature larvae are white, legless and measure 0.5 of an inch. Pupae are white when first formed but turn brown as they age.

Life Cycle

The boll weevil has four life stages: egg, larva (three instars), pupa and adult. They overwinter as adults in sheltered areas, including woods, fence rows and road ditches around cotton fields. They emerge in March through June, and feed on cotton seedlings or the pollen of other flowering plants. They do not lay eggs until males consume cotton squares and release a pheromone that attracts females. Females chew a hole in the developing square or boll to lay an egg, then seal with frass. Eggs hatch in three to five days, and the larva feeds for seven to 14 days and pupates inside the square. The adult emerges and chews a hole in the square to emerge and feed for about five days. Under ideal temperatures, a boll weevil can complete its development in 18 days, and produce up to six generations in a growing season.



Shaded section indicates overwintering stage

Hosts

Boll weevil can complete its life cycle only on cotton or related species of *Gossypium*; *Cienfuegosia rosei, Hampea rovirosae* or *Pseudabutilon lozani*. It may consume pollen from other plants, but cannot live on them.

Damage

Adults and larvae are the damaging stages, using their chewing mouthparts. Adult feeding does not cause important damage, but does indicate boll weevil presence and egg deposition. Larvae consume the contents of the developing square. That feeding causes the square to lighten in color and the square bracts to open. It eventually falls to the ground. Each square that is infested results in direct yield loss. If enough squares are infested, the plant simply becomes a rank, vegetative plant with few cotton bolls.

Management

Boll weevil has been eradicated from Oklahoma using an area-wide approach that involved trapping with an insecticide program. The Boll Weevil Eradication Act was passed by the Oklahoma Legislature in 1993. The Oklahoma Boll Weevil Eradication Organization was declared a state agency in July, 1997. In October 1997, an assessment referendum was submitted for a vote which passed by an 88 percent vote. The eradication effort began in 1998, and successfully eradicated the boll weevil in 2008. Producers continue to fund the eradication maintenance program.

BOLLWORM/BUDWORM COMPLEX:

Order Lepidoptera: Family Noctuidae

BOLLWORM: *Helicoverpa zea* (Boddie)



Steve L. Brown, University of Georgia, Bugwood.org



Clemson University-USDA Cooperative Slide Series, Bugwood.org

TOBACCO BUDWORM: *Heliothis virescens* (F.)



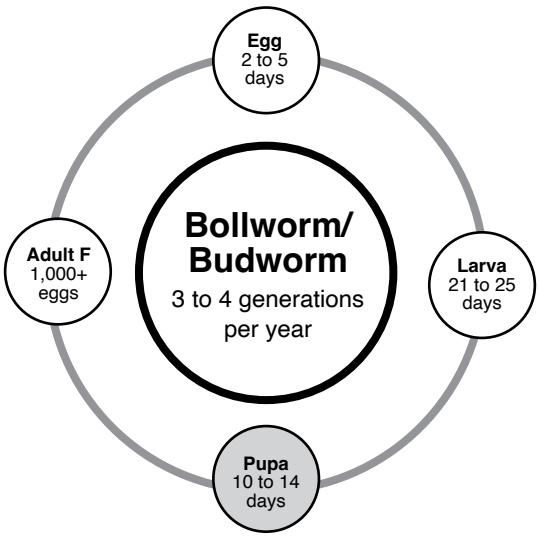
Joseph Berger, Bugwood.org



Russ Ottens, University of Georgia, Bugwood.org

Description

The adult bollworm moth is usually light yellowish olive with a single dark spot near the center of each front wing, but some adults have vague darker markings on the wings. The wingspread is about 1.5 inches. Tobacco budworm moths are light olive to brownish-olive, with a wingspan of about 1.25 inches. Each front wing has three slanted, dark olive or brown bands. Hind wings are white with dark margins. The eggs of both are almost spherical with a flattened base and white or cream in color. The larvae vary in color, ranging from shades of pink, yellow, green, brown and black. The color depends to some extent on the host plant. They usually have darker or lighter stripes running lengthwise on the body. They can be positively identified by the presence of short, sharp microspines between the hairs on the body, but magnification of 7 to 10x is necessary to see these spines.



Shaded section indicates overwintering stage

Notes

Notes

Life Cycle

Bollworms and budworms have very similar life cycles. They overwinter as pupae in the top inch or two of the soil. Adults begin to emerge in early spring. Moths also migrate north from Texas, augmenting the population that overwinters in Oklahoma. Eggs are laid on the buds or fruit of host plants. Larvae feed for 21 to 25 days before entering the soil to pupate. They prefer buds or fruit but will also feed on the leaves of many different plants. First-generation larvae are found mostly in alfalfa and seldom cause problems in vegetables. Second generation larvae commonly damage cotton beginning in mid-May.

Hosts

Bollworms and tobacco budworms feed on a variety of cultivated and weedy plants. Besides cotton, they feed on other field and vegetable crops, some ornamentals and a wide variety of wild plants. The name of the bollworm caterpillar is often based on the host plant, e. g. corn earworm, tomato fruitworm, bollworm, soybean podworm or sorghum headworm. Tobacco budworms feeds on tobacco and cotton, but they also feed on some common weeds, including beggarweed, groundcherry and ageratum.

Damage

Damage is caused by larvae using their chewing mouthparts. They feed on leaves, buds, squares, blooms and bolls. They begin by feeding on leaf tissue but feed on larger plant parts as they grow.

Management

Most cotton varieties now incorporate the gene that produces the Bt toxin, typically known as Bollgard. Despite their widespread use, the trend is that this complex was becoming more tolerant of the toxin that is being produced within the plant. Over time, this technology has been replaced with cottons that stack multiple Bt toxins. For example, Bollgard 3, WideStrike 3 and TwinLink Plus. They do not require any non-Bt cotton refuges, unlike the original Bollgard cottons. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

COTTON APHID:
Aphis gossypii Glover

Order Hemiptera: Family Aphididae



Richard Grantham, Oklahoma State University



Mohammed El Damir, Bugwood.org

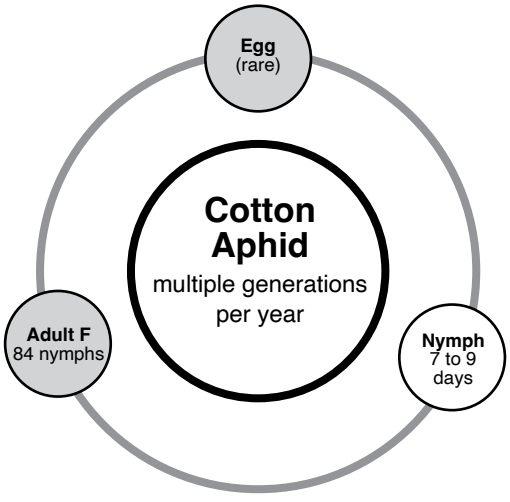
Description

Cotton aphid is also known as the melon aphid. This soft-bodied, pear-shaped insect is pale to dark green in cool seasons and yellow in hot, dry summers. Though winged forms develop periodically, most adults are wingless and about 0.6 of an inch long. All forms have a pair of tailpipe-like appendages known as cornicles. The nymphs are smaller than, but similar in shape and color, to the wingless adults. (Cow pea aphid is also a pest of cotton).

Life Cycle

Cotton aphids spend part of the winter on weed hosts on cold-tolerant plants. In spring, winged females fly to suitable host plants and give birth to living young. Each female produces an average of 84 nymphs. With favorable conditions, a nymph will mature in about eight days and begin producing progeny. Most nymphs develop into wingless female adults. However, when crowding occurs or food becomes scarce, winged adults develop and fly to new host plants. This aphid is also a pest of many plants in greenhouses where it breeds continuously. Many overlapping generations are produced each year.

In northern regions, a gynopara (winged female) will fly to its primary host (Rose of Sharon or catalpa) and produce male and female forms that mate. The female ovipara lays eggs that will overwinter. Females that hatch from eggs will either feed on the primary host continuously, or produce winged forms that migrate to feed on secondary hosts.



Shaded section indicates overwintering stage

Hosts

Primary host is Rose of Sharon or catalpa. A wide range of field and ornamental as well as vegetable crops may be infested by cotton aphid. Some vegetable hosts include asparagus, beans, beet, cowpeas, cucurbits, eggplant, okra, spinach and tomato. Among cucurbits, cucumber and watermelon are most likely to be infested, followed by squash and pumpkin.

Damage

Cotton aphids feed on plant sap with piercing/sucking mouthparts. They are considered to be a secondary pest of cotton. They prefer to feed on the underside of leaves. Damage usually becomes obvious on cotton when cotton leaves begin to curl downward and pucker, and older leaves turn yellow. Heavily infested plants may begin to shed squares. Honeydew secreted by aphids makes plants sticky and enhances development of black sooty mold on plant foliage.

Notes

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Management

Insect parasites and predators are important natural control agents of cotton aphids. In addition, damp weather promotes a fungus disease and hard, driving rains tend to kill large numbers of aphids. If 20 percent of aphids are mummies or are infected with fungus, populations will generally decline. Aphids can also be controlled by cultural practices. Early planted cotton is less likely to become infested. Insecticides should be applied when it becomes evident that natural and cultural controls are not keeping aphids in check. Treatment threshold is 50 percent of plant terminals are infested and aphids average 50 per leaf. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control and OSU Extension* and Fact Sheet EPP-7313, *Home Vegetable Garden Insect Pest Control*.

COTTON FLEAHOPPER: *Pseudatomoscelis seriatus* (Reuter)

Order Hemiptera: Family Miridae



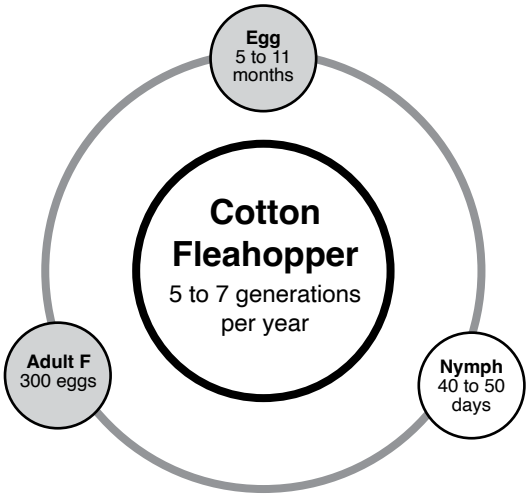
James Smith, Mississippi State University, Bugwood.org

Description

Cotton fleahopper is oval-shaped, about 0.125 of an inch long, yellowish to pale green to nearly translucent white with prominent antennae. They have tiny "hairy" black spots on their legs and the back of their wing covers. Nymphs are similar in color but are wingless. Newly born nymphs have red eyes that turn dark as they age.

Life Cycle

The cotton leafhopper has three life stages: egg, nymph (five instars) and adult. Eggs are the overwintering stage. Non-overwintering eggs hatch in 11 days and nymphs require 14 or 16 days to mature. Five to seven generations are produced per year. This insect typically moves from weed hosts into cotton.



Shaded section indicates overwintering stage

Hosts

Wooly croton (*Croton caputatus*), horsemint and beebalms (*Monarda* spp.), cutleaf evening primrose and other *Oenothera* spp. and silverleaf nightshade (*Solanum elaeagnifolium*) are preferred hosts.

Damage

Both adults and nymphs feed on cotton sap with their piercing/sucking mouthparts. As they feed, they focus on leaf and fruit buds (called squares), causing them to turn brown and abort. The physical appearance of these dying buds are called blasted. Heavy infestations that result in significant leaf and flower bud abortion causes the main internodes of the plant to shorten with numerous sucker shoots so the plant is described as "whippy."

Management

The treatment threshold is based on the squaring rate and level of cotton fleahopper infestation. They can be sampled visually by examining plant terminals or with a sweep net. When cotton fleahoppers (adults and nymphs) reach or exceed 30 per 100 terminals or 12 to 15 per 100 sweeps during the first three weeks of square set, treatment is justified. Once first bloom is reached, treatment is rarely justified. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

Notes

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LYGUS BUG COMPLEX:

Order Hemiptera: Family Miridae

***Lygus lineolaris* (Palisot de Beauvois)**



Scott Bauer, USDA ARS, Bugwood.org

***Lygus hesperus* Knight**



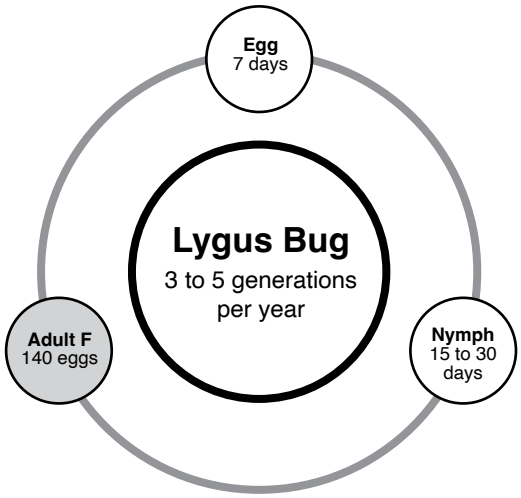
Whitney Cranshaw, Colorado State University, Bugwood.org

Description

Known as the tarnished plant bug and western tarnished plant bug, the adult measures 0.2 to 0.24 of an inch long. The head and body are brown with yellowish and reddish markings. Typical is a V shape on the scutellum behind the head. The beak is four-segmented.

Life Cycle

Adults overwinter in vegetation in fields, timber margins and road ditches. They emerge in spring and lay eggs in the stems and leaf midribs of host plants. Eggs hatch in five to 17 days, and nymphs live from 15 to 30 days, molting five times before becoming adults. Oklahoma experiences three to five generations. They prefer to feed on plants that are about to flower.



Shaded section indicates overwintering stage

Hosts

Plant hosts are numerous, including hundreds of plant species. They feed on many vegetable and fruit crops including apple, blackberry grape, peach, pear, plum, strawberry, green pepper, lettuce and tomato. Crops include alfalfa, cotton and soybean. They will feed on many weed species including bitterweed, horseweed, smartweed, sunflower, vetch, pepperweed, wild mustard, wooly croton and henbit. They are also known to feed on other insects, including the alfalfa weevil, pea aphid, spotted alfalfa aphid and insect eggs.

Damage

Lygus bugs are a major pest of alfalfa seed production, but not for forage production. They are a pest of cotton, especially when the cotton is located near an alfalfa field, because they leave the alfalfa and move into cotton in late summer. Both adults and nymphs feed on cotton squares and small bolls. They feed by inserting their mouthparts into the tissue and sucking. Small to medium-sized squares will usually darken, shrivel and fall from the plant, while larger squares may remain on the plant. However, flowers may have tan to brownish colored markings and are referred to as a dirty blooms. These dirty blooms will often have blackened shriveled anthers incapable of producing pollen. Bolls that develop from these blooms may be malformed and lopsided because some locules do not produce seed and lint. These bolls are often called parrot-beaked bolls. Lygus will feed on bolls as well, causing small black sunken spots on the outside of the boll. Small bolls that are fed upon may suffer internal damage, including stained lint and empty locules.

Management

Cotton varieties, commonly known as ThryvOn, provide early season protection against insect pests. The Bt protein in ThryvOn cotton varieties works by deterring lygus bug feeding and causing mortality in small nymphs, as well as reducing thrips reproduction. Plant bugs can be found on ThryvOn cotton varieties but should not be causing damage. ThryvOn varieties should reduce the need for scouting and managing lygus bugs.

Avoid planting cotton near alfalfa. Plant cotton so it does not promote rank growth. Sweep nets can be used to assess lygus density. Treat when densities reach eight to 15 lygus per 100 sweeps during the first three weeks of squaring coupled with unacceptable square set. Treat when densities reach 15 to 20 per 100 sweeps after peak bloom, and fruit set is unacceptable. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

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PINK BOLLWORM: *Pectinophora gossypiella* (Saunders)

Order Lepidoptera: Family Gelechiidae



Mississippi State University, Bugwood.org



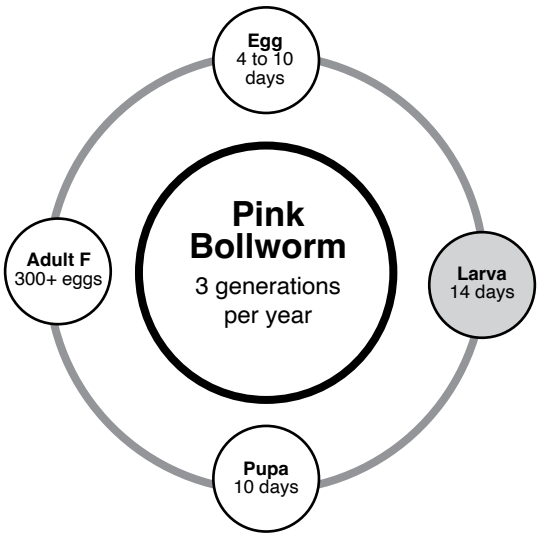
Peggy Greb, USDA ARS, Bugwood.org

Description

Pink bollworm moths are about 0.38 of an inch long with mottled brown and gray, oval shaped wings. Antennae are about half the length of the body. Larvae are white with a black head when first hatched. As they grow, they develop the distinct pink bands that gave them their common name. Mature larva reach 0.5 of an inch long.

Life Cycle

The pink bollworm has four life stages: the egg, larva (four instars), pupa and adult. They overwinter as fourth instar larvae in the soil or fallen, discarded bolls. The adult moth will emerge in late spring, and lay up to 200 eggs in cotton during a 10-day period. Eggs are typically placed in groups of five to 10 on leaves, stems, terminals and squares. The can produce three to four generations per year, however three is typical for Oklahoma.



Shaded section indicates overwintering stage

Hosts

Besides cotton, pink bollworm can feed on *Hibiscus cardiophyllus*, *H. coulteri* and *H. dendulatus*. It has been known to feed on okra (*Hibiscus esculentus*) and hollyhock (*Althaea rosea*).

Damage

Pink bollworm larva is the damaging stage. They feed on cotton fruit with their chewing mouthparts. The first generation is not considered to be economically damaging. They will feed mainly on cotton squares, eating the pollen and plant material. As the infested squares develop, they produce blooms that the larvae tie together with silk webbing. These flowers are called rossetted. Second generation larvae feed on developing bolls, eating the seed and lint within a boll chamber. They cause direct yield loss, but can also open the boll to boll rot fungi.

Management

Pink bollworm is an infrequent pest of cotton in Oklahoma, and in fact, was removed from the list of pink bollworm-quarantined states in 2002 (67 FR 58320). Pink bollworm was traditionally managed using a host-free planting period coupled with insecticide applications. A pink bollworm eradication program was initiated around 2001 using a sterile male technique, combined with the use of transgenic cotton in an area-wide approach. It seems to have been successful in eradicating it from the continental U.S. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

STINK BUGS

Order Hemiptera: Family Pentatomidae

Green stink bug *Chinavia hilaris* (Say)
Brown stink bug *Euschistus servus* (Say)
Southern green stink bug *Nezara viridula* (L.)


