

# Common Natural Enemies

of Nursery Crops and Garden Pests  
in the Pacific Northwest



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## Using this guide

This guide is designed to help you quickly learn and identify the most common natural enemies found in nursery systems.

Each card provides the name of a natural enemy or a group of natural enemies, as well as identification information, target pests and monitoring suggestions. Use this field guide to supplement other publications that can provide more complete information.

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**FOR HOME PRINTERS:** Print on regular paper or cardstock. Fold on the center horizontal line and then cut on the dotted lines to create three double-sided cards per sheet. Laminate if desired.

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## Using natural enemies for biological control



Find out which natural enemies already exist, and monitor their numbers to determine the ratio of natural enemies to pests.

These tactics can enhance biological control as a part of an integrated pest management plan:

- **Provide supplementary habitat** and food sources for natural enemies, especially for the growth stages in which the organisms do not feed on pest insects.
- **Manipulate the behaviors** of natural enemies with attractants, or by structuring and arranging plants.
- **Boost numbers** by releasing commercially available or lab-reared natural enemies, when available.
- **Introduce natural enemies** that are absent in the system, but present in the natural areas nearby.
- **Use complementary pest management techniques** to protect natural enemies from disturbance. These could include applying pesticides to fight predators and discouraging ants, among other management practices.

## General observation tips



When doing visual counts:

- **Inspect the underside of leaves.** Predators stay in areas where food is available and lay their eggs near pest insect food resources.
- **Approach fast-moving insects slowly.** Predators have to be fast and usually have good eyesight, and can be frightened off by large movements nearby.
- **Use nets, beat sheets and trays or traps to get a closer look.** It's a good idea to keep a few vials or containers with you in the field to capture and hold insects of interest for close examination.
- **Avoid using traps that capture and kill.** If natural enemies are present, killing traps may damage their populations in the nursery.
- **Make observations about behavior.** The best way to identify natural enemies is to observe them feeding on prey. Observe the insects interacting in the nursery. Or, collect and place pests and suspected predators together in an enclosed environment to see if the pest is attacked.

## Lady beetles

*Coccinellidae*

**Target pests:** Aphids, whiteflies, scales, mites and other small, soft-bodied insects. All life stages are predatory.

**Identification:** Adults and larvae are usually red and black patterned. Adults are round and smooth, while larvae are elongate and spiny in appearance. Eggs are oblong and yellow or orange, usually laid in clusters but also individually.

**Monitoring:** All stages can be found on plants where pests can be observed or searching for prey.

**Similar to:** Chrysomelid beetles (pests)



*Adalia bipunctata*:  
Two-spotted lady beetle



The life cycle of *Hippodamia convergens*, clockwise from top left: adult, pupae, eggs and larvae



Cucumber beetle, a *Chrysomelid* similar in appearance to lady beetle

## Ground beetles

*Carabidae*

**Target pests:** soil arthropods, some seeds

**Identification:** Adults are dark and metallic with textured wing covers (elytra). Larvae are grub-like, mobile and often have large jaws. There are many Pacific Northwest species; size varies from a few millimeters to 5 cm or more.

**Monitoring:** Adults are active at night. Look under flat objects such as rocks and wood. Use dry pitfall traps to capture night-active beetles. Larvae are found in soil samples. Adults and larvae are typically found in areas where organic debris accumulates. Can be encouraged with improved habitat, such as beetle banks.



*Scaphinotus marginatus* larvae



*Pterostichus melanarius*



*Carabus nemoralis*.  
Photo: Udo Schmidt



*Podabrus prunosus*, *Cantharidae* larvae and *Lampyridae* beetle. (Photo at right by Gary Griswold)

## Soldier beetles *Cantharidae*

**Target pests:** generalist predator on small insects

**Identification:** Adults are long and slender, and black or dark brown with orange/red markings. The antennae are long, and when the wings are open, the orange/red abdomen can be seen. Wings are soft, and this insect is often referred to as a “leatherwing”. Adults are 1-2 inches in total length. They can be found where pests aggregate, especially aphid colonies.

Larvae are dark, long-bodied and flat, often found feeding in the leaf litter layers on the eggs and larvae of other insects.

