Winter Cutworm: A New Pest Threat in Oregon

J. Green, A. Dreves, B. McDonald, and E. Peachey

Introduction

Winter cutworm is the common name for the larval stage of the large yellow underwing moth (*Noctua pronuba* [Lepidoptera: Noctuidae]). The cutworm has tolerance for cold temperatures, and larval feeding activity persists throughout fall and winter.

Adult *N. pronuba* moths have been detected in Oregon for at least a decade, and the species is common in many different ecological habitats. Epidemic outbreaks of adult moths have occurred periodically in this region, resulting in captures of up to 500 moths per night. However, larval feeding by *N. pronuba* has not been a problem in Oregon until recently. In 2013 and 2014, there were isolated instances reported, including damage by larvae to sod near Portland and defoliation of herb and flower gardens in Corvallis. In 2015, large numbers of larvae were observed around homes, within golf courses, and in field crops located in Oregon and Washington.

Winter cutworms have a wide host range across agricultural, urban, and natural landscapes (Table 1, page 2) and are a concern as a potential crop pest that can cause considerable damage in a short amount of time. Above-ground damage occurs when larvae chew through tissues near ground level, cutting the stems off plants. Leaf chewing and root feeding also have been observed. Winter cutworms are gregarious, which means they feed and move in groups, similar to armyworms. The severity of plant damage they cause can differ depending on specific environmental conditions, proximity to other host plants, and management practices. This publication highlights general information about winter cutworm, including identification, scouting recommendations, and potential control measures.

Photo: Nate McGhee, © Oregon State University.

Jessica Green, faculty research assistant, Department of Horticulture; Amy J. Dreves, Extension entomologist and assistant professor (senior research), Department of Crop & Soil Science; Brian McDonald, senior faculty research assistant I; and Ed Peachey, associate professor (practice), vegetable production and weed science; both of Department of Horticulture; all of Oregon State University

EM 9139
February 2016

Table 1. Partial list of documented larval host plants for winter cutworm.* Records include published literature as well as recent accounts from scientists in Oregon (in **bold**).

Group	Host plant
Small fruits	Grape
	Strawberry
Grass or forages	Alfalfa
	Clover
	Oat
	Orchardgrass
	Poa spp. (Annual bluegrass, Kentucky bluegrass, others)
	Ryegrass
	Wheat
Ornamentals	Carnation
	Clary sage
	Heartsease
	Hosta
	Ivy
	Chrysanthemum
	Mint
	Iris
	Primrose
	Violet
	Wallflower
Others	**Canola**
	Desert saltbush
Vegetables	Beet
	Carrot
	Cole crops
	Lettuce
	Potato
	Swiss chard
	Tomato
Weeds	Burdock
	Chickweed
	Dandelion
	Dock

*This list is not exhaustive, nor does it guarantee that damage to listed plants will occur.

Distribution

The large yellow underwing moth (*Noctua pronuba* L.) is native to Eurasia and is widely distributed throughout the Palearctic region and North Africa. The first documented account of *N. pronuba* in North America was made in July 1979 in Halifax, Nova Scotia, where a single male moth was found at a porch light. The moths are particularly strong fliers and can migrate over large distances. Moths can deposit eggs on a variety of ornamental plants imported by the horticultural industry, so it is possible that this species arrived to North America via trade routes. After being introduced, *N. pronuba* spread rapidly to the northeastern United States. By 2000, moths were detected in Illinois, Wisconsin, Colorado, and Wyoming. Although the adult moth is now considered widespread in the U.S., there are very few published reports of larval damage occurring on crops.

The first report of winter cutworm activity in the U.S. was made in 2007, when large numbers of larvae were noted around homes and in hayfields throughout Michigan (DiFonzo and Russell 2010). Another instance of large-scale larval feeding was reported in winter wheat in Idaho (Bechinski et al. 2009). Potential damage to crops by winter cutworm in Oregon has not been previously described but is a concern due to the recent and significant increase in the number of larval sightings.

Identification and biology

A noctuid moth life cycle is comprised of four developmental stages: adult, egg, larva, and pupa. According to published literature, *N. pronuba* has one generation per year in Eurasia and other areas of origin, with adult flight occurring from June through October. However, trapping efforts conducted in the Pacific Northwest reveal an activity pattern that suggests bivoltinism (2 generations per year). There seems to be a slight but distinct increase of flight activity occurring in April through June, and another, larger peak beginning in mid-August and continuing through October (Crabo et al. 2015).

