

Integrated Pest Management in Tree Fruits and Exotic Pests

Master Gardeners of SE Washington

March 10th, 2020



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WSDA Mission Statement

Through service, regulation and advocacy, the Washington State Department of Agriculture supports the viability and vitality of agriculture while protecting consumers, public health and the environment.



WSDA Plant Protection Division

Detecting invasive species and prevent their spread within the state of Washington.



Integrated Pest Management- IPM

- **Holistic approach and proactive to landscaping or gardening that places value on the interaction of all species within ecosystem as well as the environment.**
 - **Not just a reactive approach based on pesticide sprays**
 - **Commercial production:**
 - **Save \$\$\$\$**
 - **Doing more with less pesticides**
 - **Protect our environment as well as human health.**
 - **Homeowners can do it better than commercial growers**



What is IPM?

Integrated = Multiple strategies

1) Periodic Scouting or Monitoring



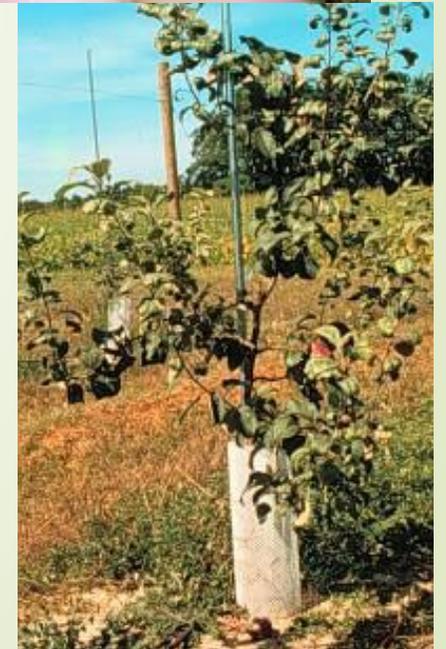
2) Biological control

- Encourage



3) Cultural control

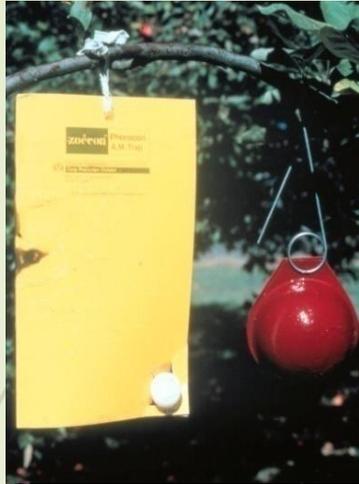
- Yard sanitation
- Tree training & health



4) Mechanical /physical



More Strategies of IPM



5) Behavioral

- Baits & traps



6) Plant breeding



7) Chemical control (pesticides).



To Be or Not To Be . . . A Pest?

Pest = Any organism in the wrong place at the wrong time!



- **Not all insects are bad – only 1% of all insect species are considered true pests that affect crop or mammalian health.**

Management = To Manipulate Beneficial Insects

- Recognize & encourage the beneficials



- Scout & monitor
- Spray “soft” pesticides to avoid crop loss & preserve plant health.



Management = To tolerate “pest” populations

- Most abundant pest in garden crops



In most years, you can tolerate aphids because they rarely affect crop/flower quality.

Why Aphids Are a Major Headache for Gardeners?

- Aphids with piercing sucking mouthparts
- Honeydew, sooty mold
- Curled, distorted leaves.



Strategies of IPM: Biological Control



**Lady beetle predators:
Adults & larvae graze
on aphids.**

Strategies of IPM: Biological Control



Wasp parasites:

**Adults lay eggs inside
aphids & larvae develops
on aphid tissues.**

Strategies of IPM: Biological Control



Lacewing predators:

**Adults & larvae graze
on aphids.**

Tactic- Encourage the Beneficial Insects

- Recognize & conserve the beneficials



- Spray “soft” pesticides
- Plant a diversity of flowers.



IPM Strategy 2) Biological control

Strategies of IPM for Aphids

- Wash aphids from foliage with a strong stream of water
- Aphids susceptible to fungal diseases including *Beauveria bassiana* (Naturalis H&G).



More Aphid Management Strategies

- **Row barriers**
- **Aphids attracted to overly vigorous plant growth (avoid excessive N fertilization)**
- **Weed management.**

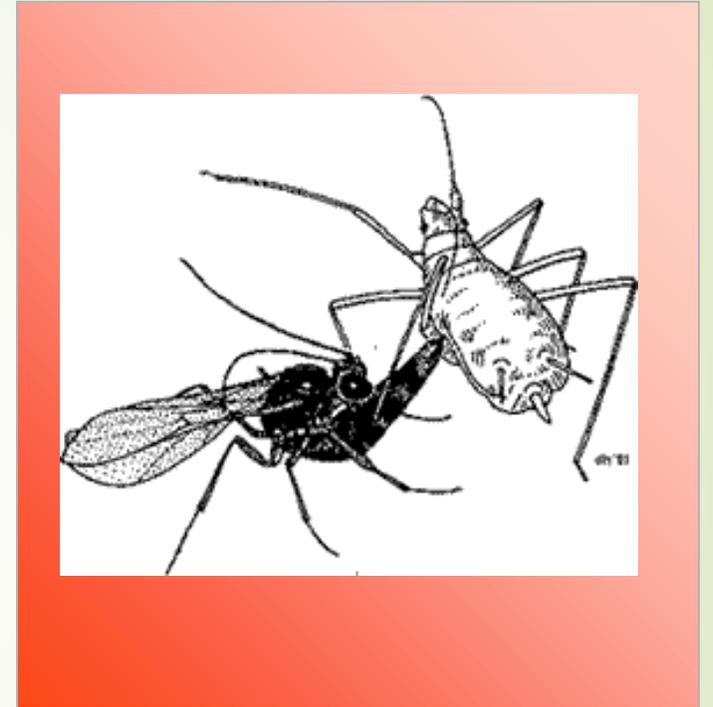


Strategies of IPM: Pesticidal & Cultural



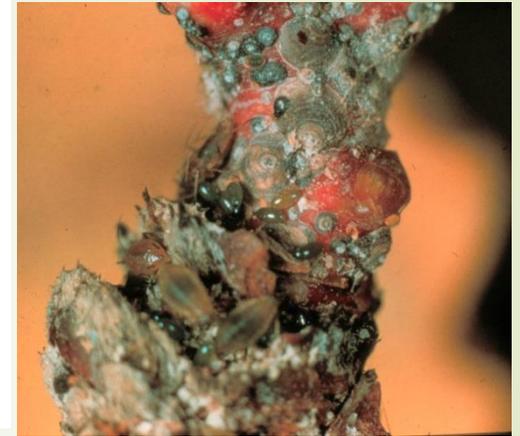
Other strategies:

- Horticultural oils
- “Soft” pesticides (Neem & soaps)



Aphid Management Later in the Season

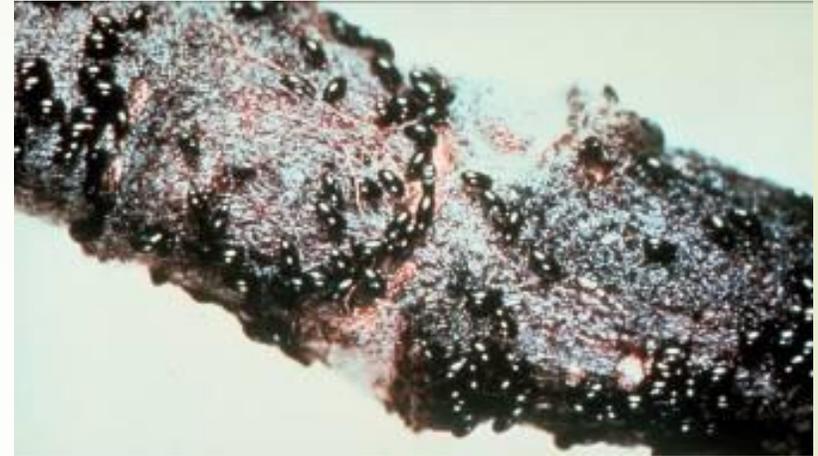
- **Registered insecticides labeled for use:**
 - **Insecticidal soaps**
 - **Pyrethroids (cyfluthrin, permethrin)**
 - **Imidacloprid**
- **Targets soft-bodied aphids**
- **Goal is to get insecticide before leaf curls.**



