

Biological Control

Department of Entomology

COMMON NATURAL ENEMIES

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The use of natural enemies to suppress or prevent insect pest outbreaks is termed "biological control." Natural enemies are called "beneficials" because they are helpful in controlling insect pests. Proper identification and understanding of natural enemies, as well as the insect pests attacked by these beneficials, is the first step in implementing biological control. Biological control can be used in combination with other control measures, such as mechanical (e.g., removing insect pests) or cultural (e.g., crop rotation) control, resistant crop varieties, and the judicious use of insecticides. Natural enemies can be classified into three major groups.

Predators attack, kill, and eat multiple numbers of prey. Predators may feed on a wide variety of pests, or they may be more specific, feeding on one or a few pest species.



A ladybird beetle devouring an aphid is a familiar sight to most home gardeners. *(Photo Credit: Max E. Badgley)*

Parasites lay an egg in or on a host, which then hatches and develops at the expense of the host. Most often the host is eventually killed as the developing parasite consumes the host's organs or body-fluids.



Only the keen observer would see this minute parasitic wasp lay an egg on the larva of a pest species. *(Photo Credit: Max E. Badgley)*

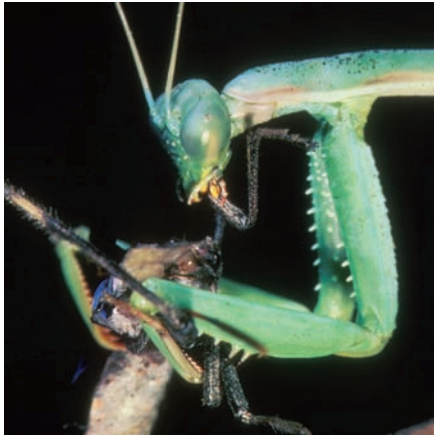
Pathogens are free-living microscopic organisms (bacteria, fungi, viruses, etc.) that invade the host's body and cause disease. The diseased host is greatly weakened and often killed.



An unseen, invading pathogen has diseased and killed this caterpillar. *(Photo Credit: G.R. Carner)*

PREDATORS

Insect predators fall into one of two groups depending on their mouthparts. Most species have "chewing mouthparts." These predators typically eat most of their prey. Other predators have "piercing-sucking" mouthparts, to suck the prey's body-fluids.



A praying mantid finds this captured plant bug quite a delectable feast. (Photo Credit: Max E. Badgley)



This spined soldier bug pierces its prey with "straw-like" mouthparts. (Photo Credit: Robert N. Wiedenmann)



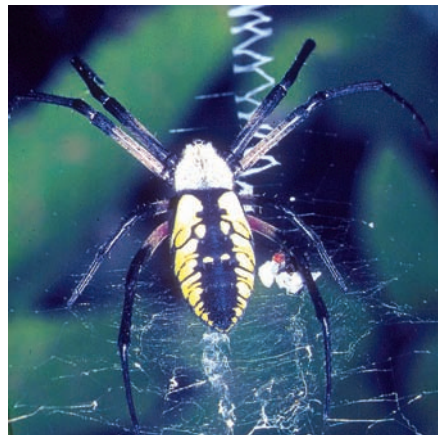
The aphid lion is the immature larva of the frail looking lacewing. It grasps prey with sickle-like mandibles. (Photo Credit: Edward S. Ross)

Insects at all life-stages can be attacked by one or more predatory species.

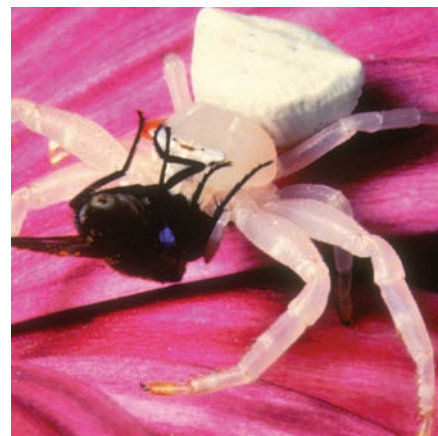


This insidious flower bug "sucks the life" out of a pest's egg. (Photo Credit: J.R. Ruberson)

A major group of non-insect predators are the spiders (8-legged arthropods). Spiders are predacious throughout their lives. Spider hunting techniques vary widely, from web spinning species to active hunters. Most spiders are "shy." Because some species can inflict a painful bite, they are best left alone to do their "job."



Garden spiders can catch quite large prey with the webs they form between plants. (Photo Credit: J.R. Ruberson)



Crab spiders wait motionless on plants to capture unsuspecting prey like this fly. (Photo Credit: Max E. Badgley)

PARASITES

There are two common types of insect parasites; stingless wasps and certain flies. The wasps are small (most less than 1/4-inch), usually black or red insects, that do not sting people (indeed they can't because they have no stinger). Parasitic flies often resemble the common house fly. Like the parasitic wasps, these flies are harmless to people, because they attack only their host. While you may notice the occasional adult parasite, you may more frequently encounter the parasitized hosts, as they are often misshapen and may have undergone noticeable color changes. Sometimes, you will find hosts with "eggs" attached to them, which may indeed be eggs or the pupal cases of the emerging parasites.



