



HOME & GARDEN

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Home & Garden Mimeo # HG 62

IPM: A Common Sense Approach to Managing Problems in Your Landscape

Integrated pest management (IPM) represents a holistic approach to pest control. IPM is part of a total community ecosystem approach to gardening which promotes good management and stewardship strategies. 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 goal is to manage pests and diseases at acceptable levels rather than attempting to eliminate them. In many cases, pest problems can be prevented by selecting the appropriate plant species and cultivars for your particular site and providing the best possible growing conditions. Regular observation or monitoring of the plants in your landscape is critical in helping you to decide if a problem requires corrective action. Be aware that many factors impact plant growth. Too often, gardeners assume that plant problems are caused by pests and diseases. For example, insect damage may occur after a plant has been weakened by other factors including site problems, cultural practices or environmental and nutritional problems.

IPM is not a strictly organic approach to pest control. When necessary, chemicals are employed as a last resort. Broad spectrum **residual insecticides** should not be relied upon as the primary management strategy. Residual pesticides remain effective in the environment for days, weeks, or months impacting beneficial organisms as well as pests. Except for some serious fruit diseases, pesticides should not be applied on a scheduled or preventive basis. In all cases, the least toxic solutions (physical, mechanical, biological controls) should always be tried first. The IPM approach compels you to consider your landscape as part of the larger community ecosystem to manage responsibly. The impact of your gardening and pest management decisions often extends far beyond your property lines.

GET TO KNOW YOUR LANDSCAPE AND GARDEN

Before you can recognize or prevent problems, you need to become familiar with your plants, their growth habit and necessary conditions for good growth.

- 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 lacebug problems).
- Replace problem plants with plants adapted to your area. Check gardening references and reputable local nurseries for ideas.

BUILDING A HEALTHY GARDEN PREVENTS PROBLEMS

- **Soil building and fertility**
Incorporate organic matter in flower and vegetable beds on a regular basis.
Take a soil test every three years and adjust the pH accordingly.
Fertilize as needed to maintain vigor.
Avoid over-fertilizing plants, as it can lead to pest problems.

Educating People To Help Themselves

Local Governments - U.S. Department of Agriculture Cooperating

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- **Mulches**
Help to maintain even soil moisture, prevent weed growth and soil erosion, and protect plant roots and crowns from winter damage.
Mulch layers should not exceed 2-3 inches in depth.
- **Choose the right plant for the right place**
Select well-adapted varieties for the site conditions.
Select disease or insect resistant varieties.
Purchase healthy, certified, disease free seeds, transplants and nursery stock.
Plant at the right time.
- **Proper planting techniques**
Select suitable sites for the selected plants.
Prepare soil correctly.
Water newly planted trees and shrubs deeply (2" of water) every 1 to 2 weeks as needed.
- **Irrigation techniques**
Avoid overhead watering and splashing soil onto plants.
Water trees and shrubs slowly and deeply. Remember that the root zone can extend out 2 to 3 times the height of the tree beyond the dripline. Check the depth of soil moisture after irrigation by digging a small hole or inserting a stick.
Use drip irrigation and soaker hoses where practical.
- **Remove or mow weeds**
Weeds rob plants of moisture and nutrients and are alternate hosts for pests and diseases.
- **Other cultural practices**
Prune to increase air circulation.
Avoid accidental root pruning through hoeing and tilling.
Don't work with plants when foliage or soil is wet.
Use floating row covers to prevent pest problems.
- **Garden sanitation**
Remove and dispose of diseased or infested plant parts and dead plants.
Rake up and dispose of diseased leaves and fruits.
Clean up and compost garden debris in the fall. (Compost temperatures must exceed 130° F. to kill pathogens and weed seeds.)
- **Healthy transplants**
Use soil-less media.
Use clean, sanitized seedling flats and plant containers.
Do not over-water.
Acclimatize transplants that are grown indoors by slowly introducing them to outdoor conditions.
Protect new transplants and seedlings from cutworms and slugs with paper collars or floating row covers.

MONITORING: "CHECKING OUT YOUR LANDSCAPE"

Gardeners should observe plants carefully to effectively monitor plant health and potential problems. Weekly inspections of your garden will catch most problems before they get out of hand. Examine all plants carefully including leaf undersides. Gently lift small unthrifty plants out of the soil to observe roots. Use a hand lens or magnifying glass if necessary. Where pests or disease symptoms are observed, identify the culprit and learn the life cycle, habits, characteristics, damage potential and best time to take action.