Key Strategy: Horticultural Oil Sprays

- ▶ **Problem last year with aphids? – Be Proactive!**
- ▶ **Dormant to delayed dormant oil sprays**
- ▶ **Targets egg stage**
- ▶ **Mind weather forecast**

• **Summer Oil Sprays.**



Horticultural Oil Sprays Control other 2nd Pests

- **Scale insects**
- **Spider mites**



IPM Strategy 7) Chemical control

The Key Strategy for Home Gardens

- Plant health
- Healthy plants better tolerate pest damage
- The WSU Garden Extension Team
- Vegetable gardens
- Fruits
- Pest Management



• <http://gardening.wsu.edu/home/>

IPM for Slugs & Snails

- **Observe & monitor for signs of the nocturnal pest.**



Key Management Strategies:
Garden sanitation- remove debris, weeds

IPM for Slugs & Snails



UC Statewide IPM Project
© 2000 Regents, University of California



UC Statewide IPM Project
© 2000 Regents, University of California

Key Management Strategies:

Handpick & kill slugs early in season

Bait stations.

IPM for Slugs & Snails

**Key Management Strategies:
Encourage Predators**



**Final option- Slug & snail baits- metaldehyde
& iron phosphate.**

Management of Codling Moth and Apple Maggot in Backyard Apple Trees



- Pest #1 = Codling moth, *Cydia pomonella*
- Pest #2 = Apple maggot, *Rhagoletis pomonella*
- Problems & headaches for Bush!



Homeowner Problems w/ Backyard Fruit Trees

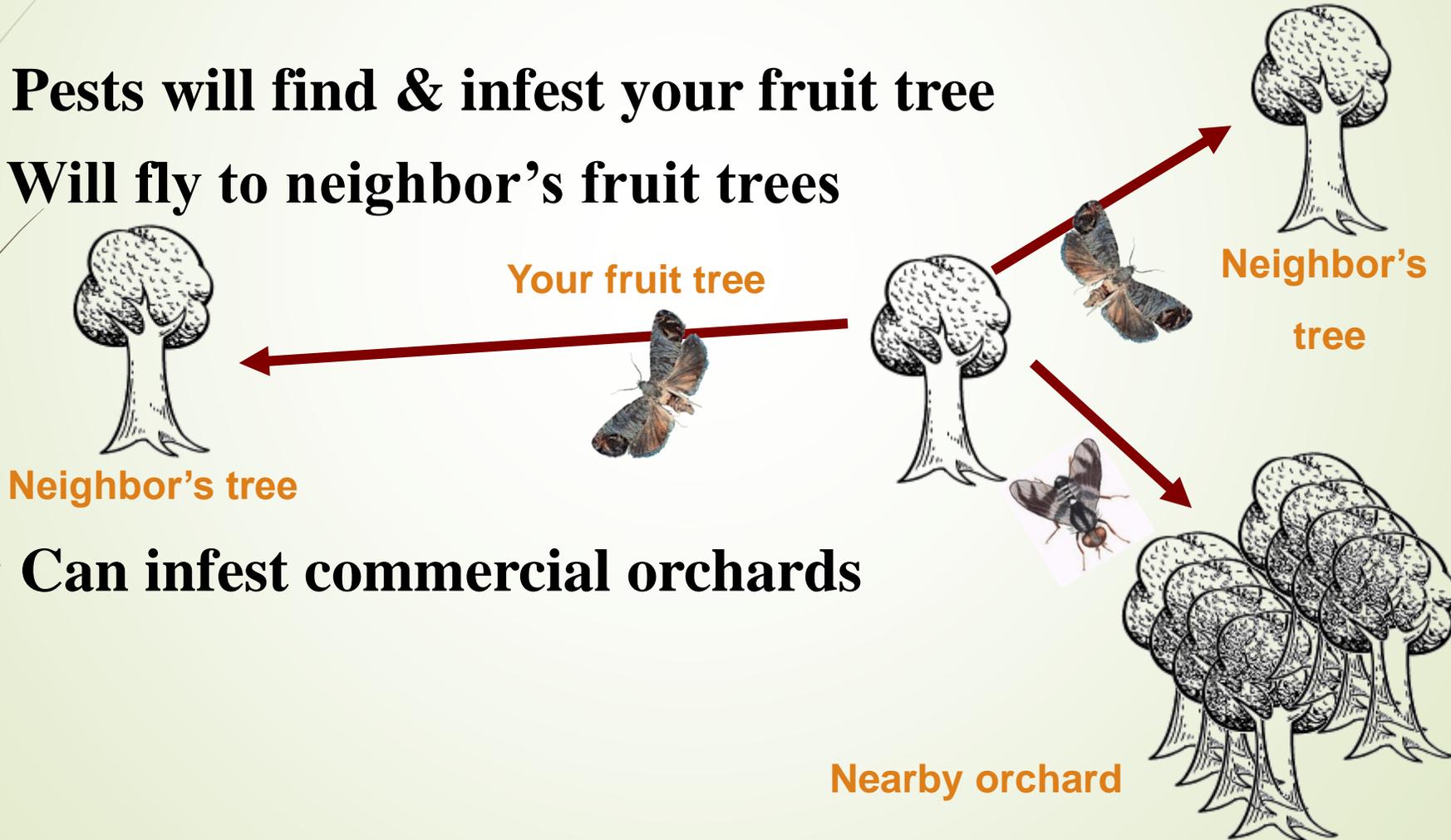
- Perennial crop that requires annual care
- Apples have serious insect pest problems that require management.



Homeowner Headache- State Regulations!

➔ WA State's RCW 15.09.060

- Pests will find & infest your fruit tree
- Will fly to neighbor's fruit trees



- Can infest commercial orchards

Tip #1- Think “Bonsai”

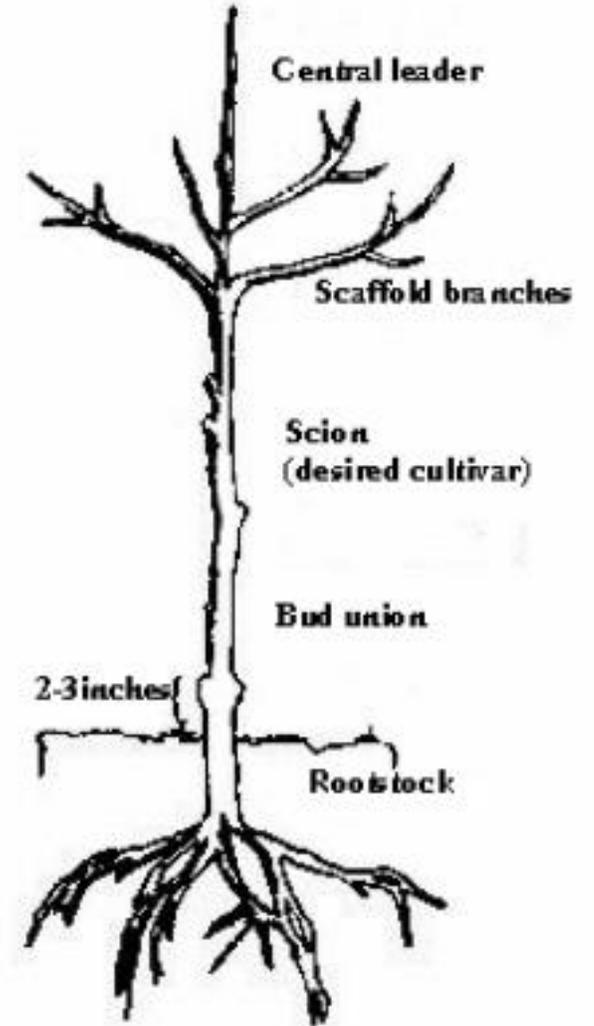
➤ Manage tree size to less than 10 feet tall

- Why?
 - Less space in yard
 - Reduce ladder work
 - Can you spray a tree $> 10'$ tall?
 - Read pesticide labels
 - Pesticide spray equipment
- *You can* get quality fruit with good size on a smaller tree.



