Integrated Pest Management

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UC Master Gardener Program
El Dorado County

What Is Integrated Pest Management (IPM)?

- A systematic, ecosystem-based approach to manage pest problems using least-toxic methods which include biological, cultural, mechanical and/or chemical methods
- Goal: Minimize impact on non-target organisms, the environment & humans

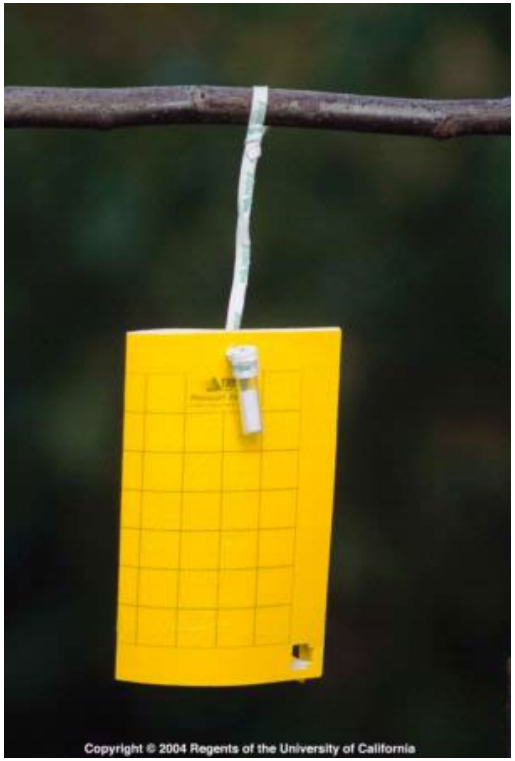
Advantages of IPM

- A more sustainable, precise & effective pest management strategy
- Focus on long-term prevention of pests & their damage
- A better understanding of your garden pests
- Elimination of unnecessary pesticide use

Using An IPM Program In Your Garden

- **Monitor** your garden on a regular basis
- **Identify the problem** Insect? Disease? Climate? Irrigation practices?
- **Know** your tolerance level
- **Decide** on appropriate management of problem starting with least toxic method
- **Evaluate** the results

Monitoring



The backbone of any IPM program

Management Methods

- Prevention
- Non-chemical
- Chemical

Prevention

- Plant resistant varieties
- Use good sanitary practices
- Use proper cultural practices

Non-Chemical Control Options

- Cultural control
- Mechanical control
- Environmental control
- Biological control

Cultural

- Use resistant varieties of plants
- Practice crop rotation
- Use fertilizers & water properly
- Change planting time
- Incorporate plant diversity
- Garden cleanup

Mechanical

- Mulching
- Weeding
- Proper pruning
- Mowing
- Preventive devices
- Handpick insects
- Wash plants
- Traps
- Painting tree trunks

Environmental

- Keep foliage dry
- Soil sterilization
- Light traps (questionable value)

Biological

- Introduction of parasites & predatory organisms
- Encourage & conserve beneficial insects
- Exclude ants

Chemical Control Options

- The last resort!
- Applying right pesticide at right time (selective better than broad-spectrum)

Pesticides

- **Always read & follow instructions on the label**
- **It is against the law to mix or apply pesticides in any manner not prescribed by manufacturer**
- **Properly dispose of pesticides**
  Where? Management Transfer Station (county dump Fridays & Saturdays from 9 – 3; call 642-0731 for more info)

Types Of Pesticides

- **Microbials *:** Bt (*Bacillus thuringiensis*)
- **Insecticidal soaps *:** Safer®, Spinosad
- **Horticultural oils ***: Dormant season, in-season
- **Botanicals *:** Neem, pyrethrin
- **Inorganics:** Substances refined from minerals (sulfur and copper)
- **Synthetics:** Permethrins, organophosphates, carbamates, pyrethroids

* least toxic

Pesticide Label Warnings

Highly Toxic > ..... < **least Toxic**

Category I	Category II	Category III	Category IV
"danger"	"warning"	"caution"	"caution"

