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IPM and Plant Diagnostics

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Chapter 9

IPM and Plant Diagnostics

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IPM and Plant Diagnostics

Learning Objectives

At the end of this unit you will be able to articulate and explain:

- The principles and practices of integrated pest management (IPM);
- Techniques for preventing insect and disease problems;
- Cultural, physical, chemical, and biological management strategies for managing pests;
- Basic steps involved in diagnosing a plant sample; and
- Patterns of injury and the development of symptoms over time for diseases and abiotic problems.

Introduction

Integrated pest management (IPM) represents a common-sense approach to pest control. It involves an understanding and careful examination of all factors (and their interrelationships) influencing plant growth. These include soil, water, air, nutrients, insects, diseases, landscape design, weeds, animals, beneficial organisms, weather, and cultural practices. The IPM goal is to manage problems at acceptable levels rather than attempting to eliminate them. In many cases, you can prevent pest problems by selecting the appropriate plant species for your particular site and providing the best possible growing conditions. Regular observation (monitoring) of the plants in your landscape is critical in helping you to decide if a problem requires corrective action. You need knowledge, skill, and experience to use IPM principles and correctly diagnose plant problems. This chapter is a starting point for learning basic diagnostic concepts and how to prevent and manage plant and pest problems. Too often, gardeners assume that plant problems are caused by pests and diseases that require chemical control. In fact, many plant problems are caused by cultural and environmental factors, and most of the actual insect pests and diseases encountered in home landscapes can be managed successfully without chemical pesticides.

IPM research and education is a principal mission of the United States Department of Agriculture and the University of Maryland's College of Agriculture and Natural Resources. Master Gardeners play a critical role in educating the public about IPM and helping residents and communities solve plant and pest problems.

This large chapter is divided into four parts:

- IPM (introduction to the principles and practices);
- Diagnosing Plant Damage (a systematic approach to this important process);
- Diagnostic Keys (to determine possible causes of specific plant problems); and
- Color Photos (of major biotic and abiotic plant problems).

Part I. IPM

The term Integrated pest management was introduced in the late 1960s. Different aspects of IPM, such as the introduction of predators and parasites to reduce a pest population, had been known and used for some time. The full IPM concept developed, in part, as a reaction to the limitations and problems associated with chemical pesticides. These include accumulation in the food chain (e.g., DDT), pest resistance, secondary pest build-up, non-target injury pollinator losses, human health risks, and potential water, air, and soil pollution.

IPM is a knowledge-based, holistic approach to managing pests at an acceptable level. It emphasizes biological, cultural, and physical methods to prevent and manage problems. Least-toxic pesticides may also be warranted. The impact of your gardening and pest management decisions often extends far beyond your property lines. The IPM approach compels you to consider your landscape as part of the larger community ecosystem to manage responsibly.

An important educational component of IPM is desensitizing people to insects and minor plant injury from common diseases and pests. For example, hundreds of native insect species, especially caterpillars, feed on native plants. Plants and herbivores have co-evolved to create a durable ecosystem. The caterpillars don't typically defoliate or kill the host plants because their populations are kept in check by disease and other critters. Accepting the presence and activities of these plant feeders is a critical first step in reducing unnecessary pesticide use and creating healthier landscapes.

IPM Steps

1. Know your backyard environment

Learn about the plants, insects, diseases, and wildlife in your backyard and community. The information is in books, Extension publications, websites, and the experiences of you and your fellow gardeners. Before you can recognize or prevent problems, you need to become familiar with your plants, including their growth habit and necessary conditions for good growth. Learn which plants are native and which are exotic, which plants are prone to serious pest problems, and which are better adapted to conditions in your area.

Learn to tolerate some damage. Most healthy herbaceous and woody plants can tolerate 20% to 30% defoliation without suffering long-term damage or yield reduction. Learn the habits, life-cycle, and best ways to control the really serious pests. Keep a notebook for recording observations, successes, and failures. Update your notebook regularly and refer back to it to avoid repeating mistakes.

