

**POCKET GUIDE TO**

# **GRASS SEED PESTS AND BENEFICIALS**

**Identification • Monitoring • Management**

**OREGON STATE UNIVERSITY EXTENSION SERVICE**

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## Cover photo

Former Oregon State University Extension entomologist Glenn Fisher, right, examines mites with Mylen Bohle, Central Oregon Agricultural Research Center forage specialist.

Photo: Lynn Ketchum, © Oregon State University

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Adult meadow plant bug.  
Photo: Thomas Palmer, BugGuide.net

## Using the guide

This pocket guide provides information on pests and beneficial organisms found in grass seed production fields across the state of Oregon.

Pests are organized alphabetically within each category. The guide includes common occurrences; where pests are found; arthropod pest status; identification; biology; symptoms of damage; what you might mistake one for; thresholds, if known; ways to monitor; prevention tools and management; and a pest scouting calendar based on crop stage.

Current registered chemical management options can be found in the *PNW Insect Management Handbook*, <https://pnwhandbooks.org/insect>.

## Glossary

**Cauda:** The “tail” or appendage at the end of an aphid’s abdomen.

**Cornicles:** Pair of dorsal, tubular processes on dorsal, posterior end of an aphid’s abdomen (“tailpipes”); corniculi.

**Crochets:** On moth larvae (cutworms, armyworms, webworms), the bottom of prolegs can have a series of hooklike structures arranged in rows, bands, circles or half-circles that are helpful in identification to family level.

**Economic threshold:** The density of a pest at which damage can occur and control is warranted.

**Entomopathogenic nematode:** A nematode (roundworm) infecting insects only.

**Frass:** Excrement or droppings left by insects.

**Honeydew:** Sugary, liquid excretions released from the anus of aphids, leafhoppers and mealybugs.

**Immature stage:**

- **Grubs** are generally referred to as immature beetle larvae.
- **Larvae, or caterpillars**, have wormlike bodies with legs and are different from the adult (for example, moths and beetles).
- **Maggots** are wormlike without legs (fly larvae, for example).
- **Nymphs** molt, wings develop, and they resemble the adult form (grasshoppers and leafhoppers, for example). They do not reproduce.
- **Pupa/pupae or hibernaculum** is the resting or overwintering stage of an insect.
- **Neonates** are young, immature, nonreproductive slugs.

**Molted skins:** Sloughing or shedding of the insect skin.

**Prolegs:** Small, fleshy, stubby-looking legs found on the posterior of wormlike larva body that help them grip.

**True legs:** Six jointed legs located near the head of the larvae. True legs are retained through adulthood.

Source: CAB Direct, <https://www.cabdirect.org>

## English-metric conversions

Sizes smaller than 1 inch are listed in metric units. Sizes greater than 1 inch are listed in both English and metric units.

English measurement	Metric equivalent	
1/8 inch	3.2 mm	
1/4 inch	6.4 mm	
1/2 inch	12.7 mm	
1 inch	25.4 mm, 2.54 cm	
1 foot (ft.)	30 cm, 0.33 m	
1 yard (yd.)	0.91 m or 3 ft.	
1 square inch (sq. in.)	6.5 cm <sup>2</sup>	
1 square foot (sq. ft.)	929 cm <sup>2</sup> , 0.1 m <sup>2</sup>	
1 square yard (sq. yd.)	8361 cm <sup>2</sup> , 0.8 m <sup>2</sup>	
1 cubic foot (cu. ft.)	0.03 m <sup>3</sup> , 28,317 cm <sup>3</sup>	
1 tablespoon (T)	15 ml	
1 fluid ounce (fl. oz.)	29.6 ml	
1 cup	235 ml or 8 fl. oz.	
1 gallon (gal.)	4 liters	



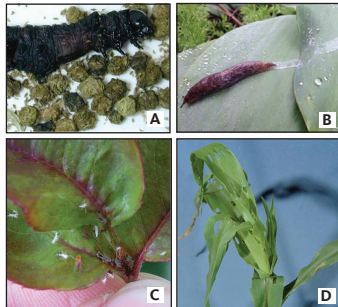
Monitor fields regularly for pests. The goal is to discover problems before damage occurs.  
Photo: © Oregon State University

## A step-by-step guide to diagnosing plant problems

Incorrectly identifying a pest problem will lead to a poor management decision. Monitor agricultural sites regularly for pests. Closely follow a plant's health as it grows to discover pest problems before economic damage occurs. Identifying pest problems is detective work; be inquisitive.

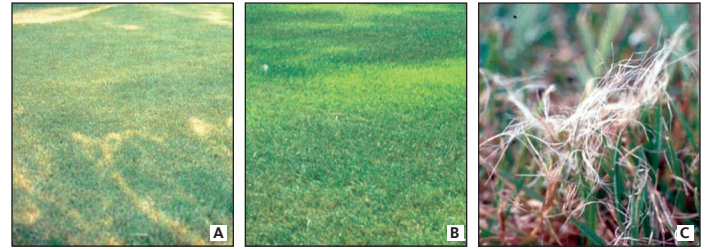
### Describe the plant abnormality or problem. Ask questions:

- What should a normal plant look like at the time of observation?
- Am I giving the plant what it needs (water, nutrients, light)?
- Are the problem symptoms found on new or old growth, in the whole field or localized, on the stem or on other plant parts?



Signs of damage can include frass (A), slime trails (B), the skins of molted insects (C) and plant tissue rolled up, folded or chewed (D).

Photos: Amy Dreves, University of the Virgin Islands (A–C), Bugwood.org (D)



### Collect evidence from living organisms (biotic)

- Do you see pest signs on the damaged plant? These can include: frass (large caterpillar droppings, pepperlike excretions), slime trails, stickiness from honeydew, molted insect skins, webbing, eggs, fungal spores or bacterial ooze, or the organism itself, invertebrates (such as insects, mites, symphylla), vertebrates (rats, mice, birds, rabbits, raccoons, possums, deer), weeds (dandelions, ragwort, bindweed, thistle), pathogens (mildew spores, scabs, galls).
- Do you see plant “symptoms” from abnormal conditions? These can include: plant tissue rolled up, folded or chewed; leaves stippled with small white spots, viral mosaic patterns, fungal and bacterial leaf spotting, wilting, stunting or distortion.

### Collect evidence from nonliving factors (abiotic)

- **Chemical:** A film or residue, plant or leaf distortion (epinasty), yellowing or necrotic spots due to chemical phytotoxicity, runoff, inadequate chemical agitation of mixture, fertilizer sensitivity, mix of noncompatible chemicals.
- **Environmental:** High winds, extreme temperature or other weather-related factor (heat, frost, hail, sunburn), moisture (drought, overirrigation, poor drainage area).
- **Mechanical:** Injury, such as plant breakage or bruising from a person or nearby construction, transplanting or equipment.
- **Other disorders:** Nutrient, soil pH, previous crop history causing weakness, yellowing with distinctive patterns, wilting or stunting.

Damage due to abiotic factors includes yellowing or necrotic spots from chemical phytotoxicity (A) and discoloration caused by weather (B). Figure C shows mechanical injury from equipment.

Photos: © Kansas State University



Uniform damage pattern.

Photo: Navneet Kaur, © Oregon State University

### Look for patterns

- Uniform damage over a large area? If so, the cause is generally due to nonliving factors (chemical, environmental, mechanical or other plant disorders).
- Scattered or random damage over a few areas? If so, the cause is generally due to living organisms (insect pests, mites, slugs, rabbits, moles, rodents, deer, geese, disease).

### Assess how damage spreads

- Is there a clear pattern or line between damaged and undamaged plants in the field?
- For nonliving factors, damage is typically immediate, rather than progressive.
- Pests (living organisms) will generally multiply over time and increase in spread and damage.



Pest damage over time.

Photo: Navneet Kaur, © Oregon State University



Photo: Alec Kowalewski, © Oregon State University

## MAJOR PESTS

# Aphids

## General description

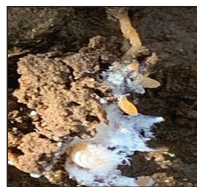
One to 5 millimeters long, yellow to dark green, soft-bodied, winged or wingless, thin legs and antennae, and two cornicles (“tailpipes”) on rear end. Root aphids can occur on grass roots; they have a white, waxy coating that resembles a fungus. Their role as a pest in grass seed crops is uncertain.

## Common aphids in grasses

- **Bird cherry-oat aphid** (*Rhopalosiphum padi*): Yellow-brown head and dark olive-green body with characteristic reddish-brown patch on back end; tips of legs, antennae, cauda and short cornicles are black or dusky-colored.
- **English grain aphid** (*Macrosiphum avenae*): Green elongated body with light and dark-colored legs, antennae. Cauda pale, cornicles long and black.
- **Rose grass aphid** (*Metopolophium dirhodum*): Light pale green to yellowish-green, antennae almost as long as the body. Cauda pale, cornicles long and pale.

## Life cycle and behavior

- Females give birth to live young (nymphs) without mating (asexual form; parthenogenesis), except winged migrant females may mate in fall and lay overwintering eggs on alternate hosts such as trees.
- Most grass aphids in Oregon overwinter as nymphs/adults on feral or cultivated grasses and cereals; some on Prunus tree spp.
- Major dispersal flights occur in spring and fall (cool and moist conditions).
- Nymphs will molt and shed their skins.
- Multiple generations.



Root aphids.  
Navneet Kaur,  
© Oregon State University



Root aphid wax resembles fungus.  
Navneet Kaur,  
© Oregon State University



English grain aphid.  
Kansas Department of  
Agriculture, Bugwood.org



Aphids on wheat.  
Amy Dreves,  
University of the Virgin Islands



Bird cherry-oat aphid.  
Adam Sisson, Iowa State University,  
Bugwood.org



Rose grass aphid.  
Ken Gray Collections,  
© Oregon State University

**Occurrence:** Statewide

**Where found:** Foliage, seed heads.

**Pest status:** Occasional to significant.

**Do not mistake them for:** Mealybugs or psyllids. Winged aphids can look like very small flies.

## Damage symptoms

Aphids have piercing-sucking mouthparts that remove plant juices. They cause wilting, yellowing and stunting of grass; can reduce vigor and yield; and can transmit diseases such as barley yellow dwarf virus to cereals and grasses. Barley yellow dwarf virus can cause stunting, reduced tillering and yellow to red-purple discoloration of leaf margins. Honeydew and black sooty mold accompany large infestations. Ants are often associated with aphids, as they feed on aphid honeydew.

## Monitoring and thresholds

- Visual exam; water traps for winged adults in spring, fall; and sweep net.
- Treat if 10 aphids for every two- to six-leaf seedling.
- Treat if 10–20 aphids per stem or head (from boot to heading stage).

## Prevention and management

- Consider beneficials (parasitic wasps, syrphid larvae (hoverflies), lacewing larvae, lady beetles) when deciding whether or not to apply an insecticide. Individual aphids that are parasitized appear brown to gold.
- Remove volunteer plants that may act as insect reservoirs.
- Avoid planting into previously infested ground; allow two weeks before planting.
- Aphids are susceptible to rainy, windy weather and sudden cold. Unseasonably high temperatures from April through June can reduce aphid populations.