"Fuzzy balls" on this dying hornworm are pupae of tiny parasitic wasp seen emerging. (Photo Credit: J. Obermeyer)



When these fly eggs hatch, the larvae will cut their way into the body of this armyworm to feed and develop. (Photo Credit: J. Obermeyer)

Insects at all life-stages can be attacked by one or more parasite species.

PATHOGENS

Pathogens gain entry into the insect's body through two main routes: directly through the insect's "skin" or orally when the insect eats contaminated plant parts. Fungi invade through the "skin" from a spore that lands on the host's body. Eventually, the host becomes filled with a growing mass of "hyphae" that turn the host "fuzzy" and rigid.



Fungal spores invaded and killed this corn borer, even in the confines of a corn stalk. (Photo Credit: J. Obermeyer)

Bacteria and viruses enter through the host's digestive system after the host has eaten contaminated plant material. Once inside the host body, these pathogens rapidly multiply, and eventually liquify the host's internal organs. Due to their microscopic size, pathogens are most often noted for the disease they cause, and the changes in the insect's body after infection.



This liquefied cabbage worm is typical of a bacteria or virus infected larva. (Photo Credit: J. Obermeyer)

Insects at all life-stages can have one or more associated diseases.

All the species described in this publication occur naturally in the field. Thus, one of the general approaches to biological control is to conserve these beneficials by adopting practices that are friendly to natural enemies.

1. Learn to distinguish between pests and beneficials. Monitor for insect pests and natural enemies to determine their presence, pest related plant damage, and effectiveness of the beneficials. Implement control measures only when it is economically and environmentally justified (e.g., some plants can withstand considerable injury from pests before yield is affected).
2. Avoid or minimize the use of broad-spectrum pesticides that are harmful to non-target organisms. If insecticides are necessary, the use of microbial insecticides (e.g., *Bacillus thuringiensis*, "B.t."), insecticidal soaps, and horticultural oils will be less harmful to beneficials.
3. Provide diverse sources of nourishment to natural enemies by planting mixed annual flowers which can provide nectar and pollen. Maintain a permanent bed of perennials in the garden to provide shelter for beneficials. Maintain ground covers, standing crops, and crop residues to supply overwintering sites for natural enemies.
4. If conserving natural enemies fails to provide suitable pest control, consider purchasing beneficials to add to naturally occurring populations. While over 100 species of natural enemies are commercially available, be sure you have the right natural enemy for the job (e.g., praying mantids do little to control cabbage caterpillars). Buy natural enemies from companies that provide information on release rates, proper handling of these living organisms, and that have a money back guarantee on product quality. For each shipment make an assessment of the viability of individuals and make releases according to company and Extension recommendations.

SELECTED REFERENCES

- Flint, M. L. and S. H. Dreistadt. 1998. Natural enemies handbook. U. California Press.
- Jeffords, M. R., S. L. Post, R. N. Wiedenmann, C. N. Nixon, and C. S. Sadof 1997. The good guys! Natural enemies of insects card set. Illinois Natural History Survey. Champaign, IL.
- Mahr, D. L. and N. M. Ridgway 1993. Biological control of insects and mites: An introduction to beneficial natural enemies and their use in pest management. NCR-481. University of Wisconsin.
- Van Driesche, R.G. and T.S. Bellows. 1996. Biological Control. Chapman and Hall, NY. 539 pp.

WEB PAGES

1. *Midwest Biological Control News*. Current information on natural enemy biology, biological control options, meetings, and contacts. <<http://www.entomology.wisc.edu/mbcn/index.html>>
2. *Suppliers of Beneficial Organisms in North America*. California Environmental Protection Agency, listing of commercially available natural enemies. <<http://www.cdpr.ca.gov/docs/ipminov/bensuppl.htm>>
3. *National Biological Control Institute*. National storehouse of information on biological control efforts, including funding, national and international programs, databases and jobs. <<http://www.entomology.wisc.edu/mbcn/misc104.html>>
4. *Purdue Extension Entomology*. Fact sheets concerning pest identification, damage and management guidelines. <<http://extension.entm.purdue.edu/publications.php>>

READ AND FOLLOW ALL LABEL INSTRUCTIONS. THIS INCLUDES DIRECTIONS FOR USE, PRECAUTIONARY STATEMENTS (HAZARDS TO HUMANS, DOMESTIC ANIMALS, AND ENDANGERED SPECIES), ENVIRONMENTAL HAZARDS, RATES OF APPLICATION, NUMBER OF APPLICATIONS, REENTRY INTERVALS, HARVEST RESTRICTIONS, STORAGE AND DISPOSAL, AND ANY SPECIFIC WARNINGS AND/OR PRECAUTIONS FOR SAFE HANDLING OF THE PESTICIDES.

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