

Biological Control in the Urban Environment: Part I

Predators



Green lacewing larva



Green lacewing adult



Lady beetle

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Using Biological Control to Maintain Natural Order

Biological control is using predators, parasites (parasitoids), and pathogens (diseases) to control pests. In the urban environment there is a multitude of beneficial insects, mites, and pathogens that prey on pests and, when not disrupted, will do a good job of keeping pests under control.

This system is usually disrupted when we overuse pesticides that kill the beneficials rather than the pests. Being able to recognize the beneficial agents that naturally occur in urban landscapes is necessary for taking advantage of biological control and maintaining natural order.

Biological control is using predators, parasites (parasitoids) and pathogens (diseases) to reduce pest populations.

Predators



Lady beetles

Adults: are small, round to oval, and dome-shaped; usually they are red to orange, or pale yellow with or without black markings, or black with red spots.

Eggs: are yellow and laid in clusters, usually on the underside of leaves.

Larvae: are dark, often with light markings, and alligator-like.

Host food: lady beetles are voracious feeders of aphids and can consume up to several hundred aphids per day; when aphids are scarce they will feed on mites, thrips, soft-scale insects, mealybugs, spider mites, insect eggs, and pollen and nectar.



Hover or Syrphid flies

Adults: bee-like, with yellow and black bands that ring the abdomen.

Eggs: white, sculptured and elongate; usually laid near aphid colonies.

Larvae: legless, slug-like maggots, often pale green in color

Host food: only the larvae are predaceous, feeding on aphids; adults are common around flowers, where they feed on nectar.



Ambush bugs

Adults: approximately 3/5 inch long and stout bodied; they are cryptic green, brown to black, with some species having red or orange markings along the body margins; they have raptorial (enlarged) front legs for capturing prey and powerful beaks used to impale prey and suck out the body fluids.

Egg: elongate orange eggs can be found in groups on top of foliage.

Nymphs: resemble adults but lack wings.

Host food: ambush bugs wait motionless on plants and grab passing bees, flies and wasps.



Assassin bugs

Adults: ¼-1½ inches long; blackish, reddish or brown with a long narrow head, round beady eyes, and needle-like beak.

Eggs: barrel shaped and laid upright in tight clusters or in rows on leaves or stems.

Nymphs (immature stage): resemble adults but lack wings.

Host food: adult and nymph assassin bugs attack moving prey; they feed on small caterpillars, aphids, and other small soft-bodied insects.



Damsel bugs

Adults: are ½ inch or less in size, slender, with an elongated head and long antennae; they range in color from mottled brown to black.

Eggs: white and cylindrical and inserted in soft plant tissue with the egg's end (cap) visible at the tissue surface.

Nymphs: look like small adults without wings.

Host food: nymphs and adults feed on insect eggs, numerous caterpillars, aphids, and plant bugs.



Bigeyed bug

Adults: have an oval body and a broad head and may be up to 1/4 inch long; they can be distinguished by their characteristic large, bulging eyes; they walk with a distinctive "waggle" and omit a foul odor when handled.

Eggs: hot dog-shaped and laid singly on leaves and stems of plants.

Nymphs: resemble small adults but without wings.

Host food: nymphs and adults feed on insects and seeds; a needle-like beak is used to suck juices from prey smaller than themselves, including mites, leafhoppers, aphids, and insect eggs.



Spiders

Adults: have two major body regions, lack antennae, and have eight legs.

Host food: they are generalist predators feeding on many pest insects; some spider species use webs to capture prey while other species stalk their prey.



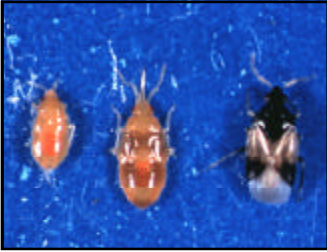
Aphid midge

Adults: are 1/8 inch mosquito-like flies.

Eggs: are orange in color and can be found upright on leaves where aphids are abundant.

Larvae: look like bright orange to red maggots with the body narrowing toward the head; they have strong "jaws" for grasping their prey; common during mid- to late summer.

Host food: over 60 species of aphids; a single larva will kill up to 80 individuals aphids.



Minute pirate bugs

Adults: approximately 1/8 inch long, oval-shaped, and black with white markings on their wings; they are abundant throughout North America.

Eggs: hidden in soft plant tissue.

Nymphs: are wingless, teardrop-shaped, and yellow-orange to brown in color.

Host food: both stages use a needle-like beak to suck the juices from their prey, including aphids, thrips, spider mites, insect eggs, and young caterpillars; they feed on pollen and plant juices when prey are not available.



Wasps (yellow jackets)

Adults: are 1/2 to 3/4 inch long with alternating yellow and black strips on the abdomen; they have a thin waist and transparent wings.

Eggs and Larvae: found in paper-like nests located in trees, shrubs, soil cavities, or under porches and eaves of buildings.

Host food: during the spring yellow jackets feed on caterpillars, flies, and beetle grubs; only during later summer to early fall do they become a nuisance when they began to seek out food people eat; freezing temperatures kill off the annual colonies and only the mated queen overwinters.



Predatory mites

Are not insects, but are more closely related to spiders.

Adults: have four pairs of legs and two major body regions; they are about the same size as pest spider mites, less than 1/32 inch long, are teardrop-shaped, long legged, and orange red, tan or brown.

Eggs: translucent, pearl-colored, and oblong; can be found on the underside or top of leaves.

Nymphs: resemble small adults.

