

## Integrated Pest Management



Claudia Groth  
MG Program Instructor  
claudia.groth.us@gmail.com



## Problems *will* come up!

There is no silver bullet  
Gardening is a process

## Integrated Pest Management

How did we get here?



## The Focus of IPM

- Prevention and management
- The individual gardener and garden
- Human health and the environment
- Available, research-based information
- All pest management strategies

## The Heart of IPM

- Good gardening practices
- Observation
- Identification
- Gardener's Tolerance
- Management Choices
- Evaluate

## Good Garden Practices Prevent Problems

- Taking care of the soil
  - Tilth, drainage, pH, fertility
- Right plant; right place
  - Bananas? Really?
- Water use and conservation
  - Irrigation planning

## This is not soil preparation!



## Right Place??



## Zonal Denial



## Start at the Nursery



Avoid pot-bound plants (unless they're really a bargain!)

## Planting the Plants

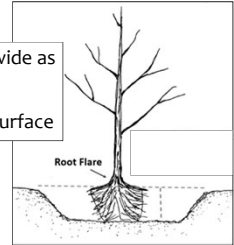
- Improper planting = stressed plants
- Beware compacted soils
- Improve drainage

Better to plant a 50¢ plant in a \$5 hole than a \$5 plant in a 50¢ hole



## The \$5 hole

- 2 - 3 times as wide as the root ball
- Root flare at surface



## Watering



## Preventing Problems

- Resources -

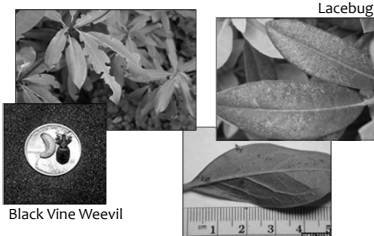


## Be Observe-y

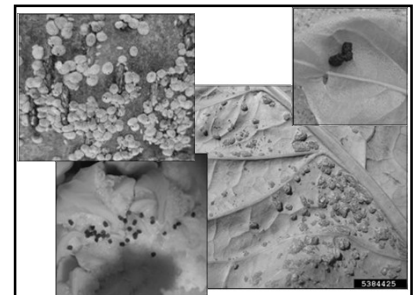
- Monitor Your Garden -

- Catch problems in their early stages
- Adjust plans and plantings
- Apply controls at the optimal time
- Look for pests and their damage
- Keep a garden journal
- Look for beneficial organisms, too

## Observation



## What do you observe?





### Sticky Traps

Aphids, thrips, whiteflies, spider mites

### Shelter Traps

Board Trap

Beer Bait

### Feeding Traps

- Apple Maggot Trap
- Color and apple scent
- Tuna for yellow jackets
- Cider vinegar for fungus gnats
- "Trap crops"

### Mating Traps

- Codling moth
- Thrips
- Gypsy moths
- Flour moths

### Aphid mummies

UC Statewide 1994 Project  
© 2005 Regents, University of California

### Monitoring Your Garden

- Resources -

- OSU Extension Garden Calendar  
– google: OSU garden calendar
- Robin Rosetta (insects):  
– OSU Nursery Extension, Research and Education (Facebook and Twitter)
- Jay Pscheidt (disease):  
– PNW Plant Disease Management (Facebook)
- Plant Clinic Monthly highlights  
– google: "OSU plant clinic year"
- MG plant clinic phone records

### Identifying the Problem

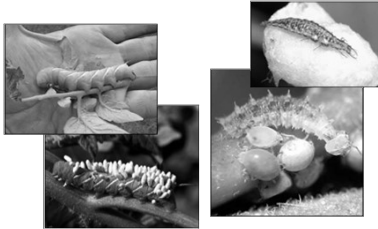
*Cryptomeria japonica* 'Miyazaki'

### Identifying the Problem

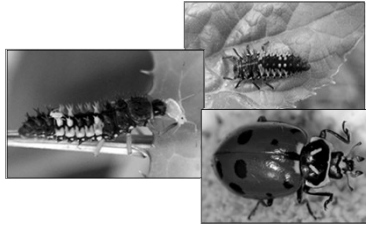
Gold Dust Plant

Xenosia CC BY-SA 3.0

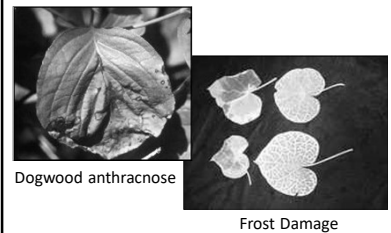
It's an insect, but ...



