Integrated Pest Management

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Pat Trimble

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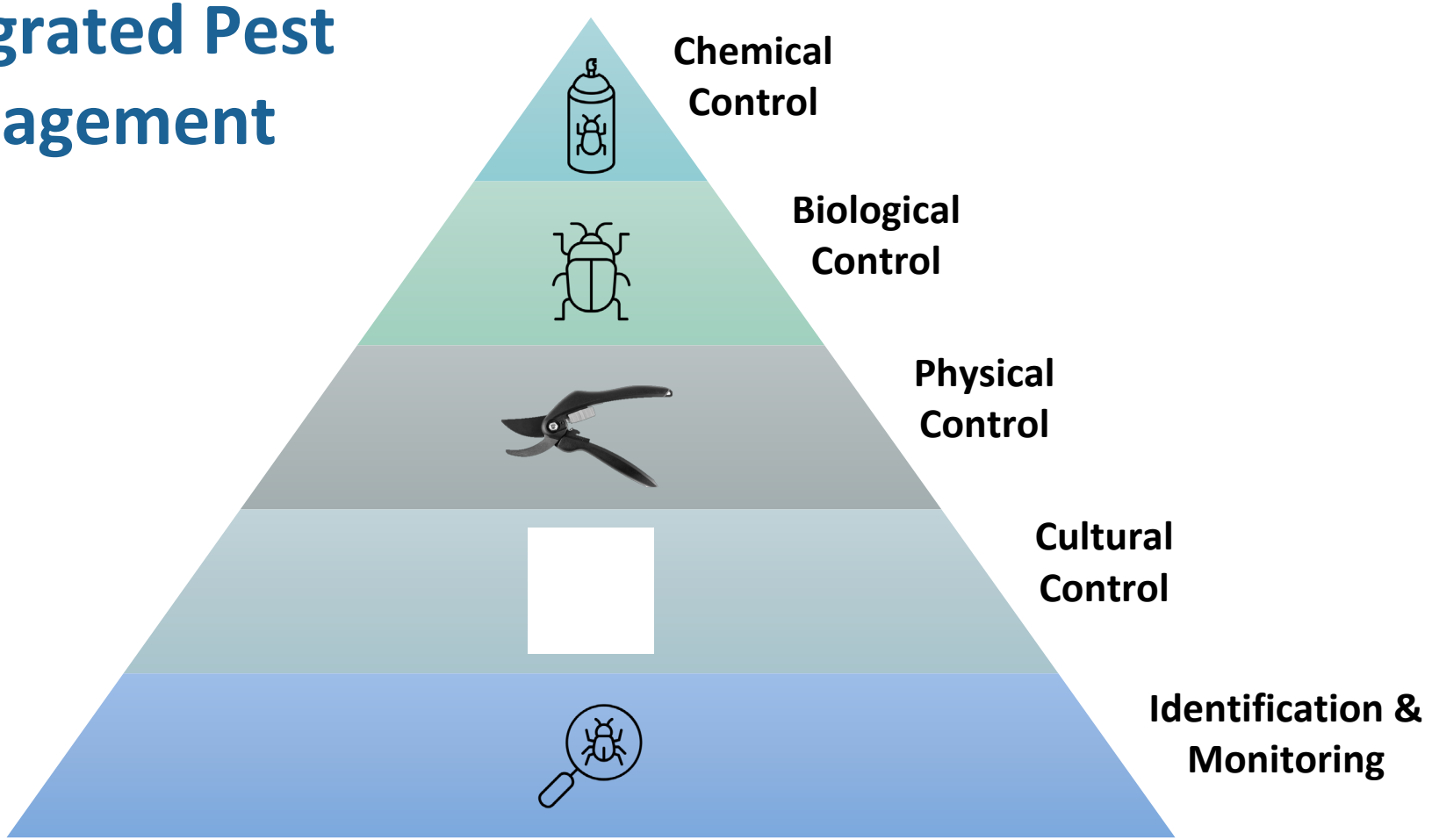
What Is IPM?

- A more sustainable way to manage pests
- Focuses on prevention of pests and their damage
- Scientific and ecosystem-based approach
- Reduces risks to people and the environment
- Combination of practices for long-term management

Components of Integrated Pest Management



What is a Pest?

Pests are...

Organisms that are annoying us or damaging our plants, structures, or person.

Pests are personal.
A pest to you, might be beautiful wildlife to me.