**Similar to:** Lampyridae beetles, or “fireflies”: The head of a soldier beetle can be clearly seen from above, while the firefly head is tucked under the thoracic shield (above right).

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## Rove beetles

*Staphylinidae*

**Target pests:** small soil organisms

**Identification:** Adults are long and slender. Wings appear as small scales on the top of the insect. Adults may raise jaws and tail in a defensive posture when disturbed. Some species are as small as 4mm, but others can range up to 3 cm. Larvae are similar in appearance and behavior, but do not have wings or elytra.

**Monitoring:** Adults are mostly active at night; look for fast-running adults and larvae under objects on the soil surface or in soil samples. Dry pitfall traps can also be used.

**Similar to:** earwigs (*Dermaptera*).



Devil's horse coach beetle, *Ocyopus olens*



*Paederus* sp. Common earwig, *Forficula*

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## Green/brown lacewings

*Chrysopidae*, *Hemerobiidae*

**Target pests:** aphids, mites, insect eggs, thrips, mealybugs, whiteflies and small caterpillars; larval stage is predatory.

**Identification:** Adults with long body delicate in appearance with large light green (*Chrysoperlidae*) or brown-colored (*Hemerobiidae*) wings appearing veiny. Long antennae and mouth-parts apparent. Larvae white, elongate and spiny, with large obvious mouth-parts. Eggs on long stalks, usually in clusters.

**Monitoring:** Eggs found on the underside of leaves and branches; larvae also found on plants near pest insects. Adults often seen flying near plants during the day, but are attracted to lights at night.



Adult *Chrysoperla*



Larval *Chrysoperla*

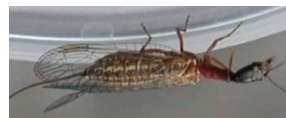


*Chrysoperla* eggs



Brown lacewing, *Micromus variegatus*

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Adult female *Agulla* snakefly. Photo: Robin Rosetta



Larval *Agulla* snakefly

## Snakefly *Raphidioptera: Raphidiidae*

**Target pests:** small insects, including eggs and larvae

**Identification:** Adults are elongate with four pairs of large net-veined wings and a kite-shaped head. They have a long prothorax, giving them the appearance of a “neck.” They are often dark in color, though lighter stripes may be visible on the abdomen. Females are easy to recognize by the very long ovipositor often mistaken for a “stinger.”

Larvae are also elongate, though the abdomen will appear lighter in color than the head. They appear similar to beetle grubs. Larvae are also predatory.

**Monitoring:** Larvae develop in the upper loose layers of soil and leaf litter; adults can be found in forested and shrub habitats.

## Assassin bugs

*Reduviidae*

**Target pests:** generalist predator on many insects

**Identification:** Adults have narrow heads, thin legs and wider abdomens. The edges of the abdomens are raised, with a checkerboard pattern. Most are nondescript brown, although many of the juveniles are brightly colored. Both juveniles and adults have piercing/sucking beaks used to feed on the fluids of prey.

**Monitoring:** Adults and juveniles can be found wherever prey insects are — on foliage of plants, grasses and shrubs. They are active ambush predators and move quickly.

**Similar to:** damsel bugs (page 12) and leaf-footed plant bugs



A variety of Assassin bugs at various life stages



Western conifer seed bug, a common Leaf-footed bug similar to Assassin bugs

## Damsel bugs

*Nabidae*

**Target pests:** generalist predator on many insects

**Identification:** Similar in appearance to assassin bugs (page 11). Body long and thin but with slightly enlarged forelegs for prey capture. Abdomen is no wider than wings when folded on the back of the bug.

**Monitoring:** An active predator, these bugs and the nymphs can often be found on the foliage of dense vegetation where prey are likely.

**Similar to:** many other “true” bugs.



*Nabis* sp. feeding on *Lygus* bug



Assassin bug, similar to a damsel bug



Stilt bug, similar to a damsel bug

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*Orius* sp. adult feedubg, left, and nymph feeding, right.

### Minute pirate bugs *Anthocoridae*

**Target pests:** generalist predator on small organisms

**Identification:** Small; adults between 2 and 4 mm. From above, black-and-white crossed pattern, oval in shape. Larvae are tear-drop shaped and yellow-orange to red.