2. Prevent plant problems

The best management method is prevention. When you focus your time, attention, and efforts on growing “the right plant, in the right place, in the right way,” you can greatly reduce plant problems. See the section, Healthy Plants: Fewer Problems, for more details on keeping plants healthy.

3. Monitor plants regularly

Monitor for pests and plant problems by closely observing visible plant parts. Use a magnifier or hand lens for a larger view. Be sure to flip leaves over and examine the undersides. Be prepared to get on your hands and knees to do a thorough job. Some pests, like slugs, are mainly active at night. Weekly inspections of your garden will catch most problems before they get out of hand. Learn not to panic when observing symptoms. Is the problem serious, is it getting worse, and is the plant in grave danger?

4. Diagnose accurately

Learn how to diagnose plant problems. Where you observe pests or disease symptoms, identify the culprit and learn the life cycle, habits, characteristics, damage potential, and best time to take action. Correct identification of pest or plant problems is critical. One-half of all plant problems are not caused by living organisms (biotic), but by cultural and environmental factors (abiotic).

5. Take action if necessary

Manage the problem using physical and cultural methods first. Apply a least-toxic pesticide as a last resort. For home gardeners, control measures often begin when pest injury reaches an “aesthetic threshold”—the point at which additional damage to plant appearance cannot be tolerated. Many insect pests and diseases cause minor injury and can be ignored.

6. Evaluate action and continue to monitor

Evaluate the effectiveness of the action taken. Continue to monitor and learn. And don't forget to enjoy your garden!

Healthy Plants: Fewer Problems

Plants

- Make a plan of your existing landscape and identify and note the location of your plants and trees.
- Note which look healthy and which seem to have problems.
- Know what your plants should look like. Are they growing normally?
- Be willing to remove plants with chronic problems (e.g., azaleas grown in full sun often have severe lace bug problems).
- Replace problem plants with those better adapted to your area and specific planting sites. Check gardening references and reputable local nurseries for ideas.
- Select disease- or insect-resistant varieties. Purchase healthy, certified, and disease-free transplants and nursery stock.
- Plant at the right time.

Soil quality

- Improve soils with organic matter prior to planting shrubs and trees.
- Incorporate organic matter in annual and perennial beds on a regular basis.
- Take a soil test every three years and adjust the pH accordingly.
- Fertilize as needed to maintain vigor. Over-fertilized plants produce excessive succulent growth that is attractive to sucking insect pests. Aphids and spider mites will reproduce at a faster rate on over-fertilized plants.

Mulches and water

- Maintain even soil moisture.
- Avoid overhead watering and splashing soil onto plants, which can then spread soil-borne pathogens onto lower leaves. Water early so plants dry thoroughly by nightfall.
- Water trees and shrubs slowly and deeply. The root zone can extend horizontally 2 to 3 times the height of the tree beyond the dripline. Check the depth of soil moisture after irrigation by inserting a stick or screwdriver.
- Use drip irrigation and soaker hoses where practical.
- Water newly planted trees and shrubs deeply (2 inches of water) every 1 to 2 weeks as needed until they become established.
- Prevent weed growth. Weeds rob plants of moisture and nutrients and are alternate hosts for pests and diseases.

Other cultural practices

- Prune to increase air circulation, which encourages more rapid drying of foliage.
- Prune diseased plant parts to help save the whole plant.
- Avoid accidental root pruning through hoeing and tilling.
- Don't work with plants when foliage is wet; you could spread diseases.

Taking Action

Even the most diligent and informed gardeners will face plant problems that require some action to prevent further injury. Pests, weather, soil conditions, or other factors may be the culprit. Use the tips below to make good decisions about when to take action:

- You have less time to make a control decision on seedlings, transplants, and newly planted trees and shrubs.
- Many pests and diseases do not need to be controlled on healthy mature plants.
- Site and/or cultural conditions may need to be modified to correct environmental problems.

