BIOLOGICAL CONTROL AGENTS OF INSECTS

Biological control refers to the use of natural enemies against a pest population to reduce the pest's density and damage to a level lower than would occur in their absence.

There are a number of predators, parasites and pathogens which impact insect pests in the region. It is useful to be able to recognize these biological agents and the benefits they provide. These agents of control can play a beneficial role in managing pest insects through conservation, augmentation and classical control.

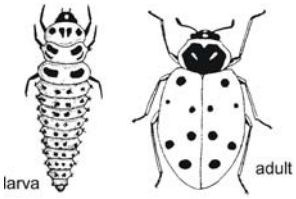
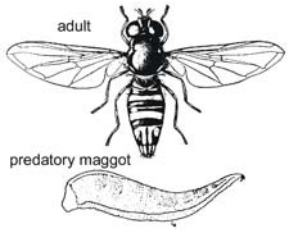
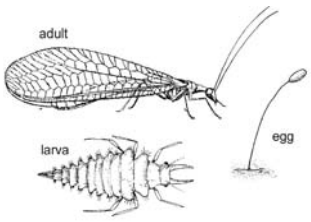
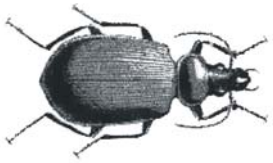
For more information on biological control of insect pests, NDSU has three recent publications available. Publications are full color for use as a field identification guide. They can be obtained by contacting the NDSU Extension Service Distribution Center at (701) 231-7883. Request copies of:

E-1225 Biological Control of Insect and Weed Pests in North Dakota Agriculture

E-1228 Biological Control in the Urban Environment: Predators

E-1229 Biological Control in the Urban Environment: Parasites and Pathogens

PREDATORS

Biological Control Agent	Description	Hosts Insect
	**Ladybird Beetles** Adults are usually red or orange with black markings. Larvae are alligator-like, dark colored, often with lighter markings. Eggs are yellow and laid in clusters on the underside of leaves.	Lady beetles can consume up to several hundred aphids per day. When aphids are scarce, they will feed on mites, thrips, other small insects, insect eggs, and pollen and nectar
	**Hover Flies (Syphrids)** The beelike adults have yellow and black bands that ring their abdomen. Larvae are legless, sluglike maggots, often pale green in color.	Only the larvae of the hover flies are predaceous, feeding on aphids. Adults are common around flowers where they feed on nectar.
	**Lacewing / Aphid Lion** The pale green or brown fragile-looking adults have four lacelike wings. The elongate, flattened, mottled brown, alligatorlike larvae (aphid lion) have characteristic pincerlike mouthparts. Eggs are laid singly on top of a slender stalk attached to a plant.	Lacewing larvae feed mainly on aphids, as well as small caterpillars, insect eggs and mites. Green lacewings are most abundant later in the season.
	**Ground Beetles** The black to iridescent blue or green adults are 1/8 to 1 ½ inches long, with flattened bodies, and characteristic prominent jaws.	Adults and larvae feed on a wide variety of pests on or beneath the soil. Some adult species climb plants in search of prey.

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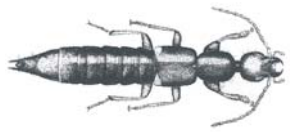
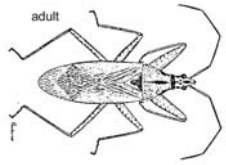
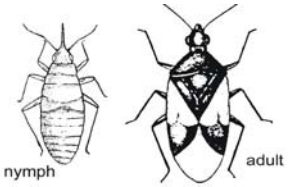
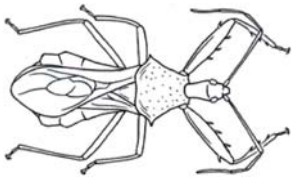
	**Rove Beetles** Adults are small, about 1/8 inch long, and black to brown. They have short wing covers, leaving much of the abdomen exposed. They will curl the tip of their abdomen when disturbed.	Rove beetles feed on small, soft-bodied insects and insect eggs. They are important mite predators, an individual can consume about 10 to 20 mites per day.
	**Damsel Bugs** The mottled brown to black adult is ½ inch or less in size, slender, with an elongated head and long antennae.	Damsel bugs will feed on insect eggs, numerous caterpillars, aphids and plant bugs.
	**Minute Pirate Bug** Adults are about 1/8 inch long, oval-shaped, and black with white markings on their wings.	Minute pirate bugs 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.
	**Two Spotted Stink Bug** The pale brown to tan in color adults are shield-shaped and about 3/4 inch long.	The two spotted stink bug attacks any slow moving prey such as larvae of the Colorado potato beetle and sunflower beetle, European corn borer or diamondback moth.
	**Assassin Bug** The adult ranges in size from 1/4 to 1½ inches. It is blackish, reddish or brown; with a long narrow head, round beady eyes; and an extended, needle-like beak. The nymph (immature stage) resembles the adult but lacks wings.	Adults and nymphs attack moving prey. They feed on small caterpillars, aphids and other small soft-bodied insects.
	**Ambush Bugs** The cryptic green, brown to black adults are about 3/5 inch long and stout bodied, with some species having red or orange markings along the body margins. They have enlarged front legs (raptorial) for capturing prey, and have powerful beaks used to impale prey and suck out the body fluids.	Ambush bugs wait motionless on plants and grab passing bees, flies and wasps.