It's an insect, but ...



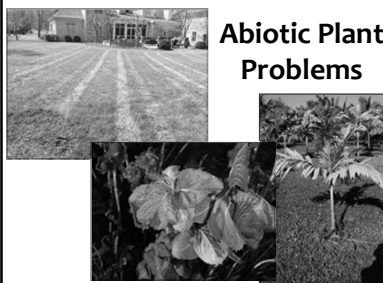
It's a problem, but ...



Dogwood anthracnose

Frost Damage

### Abiotic Plant Problems



### Abiotic Plant Problems

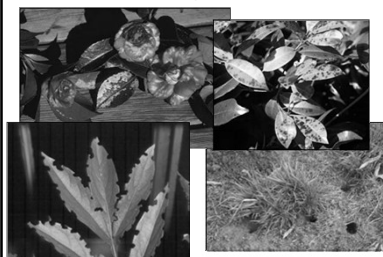


### Abiotic Plant Problems

- Weather
- Poor growing conditions
- Mechanical damage
- Nutrient deficiency or toxicity
- Pesticides

Abiotic factors also make plants more susceptible to pests and diseases

### Biotic (Living) Plant Pests



### Sucking Insect Damage

- true bugs, thrips, spider mites, aphids -

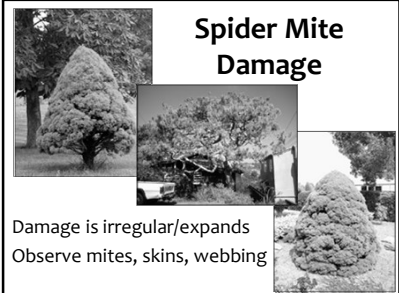


Thrips

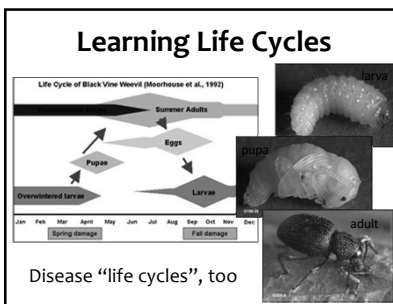
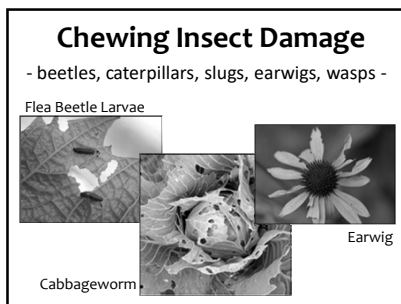
Aphids