IPM ⟶ SPM

- In California, urban pesticide use accounts for 35-55% of pesticide sales, but 65-75% of pesticide-related illnesses.

- State agencies, the agriculture community, and community groups have developed a Roadmap for Sustainable Pest Management in California which aims to eliminate adverse human health effects and impacts to the environment associated with pesticide use, by 2050.

- Sustainable Pest Management gives broader consideration to human health and social equity, environmental protections, & economic vitality.

Using An IPM Program In Your Garden

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

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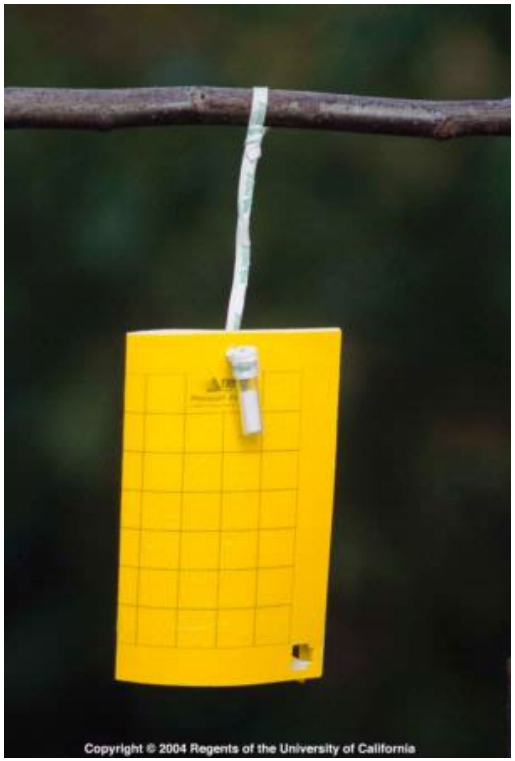
Monitoring



Monitoring is the backbone of any IPM program.

Non-Chemical Control Options

- Prevention
- Physical/Mechanical
- Cultural Practices
- Biological Control

Prevention

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

Prevent pests from invading

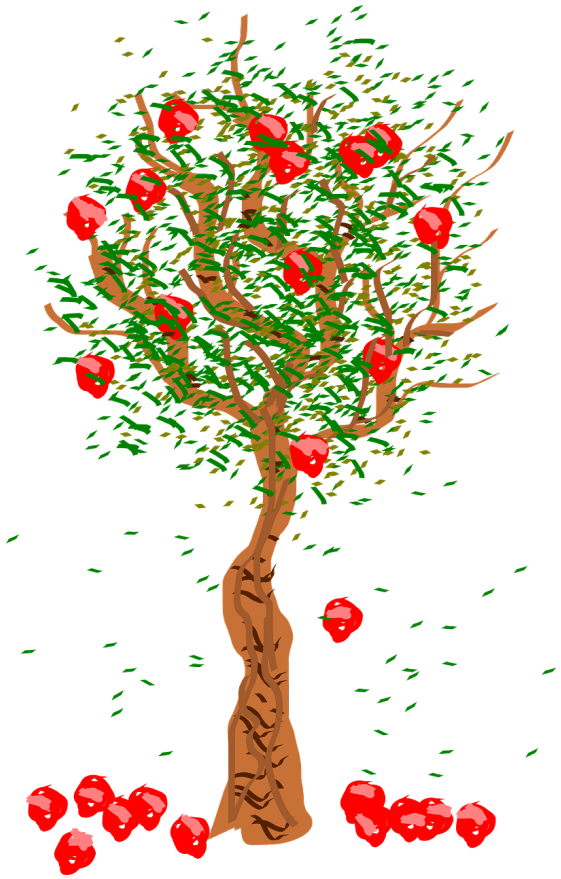
Indoors:

- Seal entry points
- Clean up spills
- Fix leaky pipes
- Seal attractive foods (sugar, pet food)
- Reduce clutter

Prevent pests from invading

Outdoors:

- Remove sources of food & water
- Use mulch & mow strips to reduce weeds
- Dispose of fallen fruit



Cultural Controls

- Use resistant varieties of plants
- Right plant – Right place
- Practice crop rotation
- Fertilize & water properly
- Change planting time
- Pruning
- Incorporate plant diversity
- Garden cleanup

Physical/Mechanical

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

Environmental

- Keep foliage dry
- Soil Solarization

Biological Control

Any activity of one species that reduces the adverse effects of another

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

Pop Quiz !