Richard Grantham, Oklahoma State University



Herb Pilscher, USDA ARS, Bugwood.org



Herb Pilscher, USDA ARS, Bugwood.org

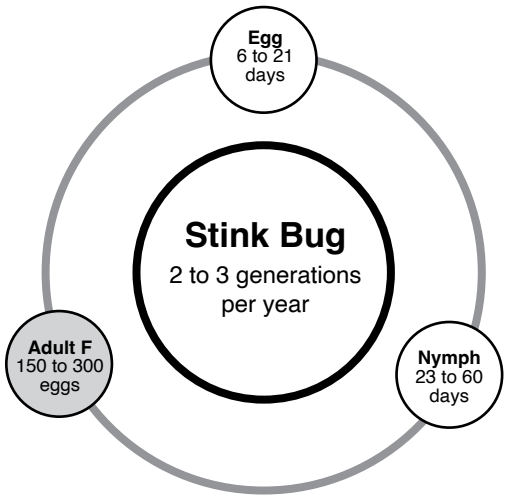

Richard Grantham, Oklahoma State University



Ron Smith, Auburn University, Bugwood.org

Description

The green stink bug measures from 0.5 to 0.75 of an inch in length and about 0.5 of an inch wide. The brown stink bug measures from 0.5 to 0.6 of an inch. Stink bugs will vary in color from bright green to a dull brown and have a characteristic shield (five-cornered) shape. The green stink bug is, as the name implies, green and has characteristic slender mouthparts containing stylets that function to suction plant juices from the tissue once the mouthparts have pierced the surface. Although this species is common in soybean, there are similar species that resemble the green stink bug and create the same damage. The brown stink bug is brown and can cause the same type of injury. The nymphs are similar to the adults, but lack wings and may also possess bright red, yellow or orange markings on the abdomen. They may range in size from about 0.125 of an inch long to nearly 0.5 of an inch long when mature.



Shaded section indicates overwintering stage

Life Cycle

Stink bugs overwinter as adults in protected areas such as fence rows, grassy field borders, under stones or bark of trees. They become active during the first warm days of spring. Stink bugs

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may undergo two to three generations during a growing season. Egg laying can occur anytime adults are present from May through August. Eggs will hatch from six days to three weeks, depending on temperatures. The five nymphal instars require 23 to 60 days to reach adulthood. Female bugs may move readily between weeds and other alternate hosts, such as fruit trees and pecans.

Hosts

Stink bugs injure soybean as adults and nymphs. They also feed on fruits, nuts, corn, sorghum seeds and many other crops.

Damage

Stink bugs eat plant fluids by piercing plant tissue with their piercing and sucking beaks. They will attack leaves, stems, blooms and seeds, but prefer tender, rapidly-growing plant tissue. Damage occurs from their digestive fluids that they inject into the plant, resulting in deformation of leaves and stems, abortion of seed pods and reduction in quality of seeds. The resulting wounds also serve as an entry point for plant diseases. Heavy feeding can delay leaf maturity and abnormal development of leaves, stems and seeds. Seed feeding in particular, can result in deformed, underdeveloped, shriveled and discolored seeds. Yield loss can be severe.

Management

Monitoring for stink bugs can be accomplished with ground (drop) cloths or sweep nets. A treatment threshold of one or more stinkbugs per row-foot warrants control. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control* and *OSU Extension fact sheet EPP-7106 Managing Stink Bugs in Oklahoma Cotton Production.*

THRIPS

Order Thysanoptera: Family Thripidae

Onion thrips: *Thrips tabaci* Lindeman
Western flower thrips: *Franklienella occidentalis* (Pergande)



Alton Sparks, Jr., University of Georgia, Bugwood.org



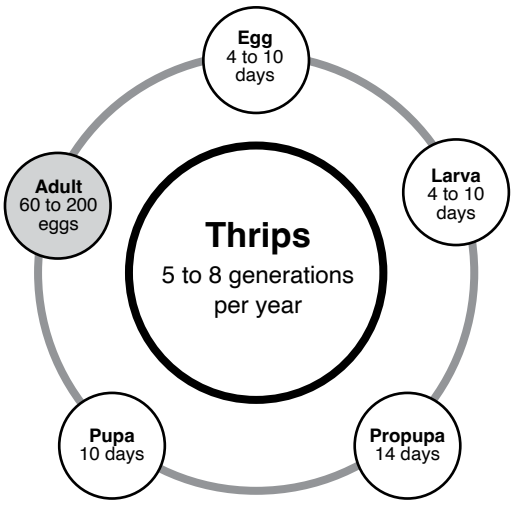
John C. French Sr., Retired, Universities: Auburn, GA, Clemson and U. of Mo, Bugwood.org

Description

The adults range from pale yellow to dark brown and are about 0.3 of an inch long. They have two pairs of narrow wings fringed with long hairs. Newly hatched larvae are white, but older larvae are yellow or green. Larvae do not have wings.

Life Cycle

Thrips have five life stages: egg, larva (two instars), propupa, pupa and adult. They typically spend the winter in sheltered areas of live or dead plants, including wheat, alfalfa or clover. In spring, development resumes and winged adults search for suitable host plants. Adults may migrate from senescing wheat or recently cut alfalfa or clover to other host plants including vegetable crops. Female thrips can reproduce without mating. Unfertilized eggs produce males, and fertilized eggs produce both males and females. A female thrips produces 10 to 100 eggs, which she inserts singly into tender plant tissue. Eggs hatch four to 10 days later and larvae feed for about five days before moving into the soil. The propupa and pupa live in the soil. New adults emerge about four days later. Although winged adults are weak fliers, they are capable of flying from plant to plant and may be carried long distances by wind. There are probably five to eight generations per year.



Shaded section indicates overwintering stage

Hosts

Besides cotton, onion, garlic and related plants are commonly attacked. These species also feed on a wide variety of other vegetables, flowers, weeds and grasses.

Damage

Thrips are an early-season pest of cotton. They are most damaging during cool, wet periods when small cotton grows slowly. They rasp the tender parts of leaves, flowers and fruit with their sharp mouthparts and feed on escaping juices. Leaves and fruit develop silvery blotches or scratch-like markings. Light infestations tend to delay plant growth and retard maturity. Heavier infestations cause the leaves to become curled, crinkled and twisted; growth stops and terminal buds may be destroyed, resulting in plants that produce excessive branching. While they are considered a pest, western flower thrips will feed on mite eggs.

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Management

Cotton varieties, commonly known as ThryvOn, provide early season protection against insect pests such as thrips. The Bt protein in ThryvOn cotton varieties works by deterring plant bug feeding and causing mortality in small nymphs, as well as reducing thrips reproduction. Thrips can be found on ThryvOn cotton varieties but should not be causing damage. ThryvOn varieties should reduce the need for scouting and managing early season thrips.

Good cultural practices can limit onion thrips populations. Destruction of volunteer plants and crop residue after harvest eliminates many favorable overwintering sites. Avoid planting during cool conditions. Avoid planting cotton near small grains or onions.

Scout carefully examining 25 plants in four areas of the field, looking carefully for adult and larvae. Inspect the upper and lower side of each leaf. Thresholds from Texas A&M are based on thrips number and plant growth stage.

Cotton stage	Action threshold
Emergence to 1 leaf	1 thrips per plant
2 true leaves	2 thrips per plant
3 true leaves	3 thrips per plant
4 true leaves	4 thrips per plant
5 to 7 true leaves	Treatment rarely justified

Specific insecticide suggestions can be found in the E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control* and OSU Extension fact sheet F-7313, *Home Vegetable Garden Insect Pest Control*.

PEANUT INSECTS

PEANUT GROWTH STAGES

Growth stage	Code	Description
0: Germination		
	00	Dry seed
	01	Beginning of seed imbibition
	03	Seed imbibition complete
	05	Radicle emerged from seed
	07	Hypocotyl with cotyledons breaking through seed coat
	08	Hypocotyl reaches the soil surface; hypocotyl arch visible
	09	Emergence: hypocotyl with cotyledons arising above soil surface (“cracking stage”)
1: Leaf development (main shoot)		
	10	Cotyledons completely unfolded[1]
	11	First true leaf (pinnate) unfolded[1]
	12	Second true leaf (pinnate) unfolded[1]
	13	Third true leaf (pinnate) unfolded[1]
	1.	Stages continuous till...
	19	Nine or more true leaves unfolded.[1] No side shoots visible[2]
2: Formation of side shoots[3]		
	21	First side shoot visible
	22	Second side shoot visible
	23	Third side shoot visible
	2.	Stages continuous till...
	29	Nine or more side shoots visible
3: Main stem elongation (Crop cover)		
	31	Beginning of crop cover: 10 percent of plants meets between rows
	32	20 percent of plants meets between rows
	33	30 percent of plants meets between rows
	34	40 percent of plants meets between rows
	35	50 percent of plants meets between rows
	36	60 percent of plants meets between rows

377	0 percent of plants meets between rows
38	80 percent of plants meets between rows
39	Crop cover complete: 90 percent of plants meets between rows
5: Inflorescence emergence	
51	First inflorescence buds visible
55	First individual flower buds visible
59	First flower petals visible. Flower buds still closed
6: Flowering	
61	Beginning of flowering
62	First carpophore pegs visible
63	Continuation of flowering
64	First carpophore pegs visibly elongated
65	Full flowering
66	First carpophore pegs penetrating the soil
67	Flowering declining[4]
68	Tip of first carpophore pegs growing horizontally in the soil
69	End of flowering[4]
7: Development of fruits and seeds	
71	Beginning of pod development: tip of first carpophore pegs swollen (at least twice the original diameter)
73	Continuation of pod development: beginning of pod filling: first pods have attained final size and are ripening
75	Main phase of pod development: continuation of pod filling
77	Advanced pod filling
79	Fresh seeds fill the cavity of the pods which have attained their final size
8: Ripening of fruits and seeds[5]	
81	Beginning of ripening: about 10 percent of pods developed to final size are ripe
82	About 20 percent of pods developed to final size are ripe
83	Continuation of ripening: about 30 percent of pods developed to final size are ripe
84	About 40 percent of pods developed to final size are ripe
85	Main phase of ripening: about 50 percent of pods developed to final size are ripe
86	About 60 percent of pods developed to final size are ripe
87	Advanced ripening: about 70 percent of pods developed to final size are ripe
88	About 80 percent of pods developed to final size are ripe
89	Full maturity: nearly all pods developed to final size are ripe
9: Senescence	
91	About 10 percent of above ground parts of plant dry
92	About 20 percent of above ground parts of plant dry
93	About 30 percent of above ground parts of plant dry
94	About 40 percent of above ground parts of plant dry
95	About 50 percent of above ground parts of plant dry
96	About 60 percent of above ground parts of plant dry
97	Above ground parts of plant dead
99	Harvested product

[1] Leaves are counted from the cotyledon node (= node 0)
[2] Side shoot development may occur earlier; in this case continue with principal growth stage 2
[3] Only for varieties with a determinate flowering period
[4] Criteria of maturity: Pericarp hard, with distinct texture, can be split open easily;
[5] Munger, L.; H. Bleiholder; H. Hack; M. Hess; R. Stauss; T. van den Boom; E. Weber (1998). “Phenological Growth Stages of the Peanut plant (Arachis hypogaea L.) Codification and Description according to the BBCH Scale – with figures.”. Journal of Agronomy and Crop Science. 180 (2): 101–107. doi:10.1111/j.1439-037X.1998.tb00377.x.

ARMYWORMS

Order Lepidoptera: Family Noctuidae

BEET ARMYWORM: *Spodoptera exigua* (Hübner)



Richard Grantham, Oklahoma State University



Robert Baurenfeind, Kansas State University, Bugwood.org

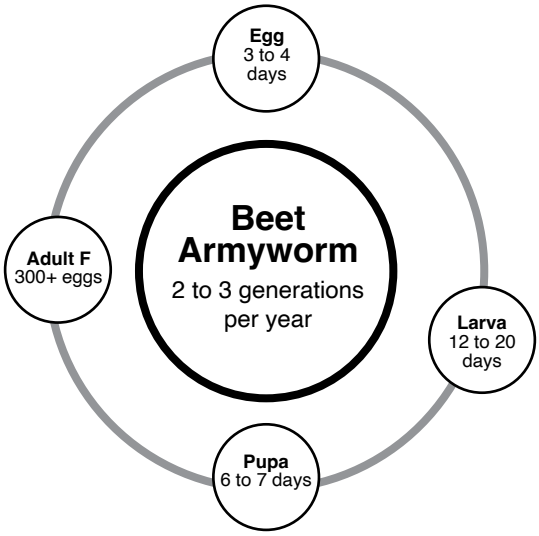
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Description

Adult beet armyworms are light colored, forewings have irregular banding and hindwings are grayish white with a darker line along the outer wing margin. Wingspan is about 1 to 1.4 inches. Larvae are pale green to yellow when young, but fully grown larvae measures about 1 inch and has a green body (sometimes dark) with a pink or yellow stripe that is bordered with a thin white line along each side. They have five pairs of abdominal prolegs and often have a black spot along the second thoracic segment. Eggs are laid in clusters of 50 to 150, and often are covered with a layer of whitish scales from the female body that give them a fuzzy appearance.

Life Cycle

Beet armyworm has four life stages: egg, larva (five instars), pupa and adult. Eggs typically hatch in three to four days in warm weather. Larvae can complete their growth in 12 to 20 days. They pupate in the soil for about six to seven days. Total time from egg to adult can occur in as little as 25 to 40 days. Beet armyworm does not overwinter in Oklahoma, but they can complete two or more generations in a growing season.



Shaded section indicates overwintering stage

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FALL ARMYWORM: *Spodoptera frugiperda* (J. E. Smith)



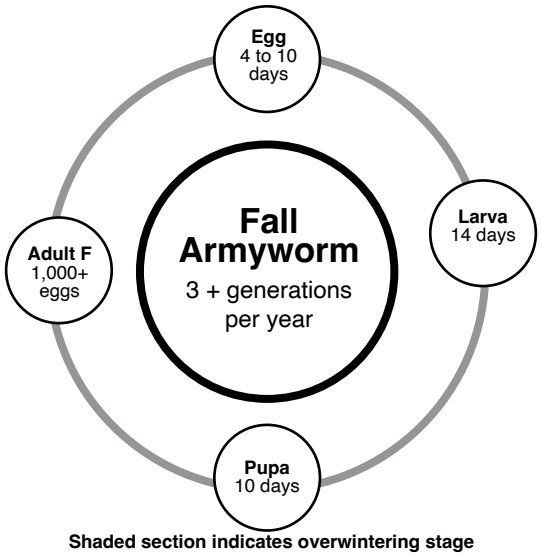
Frank Peairs, Colorado State University, Bugwood.org



Lyle Buss, University of Florida, Bugwood.org

Description

Male moths have dark gray front wings mottled with darker and lighter splotches. There is a prominent pale, diagonal marking near the center of the front half of each wing and a prominent white spot at the extreme tip. The front wings of female moths are dull gray brown with only small, inconspicuous markings. The hindwings of both sexes are white with a slight purplish sheen. The wingspan is about 1.5 inches. Eggs are pale gray, laid in masses and covered with grayish, fuzzy scales from the body of the female. Larvae have five pairs of abdominal prolegs and measure 1.5 inches when fully grown. Body color may be green, brown or almost black with black and reddish brown stripes on each side of the body and four small black spots on the dorsal side of each abdominal segment. The head capsule is mostly black and is marked with a pale, inverted Y on the front (see page 116).



Shaded section indicates overwintering stage

Life Cycle

The fall armyworm does not overwinter in Oklahoma, and infestations develop from moths that migrate northward from Texas or Mexico. They usually reach the state by late June. Each female lays about 1,000 eggs in masses of 50 to several hundred. Larvae are present by early July. After feeding for two to three weeks, the larvae dig into the soil to pupate. A new generation of moths emerges about two weeks later. There are several overlapping generations extending into October or even November in some years.

YELLOWSTRIPED ARMYWORM: *Spodoptera ornithogalli* (Guenée)



Russ Ottens, University of Georgia, Bugwood.org



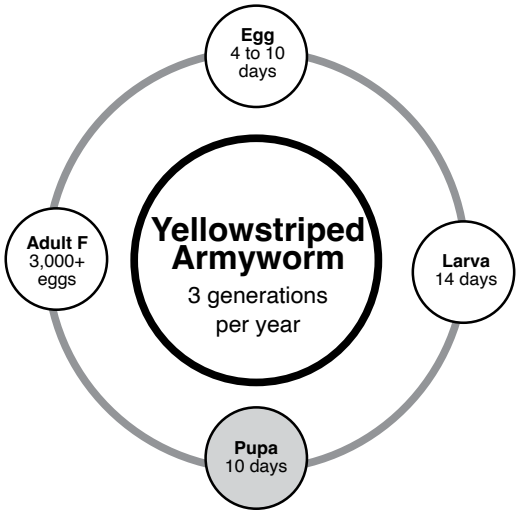
Natasha Wright, Cook's Pest Control, Bugwood.org

Description

The moths body is brown measuring about 0.5 inch with a wingspan of 1.3 to 1.5 inches. Forewings are brownish gray with an intricate pattern of light and dark markings. There is an asymmetrical set of whitish bands near the center of the wings. The hindwings are opaquely white with a narrow brown line along the outer margin of the wing. Larvae have five pairs of abdominal prolegs and measure up to 2 inches when mature. Body color varies from green when small to nearly black when large. They have two cream-yellow to orange stripes along the back, and a prominent dark spot on each side of the fourth abdominal segment. Partially grown larvae appear to have pairs of dark, triangular markings along the back of each body segment just above the light-colored stripes.

Life Cycle

Oklahoma experiences two to three generations annually. Yellowstriped armyworm overwinters as a pupa. A female lays eggs in cluster of 200 to 500 eggs on the underside of leaves. The female covers the eggs with body scales. Eggs hatch in three to 10 days. Larvae are initially gregarious, but disperse after a few days. They grow through six instars in 14 to 21 days. They pupate in the soil, where they remain for nine to 22 days.



Shaded section indicates overwintering stage

Hosts

Yellowstriped armyworm is a general feeder. Its host plants include alfalfa, canola, corn, cotton, sorghum, soybean, sunflower, wheat and numerous vegetable crops. Weed hosts include dock (*Rumex* spp.), gumweed (*Grindelia* spp.), horse nettle (*Solanum* spp.), horseweed (*Erigeron* spp.), lambsquarters (*Chenopodium* spp.) and pigweed (*Amaranthus* spp.).

Damage

Damaging stage is the larva. Beet, fall and yellowstriped armyworms are potential peanut pests in peanut in July and August. Large numbers can consume all aboveground plant parts with their chewing mouthparts, and they are capable of killing or severely retarding the plant growth. This species may migrate in large numbers in search of new areas in which to feed.

Management

Peanut is particularly vulnerable when plants are 60 to 90 days old. Fields should be inspected frequently. Threshold is three to five larvae per foot of row in rain-fed peanut, and six to eight larvae per foot or row in irrigated fields.

See the E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control* for specific insecticide suggestions.

Notes

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LESSER CORNSTALK BORER: *Elasmopalpus lignosellus* (Zeller)

Order Lepidoptera: Family Pyralidae



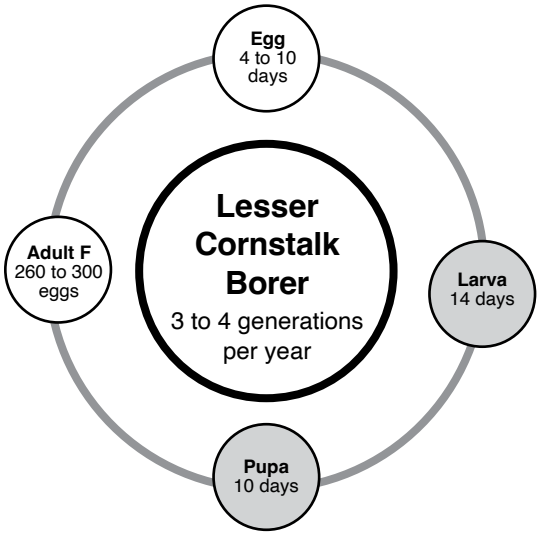
David Riley, University of Georgia, Bugwood.org



John C. French Jr., Retired, Universities: Auburn, GA, Clemson and U of MO, Bugwood.org



Mark Dreiling, Bugwood.org



Shaded section indicates overwintering stage

Description

The male moth has brown yellow front wings with gray margins and several dark spots. The female's front wings are nearly black. The wing spread is about 1 inch. The larvae are slender, blue green, brown-striped caterpillars about 0.75 of an inch long when mature. Larvae become very active and thrash about violently when disturbed.