Spider Mites

### Spider Mite Damage



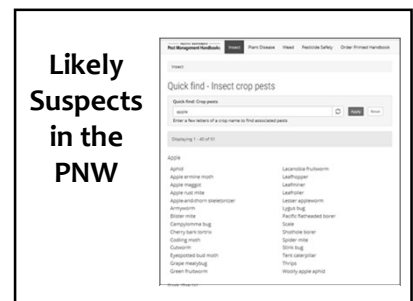
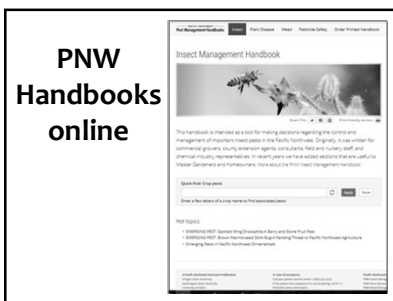
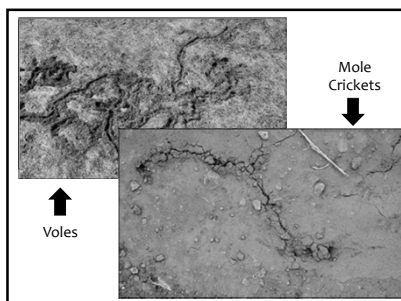
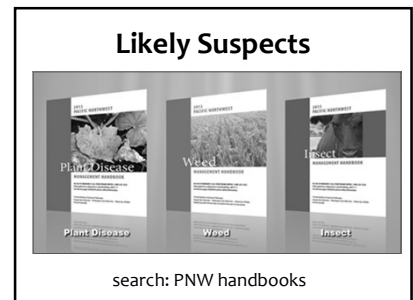
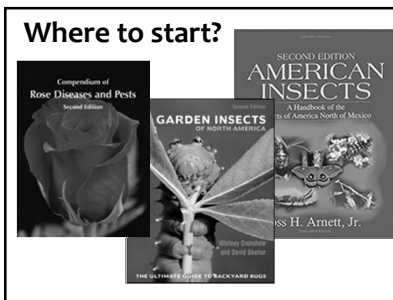
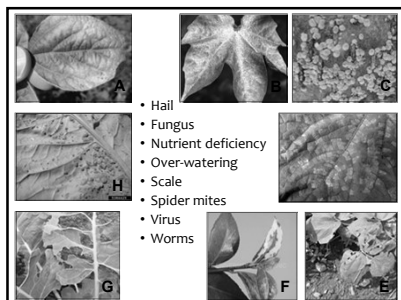
Damage is irregular/expands  
Observe mites, skins, webbing



### Practice Makes Perfect

- Look for patterns
- Observe where damage occurs
- Examine plant for signs of pests

Likely cause of damage??



- Description
- Photos
- Life cycle
- Controls



## Identification

- Resources -

- PNW Guides (books and website)
  - Insects
  - Diseases
- WSU Landscape Plant Problems
- Other resources in MG offices



## The Gardener's Tolerance

- Action? No Action? -

Take into account ...

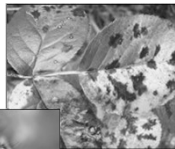
- pest characteristics
- value of plants
- time constraints
- cost of treatment
- impacts of available controls
- personal gardening philosophy

## Action Threshold

Wolf Spider



Jumping Spider



Black Spot

## Giant Willow Aphid

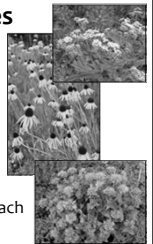


## Manage Using All Available Strategies

Cultural  
Physical  
Biological  
Chemical

Least Impact

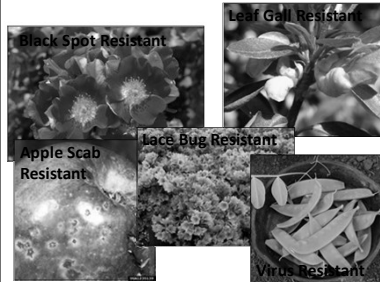
Most Impact



Use the least hazardous approach  
– but one that will WORK

## Cultural Controls

Right Plant – Right Place



## Garden Sanitation

- Reduce
  - Breeding sites
  - Shelter
  - Over-wintering sites



## All the things we talked about in prevention

Those are cultural controls:

- Choosing high quality plants and seeds
- Correct planting - technique/timing
- Understanding the plant needs
- Watering with growth and season

## Physical Controls

- Direct Intervention -

- Prevent and Control Infestations -



## Exclude Pests



## Handpicking

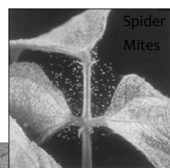


## Pruning

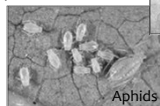


Tent caterpillars

## Water Sprays



Spider Mites



Aphids

Spray regularly to prevent return

## Surface Tilling



Weeds, slugs, garden symphylans

## Traps



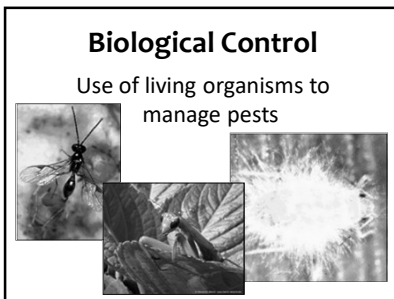
## Doing nothing!