Adult moths are polymorphic (many variations of color and patterning exist)(Figure 1, page 3). The dull, gray-brown coloring of the forewing (top wing) makes them difficult to identify while at rest. In flight, adults are easily recognizable by their

Figure 1. The large yellow underwing moth (*Noctua pronuba* L.) displays variations in color and patterning of the forewing but can be distinguished from other species by its large size (2-inch wingspan) and distinct hindwing.

Photo from Oregon State Arthropod Collection

large, 2-inch (50 to 60 mm) wingspan and colorful hindwing (bottom wing), which is bright yellow to orange with a thick, dark marginal band (Figure 1, above, and Table 2, page 4).

Eggs are laid in flat sheet clusters that may be difficult to find in the field. The eggs are spherical in shape, ribbed and reticulate, and cream-colored to yellow, but darken over time. Egg masses are laid on the underside of host plants as well as on nonplant structures. One female moth can deposit up to 2,000 eggs in her lifetime. Eggs hatch after 2 to 4 weeks, depending on temperature.

Larvae are smooth-bodied and progress in color from green to dark brown, olive, or gray as they mature. They are about ⅛ to 2 inches long (3 to 50 mm). Mature larvae are characteristically marked with a series of black dashes that run down the sides of the back (Figure 2a). Dashes are most prominent towards the posterior end. There is a light-colored line underneath the dashes, and white to cream-colored slanted lines on the sides of the body may be evident. The head is tan, with a pattern of two black, angled crescents that point inward (Figure 2b).

Winter cutworms are present in the soil from September through March and exist at varying life stages and maturity. It is presumed that the more mature larvae pupate during the winter and emerge as adults in early spring. Other, younger larvae continue to feed through the winter and spring. After larvae mature, they develop into reddish-brown **pupae** about 1 inch long (25 mm) and rest in earthen cells under soil or debris (Figure 3). The

Figure 2. Winter cutworms progress in color as they mature. Late-stage larvae have characteristic dorsal and lateral patterning on the body (a) that, when combined with examination of the head (b), help one identify them in the field.

Photos: Tom Cook

Figure 3. Like other moths, the immobile stage of *N. pronuba* is called a pupa. Differentiating *N. pronuba* pupae from other related species is difficult, but it is important to recognize what cutworm and armyworm pupae look like to aid field-scouting efforts.

Photo: Amy Dreves, © Oregon State University.

developmental stages present in our sampling efforts to date vary by site, but include mid- to late-stage larvae and a small percentage of pupae. Further study is necessary to clarify the life cycle of *Noctua pronuba* in the Pacific Northwest.

Distinguishing from other common cutworms and armyworms

There are other larvae that look similar to winter cutworm, all of which are found within the Noctuid moth family. Distinguishing between them is crucial for the most effective pest management approach, as they can behave differently and feed during different times of the year. Related agricultural pest species that could be confused with winter cutworm in this region include variegated cutworm (*Peridroma saucia*), spotted cutworm (*Xestia* spp.), Western yellowstriped armyworm (*Spodoptera praefica*), army cutworm (*Euxoa auxiliaris*), black cutworm (*Agrotis ipsilon*), glassy cutworm (*Apamea devastator*), and true armyworm (*Mythimna unipuncta*). Differences between some of these species are highlighted in Table 2 (page 4).

Table 2. Comparison of winter cutworm (*N. pronuba*) with some look-alike species of cutworm and armyworm. The species highlighted here were chosen because they may be found as larvae in late fall or winter in Oregon. The most prominent larval characteristics are listed in **bold**, but appearance can vary widely depending on maturity of the larvae. See reference citations for more information.