What is the first rule for successful pest management?

Chemical Control Options

- The last resort!

- Apply the right pesticide at the 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 all unused pesticides, those past expiration date, those without labels and/or empty containers (Where? Waste Management Transfer Station (county dump) Friday-Sunday, from 9 - 4. Call 642-0731 for more info.)

Classification Of Pesticides

- By the target pest
- By the effect on the pest
- By the way the active ingredient reaches the pest
- By how selective the pesticide is
- By how long the pesticide persists (or how quickly it degrades)
- By risk

Types Of Pesticides

Based on the source of the active ingredient

- Microbials *: Bt (*Bacillus thuringiensis*), Spinosad
- Insecticidal soaps *: Safer®
- 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.
- ✓ Always wash your hands after handling pesticides before eating or drinking.

Pesticide Selection

When purchasing pesticides, consider:

- Specificity of pesticide
- Toxicity
- Persistence
- Timing and method of application
- Amount needed

Pop Quiz !

What are the routes of entry by which people may be exposed to pesticides?

Insects


UC Statewide IPM Project
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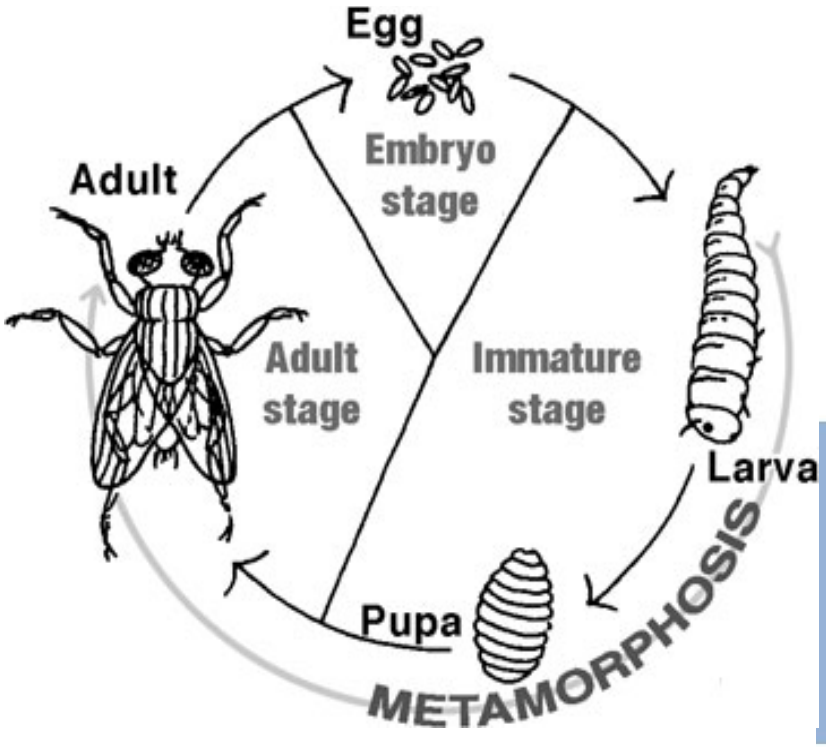
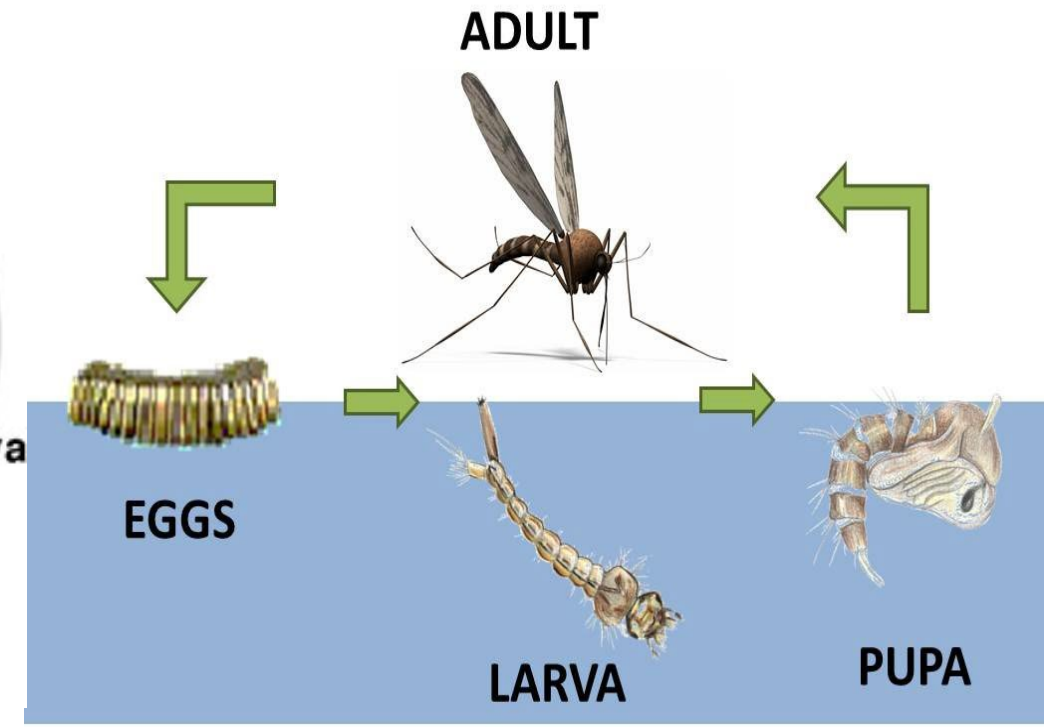
Stages of Insect Development

