






An Introduction to Natural Enemies for Biological Control of Pest Insects








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Biological control

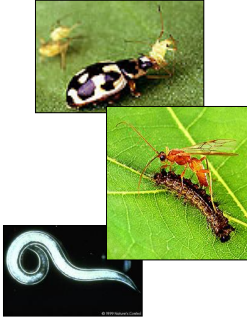
Use of natural enemies to keep unwanted pest populations low


















Natural enemies


- **Predators:** eat many prey in a lifetime, feeding both as young and as adults.
- **Parasitoids:** specialized insects that develop as a young in one host, eventually killing it.
- **Pathogens:** nematodes, viruses, bacteria, fungi, protozoans.

















| Lady beetles (Coccinellidae) | Predator |
|--|--|
| <ul style="list-style-type: none"> • Most adults and larvae feed on soft-bodied insects. These may be important in aphid population control. • Adults are rounded, and range in size from tiny to ¼ inch long. Color ranges from black to brightly colored. • Larvae are active and elongate with long legs, and look like tiny alligators. |  <p style="font-size: small;">Scott Bauer</p>  <p style="font-size: small;">Mary Gardiner</p> |

| Soldier beetles (Cantharidae) | Predator |
|---|--|
| <ul style="list-style-type: none"> • Adults feed on nectar and pollen and are often found at flowers. • Some adults eat aphids, insect eggs and larvae or feed on both flowers and insects. • Adults are elongate, with red, orange, or yellow and black patterns on head and abdomen. Adults are ¼ to ¾ inch long, with soft wing covers. • Larvae are dark, flattened and elongate. Larvae feed on eggs and larvae of beetles, butterflies, and moths in soil, leaf litter or under bark. |  <p style="font-size: small;">Susan Ellis</p> |

| Predaceous ground beetles (Carabidae) | Predator |
|---|--|
| <ul style="list-style-type: none"> • Most are predaceous on insects in and on the soil as adults and larvae. • Adults are most active at night, dark in color, with long legs. • Larvae are often in leaf litter or soil and are elongate. • Some feed on seeds and can reduce the number of weed seeds in agricultural systems. • Over 40,000 known species in the world. |  <p style="font-size: small;">Debbie Waters, Univ. of Georgia</p> |

Rove beetles (Staphylinidae)

Predator

- Most are predators and live in leaf litter as adults and larvae.
- Prey on small soft-bodied insects and insect eggs, larvae, and pupae.
- Adults brown or black with soft, short wing covers.
- Larvae are long and thin with a large head.
- About 3,100 species in North America.



Cedar Creek Natural History Area



Green lacewings (Chrysopidae)

Predator

- Adults have thin, green bodies and green wings with lacy veins; many are not predators.
- Larvae are predators, with long, curved mandibles that they use to suck the fluids out of prey.
- Larvae are about ¼ inch long, look like tiny alligators, and feed on most small soft-bodied insects. Eggs are laid on individual silken stalks.
- Common in agriculture, gardens and landscapes.



Egg

Larva



Adult



Syrphid flies, flower flies, hover flies (Syrphidae)

Predator

- Most adults eat pollen and nectar.
- Adults are black and yellow, often hover around flowers, and look like bees (but do not sting).
- Most larvae are predators on aphids and other soft-bodied insects.
- Larvae usually have an opaque skin with internal organs visible, and are usually green to dark brownish.
- About 1,000 species in North America.



Susan Ellis



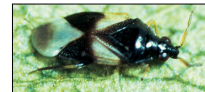
Minute pirate bugs (*Orius insidiosus*)

Predator

- This predator about ¼ inch long feeds on aphids, thrips, mites, psyllids, and insect eggs.
- The *insidiosus* species occurs in the Eastern United States, and another species, *tristicolor*, is common in the Western U.S. These insects are abundant in many habitats.
- Adults are oval, black with white markings and a triangular head. Nymphs are slightly pear-shaped and reddish brown or yellow.



Dept. of Entomology, Univ. of Nebraska-Lincoln



Damsel bugs (Nabidae)

Predator

- These bugs prey on aphids, leafhoppers, mites, caterpillars, and other insects.
- Often gray or dull brown, about ¼ inch long. Slender insects with an elongated head and long antennae.
- Nymphs sometimes look like ants.