Common name	Latin name	Notes on activity of larvae (L) and adults (A)	Larval key characteristics	Larva	Adult
Winter Cutworm	*Noctua pronuba*	**L:** move in masses; can actively feed all winter if temps are mild **A:** migratory; long-season (Apr–Nov); may have 2 overlapping generations	**Black dashes bordered by a cream-yellow line** that are most noticeable near posterior end; tan head with 2 black arcs on the eyes *(see other notes in ID section)*		 Photo (larva): Tom Cook Photo (adult): Merrill A. Peterson, Pacific Northwest Moths
True Armyworm	*Mythimna unipuncta*	**L:** move in masses; most common in grasses and grains **A:** migratory; long-season (May–Nov); move to higher elevations in late summer, then return for peak egg-laying activity in Sept–Oct	One broad, dark dorsal band; **three lateral stripes that contrast in color**, the lowest of which has a pink hue; small head with net-like markings and dark arcs on the eyes		 Photo (larva): James Kalisch, University of Nebraska, Bugwood.org, CC BY-NC 3.0 US Photo (adult): Merrill A. Peterson, Pacific Northwest Moths
Variegated Cutworm	*Peridroma saucia*	**L:** overwinter as semi-mature larvae, can be found in the soil and under field debris **A:** migratory; long activity period; suspected to have 2 generations (May–Jun and late Aug–Oct)	A series of 4 to 7 small, **yellow dorsal spots**; terminal (most posterior) body segment has a transverse yellow line and a black 'W', which is most evident on mature larvae		 Photo (larva): Rob Broekhuis Photo (adult): Merrill A. Peterson, Pacific Northwest Moths
Spotted Cutworm	*Xestia c-nigrum; Xestia xanthographa*	**L:** prone to climb; overwinter as larvae **A:** 2 distinct flight-activity periods (Apr–Jun and late Jul–Nov)	May have black dashes or **bold, triangular shaped markings, most prominent on the posterior** body segments; side of body has a wavy black line; head is light brown with dark markings on the eyes		 Photo (larva): Tiziana Dinolfo Photo (adult): Merrill A. Peterson, Pacific Northwest Moths

Scouting and damage

Visual monitoring is the easiest way to detect an armyworm or cutworm attack. Typically, cutworm damage is erratic and less uniform than armyworm damage. However, winter cutworms move en masse like armyworms, so look for large areas of clipped, mowed, or notched foliage (Figure 6, below, and Figure 7, page 6), or, in some cases, missing plants within and across rows. Spend time visually searching for damaged foliage and the presence of larvae in at least five locations.

Winter cutworm larvae are mostly nocturnal and hide during the day, but daytime feeding can occur on mild or overcast days. It may be necessary to scrape and sort through at least the top 2 inches (5 cm) of soil to sight larvae during the day. Cutworms often curl up into a "C-shape" when disturbed (Figure 4). Use a soil scoop and check near the base of plants or crowns and under clods, leaf litter, or thatch. Adult moths are nocturnal and can be sampled with a light trap.

At this point, factors that influence feeding by winter cutworm are unclear. Based on what we know from other reports, feeding may be intensified in perennial crops (especially fall-seeded crops), or areas with reduced tillage, volunteer cereals, or persistent, low-growing winter weeds. Areas with low, wet margins also may have an increased risk of cutworm feeding. However, field edges or centers can be equally affected, depending where eggs were laid. Other factors that could influence a sudden outbreak include climate, mass migration of adults into the region, and proximity to neighboring weedy areas.

Figure 4. Cutworms rest in the soil during the day, and emerge at night to feed. They typically curl into a "C-shape" when disturbed. Winter cutworms display behavior of both subterranean and climbing-type cutworms.

Photo: Jessica Green, © Oregon State University.

Notes from the field

Willamette Valley, Oregon, 2015

Turf and lawn: Incidences of winter cutworm damage were reported on putting greens, approaches, collars, and on lawns (Figure 5). Winter cutworms were observed clipping off leaf blades but, in our limited experience, did not seem to damage crowns or senescing leaves during the fall or winter.

Grass seed, cereals, and pasture: Heavy, late-season defoliation by winter cutworm could deplete root reserves, causing increased winter injury and reduced spring regrowth, depending on crop stage and winter temperatures. Fertilizer and irrigation applied to pastures in late fall usually causes abundant growth that may attract cutworms from surrounding, less-productive fields. Examine fields from different viewpoints and look for irregular-shaped and low-lying areas of damage (Figure 6). A generally accepted threshold for armyworm management in alfalfa and forage pastures is 1 to 2 larvae per square foot in recently seeded fields, and 3 to 4 per square foot in mature stands. Hayfields, grass pastures, and wheat may tolerate 4 to 6 armyworm

Figure 5. Winter cutworms are numerous and can cause severe defoliation to lawns during the fall and winter.

