

Introduction to Beneficial Insects

Landscape Managers are increasingly asked to provide nonchemical means of pest control for customers. Government regulation of pesticides is becoming more and more restrictive, providing further incentive to use biologically-based pest management methods. Natural control tactics may include the use of pest-resistant plants (a subject treated elsewhere in this manual), use of pheromones, sterile male releases. The use of parasites, predators, and pathogens to reduce numbers of unwanted insect or mite pests is the most common definition of biological control and will be the subject of this section.

Reduction of pest insects or mites below a damaging level through biological control may be achieved by conservation of existing natural enemies, augmentation of their numbers, use of products containing pathogens or nematodes, or through importation of natural enemies from the native location of an exotic pest.

Conservation, or the protection of existing natural enemies, may be accomplished by using management practices that favor their survival and minimize harmful effects. This includes the use of pesticides only when necessary and then, as spot sprays rather than blanket coverage of an area. The choice of a pesticide that is least toxic to beneficial insects and mites.

Avoid or be very selective in applying broad-spectrum or persistent pesticides. Often natural enemies are even more susceptible to these types of pesticides than are the pests you are trying to control. Natural enemies may be immediately killed and toxic residues will further reduce the beneficial population. Dust interferes with the activity of many natural enemies and can contribute to an outbreak of mites. By planting ground covers and reducing dust, you favor the activity of beneficial insects and mites. Similarly, planting a variety of flowering species can provide additional nectar sources and sources of alternative prey for generalist predators and parasites.

Augmentation of natural enemies may be considered when the resident populations are insufficient to reduce pest numbers to an innocuous level. In this case natural enemy numbers can be increased (augmented) through the purchase and release of commercially available beneficial species.

Although this method has been widely used in the management of greenhouse pests, there has been relatively little research on the use of commercially produced beneficials in landscape settings. Natural enemy releases are most likely to succeed in areas on plant materials where a certain amount of infestation and pest damage can be tolerated. Situations where high numbers of pests and a high degree of damage are already apparent are not good candidates for natural enemy releases. Two tactics for augmenting beneficials are inoculative releases and inundative releases. Inoculative releases occur when a small number of individuals of a beneficial species is released into a low level pest infestation. The progeny of these beneficials may be sufficient to keep pest levels at or below the desired level. When large numbers of

natural enemies are released, often several times in a season, these are said to be inundative releases.

Importation, or classical biological control, is used most often against pests that have been accidentally introduced to the area where they are currently a problem. Insects that are not pests in their native habitat may explode in a new area where the regulation of population size by natural enemies has been removed. Natural enemies collected from the pest's native region and studied for the potential to suppress the pest can be introduced in the new environment. The introduction of exotic natural enemies must be done by qualified scientists as required by law, but represents another category of natural enemies that should be recognized and conserved.

Formulated products containing entomogenous (insect-eating) nematodes or bacteria are available for the control of many insect pests. These are produced commercially and may be applied in a manner very similar to that used for conventional pesticides. These types of products, however, often require a much more restrictive set of environmental conditions to function optimally. Nematodes, for example, require a high moisture environment in order to move and locate insect hosts. If soils are too dry the product may not work as well. In other cases products may be sensitive to high temperatures or UV light, or may require refrigeration. Most nematodes and pathogens are relatively slow acting. Patience is required. A quick knock-down of pests should not be expected. A reduction in pest numbers will occur over time. Usually, a particular life stage of the pest is the only one vulnerable to a nematode or pathogen, thus requiring repeat applications to allow for the appropriate stage or stages to be targeted.

Types of Biological Control Agents

THREE GENERAL CATEGORIES OF NATURAL ENEMIES MAY OCCUR OR BE USED IN MANAGED LANDSCAPES: PREDATORS, PARASITES (OR MORE CORRECTLY PARASITOIDS), AND PATHOGENS OR DISEASE-CAUSING AGENTS.

1. Predators are generally insects, spiders or mites that must find and kill several prey individuals in order to complete their life cycle. This might be a ladybird beetle that consumes hundreds of aphids as both a larva and an adult, or an insect like the minute pirate bug that feeds voraciously on thrips and insect eggs. Predators are usually larger than the prey they eat, although there are exceptions. Predators that feed on insects also occur among the birds, reptiles, amphibians, mammals, and fish. Some can cause significant reductions in insect numbers. Most often we are talking about invertebrate predators in insect and mite control.
2. Parasites are defined as organisms that live in or on the body of their host during some part of the parasite's life cycle. Parasitoids are a type of parasite that may consume part or all of its host's tissues resulting in the death of the host. The most abundant parasitic insects are flies or wasps. Parasitic insects usually require only one host to complete their development, in contrast to predators which require several. Parasitic insects may

be responsible for controlling several pests, however, when they oviposit, or lay eggs, on a number of new hosts.

3. Pathogens may be bacteria, viruses, or fungi that cause disease in insects. Nematodes that infect insects are often included in this category too. Many pathogens that attack insects exist in the landscape and several have been formulated and are commercially available for use in agriculture, greenhouses, nurseries, and the landscape.

The first step in being able to more effectively use biological control in landscape management is to be able to correctly identify certain common natural enemies and to know what pests they may be active against. Many natural enemies are generalists feeding on a wide variety of prey or, in the case of parasites, parasitizing several host species. Some, on the other hand, are very specialized in the type of prey or host they can successfully overcome. Knowledge of the life cycle is important too. Many natural enemies attack only a particular stage of a pest, perhaps the egg or the larval stage.