Mummified aphid and molted skin.  
Silvia Rondon, © Oregon State University



Ant-aphid association.  
E. Bradford Walker, Vermont Department of Forests, Parks  
and Recreation, Bugwood.org



Syrphid larvae, natural enemies of aphids.  
Alton N. Sparks Jr., University of Georgia, Bugwood.org



Adult hoverfly.  
Whitney Cranshaw, Colorado State University, Bugwood.org



# Billbugs

## Common billbugs in grasses

- **Western orchardgrass billbug** (*Sphenophorus venatus confluens*) — Western Oregon only. Adults are large (6–10 millimeters), dark-colored beetles with the mouthparts at the end of a long snout; clubbed antennae. The body is covered with irregularly sized pinholes.
- **Bluegrass billbug** (*Sphenophorus parvulus*) — Both eastern and western Oregon. Adults are black or gray-brown beetles, 5–8 millimeters long.
- **Denver billbug** (*Sphenophorus cicatristriatus*) — Eastern Oregon only. Denver Billbugs are considerably larger than either the Western orchardgrass or bluegrass billbug, reaching 8–15 millimeters in length with distinctive double-lobed markings or punctures on the wing covers.

## Life cycle and behavior

Billbugs mostly overwinter as adults in field or field margins. (Some remain in larval stage and feed in spring). They seldom fly but walk slowly into fields from borders where they overwinter. Adults play “possum” or act as if they are dead when disturbed.

Female lays eggs in crown and stems in May and June; eggs hatch in two to three weeks. Larvae feed in plant stems, then crown and roots. They pupate in August. Adults emerge in October, feed briefly, disperse by mid-November and hibernate through winter. One generation per year.

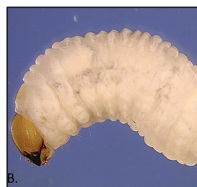
**Occurrence:** Statewide. Adults found in or on soil; often in crown. Larvae found in crown or stems.

**Pest status:** Occasional to significant in orchardgrass, Kentucky bluegrass, tall fescue and fine fescues. Some adult feeding damage on winter wheat following grass.



Adults are grayish-black beetles with a long narrow snout. They are nocturnal.

David Shetlar, Ohio State University, Bugwood.org



Larvae have a white to cream body; brown head capsule, somewhat C-shaped; chubby, bulbous, with fleshy unnoticeable “nubbins” for legs.

David Shetlar, Ohio State University, Bugwood.org

After they hatch, larvae feed in plant stems, then the crown and roots. They pupate in August.

Navneet Kaur,  
© Oregon State University



**Do not mistake them for:** Strawberry root weevil larvae (curled white grubs), drought stress, disease or chinch bugs.

## Damage symptoms

- Adults feed on leaves and show parallel mirror image holes on either side of the leaf mid-rib.
- Larvae feed inside stems and crowns, leaving powder-like frass.
- Dead and dying crowns.

## Monitoring and thresholds

- **Spring (April).** Visual exam (200 crowns) for adults; record the number of crowns with leaf-feeding. Treat if 8% (16 crowns) have damaged leaves.
- **Fall (October).** Visual exam for adult leaf feeding. Place pitfall traps in areas with damage. Inspect every five to seven days and record numbers. Treat when numbers in traps increase to approximately six billbugs per trap over a two-week period. Adults will be emerging from the ground and seeking suitable overwintering sites, most likely in September and October.

## Prevention and management

- Open-field burns, where permitted, can cause 35% mortality in adults.
- Crop rotation.
- Wheat will sustain feeding damage from Western orchardgrass billbug without resulting in significant yield loss.
- A fungal disease, *Beauveria* spp., has been present in a small percentage of larvae and adults.



Look for parallel mirror image holes on either side of the leaf.

John C. French Sr., Clemson University and University of Missouri, Bugwood.org



Billbugs also feed inside stems and crowns.

David Shetlar, Ohio State University, Bugwood.org

# Cereal leaf beetles

*Oulema melanopus*

## General description

- **Adults:** Slender, about 8–9 millimeters long, with metallic, bluish-black wing covers. Insects have a black head, orange thorax and orange legs.
- **Larvae:** Resemble bulbous, dark slugs with a glossy, slimelike substance covering their body.
- **Eggs:** Yellow-orange color, cylindrical, often laid singly on top side of leaves parallel to the mid-vein.

## Life cycle and behavior

- Overwinter as adults on margins of, or outside, grass seed fields. Migrate to fields, mate and lay eggs in spring.
- A female can lay hundreds of eggs, mostly in cereal crops but also in tall fescue and perennial ryegrass.
- Larvae feed for three to four weeks, then drop to soil and pupate. Adults emerge in June and migrate from fields.
- In late summer and fall, adults disperse to cereals and grasses to feed briefly before leaving field to overwinter elsewhere.
- One generation per year.

**Occurrence:** Statewide.

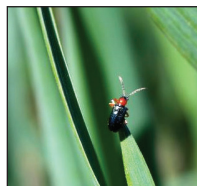
**Where found:** Foliage.

**Pest status:** Occasional.

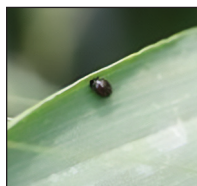
**Do not mistake them for:** No other insect in grass seed crops has similar coloration; larvae can resemble slugs.

## Damage symptoms

- **Spring:** The beetle reproduces on tall fescue. Adults and larvae feed between veins of leaves, cause yellowing and reduce chlorophyll, and create cellophane “windows.”
- **Late summer:** Adults migrate to and feed heavily on all grass species. Damage can be serious on seedlings.



Cereal leaf beetle.  
Navneet Kaur,  
© Oregon State University



Cereal leaf beetle larvae resemble dark slugs.  
Amy Dreves,  
University of the Virgin Islands

## Monitoring and thresholds

- Visual exam for eggs, adults and larvae. Inspect for characteristic strip-feeding (between veins) **on leaves.**
- Seedling grasses may need protection from feeding injury. Count the number of eggs and larvae observed per 10 tillers (entire stem) in at least 10 locations across a field. Treat when population levels reach an average of 25 eggs or larvae per 100 winter wheat tillers or other grass crop stems; until cereals reach boot stage of growth (one larva/flag leaf).

## Prevention and management

- USDA and the Oregon Department of Agriculture released egg (*Anaphes flavipes*) and larval parasitic wasps (*Tetrastichus julis* (Walker)) for biological control of the larvae. Overall, parasitization can be as high as 45% of eggs and 62%–91% of larvae.
- If available, a pheromone trap can be effective for capturing adults during spring migration of overwintering adults.
- Lady beetles will consume eggs.
- Agronomic growing practices that favor well-established stands with vigorous, well-tillered plants can tolerate beetle damage.



Cellophane “windows.”  
Mourad Louadfel, Bugwood.org

# Click beetles (wireworms)

## General description

- **Adults (click beetles)** are 7–10 millimeters long, hard-shelled, flattened, narrow and slender, ranging in color from tan to reddish-brown to very dark brown.
- **Larvae (wireworms)** are one-quarter to 1 inch (6–25 millimeters) long, slender, segmented yellow-brown bodies with a dark head capsule and three pairs of small legs behind the head. The last segment of the body is usually pronged, smooth, forked or “keyhole-shaped” at the end. Wireworm species identification is extremely difficult. Seasonal feeding differences between species are being studied. The shape of the tail with appendage designs on the end can help distinguish between genera.



Adult click beetle.  
Lynn Ketchum,  
© Oregon State University



Wireworm larvae.  
Frank Peairs, Colorado State  
University, Bugwood.org



Pacific Coast wireworm.  
Ken Gray Collection,  
© Oregon State University



Sugar beet wireworm.  
Ken Gray Collection,  
© Oregon State University

## Common wireworms in grasses

- **Pacific Coast wireworm (*Limonius canus*):** A small open keyhole shape at end of body; native to wet soils along streams.
- **Sugar beet wireworm (*Limonius californicus*):** A small almost closed keyhole with two spike appendages; intermediate and higher precipitation zones, and irrigated regions.
- **Great Basin wireworm (*Selatosomus (=Ctenicera) pruinita*):** A larger open U-shaped keyhole with a pair of two forked appendages at end; dry-farming regions.
- **Western field wireworm (*Limonius infuscatus*):** Small open keyhole with two curled hooklike appendages at end, intermediate and higher precipitation zones, and irrigated regions.

## Life cycle and behavior

- Adult beetles appear in spring and summer and lay hundreds of eggs in the soil, crop or fallow land. Eggs hatch in three to four weeks. The beetle snaps its body with a clicking sound to flip upright if upside down.
- Larvae grow, feed and remain in the soil for up to five years. They feed in fall, winter and spring. Wireworms move to the soil surface in response to abundant moisture and mild temperatures (between 45 and 80 degrees Fahrenheit).

**Occurrence:** Statewide.

**Where found:** Adults above ground; larvae below ground.

**Pest status:** Occasional to significant in all grass species; can be a common pest on “new ground” brought from dryland into irrigation or in established crops (several years) where no tillage or crop rotation has occurred.

**Do not mistake for:** Ground beetles (larvae and adults).

## Damage symptoms

- Larvae grow and feed on roots, seedlings and crowns; grass becomes stunted, severely chlorotic, poor yielding and may die. Symptoms are patchy and unpredictable in the field. In many cases, found on the edge of fields. Seedlings are often killed.
- Adults do not cause damage since they feed on flowers.



Symptoms of wireworm damage.  
Arash Rashed, University of Idaho

## Monitoring and thresholds

- Look for dead and dying seedlings or crowns. Inspect soil, roots and crowns for chewing damage, discolored tissue and presence of wireworms.
- Dig a cubic-foot soil sample, screen soil and plant material for larvae.
- Bait stations may attract larvae. Add potato, soaked oats, cracked wheat, corn or pieces of carrot buried to a depth of 4 to 6 inches (10–15 centimeters), flag and water lightly; check in four to seven days. Layer vermiculite, presoaked wheat, corn or barley covered with vermiculite. Some people place bait in a pantyhose and bury. Collect stations and collect the surrounding soil.
- After 2–3 inches (5–8 centimeters) of rain in September and October, small larvae feed within the roots, lower crown and stems. Large larvae are more easily found in the soil.
- Thresholds are not set; however, when damage occurs, field populations remain unless controlled. Suggested threshold for treating a field before economic injury is average of one wireworm per shovel based on 20 shovels full of soil.
- Map annual damage from previous year’s crop and sample new plantings to avoid damage.

## Prevention and management

- Plowing or disking in late winter through early spring crush larvae and pupae.
- Best time to manage is before or at planting.
- If possible, control wireworms in previous crop.

# Cucumber beetles

## General description

Adults are yellow-green, oblong and 8–9 millimeters long with either black stripes or spots on hard wing covers; long antennae.

The larvae are small (less than 15 millimeters) and white with a tiny dark brown head capsule; the last segment on the end is brown.

## Common cucumber beetles

- **Western striped cucumber beetle** (*Acalymma trivittatum*): Yellow with three black stripes down the back; middle segment (tibia) of hind leg is yellow.
- **Western spotted cucumber beetle** (*Diabrotica decimpunctata*): Yellow with 12 black spots on its back.

## Life cycle and behavior

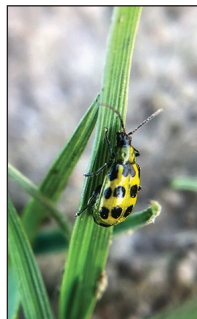
- Adults overwinter primarily as fertilized females under leaf litter/debris, protected areas near fence rows, woods, adjacent to fields.
- They become active in spring (above 55 degrees Fahrenheit, 12.7 degrees Celsius) and deposit eggs near a plant's base.
- Larvae feed on roots underground, seeds.
- Adults readily fly to new hosts when one crop becomes less desirable. They will drop to the ground and play dead when disturbed. They like moisture.
- Two generations per year, 40–60 days per life cycle.