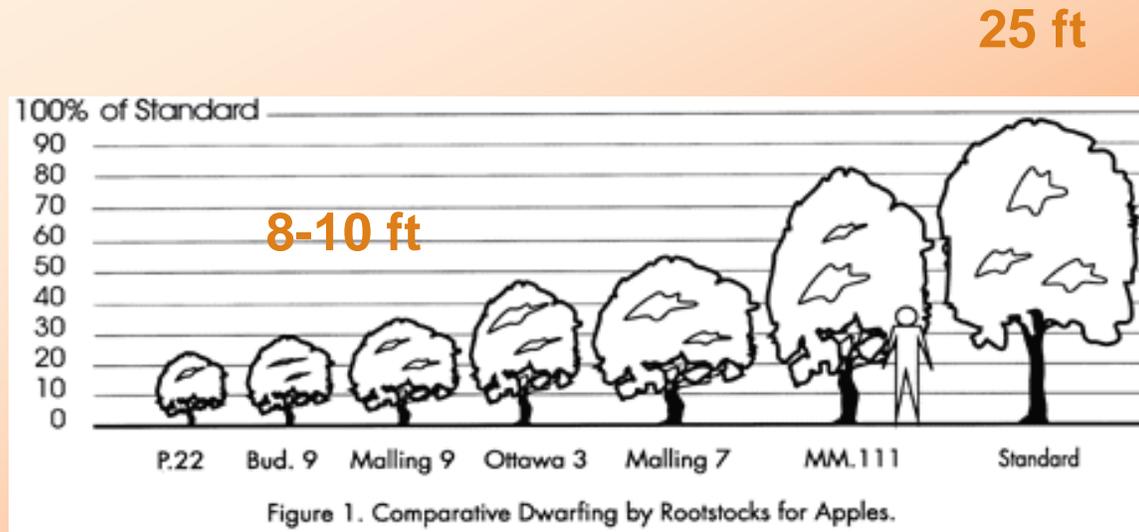
Tree Selection

- Nursery fruit trees are not self-rooted but are two plants grafted together
 - Top portion = Scion
 - Fruiting plant
 - Bottom portion = Rootstock
 - Root & collar plant
 - Soil disease resistance
 - Soil moisture tolerance.



Rootstock Selection

- By far, most important function of fruit rootstocks
 - dwarfing



- Apples: M9, M26
- Sweet cherries: Gisela rootstocks
- Peach: Genetic dwarfing rootstock



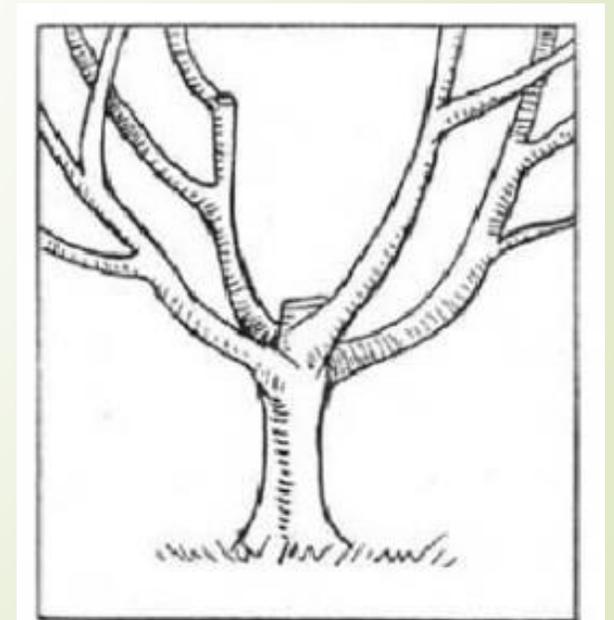
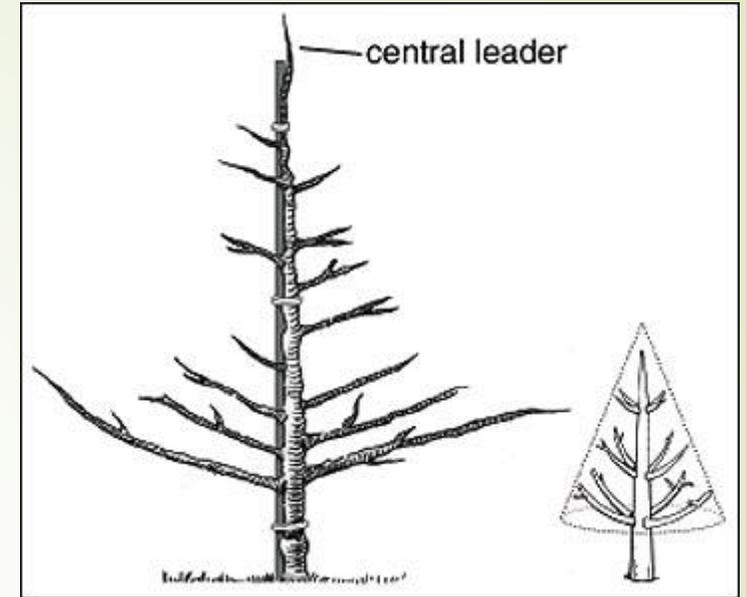
Fruit Tree Training

- *Bonsai Fruit Tree Approach*
- Overall height < 10 feet



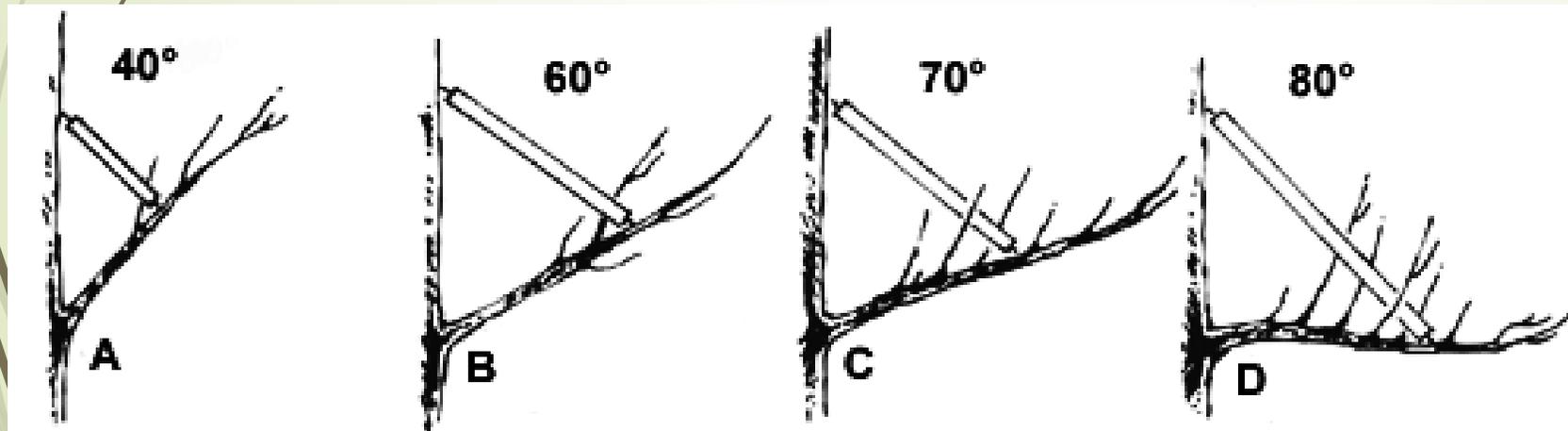
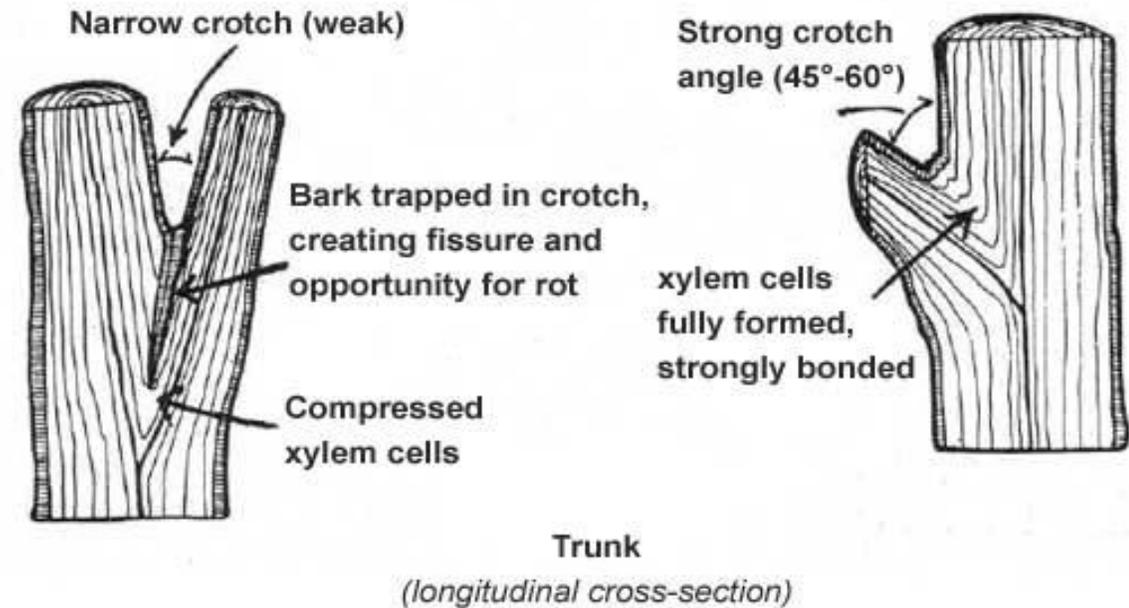
Fruit Tree Training