Photo: Brian McDonald, © Oregon State University.

Figure 6. Evidence of a feeding wave by winter cutworm in a forage pasture near Scottsburg, OR. Grass blades were severely clipped compared to unaffected areas (inset).

Photos: Daniel Sullivan, © Oregon State University.

larvae per square foot. Specific guidelines for winter cutworm have not been developed.

Vineyards: Winter cutworm damage was detected between rows, on cover crops, and in grassy or weedy areas adjacent to vineyards (Figure 7). Other climbing cutworms (*Xestia c-nigrum, Euxoa ochrogaster, Abagrotis orbis*) can damage emerging shoots (at bud break), but winter cutworm feeding on buds has not yet been confirmed in Oregon. A recent survey of Washington vineyards found *Noctua pronuba* feeding only on weeds but found a related species, *N. comes*, feeding on vines at night.

To monitor for cutworm damage in vineyards, randomly select 20 locations and check three vines within each location for buds damaged by overwintering cutworms. Night scouting is more efficient. For general cutworm damage at bud swell, treatment is justified when 10 to 15 percent of buds are damaged.

Home landscape: Adult moths can be seen at night around lights in urban areas. They may lay egg masses on nonvegetative structures such as fenceposts and plastic siding. When eggs hatch, the larvae disperse en masse, often aggregating near entryways (Figure 8), which can cause panic for homeowners. Surfaces can become slippery when cutworms perish on sidewalks and driveways. There is potential risk of damage to vegetable and flower gardens, ornamentals, and lawns. Reports from other regions mention that pets can have gastric upset from ingesting winter cutworm larvae, and one report of pet illness has been confirmed in Oregon so far.

Figure 7. *N. pronuba* larvae are deemed winter cutworms because they continue feeding late into the fall and winter. Here, damage has occurred to headlands in a vineyard during the dormant season, and the cutworms have continued to advance into the nearby grass.

Photo: Brian McDonald, © Oregon State University.

Figure 8. In residential areas, winter cutworm larvae can gather around entryways and protected areas. In addition to being a nuisance and potential threat to lawns and landscape plants, masses of larvae can cause homeowners to become alarmed.

Photos: Brian McDonald, © Oregon State University.

Management tactics

Correct pest identification is important when selecting the appropriate management method. Pest behavior, seasonality, and susceptibility to control tactics can vary widely between species. Please refer to the identification section of this document or contact a county Extension educator if you are not sure the damage is being caused by winter cutworm.

Following an integrated pest management (IPM) plan that combines cultural, biological, and chemical strategies is likely the best approach. Options will vary depending on the scenario. Also, because this is the first recorded occurrence of crop damage by winter cutworm in this region, it is not certain how effective control tactics will be.

Cultural practices

Following standard cultural control methods to reduce insect pest pressure in general also may reduce the potential for damage by winter cutworm. In cropping systems, recommended strategies include rotating crops, removing weeds and plant residue along field edges to reduce egg-laying and feeding sites, and tilling before planting to expose overwintering larvae and pupae and potentially reduce populations. In lawns, mowing regularly, irrigating in the summer, and applying enough fertilizer to maintain good density is recommended.

Biological agents

Armyworm and cutworm larvae populations are typically kept below a damaging level by natural control agents such as parasitic wasps, flies, and nematodes, bacterial and viral diseases, and general predators (ground beetles, birds, and rodents). Predation and parasitism of winter cutworm in Oregon has been documented in field collections from a volunteer rye field (Figure 9). Yet, at this point, the widespread impact of biological control on winter cutworm by beneficial organisms in the Pacific Northwest is unclear.

Figure 9. Noctuid moth larvae populations are often kept below damaging levels by natural enemies, including vertebrate predators as well as beneficial, predatory insects. The cutworm seen here is infested with a parasitoid wasp. The wasp is completing development on the larvae, evidenced by the white cocoons.

Photo: Amy Dreves, © Oregon State University.

