

Beneficial Organisms Associated with Pacific Northwest Crops



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Insects have been associated with us throughout history. Most often they are thought of as pests of people or animals. Many insects can be helpful to us, however; we call these beneficial insects. People are familiar with honey bees and their important role in pollinating and the honey they produce. Silk and shellac are also insect products. In all agricultural crops, beneficial insects help man by feeding on pest insects. These beneficial insects are often not recognized and their role in pest insect suppression is seldom understood or appreciated.

Three major types of beneficial insects are present in Pacific Northwest field crops. The first and most familiar are pollinators such as honey bees, alkali bees, and alfalfa leafcutting bees. The two other types are called predators and parasitoids, and they play an important role in pest insect suppression.

Predators, or predatory insects, feed on many host insects during the growth of the individual predator. Examples of this type are ladybird beetles, lacewing larvae, and damsel bugs. Immature or adult predators of the same species generally feed on the same prey host. Parasitoid insects, or parasites, generally use only one prey host for the development of one or more individual parasites. Ex-

amples of this type would be wasps that parasitize aphids and flies that parasitize caterpillars or grasshoppers. The larval form feeds in or on the host while the adults feed mainly on pollen, nectar, or other food sources.

Predators and parasites help suppress insect populations in field crops. We need to be able to recognize them because control decisions can be influenced by the presence or absence of these insects. Beneficial insects may keep pest populations at levels low enough to preclude the use of artificial controls. Note, however, that even though these insects can control pest insect outbreaks, they may do so only after significant crop loss has already taken place. In all field crop situations where insect pests are to be sprayed, the beneficial insect population should be considered for its susceptibility to the available insecticides and for its role in limiting the pest population naturally. Beneficial insects generally are at least as susceptible to insecticides as the pest species.

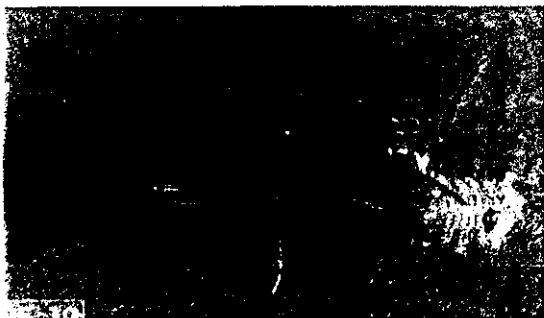
This publication will help identify the more common beneficial insects — as well as spiders, mites, and fungi — found in PNW field crops. The insects pictured are important in PNW agro-ecosystems and should be considered in all pest control decisions.

Predator Mites (Phytoseiidae)

Several species of predator mites feed on harmful plant-feeding mites. The most common beneficial mites include *Typhlodromus*, *Phytoseiulus*, and *Amblyseius* species. These tiny predator mites are usually smaller (about $\frac{1}{100}$ to $\frac{1}{50}$ inch long) than the plant-feeding mites, two-spotted mite, and European red mite upon which they feed. They are usually yellowish or clear in color and teardrop shaped. Beneficial mites overwinter as adult females on trees and in soil debris. They become active in April and May and begin to feed on available prey. Female mites consume about 70 to 80 prey during their 6-week lifetime. Ten or more generations can be produced per year.



Adult predatory mite feeding on two-spotted spider mite.



Collops beetle adult feeding on aphid weevil larvae.

Collops Beetles (Malachiidae)

Collops beetles are general predators that feed on corn leaf aphid, larvae of the alfalfa weevil, and green stink bug eggs. These beetles are probably the major predators of plant-feeding stink bugs in the West. They are $\frac{1}{4}$ inch long and usually orange underneath and metallic green or blue on the dorsal surfaces. Larvae are orange colored, up to $\frac{1}{2}$ inch long with two hooks on their rear segment. They live in the soil and are general predators.

Black Lady Beetle (Coccinellidae)

Small black lady beetle adults (*Stethorus* spp. and *Scymnus* spp.) are very small, from pinhead size to 1/10 inch. Both the adults and larvae feed on mites, small insects such as mealy bugs, scales, aphids, and insect eggs. The adults lay their eggs singly in prey colonies. The larvae are dark brown or nearly black and are clothed with hairs, which give them a velvety appearance. These small lady beetles have many generations each year and feed on their prey from early spring until late summer.