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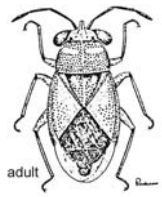
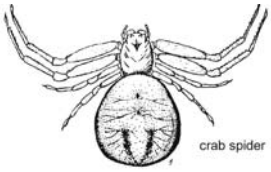
	**Bigeyed Bugs** Adults have oval bodies and broad heads and may be up to 1/4 inch long. Nymphs resemble small adults but without wings. They can be distinguished by their characteristic large, bulging eyes. They walk with a distinctive "waggle" and omit a foul odor when handled.	Bigeyed bugs feed on insects smaller than themselves, including mites, leafhoppers, aphids and insect eggs. They also feed on seeds.
	**Spiders, Harvest Man, Daddy longlegs** Adults are about ½ inch in size and have two major body sections, eight legs, and lack antennae. They have long, slender legs and short, globular bodies with the upper surface colored with a light gray or brown pattern and the lower surface is light cream.	Spiders are generalist predators, feeding on pest and non-pest insects.

PARASITES (PARASITOIDS)		
Egg Parasites	Egg parasites are some of the smallest of insects, usually about 1/50 to 1/16 inch in size.	Parasitic wasps attack the eggs of several crop insect pests, including the red sunflower weevil, sunflower beetle, sunflower stem weevil, European corn borer, orange wheat blossom midge and lygus bugs.
Larval Parasites	Larval parasites are slender with long segmented antennae, and a long needlelike ovipositor (egg-laying apparatus) projecting from the posterior of the abdomen. Some are stout bodied.	Several species of larval parasites attack the larvae of many crop insect pests, including the Bertha armyworm, diamondback moth, red sunflower weevil, banded sunflower moth, sunflower beetle, sunflower stem weevil, European corn borer, wheat stem sawfly, and armyworm.
Beetle parasites	These parasites are small insects (< 1/8 inch in length), and many have a brilliant metallic coloration.	Beetle parasitoids attack major crop pests, including sunflower beetles.
Aphid Parasitoids	Aphid parasitoids reproduce by laying their eggs in aphids. A parasitized aphid (aphid mummy) is puffy, mummified and tan or golden in color.	Several aphid parasitoid species are important biological control agents of many economic pest aphids.
Parasitoid flies	Tachinidae is the most important family of parasitic flies. They are usually large, bristly and beelike or wasplike in appearance.	Species of parasitic flies attack larvae of moths and butterflies, including the alfalfa looper, fall armyworm, variegated cutworm. They attack beetle pests, including the Colorado potato beetle.

PATHOGENS (DISEASE-CAUSING ORGANISMS)		
Bacteria	The early insect larval instars are the most susceptible stages to the bacteria. Infected insects show a loss of appetite, sluggishness, discharge from the mouth and anus, discoloration, and liquefaction and putrefaction of the body tissues. *Bacillus thuringiensis* (commonly called *Bt*) is the most important *Bacillus* bacteria for insect pest control.	*Bacillus thuringiensis (Bt*) is commercially available for various crop insect pests including the Colorado potato beetle, caterpillars of the diamondback moth, and other caterpillar pests.
Fungi	Insects that are attacked by fungi often retain their shape but usually become hardened, "mummylike" and appear "fuzzy" from the fungal growth.	***Beauveria bassiana****,* known as the white muscardine fungus because infected larvae turn white or gray, is available commercially for aphids, grasshoppers, Colorado potato beetle, lygus bugs, chinch bug and European corn borer. ***Nomuraea rileyi*** has activity against green cloverworm, cabbage looper, imported cabbageworm, armyworms and corn earworm.
Viruses	A virus-infected insect appears sluggish, will stop feeding, the cuticle will have a pale discoloration, and will often hang from its legs. Viruses usually attack the larval stage and nfected insects will die 1 to 2 days after the symptoms appear.	Nuclear polyhedrosis viruses (NPV), cytoplasmic polyhedrosis viruses (CPV) and granulosis viruses (GV) are important groups of viruses that attack insects
Nematodes	Nematodes are tiny (microscopic) roundworms. Insects killed by nematodes become brownish-yellow to red in color and the tissue assumes a gummy consistency.	***Steinernema carpocapsae*** is the most available commercial formulation of all the **entomopathogenic** nematodes and is most effective against surface-dwelling insects such as caterpillars, including cutworms and armyworms.