BENEFICIAL INSECTS, MITES AND NEMATODES

It is important that all creatures in your landscape not be viewed as pests. Hundreds of different insects, spiders and other beneficial organisms inhabit even the smallest yards. Together with your plants they comprise your unique backyard ecosystem. Many of these are either beneficial or innocuous. Some may be occasional feeders on favorite garden plants, but will not become damaging pests. (Only 10% of all insect species are considered to be plant pests.)

Concern for the environment, pesticide resistance, problems with pesticide safety, and pesticide effects on non-target organisms has sparked interest in finding alternative means of controlling pests, while conserving beneficial organisms. It is first important to recognize and distinguish pests and beneficial species.

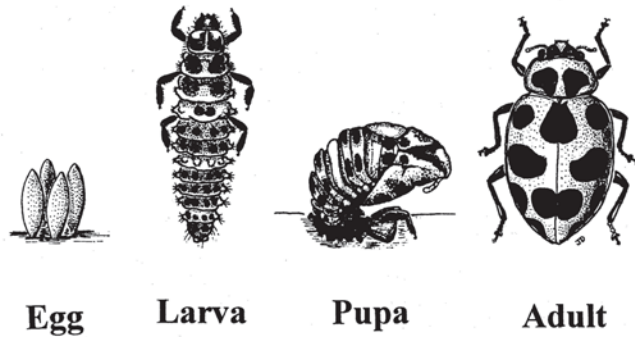
Predators attack and consume pests directly. They are usually larger and more active than the prey they eat. For example, insect predators tend to move rapidly and have large eyes and forward pointing mouthparts.

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.

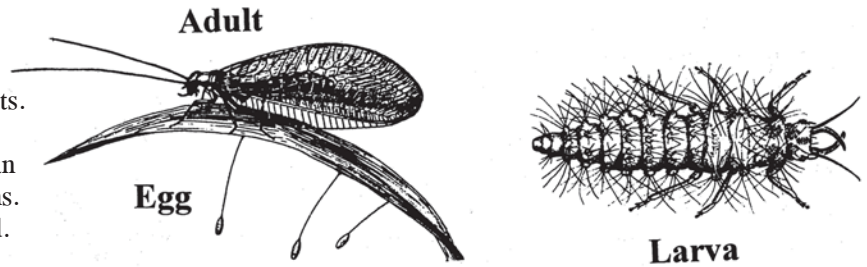
Predatory and parasitic insects are often collectively referred to as beneficial insects or “beneficials”. It is important to remember that many other beneficial organisms such as fungi, bacteria, earthworms and nematodes also exist in your yard.

SOME COMMON INSECT PREDATORS

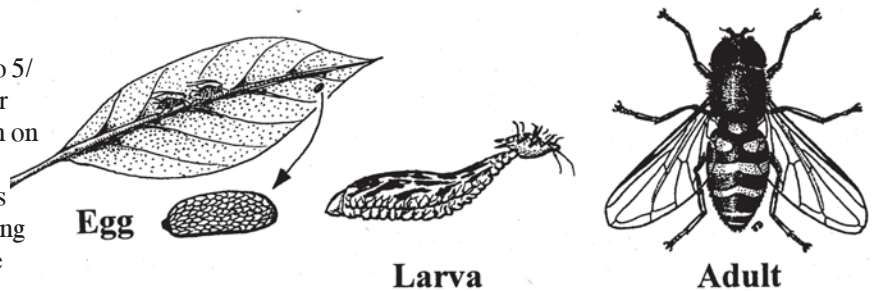
Ladybird beetles (ladybugs, lady beetles): predators of aphids, mealybugs and other small insects. Adults vary in size from 1/8 to 3/8 inch long. The color ranges from all black to black with red to yellow spots, or red to orange with black spots, or grayish with black spots. There are more than 30 species in Maryland. Immatures are 1/8 to 3/8 inch long, alligator-like, 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.



Lacewings: 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 wings are longer than the body, transparent 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.



Syrphid or flower flies: 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 that feed on aphids. Adult females lay eggs around aphid colonies and may be seen flying around aphid-infested plants. They are not available commercially.



Praying mantids: large, general predators. They will eat anything they happen upon, including each other. The adults are 2½-4 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 mantids lay eggs in frothy masses glued to stems and twigs. They are straw-colored and resemble foam. Buying and releasing mantids is not recommended.

Ground beetles: large, general predators. Adults are 1 inch or less, fast moving, iridescent bluish-black in color. They hide under rocks and other objects during the day. Larvae are elongated and dark brown-black with large heads. They are not available commercially.