Mite-destroying black lady beetle adult.



Mite-destroying black lady beetle larva.

Convergent Lady Beetle (Coccinellidae)

One of the most common lady beetles is the convergent (*Hippodamia* spp.) lady beetle. It has a black body with converging white stripes and white margins on the pronotum. The elytra or hind wings are orange to red in color with 12 black spots. The convergent lady beetle is one of several lady beetles that look very similar and have comparable life cycles. The larva is a long, alligator-like, aggressive predator with a waxy orange and blue coloration. The adults migrate to mountain canyons or foothills to hibernate in late summer. They fly back to the valleys in the very early spring. Lady beetles feed primarily upon aphids, but they also will feed upon any small insect. The females lay their yellow eggs on plant foliage only after feeding on prey. The number of eggs she lays will depend upon the availability of prey.



Lady beetle adult feeding on aphid.



Lady beetle pupa feeding on aphid.



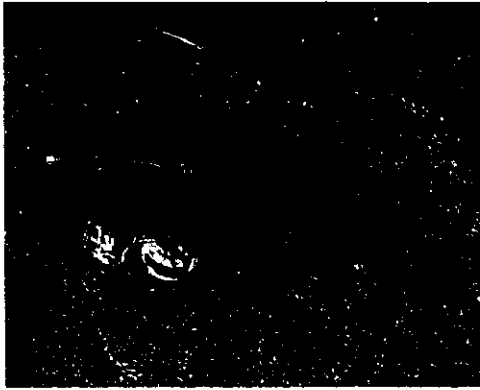
Ground beetle adult.

Predacious Ground Beetles (Carabidae)

Predacious ground beetles, or carabids, are large beetles (1/4 to 1 1/4 inch) and are usually black or dark metallic colors. Most species have the same characteristic shape. Larvae are elongate and wormlike but are fast moving and capture prey with large mandibles. Both larval and adult stages feed at night on a variety of insects such as cutworms and maggots. Some species also feed on snails and slugs. Adults are the wintering stage, and larval development takes about 1 year. Carabids can be found foraging in most PNW crops.

Minute Pirate Bug (Anthocoridae)

Adult pirate bugs (*Orius* spp.) are small ($\frac{1}{16}$ inch) black and white insects. The nymphs are orange to amber in color and are very active. These predators have the most rapid productive rate of any of the common predator insects. Development from egg to adult can be as short as 15 days. Both adults and nymphs of pirate bugs suck body fluids from their prey. Food generally consists of thrips (major prey source), small aphids, spider mites and various insect eggs. They winter in the adult stage and several generations occur each summer.



Minute pirate bug nymph feeding (left) and adult feeding in aphid (right).

Big-Eyed Bug (Lygaeidae)

These insects are characterized by their large kidney-shaped, reddish brown eyes. Big-eyed bug (*Geocoris* spp.) adults are $\frac{3}{16}$ inch in length and greyish or brownish. Nymphs are greyish with the same shape as the adults but are lighter in color with irregular patterns of spots on the top of the body. Several generations occur during the summer. They winter as adults. Big-eyed bugs feed on aphids as well as eggs, small nymphs and young larvae of several pest species. This insect can disperse rapidly during the summer and, therefore, can aid in suppressing sparse pest populations.



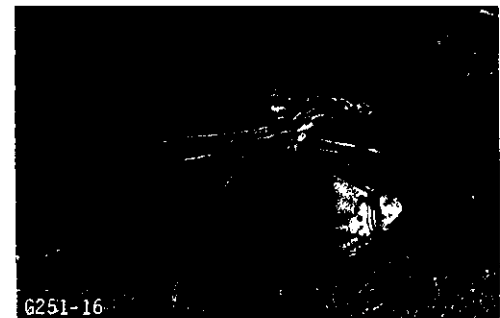
Big-eyed bug nymph feeding on aphid.