Insecticides

Currently registered insecticides that effectively control cutworms and armyworms in different crops can be found by searching the *Pacific Northwest Insect Management Handbook* (http://insect.pnwhandbooks.org/). This resource is updated annually and should be considered the primary source for the most up-to-date insecticide recommendations. For convenience, we have distilled information about commonly used products for cutworm and armyworm control in crops that may be affected by winter cutworm (Table 3, pages 8–12). Please note that there is limited information available about the efficacy of products against winter cutworm specifically. **Always consult the pesticide label and remember that a product may only be used if (and only if) the crop or site is specified on the label.**

The following points are important to remember when implementing a chemical control strategy:

- In general, small, younger larvae (shorter than 1 inch) are more susceptible to insecticides than larger, mature ones.
- Fall rains may help incorporate insecticides into the soil where larvae are feeding, but too much rain may carry insecticides below the target pest.
- Consider using "reduced risk" insecticides rather than broad-spectrum products in order to lessen the effects on natural enemies and pollinators.
- Rotating among products with different modes-of-action (MOA) may yield better results and reduces risk of development resistance.
- If possible, apply insecticides late in the day to maximize exposure to night-feeding larvae.
- Pesticides may require repeat application, specific modes of incorporation, and other specifics that can be learned only by reading the product label. **ALWAYS READ THE LABEL.**

For more information

Large yellow underwing; a new cutworm in Idaho (CIS 1172). Bechinski, E., L. Smith, and F. Merickel. 2009. http://www.cals.uidaho.edu/edcomm/detail.asp?IDnum=1554

Noctua pronuba *(Lepidoptera: Noctuidae): an outbreak in emails.* Difonzo, C. and H. Russell. 2010. *Journal of Integrated Pest Management* 1(1): B1-B6. http://jipm.oxfordjournals.org/content/1/1/B1

Noctua pronuba reaches the Pacific Coast. Powell, J. A. 2002. *News of the Lepidopterist's Society.* Vol. 44 (4): 120. http://images.peabody.yale.edu/lepsoc/nls/

Pacific Northwest Insect Management Handbook. Hollingsworth, C. S., ed. 2015. http://insect.pnwhandbooks.org

Pacific Northwest Moths. Crabo, L., Zack, R., and M. Peterson. 2015. http://www.pnwmoths.biol.wwu.edu

Table 3. Chemical control strategies for general management of cutworms and armyworms[1]. This table lists insecticides by crop group and indicates products approved for use in the state of Oregon[2] as of 2015. The information comes from the *Pacific Northwest Insect Management Handbook* (http://insect.pnwhandbooks.org). Always refer to the latest version of the handbook to get the most up-to-date information. Restricted-use pesticides must be purchased and applied by a licensed pesticide applicator. **Always consult the pesticide label to determine if a product is registered for use on your crop or site.**

Crops	Active ingredient	Product name (example)	MoA group[3]	Notes[4]
Grass seed	lambda-cyhalothrin	Warrior	3A	**Restricted-use pesticide.**
(annual and perennial—see notes)	zeta-cypermethrin	Mustang	3A	**Restricted-use pesticide.** Do not make applications less than 7 days apart.
	cyfluthrin	Baythroid XL	3A	Only effective against small larvae.
	bifenthrin	Brigade	3	**Restricted-use pesticide.** Consult label for PHIs and grazing restrictions.
	carbaryl	Sevin	1A	---
	chlorpyrifos	Lorsban	1B	For use on perennial grass seed only. **24c Special local needs (SLN) labels OR-090009** (no more than 3 applications per year); **WA-090010 and ID-090003** (can be used only in first year of establishment).
	spinosad	Blackhawk, Success	5	---
Leguminous, forage, and seed crops *(alfalfa, clover, vetch)*	chlorantraniliprole	Coragen	28	Alfalfa grown for seed only. Do not make more then one application per cutting. Relatively safe to beneficial insects, but consult label regarding bloom periods. Toxic to fish and aquatic invertebrates, use caution to avoid drift or runoff to neighboring waterways.
	lambda-cyhalothrin	Warrior	3A	**Restricted-use pesticide.** Do not apply while bees are active. Advisable to move bee shelters for 2 to 3 days after application.
	zeta-cypermethrin	Mustang	3A	**Restricted-use pesticide.** For use on alfalfa grown for seed and vetch grown for seed only. Do not make applications less than 7 days apart. Consult label for grazing PHIs.
	permethrin	Cutworm Bait	3A	**Restricted-use pesticide.** For use on alfalfa grown for seed only. Do not apply more than 40 lb of product per acre per cutting. Avoid application when bees are foraging. Do not apply to mixed stands.
	carbaryl	Sevin	1A	For forages only (not seed crops). May cause temporary bleaching of young alfalfa. Most effective against cutworms that feed on upper portions of the plant.
	azadirachtin	Azera	UN	For forages only (not seed crops). Use higher rates on mature larvae.

