What is Plant Pathology?

... the study of plant diseases

... conditions in which a plant varies in some way from a healthy plant in development, structure or function
Why are Plant Diseases Important??

Management

Holly leaf & Twig Blight 
(*Phytophthora ilicis*)

Management:

- Pruning out infected tissue
- Preventative fungicide applications
- Good air circulation & careful water management
- Replace holly with another species
Why are Plant Diseases Important??

... Food Supply
  quantity, quality, diversity

Example:
Irish Potato Famine
  “Late Blight” Phytophthora infestans

... Food Safety
Why are Plant Diseases Important??

Landscape Value
Examples:
Dutch elm disease, chestnut blight, dogwood anthracnose, Phytophthora ramorum (sudden oak death)

Phytophthora ramorum- leaf & shoot blight

N. Dart
Diseases Affect How Plants Work!!
So...

How Do Plants Work?

... What are the normal structures and functions of a plant?
Normal Plant Function

leaves:
absorb $\text{CO}_2$ & light,
make sugars

flowers:
sexual organs

fruit:
reproduction;
storage

roots:
absorb water &
nutrients; store
food

stem:
support; conduct
sugars, water &
nutrients
Diseases Affect Functions

leaves:
spots, blights, chlorosis, necrosis, wilt

flowers:
blight, wilt

fruit:
soft rot, seed decay

roots:
rot, galls, nematodes

dampening-off;
canker; wilt; gall;
blight
Causal Agent Terminology

Pathogen- causes disease (harms plant)

Parasite- lives in or on, and obtains nutrients from, another living organism (host); harms its host

Saprophyte- obtains nutrients from non-living organic material
**Terminology**

**Host plant** - plant on which a particular disease may develop

**Nonhost** - a particular disease is unable to infect or become established on the plant

**Alternate host** - another species of plant required for pathogen to complete its lifecycle.

**Host Range** - all plant & cultivars or varieties that can be infected by a particular pathogen
Resistance- plant properties that prevent or impede disease development

Susceptibility- properties that make plant prone to develop a disease when infected by a pathogen

Immunity– plant cannot be infected by a particular pathogen – it is never a host
Example

white pine blister rust resistant

*Pinus monticola*
Terminology

Symptom- abnormal appearance of the plant

Sign- physical presence of pathogen, pest or problem causing entity

WSU Hortsense Images: R. Byther
Symptoms:
abnormal plant appearance

*Pucciniastrum* rust of fuchsia

- Leaf spots
- Chlorosis
- Necrosis

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Signs: physical presence of problem causing entity

*Pucciniastrum* rust of fuchsia

Rust sporulation

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Symptoms Often Require Further Investigation

Phytophthora root rot: pathogen thrives in saturated soils
What Causes Plant Diseases?

1) Nonliving Factors
   (disorders, nonpathogenic, abiotic)
   Environmental/ Physical/ Mechanical/ Chemical

2) Living Organisms
   Pathogens: Fungi/Bacteria/ Viruses, Nematodes, etc.
   (diseases, pathogenic diseases)
   Other biotic agents: Insects, Large Animals, Parasitic Plants
Physical Environment

sunburn, frost injury, cold
Marginal or Tip Necrosis

indicative of water obstruction
Mechanical Injury
Pesticide Injury

types, rates, dates applied
drift, vaporization, root absorption

WSU Hortsense: R. Maleike
Herbicide Injury

growth regulator herbicide
Nutrient Deficiency & Toxicity

new growth = immobile (iron)  old growth = mobile (nitrogen)
Pathogenic Causes

• Fungi
• Bacteria
• Viruses
• Nematodes
Fungi

- largest group of plant pathogens
- reproduce by spores
- germinate to produce threadlike hyphae (mycelium)
- enter plants via enzymes, mechanically or openings

Powdery mildew spore pictures: credit D. Glawe
Bacteria

- small, one-celled organisms
- reproduce by fission
- water important in spread of bacterial disease
- enter plants through wounds and natural plant openings
Viruses

- submicroscopic particles
- central core of nucleic acid and an outer coating of protein
- reproduce only in living cells
- transmitted by insects (vectors), mechanically or via plant tissue (pollen, seed, vegetative reproduction)
Nematodes

• Roundworms
• Some are animal parasites (horses). Many are free-living
• plant parasitic nematodes puncture plant cells with a stylet
• they feed on cell contents and inject a toxin
• reproduce by laying eggs
Disease Management Strategies

- exclusion
- eradication
- sanitation
- protection
- resistance
Integrated Disease Management

✓ Cultural Methods

✓ Biological Methods

✓ Chemical Methods
Cultural Methods

- Sanitation

- Improvement of growing conditions of plants

- Creating conditions unfavorable for the pathogen

- Crop rotation, planting date

Pruning for good air circulation....
How Do Pathogens Spread?

- Wind
- Water
- Animals, especially insects (Vectors)
- Within infected plants & infested soils

Crucial Step:

Investigate the specific disease problem to determine HOW spread occurs & what YOU can do to prevent further spread
How Do Pathogens Survive From Year to Year?

- Understanding pathogen survival is important for developing MANAGEMENT strategies
- Overwintering stage is often the weakest link
- Common sites: plant debris, in cankers, in the vascular tissue, in buds, in vectors, exposed in water/soil, etc.
Apple scab
Biological Methods

• Resistant varieties
• Interference of the pathogen with another organism
Chemical Methods

• Correct diagnosis

• Understand the biology of the pathogen

• **CAREFULLY** read, understand, and **follow** all label instructions
Pesticide damage

R.S. Byther, WSU
Fungicides are usually applied as Protectants.
How Do Pathogens Penetrate Plants?

- Direct Penetration Methods (fungi, nematode)
- Natural Openings
  - Stomata
  - Lenticels
  - Hydathodes
  - Nectaries
- Wounds
- Vectors
General Principles for Healthy Plants:

• monitor often
• sanitation
• careful watering
• healthy planting stock
• resistance & diversity
• right environment for species!