Life Cycle

Lesser cornstalk borer overwinters as larvae or pupae, but they usually spend most of the winter as larvae and pupate in late winter or early spring. Moths emerge early in the spring and lay eggs on or near the hosts leaves or stems. The eggs hatch in two to seven days. Larvae may first feed on leaves or roots or tunnel up the main stem of a plant. Later, they construct underground silken tubes or burrows from which they bore into plants near the ground line. They become fully grown in two to three weeks, leave their burrows and spin silken cocoons under trash on the surface of the ground. In these cocoons, they change to pupae from which moths emerge in two to three weeks. There appears to be at least three generations per year in Oklahoma.

Hosts

The lesser cornstalk borer feeds on corn, beans, cowpeas, crabgrass, Johnsongrass, peas, peanuts, sorghum, soybeans and wheat.

Damage

Larva is the damaging stage. It can tolerate hot, dry conditions, thus damage is most prevalent in crops grown on sandy soils during dry conditions. Injury is caused when a larva bores into the stalk

of a host plant or girdles the stem with its chewing mouthparts. Stalks on larger plants can break off when infested. The larvae bore into pegs and developing pods of peanuts and they may feed on the roots of host plants.

Management

Damage is most frequent when plants are under water stress. The lesser cornstalk borer will make sand/silken tunnels that surround the infested plant. Fall and winter cleanup of fields and field margins as well as rotations with crops not attacked by this pest materially reduce the damage. Irrigation is the best treatment. Specific insecticide suggestions can be found in E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control*.

Notes

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POTATO LEAFHOPPER: *Empoasca fabae* (Harris)

Order Hemiptera: Family Cicadellidae

Potato leafhopper adult



Empoasca adult, Wikipedia.org

"Hopper burn"



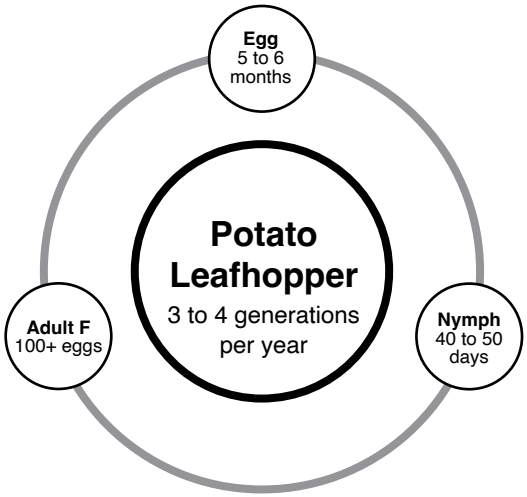
John C. French Jr., Retired, Universities: Auburn, GA, Clemson and U of MO, Bugwood.org

Description

The adult is small, green, wedge-shaped and about 0.125 of an inch long. There are a number of small, pale yellow or white spots on the body. The hind legs are long and enable the insect to jump a considerable distance. The nymphs (immature insects) are similar in shape to the adults, but lack wings. They are pale green in color.

Life Cycle

This insect overwinters in the Gulf Coast states and migrates into Oklahoma in the spring or more likely early summer. Large numbers of flying adults often appear suddenly in fields soon after the plants come up. Beginning three to 10 days after mating, females use their sharp ovipositors to insert eggs into the main veins or petioles of leaves. Each female lives a month or more and produces two or three eggs per day. Eggs hatch in about 10 days and the nymphs mature in about two weeks. Nymphs usually mature on the leaves where they hatched. Mating occurs about 48 hours after maturation and the life cycle is repeated. There are three or four generations per year.



Shaded section indicates overwintering stage

Hosts

In addition to peanut, potato leafhoppers feed on more than 200 cultivated and wild plants including alfalfa and soybeans, where they cause similar hopper burn symptoms.

Damage

Both nymphs and adults feed on the undersides of leaves with their piercing/sucking mouthparts. By extracting sap, they cause stunting of plants, curling of leaf margins and crinkling of the upper surface of leaves. While feeding, leafhoppers also inject a toxic substance into plants which, in most hosts, causes a condition known as hopper burn. This condition is characterized by a yellowing of the tissue at tips and margins of leaves that increases until the leaves die. Symptoms of leafhopper damage are sometimes confused with drought stress. They can severely stunt alfalfa and reduce forage production.

Management

Georgia thresholds suggest that treatment may be considered if 20 to 30 percent of plants have hopper burn and leafhoppers are present. If an insecticide application is being considered, specific registered insecticides can be found in E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control*.

REDNECKED PEANUTWORM: *Stegasta bosqueella* (Chambers)

Order Lepidoptera: Family Gelechiidae



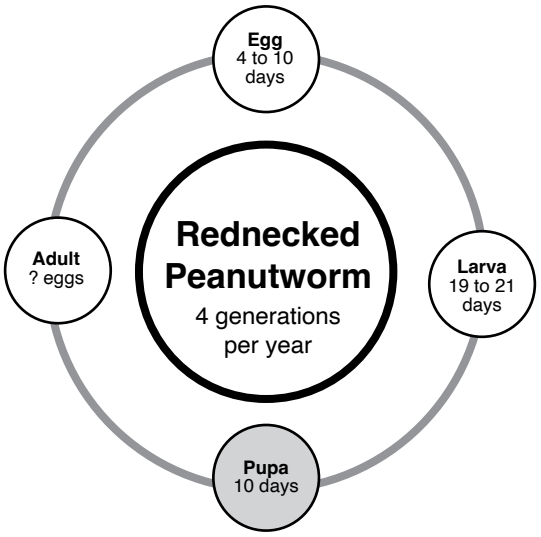
John C. French Sr. Retired, Universities: Auburn, GA, Clemson and U. of MO. Bugwood.org



Mark Dreiling, Bugwood.org

Description

The adult moth is small, with a whitish-yellow head, brown antennae, brown forewings with three white marks on the forewings that create a whitish-yellow configuration when at rest. Fully-grown larvae measure 0.3 to 0.4 of an inch. The head capsule is brownish, the "neck" is red and the body is cream white.



Shaded section indicates overwintering stage

Life Cycle

Rednecked peanutworm overwinters as a pupa in the soil. It undergoes four generations in Oklahoma. Females lay about 16 eggs that hatch in three to 10 days. Larvae undergo five instars in about nine to 21 days. Larvae spin a thin, silken cocoon that encloses the pupae, which emerge as adults in six to 12 days. They overwinter as pupae in the soil.

Hosts

Besides peanut, rednecked peanutworm has been recorded to feed on alfalfa (*Medicago sativa*), Partridge pea (*Cassia fascicluata*), prairie acacia (*Acacia anqustissima*), field pea (*Pisum arvense*), hairy vetch (*Vicia villosa*), cowpea, soybean and kudzu (*Pueraria thumbergiana*).

Damage

Damaging stage is the larva. This insect is a foliage feeder using its chewing mouthparts. It feeds in the terminals of developing peanut plants on young leaves that have not yet expanded. Damage is mostly cosmetic, but populations can build late in the growing season. Because they feed on folded leaves, damage can seem more severe. Once leaves have fully expanded, the level of defoliation is not significant.

Management

Inspect plants in several locations, and unfold terminal leaves. Treatment is seldom necessary, and research suggests that yield return from control does not justify cost of an application.

Notes

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THRIPS

Order Thysanoptera: Family Thripidae

WESTERN FLOWER THRIPS: Frankliniella occidentalis (Pergande)



Frank Peairs, Colorado State University, Bugwood.org



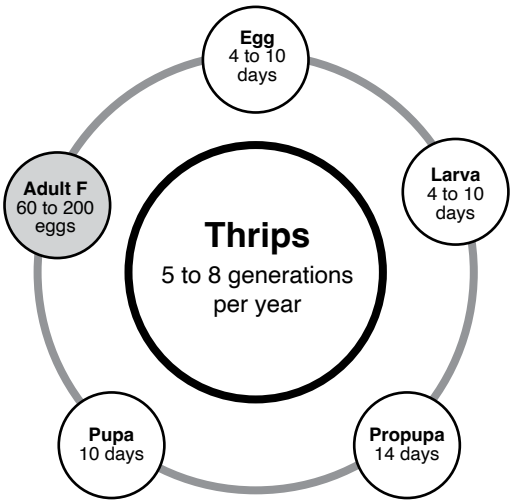
John C. French, Sr., Retired, Universities: Auburn, GA, Clemson and U of MO, Bugwood.org

Description

Thrips have five life stages: egg, larva (two instars) propupa, pupa and adult. The most common species in peanut are the western flower thrips and the onion thrips. The adults are cigar-shaped with a body color that ranges from pale yellow to dark brown and are about 0.03 to 0.06 of an inch long. Adults have two pairs of narrow wings fringed with long hairs. Newly hatched larvae are white and older larvae are yellow or green. Larvae do not have wings.

Life Cycle

Thrips spend the winter in sheltered areas of live or dead plants, including wheat, alfalfa or clover. In spring, development resumes and winged adults search for suitable host plants. Adults may migrate from senescing wheat or recently cut alfalfa or clover to peanut. A female thrips produces 10 to 100 eggs, which she inserts singly into tender plant tissue. Eggs hatch four to 10 days later and larvae feed for about five to seven days before pupating in the soil. New adults emerge about four days later. Although winged adults are weak fliers, they are capable of flying from plant to plant and may be carried long distances by wind. There are probably five to eight generations per year. Thrips can reproduce without mating, but if not mated, they produce only males.



Shaded section indicates overwintering stage

Hosts

Alfalfa, canola, cotton, soybean and a wide variety of other vegetables, flowers, weeds and grasses.

Damage

Thrips are a common pest of peanut. Thrips rasp the tender parts of leaves, flowers and fruit with their sharp mouthparts and feed on escaping juices. While they are considered a pest, western flower thrips will feed on mite eggs.

Management

Good cultural practices can limit thrips populations. Thrips have not been shown to cause economic damage to peanut. For specific insecticide suggestions, see E-832 *OSU Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

SMALL GRAINS INSECTS

WHEAT GROWTH STAGES (FEEKES)

Tillering

1	One shoot (number of leaves can be added) = “brairding”
2	Tillering begins
3	Tillers formed, leaves often twisted spirally. In some varieties of winter wheats, plants may be “creeping” or prostrate
4	Beginning of the erection of the pseudo-stem, leaf sheaths beginning to lengthen
5	Pseudo-stem (formed by sheaths of leaves) strongly erected

Stem extension

6	First node of stem visible at base of shoot
7	Second node of stem formed, next-to-last leaf just visible
8	Last leaf visible, but still rolled up, ear beginning to swell
9	Ligule of last leaf just visible
10	Sheath of last leaf completely grown out, head swollen but not yet visible

Heading

10.1	Head just visible (awns just showing in barley, ear escaping through split of sheath in wheat or oats)
10.2	Quarter of heading process completed
10.3	Half of heading process completed
10.4	Three-quarters of heading process completed
10.5	Head completely out of sheath

Flowering (wheat)

10.5.1	Beginning of flowering (wheat)
10.5.2	Flowering complete to top of ear
10.5.3	Flowering over at base of ear
10.5.4	Flowering over, kernel watery ripe when squeezed

Ripening

11.1	Kernel milky ripe when squeezed
11.2	Kernel mealy ripe, contents of kernel soft but dry when squeezed
11.3	Kernel hard (difficult to divide by thumb-nail)
11.4	Ripe for cutting. Straw dead.

Feekes, Willem (1941). “De tarwe en haar milieu [Wheat and its environment].” Verslagen van de Technische Tarwe Commissie. (in Dutch (English summary)). 17: 523–888.

Notes

BIRD CHERRY-OAT APHID
Rhopalosiphum padi (L.)

Order Hemiptera: Family Aphididae

Barley Yellow Dwarf



Richard Grantham, Oklahoma State University



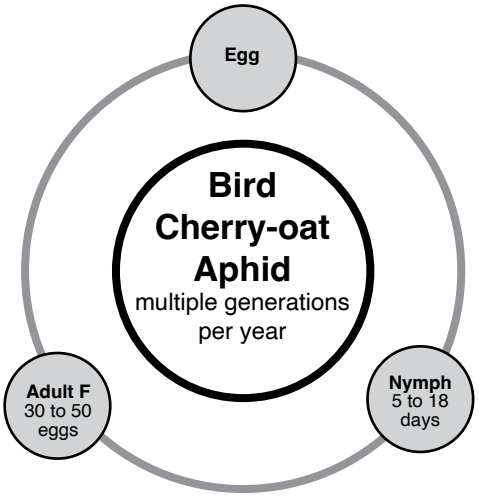
Robert Hunger, Oklahoma State University

Description

Bird cherry-oat aphids are comprised of winged and wingless forms, but most adults are wingless. The adult aphid measures 0.03 to 0.06 of an inch long. Body coloration is dark green, varying from green to black. The antennae and tarsi are dark with green legs. Cornicles (tailpipe-like appendages) are green to dark green with black tips. An orange-red patch surrounds the cornicles on the abdomen. The nymphs are smaller than, but similar in shape and color to, the wingless adults.

Life Cycle

Bird cherry-oat aphid has two (and sometimes three) life stages: egg (rarely) nymph (four instars) and adult. Bird cherry-oat aphids are present in winter wheat in Oklahoma throughout the year. The life cycle of bird cherry-oat aphid involves a sexual and nonsexual phase. It overwinters on its primary hosts (chokecherry or birdcherry), where it produces the sexual stages, which mate and the female lays eggs. The eggs hatch in spring and migrate to its grass hosts.



Shaded section indicates overwintering stage

Hosts

Its overwintering hosts are chokecherry or birdcherry. Its summer host include more than 100 grasses, including perennial ryegrass, Italian ryegrass, oat and wheat. In the southern U.S., it remains on grasses year-round as asexual reproductives.

Damage

Bird cherry-oat aphids damage wheat directly through their feeding, and indirectly because they are an efficient vector for barley yellow dwarf virus. The virus results in stunted plants that do not produce significant grain.

Management

Historically, bird cherry-oat aphid does not produce visible signs of injury, recent research suggests that bird cherry-oat aphid can reduce yield if numbers become high. A producer may need to make a control decision if numbers get too high. To accurately determine the need for control, growers should; have a good estimate of aphid numbers, know the value of their crop and know the cost of control.

Estimate aphid numbers by averaging counts of aphids on 75 randomly selected tillers (three tillers at 25 locations) per field. Then consult the table and line up the control costs with the market value of the wheat crop. If the average number of bird cherry-oat aphids in the field exceeds the number listed in the table, then treat with an insecticide.

Market value of Crop ($) per acre

Control cost per acre $	50	75	100	125	150	175	200	250+
# Bird Cherry Oat Aphid/Tiller								
4	50	50	25	25	25	25	25	25
5	50	50	25	25	25	25	25	25
6	DT	50	50	25	25	25	25	25
7	DT	50	50	50	25	25	25	25
8	DT	DT	50	50	50	25	25	25
9	DT	DT	50	50	50	50	25	25
10	DT	DT	50	50	50	50	50	25
11	DT	DT	DT	50	50	50	50	50
12	DT	DT	DT	50	50	50	50	50

DT = Don't Treat

For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

Notes

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CORN LEAF APHID: *Rhopalosiphum maidis* (Fitch)



Richard Grantham, Oklahoma State University



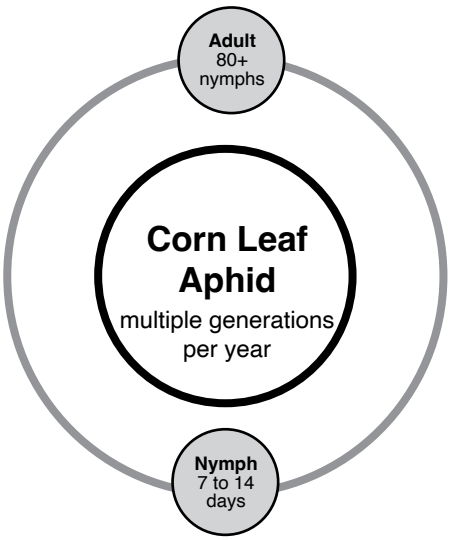
Richard Grantham, Oklahoma State University

Description

Corn leaf aphids are comprised of winged and wingless forms, but are most commonly wingless. Adults measure 0.03 to 0.06 of an inch long. Body color is blue green with black legs and a pair of short swollen cornicles (tailpipe-like appendages) that are also black. Winged forms measure 0.06 of an inch long. Wings are clear and the eyes, thorax and legs are black. The abdomen is blue green. Nymphs are similar in body color, but are smaller.

Life Cycle

Corn leaf aphids have two life stages: nymph (four instars) and adult. Corn leaf aphids reproduce primarily by parthogenesis, giving birth to live young that are all females. Nymphs grow through four instars in seven to 14 days and can complete up to 10 generations per year in Oklahoma. They are not thought to overwinter north of Texas, but winged forms migrate each spring, extending their range into Canada. They do overwinter in Texas on Johnsongrass and other grasses. They seem to favor dry conditions, which impede development of fungal pathogens that help keep them under control.



Shaded section indicates overwintering stage

Hosts

Corn leaf aphids prefer corn, but will also feed on barley, green beans, Johnsongrass, millets potato, rice, sorghum, sugarcane, tobacco and wheat as well as other grasses.

Damage

This aphid will occasionally be found in wheat in the fall. They serve as a food source for lady beetles and the parasitic wasp, *Lysiphlebus testaceipes*. They do not possess toxins in their saliva, but remove plant sap from their host plant. They are a vector for barley yellow dwarf virus.

Management

Corn leaf aphid infestations rarely require control in wheat. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

ENGLISH GRAIN APHID: *Sitobion avenae* (Fabricius)



Kansas Department of Agriculture, Bugwood.org

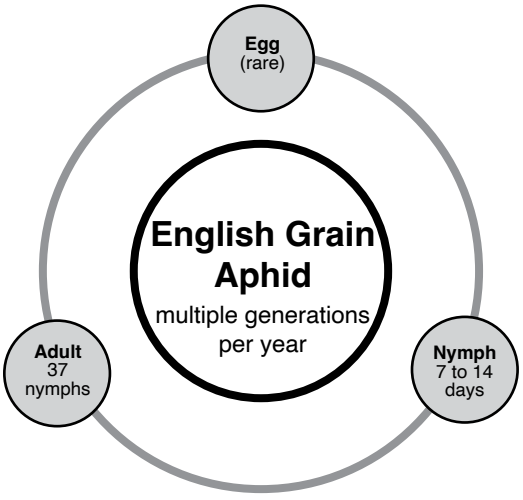


Description

The English grain aphid is larger than the other small grain aphids (about 0.125 of an inch long) and has a spidery appearance due to its long legs and narrow, long cornicles. The body of the English grain aphid is green (but can become light brown). Cornicles (tailpipe-like appendages) are completely black. Legs have alternate bands of green and black, but the tarsi (feet) are black. This aphid produces wingless and winged forms.

Life Cycle

English grain aphids reproduce primarily by parthogenesis, giving birth to live young that are all females. Nymphs grow through four instars in seven to 14 days. They overwinter in southern states as adults and nymphs, but winged forms migrate each spring, extending their range into Canada. They seem to favor cool conditions in spring.



Shaded section indicates overwintering stage

Hosts

English grain aphids feed on several grasses, including foxtail, and wheat, oat, barley, rye and corn.