Why this works




## Biological Control


Use of living organisms to manage pests



### Notable Successes



Cottony cushion scale  
—Vedalia beetle



Tansy ragwort  
— Cinnabar moth  
— Tansy flea beetle






Photo: public domain AG  
Photo: L. Lawrence LC 01-04 510  
Photo: L. Lawrence LC 01-04 510

### Design for Diversity



- Yards with lawns  
— 4 species
- Low water-use plants  
—10 species



- Urban desert parks  
— 12 species
- Natural desert areas  
— 18 species

### Conservation Biological Control

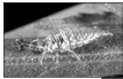
Complex landscapes suppressed azalea lace bug infestations (Shrewsbury and Raupp 2006)

More web-building sites for spiders








### Who Are They?



### What Are They Doing?







### Natural Enemies

Insect Predators	Insect Parasitoids	
—Hunt and kill prey	—Lay eggs in prey	
<ul style="list-style-type: none"> <li>• Beetles</li> <li>• Spiders</li> <li>• Mites</li> <li>• Wasps</li> </ul>	<ul style="list-style-type: none"> <li>• Flies</li> <li>• Microbes</li> <li>• Springtails</li> <li>• Nematodes</li> </ul>	<ul style="list-style-type: none"> <li>• Birds</li> <li>• Bats</li> <li>• Toads/frogs</li> </ul>

### Ground Beetles

- Attack
  - caterpillars, snails, slugs, other soft insects: aphids, beetle larvae, rootworms

ARKIVE  
© E. J. Benstead

### Lacewings

- Attack
  - mealybugs, whiteflies, caterpillars, leafhoppers, thrips, scale



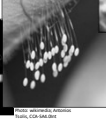
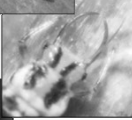







Photo: Claudio G. Smith  
Photo: Michael J. Krombein  
Photo: Michael J. Krombein  
Photo: Michael J. Krombein

### Wasps




- Thread-waist—yellow jackets, hornets  
—caterpillars, beetles
- Parasitic wasps  
—cutworms, hornworms, beetles, corn earworm, leafrollers, prey eggs

Agda Horticulture, tamu.edu

### Bringing the Bugs Home

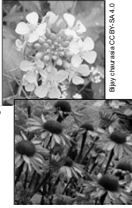
- Food
  - For all life stages
- Shelter
  - Summer and winter
- Protection from Pesticides
  - Toxic to pests and beneficials



### Building the Insectary

- Small insects have small mouthparts
  - Need shallow flowers
  - Single vs. double flowers
- Diversity of plants
  - Include natives for natives
  - Continuous bloom
  - Multiple colors
  - Shrubs – Trees – Flowers

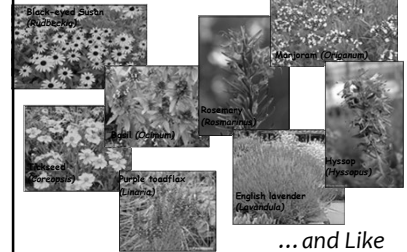


### The Basic Insectary

- Carrot family
- Mustard family
- Aster family
- Bunch grasses



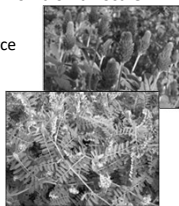
### Use Plants You Know ...



... and Like

### Cover Crops Count

- Multiple benefits - even on a small scale
  - Brings in beneficials
  - Immediate nectar source
  - Refuge
- Legumes, grasses, brassicas, buckwheat, crimson clover, etc.