Whitney Cranshaw



Stink bugs (Pentatomidae)

Predator

- Genus *Perillus* and *Podisus* are predators with forward pointing tubular mouthparts.
- Most other stink bugs are plant feeders.
- Shield-shaped, often brownish, usually less than ½ inch long.
- Nymphs are rounder than adults with underdeveloped wings.

Genus *Podisus*



Susan Ellis



**Long-legged flies
(Dolichopodidae)**

Predator

- Adults prey on small insects and are less than ¼ inch long, often metallic.
- They are abundant, especially near swamps, streams, in woodlands, and meadows.
- Larvae are found in varied habitats, including water, decaying wood, and grass stems. Little is known of their feeding habits but some are predators.



Susan Ellis



Dance flies (Empididae)

Predator

- Predators as larvae and adults.
- Larvae are pale and cylindrical, feed on varied prey in litter, soil, water, or under bark.
- Adults stalk small insects on bark or flowers. Adults have a large thorax and smaller abdomen, and often a beaklike mouth. Most are less than ¼ inch long.
- Over 700 species in North America.



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**Jumping spiders
(Salticidae)**

Predator

- Day active hunters in plants or on the ground.
- Do not make a web, but stalk and pounce on prey.
- Distinctive eye pattern with a front row of four eyes and two pairs behind the front row in a perpendicular line.
- About 300 species in North America.



Patricia Reynolds



Crab spiders (Thomisidae)

Predator

- Crab spiders stalk and capture insects resting on surfaces or walking. They do not spin webs.
- The front two pairs of legs are enlarged and extend to the side of their body, giving them a crablike appearance.
- Over 200 species in North America.



David Keith



**Hornets, paper wasps
(Vespidae Polistes)**

Predator

- Adults eat mainly caterpillars and feed their larvae beetles, flies, true bugs, and other wasps.
- Adults switch to feed on sugar in late summer.
- While some insects in this family are aggressive, native species in the genus *Polistes* are less likely to sting people.
- Adults are black and yellow and fold their wings lengthwise when at rest. Colonies do not overwinter in areas with cold winters, but may grow for several years in milder climates.



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**Braconid wasps
(Braconidae)**

Parasitoid

- Parasitize larvae of beetles, caterpillars, flies and sawflies.
- Adults usually are less than ½ inch long with a thin abdomen that is longer than the head and thorax combined.
- Over 1,000 named species worldwide.



Jim Kalisch and Tom Clark



Chalcid wasps (Chalcidoidea)

Parasitoid

- This group includes many families of wasps that have many hosts.
- Many parasitize aphids; some lay eggs inside of insect eggs.
- Other hosts include beetles, flies, moths, sawflies, mealybugs, and scales.
- These insects are very small, less than ¼ inch long.



Gerald J. Lenhard



Ichneumonid wasps (Ichneumonidae)

Parasitoid

- Ichneumonids attack specific insects, but some species of most types of insects are attacked by this family.
- Common hosts include beetles, caterpillars, and wasps.
- Adults are usually slender with a long ovipositor.
- Over 3,100 species in North America.



Gerald J. Lenhard



Bee flies (Bombyliidae)

Parasitoid

- Most are internal and external parasites of butterfly, moth, bee, and wasp larvae.
- Some attack larvae of beetles, flies, moths, or grasshopper eggs.
- Adults are short, very hairy, medium to large flies with long, thin mouthparts.
- About 3,000 known species.



Jeff Evans



Tachinid flies (Tachinidae)

Parasitoid

- Hosts include larvae of beetles, butterflies, and moths.
- Adults are often dark, thick-bodied hairy flies that look like houseflies but with stout bristles at the tip of their abdomen.



H. Gross



Acknowledgements

For more information: <http://ipm.msu.edu/plants/home.htm>

Natural Enemies Handbook: The Illustrated Guide to Biological Pest Control, Publication 3386, - University of California. Division of Agriculture and Natural Resources, by Mary Louise Flint, Steve H. Dreistadt, Jack Kelly Clark (Photographer), University of California Statewide Integrated Pest Management Program (Corporate Author).

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