Damage

English grain aphids do not appear to have a toxin in their saliva. Injury is caused from removal of carbohydrates and nutrients as a result of their feeding. They prefer to feed on the flag leaf and developing grain head, especially on the glume. Their feeding can reduce seed number, seed weight and grain protein level. They also produce honeydew, which can result in sooty mold developing on the grain head. English grain aphid is also a vector of barley yellow dwarf virus and has also been associated with symptoms of black chaff disease, caused by the bacterium *Xanthomonas campestris.*

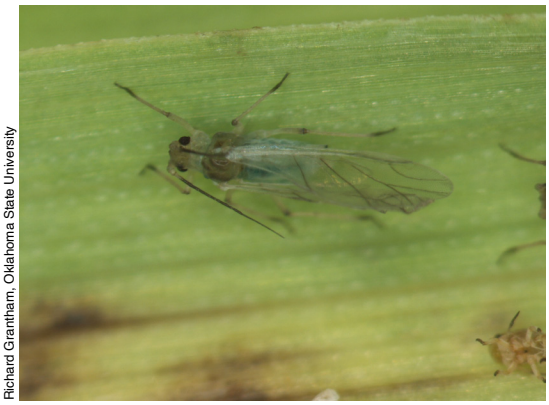
Management

English grain aphid is not an important pest of Oklahoma wheat. Suggested thresholds are five aphids per stem at flag leaf, and 10 per stem from head emergence to milk stage. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

Notes

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GREENBUG: *Schizaphis graminum* (Rondani)



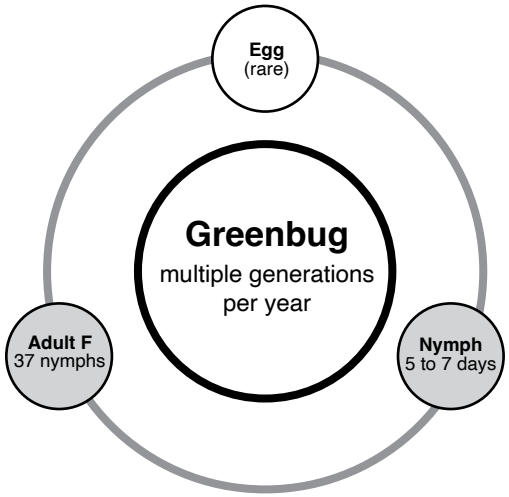
Richard Grantham, Oklahoma State University



Richard Grantham, Oklahoma State University



Alton Sparks Jr., University of Georgia, Bugwood.org



Shaded section indicates overwintering stage

Description

A mature greenbug measures 0.06 of an inch with an oval-shaped, light-green body and a darker green stripe down its back. It possesses two cornicles (tailpipe-like appendages) with dark tips on the posterior end of the abdomen, green legs with dark tarsi and dark antennae. Winged forms are similar in body color with a brownish head and thorax.

Life Cycle

Greenbugs have three life stages: egg, nymph (four instars) and adult. Eggs are typically not produced in the southern U.S. Greenbugs are present throughout the year. Winged forms migrate to wheat as it emerges in fall. In winter, they can be found on winter wheat, but optimal growth and reproduction occurs at temperatures between 50 and 85 F. Greenbugs reproduce by parthenogenesis, giving birth to live young (which are all females). They can become adults within one to two weeks of birth. Newly born greenbugs molt (shed their skin) four times before becoming an adult. Adult greenbugs are winged or wingless, and both forms often occur in the same colony. Wingless forms are more commonly seen, since all immature greenbugs are wingless.

Hosts

More than 70 grass species have been identified as host for greenbug, including species in the genera *Agropyron, Avena, Bromus, Dactylis, Festuca, Horedum, Lolium, Oryza, Panicum, Paspalum, Poa, Sorghum Triticum* and *Zea*. In Oklahoma, they are a pest of wheat and sorghum. They are also a pest of Kentucky bluegrass in more northern states.

Damage

Adult and nymph are the damaging stages. The greenbug, like other aphids, feeds on plant sap through its straw-like mouthparts. As they feed, they inject chemicals that injure the wheat plant. Injury from greenbug feeding first appears as tiny reddish or copper colored spots on leaves. While greenbugs typically feed on the underside of the leaf, the injury is also visible on the upper side of an infested leaf. As greenbugs continue to feed and reproduce, the infested leaf becomes yellowed and finally dies. They are also a known vector for the barley yellow dwarf virus.

Management

Sampling for greenbugs can be accomplished by using the greenbug Glance-N-Go™ sampling app for smartphones. The sampling app calculates a treatment threshold based on user inputs, then provides a presence/absence sampling program that will reach a decision when the program determines that the threshold limits (to treat or not treat) have been reached, instead of requiring a fixed number of samples.

The app is available for iOS or Android systems. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

Notes

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RUSSIAN WHEAT APHID: *Diuraphis noxia* (Kurdjumov)



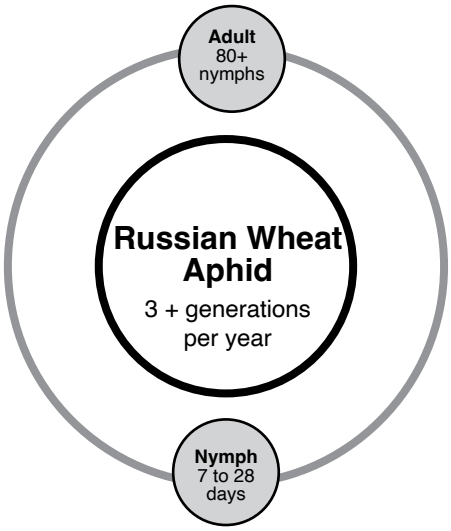
Richard Grantham, Oklahoma State University



Richard Grantham, Oklahoma State University



Tom A. Royer, Oklahoma State University



Shaded section indicates overwintering stage

Description

Russian wheat aphid measures 0.06 of an inch, and has a lime green body that is spindle shaped with short antennae and no prominent cornicles. It has a projection above the tail that gives it a double tail appearance.

Life Cycle

Russian wheat aphids have two life stages: nymph (four instars) and adult. Like other aphids, they reproduce by parthenogenesis, giving birth to live young (which are all females). They can become adults within one to four weeks of birth.

Hosts

Russian wheat aphid is basically a pest of wheat and barley and will most likely be found during spring in winter wheat. Several native grasses are suitable as summer hosts, including downy brome, blue gramma, jointed goatgrass, wild oats and several species of wheatgrass. Fortunately, the Russian wheat aphid does not appear to survive on corn or sorghum.

Damage

Adults and nymphs are the damaging stages. The Russian wheat aphid feeds on plant sap with its piercing/sucking mouthparts and can injure and cause yield loss in wheat even at low numbers. It feeds on the newest growth of the plant, and contains chemicals in its saliva that affect plant growth. As the Russian wheat aphid feeds, it causes the leaf to curl and enclose the aphid, which protects it from climate, natural enemies and insecticides. Damage symptoms become visible as white, yellow or purple longitudinal streaks, depending upon weather and growth conditions. One, two or all three symptoms may be present on plants in a field.

Management

Resistant varieties have been developed for Russian wheat aphid; however there are different strains that have overcome the resistant varieties. For scouting, examine and count the number of tillers containing Russian wheat aphid. Walk a diagonal or zigzag pattern across the field, stop 10 times and collect 10 tillers at random at each stop. To avoid bias, take the 10 tillers closest to your foot or every third tiller starting with the one closest to your foot. Thresholds can be found in Extension Fact Sheet EPP 7099. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

Notes

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ARMYWORM:
Mythimna unipuncta (Haworth)

Order Lepidoptera: Family Noctuidae



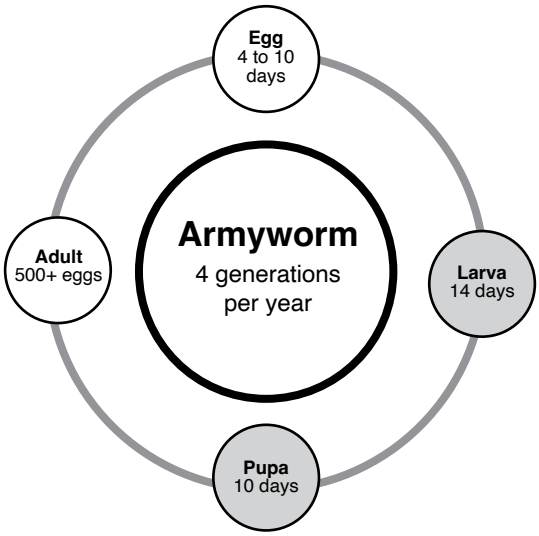
Herbert A. "Joe" Pase III, Texas Forest Service, www.insectimages.org



Tom A. Royer, Oklahoma State University

Description

The adult moth is uniformly pale brown to grayish brown in color, with a wingspread of about 1.5 inches and a characteristic small, white spot near the center of each front wing. The spherical eggs are greenish white and are laid in masses. Mature larvae measure 1.5 inches long with a yellowish or grayish ground color, more or less tinged with pink. The dorsum is greenish brown to black with a narrow, broken, light median stripe. A dark stripe on each side includes the black spiracles in its lower edge. The subspiracular stripe is pale orange, mottled and edged with white.



Shaded section indicates overwintering stage

Life Cycle

Armyworms overwinter as pupae or as mature larvae which pupate in the spring. Moths emerge in the spring, mate and lay eggs in masses on host plants (mostly in the grass family). Larvae feed for about four weeks, but do most of their damage during the last 10 days before pupation. They then pupate in cells in the soil. A new generation of moths emerges about one week later. There are four generations per year in Oklahoma.

Hosts

Small grains, corn, timothy grass, millet and some legumes and turf grasses.

Damage

Damaging stage is the larva. Young caterpillars skeletonize the surface of leaf blades and the inner surface of the sheaths with their chewing mouthparts. Older larvae begin feeding from the leaf edges and consume entire leaves. They will also feed on awns (beards) and clip grain heads by feeding directly underneath the head. Armyworms are often more numerous in wet areas of a field, areas with dense canopies or areas where plants have lodged. This species is a true armyworm; the larvae may migrate en masse from a decimated area to enter an area of abundant food supply.

Damage is typically caused by the first generation (during May) in Oklahoma. In years when wheat is infested over a wide area, homeowners often will find the adult moths in large numbers hiding in shrubs and trees in early summer.

Management

Armyworms are not easily seen because they hide in the soil during the day and feed on the leaves and heads at night. Heaviest infestations will more likely occur near field margins and in low-lying areas of rank growth or where plants have lodged. Look for this insect in and under debris at the base of plants. The presence of frass (feces) and dropped plant material indicates ongoing feeding activity. When scouting, examine several locations within the field and take an average of caterpillar counts. Generally, if wheat is past the soft dough stage, control is not warranted unless obvious head clipping can be seen and caterpillars are still present and feeding. Worms feeding on the awns when plants are past soft dough will not cause enough yield loss to justify the expense of an insecticide application. Head clipping in winter wheat is usually restricted to secondary tillers with very small, green heads that would not likely contribute much to yield.

The treatment threshold is four to five unparasitized armyworm larvae per linear foot of row. Pay attention to evidence of natural enemy activity. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control*.

Notes

Notes

ARMY CUTWORM: *Euxoa auxiliaris* (Grote)

Order Lepidoptera: Family Noctuidae

Army Cutworm Army Cutworm Damage



Frank Peairs, Colorado State University, Bugwood.org



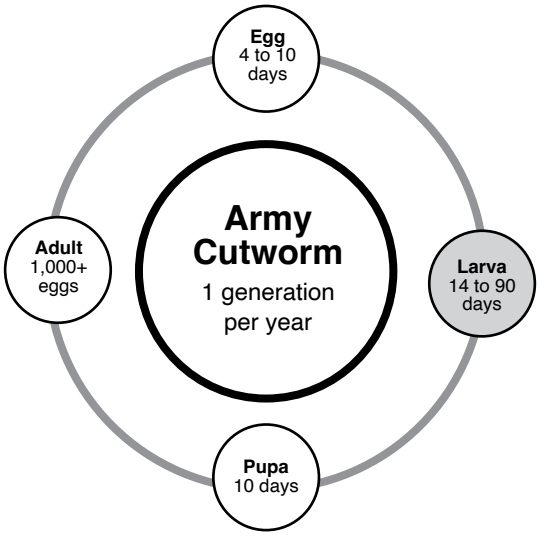
Kansas State University, University

Description

Adults are gray to light brown, and have a wavy pattern of alternating dark and light markings on their wings. The front wings typically have several light-rimmed spots, with one prominent kidney-shaped spot on each wing. The hind wings display a whitish fringe. The wingspan is generally between 1.5 and 2 inches. Eggs are small, pale yellow ovals, laid singly. Larvae are gray, or a mixture of brown and gray caterpillars. A light, broad stripe runs down the back with blackish fringes giving way to darker sides. Larvae often curl into a C-shape upon disturbance. Mature larvae are generally 1.5 to 2 inches long. Pupae are dark brown in color and are located in the soil.



Mark Dreiling, retired, Bugwood.org



Shaded section indicates overwintering stage

Life Cycle

Females lay eggs from late summer to early autumn. Weedy areas in crop fields and gardens are preferred deposition sites. One generation is conceived each year. Eggs typically hatch from a few days to a few weeks after deposition. Nascent larvae begin feeding nocturnally, remaining in the soil during daylight hours. As fall advances and soil temperatures drop below freezing, immature larvae cease activity and overwinter. Larvae resume feeding and activity early in the year, typically when daytime temperatures rise above freezing. Larvae pupate at a depth of 2 to 3 inches in late spring, with adults emerging in early summer. Adults progressively migrate west to higher elevations for summer nectar-feeding, during which reproduction is suspended. In late summer and early fall the moths return east to mate and lay eggs.

Hosts

Army cutworm is known to be a pest of significance in alfalfa, canola and wheat. They feed on a wide variety of plants but seem to prefer broadleaf plants over grasses.

Damage

Damaging stage is the larva. They feed on plants with their chewing mouthparts. Damage is first detected as leaf defoliation, with holes chewed through leaves and semicircles cut from the edges. Larvae may cut plants down to the soil line, and during daylight hours feed on foliage pulled into soil cracks during the night. Damage is generally greatest in mid- to late spring, as larvae approach pupation and results in stand loss. Army cutworms will move en masse to new areas when local food sources are exhausted.

Management

Often, damage goes unnoticed until spring because the larvae grow slowly through the winter and are not large enough to cause visible stand loss until temperatures warm in the spring. Signs of injury to wheat include wheat that is slow growing or fails to green up. Unfortunately, that is also a sign of poor growing conditions due to drought (which cutworms also like), so it is critical to scout fields for cutworm presence.

A field can be sampled by stirring or digging the soil to a depth of two inches. Take counts in at least five locations within your field If field counts turn up four or more per square foot (two to three per linear foot), treatments should be considered, based upon the growing conditions and yield potential of the crop. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

Notes

Notes

FALL ARMYWORM: *Spodoptera frugiperda* (J. E. Smith)

Order Lepidoptera: Family Noctuidae



Frank Peairs, Colorado State University, Bugwood.org



Lyle Buss, University of Florida, Bugwood.org

Inverted "Y"



Tom A. Royer, Oklahoma State University

Windowpaning



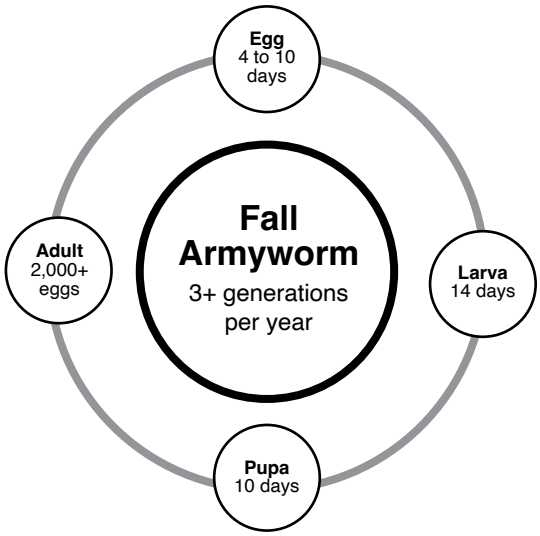
Tom A. Royer, Oklahoma State University

Description

Male moths have dark gray front wings mottled with darker and lighter splotches. There is a prominent pale, diagonal marking near the center of the front half of each wing and a prominent white spot at the extreme tip. The front wings of female moths are dull gray brown with only small, inconspicuous markings. The hindwings of both sexes are white with a slight purplish sheen. The wingspan is about 1.5 inches. Eggs are pale gray, laid in masses and covered with grayish, fuzzy scales from the body of the female. Larvae have five pairs of abdominal prolegs and measure 1.5 inches when fully grown. Body color may be green, brown or almost black with black and reddish-brown stripes on each side of the body and four small black spots on the dorsal side of each abdominal segment. The head capsule is mostly black and is marked with a pale, inverted Y on the front.

Life Cycle

The fall armyworm does not overwinter in Oklahoma, and infestations develop from moths that migrate northward from Texas or Mexico. They usually reach the state by late June. Each female lays about 1,000 eggs in masses of 50 to several hundred. Larvae are present by early July. After feeding for two to three weeks, the larvae dig into the soil to pupate. A new generation of moths emerges about two weeks later. There are several overlapping generations extending into October or even November in some years.



Shaded section indicates overwintering stage

Hosts

This species will feed on a very wide variety of plants but prefers plants in the grass family. Corn, sorghum and wheat are subject to infestation.

Damage

Larvae are the damaging stage. They feed with their chewing mouthparts. Evidence of an infestation includes windowpaning of young wheat plants because they are not large enough to chew through a leaf.

Large numbers can consume all above-ground plant parts, and they are capable of killing or severely retarding the growth of wheat. This species may migrate in large numbers in search of new areas in which to feed.

Management

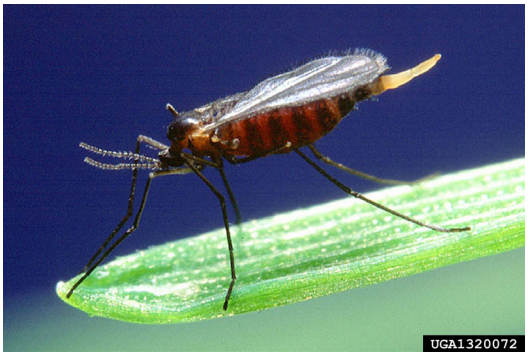
Fall armyworm is most likely to become a pest of wheat in fall. Fields should be inspected soon after emergence, and regularly afterword. Insecticide treatment is suggested when numbers reach three to four larvae per foot of row and feeding damage is evident. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

Notes

Notes

HESSIAN FLY: *Mayetiola destructor* (Say)

Order Diptera: Family Cecidomyiidae



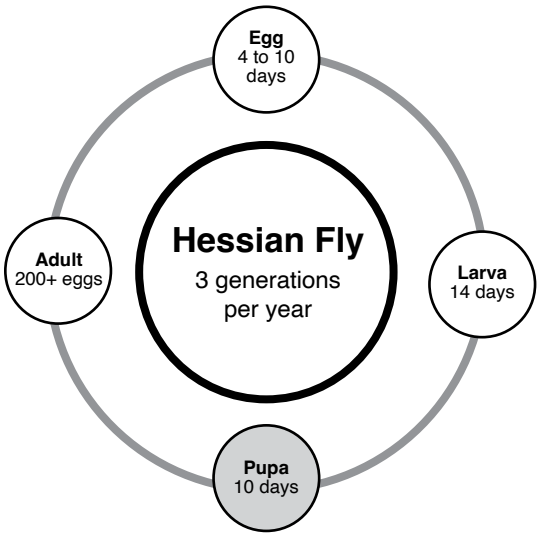
Scott Bauer, USDA ARS, Bugwood.org



Tom A. Royer, Oklahoma State University

Description

The adult Hessian fly is a tiny gnat-like fly, measuring 0.125 of an inch long. Hessian fly eggs are oblong, orange, measure less than 0.02 of an inch and can be mistaken for early signs of leaf rust. A newly hatched first-instar larva is also orange and quickly crawls downward to its favored feeding site. Larvae feed by consuming plant sap. Just before molting, larvae become more robust and slug-like. After molting, the second-instar larva is immobile, whitish green and measures 0.4 inch when fully grown. Second instar larvae form a rice-like, shiny, dark brown puparia commonly referred to as a flaxseeds. They molt into a third instar larvae, which then pupate within the puparia. This represents the overwintering and summering life stages.