**Occurrence:** Statewide; mainly west.

**Where found:** Primarily on seedling grasses.

**Pest status:** Occasional or significant.

**Do not mistake for:** Beneficial ladybugs or damage from slugs or other chewing insects like western corn rootworms.



Adult cucumber beetle.  
Navneet Kaur,  
© Oregon State University

## Damage symptoms

- Generalist feeder on many plants (cucurbits, corn, grasses) causing holes, scarring, yellowing, wilting leaves.
- Both adult species feed on seedling grasses, stems, pollen, flowers, pods and seeds.
- Larvae feed on the roots and stems.
- They can vector a bacterium that causes disease. Chewing damage can be entry points for pathogens (such as Erwinia).

## Monitoring and thresholds

- Monitor after seedlings emerge. Count the number of beetles per plant to understand the level of the population and potential for damage.
- Sweep net foliage for adults in four locations.
- Use yellow sticky or water traps just above foliage to catch beetles.
- Thresholds and specific treatments are not well defined for grasses grown for seed and other field crops. However, if you find one beetle per 10 feet of seedling rows, two to four per sweep prior to first bloom or two beetles per yellow sticky trap, consider treating the crop.

## Prevention and management

- Control beetles during peak spring activity.
- Plant late to avoid beetles.
- Plant beetle-attractive crops on the perimeter where beetles can aggregate.
- Natural predators include a tachinid fly, entomopathogenic nematodes, ground and rove beetles, and spiders (such as wolf, ground, harvestmen).



Damage caused by adult cucumber beetle.  
Navneet Kaur, © Oregon State University

# Strawberry root weevil

*Otiorhynchus ovatus*



Strawberry root weevil adult.

Whitney Cranshaw, Colorado State University, Bugwood.org



Strawberry root weevil larva.

Navneet Kaur, © Oregon State University

## General description

- Adults are reddish-brown to black and approximately 2–11 millimeters in length; larvae are C-shaped, legless, white with tan heads, and up to 12 millimeters long.
- Damage is done by the larvae, which feed through the winter and spring on the root systems of host plants. Larvae feeding on roots can cause stunting and poor yields. With severe infestations, plants may die.

## Life cycle and behavior

- Weevils overwinter as larvae in the soil. Feeding may occur throughout mild winters.
- From April to June, larvae pupate and adults emerge. Adults are night feeders that remain in the soil or in organic material at the base of the plant during the day, then climb up to feed on leaves at night.
- Small, white- to amber-colored round eggs are laid in clusters in or on the soil from June through September, totaling approximately 150 eggs. The eggs hatch and the larvae immediately wiggle through the soil to begin feeding. There is one generation per year.

**Occurrence:** Mainly western Oregon.

**Where found:** Soil.

**Pest status:** Significant.

**Do not mistake them for:** Billbug larvae.

## Monitoring and thresholds

Examine roots to determine if root weevil larvae are present. Dig several plants and look for C-shaped grubs in the crown or roots.

## Prevention and management

- Cultivation of the soil in April and May can eliminate overwintering larvae before planting.
- Use a cereal cover crop to disrupt weevil numbers, as small grains are not a recorded host for root weevils.
- Apply pesticides as adults become active and before egg-laying occurs.

# Crane flies

## General description

- **Adults:** Grayish-brown, about 1 inch (2.5–3 centimeters) in length, look like an oversized mosquito with one pair of large wings, long legs. They are weak fliers.
- **Larvae:** About 1–1.5 inches (3–4 centimeters) long, cylindrical, smooth tough skin, gray-yellow color, and no noticeable head. Larvae are called leatherjackets.
- **Pupae:** Nonfeeding stage, grayish-brown, 1 inch long (2.5 centimeters).
- **Eggs:** 0.5–1.0 millimeters and black, deposited singly.

## Life cycle and behavior

*T. paludosa* adults emerge from soil in August and September, mate and lay eggs in September and October. Larvae hatch from eggs after first fall rains and feed through the following May. From June to August, larvae are present in soil but nonfeeding, and pupate in August and September. One generation per year.

*T. oleracea* adults fly in the fall and again in late spring. Larvae feed on and damage plants in the fall from October through March. New adults emerge in April and lay eggs. These larvae feed and damage plants through late spring and early summer. One or two generations per year.

**Occurrence:** Western and eastern Oregon.

**Found:** Larvae on crowns, roots and in soil.

**Pest status:** Occasional to significant (new seedlings or weaker grass stands).

**Do not mistake them for:** Larvae of March fly; or armyworm, cutworm or slug damage.

## Damage symptoms

- Larvae feed primarily in top 1 inch (2.5 centimeters) of soil on roots and crowns, shredding plant tissue and killing seedling plants.
- Larger larvae occasionally feed above ground on foliage at night.
- Damage most often found in low swales or the wettest parts of fields.



Crane fly adult.  
Tom Cook, © Oregon State University



Crane fly larvae.  
Tom Cook, © Oregon State University

## Monitoring and thresholds

- Take a core or a square-foot (0.1 square meter) soil sample, about 4 inches (10 centimeters) deep including plants and roots. Screen soil for larvae.
- Soapy-water flush applied to one square yard of soil/turf using 2 tablespoons of liquid dish detergent in two gallons of water. The soap solution irritates larvae, causing them to surface.
- Populations in excess of 25 larvae per square foot (0.1 square meter) can injure established grass; more than five larvae per square foot (0.1 square meter) can damage seedling stands. Symptoms of damage at levels of 12–15 larvae/square foot can be seen in less-than-favorable turfgrass.

## Prevention and management

- Predation by birds and other vertebrates; beneficial entomopathogenic nematodes.
- Vigorous and healthy grass can support relatively high populations with less damage.
- Apply insecticide in the late fall at time of egg-laying or in early spring when grass injury is becoming apparent.
- Injury is exacerbated when grass is weak or waterlogged.
- Improving field drainage may help, such as installing drain tile where allowed.



Crane fly pupae.  
Tom Cook, © Oregon State University



Crane fly feeding damage.  
Tom Cook, © Oregon State University

# Frit fly

*Oscinella frit*



Adult frit fly.  
Stephen Luk, BugGuide.org

## General description

- **Adults:** 1.5-2.5 millimeters; blackish with yellow markings on legs, and two short wings.
- **Larvae:** Tiny, off-white and legless. Pupae are reddish-brown.
- **Eggs:** Tiny, pure white with ridged surface.

## Life cycle and behavior

- Overwinter in the larval stage in the stems of grasses.
- Pupation takes place in spring, and the first adults emerge in the spring.
- Eggs are laid on or near the leaves, base of shoots and leaf sheaths of grasses.
- Up to three generations per year (May–June, July–August, September–October).

**Occurrence:** Western Oregon.

**Found:** Larvae in grass stems; eggs on foliage.

**Pest status:** Occasional pest of fall-seeded grasses.

**Do not mistake for:** Damage symptoms can resemble “damping off” fungal disease.

## Damage symptoms

- Larval damage typically from third generation, September to February.
- Larvae burrow into new seedlings or young tillers, weakening and killing the central shoot. Seedlings are stunted, grow poorly, turn yellow/brown and die. Symptoms are most pronounced at the four-leaf stage.

## Monitoring and thresholds

- A hand lens, OptiVisor or dissecting microscope is useful in finding very small larvae inside young stems.
- Treatments are rarely needed unless damage is occurring.
- Inspect seedling stands at one- to four-leaf stage for small flies in the field, eggs on plant leaves and dying central shoots. Crop at risk if more than 10% of plants are attacked at the one- to two-leaf stage.

## Prevention and management

- Grass planted later in fall is less likely to be affected by the fly.
- Leave a gap of six to eight weeks before rotating from a previous grass crop to a new grass seed or cereal crop.
- Larval and pupal parasites.



Signs of damage caused by frit fly larvae.  
Richard Derbyshire, Agrii.co.uk

## Leafminer

*Chromatomyia nigra*

### General description

- **Adults:** Black and yellow fly 4 millimeters long.
- **Larvae:** White larvae mine within the leaves.

### Life cycle and behavior

Two to three generations per year, beginning in spring.

**Occurrence:** Western Oregon.

**Found:** Larvae in leaves of seedling grasses.

**Pest status:** Occasional.

**Do not mistake for:** If you see a transparent blotch or trail on leaves, don't confuse it for some type of disease. Early instars of a lepidopteran pest, omnivorous leaf-tiers, also mine in the leaf tissue before they begin tying the leaves together.

### Damage symptoms

Larvae mine and feed between the epidermal layers of grass blades, removing chlorophyll. Very localized damage within a field coupled with moisture stress may result in some seedling die-out.

Leafminers seldom cause plant death.

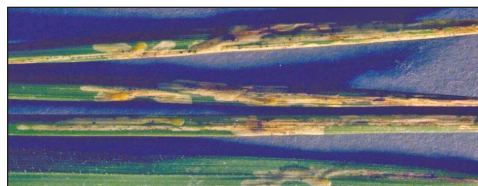
### Monitoring

Visually examine leaf sheath to see mining pattern and chlorophyll removal.

### Prevention and management

Populations of this fly are usually maintained below noticeable levels by parasitic wasps that feed on and kill the fly larvae.

Infestations seldom require treatment. Insecticides are *not* recommended.



Leafminer damage.  
Ken Gray Collection, © Oregon State University

## March fly

*Bibio xanthopus*

### General description

- **Adults:** 10–12 millimeters, dark brown to black bodied; wings with dark veins and reddish-brown legs.
- **Larvae:** 10–20 millimeters, gray-brown cylindrical body with small spines on skin and a brown head capsule.

### Life cycle and behavior

- Adult flies emerge from pupae in the soil during April and May. Adults frequent blooms on ornamental and fruit trees where they feed on nectar, then mate. Females scatter eggs on newly worked or direct-seeded moist soils.
- Eggs hatch with fall rains.
- Larvae feed through February, then pupate.
- One generation per year.

**Occurrence:** Western Oregon.

**Found:** Larvae on or in soil.

**Pest status:** Occasional.

**Do not mistake them for:** Crane fly larvae.

### Damage symptoms

- Larvae are herbivores and scavengers and may dislodge seedlings when large numbers occur in seed furrow and move around feeding on decaying organic matter in late fall, early winter.
- Large numbers of larvae may damage healthy plants by disturbing the soil around plant roots.
- Generally not a pest, but large numbers of larvae in seedling fields may result in some stand loss.

### Monitoring and thresholds

When seedling damage is noticed after fall rains, screen soil in and around seed furrow. Inspect for larvae. Thresholds not available.

### Prevention and management

- If large numbers of larvae are associated with seedling loss, an insecticide treatment may be necessary.
- Good soil drainage is important.
- Prepare a fine seedbed, pack well and close seed row at planting.
- Plant early. Well-established seedlings tolerate more injury than smaller ones.
- Predators, such as rove beetles and ground beetles, help control fly larvae.



March fly adult.  
David Cappaert, Bugwood.org



March fly larvae  
Jim Baker, North Carolina State University, Bugwood.org



## Grass mealybugs

*Phenacoccus graminum*

### General description

- Adults are 1 millimeter or smaller, white to yellow in color covered with white filamentous wax.
- Crawlers (dispersal stage) are yellow, mobile and flat.

### Life cycle and behavior

- Adult females or eggs overwinter under cottony masses. Crawlers occur in spring.
- Dispersal of crawler stage is by rain, wind, equipment, animals and people.
- Multiple generations per year, approximately every two months. However, the development time is not well known.

**Occurrence:** Western Oregon (eastern Oregon: uncertain).

**Where found:** Foliage.

**Pest status:** Occasional to significant in Kentucky bluegrass.

**Do not mistake them for:** Aphids, cottony scale insects.

### Damage symptoms

- Stunting and yellowing of plants, browning of leaf sheaths, leaf tip dieback and silver top of heads.
- Reduced seed yield.