**Monitoring:** Common, found on foliage and flowers especially where prey populations have been robust — thrips, aphids, spider mites and small caterpillars, and eggs. Easily monitored with sweep nets and beat sheets, but will bite. Bite is not venomous, but temporarily irritating.



Insects similar to minute pirate bugs include big-eyed nymphs, left, chinch bugs, center, and some plant bug nymphs, right.

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### Predatory wasps *Vespidae, Sphecidae*

*Vespidae, Sphecidae*

**Target pests:** generalist predator on many insects

**Identification:** Adults medium–large in size, hairless, with alternating patterns of black with white, yellow or red, with a narrow waist. Wings are clear to smoky with veins apparent.

**Monitoring:** Can be lured with protein baits and pheromone traps, or observed during the day in/around plants.

**Similar to:** bees (several species), hoverflies (family *Syrphidae*)



*Vespula* sp.



*Sceliphron caementarium*



*Dolichovespula*, bald-faced hornet



Sweat bee (*Halictidae*)

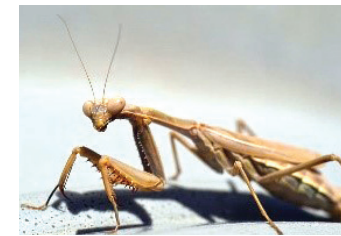


*Anthophora* bee



Hoverfly

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Adults are often longer than 2 in.



Mantid “ootheca,” or egg sac

### Praying mantis *Mantidae*

**Target pests:** generalist ambush predator

**Identification:** Large green or light brown insect with elongate pro-thoracic segment and enlarged forelegs, armed with spines for prey capture. Nymphs appear as smaller, wingless versions of adults.

**Monitoring:** Active during the daytime, mantids will seek shade when hot, and shelter from rain. They wait on plant tips for prey insects to pass, but are territorial (only one per plant). Mantids will remain as long as food is available. In the fall, search for eggs sacs — “ootheca” — attached to grass straw or sturdy structures found in and around hunting territory.

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*Geocoris* adult, left, and larvae, right, feeding

### Big-eyed bugs *Geocoridae*

**Target pests:** Lygus, aphids, leafhoppers, spider mites

**Identification:** Adults and nymphs appear similar to minute pirate bugs, but lack black-and-white pattern and are slightly larger. Fast moving on vegetation. Large, kidney-shaped eyes protrude on the sides of the head.

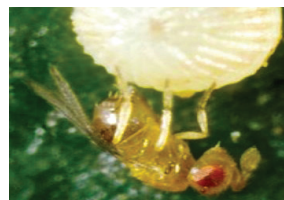
Nymphs appear as adults, but are smaller and wingless.

**Monitoring:** Can be captured with sweep nets and beat sheets, but are quick to fly away once disturbed.



Insects similar to big-eyed bugs include minute pirate bugs, left, chinch bugs, center, and some plant bug nymphs, right.

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*Trichogrammatid* wasp parasitizing an egg



*Ichneumon* wasp

### Parasitic wasps

**Target pests:** many insects, some generalist species and some host-specific

**Identification:** Variable. They resemble many other wasps, and may be very small (2mm in length), like the *Trichogrammatid* wasps, or quite large (2 cm), like the larger *Ichneumon* wasps. Some of the larger wasps are brightly colored, but many of the smaller wasps are dark and nondescript. In general, look for a long abdomen and a thin waist, with long antennae.

**Monitoring:** It is possible to observe adults searching for host insects during the day; however, some parasitoids (like the *Ichneumon* wasp) are active at night. *Ichneumon* is attracted to light and can be monitored with no-kill light traps. For many wasps, the best way to monitor is to search for parasitized prey (see page 22).

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*Eupeodes fumipennis*. Photo: J. Maughn, CC BY-NC 2.0



*Scaeva pyrastris* larvae. Photo: Sarah “Asher” Morris, CC BY-NC 2.0

### Predatory hoverflies *Syrphidae*

**Target pests:** Larvae are aphid and scale feeders; some species not predatory.

**Identification:** Adults mimic bees and wasps, but have characteristic “hover” flight pattern and rapid forward flight. Larvae are whitish-yellow or whitish-pink and oblong with obvious segmentation. Large eyes and aristate antennae are an easy way to distinguish them from bees, wasps and flies.