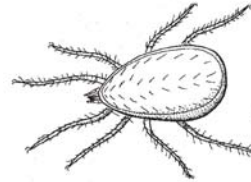


Ground Beetle



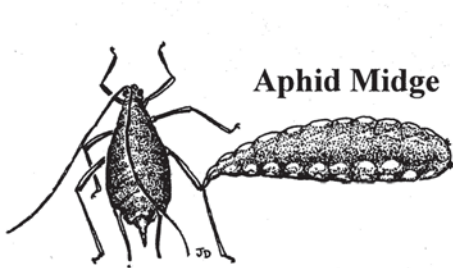
Mantid

Predatory mites: widely used as biological control organisms. They are the same size or larger than spider mites and move rapidly. The color may be white, tan, orange or reddish. Predatory mites are commercially available and the supplier can suggest the species and quantity to buy.



Adult Phytoseiid Mite

Other naturally occurring predators, including assassin bugs, predatory bugs, aphid midges, lightning bugs, dragon and damsel flies, predatory wasps and spiders are busy during the growing season controlling pests in your landscape.



Aphid Midge



Minute Pirate Bug



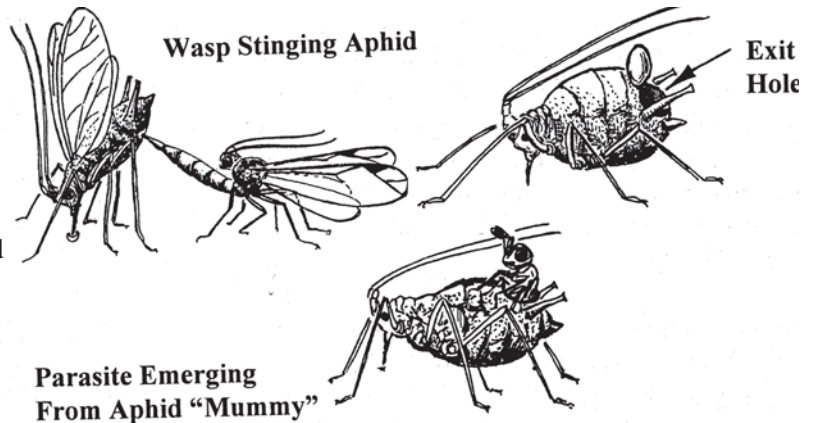
Dragonfly



Wolf Spider

SOME COMMON INSECT PARASITES

Aphid parasites: adults are about the size of aphids. They are tiny black or brown wasps. The adult female inserts her eggs into aphids. The larvae hatch out, feed, and eventually kill the aphid. The parasitized aphid remains attached to the plant, and eventually turns into a “mummy”. It is swollen, brown and papery in appearance. Close examination may reveal a small exit hole chewed in the mummy’s back from which the adult wasp emerged. Several species are available commercially, but are usually not needed in the home garden. Naturally occurring parasites will find an aphid infestation on their own.



Wasp Stinging Aphid

Parasite Emerging From Aphid “Mummy”

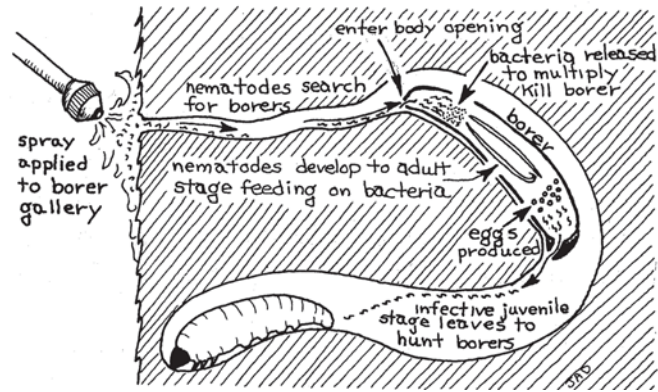
Exit Hole

Parasitic wasps: a large group of small to large wasps that parasitize a variety of caterpillars, beetle larvae, flies, aphids and other insects. They are slender and black or yellowish to brown. They have a pinched waist and clear wings. Some females may have very long ovipositors or “stingers”, but they can not sting people. The female inserts her eggs into host insects. When the larvae complete their development, they spin cocoons on or near a dead or dying host, and then pupate. Parasitized hornworms are often seen with many white, silken cocoons attached to their bodies. Egg and larval parasites are available commercially.



Thread-waisted Wasp

Parasitic nematodes: are tiny, parasitic worms that are not harmful to humans, animals or plants. These occur naturally, mainly in soils, and can be purchased to control clear-wing borers and cutworms. There are two types available- *Steinernema* (Sc) and *Heterorhabditis* (Hb). Sc nematodes work on insects that feed near the soil surface or inside plants while Hb nematodes can move through the soil profile to attack certain beetle grubs. Follow package directions for appropriate storage and application techniques.