### Monitoring

- Visually inspect leaves, leaf axils, stems, crowns, seed heads and roots for white cottony masses in areas of weak grass plants. No threshold information available.

### Prevention and management

Lady beetles, parasitic wasps, big-eyed bugs, lacewing larvae.



Grass mealybug.  
Lyle Buss, University of Florida

## Mites

### General description

Less than a millimeter long, round or oval with eight legs.

Common mites on grasses include:

- **Winter grain mite (*Penthaleus major*):** Dark brown color with orange-red legs and an orange or red spot on the upper abdomen. Cool season mite.
- **Clover mite (*Bryobia praetiosa*):** Reddish-brown to a dark green-brown color with a distinctive front pair of legs twice the size of the others and extended forward near the head.
- **Banks grass mite (*Oligonychus pratensis*):** Green to brown in color with a distinguishing row of dark spots; brown to reddish-brown on either side of the abdomen extending from near the head to the end of the abdomen.

### Life cycle and behavior

- Clover mites and winter grain mites overwinter as red eggs in grasses, cereals or other hosts and wait to hatch in October. Mite populations build up through winter and have a second generation in late winter/early spring (April). They move up plants at night and on cloudy days. Damage is seen in fall and winter.
- Banks grass mites overwinter as eggs and adults. They become active in late spring and summer when temperatures warm, and when damage is seen.
- Multiple generations per year, every 10 days to one month.

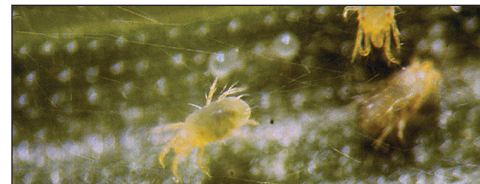
**Occurrence:** Winter grain mites occur in western and eastern Oregon; clover mites and banks grass mites occur in eastern Oregon.



Winter grain mite.  
Ken Gray Collection,  
© Oregon State University



Clover mite.  
Ken Gray Collection, © Oregon  
State University



Banks grass mites.  
F.C. Schweissing, Bugwood.org

## MAJOR PESTS • MITES

**Where found:** Foliage.

**Pest status:** Occasional to significant (notably in northern Willamette Valley perennial ryegrass).

**Do not mistake for:** Mite damage can be mistaken for symptoms of drought, low soil fertility or leafhoppers.

### Damage symptoms

- Large populations remove plant sap, and grasses wilt and turn yellow, chlorotic spotting, silver or brown.
- Damage starts on lower leaves and moves up.
- Reduced vigor.

### Monitoring and thresholds

- Visual inspection of grass leaves with a 10- to 20-times hand lens in early morning or on overcast days (clover mites and winter grain mites hide in soil when sun is out). On hot, dry days it may be necessary to dig into the soil to a depth of 4–5 inches (10–13 centimeters) to find mites.
- Look for mites, chlorosis, white stippling or spotting, and silvering of grasses in fall, spring and early summer.
- Banks grass mite is a hot weather mite. If present, they can be found on leaves when sun is out.
- Eleven to 18 mites per infested leaf will cause moderate damage, 1% to 5% of Kentucky bluegrass foliage.

### Prevention and management

- Wet and cold weather reduce populations.
- Apply treatments when grass regrowth is slow and foliage displays extreme symptoms.
- Windy and dry conditions favor outbreaks.



Damage symptoms of mites.  
Ken Gray Collection, © Oregon State University

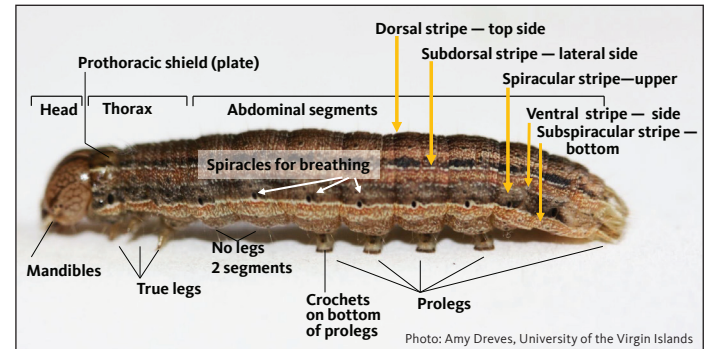
## MAJOR PESTS • MOTH LARVAE

# Moth larvae

Armyworms, cutworms and webworms are closely related moths mainly in the Noctuid family, order Lepidoptera (moths and butterflies). The order Lepidoptera pass through egg, larval, pupal and adult moth stages. The larva (or caterpillar), with chewing mouthparts, is the economically damaging life stage. The legs of cutworms are typically shorter than those of the armyworm.

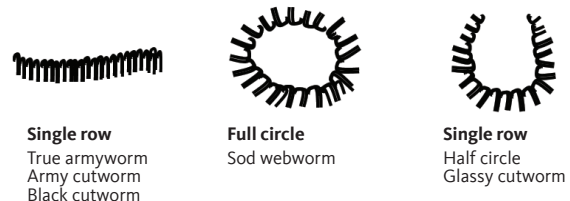
The arrangement of crochets on the bottom of prolegs can help identify larvae to family level. After larvae mature, they develop into 1-inch (25 millimeters), reddish-brown pupae that rest in cells under soil or debris.

### Parts of true armyworm larva



### Crochet configuration at base of prolegs on larval abdomen

The arrangement of crochets on the bottom of prolegs can help identify larvae to family level.



Graphic: Amy Dreves, University of the Virgin Islands

# True armyworm

*Mythimna unipunctata*  
(formerly *Pseudoletia unipuncta*)

## General description

- **Adults:** Wingspan is 1.5 inches (3.8 centimeters). Forewings are pale buff; a small white spot in center of forewing, often with small dark markings on either side on back half of wing.
- **Mature larvae:** About 1.5–2 inches (3.8–5.1 centimeters); uniform markings, characterized by greenish brown heads with lateral brown, black and yellow lines running the length of the body. Prolegs have hooks (crochets) arranged in longitudinal bands at base of prolegs. Lacks teeth on cutting surface of mandibles, unlike cutworms.

## Life cycle and behavior

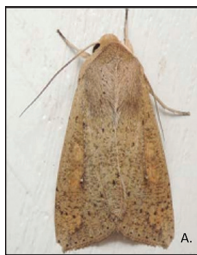
- Adults fly throughout summer and lay eggs in grasses, cereals and corn.
- Eggs hatch into larvae that feed for six to eight weeks through the fall, and then pupate.
- Adults emerge in 10 to 17 days and migrate south to overwinter.
- One generation per year.

**Occurrence:** Statewide.

**Where found:** Foliage.

**Pest status:** Occasional to significant (fall-planted grasses and early carbon-seeded fields along river bottoms).

**Do not mistake them for:** Cutworms, crane fly or sawfly larvae.



Adult true armyworm.  
Photo: Amy Dreves,  
University of the Virgin Islands



True armyworm larva.  
Photo: Amy Dreves,  
University of the Virgin Islands

## Damage symptoms

- Larvae feed from dusk to dawn, as well as on overcast days, consuming all but the toughest stems and leaf veins.
- On bright days, the larvae hide under field residue or in crowns. Larger larvae may clip leaf veins and seed stalks of grasses similar to black cutworm.
- Significant defoliation may injure young stands. Outbreaks occur every 10 to 15 years.

## Monitoring and thresholds

- **Visual assessment:** Look for large numbers of moths around yard lights at night through summer months. Two weeks later, begin checking grass along fence lines for larvae by parting grasses and uncovering soil litter. Look for curled up armyworms on the soil surface and in soil cracks. Examine approximately 1 square yard (1 square meter) in five or more areas on the ground and debris.
- **Sweep net:** Ten straight-line sweeps in 10–15 locations throughout a field. Dip the net deep into the grass, sweep vigorously and cover a 5-foot swath (1.5 meters). Do this in the evening (after 10 p.m.) or early morning before daylight when larvae are still above ground and feeding on the plant foliage.
- **Thresholds:** Visual — on grass seedlings, one to three larvae per square foot; on established grass, three to five larvae per square foot (0.1 square meter). Sweep net — three to six larvae per sweep.

## Prevention and management

- Parasitic wasps and tachinid flies.
- Several types of viruses, a microsporidium and fungi can infect armyworm larvae.
- A cool and wet spring favors armyworm development while hindering parasite and predator populations.

# Army cutworm

*Euxoa auxiliaris*

## General description

- **Adult:** Wing span up to about 1.5 inches (4 centimeters). Generally gray to light brown with variable wavy light and dark markings but a distinctive kidney-shaped marking on the forewing.
- **Larvae:** About 1.5 inches (4 centimeters) long when mature. Head is light brown/gray with pale brown marks. Body is pale gray with white splotches, brown-tinged top line, and dark lateral lines. Crochets are arranged as a longitudinal band at base of prolegs.

## Life cycle and behavior

- Occurs on all grass seed species and wheat.
- Moths hibernate in the mountains through summer. In late summer and early fall, moths migrate to crop land and lay several hundred eggs per female, scattering them over the soil surface.
- In seven to 10 days, eggs hatch and larvae feed through fall, winter and spring, and pupate in late spring. They overwinter as larvae.
- One generation per year.

**Occurrence:** Eastern Oregon.

**Where found:** Foliage.

**Pest status:** Occasional.

**Do not mistake them for:** Other armyworms, cutworms, sawfly larvae.

## Damage symptoms

- Damage is usually seen in spring.
- In the fall, winter and spring, larvae feed and defoliate above ground at night and on cool days. They hide in the soil or under grass/soil clods and vegetation by day.



Adult army cutworm.

Photo: John Capinera, University of Florida



Army cutworm larva.

Photo: John Capinera, University of Florida

## Monitoring and thresholds

- **Visual assessment:** In the fall, the first signs of damage are holes in leaves and semicircular notches eaten from the edges of leaves from larvae. Clipping and defoliation occurs afterwards.
- **Soil samples:** During the day, larvae are within the top 2–3 inches (5–7 centimeters) of soil surface. Dig to this depth and screen 1 square foot (0.1 square meter) soil samples in different areas of the field, record larval numbers and average them.
- **Pheromone traps:** Monitor late summer moth flights (when flight begins, the magnitude and when it ends). Large numbers indicate potential for damage. To our knowledge, they have not been used in Oregon.
- **Thresholds:** Grass seedlings — one to three larvae per square foot (0.1 square meter). Established grass — three to eight larvae per square yard (0.8 square meter).

## Prevention and management

- Parasitic wasps and flies generally keep larval populations in check. Birds feed on moths.
- Moths lay eggs in late summer and fall on bare soil or in residue of previous crop. If present in spring, either cultivate to kill larvae or delay seeding until mid-May when most larvae in soil will have pupated.

# Black cutworm

*Agrotis ipsilon*

## General description

- **Adults:** Wing span up to 2 inches (5 centimeters). Forewings have black dagger marks.
- **Mature larvae:** About 1–2 inches (3–4 centimeters) long with a brownish head with black marks. Body is somewhat flattened, gray to black above, pale with light flecks below. Skin is greasy with many small black granules/bumps. Prolegs have hooks (crochets) arranged in longitudinal bands at base of proleg. Head with well-formed mandibles; inverted “Y” mark on head capsule of cutworm.

## Life cycle and behavior

- Overwinter as pupae.
- Moths fly in April through June, and again in August and September. Lays eggs at base of plants and hatch in five to 10 days.
- Larvae hide under refuse or in soil by day and feed at night. Fast-moving larvae curl up when disturbed.
- Two generations per year.