### More Shelter Options

- Mulch with composts, fall leaves
- Leave harvested plants for shelter
- Plant a bit higher (drier)
- Bunch grasses/thick crowns
- Untilled ground



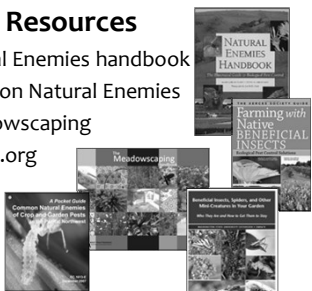
### Upscale Shelter

Insect hotels



### Resources

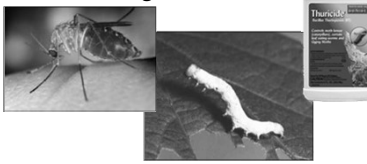
Natural Enemies handbook  
Common Natural Enemies  
Meadowscaping  
Xerces.org



### Biological ↔ Chemical Control

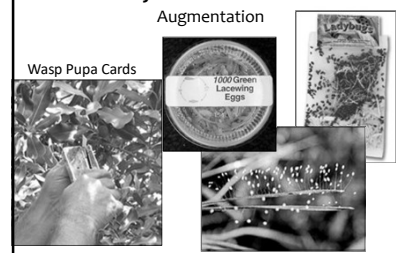
#### Beneficial microorganisms

Bacillus thuringiensis or B.t.



### Buy and Release

Augmentation



## Nematodes

- Fungus gnats
- Thrips
- Leaf miners
- Root maggots
- Root weevils
- Cutworms/army worms
- Fleas/other lawn pests



<http://nematode.uill.edu>

## Spinosad Insect Control



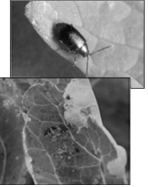
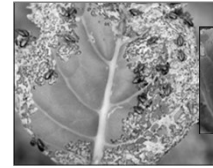
**Bacillus subtilis**  
Disease Control



## Case Study

Flea beetles on broccoli

What can we do?



## Flea beetles on broccoli

- Waxy-leaved varieties more tolerant
- Overwinter in trash and debris
- Active in late March through May
- Active again in July/August
- Young plants (< 8 leaves) most susceptible
- Most severe in hot, dry weather



## Flea beetles on broccoli

- **Physical/Cultural**
  - Delay seeding, plant starts, row covers, reflective mulch, trap crops, sanitation, resistant varieties
- **Biological**
  - Predatory nematodes
- **Chemical**
  - PNW Insect Management Handbook

## Blossom End Rot



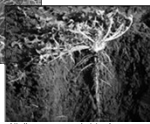
Scott Nelson, Flickr.com

Debra Holmes, California Polytechnic State University, Bugwood.org

## Dandelions in lawn



Copyright 2002, University of Illinois



<http://lawn-www.agron.uillinois.edu>

## Azalea Lace Bug

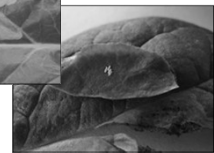


© Robin Rosetta

## Leafminers in vegetables



© Iowa.edu/pestmanagement



Lyndon Porter, USDA-ARS

## Apple Scab



## Chemical Control and IPM

- Re-design
  - correct landscape design issues
- Reduce
  - spray only when needed
- Replace
  - use less toxic alternatives first

## MGs do not recommend homemade solutions!

- Alcohol/whiskey
- Shampoo
- Cleaning agents
- Sudsing agents
- Stabilizing agents
- Colorants
- Perfumes
- Botanical oils



## Chemical Control Products

- natural origin -  
- synthetic origin -



## Minimizing Pesticide Problems

### - Best Practices -

- Always read the label, follow directions
- Spot treat, rather than broadcast
- Wear protective clothing and eyewear
- Dispose of properly

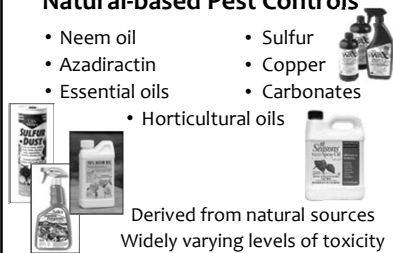
## Minimizing Pesticide Problems

### - Best Practices -

- Narrow-spectrum products
- Targeted applications
  - Just the pests – just that problem
- Avoid spraying soil – beneficials
- Non-blooming areas/times
- Most insects active in daylight