- **Training to increase light penetration & interception**
 - Central leader system
 - Open vase system
 - Espalier system.



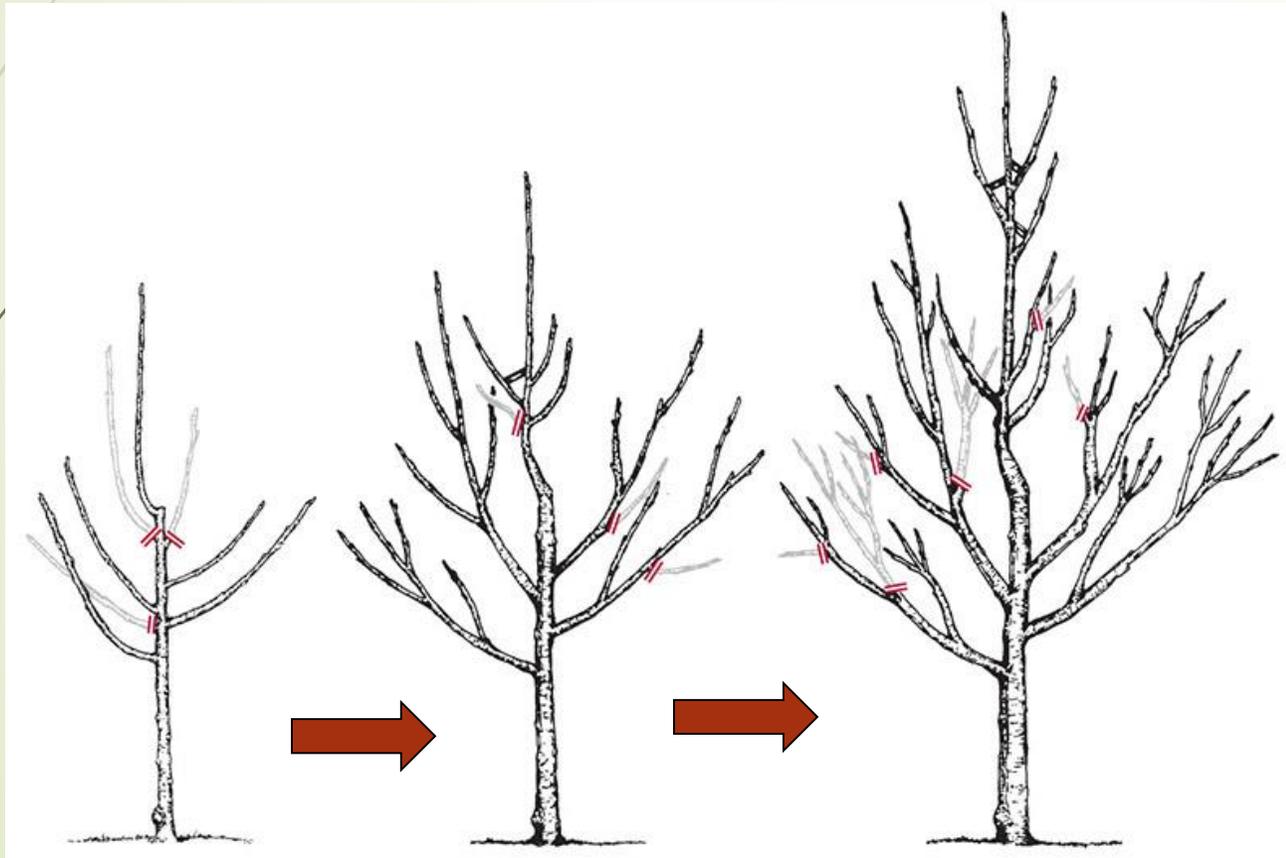
Fruit Tree Training

- ▶ **Limb angles are important**
 - ▶ **Vertical angles promote vegetative growth**
 - ▶ **45 to 60 angles not only promote fruit bearing**
 - ▶ **Stronger, sturdier limbs.**

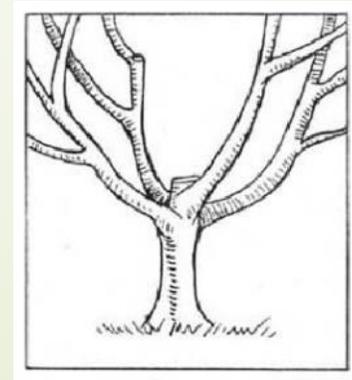
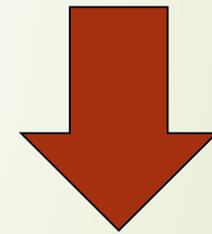
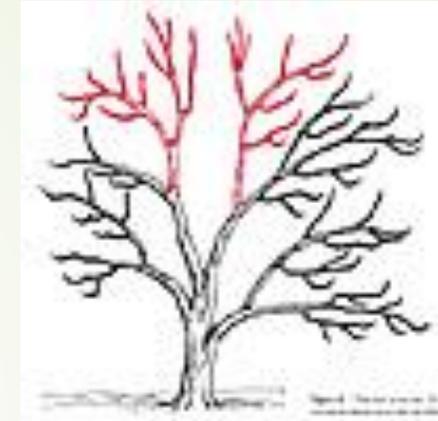


Fruit Tree Pruning

- Removing dead, diseased and dying limbs
- Pruning out limbs to increase light, air and pesticide penetration.



Central leader system



Bonsai Fruit Tree Approach by Yakima MG- Fred Stolach



The #1 Pest in Apples of eastern WA is . . .

