Master Gardener Training: Plant Pathology

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• Extension Community Horticulturist

• Trained as plant pathologist
  – M.S. in landscape plant diseases
  – Ph.D. in vegetable diseases

• Work in plant diagnostic clinics
  – Iowa, N. Carolina, Colorado, Oregon
  – Homeowner & commercial samples
Resource Materials

• Sustainable Gardening: Chapter 15 & 16

• PNW Disease Management Handbook
  https://pnwhandbooks.org/plantdisease/

• Handout: How to use the PNW Disease Management Handbook
What is a plant disease?

• Any disorder that is detrimental to the health and value of the plant or any of its parts
Diseases Categories

• Biotic
  – Caused by another living organism
  – Can spread to a healthy plant

• Abiotic
  – Caused by a nonliving factor
  – Cannot spread to a healthy plant
She says this is a "pop quiz." I'm hoping the answer is root beer.
Biotic & Abiotic Problems

- Fungi
- Bacteria
- Virus
- Nematodes
- Parasitic plants

- Mechanical factors
  - Construction
  - Transplanting
  - Lawn mower blight

- Environmental factors
  - Temperature
  - Light
  - Moisture
  - Wind
  - Soil
  - Pollinator issues

- Chemical factors
  - Pesticides
  - Nutritional issues

What else???
Three conditions required for biotic diseases to occur:

- Host
- Environment
- Pathogen

Venn diagram:

- Susceptible Host
- Disease
- Conductive Environment
- Pathogen

Ven diagram: http://commons.wikimedia.org/wiki/File:Plant_Disease_Triangle.svg; Stool drawing: Openclipart
Three conditions required for biotic diseases to occur:

- Environment
- Host plant
- Pathogen

Disease
Symptoms vs. Signs

The visible effect of disease on the plant

Physical evidence of the pathogen
Plant Pathogen Groups

- Fungi
- Bacteria
- Phytoplasmas
- Viruses
- Nematodes
- Parasitic plants
Fungi & plants

- Saprophytes (decomposers)
- Mycorrhiza
- Lichens (fungus + algae/Cyanobacteria)
- Endophytes
- Plant pathogens
Common features: Mycelium & hyphae
Common Features: Fruiting Bodies
Common features: Fruiting Bodies

• Most fungi produce some form of a fruiting body
• Can help with ID

Photo: http://bulletin.ipm.illinois.edu/photos/phyllosticta.jpg
Common Features: Reproductive Spores

Example: Rust spores

http://ars.usda.gov/is/br/canadathistle/teliospore.jpg
http://oi30.tinypic.com/e6aonp.jpg
Powdery Mildews

Fungal Leaf Spots

A. Black spot of rose
B. Colletotrichum leaf spot of English ivy
C. Phyllosticta leaf spot of rhododendron
D. Cercospora on eggplant
Japanese Maple (*Acer palmatum*): Verticillium wilt (*Verticillium dahliae*)

Photo: Neil Bell

Vascular Wilts
Streaking in Vine Maple
**Phytophthora** sp. (Oomycetes)

Cankers

Root rot

Foliar & twig dieback
Bacteria
Bacterial Blight (lilac, fruit trees)
P. syringae on foamflower (Tiarella spp.)
Gummosis of stone fruit trees

Pseudomonas syringae

http://www.goodfruit.com/bacterial-canker/
Phytoplasmas

• Similar but not *quite* like a bacteria
• Obligate parasite
  – What does that mean??
  – Survives only in a living host (plant & insect vector)
Healthy *Echinacea* sp.
Echinacea sp. (cone flower)
Healthy *Rudbeckia sp.*
Infected *Rudbeckia* sp.

http://www.missouribotanicalgarden.org/Portals/0/Gardening/Gardening%20Help/images/Pests/Aster_Yellows103.jpg
Viruses
Symptoms of Virus Infected Plants