Shaded section indicates overwintering stage

Life Cycle

Hessian fly completes its life cycle in about 40 days to 50 days, but once the flaxseed stage is reached, it may remain dormant for three to four months. After emergence and mating, the female fly lays eggs in between the leaf margins of its host plant. Newly hatched larvae crawl down the plant and begin feeding in the area between the sheath and stem just above the crown, just below the soil surface (fall) or between the stem and leaf sheath at the first node above the soil surface (spring). The fall generation overwinters as flaxseed, emerging in spring; the spring generation summers as flaxseed in wheat stubble, emerging in the fall.

Hosts

Hessian fly is known to feed on barley, rye and triticale, but its preferred host is wheat. Hessian fly does not attack oat but will feed on several wild grasses (quackgrass, western wheatgrass, little barley, goatgrass and timothy grass).

Damage

Hessian fly larvae injure the wheat by feeding on stem tissue at the crown of young plants or just above the nodes of jointed wheat. As they feed, they inhibit growth of the plant. During a fall infestation, young infested plants become dark green to bluish green and are stunted with thickened leaves. Individual infested tillers eventually die. Some varieties of wheat may compensate by producing secondary tillers, but others fail to produce any secondary tillers after being infested. Often, fall-infested wheat becomes less winter hardy and dies. During the spring, Hessian flies emerge around the time jointing begins. Larvae feed just above the node between the leaf sheath and stem. Feeding inhibits stem elongation and the plant's ability to

transport nutrients to the developing wheat head, resulting in poor grain fill and/or stem breakage at the weakened feeding area. Significant lodging can occur and an infested field is often mistaken to have suffered hail damage. In such fields, careful inspection of lodged plants will reveal Hessian fly flaxseeds that are inserted at the first joint of the stem just under the leaf sheath.

Management

Fields exhibiting poor growth should be checked for signs and symptoms beginning in early October through November. Infestations may be heavier along field margins. Pay particular attention to the presence of volunteer wheat in field margins or ditches. Plants will be stunted with thickened leaves and are often darker green compared to uninfested plants. Pull plants and look for dead or dying tillers. Peel back leaves to their point of attachment to the stem and look for flaxseeds. In spring, damage is best assessed as the wheat matures. Look for broken stems above the first node and check stems for flaxseed. Yield loss can be estimated by counting infested plants or number of flaxseeds per tiller. A field averaging 10 percent infested plants may suffer one bushel of yield loss. Based on studies in Oklahoma, an average count of one flaxseed per tiller on susceptible varieties will result in a 5-bushel-per-acre yield loss.

Unfortunately, chemical control is not a viable option for Hessian fly management. Best practices include stubble destruction, delayed planting, crop rotation and use of Hessian fly-resistant varieties. Unfortunately, delayed planting is not very effective due to the warm periods experienced in Oklahoma. For more information on Hessian fly, refer to the latest version of EPP-7086 *Hessian Fly Managemtent in Oklahoma Winter Wheat*. For more information on which varieties are resistant to Hessian fly, refer to the latest revision of Fact Sheet PSS-2142 *Wheat Variety Comparison Chart*.

Notes

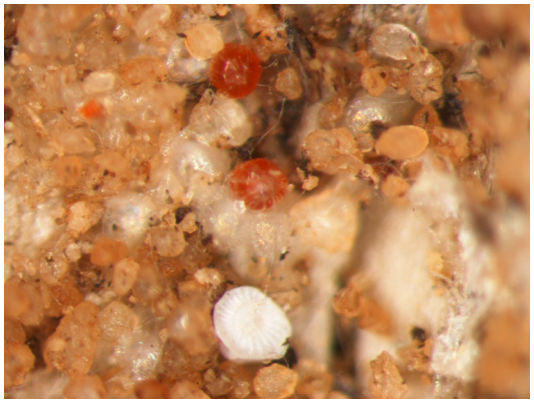
Notes

MITES

Mites are not insects, but are closely related to spiders and ticks. Some are predaceous, while others feed on plants. Three species are common pests of wheat in Oklahoma, including the brown wheat mite, the winter grain mite and the wheat curl mite.

BROWN WHEAT MITE: *Petrobia latens* (Müller)

Order Acari: Family Tetranychidae



Richard Grantham, Oklahoma State University



Richard Grantham, Oklahoma State University



Tom A. Royer, Oklahoma State University



Tom A. Royer, Oklahoma State University

Description

The brown wheat mite occurs throughout Oklahoma, but is more common in western Oklahoma and the Panhandle. Brown wheat mites measure 0.02 of an inch long and have a dark brown body with four light brown to yellow legs. Their front pair of legs are twice as long as the remaining three pair.

Life Cycle

Brown wheat mite males have not been found, so it is believed that brown wheat mite reproduces via parthenogenesis. Brown wheat mites go through multiple generations each year. In the fall, mites hatch from dormant eggs, feed for about 21 days until they become adults. They produce red-colored eggs that hatch in about seven days. New generations cycle every 21 days until spring. In spring, female mites lay white eggs in the soil that will aestivate through the summer and hatch the following fall.

Hosts

Brown wheat mite is a pest of wheat, but has also been found on onions, carrots, cotton, endive lettuce, sorghum, alfalfa, Kentucky bluegrass and probably numerous grassy and broadleaf weeds.

Damage

Brown wheat mites feed on plant sap by piercing plant cells in a leaf which results in a stippled appearance on the leaves. The injury on the plants make them appear scorched or bronzed

and withered, which can be confused with drought because they typically occur during hot, dry conditions.

Management

Feeding activity is greatest during afternoons, on warm days. They are more often associated with continuous wheat production. This mite is more often a problem with continuous wheat production systems. Crop rotation with canola can be an effective deterrent. Precipitation and temperature can affect brown wheat mite buildup. Rainfall of greater than 0.25 of an inch will often reduce mite populations and plant stress. Research suggests a treatment threshold of 25 to 50 brown wheat mites per leaf in wheat that is 6 to 9 inches tall is economically warranted. For specific acaricide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control*.

Notes

Notes

WINTER GRAIN MITE: *Penthaleus major* (Dugès)

Order Acari: Family Eupodidae



Richard Grantham, Oklahoma State University



Richard Grantham, Oklahoma State University



Tom A. Royer, Oklahoma State University



Tom A. Royer, Oklahoma State University

Description

Winter grain mite is slightly larger than the brown wheat mite, measuring 0.03 to 0.05 of an inch. It has a dark blue to black body and has orange-red legs and an orange or red spot on the upper abdomen. The front pair of legs are slightly longer than the other three pair.

Life Cycle

Winter grain mites spend the summer as kidney-shaped eggs, typically attached to leaf blades or soil, that hatch in the fall. There are two generations, the first beginning in fall and the second from eggs laid in January and February. In all cases, the mites are female, which can lay eggs cycling about 21 days, depending on temperature. Winter grain mites thrive under wet, cool conditions and populations decline with warmer temperatures.

Hosts

Winter grain mite feeds on grasses including wheat, barley, oats, bluegrass, bentgrass, ryegrass and fescue. They will also feed on vegetables, legumes, ornamental flowers, cotton, peanut and various weeds.

Damage

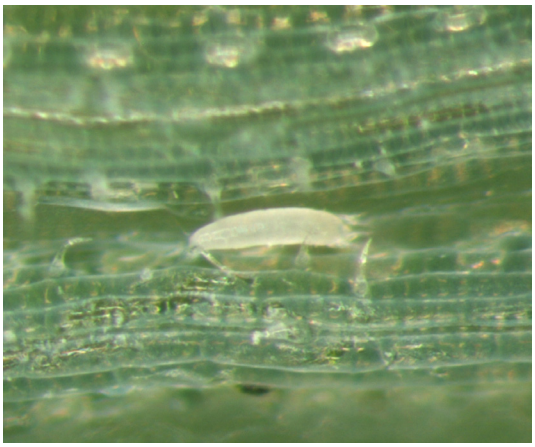
This mite is associated with continuous wheat production systems. Wheat fields infested with winter grain mites take on a silvery-gray color and the leaf tips may turn brown. Plants may become stunted.

Management

Winter grain mites are more visible on cloudy days or in the morning or evening. They hide under clods or just beneath the soil crust during daylight hours. An easy way to inspect for brown wheat mite is to shake some plants onto a white piece of paper, making them easy to observe. During the day, use a magnifying glass to inspect the base of wheat plants and under dirt clods. Control is not usually required, but there are effective acaricides available. An acaricide treatment should be considered when plants show visible injury and mites are still present. For specific acaracide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

WHEAT CURL MITE: *Aceria tosichella* Keifer

Order Acari: Family Eriophyidae



Richard Grantham, Oklahoma State University

Wheat Streak Mosaic Virus



Robert Hunger, Oklahoma State University

Description

The wheat curl mite is a whitish, sausage-shaped mite measuring about 0.01 of an inch and has two pair of legs located near the head.

Life Cycle

Wheat curl lay eggs along leaf veins. Under optimal conditions (75 to 85 F), wheat curl mites can complete a generation in 10 days. As they feed, they cause the outer margins of leaves to roll up and the mites reside within those tight rolls. When plants begin to dry down, they move to the flag leaf or head and are carried by the wind to their over-summering grass hosts. The reverse occurs when their summer hosts dry down — they move back to wheat.

Hosts

Besides winter wheat, wheat curl mite feeds on maize and several weed grasses, including western wheatgrass, jointed goatgrass, sandbur, Canada wildrye, barnyardgrass, stinkgrass, witchgrass and green foxtail.



Richard Grantham, Oklahoma State University

Damage

Wheat curl mites prefer to feed on terminal leaves and the most tender leaf tissue, and will move to newly emerging leaves. While the physical damage from their feeding can cause problems, the most important damage are the vectors of viruses they carry causing Wheat streak mosaic (WSM), High plains disease (HPD) and Triticum mosaic (TrM). All three diseases can cause severe problems when infections are heavy.

Management

The mites can be seen with a 10X magnifying lens by carefully unrolling the leaves. Unfortunately, chemical control options for wheat curl mite are not effective. Management options include destruction of volunteer wheat at least two weeks prior to planting, planting later in the fall and selecting WSM resistant varieties. Some wheat varieties offer resistance or tolerance to WCM or WSMV. Consult the latest OSU variety trial data to select adapted varieties for north-central Oklahoma that carry these traits. Currently, Breakthrough is the most resistant OSU variety, which carries the WSMV resistance gene, Wsm1.

Notes

Notes

WHEAT HEAD ARMYWORM: *Dargida diffusa* (Walker)

Order Lepidiptera: Family Noctuidae



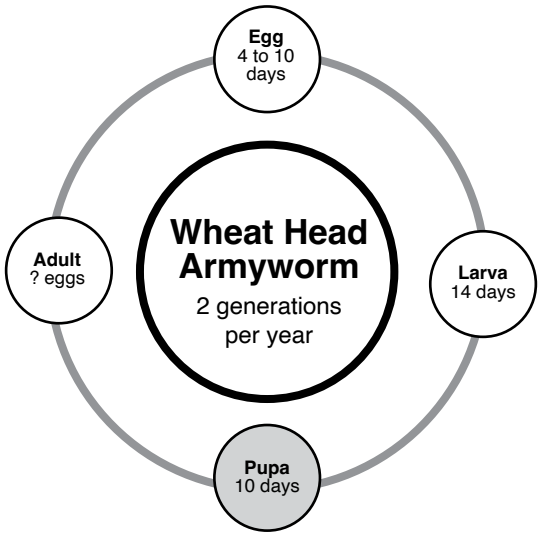
Robert Bauernfiend, Kansas State University, Bugwood.org



Tom A. Royer, Oklahoma State University, Stillwater.



Tom A. Royer, Oklahoma State University, Stillwater.



Shaded section indicates overwintering stage

Description

Wheat Head Armyworm moths are yellowish brown with a dark brown streak running the length of the forewing that is interrupted near the middle of the forewing. The caterpillars range in color from gray to greenish with distinct yellow, white and brown stripes going lengthwise across the body. They typically have a larger head relative to their body

Life Cycle

Wheat head armyworms go through two generations each year, and pass the winter as pupae in the soil. Adult moths lay eggs on wheat in the spring, and the larva feed directly on grain heads, mostly at night. The next generation feeds on warm-season summer grasses.

Hosts

Wheat head armyworm feeds on the seed heads of various grasses and cereal crops, especially timothy grass, *Phleum pretense* L.

Damage

Wheat head armyworms feed on developing wheat kernels, causing direct damage to the seed. The major issue with wheat head armyworm damage has to do with the grain grading, which is classified as insect damaged kernels. Grain elevators will dock wheat when samples contain a certain level of damaged kernels per 100 grams of seed. Damage that exceeds that level can only be sold as animal feed. It is important to note that although the wheat is damaged, it is not an indication of an on-going infestation of grain weevil or some other stored grain insect pest.

Management

The body color of the wheat head armyworm caterpillar blends in well with the developing wheat head, making it difficult to see by casual observation. Fields can be scouted with a sweep net to determine numbers of caterpillars. There is no established treatment threshold because wheat head armyworm rarely causes economic damage and when it does, the damage is usually not noticed until the grain is harvested. If wheat is at soft dough (Feekes 11.2), consider treating the field to reduce damage. This insect often is found along the margins of fields, so if scouting shows that they are restricted to the field edges, consider spraying the field margins with a border spray. Pay careful attention to pre-harvest intervals when selecting an insecticide. The best strategy to manage the problem at harvest is to blend wheat harvested from head rows with wheat harvested from the rest of the field to dilute insect damaged kernels percentages. Treating a field with insecticide at harvest will be of little help because the damage is already done, most of the caterpillars have already pupated and remaining larvae can't feed on the mature wheat grain.

For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

Notes

Notes

WHEAT STEM MAGGOT: *Meromyza americana* (Fitch)

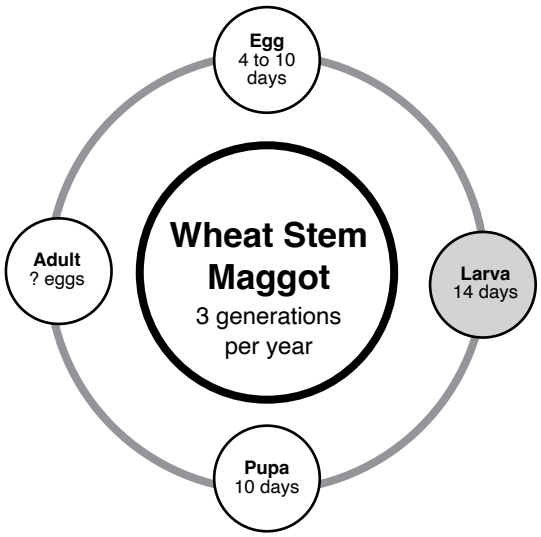
Order Diptera: Family Chloropidae



Ken Gray Collection, Courtesy of Oregon State University



Ken Gray Collection, Courtesy of Oregon State University



Shaded section indicates overwintering stage

Description

Adult fly measures 1.5 inch and is yellowish-white with green eyes and three conspicuous stripes on the top of its thorax and abdomen. Larva is a greenish maggot that measures 0.25 of an inch when fully grown.

Life Cycle

Wheat stem maggot has four life stages: egg, larva (three instars), pupa and adult. It overwinters as a third-instar larva in the stem of a wheat plant or other host. First generation emerges in spring, and adults lay eggs singly on the leaves or leaf sheath and stem of a wheat plant. Eggs hatch in four to 10 days, and the larvae feed in the stem for about two weeks. Adults emerge from non-overwintering pupae in about 10 days. There are likely three generations per year.

Hosts

Wheat stem maggot uses numerous grasses as host, including rye, barley and oats. timothy grass (*Phleum pratense*), quack grass (*Elymus repens*), wheat grasses (*Agropyron* species), wild barley (*Horedum spontaneum*), *Bromus* species and *Seteria* species foxtails.

Damage

Damaging stage is the larva. Wheat stem maggot feeds on plant tissue within a stem with its modified chewing mouthparts. Feeding causes partial severing of the stem, which reduces sap flow to the developing head. The developing wheat head turns white and is easily pulled out from the stem. Typically, yield reduction from stem maggot is less than 2 percent

Management

Delayed planting can reduce potential for infestation. Destruction of volunteer wheat is also recommended. Chemical control has not been successful because timing of the application unknown. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

SOYBEAN INSECTS

SOYBEAN GROWTH STAGES

Growth stage	Code	Description
0: Germination		
	00	Dry seed
	01	Beginning of seed imbibition
	03	Seed imbibition complete
	05	Radicle emerged from seed
	07	Hypocotyl with cotyledons breaking through seed coat
	08	Hypocotyl reaches the soil surface; hypocotyl arch visible
	09	Emergence: hypocotyl with cotyledons break through soil surface (“cracking stage”)
1: Leaf development		
	10	Cotyledons completely unfolded
	12	2 full leaves (first leaf pair unfolded)
	13	3rd true leaf (first trifoliate leaf) unfolded
	1.	Stages continuous till...
	19	9 or more leaves (2 full leaves, 7 or more trifoliate) unfolded
2: Formation of side shoots		
	21	First side shoot visible
	22	2nd side shoot visible
	23	3rd side shoot visible
	2.	Stages continuous till...
	29	9 or more side shoots visible

5: Inflorescence emergence

51	First flower buds visible
55	First flower buds enlarged
59	First petals visible, flowers still closed

6: Flowering

60	First flowers open (sporadically within the population)
61	Beginning of flowering: 10 percent of flowers open[1]
	Beginning of flowering[2]
62	20 percent of flowers open[1]
63	30 percent of flowers open[1]
64	40 percent of flowers open[1]
65	Full flowering: 50 percent of flowers open[1]
	Main flowering period[2]
67	Flowering finishing: majority of petals fallen or dry[1]
69	End of flowering: first pods visible[1]

7: Development of fruit

71	10 percent of pods have reached typical length[1]
	Beginning of pod development[2]
72	20 percent of pods have reached typical length[1]
73	30 percent of pods have reached typical length[1]
74	40 percent of pods have reached typical length[1]
75	50 percent of pods have reached typical length, beans beginning to fill out[1]
	Main pod development period[2]
76	60 percent of pods have reached typical length[1]
77	70 percent of pods have reached typical length, pods still break cleanly[1]
78	80 percent of pods have reached typical length[1]
79	Pods: individual beans easily visible[1]
8:	Ripening of fruit and seed
81	10 percent of pods ripe (beans hard)[1]
	Seeds beginning to mature[2]
82	20 percent of pods ripe (beans hard)[1]
83	30 percent of pods ripe (beans hard)[1]
84	40 percent of pods ripe (beans hard)[1]
85	50 percent of pods ripe (beans hard)[1]
	Main period of ripening[2]
86	60 percent of pods ripe (beans hard)[1]
87	70 percent of pods ripe (beans hard)[1]
88	80 percent of pods ripe (beans hard)[1]
89	Fully ripe: pods ripe (beans hard)[1]

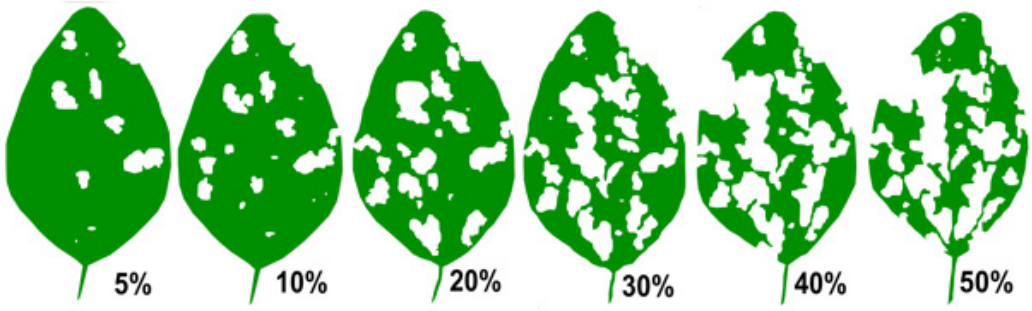
9: Senescence

97	Plants dead
99	Harvested product

[1] For varieties with limited flowering period
[2] For varieties in which the flowering period is not limited

There are several pests that will feed on leaves of soybean. Treatment thresholds for soybean are often based on percent defoliation, growth stage of the soybean stand and presence of a defoliating pest. The choice of insecticide can depend on the particular pest causing the defoliation. To estimate defoliation in soybean, randomly collect six leaflets (two from the lower, two from the middle and two from the top of the canopy) in five locations and estimate percent defoliation by averaging the defoliation level from 30 leaflets.