ATTRACTING AND CONSERVING BENEFICIAL ORGANISMS INTO YOUR LANDSCAPE

To conserve and protect beneficial organisms in your garden or landscape, provide water, food, cover, nesting places and a diversity of flowering plants. Reduce or eliminate pesticide use or switch to careful timing of biorational, nonresidual pesticides such as insecticidal soaps, horticultural oils, and B.t. products. Soaps, oils and botanical pesticides have short term effects on populations of beneficials compared to typical synthetic pesticides. In addition, try to maintain a diverse habitat. Provide pollen and nectar sources for adult beneficials by growing a wide variety of annual and perennial flowers so that some plants are blooming at all times during the growing season. Check the box below for some good choices. Provide water by misting or wetting down plants and mulch. This also cools the area during hot weather. Leave shallow, open containers or basins of fresh water on the ground in shade for birds, toads, frogs, turtles, snakes, spiders and insects. A diverse habitat of trees, shrubs and other plants also provides shelter, hiding places and overwintering sites. Straw mulch is especially attractive to spiders.

“Plants to Attract and Feed Beneficial Insects”

Umbelliferae family	carrot, yarrow, Queen Anne’s lace, dill, anise, fennel, coriander, parsley
Compositae family	zinnia, marigold, aster, daisies, mums, black-eyed susan, coneflower, coreopsis
Mint family and perennial herbs	mints, thyme, sage, oregano, bee balm, basil
Other plants	salvias, wallflowers, nasturtiums, poppies, many types of wildflowers, etc.

NON-CHEMICAL CONTROL STRATEGIES FOR PESTS AND DISEASES

Learn to tolerate some damage: Most healthy herbaceous and woody plants can tolerate 20-30% leaf defoliation without suffering long-term damage or yield reduction.

Wait for the “good guys”: Aphid feeding in the spring alarms many gardeners. Natural predators and parasites usually clean up local infestations in a month or so.

Remove plant or plant parts: Simply removing and disposing of badly damaged plants may minimize the problem on adjacent plants and prevent recurrence.

Timing of seeding and planting: Some pests can be circumvented by growing vulnerable plants when damage is least likely. For example, summer squash crops planted early and late are less troubled by squash vine borer. This requires knowledge of pest life cycles.

Late fall or early spring tillage: Many pests over-winter in the crop debris of host plants or in the soil around host plants. Tilling can disrupt pest habitats.

Water stream: A strong hose spray may temporarily dislodge mites, aphids and other pests. Be careful not to damage plants.

Hand picking: Pick off adult and immature insects and egg masses. Pests can be squashed or dropped into a jar of soapy water.

Grow pest resistant or tolerant plants: Check with the nursery or gardening catalogs when selecting plants for those with resistance or tolerance to pests and diseases. Many native plants are good choices.

Compost: Adding compost to soil can reduce problems with nematodes and some soil borne diseases.

Do not overfertilize: Aphids and spider mites will produce more young on overfertilized plants.

Barriers: A floating row cover is an excellent material for excluding insect pests. Other examples are paper collars for cut-worms and diatomaceous earth for slugs.

Rotation: Rotate crops that are prone to pests and diseases. However, it is often very difficult to rotate away from disease problems in small gardens that over-winter in soil or garden debris.

SUMMARY OF WEED IPM METHODS
DESIGN/REDESIGN SITES TO AVOID WEED PROBLEMS
<ul style="list-style-type: none">• Select species that are well adapted to local climate and soil conditions.• Group together plants that require similar cultural care, such as like requirements for water.• Separate plants with incompatible growth characteristics.• Select plants that develop an overlapping canopy to shade out weeds.
PREPARE THE SITE BEFORE PLANTING AND PLANT PROPERLY
<ul style="list-style-type: none">• Eliminate any established weeds, especially perennial species.• Grade and prepare the site for good drainage.• Loosen and amend or add topsoil if needed.• Provide for any needed irrigation.• Plant trees and shrubs properly.• Choose appropriate mulch and apply it correctly.
PROPERLY CARE FOR ESTABLISHED LANDSCAPES
<ul style="list-style-type: none">• Provide desirable species with proper cultural care.• Monitor regularly and frequently for weeds and keep written records of when different species appear.• Determine which weeds can be tolerated and when control is warranted.• Hand-pull or hoe weeds while they are seedlings.• Correctly maintain mulch.• Minimize any disturbance to the soil.• Use a preemergent herbicide or spot applications of a contact herbicide where appropriate.• Consider redesigning and replanting problem-prone landscapes.