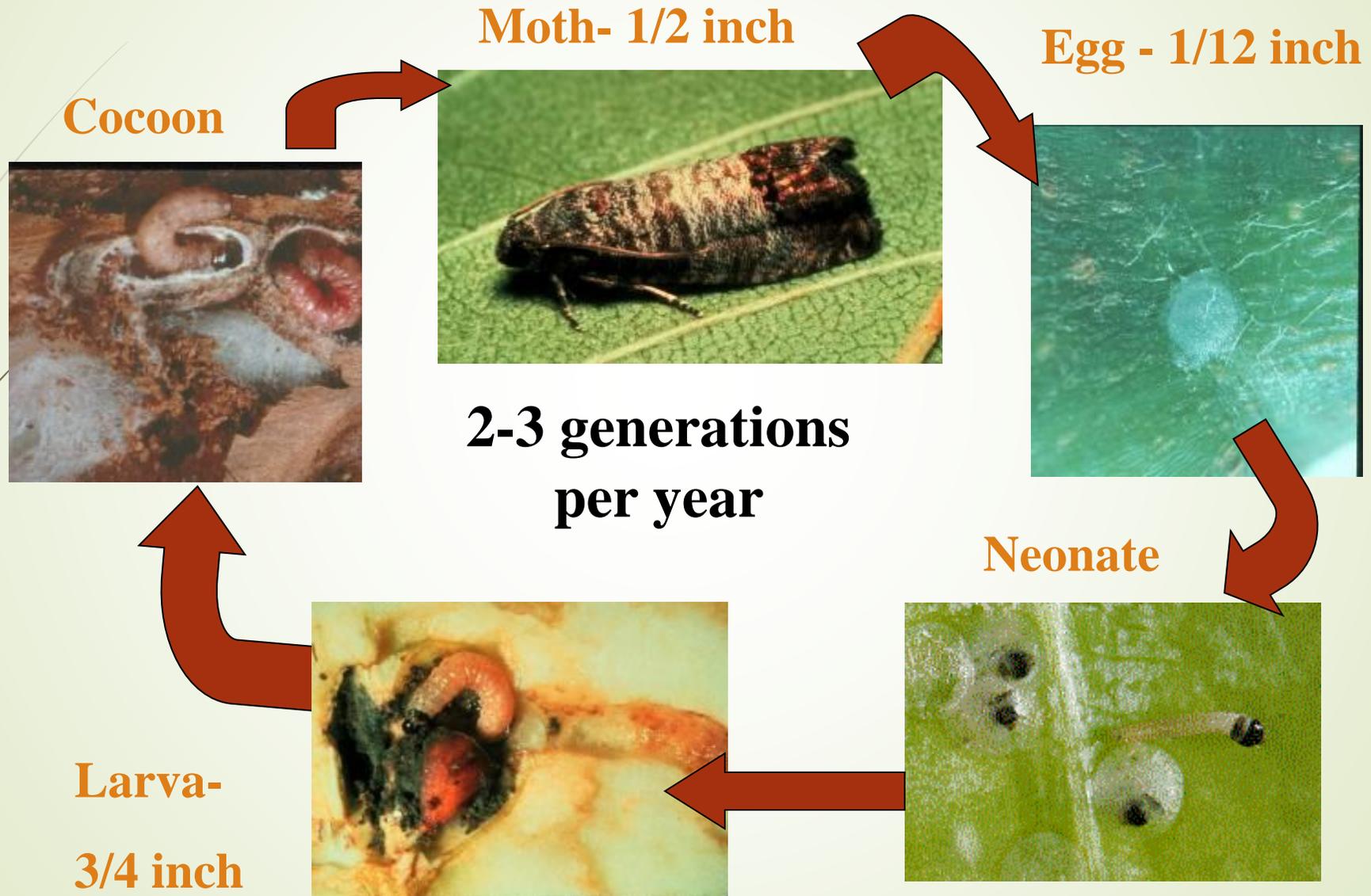


- **The Codling moth**
- The “apple worm”
- 80-95% apple infestation if not managed

• **Learn to recognize damage.**



Codling Moth Life Cycle



Strategies to Control Codling Moth- Plant Breeding & Cultural

- **Cultural Control**
 - **Visual fruit inspection**
 - **Remove & destroy “wormy” fruit**
- **Plant trees on dwarfing rootstock**
- **Plant early-maturing varieties.**



More Codling Moth Control Strategies-- Physical/Mechanical

- **Particle films**
 - **Surround at Home**
- **Must spray every 10 - 14 days starting at petal fall**
- **Works best when you use it & your neighbor doesn't**



More Codling Moth Control Strategies-- Physical/Mechanical

- **Fruit Bagging Study**
- **Bag when diameter of quarter**
- **Thin off all un-bagged fruit**

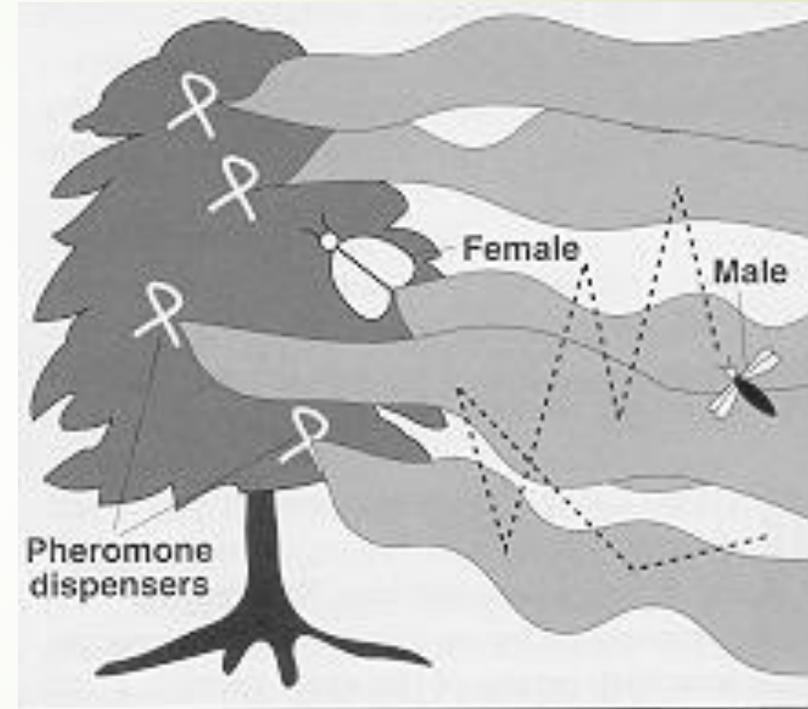


Controlling Codling Moth in Orchards- Behavioral Tactic

- ➔ Sex pheromone = female moth 'perfume'



- Mating disruption over 80% commercial acreage



- Poor male moth either
 - Can't find female, or
 - Too tired, spent.

Myth: Homeowners Use Pheromones to Control Codling Moth

- Sex pheromones/traps
 - Attract & Kill tactic



- Affects male moths only!

Codling Moth Control With Insecticides

- Chemical control
 - OPs (Malathion)
 - Pyrethroids
 - Horticultural oils
 - Spinosad
 - **2-3 covers per generation**

1st generation: 1-2 weeks after full bloom

2nd generation: July to mid Aug.

3rd generation: mid Aug to Sept.



Insect Pest Management

- **Occasionally, pesticides are the best option available**
- **(Always read pesticide label)**
- **So much easier on bonsai tree**
- **Often the best solution utilizes a combination of all options = IPM.**



IPM Strategy 7) Chemical control

Disease Pest Scouting

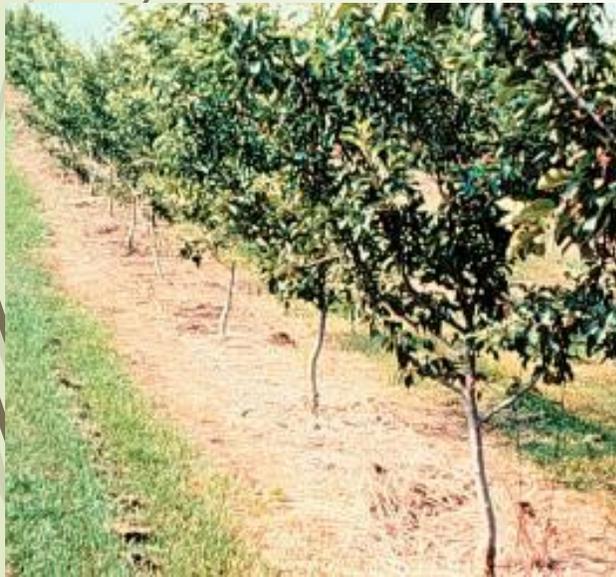
- **Get to know your plant- recognize what is healthy & what is not**
- **Identify diseased tissue ASAP**
- **A few fungicides exist**
- **Prune out disease material ASAP.**

IPM Strategy-- 1) Scouting



Cultural Control Weed Management

- Weeds compete-- water, nutrients, light
- Critical for young non-bearing trees
- **Clean cultivation under tree**
 - Weeding & Mulches
- **Mature trees fend for themselves!**