	bifenthrin	Brigade	3	**Restricted-use pesticide. 24c Special local needs (SLN) labels OR-070013 and WA-070015.** Alfalfa seed and clover seed only. Do not graze after application. Do not feed treated hay. Processed seed must be labeled.
	bifenthrin	Discipline	3	**Restricted-use pesticide. 24c Special local needs (SLN) labels OR-040039 and WA-040027.** Alfalfa seed and clover seed only. Do not graze after application nor feed treated hay. Seed must be labeled before sale and distribution.
	chlorpyrifos	Lorsban	1B	Forage alfalfa is listed, but **24c special local needs (SLN) label OR-090010** is for clover seed only. Do not graze after application. Do not feed treated hay. Seed must be labeled before sale and distribution. Highly toxic to bees; do not apply if bees are foraging.
	Bacillus thuringiensis (Bt) ssp. kurstaki or aizawai	various products	11A	Most effective on small larvae. Thorough coverage of foliage is important. Ineffective if larvae do not eat plant tissue treated with Bt. Repeat applications may be necessary. A spreader-sticker (adjuvant) may improve performance.
	spinosad	Success, Entrust		**Supplemental label** specifies "Legume forages and legume forage grown for seed." Some formulations are approved for organic use (e.g. Entrust).
Brassica and radish crops	carbaryl	Sevin	1A	For brassica leafy vegetables. Sevin 5 Bait may be used on radish and turnip. Canola not listed.
(crucifer vegetables, radish, canola)	methomyl	Lannate LV or SP	1A	**Restricted-use pesticide.** Add a wetting agent to improve coverage. Pre-harvest intervals (PHIs) range from 1 to 3 days, consult label.
	esfenvalerate	Asana XL	3	**Restricted-use pesticide.** For broccoli, Brussels sprouts, cabbage, cauliflower. Pre-harvest intervals (PHIs) range from 3 to 7 days, consult label.
	bifenthrin	Sniper, Bridage 2EC, Capture LFR	3	**Restricted-use pesticide.** Do not make applications less than 14 days apart.
	azadirachtin	Azaguard	UN	Botanical insecticide. Most effective against small larvae. Repeat application every 5 to 7 days (nonfood crop) or 7 to 10 days (food crop).
	indoxacarb	Avaunt	22	Do not apply more than 14 oz of product per acre per season. Add a wetting agent to improve coverage.
	permethrin	Cutworm Bait	3A	**Restricted-use pesticide.** Approved for use on many brassica vegetable crops, but not on radish or canola. May be used on turnips in WA only. Toxic to bees, fish, and aquatic invertebrates. Avoid application when bees are foraging.
	tebufenozide	Confirm	18	Not labeled for radish. Equally effective on all stages of larvae, assuming thorough coverage and higher rates. Re-application every 10 to 14 days will be necessary. Potential groundwater contaminant.