- Judgments are based on aesthetics, plant value, and actual threat to the plant's health, or to structures (e.g., carpenter ants) or personal safety (e.g., hazardous trees). Monitor pest or disease progression carefully.
- Realistic thresholds should be set for insects and diseases. It is very important to identify the pest or disease and become familiar with its life cycle. Ignore minor pests and focus instead on serious threats. For example, gypsy moths should be controlled because oaks suffer from early defoliation and use up energy reserves to refoliate. A few years of heavy feeding can kill a mature tree. Eastern tent caterpillar feeding occurs early enough in the season for cherry trees to refoliate without causing harm to the tree.
- Sometimes by the time you observe the disease or insect damage, it is too late to do anything about the problem until next season.
- Treatment decisions depend on the type of plant that has a problem. If a plant is easy to replace, such as an annual, just pull the problem plant and replace it. Plants that continue to grow throughout the season will often outgrow the pest or disease damage, such as locust leafminers on locust and anthracnose on sycamore.
- Once you have identified the problem and determined that it requires corrective action, select a control strategy. Always select the least toxic solutions first, such as physical (hand removal, change watering practices, prune out damage) and biological (encourage beneficials). Pesticides should be used selectively (spot treatments) with the least toxic materials. Many of these least toxic products are known as bio-rational pesticides because they are less likely to harm beneficial organisms and they degrade quickly. Some examples are Bt (*Bacillus thuringiensis*), baking soda, insecticidal soap, and horticultural oil. Horticultural oil has been used for both insect and disease management.
- Residual broad-spectrum pesticides, by contrast, usually affect many non-target organisms and persist a long time in the environment.

Biological Control

It is important that all creatures in your landscape not be viewed as pests. Hundreds of different insects, spiders, and other beneficial microorganisms, such as soil fungi and bacteria, inhabit even the smallest yards. Bt, for example, is naturally occurring at low levels in many garden soils. Together with your plants they comprise your unique backyard ecosystem. Many of these are either beneficial or innocuous. Some insects may be occasional feeders on favorite garden plants but will not become damaging pests. For example, aphid feeding in the spring alarms many gardeners. Natural predators and parasites are often close behind, cleaning up local infestations in a few weeks.

Predators attack and consume pests directly. They are usually larger and more active than the prey they eat. For example, insect predators tend to move rapidly and have large eyes and forward-pointing mouthparts.

Parasites use pests as food sources for their young. For example, insect parasites lay their eggs in, on, or near the pest insect. The offspring then grow in or on the host, eventually killing it.

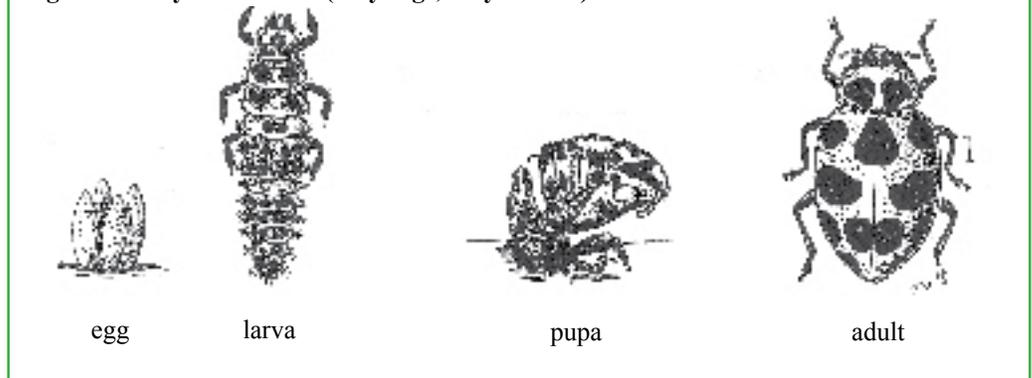
Predatory and parasitic insects are often collectively referred to as beneficial insects or "beneficials." It is important to remember that many other beneficial organisms such as birds, earthworms, and nematodes also exist in your yard.

Some Common Insect Predators

Ladybird beetles (ladybugs, lady beetles) (Fig. 9-A)

Predators of aphids, mealybugs, and other small insects. Adults vary in size from 1/8- to 3/8-inch long. The color ranges from all black to black with red to yellow spots, or red to orange with black spots, or grayish with black spots. There are more than 30 species in Maryland. Immatures are 1/8- to 3/8-inch long, alligator-like, and segmented, and usually have short spines (bristles) on their bodies. The color is usually gray to black with yellow to orange markings. Eggs are usually yellow, oval-shaped, and laid upright in clusters on leaf undersides. It is not necessary to buy and release ladybird beetles. They will come into your landscape on their own as long as residual insecticides are not sprayed.