Big-eyed bug adult feeding on lygus nymph.

Damsel Bug (Nabidae)

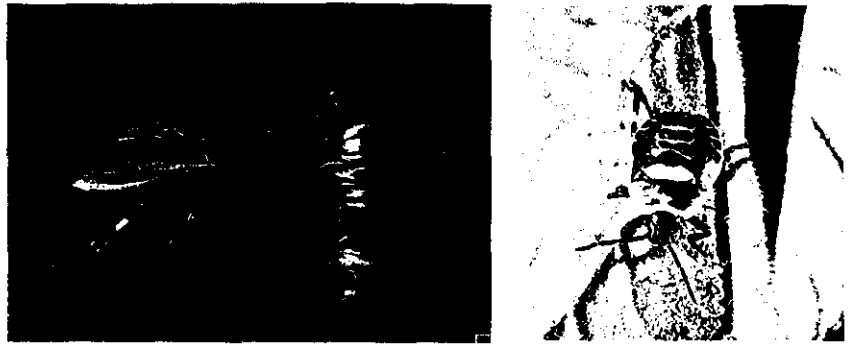
Damsel bugs (*Nabis* spp.) are slender, greyish or tan insects that are common predators in the Northwest. The adults are about $\frac{3}{8}$ inch in length. Damsel bugs lay their eggs in plant tissue. The nymphs hatch and feed with the adults by sucking the body contents from aphids and lygus bugs. Damsel bugs are also a general predator on many other species of insects. Usually three or four generations occur each year. Damsel bugs overwinter as adults in weeds, grain or alfalfa fields.



Damsel bug nymph (left) and adult (right) feeding on lygus bugs.

Two-Spotted Stink Bug (Pentatomidae)

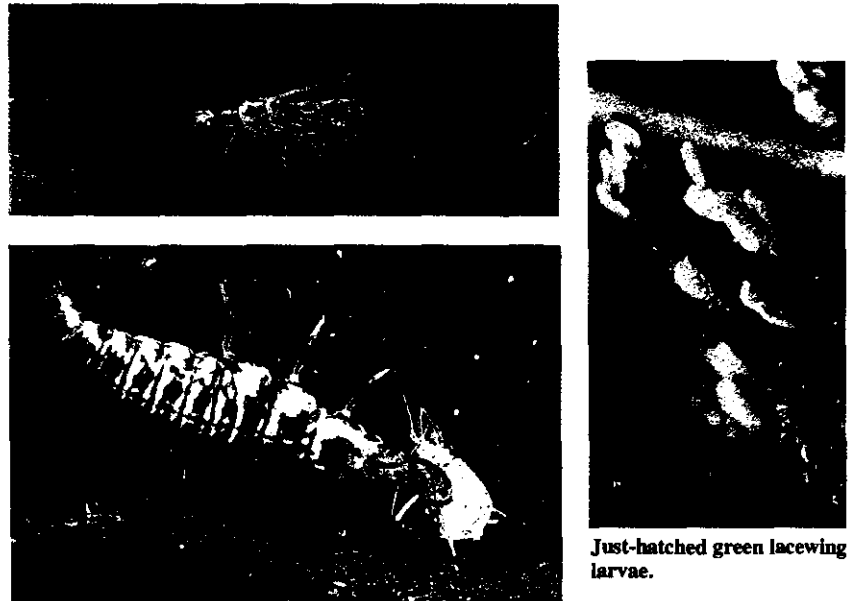
The two-spotted stink bug (*Perillus bioculatus*) is a rather colorful predatory bug. Typically, the adult is black with reddish markings on the back. Occasionally a yellow or black form is found. Nymphs and adults ($\frac{3}{8}$ inch) feed on caterpillars and beetle larvae, holding them in the air as they suck out the body fluids. They are important predators of Colorado potato beetle larvae. An individual bug may destroy 150 or 200 larvae in its lifetime.



Dark form of two-spotted stink bug feeding on Colorado potato beetle larva (left) and two-spotted stink bug nymph on leaf (right).