	chlorantraniliprole	Coragen	28	Broad-spectrum diamide. Relatively safe to beneficial insects, but consult label regarding bloom periods. Toxic to fish and aquatic invertebrates, use caution to avoid drift or runoff to neighboring waterways.
	Bacillus thuringiensis (Bt) ssp. kurstaki or aizawai	Dipel, Javelin, Attack, Thuricide, Certan	11A	Only effective on small larvae (less than 0.5" long). Thorough coverage of foliage is important. Sunlight inactivates Bt on foliage, so make applications in the evening if possible. Repeat applications may be necessary.
	lambda-cyhalothrin	Warrior	3A	**Restricted-use pesticide.** Do not apply while bees are active.
	zeta-cypermethrin	Mustang	3A	**Restricted-use pesticide.** Do not make applications less than 7 days apart. PHIs vary by crop, consult label.
Small grains *(wheat, barley, oat, rye, triticale)*	methomyl	Lannate SP	1A	**Restricted-use pesticide.** May be used on barley, rye, oats, and wheat. Do not graze within 10 days. Do not apply more than 1.8 lb ai per acre per crop. Highly toxic to bees.
	chlorpyrifos	Lorsban	1B	**Restricted-use pesticide.** Wheat only. Expect suppression only if high infestations or mature larvae. Consult label for grazing and straw PHIs. Do not make more than 2 applications per season.
	Bacillus thuringiensis (Bt) ssp. kurstaki or aizawai	Dipel, Javelin, Attack, Thuricide, Certan	11A	Only effective on small larvae (less than 0.5" long). Thorough coverage of foliage is important. Repeat applications may be necessary.
	cyfluthrin	Baythroid XL, Tombstone	3A	Tombstone is for wheat only; Baythroid XL can be used on all cereal grains.
	alpha-cypermethrin	Fastac	3A	Wheat and triticale only.
	zeta-cypermethrin	Mustang	3A	**Restricted-use pesticide.** 14-day PHI for grain, straw, and hay. Do not make applications less than 14 days apart.
	lambda-cyhalothrin	Warrior	3A	**Restricted-use pesticide.** Livestock grazing PHI is 7 days. Treated straw PHI is 30 days.
	azadiractin	Aza-Direct	UN	Botanical insecticide. Most effective against small larvae.
Vineyards *(barrier and foliar—see notes)*	bifenthrin	Talstar, Onyx	3	**Restricted-use pesticide.** Barrier use only (wires, trunks, posts); minimize contact to foliage.
	fenpropathrin	Danitol	3	**Restricted-use pesticide.** Apply as a barrier spray before cutworms start moving from the soil to feed on buds and shoots during the dormant period.
	chlorpyrifos	Lorsban	1B	Washington and Idaho only. **24c Special local needs (SLN) labels WA-090002 and ID-090004.** Apply product as a banded application to the base of vines for cutworm control. Do not apply after bloom. PHI is 35 days.
	fenpropathrin	Danitol	3	**Restricted-use pesticide. Supplemental label** specifies it may be used as as a foliar spray in WA only (21-day PHI). Consult label for more details.

	carbaryl	Sevin	1A	Most effective against climbing cutworms. Do not concentrate on the bunch or visible residues may result. If weeds or cover crop between rows are blooming, mow before application to limit effect on bees.
	spinoteram	Delegate	5	Suppression of mature larvae may require repeat applications. Do not make more than 2 consecutive applications of spinosad or spinoteram.
	spinosad	Success, Entrust	5	Suppression of mature larvae may require repeat applications. Do not make more than 2 consecutive applications of spinosad or spinoteram. Some formulations are approved for organic use (e.g. Entrust).
Turfgrass *(commercial)*	bifenthrin	Talstar, Onyx	3	**Restricted-use pesticide.** Not for use on sod farms or in commercial seed production. Very toxic to fish and aquatic invertebrates. Do not allow drift or runoff into neighboring waterways.
	bifenthrin	Capture LFR	3	**Restricted-use pesticide.** May be used on sod; delay irrigation or mowing for 24 hrs after application.
	spinosad	Conserve SC	5	Delay watering or mowing of treated area for 12 to 48 hrs after treatment. Do not reapply within less than 7 days.
	Bacillus thuringiensis (Bt) ssp. kurstaki or aizawai	Deliver, others	11A	Apply to early instar larvae. Repeat application may be necessary. Breaks down rapidly in sunlight and washes readily off leaves. Do not irrigate for 2 days after treatment.
	carbaryl	Sevin	1A	---
	azadirachtin	Azatrol, Neemix, Azaguard	UN	Most effective on young larvae. Can be used on both warm- and cool-season grasses. Irrigate well before applying. A crop oil concentrate will help the spray to penetrate turf.
	beta-cyfluthrin	Tempo	3A	---
	carbaryl	Sevin	1A	Will persist in the application area for up to several weeks. Should not be applied to blooming plants or to lawns containing clovers or other flowering plants since it is highly toxic to bees and other pollinators.
	chlorantraniliprole	Acelepryn	28	Broad-spectrum insecticide in the diamide class. Notably safe on terrestrial, beneficial predatory insects but hazardous to aquatic invertebrates, including oysters and shrimp. Not for use on turf grown for seed production.
	cyantraniliprole	Ference	28	Broad-spectrum insecticide in the diamide class. Spray drift and residues are toxic to bees; avoid use if bees are foraging. Hazardous to aquatic invertebrates and classified as a high-risk water contaminant. Consult label for groundwater advisories. Not for use on turf grown for seed production.
	indoxacarb	Provaunt	22A	Can be used near waterways and around vegetative ornamentals.