**Monitoring:** White, oblong eggs can be found among aphids in colonies, sometimes accompanied by tar-like feces. Adults can be seen hovering above or resting on flowers (not predatory).

**Similar to:** bee flies, bees and wasps

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## Tachinid flies

Tachinidae

**Target pests:** many beetles, caterpillars and other pests

**Identification:** Adults appear similar to house flies, but slightly larger with heavy bristles on the abdomen. Pupae are reddish-brown, opaque and oblong. Larvae can be found inside the host though not visible from the outside; however, white eggs are visible and deposited directly onto host insects.

**Monitoring:** Adults rest on flowers and foliage; pupal cases may be found near dense host populations.



*Gonia longipulvilli*



Pupal case and cocoon



Egg on caterpillar larvae



Insects similar to tachinid flies (from left): house flies, blow flies and flesh flies

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## Predatory midge larvae

Cecidomyiidae

**Target pests:** pest mites and aphids

**Identification:** Larvae are orange/red/brown and can be as long as 2mm. They forage for prey on the leaves of plants, and will feed for several days before pupating on the undersides of leaves or in the soil. The pupae are soft and whitish. It takes very little time (sometimes less than a week) for the adult to emerge. Adults appear as small mosquitoes, and can be similar in appearance to fungus gnats.

**Monitoring:** Check leaf surfaces for presence of larvae where pest populations occur.



*Feltiella*, a predator of mite pests



*Feltiella*, a predator of mite pests



Adult *Feltiella*



Insects appearing similar: adult mosquito, left, adult fungus gnat



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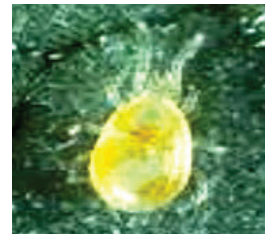
## Predatory mites

**Target pests:** thrips, aphids, pest mites

**Identification:** Adults are very small, less than 0.5mm, often requiring a hand lens to view. They are teardrop- or pear-shaped arachnids with no antennae or segmentation visible on the body. In general, predatory mites are more active than plant-feeding mite species and will move rapidly over foliage and across the soil surface.

**Monitoring:** Predatory mites are best identified by observing behavior. Eggs are easier to observe – they are ovate and clear, and are larger than pest mite eggs; they can be found laid as individuals on the underside of leaves where prey populations are found.

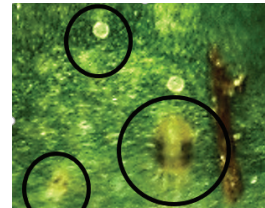
**Similar to:** pest mites



*Neoseiulus fallacis*



*Phytoseiulus persimilis* feeding on a spider mite pest



*Phytophagous* 2-spotted spider mite adult, juvenile and eggs

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## Identifying parasitized pests

Parasitized insects can be difficult to identify. The best method is to collect insects that look or behave unusually and keep them in a container until the parasitoid emerges.



Chalcid wasp parasitoid exit hole in host pupal case



Eulophid wasps parasitizing lepidoptera larvae



Bracnoid wasp parasitizing aphid hosts

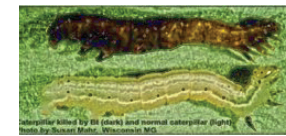


Aphidius (aphid wasp) host aphids, "mummies," with exit holes



Tachinid fly *Platyprepia* larvae emerging from lepidoptera pest

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Caterpillar killed by Bt (dark) and normal caterpillar (light)



Noninfected (top) vs. infected (bottom) fungal host insect.

## Identifying diseased pests

**Identification:** Insects are susceptible to viruses and bacteria, and some of these weapons have been harnessed for use in agriculture production systems. Individuals with infections are often dark in comparison to healthy individuals.

Insects can also be attacked by fungus present in soils naturally, as well as certain types of fungus that are commercially available to control pest populations. Insects infected with fungal pathogens often appear fuzzy as the reproductive stages of the fungus emerge from the insect skin.

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