Green Lacewing (Chrysopidae)

Adult lacewings (*Chrysopa* spp.) are light green with two pairs of large membranous net-like wings. They are usually $\frac{1}{2}$ to $\frac{3}{4}$ inch long. Adults feed on aphid honeydew and plant fluids. The larvae reach $\frac{1}{2}$ inch long at maturity and resemble tiny light-brown alligators. They feed primarily on aphids, capturing them with their sickle-like mandibles. As many as 750 aphids may be consumed by each lacewing during its several-stage larval development. Several generations are produced each season.

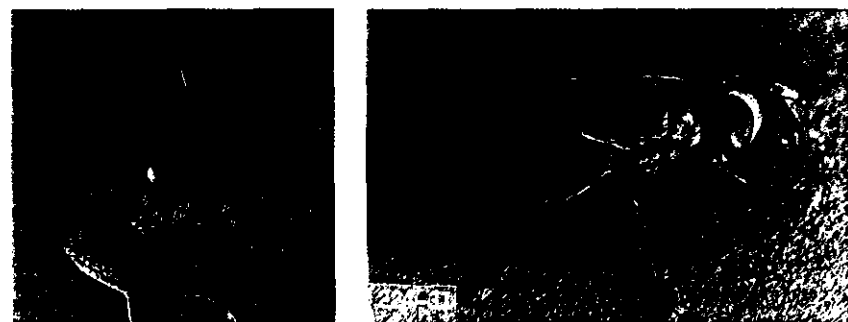


Green lacewing adult (above) and larva (below) feeding on aphid.

Just-hatched green lacewing larvae.

Tachinid Flies (Tachinidae)

Tachinid flies are a valuable group of insects whose larval stage parasitizes and kills other insects. Tachinids are large, bristly and bee-like or wasplike in appearance. Tachinid flies attack the larvae of butterflies and moths, beetles, sawflies and several other insect orders. Tachinids generally deposit their eggs directly on the body of their host. It is not unusual to see a caterpillar with several tachinid eggs attached to its body.



Parasitic tachinid fly egg on head of caterpillar (left) and adult (right).

Syrphid Flies, Flowerflies (Syrphidae)

These flies are generally brightly colored and closely resemble bees or wasps. The adults are often found hovering around flowers where they feed on nectar and honeydew from aphids and scale insects. The larvae are blind, slug-like in appearance, usually pale green to brown and characteristically tapered toward the head. The larvae are found throughout the growing season feeding on aphids or other soft-bodied insects. Black oily smears of excrement on plant foliage are typical signs of syrphid fly feeding. Many generations occur each year.



Syrphid fly adult (above) and syrphid fly larva (below) feeding on aphids.

Aphid Parasites (Braconidae)

Aphid wasps are small (less than 1/4 inch), solitary wasps that parasitize and kill aphids. Their life cycle is closely synchronized with that of their host. The adult female wasp deposits an egg inside an aphid host. The hatching wasp larva eventually kills its host by consuming its internal tissues and organs. The dead aphid "mummy" has a bloated appearance, is bronze or grey in color and is quite distinct from unparasitized aphids. Inside the aphid mummy, the mature wasp larva spins a cocoon in which to pupate, and emerges as an adult through a hole on the top part of the aphid. Numerous overlapping generations of wasps are produced each season. The wasps do not bite or sting humans.



Parasitized aphid host exit hole (above) and *Bathyplectes* alfalfa weevil parasitic weevil (below) laying eggs in cabbage aphid.

Bathyplectes (Ichneumonidae)

Bathyplectes is a parasitic wasp that attacks only the alfalfa weevil. This small wasp may parasitize up to 90 percent of a weevil population. The adult female starts laying her eggs in the weevil larvae when the larvae are about one-half grown. The parasitized weevil larvae finish their development and spin a cocoon. The wasp larva devours the weevil larva, then spins a typical hard brown, football-shaped cocoon with a white band around the middle. The early emerging wasps may have a second generation, but the later ones only have one generation each year.



Alfalfa weevil pupa in cocoons with *Bathyplectes* pupa (left) and *Bathyplectes* alfalfa weevil parasite adult (right).