Home lawn				
	azadirachtin	BioNeem	UN	A botanical pesticide extracted from the seeds of the neem tree. Used to control cutworms, armyworms, and the larvae of lawn moths. Noticeable efficacy may take many days. Best results with repeat applications. Approved for organic use.
	spinosad	Green Light with spinosad	5	Naturally based insecticide derived from soil microorganisms. Approved for organic use, but does have broad-spectrum activity, and therefore may harm bees and other beneficial insects.
	carbaryl	Sevin	1A	Will persist in the application area for up to several weeks. Should not be applied to blooming plants or to lawns containing flowering clovers or other flowering plants since it is highly toxic to bees and other pollinators.
	chlorantraniliprole	GrubEx1	28	Broad-spectrum control product from the diamide class of insecticides. Meant to be applied once per season; consult label. A potential water contaminant; use caution near waterways.
	Bacillus thuringiensis (Bt) ssp. kurstaki or aizawai	Safer's caterpillar killer, many others	11A	Specific to larvae, but only works on young or small larvae. Thorough coverage of foliage is important. Sunlight inactivates Bt on foliage, so make applications in the evening if possible. Repeat applications may be necessary. Approved for organic use.

[1] This list does not intend to promote or discriminate between products, and does not list all available formulations for each active ingredient.

[2] As of March 2015. For updated information consult the *Pacific Northwest Insect Management Handbook* and the Pesticide Information Center Online (PICOL).

[3] Mode of action (MOA)—IRAC classification as of May 2015 http://www.irac-online.org/

Rotate chemicals with a different MOA group number and do not use products with the same MOA group number more than twice per season to help prevent the development of resistance. (UN = uncertain MOA)

[4] Restricted-use pesticides are available only to currently licensed pesticide applicators. For more info see http://www.oregon.gov/oda/programs/Pesticides/Licensing/Pages/PesticideLicensing.aspx

ALWAYS CONSULT THE LABEL FOR ACCEPTABLE USE, RATES, AND HAZARDS

The authors would like to gratefully acknowledge the Oregon State Arthropod Collection staff (C. Marshall, P. Hammond, and D. Ross) for assistance with identification, photography, and ecological accounts of *N. pronuba* and related species. Input from OSU Extension faculty C. Sullivan, N. Anderson, and S. Filley was instrumental in preparing this publication. S. Angima, B. Braunworth, J. Noller, and L. Brewer provided editorial and administrative support.

Use pesticides safely!

- Wear protective clothing and safety devices as recommended on the label. Bathe or shower after each use.
- Read the pesticide label—even if you've used the pesticide before. Follow closely the instructions on the label (and any other directions you have).
- Be cautious when you apply pesticides. Know your legal responsibility as a pesticide applicator. You may be liable for injury or damage resulting from pesticide use.

Trade-name products and services are mentioned as illustrations only. This does not mean that the Oregon State University Extension Service either endorses these products and services or intends to discriminate against products and services not mentioned.

© 2016 Oregon State University. This publication was produced and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. Extension work is a cooperative program of Oregon State University, the U.S. Department of Agriculture, and Oregon counties. Oregon State University Extension Service offers educational programs, activities, and materials without discrimination based on age, color, disability, familial or parental status, gender identity or expression, genetic information, marital status, national origin, political beliefs, race, religion, reprisal, sex, sexual orientation, veteran's status, or because all or a part of an individual's income is derived from any public assistance program. Oregon State University Extension Service is an AA/EOE/Veterans/Disabled.

Published February 2016