Complete Metamorphosis





Stages Of Insect Development

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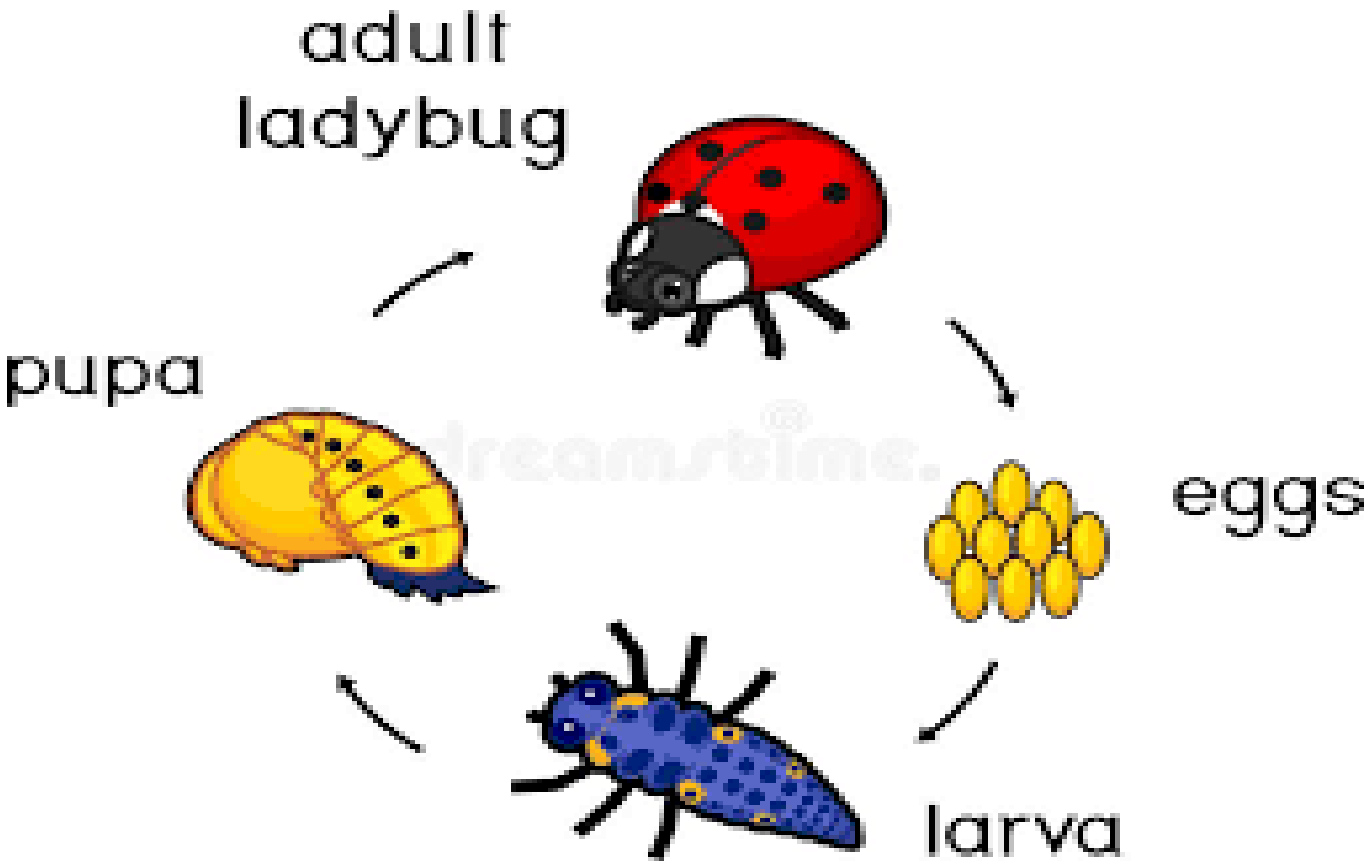