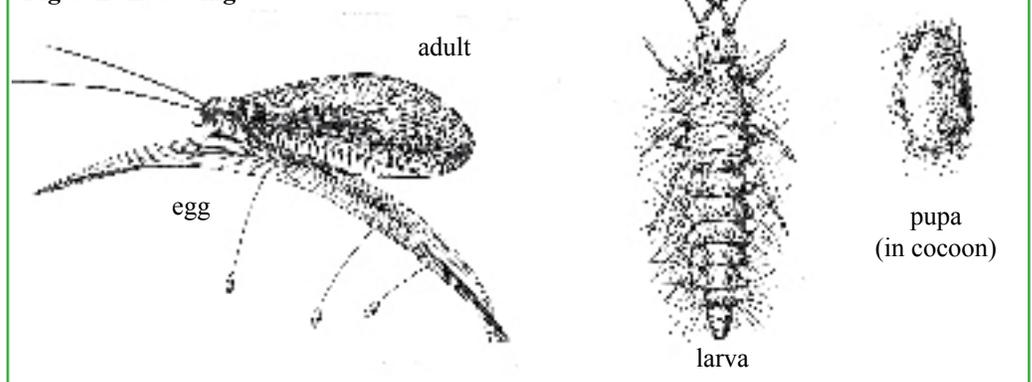
Fig. 9-A. Ladybird beetles (ladybugs, lady beetles)



Lacewings (Fig. 9-B)

Predators of aphids and other small insects. Adults are 1/2- to 3/4-inch long, green or brown, with small heads and large eyes. The transparent wings are longer than the body and have a fine network of veins. Larvae are spindle-shaped, yellow-brown, and mottled. They have spines along their sides and long, curved mouthparts. Eggs are laid on the ends of long, fine stalks and are often attached to leaves or twigs. Lacewings are available commercially.

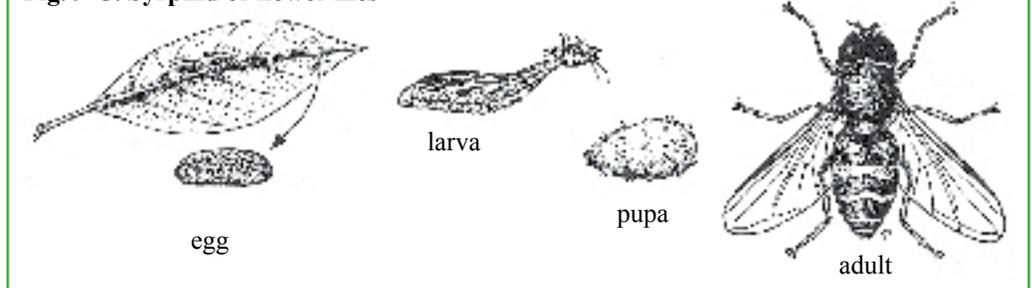
Fig. 9-B. Lacewings



Syrphid or flower flies (Fig. 9-C)

Aphid predators, adults 1/8- to 5/8-inch long. They resemble bees with yellow-black or white-black striped abdomens. Adults are often seen on flowers feeding on nectar. Larvae are grayish or greenish maggots and feed on aphids. Adult females lay eggs around aphid colonies and may be seen flying around aphid-infested plants. They are not available commercially.

Fig. 9-C. Syrphid or flower flies



Praying mantids (Fig. 9-D)

Large, general predators. They will eat anything they happen upon, including each other. The adults are 1/2- to 4-inches long, green or brown with long bodies, large eyes, and papery wings. Front legs are enlarged and adapted for grabbing prey. Immatures resemble adults but are smaller and wingless. Female mantid lays eggs in frothy masses glued to stems and twigs. They are straw-colored and resemble foam. Buying and releasing mantids is not recommended.

Fig. 9-D. Praying mantid