Example of Soybean Defoliation Levels.



Notes

BEAN LEAF BEETLE: *Cerotoma trifurcata* (Forster)

Order Coleoptera: Family Chrysomelidae:



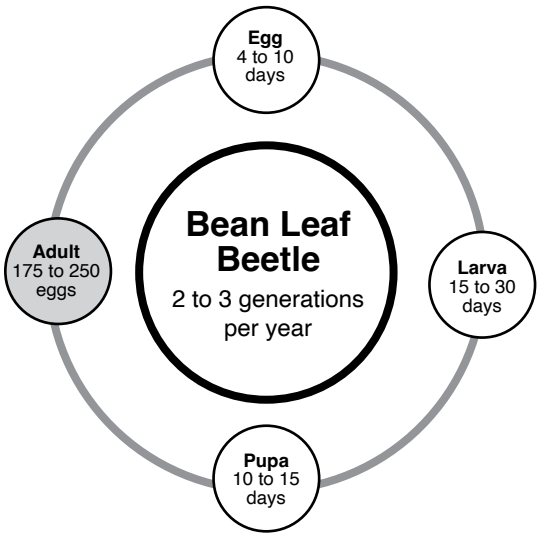
Ward Upham, Kansas State University, www.Bugwood.org

Description

Adult bean leaf beetles measure 0.2 to 0.25 of an inch. Their body color ranges from and yellow to orange to red with a black head and black spots down the center of the back. Normally, there are six black spots that may run together so it appears only three spots are present, or they may be completely absent. The triangular black mark at the base of the wing covers is always present. The yellow, spotted forms can be mistaken for a small spotted cucumber beetle.

Life Cycle

Bean leaf beetles have four life stages: egg, larva (three instars), pupa and adult. Adults overwinter in leaf litter or other vegetation, primarily in wooded areas. They become active in early spring and move to the earliest host plants available (typically alfalfa) where they feed for several days and then mate. One female lays 175 to 250 eggs in clusters of 12 to 24 in the soil at the base of plants. Eggs hatch in five to seven days, depending on temperature. Larvae find their way to the base of the stem or roots and feed on root hairs and nodules for 15 to 30 days. Mature larvae form earthen cells to pupate. Adults emerge in one to nine days. There are two or three overlapping generations, and adults are present almost continuously from early spring to late fall.



Shaded section indicates overwintering stage

Hosts

The adults feed primarily on legumes. The most common hosts are snap beans, soybeans and alfalfa in Oklahoma.

Damage

Damaging stages are adults and larvae. Bean leaf beetles feed with chewing mouthparts. Larvae feed on root hairs and nodules, but the extent of damage is minor. Adult beetles feed on the underside of bean leaves and the damage will appear as small, round holes. Damage often occurs as the plants are emerging and, if the beetles are present in large enough numbers, stand reduction can occur. Large populations are capable of causing extensive defoliation to older stands. In late summer, they will also feed on pods. Besides the direct damage caused by pod feeding, and the indirect damage caused by defoliation, bean leaf beetles have also been shown to allow for entry by seed pathogens such as *Alternaria tenuissima*. They have also been shown to transmit bean pod mottle virus, cowpea mosaic virus and southern bean mosaic virus.

Management

Trap cropping is used on some southern states, where 10 percent of the acres is planted with an early-maturing variety two to three weeks earlier than the main planting. Adults congregate in the trap crop, and are sprayed. Regular control is based on beetle numbers obtained through scouting. For specific insecticide suggestions, see CR-7167 *Management of Insect and Mite Pests in Soybean* or E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

CORN EARWORM: *Helicoverpa zea* (Boddie)

Order Lepidoptera: Family Noctuidae



Clemson University USDA Cooperative Extension Slide Series,Bugwood.org



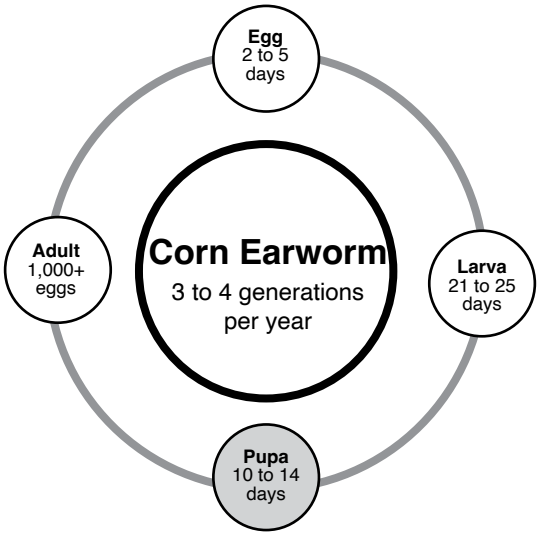
Steve L. Brown, University of Georgia, Bugwood.org

Description

The adult moth is usually light yellowish olive with a single dark spot near the center of each front wing, but some adults have vague darker markings on the wings. The wingspread is about 1.5 inches. The eggs are almost spherical with a flattened base and white or cream in color. The larva color varies with the host plant and ranges from shades of pink, yellow, green, brown and black. Larvae usually have darker or lighter stripes running lengthwise on the body and can be positively identified by the presence of short, sharp microspines between the hairs on the body.

Life Cycle

Corn earworm has four life stages: egg, larva (five to six instars), pupa an adult. Earworms overwinter as pupae in the top inch or two of the soil. Adults begin to emerge in early spring. Moths also migrate north from Texas, augmenting the population that overwinters in Oklahoma. Eggs are laid on the buds or fruit of host plants. Larvae feed for 21 to 25 days before entering the soil to pupate. They prefer buds or fruit, but will also feed on the leaves of many different plants. There are at least four generations per year. First-generation larvae are found mostly in alfalfa and seldom cause problems early in most summer crops. Second-generation larvae commonly damage corn, beginning in mid-May. Third-generation moths probably attack soybean pods.



Shaded section indicates overwintering stage

Hosts

This insect is a general feeder of crops, fruits and vegetables and can feed on more than 300 host plants. The common name of the caterpillar is often based on the host plant, e.g. corn earworm, tomato fruitworm, cotton bollworm, soybean podworm or sorghum headworm.

Damage

Larva is the damaging stage. They damage soybean by feeding on seed pods of older plants with their chewing mouthparts.

Management

Generally, corn earworm control is not warranted for ear feeding in corn or whorl feeding in corn and sorghum. An economic threshold that is based on plant population and crop value and control costs as well as an efficient sampling plan can be accessed using the sorghum headworm calculator http://entoplp.okstate.edu/shwweb/index.htm. For specific insecticide suggestions, see CR-7167 *Management of Insect and Mite Pests in Soybean* or E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

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DECTES STEM BORER: *Dectes texanus* (LeConte)

Order Coleoptera: Family Cerambycidae



J.P. Michaud, Kansas State University, Bugwood.org



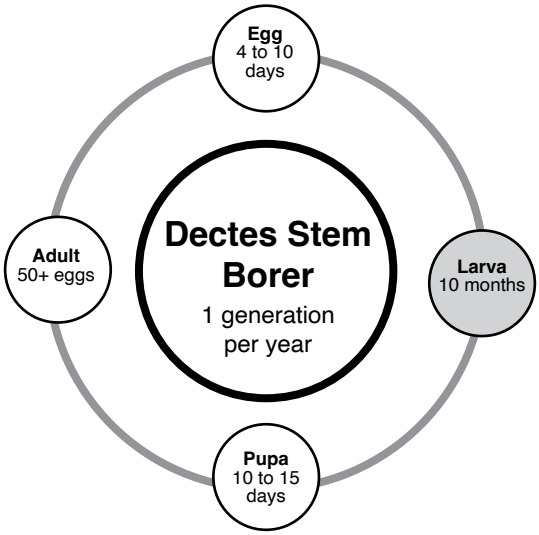
Frank Peairs, Colorado State University, Bugwood.org

Description

The adult beetle is gray, with antennae that extend past the tip of the abdomen. It measures 0.25 to 0.4 of an inch. Egg is yellow, narrowing at both ends. Larva is creamy white with a brown head capsule. Mature larva measure 0.6 inch long.

Life Cycle

Dectes stem borers have four life stages: egg, larva (six instars), pupa and adult. Adults emerge in late spring through summer, mate and females begin to lay eggs in about two weeks. Larvae feed in a soybean stems and overwinter as late instars in host plants below the soil line. Larvae resume feeding the following spring and pupate in late spring. They remain as pupae for 10 to 15 days.



Shaded section indicates overwintering stage

Hosts

Besides soybean, the preferred hosts for Dectes include sunflower, cocklebur (*Xanthium* spp.) and ragweed (*Ambrosia* spp.).

Damage

Larvae are the damaging stage. Adult beetles feed sparingly on their host just before egg deposition. They lay eggs on the upper petioles of soybean in July and August. At hatching, larvae feed and move to main stems, where they tunnel up and down. They tunnel inside the stems, eating the pith from late July through November. At fourth instar, they move down the stem to ground level and girdle the inside of the plant to form an overwintering chamber.

Management

Control of weed hosts can reduce preferred egg-laying sites. Burial of stem borer infested stubble can reduce overwintering larvae. Chemical control has not been found to be economical or effective.

GREEN CLOVERWORM: *Hypena scabra* (F.)

Order Lepidoptera: Family Eribidae



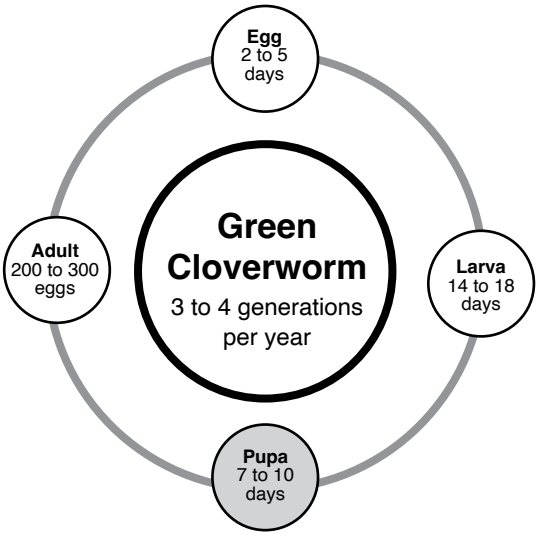


Description

Adult moths are dark brown to black, with spotted or mottled silver and brown patches, with a wingspan of 1.2 inches. Larvae are pale green with two longitudinal stripes, and four pairs of abdominal prolegs. A mature larva measures 1.15 inches.

Life Cycle

Green cloverworms have four life stages: egg, larva (six instars), pupa and adult. They overwinter as larvae or adults and are not thought to be able to overwinter north of 41 degrees latitude (about the Missouri/Iowa boarder). They are active year-round along the Gulf Coast. Adult female moths lay eggs singly, and one female can lay up to 300 eggs.



Shaded section indicates overwintering stage

Hosts

Besides soybean, the green cloverworm will feed on numerous legumes, including bean, clover, cowpea, pea and other legumes.

Damage

Larvae are the damaging stage. They feed on plant foliage with their chewing mouthparts. When populations get high, they can cause serious defoliation, resulting in yield loss.

Management

Green cloverworm is very susceptible to a disease caused by the fungus *Nomuraea rileyi*. If infestations become severe, they can be difficult to control with an insecticide. Insecticide application decisions should be based primarily on the presence of larvae and presence of significant damage. Current recommendations are to treat when there is 35 percent defoliation at vegetative stages, 15 to 20 percent defoliation during flowering and pod fill and 35 to 40 percent after full pod. For specific insecticide suggestions, see CR-7167 *Management of Insect and Mite Pests in Soybean* or E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

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SEEDCORN MAGGOT: *Delia platura* (Meigen)

Order Diptera: Family Anthomyiidae



Pest and Diseases Image Library, Bugwood.org



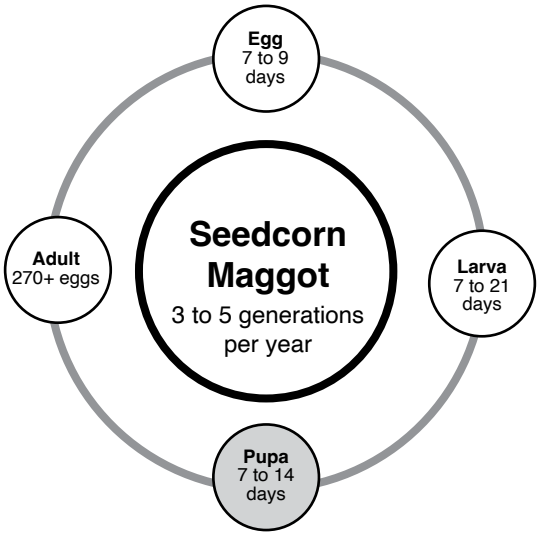
Purdue University

Description

The adult is a small, gray fly with black legs and scattered bristles on its body. It is less than 0.25 of an inch long. The larva is a typical fly maggot; legless and tough skinned with a pointed head and a rounded tail. It is white to yellow white and about 0.25 of an inch long when mature. Both adults and larvae are almost identical to those of the onion maggot.

Life Cycle

The seedcorn maggot overwinters as a pupa in the soil. The adults emerge in early spring. Females can lay up to 270 eggs, singly or in small clusters, in moist soil. Freshly disturbed soil, fields with decaying seed or crop remnants and organically fertilized soils are all attractive to ovipositing females. Eggs hatch in seven to nine days and larvae feed in seeds. They remain active at temperatures as low as 40 F. After feeding for one to three weeks, the larvae burrow deeper into the soil to pupate. There are three to five generations per year. Spring and fall generations are the most abundant and destructive. During summer, only a limited number of adults survive. Trapping records in Oklahoma show adults are active primarily from February to early June and from early September to early December.



Shaded section indicates overwintering stage

Hosts

Although it feeds primarily on decaying organic matter, the seedcorn maggot infests seeds and/or roots of nearly 50 plant species. In Oklahoma, damage is most commonly seen in corn, soybean and peas in April (ranges from late March to early May).

Damage

Larvae are the damaging stage. Seedcorn maggots damage newly planted seeds. They eat seed contents with their modified chewing mouthparts, often leaving empty shells and resulting in poor germination. Seedlings that do emerge are tall and spindly with few leaves. They rarely reach maturity, or mature late because of poor seed quality. Occasionally, seedcorn maggots tunnel in seedling roots or stems. Either type of feeding allows entry of plant pathogens. Damage is most likely in cold, wet springs and on land high in organic matter.

Management

Damage is rarely seen until plants fail to emerge or die soon after emergence or transplanting. If this occurs, dig up the plants or seeds and check for damage and/or larvae in or around the seed or roots. Seeds planted in a well-prepared seedbed with soil temperatures warm enough to encourage rapid germination can minimize infestations and plant injury. Prompt replanting of damaged crops usually gives a good stand because it is unlikely that adults will remain to infest the new plants. Seed treatments or soil-applied insecticides can be used to prevent seedcorn maggot damage. For specific insecticide suggestions, see CR-7167 *Management of Insect and Mite Pests in Soybean* or E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

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SOYBEAN APHID: *Aphis glycines* Matsumura

Order Hemiptera: Family Aphididae



Adam Sisson, Iowa State University, Bugwood.org



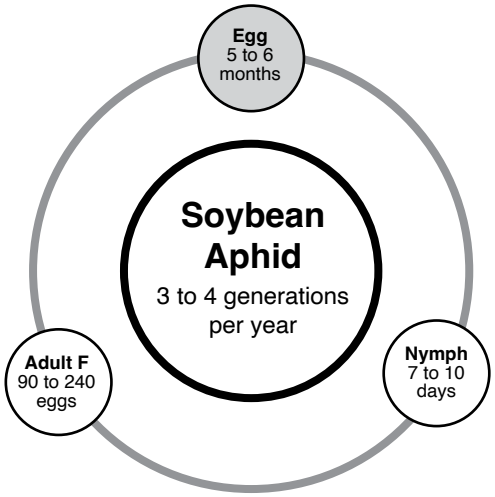
Christine DiFonzo, Michigan State University, Bugwood.org

Description

A mature soybean aphid measures 0.125 of an inch with a pear-shaped, light yellow to green body. It possesses two dark-tipped cornicles (tailpipe-like appendages) on the posterior end of the abdomen. They have yellow legs with dark tarsi and antennae that are light near the head and dark distally.

Life Cycle

Soybean aphid was introduced into the U.S. sometime before 2000. Soybean aphids have a complex life cycle that involves three life stages: egg, nymph (four instars) and adult (female and sometimes male). During the asexual phase, they reproduce by parthenogenesis, giving birth to live young (which are all females) which can become adults within seven to 10 days from birth. One female can produce up to 240 nymphs over 30 days. Newly born soybean aphids molt (shed their skin) three times before becoming an adult. Adult soybean aphids are winged or wingless, and both forms often occur in the same colony. In fall, winged female soybean aphids (called gynoparae) migrate to their secondary host (buckthorn, *Rhamnus* spp.) and produce sexuales (male and female) that mate, and the female oviparae lay eggs that will overwinter. Eggs hatch (producing fundatrices), that give birth to live young and spend several generations feeding on buckthorn. A winged form migrates to soybean and colonizes early vegetative stages (V1-V5). Winged aphids are a main source of new infestations.



Shaded section indicates overwintering stage

Hosts

Soybean aphid relies on soybean and buckthorn to complete its life cycle.

Damage

Adults and nymphs are the damaging stages. Damage by soybean aphid in soybean is dependent on the growth stage of the soybean plant. They directly remove sap from the plant with their piercing/sucking mouthparts, which removes sugars and nutrients and increases water stress. They produce copious amounts of honeydew (a liquid waste product), which is a substrate for sooty mold. Sooty mold can reduce photosynthesis. Heavy infestations can kill leaves and weaken plants. Heavy infestations can stunt plants, cause flower and pod abortion and reduce seed size and seed count. Soybean aphid is known to transmit soybean plant viruses, such as Soybean Mosaic Virus and Alfalfa Mosaic Virus. Fortunately, this aphid has rarely been found infesting soybean in Oklahoma.

Management

Varieties with Rag genes (Rag1, Rag2) show some resistance to soybean aphid. Planting early will help reduce aphid pressure. The use of insecticide seed treatments can delay aphid buildup early. Natural enemies, particularly the multicolored Asian lady beetle can reduce moderate soybean aphid infestations.