## Natural-based Pest Controls

- Neem oil
- Azadiractin
- Essential oils
- Sulfur
- Copper
- Carbonates
- Horticultural oils



Derived from natural sources  
Widely varying levels of toxicity

## Synthetic Pest Controls

- Broad-spectrum vs. narrow-spectrum
- Concentrates vs. ready-to-use
- Wide range of toxicity
- Systemic vs. contact
- Combinations



## PNW Handbooks

### Management-biological control

Biological control can assist significantly in the control of imported cabbageworm. Important parasites include the pupal, larval, and egg parasites in the Trichogramma genus, as well as tachinid flies. Timely mass releases of commercially available Trichogramma during peak flight can be an effective control agent. Viruses and bacterial diseases are also sometimes important control factors in the field. If possible, use *Bacillus thuringiensis* to avoid adverse impact on natural enemies. *Bacillus thuringiensis* is very effective against imported cabbageworm, especially when applied to young, newly hatched caterpillars.

### Management-cultural control

Thorough cleaning of fields such as Mammoth Red Root, Chiefman Savoy, and Savoy Perfection Drumhead provides some protection, but not complete control. Make new plantings as far as possible from those of the previous year. At the end of the year, harvest crops without delay. Plowing under or destroying plant residues at this time eliminates an important source of overwintering generation of cabbageworms.

### Management-chemical control: MOME USE

- *Bacillus thuringiensis* var. *kurstaki* (Bt) Some formulations are OMRI-listed for organic use.
- Insecticides
- Carbaryl

## Choosing Chemical Controls

Management-chemical control: HOME USE

Apply first in early July.

- acetamiprid
- carbaryl
- esfenvalerate
- gamma-cyhalothrin
- kaolin clay-Applied as a spray to leaves, stems, and fruit, it acts as a repellent to some insect pests. Some formulations are OMRI-listed for organic use.
- malathion
- pyrethrins-Some formulations are OMRI-listed for organic use.

Organic

Organic

## Printed Handbooks

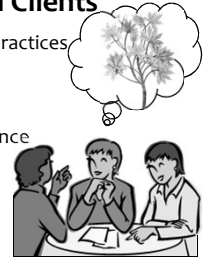
- Rally 40 WSP at 5 to 8 oz/A, depending on tree size, plus another fungicide. Do not apply within 14 days of harvest. Group 3 fungicide, 24-hr reentry.
- Blue Lime Sulfur Solution (BPS) at 1.5 to 2 gal/100 gal water through bloom then 0.5 gal/100 gal water for cover sprays. May injure fruit on 'Delicious' apples and is not for use on 'Ginger Gold'. 48-hr reentry (2).
- Scala SC at 7 to 10 fl oz/A alone or at 5 to 10 fl oz/A when tank mixed with another fungicide active against apple. Do not use at any time in the orchard if your packing house uses Punstone pasteurized wax. Do not apply within 7 days of harvest. Effectiveness rated as fair. Group 9 fungicide, 48-hr reentry.
- Sereas at 2.2 to 6.4 gal/A. Use as a protectant fungicide and not curatively. Do not use within 30 days of harvest. Injury may occur to some sweet cherries, such as 'Van', if accidentally sprayed. Group 11 fungicide, 12-hr reentry.
- Spectracide Imidazole at 0.67 fl oz/gal water. Do not use within 2 weeks of harvest. Do not apply more than 10 times per season. (3)
- Silt FL at 2.5 pints/A plus another fungicide. Do not apply more than two (2) applications or after pink bud. Some cultivars may become if used during bloom or freezing conditions. Group 12 fungicide, 48-hr reentry.
- Trifloxystrobin-based fungicides are registered. Do not use within 75 days of harvest. Group 3 fungicide, 3-day reentry.

Organic

Homeowner

## Working with Clients

- Good gardening practices
- Observation
- Identification
- Gardener's Tolerance
- Offer options
- Asking questions



## Integrated Pest Management

Oregon IPM

Claudia Groth  
MG Program Instructor  
claudia.groth.us@gmail.com