Personal Protective Equipment

- When using pesticides, always read the label first
- Wear protective glasses, clothing & gloves
- Avoid splashing into eyes, onto skin or clothes, or inhaling the product

Pesticide Selection

When purchasing pesticides, consider:

- Specificity of pesticide
- Toxicity
- Persistence
- Timing & method of application

A Note About "Neonics"

- Neonicotinoids are insecticides containing synthetic derivatives of the natural plant alkaloid, nicotine
- Neonics disrupt the nervous systems of insects; because of differences in nervous systems between invertebrates and vertebrates, they are much less toxic to humans, other animals, birds & fish

A Note About "Neonics"

- Developed in the late 1980's, neonics were the first new class of insecticides in 50+ years
- Imidacloprid is now the most widely used insecticide in the world
- High water-solubility means neonics can be applied as a seed coating or as a drench to soil & tree trunks, and taken up by plants and distributed to all plant parts

A Note About "Neonics"

- Although seed, soil & trunk applications reduce the risk to non-target organisms by direct application & drift, the active ingredients can be translocated throughout the plant to pollen & nectar, upon which many beneficial insects feed
- Because of their high water-solubility, neonics can also end up in surface waters

Insects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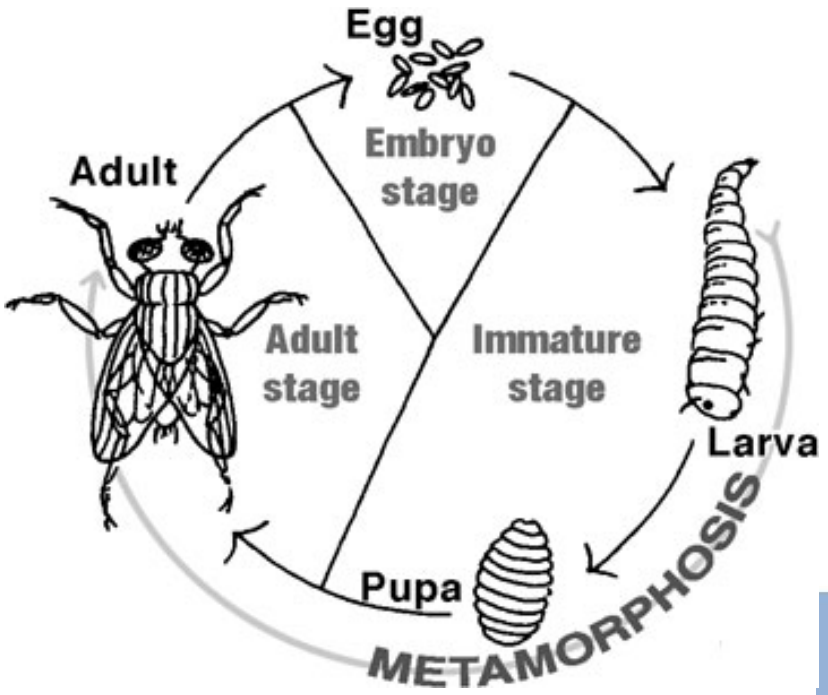
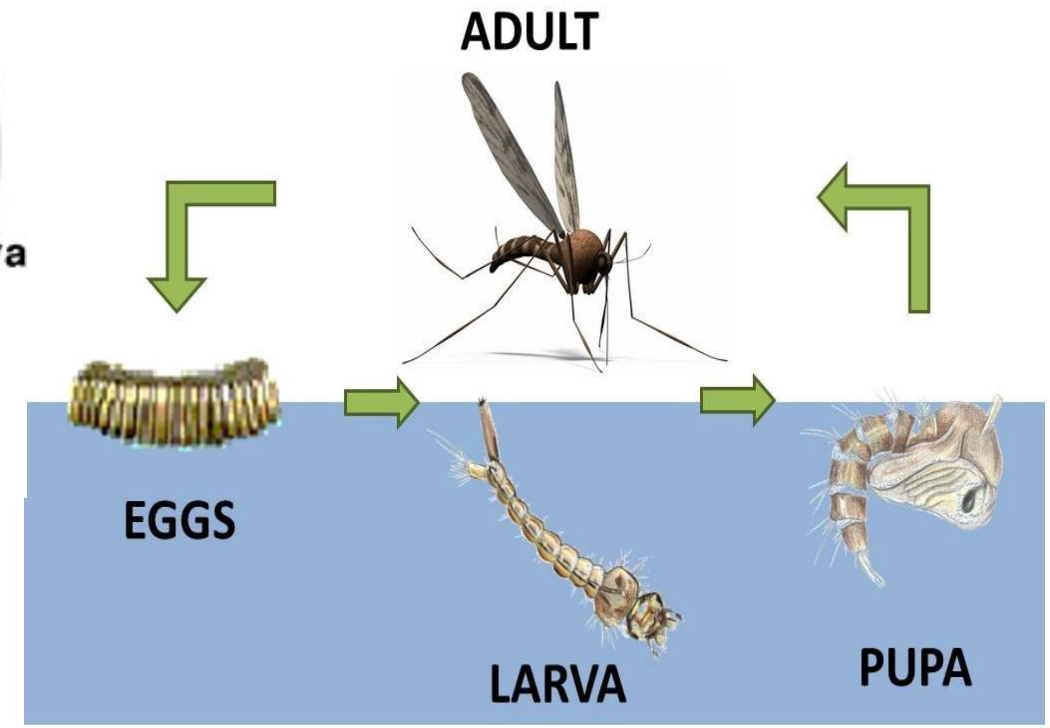
Stages of Insect Development