Apanteles (Braconidae)

Apanteles are braconid wasps that are usually parasites of loopers and other large worms. The adult female seeks the host larva and inserts her eggs into the caterpillar. She may lay as many as 100 eggs in large worms. The parasites complete their development inside the worm. The mature larva then cuts a hole in the side of the host and spins a cocoon on the outside of the worm. Many generations occur each year.



Caterpillar parasitic wasp pupa (above) with immature hosts. Caterpillar parasitic wasp adult (below).

Crab Spiders (Thomisidae)

Several species of crab spiders may be found in PNW crops. They are important predators and contribute to the overall natural control of many pest insects. Crab spiders are general feeders, feeding on beneficial as well as harmful insects. These spiders do not spin a web in which to capture prey. Rather, they lie in wait on foliage and grab the prey insect as it moves closer. Crab spiders vary in size from $\frac{1}{8}$ inch to nearly $\frac{3}{4}$ inch long and in color from light brown to green. Some species exhibit camouflage or protective coloration.



Crab spider feeding.

Wolf Spiders (Lycosidae)

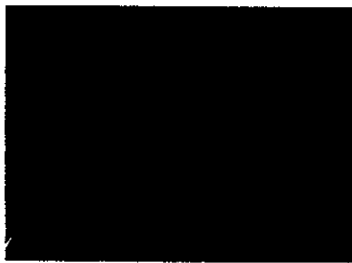
Wolf spiders are important predators of many insect pests. They are usually brown in color but variable in size ranging from $\frac{1}{4}$ inch to more than 1 inch in length. They are opportunistic or general feeders capturing harmful and beneficial insects alike. Wolf spiders are so named because of their hunting habits: they use their running speed to capture prey. They do not spin a web to capture prey but do spin webbing for their nest area. Some species carry the egg sac and eventually the young spiderlings on their back.



Wolf spider adult.

Bacteria and Viruses Affecting Caterpillars

When caterpillars consume insect-pathogenic bacteria they stop feeding, become lethargic, and die in place. Caterpillars killed by viruses either hang from leaves by their hind legs and dry, or they liquify on the leaf surface. Early symptoms of viral infection are lethargy and lighter-colored body contents.



Looper (left) and corn earworm (right) killed by virus diseases.

Fungi

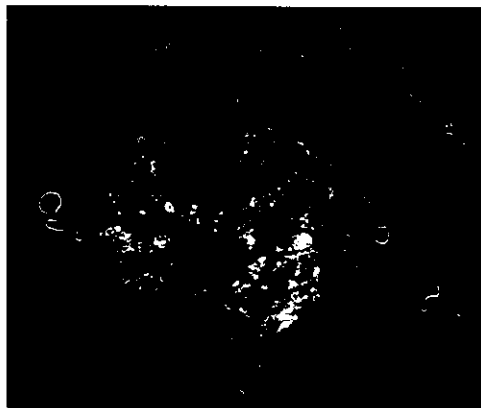
Insects are susceptible to attack by many naturally occurring diseases such as fungi, viruses, bacteria, and protozoa. Because aphids have sucking mouthparts, they are commonly attacked by fungal diseases. The germ tubes produced by fungal spores penetrate their host directly. Aphids killed by a fungal epidemic are easily recognized because they will be attached to a leaf and appear fuzzy or "moldy." Fungus epidemics are limited by moisture and temperature and generally do not occur unless relative humidity is greater than 90 percent. Currently, no commercially developed fungi are available for aphid control, but naturally occurring epidemics of fungi may be noticed in the field, and entire aphid populations may be killed. Some common fungi include *Beauveria*, which attack beetles, and *Entomophthora*, which attack flies and grasshoppers.



Russian wheat aphid killed by fungus.

Nematodes

Insect-parasitic (entomopathogenic) nematodes attack and kill insects, primarily those living in soil. The nematodes enter insects through natural body openings and release bacteria into the insect's body cavity. The bacteria kill the insects, and the nematodes then multiply by eating the insect cadavers and the bacteria. Insect-parasitic nematodes are available commercially.



Immature and mature nematodes in dead Japanese beetle grub.

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