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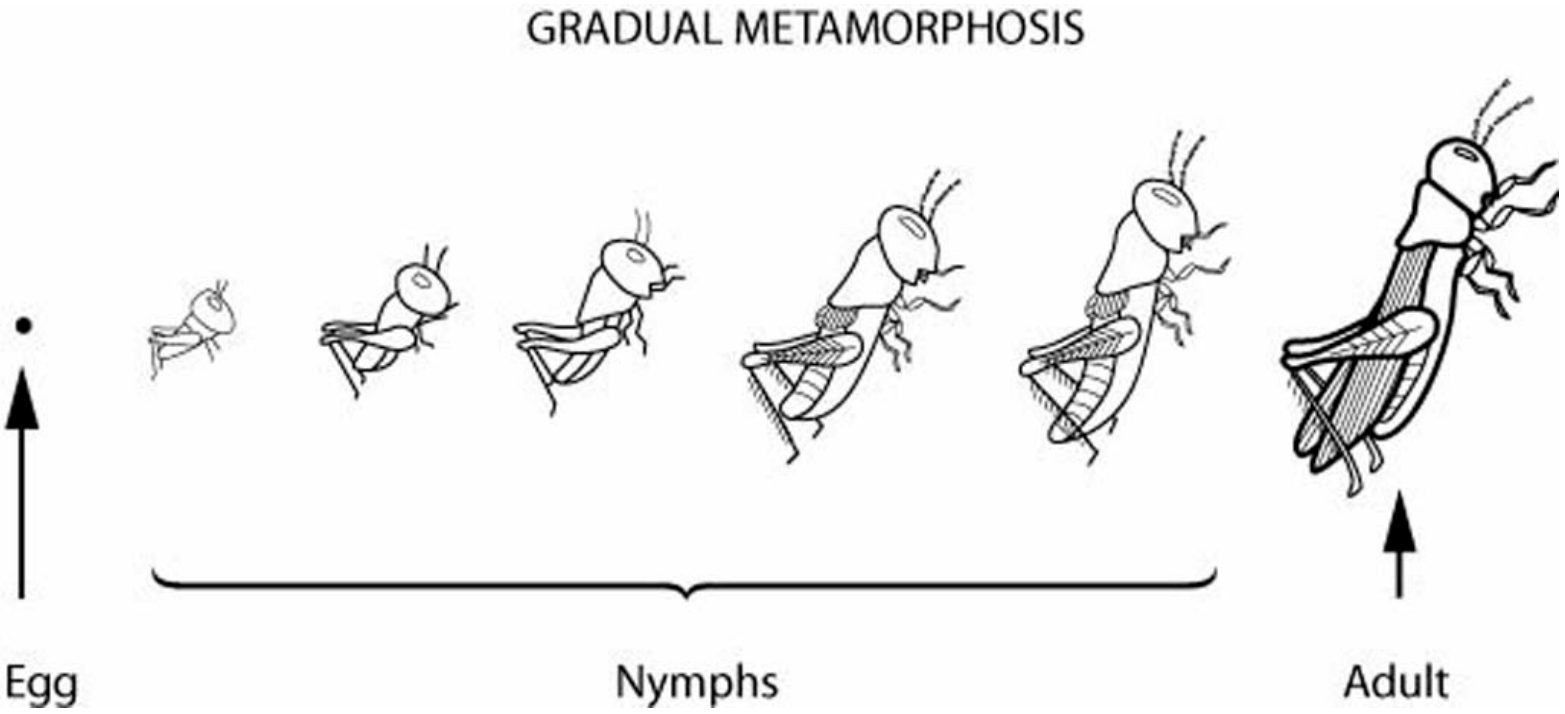
Stages Of Insect Development



"Good" Vs. "Bad" Bugs

Good:

- ***Beneficials*** pollinate flowers

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

Bad:

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

Pop Quiz !