**Occurrence:** Statewide.

**Where found:** In soil by day; on foliage at night.

**Pest status:** Occasional to significant (on new seedlings).

**Do not mistake for:** Slug damage; crane fly, wireworm, or sawfly larvae.

## Damage symptoms

- Damage occurs in spring and early summer (April–July) and fall (September and October).
- Grass is clipped just above or below the growing point.



Black cutworm adult.  
Photo: Roger Schmidt, University of Wisconsin-Madison, Bugwood.org



Black cutworm larva.  
Photo: Roger Schmidt, University of Wisconsin-Madison, Bugwood.org



Cutworm damage.  
Photo: W.M. Hantsbarger, Bugwood.org

## Monitoring and thresholds

- Visual inspection for clipped seedlings and frass (droppings) in and around the grass crowns. Look for larvae at night with a light or by day under organic matter or clods in field.
- Baits: Use treated bran bait placed under a 1 square foot (0.1 square meter) piece of plywood. The bran will attract and kill larvae.
- Screen soil to detect small larvae.
- Soap- or mustard-flushing solution applied to soil: 1 tablespoon (15 milliliters) liquid dish soap in 1 gallon (4 liters) water or 1 level tablespoon of dry mustard dissolved in 1 gallon (4 liters) water. Pour solution over 1 square foot (0.1 square meter) of soil. After application, cutworm larvae will be irritated and appear at soil surface within five to 10 minutes.
- Threshold: Seedling grass — two or more larvae per 1 square foot (0.1 square meter). Established grass — five to eight larvae per 1 square foot (0.1 square meter).

## Prevention and management

- Parasitic wasps, flies and birds keep cutworms under control.
- Cultivation prior to fall seeding when following another grass, sugar beets or clover crop will help control larvae in soil from previous crop.
- Deep tillage late in the fall can destroy overwintering pupae.



Sampling technique using soapy water flush.  
Photo: Casey Reynolds, Texas A&M University

# Glassy cutworm

*Apamea devastator* WEST OF CASCADES  
*Protagrotis obscura* EAST OF CASCADES

## General description

- **Adults:** Moth has a wing span of 2 inches (4 centimeters). Markings are distinctive.
- **Larvae:** About 1.5–2 inches (3.5–5 centimeters). Chestnut brown head; body is a dirty, translucent to milky white or gray; fast moving. Crochets on base of prolegs are half round, like eyelashes.

## Life cycle and behavior

- Moths fly in late June through August. Hundreds of tiny, round, yellowish-white eggs are laid singly or in small groups on bare soil or in grass leaf blades.
- Eggs hatch into larvae in seven–10 days.
- Larvae feed and remain deep 1–2 inches (2.5–5.0 centimeters) in root zone, under crowns where they feed from late summer, through winter and early spring, never coming to the soil surface.
- Pupation occurs in April and May. Overwinters as a larva.

**Occurrence:** Statewide.

**Where found:** Larvae in soil and crown.

**Pest status:** Occasional to significant.

**Do not mistake them for:** Other cutworms, sod webworms.

## Damage symptoms

Larvae kill seedlings, weaken and occasionally kill established crowns by feeding on roots and crown tissue deep in plant.



Glassy cutworm adult.  
Photo: Frank Peairs, Colorado State University, Bugwood.org



Mature glassy cutworm larva.  
Photo: Frank Peairs, Colorado State University, Bugwood.org

## Monitoring and thresholds

- Monitor for larvae in early spring and fall (they are small and difficult to see).
- Dig injured plants with crown and some roots intact. Tease soil and tissue apart to locate larvae.
- Drenching with soap or other flushing agents doesn't work well because this pest lives deep in the soil.
- Thresholds not available.

## Prevention and management

- Parasitic flies and wasps may suppress larvae.
- Newly broken land and summer fallow with grassy weeds should be well cultivated.
- Chemical control has not been very effective when larvae at a depth in soil and in crown tissue unless irrigation is used.

# Winter cutworm

*Noctua pronuba*

## General description

- **Adults:** Gray-brown moth with a wing span up to 2 inches (50 millimeters). Markings are distinctive by its yellow-orange underwing with a black band along bottom margin.
- **Larvae:** About one-eighth inch–2 inches (3–50 millimeters) long; green to dark brown, olive or gray color; marked with prominent dashes that run down the back and a light-colored line underneath the dashes; head tan with two black angled crescents.
- **Pupae:** After larvae mature, they develop into 1 inch (25 millimeters) reddish-brown pupae that rest in cells under soil or debris.

## Life cycle and behavior

- Moth flight activity late April through June and perhaps another peak beginning in mid-August continuing through October and November. Hundreds of egg masses are scattered on weed or grass leaf blades. Eggs are laid in flat sheet clusters on the underside of host plants and nonplant structures, which may be difficult to find in the field.
- Eggs hatch into larvae in two to four days, depending on conditions.
- Larvae are nocturnal feeders, mostly on aboveground foliage, some root feeding has been observed; can disperse in masses and are cold tolerant.
- Most pupation occurs in April and May. Overwinters primarily as a mature larva.

**Occurrence:** Statewide.



Adult winter cutworm.  
Photo: Amy Dreves,  
University of the Virgin Islands



Winter cutworm pupa.  
Photo: Amy Dreves,  
University of the Virgin Islands



Winter cutworm larva.  
Photo: Amy Dreves, University of the Virgin Islands

**Where found:** Foliage.

**Pest status:** Occasional to significant.

**Do not mistake them for:** Other cutworms (spotted), armyworms (true), sod webworms.

## Damage symptoms

- Winter cutworms are gregarious, which means they feed and move in groups, similar to armyworms.
- Damage is erratic and less uniform than armyworm damage; large areas of clipped, mowed or notched foliage. They advance from the borders into a field.

## Monitoring and thresholds

- Detect a cutworm attack by visually monitoring for larvae or damage. Search on foliage and/or scrape away the top 2 inches of soil to find larvae during the day.
- Sample for flight of moths by using a light trap.
- There are no established thresholds, but recommendations for armyworm/cutworm management suggest thresholds of one or two larvae per square foot in newly planted grass seed fields, and three or four larvae per square foot in mature stands. Hay and grass pastures can tolerate as many as four to six larvae per square foot.

## Prevention and management

- Rotating crops, removing weeds and plant residue along field edges to reduce egg-laying and feeding sites.
- Tilling early spring before planting to expose overwintering larvae and pupae.
- Natural enemies such as diseases, parasitic flies and wasps may significantly suppress larvae and pupae.

## Cereal stem moth

*Ochsenheimeria vaccuella*

### General description

- **Adults:** Wing span from 0.3–0.6 inches millimeters. Mottled brown and gray.
- **Larvae:** Eight–10 millimeters 0.3- 0.4 inches when mature. Head: roughened and light brown. Body: pale white.

### Life cycle and behavior

- Larvae hatch from eggs laid on trees or buildings by moths in fall or winter.
- In late winter and early spring (February–March), the larvae balloon on silk strands to grass fields.
- Initially mine leaves, and then bore into stems through May as the seed heads form. Few to no seeds are produced in seed heads that turn prematurely white.
- One generation per year.

**Occurrence:** Western Oregon.

**Where found:** Foliage and in stems of annual ryegrass.

**Pest status:** Occasional.

**Do not mistake them for:** No other stem-mining larvae are found in annual ryegrass.

### Damage symptoms

Larvae mine leaves of annual ryegrass in February and March. Larvae migrate from leaves to bore into stems as they appear. Unfilled, light and prematurely white heads (silver top) are symptoms.

### Monitoring and thresholds

Look for mined leaves in February and March, and unfilled heads and mined stems at harvest.

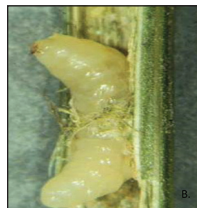
### Prevention and management

Heavily parasitized by wasps.

The practice of grazing sheep in annual ryegrass fields in the late winter/early spring can reduce larval infestations.



Adult cereal stem moth.  
Photo: Amy Dreves,  
University of the Virgin Islands



Cereal stem moth larva.  
Photo: Amy Dreves,  
University of the Virgin Islands

## Grass gelechiid

*Chionodes psiloptera*

### General description

- **Adults:** Very small, dark moth with fringes of hair on wings; wing span is 0.5 inches.
- **Larvae:** Greater than 0.4 inches long with rusty, red-brown or slightly pink body segments, with a deep tan head. Crochets are arranged in circles on prolegs.

### Life cycle and behavior

- Moths fly in short, darting movements, hide in vegetation and lay eggs in grasses in early June through July.
- Larvae hatch in about five–10 days, feeding from July through fall. They hibernate in silk tunnels with the onset of winter. In spring (late March through mid-May), larvae resume feeding.
- They cease feeding and pupate on the soil surface from late April through May.

**Occurrence:** Eastern Oregon.

**Where found:** In crowns.

**Pest status:** Significant.

**Do not mistake them for:** Sod webworm.

### Damage symptoms

- Larvae feed on and in crowns of grass, producing significant webbing. They may feed on the root system and often burrow into the base of the stem. They defoliate, weaken and kill crowns.
- Damage first appears as individual dead tillers, progressing to destruction of the plant, August through November.

### Monitoring and thresholds

- Take individual crown, root and soil samples from damaged areas. Do this postharvest but before November, or in the following April but before the larvae pupate. Tease apart roots and crown tissue (along with soil) over screens, finishing with window screen-size mesh, to look for larvae.
- Thresholds are not set.

### Prevention and management

Insecticides are not labeled for this pest.



Adult grass gelechiid.  
Photo: Amy Dreves,  
University of the Virgin Islands



Grass gelechiid larva.  
Photo: Amy Dreves,  
University of the Virgin Islands



# Sod webworm

*Chrysoteuchia topiaria*

## General description

- **Adults:** Buff-colored moth, 0.5-0.7 inches, with a darkish line on the top of each wing cover. Two small projections visible at the front of the head that look like a snout. When at rest, the wings have a tubular shape.
- **Mature larvae:** Cream to white or gray with scattered dots on body; about 1 inch (2.5 centimeters) long. They curl up when disturbed. Often found in crowns with frass. Crochets arranged in full circles on prolegs.

## Life cycle and behavior

- Moths generally fly and lay eggs in grasses, turfs and lawns from May to July. Peak flights usually occur during swathing in western Oregon. Adults will fly and dart upward when disturbed.
- First larvae found in crowns or roots in early August. Larvae feed through early November.
- Half of the larval population has stopped feeding and hibernates by late October.
- Larvae hibernate in silk cocoons (hibernacula) through winter. Pupae form the next spring and moths emerge shortly afterwards.

**Occurrence:** Statewide; very common in western and eastern Oregon.

**Where found:** In crown and roots.

**Pest status:** Significant.

**Do not mistake them for:** Glassy cutworm; grass gelechiid.

## Damage symptoms

- Larvae feed on roots and crowns of all grass seed crops. In outbreak years, eight to 12 larvae may be found in a single crown.
- Large patches of weak, dying and dead crowns are seen at fall green-up and when 50% of larvae have ceased feeding.
- Bentgrass stands are known to have the most damage as they are harvested late in the season.



Sod webworm adult.  
Photo: Ken Gray collection,  
© Oregon State University



Sod webworm larvae.  
Photo: Ken Gray collection,  
© Oregon State University

## Monitoring and thresholds

- Soil crown and root samples: Small larvae can usually be found in soil around roots and crowns near the end of August. Dig and tease apart crown, roots and soil around roots. Screen through different size mesh screens, finishing with window screen. Look for small white larvae with brown heads.
- Threshold is three to five larvae per crown.
- Pheromone traps for male moths are placed at canopy level along downwind borders of fields in early June and monitored for a four-week period to help predict a larval infestation.
- More than 50 moths per trap in any seven-day period indicate potential problem.