- Mosaic
- Mottle
- Leaf distortion
- Ringspots
- Flecks
- Vein clearing
- Leaf spots
- Chlorosis
- Leaf rolling
- Fruit distortions
- Rugose (Crinkling or puckering)
- Stunting
- Color break of flowers
- Stem pitting
- Cracking
- Yield reductions
Tomato Spotted Wilt Virus (TSWV)
Tomato Spotted Wilt Virus (TSWV)
Necrotic Ringspot Virus on Rhododendron
Nematodes

- Round worm (round in cross-section)
- Animal & plant pathogens
- Not all parasitic

http://www.jgi.doe.gov/sequencing/why/hglycines.jpg
*Ditylenchus dipsaci* on onion

Healthy

Damaged by *Ditylenchus*

http://www.omafra.gov.on.ca/IPM/english/onions/diseases/bulb_stem_nematode.html
Parasitic Plants

Broadleaf mistletoe (*Phoradendron* sp.) on *Quercus*
What is dodder?

- *Cuscuta* sp.
- Parasitic plant
- Grows from seed and then plant to plant

Photo: http://www.fcps.edu/islandcreekes/ecology/dodder.htm
Dodder grows into host plant
Slime Molds

- Not plant pathogens
- May get samples from mulch
- “Dog Vomit” fungus is very common

https://www.youtube.com/watch?v=B79Z56vl02A
Key Characteristics?

- Fungi
- Bacteria
- Phytoplasma
- Viruses
- Nematodes
- Parasitic Plants
Understanding Disease Cycles
Disease cycle example: Apple Scab
(caused by the fungus *Venturia inaequalis*)
Apple scab symptoms on leaves
SPRING  

Ascospores spread in the wind

New season fruit and leaves infected

SUMMER

Scab spots form on the infected fruit and leaves

Conidia (secondary spores) form on spots over spring, summer and autumn.
Rain splash and wind spread conidia throughout orchard, causing more infections

AUTUMN

Ascospores produced in flask-shaped bodies in dead leaves

Fungus overwinters in dead leaves on the ground

WINTER

Ascospores ejected in spring, after rainfall

Principles of Biotic Plant Disease Management

1. Exclusion
2. Avoidance
3. Eradication
4. Protection
5. Resistance

Graphic: https://pixabay.com/static/uploads/photo/2014/04/02/18/toolbox-306888_960_720.png
1. Exclusion

• Keep new diseases out of U.S. and Oregon
  – Quarantines
  – Inspections
  – Certifications
2. Avoidance

• Example: “Damping off”
• Avoid by planting in drier and warmer soils
3. Eradication

- Crop rotation
- Sanitation
- Remove alternate hosts
- Chemical applications
- Heat treatment*
Sanitation

- **Eradicate** by removing infected plant debris

*Fusarium* on strawberry

http://ucanr.edu/blogs/strawberries_caneberries/blogfiles/17490_original.jpg
What to do with diseased debris?

✓ Burn
✓ Bury
✓ HOT compost

Not effective for composting diseased plants!

4. Protection

• Treat plant with pesticide before it becomes diseased
• Acts like a shield
5. Resistance

- Some plant varieties are resistant to certain diseases
- Very specific interaction
- *Note: Resistance is not always 100%*
# Cornell University resistant vegetable tables

**Cherry Tomato Variety**

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<th>Angular Leaf Spot</th>
<th>Alternaria Blight</th>
<th>Alternaria Stem Canker</th>
<th>Bacterial Leaf Spot</th>
<th>Bacterial Wilt</th>
<th>Corky Root (Rot)</th>
<th>Crown Wilt</th>
<th>Early Blight</th>
<th>Fusarium Wilt 1</th>
<th>Fusarium Wilt 2</th>
<th>Fusarium Wilt 3</th>
<th>Fusarium Crown Rot &amp; Root Rot</th>
<th>Fruit Soft Rot</th>
<th>Gray Leaf Spot (ST)</th>
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Activity Time!

Station #1: How to use the PNW Disease Management Handbook
• Use the handbook to answer questions

Station #2: Recognizing Symptoms & Signs
• Match the photo to the definition using the provided glossary

Work at your own pace & it’s okay to work together