Squish or protect?

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Good Bugs

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most spiders

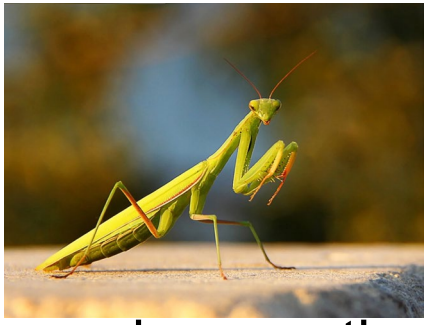
green lacewing

assassin bug

pirate bug

lady beetle

parasitic wasp



praying mantis

adult syrphid or hover fly

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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

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Photo: www.ipm.ucdavis.edu

Rose Curculio Weevil

Color: Red body with 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

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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; cans filled with vegetable oil or beer

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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: *Pests of the Garden and Small Farm*

Tomato Hornworm

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

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

Management: Handpick and discard; snip in half; Bt is effective on larvae

Photo: www.nationalgardening.com

Pop Quiz !

What is your favorite way to get rid of tomato hornworms?

Plant Diseases

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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 the leaf veins; affected tissue is often tan or brown

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

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Photos: University of Florida

Black Spot

Description: Dark spots, feathery edges appear on upper leaf surfaces

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

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Photos: courtesy of Baldo Villegas

Downy Mildew

Description: Upper side of the 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, especially in winter; fungicides are ineffective

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Photo: www.ipm.ucdavis.edu

Powdery Mildew

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

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

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Photo: www.ipm.ucdavis.edu

Rust

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

Management: Avoid overhead watering; prune out & discard 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

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Photo: www.ipm.ucdavis.edu

Pop Quiz !

What do you call the group of chemicals used to kill weeds?

Bacterial Diseases

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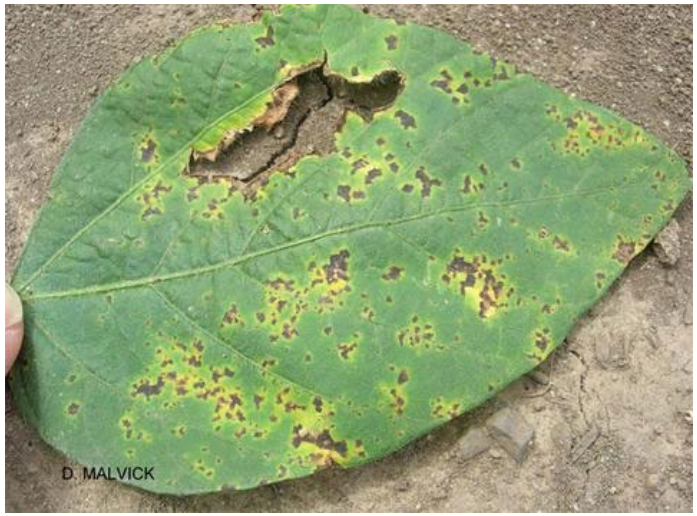
Fire Blight

Description: In spring, watery, light tan ooze coming from cankers on branches, twigs or trunks, eventually turning dark; dead, blackened leaves & fruit cling to branches

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, but not eliminate, new or existing infections

Photo: www.ipm.ucdavis.edu

Bacterial Blight



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

Management: Prune out & dispose of 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 the base of stem, root crown or other plant parts, infecting only through fresh wounds; bacterium lives in soil

Management: Solarize soil; clean tools & surfaces that contact plant material with disinfectant solution

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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

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

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Photo: UC IPM

Sunburn

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

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

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

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

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Photo: Placerville shopping area

Pop Quiz !

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

Reading Pesticide Labels

- Active Ingredient
- Signal word
- Personal protective equipment (PPE)
- Non-target organisms?
- Formulation
- Concentrate or Ready to use
- Application rate

Reading Pesticide Labels

- List of plants this product can be used on
- Restrictions by season or weather
- Length of time after application to harvest

Useful References

- https://ipm.ucanr.edu/#gsc.tab=0
- https://apps.cdpr.ca.gov/docs/label/labelque.cfm
- https://ipm.ucanr.edu/home-and-landscape/pesticide-active-ingredients-database/#gsc.tab=0
- https://npic.orst.edu/

Thanks for attending!

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