## Prevention and management

- In irrigated fields, treat adults prior to harvest (late June and early July) and swathing to prevent larval damage later in fall.
- When postharvest irrigation is available: Take at least 20 soil samples beginning late August, as directed above. Record size and numbers of larvae per sample.
- If three to five larvae or more per sample are found, apply a drench treatment, or broadcast spray and immediately irrigate with at least 2 inches (5 centimeters) water or time your application with imminent rainfall.

# Sawflies

*Dolerus nitens*, *Pachynematus setator*

## General description

- **Adults:** One centimeter, broad-bodied, predominantly black and yellow with brown legs and markings on the body. Not a true fly, but a wasp.
- **Larvae:** Yellow, green; have a pair of prolegs on almost every segment of the abdomen, unlike moth larvae.

## Life cycle and behavior

- Adults emerge in April, mate and lay eggs on grass.
- Eggs hatch in seven to 10 days; resulting larvae feed on grass foliage, causing minor, local defoliation.
- Larvae feed for three to four weeks and grow to about 1 inch (2.5 centimeters). Feed by day and retreat to the ground at night.
- Larvae spin cocoons in the soil and emerge as adults the following spring.
- One generation per year.

**Occurrence:** Western Oregon.

**Where found:** Foliage.

**Pest status:** Occasional.

**Do not mistake for:** Armyworms, cutworms or other moth larvae.

## Damage symptoms

- Leaf feeding, flag leaves, stem clipping and defoliation.
- Most damage occurs in May and June.

## Monitoring and thresholds

- **Sweep net:** In late morning or early afternoon.
- **Threshold:** When an unacceptable number of stems or seed heads are clipped, or when seven to 10 or more larvae are found per sweep.

## Prevention and management

- If permitted, open field burns and cultivation destroy overwintering cocoons.
- Wasp parasites can be found on overwintering larvae.
- Mild winters, no-till practices, and buildup on grasses favor sawflies. Cultivation crushes/buries overwintering larvae.



Sawfly adult.  
Ken Gray collection,  
© Oregon State University



Sawfly larva.  
Ken Gray collection,  
© Oregon State University

# Slugs

## General description

- **Adults:** Soft-bodied mollusks covered with slimy mucous coating.
- **Neonates:** Young slugs resemble adults but are smaller.
- **Eggs:** Transparent to opaque spherical eggs in small clutches found on or in the soil. Turn white as they mature.

## Common slugs on grasses

- **Gray field slug (*Deroceras reticulatum*)** Most economically important slug species; body plain or with reticular or spotted patterns.
- **Marsh slug (*Deroceras laeve*):** This is a small slug and body is cylindrical and somewhat broader distally.
- **Arion species (*Arion fasciatus*, *A. leave*, and *A. circumscriptus*):** A complex of exotic species, *A. circumscriptus* is becoming more common in grass seed fields in western Oregon.

## Life cycle and behavior

- Fall rains initiate migration of slugs to the soil surface from October through December. They feed through midspring during the night, or during the day in periods of low light and/or rainfall. From fall through spring, adults and even smaller juveniles (neonates) mate. Females lay small clutches (five–50) of transparent to opaque spherical eggs. It is common for a female to lay 200–300 eggs during her six- to 12-month life span.
- Dispersal into a field occurs from farm machinery or flooding. Slugs commonly invade from fencerow or neighboring border vegetation.



Mature slug eggs.  
Photo: Amy Dreves,  
University of the Virgin Islands



Marsh slug.  
Photo: B. Frank, Slug Portal,  
© Oregon State University



Roundback slug.  
Photo: Amy Dreves,  
University of the Virgin Islands

Gray field slugs.  
Photo: Amy Dreves,  
University of the Virgin Islands

## MAJOR PESTS • SLUGS

- Slugs are commonly found on ridges and crane flies are found in the swales.
- One or two generations per year.

**Occurrence:** Western Oregon.

**Where found:** Foliage and crowns.

**Pest status:** Significant.

**Do not mistake them for:** Cutworm or slug damage; cereal leaf beetle larvae; fertilizer (slug eggs).

### Damage symptoms

- Look for interveinal stripping of tissue between grass leaf veins; shiny slime trails on soil and foliage; overnight seedling stand reduction.
- Foliar feeding can destroy growing points; damage is most severe in minimum-till and no-tillage fields.



Slime trails mark the path of slugs.  
Photo: Amy Dreves, University of the Virgin Islands

### Monitoring and thresholds

- **Bait station:** Place several pellets of metaldehyde or other attractive bait under 1 square foot (0.1 square meter) plywood boards one-half inch (1 centimeter) thick or under a slug blanket to lure and kill slugs. Slugs will aggregate under the board, feed and die. Visit the station in the morning and record numbers. Use multiple stations per field.
- **Threshold for seedling grass:** Three to five slugs per bait station.
- **Threshold for established grasses:** When damage compromises vegetative growth, usually more than 10 slugs per bait station.

### Prevention and management

- Predation by birds (ducks, sea gulls, geese and killdeers), ground beetles, rove beetles; prolonged winter flooding.
- Plowed and disked fields, and fine seed beds without soil clods have less slug problems.
- Remove postharvest residue.
- Heavy sheep grazing on volunteer ryegrass and clover fields.
- Bait with either iron phosphate, iron chelates or metaldehyde.
- Bait in late fall (October and November) and/or early spring (March) to target young active slugs at surface before temperatures drop below 40 degrees Fahrenheit.



A researcher checks a bait station for slugs in a grass seed field.  
Photo: Bob Rost, © Oregon State University



A bait station for slugs.  
Photo: Amy Dreves, University of the Virgin Islands



A slug blanket for monitoring.  
Photo: Amy Dreves, University of the Virgin Islands

# Symphylans

*Scutigera immaculata*

## General description

- 0.5–0.8 millimeter long.
- Cream- to white-colored.
- Long, beaded and filamentous antennae that rapidly vibrate when disturbed in soil samples, very quick moving.
- Larvae have six to 12 pairs of legs, gaining one new pair at each molt for a total of 12 pairs on adults.
- Rear end never has long filamentous tail, just a small, short, thickened appendage.



Symphylans.  
Photo: Ken Gray collection,  
© Oregon State University

## Life cycle and behavior

- Symphylans damage fine roots of grasses any time of year, but most injury occurs from spring through fall when soil is moist within root zone. Eggs are laid in small clumps primarily in early spring and fall.
- Symphylans may be found more than 11–12 inches (30 centimeters) below the soil surface moving in soil cracks, worm holes.
- Infested fields typically have chronic and recurring symphylan problems, as this pest is never eliminated by chemical control, rebounding late the next season or the season after. Symphylans move laterally in the soil or on the surface at night about 2–3 feet (0.6 to 1.0 meter) in a lifetime. Field-to-field movement occurs with infested soil or when organic matter is brought into a field; or moved around with infested soil on farm machinery.

**Occurrence:** Southwestern Oregon.

**Where found:** Soil.

**Pest status:** Significant.

**Do not mistake them for:** Nonpests such as diplurans (such as two-pronged bristletails), collembolans (such as springtails) or centipedes, or damping-off disease.

## Damage symptoms

- Damage occurs in patches throughout a field. Uneven growth of seedlings with many skips is seen.

- Symphylans feed on newly forming roots of germinating seeds and root hairs.
- Extensive damage can occur in new plantings. Seedling grasses are yellow, stunted and death can result.
- Moderate populations can result in very uneven stands of grass and reduced yields.

## Monitoring and thresholds

- **Potato bait stations.** Push away dry soil near plants. Cut a thick slice of raw potato and place face-down, directly on top of a dug-out moist soil surface. Cover the potato with a large plastic container (planting pot) to protect the bait from drying out. Check one to two days after placement. In early morning, remove the cover, slowly lift the potato slice, and quickly count the symphylans, both on the potato slice and on the soil surface underneath. Seedling damage is likely to occur if five or more symphylans are found on potato bait.
- Beginning in late April, or when soil is workable, take a 1 cubic foot (929 square centimeters) soil sample and screen over three sizes of mesh screen, the last being window screen size. Pick apart clods and organic matter. Using a black background below the last screen makes symphylans easier to see.
- **Soil sample:** Dig 6-inch long by 6-inch wide by 12-inch deep (15 by 15 by 30 centimeters) samples, or cores of 2.5 inches (6 centimeters) in diameter by 6–12 inches (15–30 centimeter) depth. When soil samples are taken, the soil from each sample is usually placed on a dark piece of plastic or cloth where the aggregates are broken apart and the symphs are counted. Average of five or more symphs per 1 cubic foot (929 cubic centimeters), or one or two per 6-by-6-by-12-inch (15-by-15-by-30 centimeter) sample of soil prior to seeding indicates potential for damage.



Potato bait station for symphylans.  
Photo: Ken Gray collection, © Oregon State University

## Prevention and management

- Centipedes, ground beetles and various fungi feed on them.
- Compact or sandy soils are not favorable for symphs; good soil with high organic is.
- Control them in the previous crop with an insecticide.

# Thrips

*Anaphothrips obscurus*

## General description

- **Adults:** Small (1–2 millimeters), yellow, brown-winged, narrow insects. Look like small thin “splinters.”
- **Nymphs (larvae):** Larvae are wingless with a whitish (when newly hatched) to yellow-orange color, then gradually turn yellow to brown with age.

## Life cycle and behavior

- Overwinter as adults or pupae. Infest grass in the spring.
- Multiple generations.

**Occurrence:** Statewide.

**Where found:** Boot and seed heads.

**Pest status:** Occasional to significant.

**Do not mistake their damage for:** Plant bugs, leafhoppers and mites.

## Damage symptoms

- Feeding with rasping and piercing mouthparts results in silver, stipple and yellow leaves.
- Causes “silver top.”
- When thrips feed on flowers and developing seeds, this results in premature-appearing white heads in field. These heads have very few if any viable seeds.



Grass thrips.  
Photo: Ken Gray collection,  
© Oregon State University

## Monitoring and thresholds

- Inspect susceptible varieties (fine fescue and bentgrass) as heads approach boot stage.
- Large numbers of thrips (more than 10 per grass head) will probably result in “silver top” symptoms.
- When head is in the boot stage, pull flag leaf back and look for thrips within leaf and on developing seed head.

## Prevention and management

- Minute pirate bugs, predatory mites, pathogens.
- Apply insecticides at boot stage.



Silver top damage symptom caused by thrips.  
Photo: Bugwood.org

## Meadow plant bug

*Leptoterna dolabrata*

### General description

- **Adults:** Ten millimeters long, yellow, green or brown with piercing sucking mouthparts and either short (nymphs) or long wings (adults). They have an unpleasant odor.
- **Young nymphs:** Smaller than adults with similar coloring and short wing pads.

### Life cycle and behavior

- Eggs overwinter in stems and straw of previous crop and hatch in spring.
- Nymphs feed in spring and early summer; become adults about boot stage.
- One generation per year.

**Occurrence:** Western Oregon.

**Where found:** On developing seed heads.

**Pest status:** Occasional but significant on fine fescue, bentgrass and bluegrass.

**No lookalikes:** No other insect in grass seed crops is similar to meadow plant bug.

### Damage symptoms

Feeding on seed heads from boot stage through seed set results in white (unfilled) heads and shriveled seed. Feeding is one cause of “silver top.”

### Monitoring and thresholds

- Sweep net (prior to boot through early seed set).
- Threshold not well defined: three to five per sweep may require management (from boot stage forward).