This aphid can build numbers quickly during vegetative growth stages. Scouting for them is essential. Current economic thresholds are 250 aphids per plant. A speed-scouting method has been developed. If a plant has more than 40 aphids, it is considered infested (and tied to the 250 economic threshold). For specific insecticide suggestions, see CR-7167 *Management of Insect and Mite Pests in Soybean* or E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

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SOYBEAN LOOPER: *Chrysodeixis includens* (Walker)

Order Lepidoptera: Family Noctuidae



Russ Ottens, University of Georgia, Bugwood.org



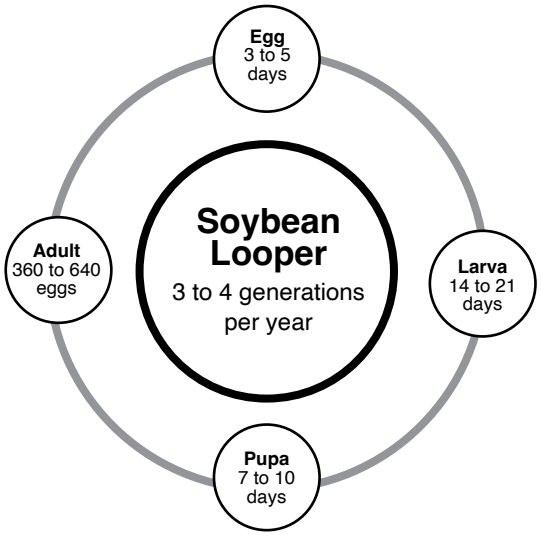
Clemson University, USDA Cooperative Extension Slide Series, Bugwood.org

Description

Adult moths have a wingspan of 1.5 inches. The forewings are mottled brown with a bronze sheen with a silvery spot resembling a V or figure 8 near the center. The hindwings are dusky brown. Eggs are round, greenish white and slightly smaller than a pinhead. Newly hatched larvae are green. As they mature, they develop white stripes, two on top and two on each side. They have three pairs of prolegs, two pairs on the abdomen and one pair at the anal end. Larvae move in a characteristic looping motion. They reach about 1.2 inches long at maturity. The pupal stage is encased in a loosely woven, white cocoon on the host plant.

Life Cycle

Soybean looper has four life stages: egg, larva (six instars), pupa and adult. This species does not overwinter in Oklahoma. If is known to reproduce continuously in Florida and southern Texas. The moths are active at night and each female may lay up to 640 eggs singly on the upper surface of leaves. Larvae feed for two to four weeks before pupating. The pupal stage lasts for two weeks. With warm temperatures, development of cabbage loopers from egg to adult takes about 24 to 30 days.



Shaded section indicates overwintering stage

Hosts

Preferred hosts are soybean, sweet potato and peanut. Other hosts include cotton, tomato, crucifers, pea, tobacco and cocklebur.

Damage

Young larvae scarify the leaves, older larvae with their chewing mouthparts. Older larvae chew irregularly shaped holes of various sizes as they get older. When caterpillars feed on the growing point, they can kill or cause branching from auxiliary buds. They will also rarely feed on developing seed pods.

Management

While present in soybean, they rarely cause economic damage. If infestations become severe, they can be difficult to control with an insecticide. Insecticide application decisions should be based primarily on the presence of larvae and presence of significant damage. Current recommendations are to treat when there is 35 percent defoliation at vegetative stages, 15 to 20 percent defoliation during flowering and pod fill and 35 to 40 percent after full pod. For specific insecticide suggestions, see CR-7167 *Management of Insect and Mite Pests in Soybean* or E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

STINK BUGS

Order Hemiptera: Family Pentatomidae

Green stink bug *Chinavia hilaris* (Say)
Brown stink bug *Euschistus servus* (Say)
Southern green stink bug *Nezara viridula* (L.)



Richard Grantham, Oklahoma State University



David Cappaert, Bugwood.org



Richard Grantham, Oklahoma State University



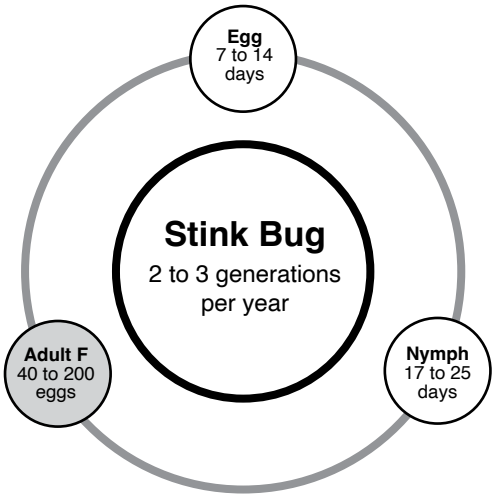
Richard Grantham, Oklahoma State University

Description

The green stink bug measures from 0.5 to 0.75 of an inch and will vary in color from bright green to a dull brown and have a characteristic shield (five-cornered) shape. The green stink bug is, as the name implies, green and has characteristic slender mouthparts containing stylets that function to suction plant juices from the tissue once the mouthparts have pierced the surface. Although this species is common in soybean, there are similar species that resemble the green stink bug and create the same damage. The brown stink bug is brown and can cause the same type of injury. The nymphs are similar to the adults, but lack wings and may also possess bright red, yellow or orange markings on the abdomen. They may range in size from about 0.125 of an inch long to nearly 0.5 of an inch long when mature.

Life Cycle

Stink bugs overwinter as adults in protected areas such as fence rows, grassy field borders, under stones or bark of trees. They become active during the first warm days of spring. Stink bugs may undergo two to three generations during a growing season. Egg laying can occur anytime when adults are present from May through August. Eggs will



Shaded section indicates overwintering stage

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hatch from six days to three weeks, depending on temperatures. The five nymphal instars require 23 to 60 days to reach adulthood. Female bugs may move readily between weeds and other alternate hosts, such as fruit trees and pecans.

Hosts

Stink bugs injure soybean as adults and nymphs with their piercing/sucking mouthparts. They also feed on fruits, nuts, corn, sorghum seeds and many other crops.

Damage

Stink bugs eat plant fluids by piercing plant tissue with their piercing and sucking beaks. They will attack leaves, stems, blooms and seeds, but prefer tender, rapidly growing plant tissue. Damage occurs from the digestive fluids they inject into the plant, resulting in deformation of leaves and stems, abortion of seed pods and reduction in quality of seeds. The resulting feeding wounds also serve as an entry point for plant diseases. Heavy feeding can delay leaf maturity and abnormal development of leaves, stems and seeds. Seed feeding in particular, can result in deformed, underdeveloped, shriveled and discolored seeds. Yield loss can be severe.

Management

Monitoring for stink bugs can be accomplished with ground (drop) cloths or sweep nets. A treatment threshold of one or more stinkbugs per row-foot warrants control. For specific insecticide suggestions, see CR-7167 *Management of Insect and Mite Pests in Soybean* or E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

THREECORNERED ALFALFA HOPPER: *Spissistilus festinus* (Say)

Order Hemiptera: Family Membracidae



Gerald J. Lenhard, Louisiana State University, Bugwood.org



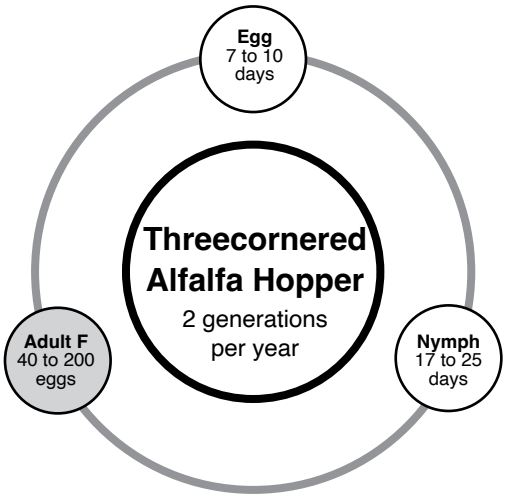
David Adams, University of Georgia, Bugwood.org

Description

The threecornered alfalfa hopper adult is triangular, bright green and measures 0.2 to 0.25 of an inch. Nymphs have 12 pairs of projecting spines along the top of the body. Nymphs are transparent when first hatched, turning buff colored after the first molt and light green after the second molt.

Life Cycle

Threecornered alfalfa hoppers have three life stages: egg, nymph (five instars) and adult. Three cornered alfalfa hoppers overwinter in pine debris. In early spring, they move onto alternate hosts to feed and reproduce. The first-generation adults then move into soybean to feed. When second-generation adults become active, they move into potential overwintering sites, but actively feed if temperatures warm during the winter.



Shaded section indicates overwintering stage

Hosts

Hosts include lespedeza, red and white clovers, vetch, cocklebur, dock and wild geraniums.

Damage

Threecornered alfalfa hoppers feed on plant sap with their piercing/sucking mouthparts. Both adults and nymphs are damaging stages. They can cause indirect damage resulting in yield reductions through their feeding. Direct damage occurs when they girdle stems, causing disruption of nutrient flow, plant lodging, pod and flower abscission and even plant death.

Management

Management decisions are made through scouting using a sweep net or ground cloth for nymphs. Threshold is 10 to 30 percent of plants girdled with nymphs present. For specific insecticide suggestions, see CR-7167 *Management of Insect and Mite Pests in Soybean* or E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

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VELVETBEAN CATERPILLAR: *Anticarsia gemmatalis* Hübner

Order Lepidoptera: Family Eribidae



John C. French Jr., Retired, Universities: Auburn, GA, Clemson and U of MO, Bugwood.org



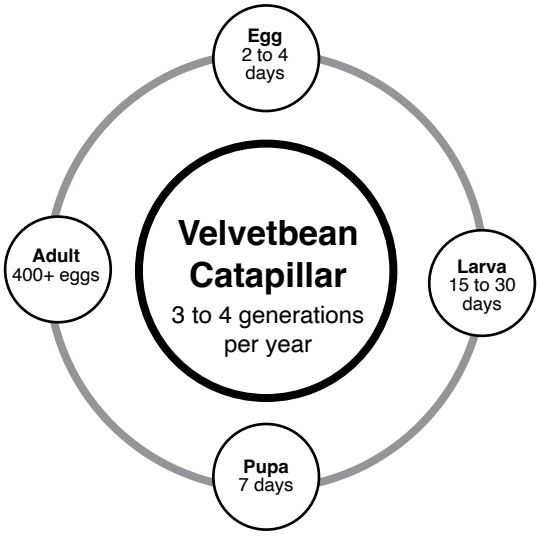
Clemson University-USDA Cooperative Extension Slide Series, Bugwood.org

Description

Adult moths have a wingspan of 1.2 to 1.5 inches. The forewings are variable in color, ranging from dark reddish brown to light ash gray, to light yellowish brown. Hindwings are cinnamon brown with a row of light spots near the margin. A dark diagonal black line across the wings is always present. Eggs are round but flattened on the lower surface and turn pink just before hatching. Larva also vary in color from green to brown to black. As they mature, they develop white stripes, one on top and two on each side. They have five pairs of prolegs, four pairs on the abdomen and one pair at the anal end. Larvae thrash violently when disturbed. They reach about 1.9 inches long at maturity.

Life Cycle

Velvetbean caterpillar does not overwinter in Oklahoma. It has four life stages: egg, larva (six instars), pupa and adult. Adult moths lay eggs singly on leaves, stems and pods. One female can lay upwards of 400 eggs. Larva hatch, and the first instar consumes its egg capsule. Second through sixth instars feed on foliage. Pupa is 0.75 inches, light green to brown with three hooked spines at the end of the abdomen. Larvae feed for two to six weeks before pupating. The pupal stage lasts for one week. With warm temperatures, development of velvetbean caterpillars from egg to adult takes about 24 to 30 days.



Shaded section indicates overwintering stage

Hosts

Besides soybean, velvetbean caterpillar will eat kudzu, peanut and of course, velvetbean. They have also been found on cotton, cowpea and black locust.

Damage

Larva is the damaging stage. They feed on plant foliage with their chewing mouthparts. When populations get high, they can cause serious defoliation, resulting in yield loss. They are very susceptible to natural enemies and diseases.

Management

Velvetbean caterpillar is very susceptible to natural enemies. Insecticide application decisions should be based primarily on the presence of larvae and presence of significant damage. Current recommendations are to treat when there is 35 percent defoliation at vegetative stages, 15 to 20 percent defoliation during flowering and pod fill and/or 35 to 40 percent after full pod. For specific insecticide suggestions, see CR-7167 *Management of Insect and Mite Pests in Soybean* or E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

YELLOW WOOLLY BEAR: *Spilosoma virginica* (F.)

Order Lepidoptera: Family Eribidae



Daren Mueller, Iowa State University, Bugwood.org



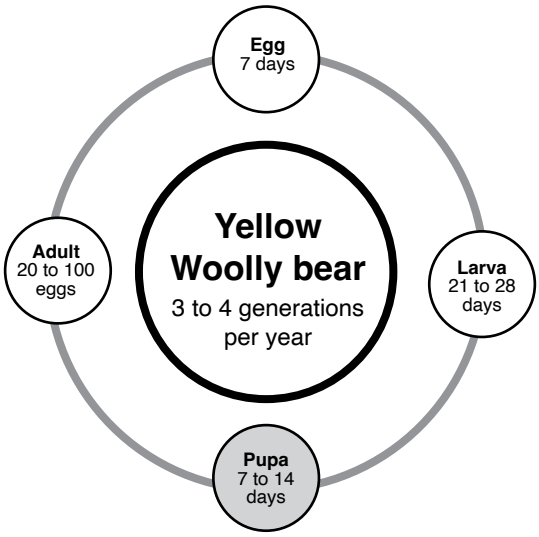
Mark Dreiling, Bugwood.org

Description

Adult moths are nearly pure white except for the yellow pattern on the sides of the abdomen and a few black spots scattered on each wing. Wingspan of 1.5 inches. Eggs are lemon to golden yellow, laid in a cluster of 50+ and often covered with hairs from the body of the female moth. Larva is densely covered with long and short, soft setae (hairs). Color varies from pale yellow to brownish yellow to red and even black. A mature caterpillar can measure nearly 2 inches. Pupa is surrounded by a thin, silken cocoon.

Life Cycle

Yellow woolly bear caterpillar has four life stages: egg, larva (six instars), pupa and adult. It overwinters in the pupal stage. Adult moths emerge in spring and begin to lay eggs. Eggs hatch in about seven days. Young larvae may feed in clusters before scattering as they become older.



Shaded section indicates overwintering stage

Hosts

Besides soybean, it is known to feed on a variety of plants, including aster, clover, corn, elm, maple and other trees, sunflower and other garden plants.

Damage

Larva is the damaging stage. Yellow woolly bear feeds on foliage with its chewing mouthparts.

Management

Yellow woolly bear rarely causes damage to soybean in Oklahoma. Current recommendations are to treat when there is 35 percent defoliation at vegetative stages, 15 to 20 percent defoliation during flowering and pod fill and 35 to 40 percent after full pod. For specific insecticide suggestions, see CR-7167 *Management of Insect and Mite Pests in Soybean* or E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

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SUNFLOWER INSECTS

SUNFLOWER GROWTH STAGES

Code	Description
Principal growth stage	
0:	Germination
00	Dry seed (achene)
01	Beginning of seed imbibition
03	Seed imbibition complete
05	Radicle emerged from seed
06	Radicle elongated, root hairs developing
07	Hypocotyl with cotyledons emerged from seed
08	Hypocotyl with cotyledons growing towards soil surface
09	Emergence: cotyledons emerge through soil surface
Principal growth stage 1: Leaf development[1]	
10	Cotyledons completely unfolded
12	Two leaves (first pair) unfolded
14	Four leaves (second pair) unfolded
15	Five leaves unfolded
16	Six leaves unfolded
17	Seven leaves unfolded
18	Eight leaves unfolded
19	Nine or more leaves unfolded
Principal growth stage 3: Stem elongation	
30	Beginning of stem elongation
31	One visibly extended internode
32	Two visibly extended internodes
33	Three visibly extended internodes
3.	Stages continuous till...
39	Nine or more visibly extended internodes

Principal growth stage 5: Inflorescence emergence

51	Inflorescence just visible between youngest leaves
53	Inflorescence separating from youngest leaves, bracts distinguishable from foliage leaves
55	Inflorescence separated from youngest foliage leaf
57	Inflorescence clearly separated from foliage leaves
59	Ray florets visible between the bracts; inflorescence still closed

Principal growth stage 6: Flowering

61	Beginning of flowering: ray florets extended, disc florets visible in outer third of inflorescence
63	Disc florets in outer third of inflorescence in bloom (stamens and stigmata visible)
65	Full flowering: disc florets in middle third of inflorescence in bloom (stamens and stigmata visible)
67	Flowering declining: disc florets in inner third of inflorescence in bloom (stamens and stigmata visible)
69	End of flowering: most disc florets have finished flowering, ray florets dry or fallen

Principal growth stage 7: Development of fruit

71	Seeds on outer edge of the inflorescence are gray and have reached final size
73	Seeds on outer third of the inflorescence are gray and have reached final size
75	Seeds on middle third of the inflorescence are gray and have reached final size
79	Seeds on inner third of the inflorescence are gray and have reached final size

Principal growth stage 8: Ripening

80	Beginning of ripening: seeds on outer third of anthocarp black and hard. Back of anthocarp still green
81	Seeds on outer third of anthocarp dark and hard. Back of anthocarp still green
83	Dark of anthocarp yellowish-green, bracts still green. Seeds about 50 percent dry matter
85	Seeds on middle third of anthocarp dark and hard. Back of anthocarp yellow, bracts brown edged. Seeds about 60 percent dry matter
87	Physiological ripeness: back of the anthocarp yellow. Bracts marbled brown. Seeds about 75 to 80 percent dry matter
89	Fully ripe: seeds on inner third of anthocarp dark and hard. Back of anthocarp brown. Bracts brown. Seeds about 85% dry matter

Principal growth stage 9:

92	Over ripe, seeds over 90 percent dry matter
97	Plant dead and dry
99	Harvested product

[1] Stem elongation may occur earlier than stage 19; in this case continue with the principal stage 3.

Lancashire, P.D.; H. Bleiholder; P. Langeluddecke; R. Stauss; T. van den Boom; E. Weber; A. Witzen-Berger (1991). "A uniform decimal code for growth stages of crops and weeds." *Ann. Appl. Biol.* 119 (3): 561–601. doi:10.1111/j.1744-7348.1991.tb04895.x.

DECTES STEM BORER: *Dectes texanus* LeConte

Order: Coleoptera: Family Cerambicidae



J.P. Michaud, Kansas State University, Bugwood.org



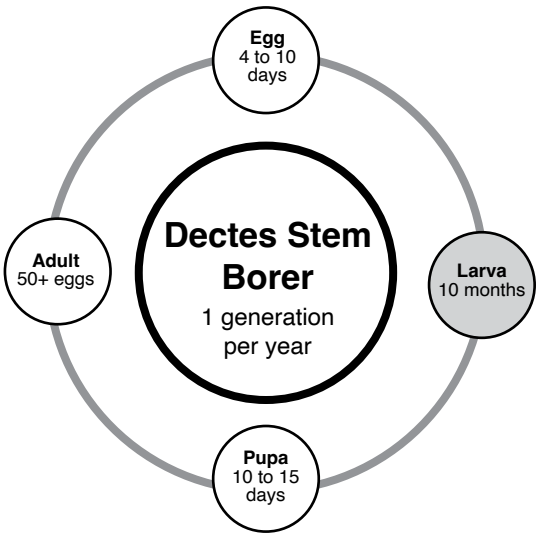
Kansas State University Insect Gallery http://entomology.k-state.edu/extension/insect-photo-gallery/Soybean.html

Description

Adult beetle is gray, with antennae that extend past the tip of the abdomen. It measures 0.25 to 0.4 of an inch. Egg is yellow, narrowing at both ends. Larva is creamy white with a brown head capsule. Mature larva measure 0.6 inch long.