"Good" vs. "Bad" Bugs

Good:

- ***Beneficials*** pollinate flowers

- ***Natural enemies*** attack & eat other insects, or are parasites that lay their eggs on or in other insects

Bad:

Considered pests because they damage or consume plants; even bad bugs have their place in the garden

Good Bugs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most spiders

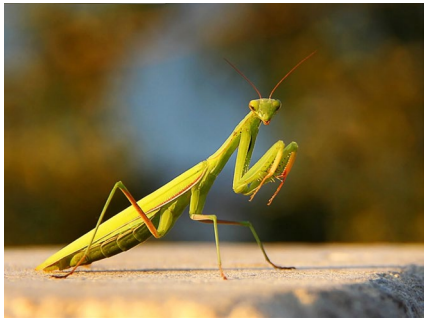
green lacewing

assassin bug

pirate bug

lady beetle

parasitic wasp



praying mantis

adult syrphid or hover fly

Photos: *Pests of Landscape Trees and Shrubs*

Bad Bugs

Aphids

Color: Green, yellow, brown, red, black; pear-shaped

Damage: Decreased plant vigor; honeydew excretion; sooty mold

Control: Wash off with water spray; control ants; use insecticidal soap; don't over-fertilize with nitrogen

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Photos: www.ipm.ucdavis.edu

sticky honeydew

black sooty mold fungus

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Photos: www.insectimages.org

Earwigs

Color: Brown-black

Damage: Irregular holes chewed in leaves

Control: Cans filled with vegetable oil or beer; iron phosphate baits; clean garden area of debris

Photo: www.ipm.ucdavis.edu

Rose Curculio Weevil

Color: Red body, black snout

Damage: Circular holes in buds & stems

Control: Handpick adults; dispose of damaged buds & blossoms

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Photos: courtesy of Baldo Villegas

Armored Scales

Color: Varies

Damage: Extract plant fluids leading to reduced growth & vigor

Control: Horticultural oil is preferred management method

Photo: *Pests of Landscape Trees and Shrubs*

Soft Scales

Color: Varies

Damage: Phloem-sucking leading to decreased plant vigor; produce honeydew which can lead to black sooty mold

Control: Insecticidal soap, horticultural oil; pick off

Photo: Utah State University

Snails & Slugs

Damage: Eat entire leaves on larger plants & above-ground parts of seedlings; eat holes in ripening fruit; leave slime trails