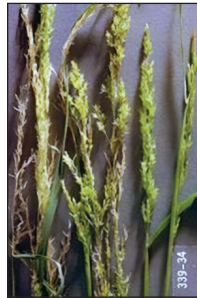
### Prevention and management

Open field burn, plowing and mechanical straw removal all reduce overwintering eggs and damage potential.



Adult meadow plant bug.

Photo: Thomas Palmer, BugGuide.net



Silver top damage symptom caused by meadow plant bug.

Photo: Ken Gray collection, © Oregon State University

## Grass bugs

### General description

**Black grass bug** (*Labops hesperitius*) and **Pacific grass bug** (*Irbisia pacifica*) are grayish brown-black bugs, about one-quarter inch long. They cause pale spots or stippling appearance on leaves of cereals by using their piercing-sucking mouthparts.

### Life cycle and behavior

- Black grass bugs overwinter as eggs in grass stems. Eggs hatch in the spring as grass plants begin to grow. Heavy infestations may prevent seed formation, and black grass bugs often are pests of grass seed production fields.
- One generation of black-grass bugs is produced each year.

**Occurrence:** Statewide.

**Where found:** On developing seed heads.

**Pest status:** Occasional; higher number in recent years east of the Cascades.

### Monitoring and thresholds

Look for damage and the insects in April and May.

### Prevention and management

Identify an infestation of black grass bugs early in the spring if chemical controls will be applied to prevent damage.



Characteristic stippling damage caused by grass bugs.

Photo: Whitney Cranshaw, Colorado State University, Bugwood.org



Black grass bug

Photo: Lynette Elliot, BugGuide.net



Pacific grass bug

Whitney Cranshaw, Colorado State University, Bugwood.org

## Lygus bugs

*Lygus* spp.

### General description

- **Adults:** Pale green to brown color, oval-shape bugs with a light yellow-green “V” or triangle-shape on the base of their backs; about 0.18–0.25 inch (5–6 millimeters) long.
- **Nymph:** pale when young, greenish as they mature with small developing wings. The immatures will molt several times before becoming adults with wings crossed over their backs.
- **Eggs:** Small oblong eggs are inserted into plant tissue.

### Life cycle and behavior

- Overwinters as adults in debris piles, ground cover, bark cracks and beneath weeds.
- Females lay eggs in spring in stems, near flowers about to bud on multiple hosts.
- Move from host to host.
- Several generations.

**Occurrence:** Statewide.

**Where found:** Adults and nymphs above ground.

**Pest status:** Occasional to significant in all grass species, wheat, alfalfa, sweet clover, mustards, weeds.



Lygus bug.  
Photo: Ken Gray collection,  
© Oregon State University



Photo: Whitney Cranshaw, Colorado State University, Bugwood.org

MINOR AND  
INCIDENTAL PESTS



Killdeer.  
Photo: Doug Greenberg, CC BY-NC 2.0

## Birds

Geese, starlings, crows and killdeer are a few that feed on insects and foliage, and create habitat in grass fields.

## Fungus gnats

The tiny white larvae of gnats thrive in cool temperatures and in an abundance of water. They feed on organic plant matter, leaf mold, feeder roots and root hairs, algae and fungi.



Fungus gnats.  
Photo: Jim Baker, North Carolina State University, Bugwood.org

## Grasshoppers

- **Adults:** Two inches (5 centimeters) with leathery forewings; hind wings clear to varying colors.
- **Nymphs:** Young grasshoppers are wingless and look like adults.

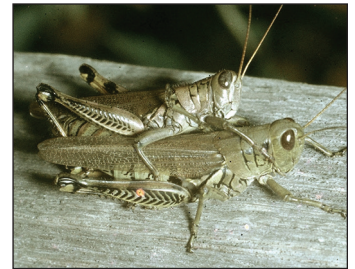
### Common grasshoppers in grasses:

- **Clear-winged grasshoppers** (*Camnula pellucida* (Scudder)): Most abundant in sweep nets, smaller in size relative to other species; hind wings clear or only slightly yellowish.



Clear-winged grasshopper.  
Photo: Whitney Cranshaw, Colorado State University, Bugwood.org

- **Valley grasshoppers**, (*Oedaleonotus enigma* (Scudder)): Found in early spring; medium-sized grasshoppers with short to fully developed wings. Widespread in grassland areas.
- **Big-headed grasshoppers**, (*Aulocara elliotti* (Thomas)): Found in early spring; medium-sized and usually colored gray. As their common name suggests, relatively large heads with slightly slanted faces and have spotted forewings that extend slightly beyond the abdomen.
- **Migratory grasshopper** (*Melanoplus sanguinipes* (Fabricius)): Medium-sized and grayish-brown in color, and often tinged with reddish-brown.
- **Red-legged grasshopper** (*Melanoplus femurrubrum* (DeGeer)): Medium-sized, reddish-brown or grayish-brown dorsally and yellow or yellowish-green ventrally. The forewings lack distinct markings; the hind wings are colorless.
- **Differential grasshopper** (*Melanoplus differentialis*): Large in size. Chevronlike markings on the hind femur.



Differential grasshoppers.  
Photo: Edward L. Manigault, Clemson University Donated Collection, Bugwood.org

### Life cycle and behavior

- Nymphs hatch from April to July, coming from egg pods deposited in soil the previous summer. The five nymphal stages last three to 12 days each, depending on temperature.
- Grasshoppers can migrate from infested fields or grasslands to infest commercial grass fields and rangeland forage.
- Elimination of fall and spring plowing in direct-seeded grasses west of the Cascades has been accompanied by occasional grasshopper outbreaks.
- Periodical outbreaks in eastern Oregon grass-seed fields can occur from rangeland infestations. In western Oregon, no-till fields can be a source of infestation.
- Warm, dry springs foster outbreaks.

**Occurrence:** Statewide.

**Where found:** Foliage.

**Pest status:** Occasional (notably in established fescue and perennial ryegrass stands). Higher numbers next to fallow areas.

**Do not mistake them for:** Grasshoppers are easily recognizable and hard to mistake.



## MINOR PESTS

### Damage symptoms

Nymphs and adults defoliate grass and feed on seed heads from late May through September.

### Monitoring and thresholds

- Sweep net or visual estimate of average number of grasshoppers per square yard (0.8 square meter).
- Threshold is three to five grasshoppers per square yard (0.8 square meter), or when damage affects the seed set or stand going into the fall.

### Prevention and management

- Control is most effective on young grasshoppers.
- If feasible, plow the field to reduce egg pod populations.
- Cold, wet weather when eggs are hatching kills nymphs.
- A protozoan (*Nosema locustae*) may be commercially available as a treatment.
- Reinfestation through migration is possible.



Symptoms of damage caused by grasshopper adults and nymphs.

Photo: Bugwood.org

## Leafhoppers, spittlebugs or froghoppers

Many species in *Deltocephalinae* subfamily of leafhoppers (*Cicadellidae*) are a pale to brown color, narrow, wedge-shaped, and sap-sucking insects that hop and fly. When disturbed, they move quickly into flight. Adults have wings that fold rooflike over their backs when on plant foliage. Adults overwinter in crop debris or noncultivated areas. In late spring, females deposit eggs within stems and larger veins of the grass leaf tissue. Young wingless nymphs feed on the grass through harvest. If in large numbers, their toxic saliva causes white specks/stippling on foliage, yellowing, leaf curling, stunting and distortion of plants. Some leafhoppers can vector plant viruses and phytoplasmas. Yield loss from leafhopper feeding has not been documented.



Adult leafhopper.

Photo: J.L. Danet, INRA Centre de Recherches de Bordeaux, Bugwood.org



Spittle bug nymph in spit mass.

Photo: Navneet Kaur, © Oregon State University

## Midges

Tiny, mosquito-like flies like warm, humid environments, and the larvae are scavengers on organic matter. There are some reports of damage under central pivot irrigation.



Midge.

Photo: David Cappaert, Bugwood.org

## Millipedes

Gray to brown, round and wormlike with two pairs of legs per segment, which can damage seeds and seedlings by feeding. Do not mistake for flat wormlike centipedes with one pair of legs per segment, which prey on insects.



Millipede.

Photo: Alex Bairstow, BugGuide.net

## Night crawlers

Earthwormlike creatures can help amend and aerate soil. However, they can create small mounds in fields while chewing their way through soil, removing seedlings and can steal slug control pellets.

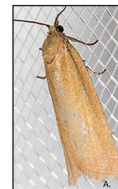


Night crawlers.

Photo: Amy Dreves, University of the Virgin Islands

## Omnivorous leaf tier

Primarily represented by bell-shaped adult moths and larvae with a tan head capsule, a black shield and a greenish-brown or yellowish-green body with lighter-colored stripes running along the side. Early instars feed within the leaf, mines and later instars tend to tie the foliage and seed heads in preparation for their overwintering. Only in rare instances, larval feeding occurs on developing seed heads.



Omnivorous leaf tier adult, left, and larva, above.

Photos: Navneet Kaur, © Oregon State University (top) and Joseph Highbee, BugGuide.net (left)

## Pillbugs and sowbugs

Light gray, segmented, with seven pairs of legs and can roll up in a ball; feed on organic matter in the soil and sometimes on seeds, grass and other plants.



Pillbug/sowbug.

Photo: Amy Dreves, University of the Virgin Islands

## Potworms

Small colorless one-quarter-inch (about 6 millimeters)-long worms commonly found in soil. They eat waste, clean up around rotting seeds and aerate the soil. Potworms thrive on more acidic soil and increased moisture.



Potworm.

Photo: Amy Dreves, University of the Virgin Islands

## MINOR PESTS

### Seed corn maggot larvae

As name suggests, the maggots (immature form) damage seeds. The maggots are known to burrow into seed and cause germination loss and emergence failures leading to large gaps in crop stand.



Seed corn maggot larvae.  
Photo: Mariusz Sobieski,  
Bugwood.org

### Spotted cutworm

*Amathes c-nigrum*

Adults have a wing marked with areas of light brown and black. Black “triangle-shaped” marks on the lateral margins of the last abdominal segments on larval body are characteristic to this species. Damage similar to other cutworm species listed under major pests section.

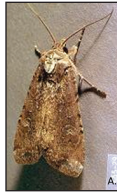


Spotted cutworm adult,  
top, and larva, bottom.  
Photos: Ken Gray collection,  
© Oregon State University

### Variigated cutworm

*Peridroma saucia*

Adult moths are large and brown to reddish-brown with dark spots on the wings. Variigated cutworm larvae are brown to tan, usually with a series of white or yellowish “keyhole” marks on each dorsal (top) abdominal segment. Damage similar to other cutworm species listed under major pests, pages 35–45.



Variigated cutworm  
adult, left, and larva,  
above.  
Photos: Ken Gray collection,  
© Oregon State University



Photo: Lynn Ketchum, © Oregon State University

# BENEFICIAL ORGANISMS

## BENEFICIAL ORGANISMS



Centipedes.  
Photo: Joyce Bonner, BugGuide.net



Diplurans.  
Photo: BugGuide.net



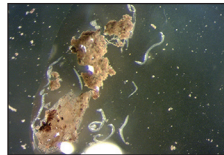
Honey bee.  
Photo: Lesley Ingram, Bugwood.org



Bumblebee.  
Photo: Lynn Ketchum,  
© Oregon State University



Lacewing larva.  
Photo: David Cappaert,  
Bugwood.org



Entomopathogenic  
nematodes and free-living  
nematodes.  
Photo: Leanna Van Slambrook,  
© Oregon State University

## Centipedes

## Diplurans

Diplurans mostly feed on a variety of live prey such as mites, springtails, insect larvae, symphylans and dead organic matter, or detritus. They may also supplement their diet with fungal mycelia and plant debris. Their life span is relatively short. Note that some dipluran species (such as the family *Projapygidae*) are herbivorous and feed on plants and plant material.