Life Cycle

Dectes stem borers have four life stages: egg, larva (six instars), pupa and adult. Adults emerge in late spring through summer, mate and females begin to lay eggs in about two weeks. Larvae feed in a soybean stems and overwinter as late instars in host plants below the soil line. Larvae resume feeding the following spring and pupate in late spring. They remain as pupae for 10 to 15 days.



Shaded section indicates overwintering stage

Hosts

Besides sunflower, the preferred hosts for Dectes include cocklebur (*Xanthium* spp.), ragweed (*Ambrosia* spp.) and soybean.

Damage

Adult and larvae are damaging stages. Adult beetles feed sparingly on their host just before egg deposition using their chewing mouthparts. They lay eggs on the upper petioles of soybean in July and August. Larva is the main damaging stage. At hatching, they feed and move to main stems, where they tunnel up and down using their chewing mouthparts. They tunnel inside the stems, eating the pith from late July through November. At fourth instar, they move down the stem to ground level, then girdle the inside of the plant to form an overwintering chamber.

Management

Control of weed hosts can reduce preferred egg-laying sites. Burial of stem borer infested stubble can reduce overwintering larvae. Management of plant populations so plants develop larger stalks can reduce the impact of stem feeding. Kansas suggests planting to obtain 11,000 to 15,000 plants per acre in non-irrigated sunflowers. Chemical control has not been found to be economical or effective.

Notes

PAINTED LADY:
Vanessa cardui (L.)

Order Lepidoptera: Family Nymphalidae



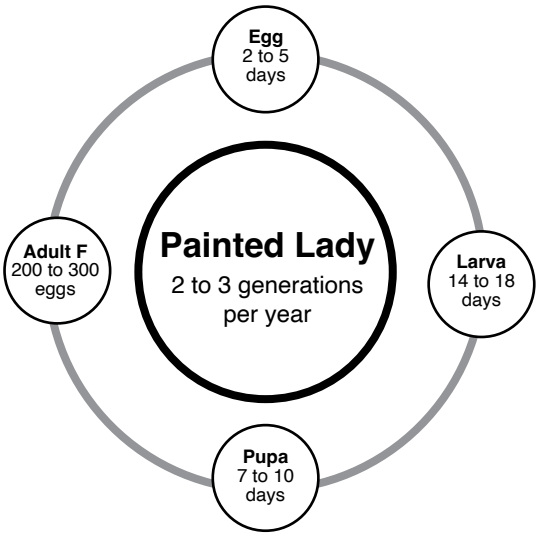
William M. Ciesla, Forest Health Management Int. Bugwood.org



Frank Peairs, Colorado State University, Bugwood.org

Description

Adults are grown with orange and black markings on forewings and hindwings, a black patch on the apex of each forewing contains five white patches. Wingspan is 2 to 3.5 inches. Larvae variably colored with ground color ranging from green to yellow to pink to black with densely spaced spines and unbranched hairs, giving it a bristly appearance. Eggs are barrel shaped and white to greenish.



Shaded section indicates overwintering stage

Life Cycle

Painted lady has four life stages: egg, larva (five instars), pupa and adult. They do not overwinter in Oklahoma, but they are a migratory species that migrates northward each spring.

Hosts

Besides sunflower, it feeds on thistles, burdock and numerous plants in the sunflower, aster and mallow families.

Damage

Larva is the damaging stage, and it feeds on leaves with its chewing mouthparts. As the grow, they can completely strip the leaves on an infested sunflower plant. The often create a loosely tied nest with webbing.

Management

Fields should be monitored. They rarely cause economic damage, but a suggested threshold is 25 percent defoliation plus presence of caterpillars. For specific insecticide suggestions, see CR-7197 *Management of Insect and Mite Pests in Sunflowers* or E-832, *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

SUNFLOWER BEETLE: *Zygogramma exclamationis* (F.)

Order Coleoptera: Family Chrysomelidae



Frank Peairs, Colorado State University, www.Bugwood.org



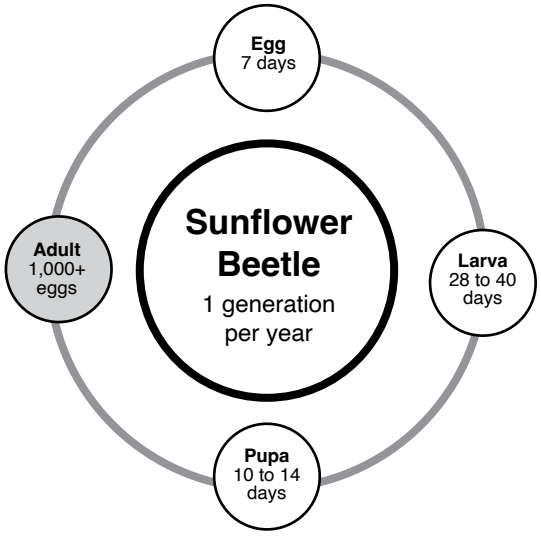
Whitney Cranshaw, Colorado State University, www.Bugwood.org

Description

The adult sunflower beetle measures 0.25 to 0.38 of an inch. It has a reddish-brown head. Its thorax is cream colored and adorned with a reddish-brown patch that extends to the border between the thorax and wing covers. Wing covers are cream colored with three longitudinal stripes along each wing, and a partial forth stripe that resembles an exclamation point. Larva is pale green to yellow, is swollen with a humped back and a light brown head capsule. It measures 0.35 inch when mature.

Life Cycle

Sunflower beetle has four life stages: egg, larva (four instars), pupa and adult. It overwinters as an adult. In spring, adult beetles mate and females begin to lay eggs. Larvae feed for about five to six weeks, then pupate into the soil. Adult beetles emerge in about two weeks, and adult beetles will also feed for about two weeks. They then re-enter the soil and overwinter.



Shaded section indicates overwintering stage

Hosts

Food plants for sunflower beetle are fairly restricted, including the annual sunflower and other *Helianthus* species.

Damage

Both adult and larva are damaging stages. Typically, adult beetles feed on leaf margins, while larvae consume the entire leaf surface using their chewing mouthparts. Larvae damage results in leaves that have a lacy appearance. Adult beetles begin to feed on young sunflower plants, seeming to prefer the first true leaves. Large numbers of adult beetles and larvae can cause severe defoliation.

Management

Delayed planting has been shown to reduce damage potential from sunflower beetle. In many years, natural enemies can keep populations from reaching damaging levels. It is important to scout and use treatment thresholds to preserve natural enemy activity as much as possible. Treatment thresholds in the northern plains suggest that seedlings should be treated when numbers reach one to two adults per seedling. As plants get older, treatment is suggested when larval numbers reach 10 to 15 per plant and leaves show 25 percent defoliation. For specific insecticide suggestions, see CR-7197 *Management of Insect and Mite Pests in Sunflowers* or E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control*.

Notes

SUNFLOWER HEADCLIPPING WEEVIL: *Haplorhynchites aeneus* (Boheman)

Order Coleoptera: Family Attelabidae



Whitney Cranshaw, Colorado State University, www.Bugwood.org



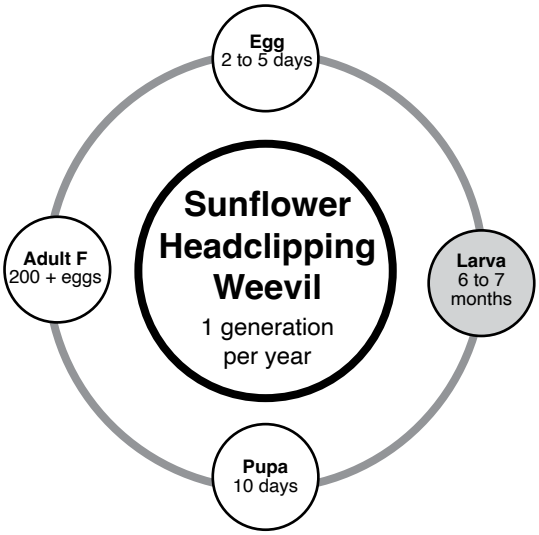
Whitney Cranshaw, Colorado State University, www.Bugwood.org

Description

The adult sunflower headclipping weevil measures 0.33 inch and has a curved proboscis and soft wing covers. Larvae are cream colored, C-shaped grubs that measure about 0.2 to 0.25 of an inch.

Life Cycle

The sunflower headclipping weevil has four life stages: egg, larva, pupa and adult. Adult beetles emerge in early-mid-summer to feed for about two to three weeks. Females eat pollen and nectar to develop energy reserves to produce eggs. When ready to lay eggs, the female makes one complete row of feeding punctures just below the sunflower head, then lays an egg on the head. The head is essentially girdled from the stem, and drops off some time later. The larvae feed on the severed head, then move to the soil to overwinter. They pupate sometime in late spring, then become adults. One female can lay 200 to 2,000 eggs



Shaded section indicates overwintering stage

Hosts

Besides wild and domesticated sunflower, it reportedly will feed on coneflowers and other members of the Aster family. It will also feed on *Silphium* spp.

Damage

Adults are the damaging stage, even though larvae feed on the clipped head. They feed with their chewing mouthparts.

Management

While this beetle causes visible damage, it is rarely a severe pest of commercial sunflower, and no threshold has been established. Kansas suggests that a field be treated if 10 percent of heads are clipped and weevils are still active. For specific insecticide suggestions, see CR-7197 *Management of Insect and Mite Pests in Sunflowers* or E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control*.

SUNFLOWER SEED WEEVIL COMPLEX

Order Coleoptera: Family Curculionidae

Gray Sunflower Seed Weevil
***Smicronyx sordidus* LeConte**



Frank Peairs, Colorado State University, Bugwood.org

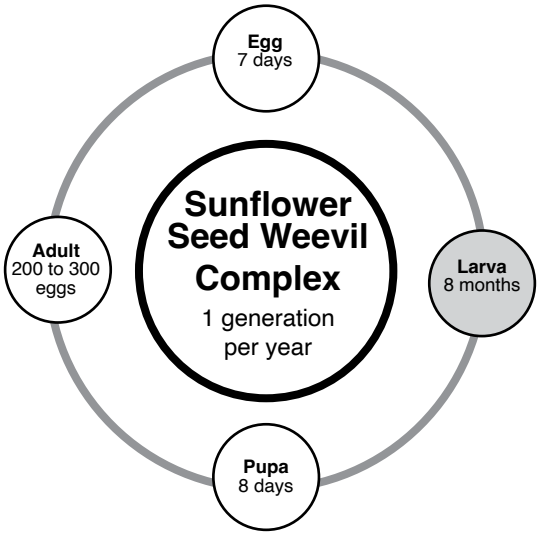
Red Sunflower Seed Weevil
***Smicronyx fulfus* LeConte**



Frank Peairs, Colorado State University, Bugwood.org



Frank Peairs, Colorado State University, Bugwood.org



Shaded section indicates overwintering stage

Description

The gray seed weevil measures 0.15 to 0.025 of an inch, with a body covered by gray scales and has a prominent snout. The red seed weevil is slightly smaller (0.10 to 0.12 of an inch) and its body is covered with orange-red scales and has a prominent snout. Larvae are whitish grubs that live inside of a sunflower seed.

Life Cycle

Both seed weevils have four lifestages: egg, larva (five instars), pupa and adult. Adult beetles emerge in late spring and inhabit sunflower fields that are nearing bloom. Gray seed weevils tend to emerge first, about 10 days before the red seed weevil. Male and female weevils feed on flower buds underneath the flower bracts. Female gray seed weevils lay eggs in flowers at the bud stage. Female red seed weevils must feed on pollen to mature their eggs, so they oviposit after pollen release. Both red and gray female weevils lay eggs singly. Larvae bore into the seed at its base, and destroy the ovaries. When mature, the larvae drop to the ground and bury themselves in the soil. They pupate in late spring.

Hosts

Literature suggests that these weevils are limited to *Helianthus* species.

Notes

Notes

Damage

Larvae of both weevils consume the seed with their chewing mouthparts, but red seed weevil usually does not consume the whole seed. Red seed weevil larvae are also often still within the seed achene at harvest, and their presence can influence seed quality in storage. The red seed weevil is considered the most damaging.

Management

Tillage has been shown to reduce seed weevils, but is not suggested where soil moisture conservation is needed. Fields should be scouted once 85 percent of plants pass the R4 growth stage. Do not scout flowers at the field's edge, as weevils tend to concentrate there first, and scouting in this area can give an inaccurate count. Go at least 100 feet into the field and walk in an X pattern. Use DEET as a flushing agent and spray the two to three most mature heads at five different locations, and wait until the adult weevils emerge from the face of the head. Threshold is 10 weevils per head for oilseed varieties and two weevils per head for confection varieties. For specific insecticide suggestions, see CR-7197 *Management of Insect and Mite Pests in Sunflowers* or E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control*.

SUNFLOWER STEM WEEVIL COMPLEX

Order Coleoptera: Family Brentidae and Curculionidae

Black sunflower stem weevil
***Apion* (Fallapion) *occidentale* Fall**



Kansas State University

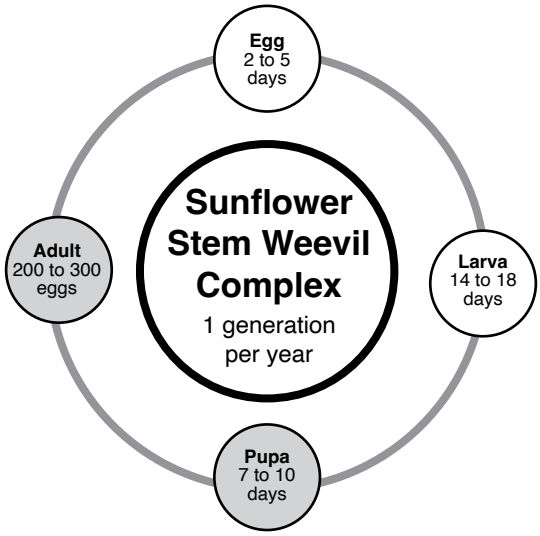


Frank Peairs, Colorado State University, Bugwood.org

Sunflower stem weevil
***Cylindrocopturus adspersus* (LeConte)**



Frank Peairs, Colorado State University, Bugwood.org



Shaded section indicates overwintering stage

Description

The adult black sunflower stem weevil is black and about 0.09 of an inch. The snout is narrow and jutted forward from the head. Eggs are very tiny, yellow and 0.02 of an inch. Larvae are yellowish, and a mature larva measures 0.125 of an inch.

The sunflower stem weevil is grayish brown with irregular-shaped white spots on the wing covers and thorax. It 0.19 of an inch long. The snout, eyes and antennae are black and the snout projects downward and recedes from the head. Eggs are yellow and tiny. Larvae have a creamy-white body with a brown head capsule, a mature larva measures 0.25 of an inch.

Life Cycle

Both weevils have four lifestages: egg, larva (five instars), pupa and adult. There is one generation per year. Sunflower stem weevils overwinter as pupae in overwintered stalks and root crowns. They begin feeding from early April through early May. After feeding on wild sunflower, they migrate to lay eggs near the base of the sunflower plant. Adults remain present through July. They tunnel into the pith of the sunflower stem. When ready to pupate, they descend to the crown root and chew a chamber in which they pupate and overwinter.

Black stem weevils overwinter as adults in soil, plant trash and weed clusters. They feed on volunteer seedling sunflowers before moving into cultivated sunflowers at the two- to four-leaf stage. After hatching, larvae tunnel into the pith, where they pupate and emerge as adults.

Notes

Notes

Hosts

Both red and gray weevils have a wide host range. Besides sunflower, they feed on many native sunflowers, ragweed, pigweed, Russian knapweed, lambsquarter, perennial sowthistle, cocklebur, kochia and sugarbeets.

Damage

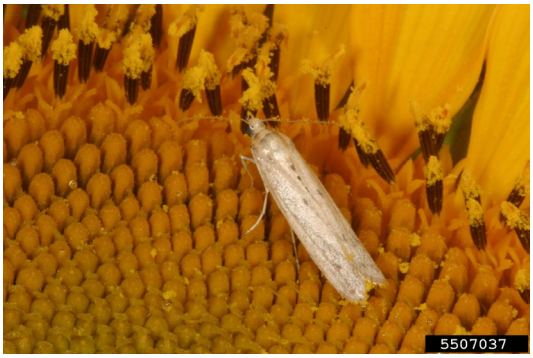
Adults and larvae damage plants with their chewing mouthparts. They do not directly reduce yield, but can reduce stalk strength, which can increase the tendency for lodging. They are also associated with infection by the fungus that causes Phoma black stem disease.

Management

Crop rotation and stem destruction with tillage can reduce numbers. Double-cropped sunflowers are not at risk from infestation. Scouting for adults is difficult because they are cryptic and numbers rarely correlate with stem infestations. An insecticide applied at the eight- to 10-leaf stage in fields that were planted before the first week of June can reduce infestations. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control.*

SUNFLOWER MOTH: *Homoeosoma electellum* (Hulst)

Order Lepidoptera: Family Pyralidae



Phil Sloderbeck, Kansas State University.



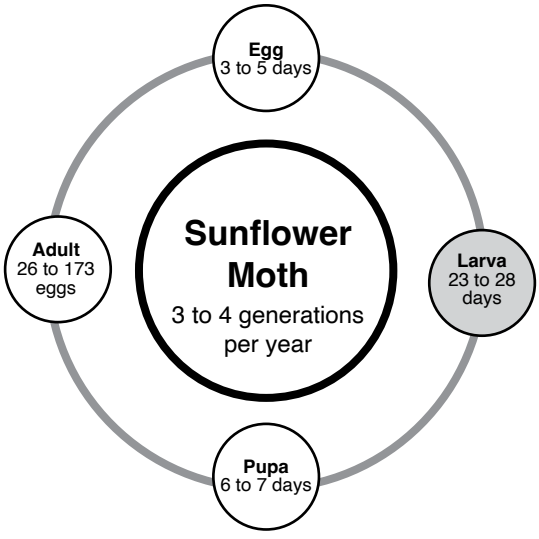
Frank Peairs, Colorado State University, Bugwood.org

Description

The adult moth is cigar shaped grayish to white and measures 0.3 to 0.65 of an inch. It folds its wings tightly around its body at rest. The larva has a brown head capsule, with a purplish-pink body that has alternating dark and light stripes running from head to tail. Mature larvae measure 0.75 to 0.9 of an inch.

Life Cycle

The sunflower moth has four life stages: egg, larva (four to five instars), pupa and adult. The moth is migratory, moving northward with successive generations. Its migration is aided by southerly weather fronts that move northward during the summer. The larva undergoes facultative diapause, but is not capable of surviving temperatures below 14 F for long periods. It appears to be able to overwinter below 40 degrees latitude.



Shaded section indicates overwintering stage

Hosts

The sunflower moth has been found on many hosts, mostly on plants in the *Asteraceae* family. Besides domestic and wild sunflowers and other wild *Helianthus* spp., they have been found feeding on musk thistle, *Gailardia* spp., sweetclover, *Englemannia pinnatifda* and *Tagetes* spp.

Damage

Sunflower moth larvae damage sunflower seed with their chewing mouthparts. Young larvae initially feed on pollen and florets, but as they grow, they tunnel under the pericarp and feed on developing achenes. They spin webbing on the flower head surface. A single larva can consume nine seeds during its life. Severe infestations can result in a 30 to 60 percent yield loss. Their feeding also can give rise to secondary infections of Rhizopus head rot.

Management

Management requires scouting. Planting early can help avoid infestations. Fields should be scouted when flowers first open. The treatment threshold is one to two moths per five plants after 20 percent bloom. For specific insecticide suggestions, see E-832 *Extension Agents' Handbook of Insect, Plant Disease and Weed Control*.

Notes



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