Host food: adults and nymphs attack the adults, nymphs, and eggs of spider mites, immature thrips, and fungus gnat eggs and larvae.



Rove beetles

Adults: are small, about 1/8 inch long, and black to brown; they have shortened wing covers, leaving much of the abdomen exposed; adults run and fly rapidly and curl the tip of their abdomen when disturbed.

Egg: white, spherical to pear-shaped; found in the soil or decaying plant debris.

Larvae: are elongate and yellow to orange, with well developed legs; larvae commonly live in the soil.

Host food: adults and larvae feed on small, soft-bodied insects and insect eggs; they are important mite predators, and an individual beetle can consume about 10 to 20 mites per day.



Predaceous stink bugs

Adults: shield-shaped; about 3/4 inch long, and pale brown to tan in color; the spined soldier bug has prominent spurs on the "shoulders."

Eggs: barrel shaped and the upper surface may have spines; usually laid in small groups on the foliage.

Nymphs: are round in shape, red and black in color, and marked with red, black, yellow-orange, and cream bands and patches as they mature.

Host food: slow moving prey such as larvae of the Colorado potato beetle, European corn borer, diamondback moth, corn earworm, fall armyworm, cabbage looper and imported cabbageworm.



adult



eggs



larva

Lacewings

Adults: are pale green or brown fragile-looking insects with four lace-like wings; they are about 1 Inch long.

Eggs: are laid singly on top of a slender stalk attached to a plant.

Host food: only the larvae feed on soft bodied insects, chiefly aphids but also small caterpillars, insect eggs, and mites; green lacewings are most abundant later in the season.

Larvae: are elongate, flattened, mottled brown, alligator-like; their characteristic pincers are used to capture and suck body fluids from prey.



Ground beetles

Adults: range in size from 1/8 to 1 1/2 inches long, have flattened bodies, are black to iridescent blue or green and have characteristic prominent jaws.

Eggs: are laid singly in the soil.

Larvae: are worm-like and live in the soil.

Host food: adults and larvae feed on a wide variety of pests on or beneath the soil; some adult species climb plants in search of prey.

Arthropod Predators

in Urban Landscapes

Predators include birds, fish, amphibians, reptiles, small mammals, and arthropods. Arthropod predators of insect and mite pests are found in most urban habitats. They search for prey on plant structures above as well as below the ground.

Ambush bugs	Lady beetles
Aphid midge	Minute pirate bugs
Assassin bugs	Predaceous stink bugs
Bigeyed bug	Predatory mites
Damsel bugs	Rove beetles
Ground beetles	Spiders
Hover flies	Wasps
Lacewings	

Characteristics of predatory arthropods

- Conspicuous and usually larger than their prey.
- Males, females, immatures and adults may be predaceous.
- Consume many individual prey during their development.
- Usually generalists (attacking more than one host species).
- Attack immatures and adult prey.

Methods of Biological Control

Where natural occurring beneficials do not maintain pest populations below levels that cause losses, control can be increased by using classical biological control, conservation or augmentation, the three primary approaches to biological control.

Classical Biological Control:

The deliberate introduction and establishment of exotic natural enemies into areas where they did not previously occur to create the checks and balances found where the pests naturally occurred.

Classical Biological Control or

Importation: The need for importation biological control occurs when a pest is accidentally introduced into an area becomes established and develops to high numbers in the absence of its natural enemies that were left behind. An attempt is made to locate these enemies and introduce them to reestablish the control that often existed in the native range of the pest. This may be from another country or another region of the same country. When a natural enemy is successfully established, it usually continues to control the pest population with no additional help from humans and at no cost beyond the initial costs for collection, importation, and rearing.

Augmentation: Rearing and release of beneficials to supplement the numbers of naturally occurring natural enemies.

Inoculative: one time release of a large number of beneficial agents.

Inundative: Periodic releases of beneficial agents when pest populations approach damaging levels.

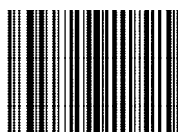
Augmentation: An attempt is made to reduce a pest's population to a non-damaging level by temporarily increasing natural enemy numbers in an area through periodic releases. A number of commercial companies rear a wide variety of natural enemies, including

predators, parasites, and pathogens. There are two approaches to augmentation, inoculative and inundative. In an inoculative release a large number of individuals are released only once during the production season, and the natural enemy is expected to reproduce and increase its population for that growing season. In inundative releases, the natural enemies are not expected to reproduce and increase in numbers. Control is achieved through the released individuals and additional releases are only made when the pest population approaches damaging levels.

Conservation: alter production practices to protect the natural enemies that are already present in an area.

Conservation: is probably the most important and readily accessible biological control practice available to home owners and gardeners, and it is generally simple and cost-effective. In conservation, an attempt is made to manipulate the environment or cultural practices to protect the natural enemies or provide needed resources (e.g. food for adults or alternate prey) for them to survive and build up populations to levels where they can manage insect pests and prevent them from causing damage to the desired plants in the urban landscape. There are several conservation approaches to increasing the number and diversity of beneficials in the urban environment, including: replacing the use of nonselective insecticides with products that are selective toward individual pests and less harmful toward natural enemies; providing flowering borders, hedges, and other perennial habitats as a source for food and shelter; ground covers or mulches that moderate temperatures within and around the vegetation, and provide hiding sites and alternative habitats for natural enemies; and the use of plants that are resistant or tolerant to insect pests.

For more information on this and other topics, see: www.ag.ndsu.nodak.edu



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