Control: Handpick; copper bands around raised beds; diatomaceous earth around plants; iron phosphate baits

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Photos: Univ. of Minnesota Extension Service

Spider Mites

Description: Look like moving dots with naked eye, but 10x lens can ID them easily

Damage: Webbing on leaves; leaf stippling; yellowing leaves that eventually drop off

Control: Reduce dusty plant environment; adequate irrigation; insecticidal soap

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Photo: *Pests of the Garden and Small Farm*

Thrips

Description: Tiny, slender insects with fringed wings

Damage: Scarred or distorted leaves; discolored or scarred flowers and fruit

Control: Shake off affected plant parts; use blue sticky traps; horticultural oil; insecticidal soap

Photo: UC Statewide IPM Project

Tomato Hornworm

Description: Striping pattern on body; distinctive horn or at rear end; black droppings on ground

Damage: Consume entire leaves & small stems; may chew large holes in fruit

Control: Handpick and discard; snip in half; Bt on larvae

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Photos: UM Extension

Plant Diseases

Causes Of Plant Diseases

Fungi

- Anthracnose
- Black Spot
- Blight
- Downy Mildew
- Powdery Mildew
- Rust
- Wilt

Bacteria

- Fireblight
- Bacterial Blight
- Bacterial Gall

Viruses

- Tobacco Mosaic Virus
- Camellia Yellow Mottle Virus
- Cucumber Mosaic Virus

Fungal Diseases

Anthracnose

Description: Irregular spots & dead areas on leaves, often following leaf veins; affected tissue is often tan or brown

Management: Good garden cleanup of debris; copper-based fungicides sometimes helpful; prune out affected leaves

Photos: University of Florida

Black Spot

Description: Dark spots, feathery edges on upper leaf surfaces

Management: Avoid overhead watering; prune out & discard affected leaves; clean up ground debris

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Photos: courtesy of Baldo Villegas

Downy Mildew

Description: Upper side leaf develops white or yellow blotchy appearance, with leaf undersides developing a gray, fuzzy-looking mildew; leaves eventually fall off

Management: Clean up garden debris; fungicides are ineffective

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Photo: www.ipm.ucdavis.edu

Powdery Mildew

Description: Whitish-grey growth on leaves, shoots & buds; appears in dry weather conditions

Management: Avoid overhead watering; prune out affected plant parts; keep garden area free of debris

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Photo: www.ipm.ucdavis.edu

Rust

Description: Small, orange pustules on leaf undersides; l leaves may drop prematurely; favored by cool, moist weather

Management: Avoid overhead watering; prune out affected leaves; use of preventive fungicides sometimes effective; keep garden area clean

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Photo: courtesy of Baldo Villegas

Wilt

Fusarium Wilt

Verticillium Wilt

Description: Lives in soil & is carried by roots up into plant; plant starts looking sad & droops, with wilted leaves that no amount of water can revive

Management: No effective treatment; get rid of plant

Photo: www.ipm.ucdavis.edu

Bacterial Diseases

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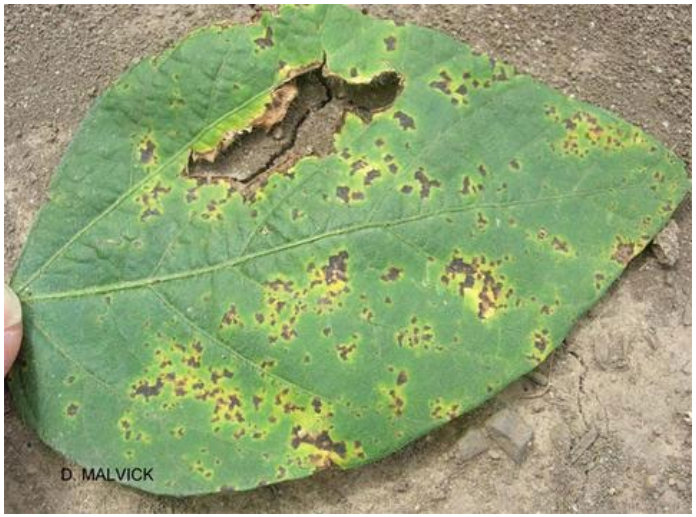
Fire Blight