Bird Management



IPM Strategy 4) Mechanical /physical

Vertebrate Management

- **Habitat manipulation**
- **Fencing**
- **Trapping**
- **Shooting**



IPM Strategy 4) Mechanical /physical

The Apple Maggot

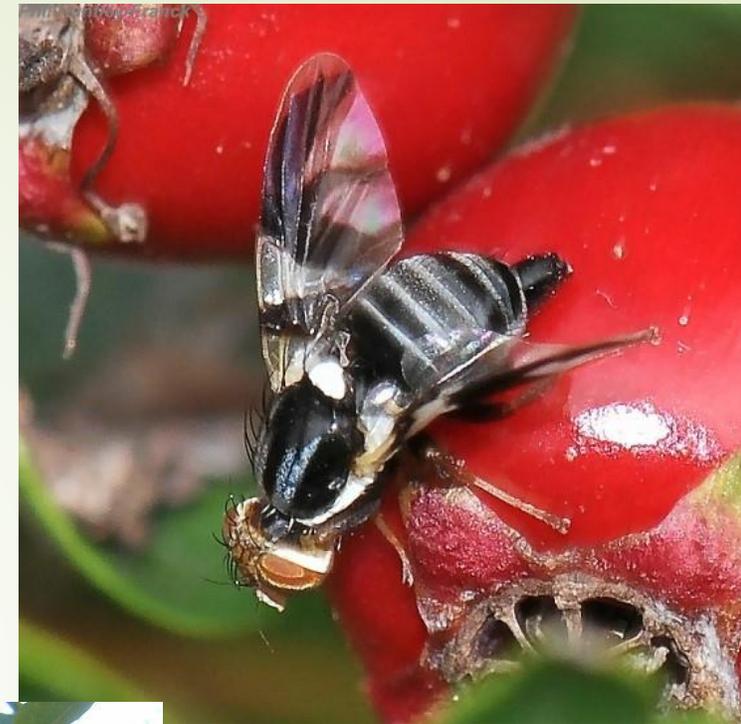


Apple maggot first described in upstate New York

Apples are native to Central China - Kazakhstan



Hawthorn to Apple = Sympatric host shift



The Apple Maggot

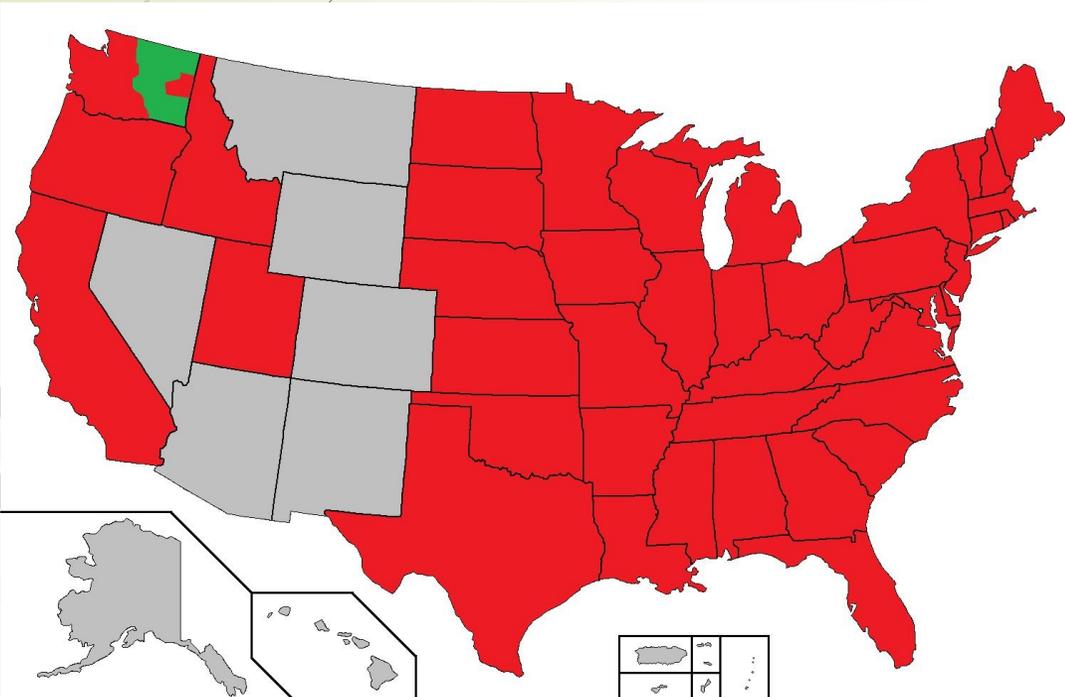
**AKA- the railroad
worm**



The Apple Maggot



**First found in WA
State in 1980**



**Apple Maggot Quarantine Area:
Goal is to prevent the spread of AM
into the commercial apple areas.**

**Estimation- “If AM becomes
established in these areas, it could
cost the industry \$550 million per
year.”**

—K Gallardo, WSU

Trappers hang out & manage 7,000 to 10,000 yellow sticky traps throughout WA State



What happens when WSDA captures an apple maggot fly?



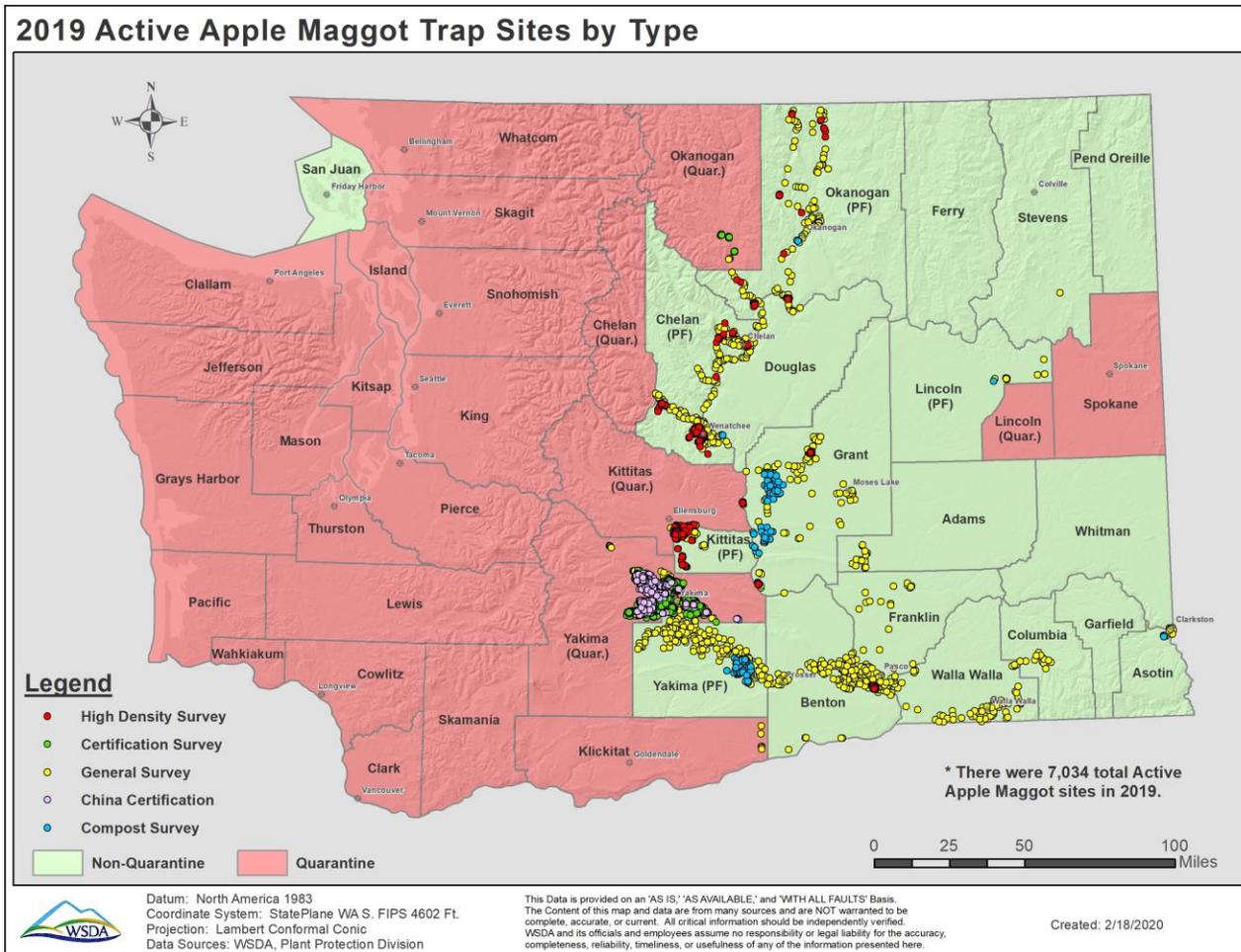
- **Collect all the apples from a tree that show signs of infestation**
- **Contact County Pest Board**
 - **Interview homeowner**
 - **Remove all fruit**
 - **Spray tree**
 - **Return for 3 years**
- **Best Case Scenario- Remove the fruit tree**