DEVELOPING DIAGNOSTIC and DECISION MAKING SKILLS

The ability to accurately diagnose a wide range of plant problems can be developed over time by patient observation and consulting on reliable reference materials. Timely diagnosis of plant problems can help you keep your landscape and gardens beautiful and productive. It can also prevent expensive removal and replacement of damaged plants.

HOW TO BEGIN

1. Keep an open mind. Do not jump to conclusions.
2. Avoid assigning “guilt by association”. The insect, animal or disease observed may not be the cause of the problem or the symptoms.
3. A “history-taking” of the problem plant is very useful. Extreme weather, site alteration, grade changes, fertilizer, pesticide and herbicide use, cultural practices, etc. all influence a plant’s relative health over time. Once mature trees begin to decline, there is often no way to reverse the process. White pines and oaks are common examples of plants which are difficult to rejuvenate after decline symptoms begin.
4. Consider all the factors that influence the plant’s growth and health. Take the time to look under leaves, and when possible at the roots, for potential causal factors.
5. Know what your plant should look like. Knowledge of general growth rates, leaf size and coloration may help alert you to early signs of trouble.
6. At least one half of all observed landscape problems are not caused by insects or diseases. Try to eliminate other causal factors first.
7. A particular problem may be caused by several factors: soil drainage, extreme weather from previous years, air pollution, pests, diseases, herbicide drift, etc.
8. The symptom may indicate a problem in a different part of the plant. For example, leaf yellowing and scorching may be caused by root damage.
9. There is a great variation in the expected life-span of landscape plants. All plants go through periods of growth, maturity and decline. Plants grown in urban conditions generally have shorter lives.
10. Many pests and diseases are plant-specific. Symptoms affecting more than one plant species may indicate cultural and environmental problems.
11. There is no substitute for “hands on” training, particularly with an experienced individual.

EXAMINING THE PLANT

1. Look at the area surrounding the problem plant. Consider factors such as: exposure to elements, proximity to roads or buildings, lighting conditions, drainage, etc.
2. Look for physical evidence of a problem: injury, changes in site conditions, soil compaction, construction injury, lawnmower injury, insects, diseases, etc.
3. Examine all parts of the plant closely and carefully, including roots, shoots, trunk and leaf undersides (use a hand lens if necessary). Look for a pattern to the injury.

4. Physical evidence of a pest includes: the pest itself, shed skins, droppings or frass, webbing, honeydew, sooty mold, pitch, gummosis, galls, slime trails, etc. Evidence of diseases includes: mushrooms, fungal growths, galls, white, orange or black powdery substances, leaf spots, water-soaked areas, cankers, discolored stem and root tissue.
5. Identify the pest, disease or problem. This is critical to making a control decision. Identification of the plant is also critical to control decisions. Some plants can tolerate more damage than others.

HOW TO DECIDE WHEN TO TAKE ACTION AGAINST A PEST, DISEASE, OR ENVIRONMENTAL PROBLEM

1. In general 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 older or mature plants. For environmental problems, the site and/or cultural conditions may need to be modified to correct the problem.
2. Judgments may be based on aesthetics, or economic (yield) loss. Realistic thresholds should be set for insects and diseases. Pest or disease progression should be monitored carefully. **It is very important to identify the pest or disease and become familiar with its life cycle.** Some pests and diseases may not require control. For example, gypsy moth should be controlled, because oaks suffer from early defoliation, and use up energy reserves to refoliate. Eastern tent caterpillar occurs early enough in the season for cherry trees to refoliate without causing harm to the tree. **Often by the time disease or insect damage is observed, it is too late to do anything about the problem until next season.**
3. 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. Examples include locust leafminer on locust, and anthracnose on sycamore.
4. Once you have identified the problem and determine that it requires corrective action, select a control strategy. Always select the least toxic solutions first such as physical (hand removal, change watering practices, pruning out damage, etc.) and biological (encourage beneficials, release predatory mites, etc.). Pesticides should be used selectively (spot treatments) with the least toxic materials (B.t., insecticidal soaps, horticultural oils, etc.) used first.
5. Continue to monitor the plant's health after treating a problem to determine if further action is needed.

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Artwork: John Davidson, Professor Emeritus, Department of Entomology, University of Maryland, College Park and U.S.D.A.

Summary of weed IPM table from: Dreistadt, S. H. and M. L. Flint. 1994. **Pests of Landscape Trees and Shrubs.** Publication 3359. University of California, Division of Agriculture and Natural Resources. Oakland, CA. 327 pp. Used with permission from the University of California, Division of Agriculture and Natural Resources.

Protect the Bay Use Pesticides and Fertilizers Wisely

**ALWAYS READ THE
PESTICIDE LABEL AND
FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS.**

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