## Honey bees and bumblebees

## Lacewings

## Nematodes

*Steinernema* and *Heterorhabditis* spp. Nematodes are entomopathogenic.



Parasitic wasps.  
Photo: Scott Bauer, USDA Agricultural  
Research Service, Bugwood.org



Ichneumonid wasp.  
Photo: Jim Baker, North Carolina State  
University, Bugwood.org



Tachinid flies.  
Photo: Amy Dreves,  
University of the Virgin Islands



Bacteria-infected moth  
larva.  
Photo: Amy Dreves,  
University of the Virgin Islands



Entomopathogenic fungi.  
Photo: Whitney Cranshaw, Colorado  
State University, Bugwood.org



Entomopathogenic virus.  
Photo: David Nance, USDA Agricultural  
Research Service, Bugwood.org

## Parasitoids, wasps and flies

- Braconid wasps, chalcid wasps
- Ichneumonid wasps
- Tachinid flies

## Pathogens (diseases)

- Bacteria-infected moth larvae
- Fungus-infected weevil
- Virus

## Predatory beetles

### Lady beetles *Coccinellids*

- Common lady beetle
- Western blood-red lady beetle (*Cycloneda polita*) (spotless)
- Multi-colored Asian (*Harmonia axyridis*)
- Seven-spotted lady beetle (*Coccinella septempunctata*)
- Two-spotted lady beetle (*Adalia bipunctata*)



Common lady beetle larva.  
Photo: Clemson University — USDA  
Cooperative Extension Slide Series,  
Bugwood.org



Common lady beetle pupa.  
Photo: Amy Dreves, University  
of the Virgin  
Islands

## BENEFICIAL ORGANISMS



Ground beetle.

Photo: Mary C Legg, Bugwood.org



Soldier beetle.

Photo: Amy Dreves, University of the Virgin Islands



Damsel bug.

Photo: Alton N. Sparks Jr., University of Georgia, Bugwood.org



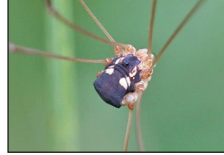
Big-eyed bug.

Photo: Russ Ottens, University of Georgia, Bugwood.org



Minute pirate bug.

Photo: Lyle Buss, University of Florida



Daddy longlegs.

Photo: Johnny N. Dell, Bugwood.org

### Ground beetles *Carabids*

- Rove beetles (*Staphylinids*)
- Soldier beetles (*Cantharis fidelis*)

### Predatory bugs

- Damsel bugs (*Nabids*)
- Big-eyed bugs (*Geocoris sp.*)
- Minute pirate bugs (*Anthocorids*; *Orius spp.*)

### Spiders/daddy longlegs

- Daddy longlegs
- Ground spider
- Orb spider



Ground spider.

Photo: Elliot Lowe, BugGuide.net



Orb spider.

Photo: David Cappaert, Bugwood.org

### Springtails *Collembolans*

A few species feed on living plants and occasionally are pests that feed on new seedlings in spring. Damage to seedlings can reportedly occur if present in high numbers. Most springtails are fungal-feeders so their presence should reflect the abundance of soil organic matter.



Springtails.

Photo: Amy Dreves, University of the Virgin Islands

The largest springtails in these fields (*Tomocerus*, *Entomobrya*) are probably shredders as well as fungivores, feeding on fungi in dead grass leaves. These big species are probably classified as living on the topsoil (epigeic), rather than soil dwellers. These are the springtails farmers will see.

### Yellowjackets



Yellowjackets.

Photo: Jim Baker, North Carolina State University, Bugwood.org

## Scouting tools

Monitor for pests by scouting plants at a pest's known critical activity time or at a specific time of plant development that is known to attract certain pests (see pest scouting calendar).

Regular scouting helps ensure early detection, determines level of pest presence and optimizes the timing of treatments.

### Baited traps

- For symphylans, wireworms, slugs. Potato for symphs; seed for wireworm; and metaldehyde pellets for slugs (see page 50).

### Beat sheet

- Insects can be easily collected by beating the plants low to the ground and placing a beat sheet next to the plant. A beat sheet is basically just a piece of heavy-duty cloth 1 square meter stretched across two diagonal pieces of wood joined at the center. They can be purchased or made. Beat sheets can vary in size, but a typical beat sheet is about 3 feet square. For flying insects, an aspirator can be used to suck up the bugs.



Beat sheet.

Photo: Amy Dreves, University of the Virgin Islands

### Berlese funnel

- A 20- to 40-watt incandescent light bulb slowly dries out the sample over a few days that sits above samples. Insects slowly migrate down following the moisture gradient as soil dries. They then fall into a jar of alcohol and can be counted and recorded.
- Used to extract insects from sod soil cores, or plant roots, crowns and foliage.



Berlese funnel.

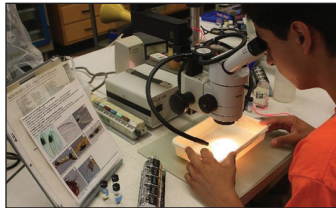
Photo: Navneet Kaur, Oregon State University

### Microscope

- A microscope is used to see objects that are too small to be seen by the naked eye.

### Pheromone traps

- For Lepidopteran pests (sod webworm, armyworm, various cutworm species).



Microscope.

Photo: Amy Dreves, University of the Virgin Islands

- The traps use pheromones to lure insects into them. Sex pheromones and aggregating pheromones are the most common types used.

### Pitfall traps

- Plastic cups with a protective lid to protect from rain and birds that remove insects that drop in. Sunk in field at ground level, marked with flag.
- Inspect for insects twice a week.



Pheromone trap.

Photo: Amy Dreves, University of the Virgin Islands

### Soil sieve

- Wood- or metal-framed, with different size wire mesh screens, to sieve soil and separate insect pests from soil and organic matter (for symphylans, wireworms, cutworms, weevil larvae).



Soil sieve.

Photo: Navneet Kaur, © Oregon State University



Pitfall trap.

Photo: Amy Dreves, University of the Virgin Islands

### Shovel and auger soil sample

- A shovelful of soil dug and placed on a tarp for examination of pest (for symphs, cutworms, root weevil larvae, mites).



Shovel and auger sample.

Photo: Amy Dreves, University of the Virgin Islands

### Sweep net

- Thresholds for controlling pests are often based on average numbers of pest insects per straight-line or 180-degree sweep of this net. Ten consecutive straight-line sweeps dipping the net halfway into the foliage are taken as one walks. Insects are counted, divided by 10 for an average number per sweep and recorded in field notebook. This is done in at least 10 different locations in a field to gain a representation of the population.



Sweep net in use.

Photo: Amy Dreves, University of the Virgin Islands



Hand lens.

Photo: Amy Dreves, University of the Virgin Islands



OptiVisor.

Photo: Amy Dreves, University of the Virgin Islands

### Visual inspection

- Hand lens, jeweler's loupe or OptiVisor.
- Simple tools for viewing small-pest life stages in the field.

### Water trap

- Yellow-colored plastic buckets or pans with a drop of soap added to reduce surface tension will attract flying insects like aphids and thrips.



Water trap.

Photo: Amy Dreves, University of the Virgin Islands

### Yellow sticky trap

- Sticky cards are useful for monitoring for thrips and aphids. The cards will trap the flying stages of flying adult insects. Yellow for aphids; blue for thrips. Hang sticky cards near plants attached to a stick.



Yellow sticky trap.

Photo: Amy Dreves, University of the Virgin Islands

## Helpful resources

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# Grass seed pest scouting calendar

Based on crop stages. An entry indicates when a life stage of the pest can be seen.

## Seedling phase

Germination to second leaf



## Vegetative phase

Third leaf to tillering



## Transition phase

Shoot elongation to 2nd node



## Reproductive phase

Flag leaf to ripe seed



## Postharvest

Vegetative regrowth



## Dormancy

Minimal growth



Illustrations: Amy Dreves, University of the Virgin Islands

### Aphids

Bird cherry-oat aphid	Adult, immature	Adult, immature	Adult, immature
Corn leaf aphid	Adult, immature	Adult, immature	Adult, immature
English grain aphid	Adult, immature	Adult, immature	Adult, immature
Rose grass aphid	Adult, immature	Adult, immature	Adult, immature

### Beetles

Billbug	Adult	Adult	Adult
Cereal leaf beetle	-	-	Adult, immature
Wireworm (click beetle)	Immature	Adult, immature	Adult, immature
Strawberry root weevil	Adult, immature	Adult, immature	-

### Bugs

Meadow plant bug	-	-	-
Seed bug	-	-	-

### Flies

Crane fly	Immature	Adult, immature	Immature
Frit fly	Adult, immature, egg	Adult, immature, egg	

### Aphids

Adult, immature	Adult, immature	Adult, immature
Adult, immature	Adult, immature	Adult, immature
Adult, immature	Adult, immature	Adult, immature
Adult, immature	Adult, immature	Adult, immature

### Beetles

Immature	Adult	Adult
Adult, immature	Adult	-
Adult	Immature	Immature
-	Immature	Immature

### Bugs

Adult, immature	-	-
Adult	-	-

### Flies

-	Adult, immature	Immature
-	Adult, immature, egg	-

**Seedling phase**

Germination to second leaf



**Vegetative phase**

Third leaf to tillering



**Transition phase**

Shoot elongation to 2nd node



**Reproductive phase**

Flag leaf to ripe seed



**Postharvest**

Vegetative regrowth



**Dormancy**

Minimal growth



Illustrations: Amy Dreves, University of the Virgin Islands

<b>Leafminer</b>	Adult, immature	Immature	Adult, immature
<b>March fly</b>	Immature	Adult, immature	-
<b>Grasshoppers</b>	-	Adult, immature	Adult, immature
<b>Grass mealybug</b>	-	Adult, immature	Adult, immature
<b>Leafhoppers</b>	-	-	Immature
<b>Mites</b>			
<b>Banks grass mite</b>	-	-	Adult, immature
<b>Brown wheat mite</b>	Adult, immature	Adult, immature	Adult, immature
<b>Clover mite</b>	Adult, immature	Adult, immature	Adult, immature
<b>Winter grain mite</b>	Adult, immature	-	-
<b>Moth larvae</b>			
<b>Armyworm</b>	-	-	Immature
<b>Army cutworm</b>	-	Immature	Immature
<b>Cereal stem moth</b>	Immature	Immature	Immature
<b>Cutworms</b>	Immature	Immature	-
<b>Grass gelechiid</b>	-	-	Adult, immature
<b>Sod webworm</b>	-	-	Adult
<b>Sawfly (wasp)</b>	-	-	Adult, immature
<b>Slug</b>	Adult, immature	Adult, immature	-
<b>Symphylan</b>	Adult, immature	Adult, immature	-
<b>Thrips</b>	-	-	Adult, immature

-	Adult, immature	-
-	Adult, immature	Immature
Adult, immature	Adult, immature	-
Adult, immature	Immature	-
Immature	Immature	-
<b>Mites</b>		
Adult, immature	-	-
-	-	-
-	Adult, immature	Adult, immature
-	Adult, immature	Adult, immature
<b>Moth larvae</b>		
Immature	Immature	-
-	Immature	Immature
Adult, immature	-	-
-	Immature	Immature
Immature	-	-
Adult, immature	Immature	-
Immature	-	-
-	Adult, immature	Adult, immature
-	Adult, immature	-
Adult, immature	-	-



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