Standard Operating Protocol

Annual Meeting with the Apple Maggot Working Group

- Prepare Annual Report
- Reassess quarantine boundary lines
- Where to increase trapping density
- Where to focus resources on public education and host tree removal

This is a grower funded program!



Apple Maggot Control Strategies

➤ Sanitation



Apple Maggot Control Strategies

➤ Fly trap out



Apple Maggot Control Strategies

- Particle films
 - Surround at Home
 - Bagging fruit on the tree



Fig. 11. A visible kaolin clay film must cover apple to be an effective insect deterrent.



Pacific Northwest Pest Management Handbooks

<https://pnwhandbooks.org/insect>



- **This handbook is intended as a tool for making decisions regarding the control and management of important insect pests in the Pacific Northwest. Originally, it was written for commercial growers, county extension agents, consultants, field and nursery staff, and chemical industry representatives. In recent years we have added sections that are useful to Master Gardeners and homeowners.**

WSU Extension Presents

Hortsense



<http://hortsense.cahnrs.wsu.edu/Home/HortsenseHome.aspx>

Weeds

Common Cultural Problems

Common Diseases

Common Insects & Mites

Herbicide Damage

Home gardener fact sheets for managing plant problems with Integrated Pest Mngt

Includes multiple management strategies.



IPM for Home Gardeners

- **You can do it better than commercial growers**
- **Know & manage your plants, pests & beneficial organisms**
- **Observe, scout & monitor for problems**
- **Use multiple strategies to control pests**
- **Use pesticides sparingly**
- **Relax, have fun not war!**

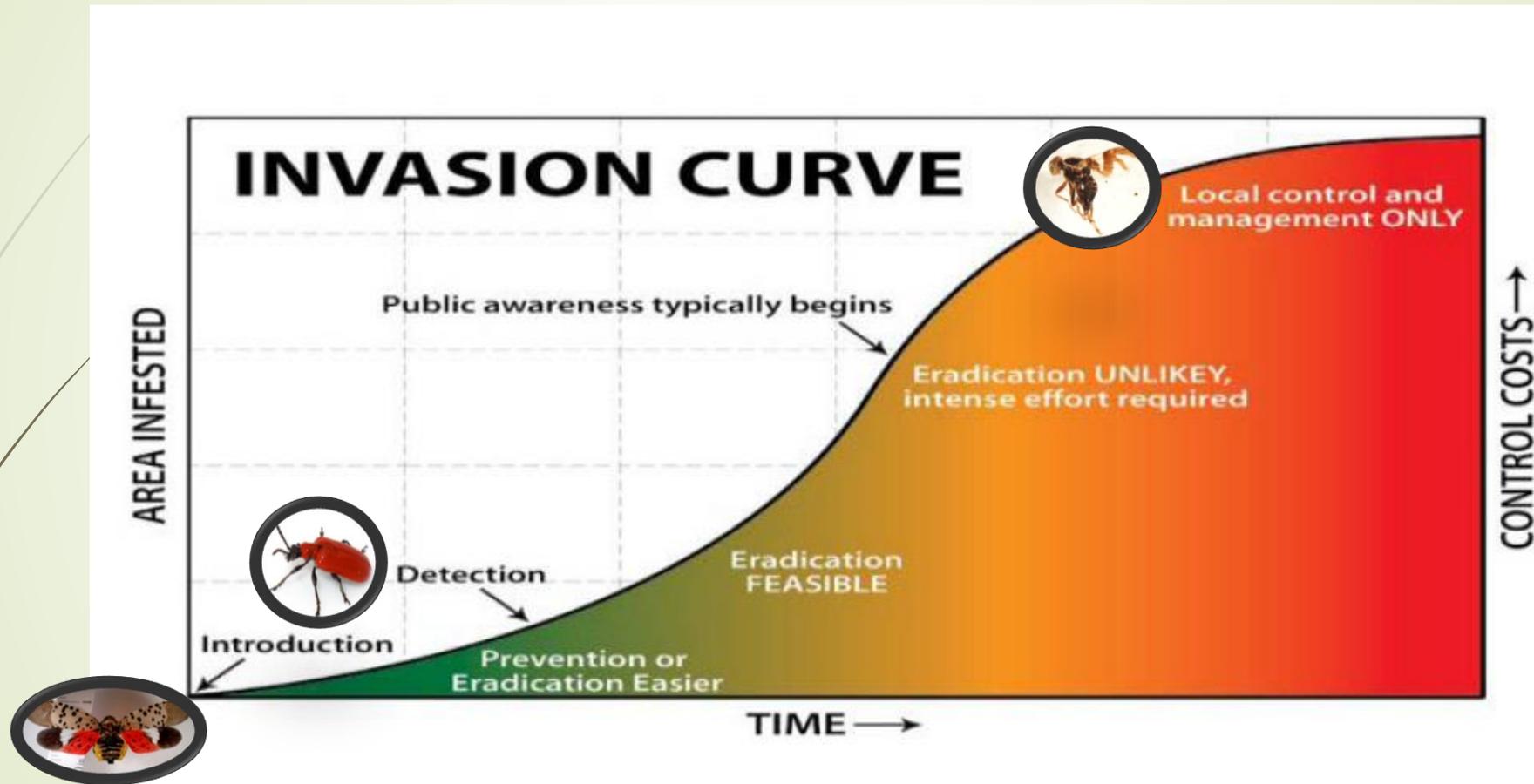




**Invasive Insects that WSDA is on the
Lookout for**



For Each Invasive Pest . . .



WSDA seeks to get ahead of this invasion curve.

Spotted Lanternfly, *Lycorma delicatula*



Actual size = ¾ to 1 inch long

- **Crop hosts: Grapes & stone fruits, hops**
- **Virginia creeper, *Acer*, *Juglans*, Tree-of-heaven.**

- **Native to China, but found in Pennsylvania in 2014**
- **Spread to New York, New Jersey & Virginia, Maryland by 2018; Delaware 2019**



Spotted Lanternfly, *Lycorma delicatula*



- Early nymphs- black with white spots
- 4th instar red with white spots.



Spotted Lanternfly, *Lycorma delicatula*



- Adults are not strong fliers
- Good hitchhikers.

- Phloem feeder
- Biggest threat = honeydew & mold
- Damage (weeping wounds) to trunks



Spotted Lanternfly, *Lycorma delicatula*



- Tends to lay eggs along trunk and limbs
- Will lay on just about any smooth surface.

- Adults can disperse
- Biggest threat = movement of egg masses



Tree-of-Heaven = *Ailanthus altissima*



- Native to northern & central China
- Weedy characteristics make T-o-H highly invasive
- Prolific fruiting
- Root sprouts vigorously
- Adaptable to disturbed sites
- Rapid growth rate
- Drought-tolerant.