Description: Watery, light tan ooze come from cankers on branches, twigs or trunks, eventually turning dark; dead, blackened leaves with stems resembling a "shepherd's hook"

Management: Prune out affected wood; sterilize pruners after each cut with 10:1 bleach/water solution; 0.5% Bordeaux mixture or other copper product applied several times as blossoms open may reduce new infections or those already existing

Photo: www.ipm.ucdavis.edu

Bacterial Blight



Description: Small, water-soaked spots, light green areas, on leaves; tissue center turns brown & dies

Management: Prune out infected plant parts during dry season; avoid overhead irrigation; bactericide applications not found to give reliable control

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Photo: www.ipm.ucdavis.edu

Bacterial Gall

Description: Galls at base of stem, root crown or other plant parts, infecting only through fresh wounds; bacterium lives in soil

Management: Heat; steam at 140° for 30 minutes or solarize soil; clean tools & surfaces that contact plant material with disinfectant

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Photo: UC IPM

Viruses

Tobacco Mosaic Virus

Description: Blotchy light & dark, mosaic-appearing areas on leaves with roughening, wrinkling & other growth distortions

Management: No cure once infected . . . dispose of plant; can live in soil up to 2 years

Photo: UC IPM

Tomato Spotted Wilt Virus

Description: Virus transmitted by thrips; chlorotic spots & blotches appear on ripe fruit

Management: No effective treatment other than plant-resistant varieties & control thrips; destroy affected plants

Photo: UC IPM

Abiotic Disorders

- Herbicide damage
- Nutrient deficiencies
- Applying chemicals when temperature too high or applying excessive amounts
- Soil compaction
- Watering too much or too little

Herbicide Damage

Rose

young almond tree

Symptoms: Distorted, stunted leaves

Causes: Aerial drift of herbicides; contaminated spray equipment

Remedies: Proper irrigation; time & patience

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Photos: NC Extension

Nitrogen Deficiency

Symptoms: Older leaves become yellow first, then pale lime-green coloration of entire plant

Causes: Excessive irrigation; putting large amounts of non-decomposed organic material into soil

Remedies: Apply nitrogen-containing fertilizers to soil

Photo: Iowa State Univ. Extension

Iron Deficiency

Symptoms: Interveinal chlorosis of young leaves; distinct narrow green veins

Causes: Soil conditions making iron unavailable to plants (soil pH above 7.0 & poorly drained soils)

Remedies: Apply chelated iron-containing fertilizers to soil; add organic soil amendments over time to lower pH

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Photo: *Abiotic Disorders of Landscape Plants, A Diagnostic Guide*

Blossom End Rot

Symptoms: Small, light brown spots at blossom end of immature fruit, gradually expanding into a sunken, leathery, brown or black lesion

Cause: Low levels of calcium in fruit; irregular watering

Remedies: Infrequent, deep irrigation to maintain uniform soil moisture; use mulch when summer turns hot & dry; incorporate lime into soil before planting

Photo: UC IPM

Sunburn

Symptoms: Drying & cracking of bark; red-brown necrotic leaf areas

Causes: High temperature & sun exposure; excessive pruning which leaves trunks exposed

Remedies: Paint tree trunks with 50/50 mixture of water & interior white latex paint; add shade when temperature is high

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Photo: *Abiotic Disorders of Landscape Plants, A Diagnostic Guide*

Soil Compaction

Symptoms: Slow plant growth; death of whole plant.

Causes: Decreased oxygen supply to roots; inability of soil to absorb nutrients or water

Remedies: Eliminate foot traffic, equipment traffic; add organic soil amendments over time

Photo: Placerville shopping area

Pop Quiz!

1. What is the first rule for successful pest management?

Pop Quiz!

2. Squish or protect?

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Pop Quiz!

3. In IPM, the least _____ method of pest control should be your first choice

Thanks for attending!

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