Tree-of-Heaven = *Ailanthus altissima*

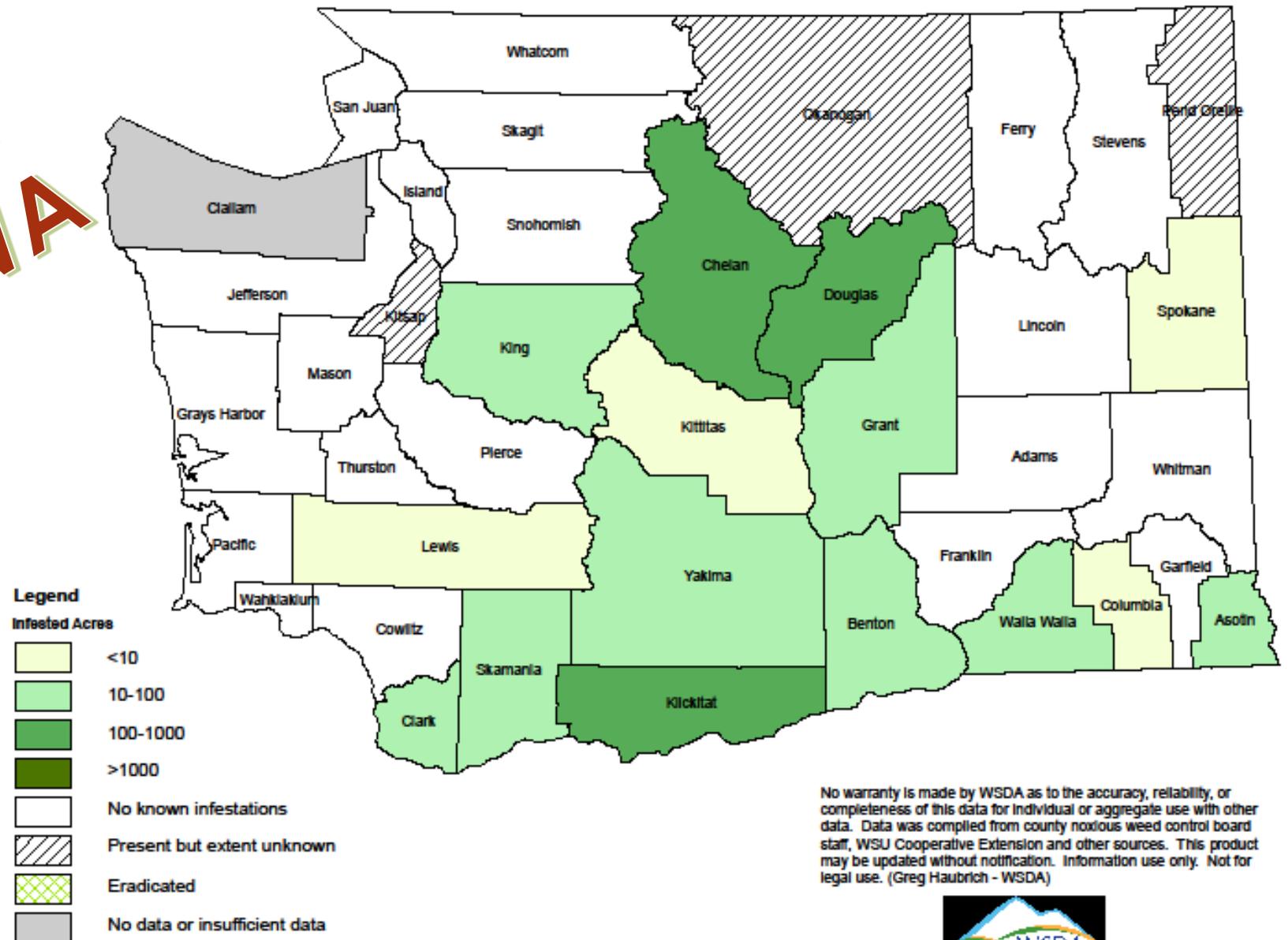


- Attractive and cultured as an ornamental
- Compound leave w/ 10 to 40 leaflets
- Resembles smooth sumac (*Rhus glabra*)

Widespread
in Central WA

Tree-of-heaven (*Ailanthus altissima*) Distribution 2018

Updated: 11/27/2018



No warranty is made by WSDA as to the accuracy, reliability, or completeness of this data for individual or aggregate use with other data. Data was compiled from county noxious weed control board staff, WSU Cooperative Extension and other sources. This product may be updated without notification. Information use only. Not for legal use. (Greg Haubrich - WSDA)



New Pests of Concern for 2020



- **GIANT ASIAN HORNET/ EUROPEAN HORNET**
- *Vespa mandarinia/Vespa carbro*
- **Native to Asia and Europe, respectively**
- **Larger than our native vespids (yellowjackets)**
- **Giant Asian hornet preys on honey bees**
- **European hornet feeds on ripening fruit**
- **Animal health concerns.**



Actual size 1.5 to 2 inches



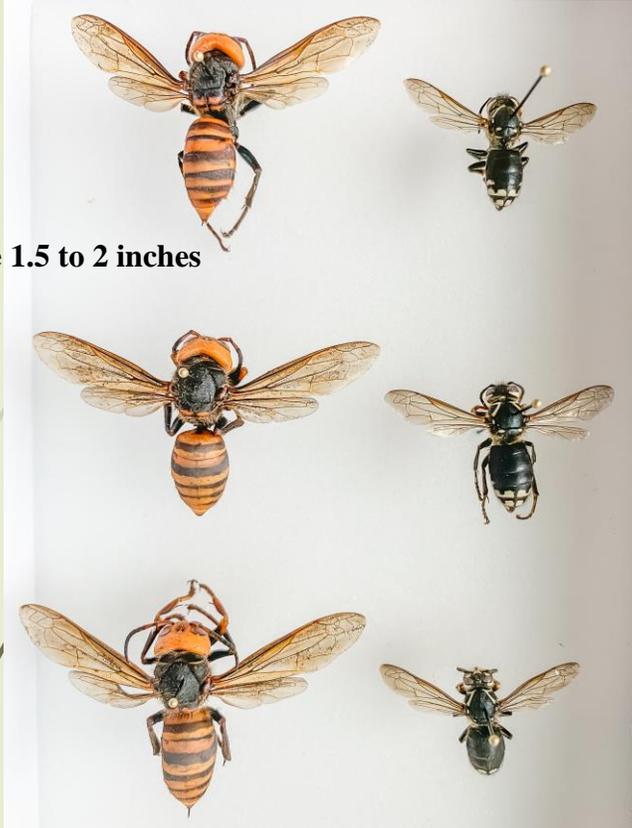
Actual size ~ 1.0 inch long



New Pests of Concern for 2020

- **GIANT ASIAN HORNET**
- Reports of this species being found and eradicated in British Columbia 2019
- December 8- confirmed find of dead hornet in Blaine, WA
- Publicity focused on human threat—overblown
- End of December- two beekeepers submit photos of hives and piles of decapitated honeybees
- WSDA strategizes response.

Actual size 1.5 to 2 inches



Baldfaced Hornet- 1" long



Reoccurring Pest of Concern



- Gypsy moth, *Lymantria dispar*
- Forest defoliator >300 trees serve as hosts; prefers oaks
- WSDA has trapped for and successfully prevented the establishment of this pest in Washington for over 40 years
- In 2019 alone, WSDA placed over 23,000 traps.



Reoccurring Pest of Concern



- European Gypsy moth, *Lymantria dispar dispar*
- Male and female moth are different in appearance
- Male can fly, female doesn't fly much at all
- Egg mass contains 100's of eggs
- Often laid on tree bark, but may be found on any smooth surface.



Other Pests of Concern for 2020

Anoplophora chinensis = Citrus Long-horned Beetle



Rhagoletis cerasi = European Cherry Fruit Fly



Lilioceris lili = Red Lily Beetle



Popillia japonica = Japanese Beetle

Agrilus planipennis = Emerald Ash Borer



Lobesia botrana = European Grapevine Moth

What Can You Do?

- **Confirm what you have found**
 - **Take a photograph of:**
 - **A specimen**
 - **Damage you observed**
 - **Collect a sample**
 - **Note your location**
- **So you noticed something abnormal and/or you collected a sample, now what?**
- **Contact:**
 - **Local MG Clinic**
 - **Local county extension office**
 - **WSDA (PestProgram@agr.wa.gov)**



Questions, Comments?

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- **Thank you for your time!**

