

## Master Gardener Training: Plant Pathology Lecture Outline

Mark C. Black, Extension Plant Pathologist  
Texas AgriLife Extension Service, Uvalde

I. Definition of Plant disease: *disturbance or irritation over time that damages a plant or prevents normal plant development, reducing economic or aesthetic value*

### II. Symptoms

- A. Infection (biotic pathogen) or Exposure (abiotic problem)
- B. Latent period → Early symptoms → Advanced symptoms
- C. Secondary invaders of dead tissue

### III. Collecting samples for diagnosis

- A. Collect a representative sample, including multiple small plants or plant parts without symptoms, early symptoms, and advanced symptoms. One leaf, leaflet, flower, or fruit is often not sufficient.
- B. Observe the site carefully and ask questions for clues (see handout: “Prompts Master Gardener volunteers can use when diagnosing plants)
- C. Avoid drying by placing in plastic bag. Avoid wetness by placing sample on dry paper towel or newspaper. Avoid heat by transporting in insulated container (Styrofoam, etc.). For some samples, it may be necessary to contact the laboratory or specialist by telephone or e-mail ahead of time for other instructions.

### IV. Disease triangle

- A. Virulent **pathogen** [some pathogens require a vector (carrier)]

B. Conducive **environment** for infection and for pathogen growth/  
reproduction/spread

C. Susceptible **plant** (host)

V. Disease control requires changing one or more parts of the disease triangle

**A. Pathogen**

1. Exclusion [*No trespassing!*]
  - a. Disease-free plants and seeds
  - b. Pathogen-free soil, potting mix, topsoil
2. Sanitation [*Let them starve!*]
  - a. Rotation [avoid supplemental plant hosts of pathogen]
  - b. Fallow [no plants, including weeds]
  - c. Roguing whole plants, pruning/hand picking diseased parts
  - d. Crop termination
  - e. Cultivation
  - f. Composting [some pathogens may survive composting]
  - g. Clean tools, stakes, containers, clothes, gloves, boots, etc.
- h. Do not increase insect vector numbers with use of  
unnecessary insecticides that harm beneficial insects
3. Eradication [*Now we're getting serious!*]
  - a. Solarization (only effective in top few inches of soil)
  - b. Heat and/or steam (practical for small quantities of soil or  
compost)
  - c. Gas (metam sodium, chloropicrin, methyl iodide, etc.)
4. Therapy
  - a. Non-systemic pesticides (protectants)
  - b. Systemic pesticides
  - c. Induced resistance [e.g., Actigard™ (acibenzolar),  
Messenger™ (harpin)]
  - d. Biological control (e.g., *Trichoderma*, *Bacillus subtilis*)

**B. Environment**

1. Optimum plant-growing-conditions are usually different from  
optimum disease-conditions
2. Irrigation

- a. Placement
- b. Frequency
- c. Quantity
- 3. Site
  - a. Air movement
  - b. Sun, shade, reflected light
  - c. Temperature (air, soil)
- 4. Soil
  - a. pH
  - b. Drainage (surface and internal)
  - c. Preparation (cultivation, beds, etc.)
  - d. Organic matter
  - e. Mulch
- 5. Nutrition
- 6. Spacing
- 7. Planting date

### **C. Plant**

- 1. Resistant variety developed from existing natural variation by controlled matings (crossing), evaluating hundreds of the offspring, selecting a new variety [may take >10-15 years]
- 2. Resistant variety developed introducing foreign genes [transgenics, GMO (genetically modified organism)]

## **VI. Pathogen types**

### **A. Viruses (singular: virus)**

- 1. Transmission
  - a. Vegetative (cuttings, tubers, rhizomes, runners)
  - b. Seed (through female flower parts and/or through pollen)
  - c. Vector (aphid, thrips, leafhopper, beetle, whitefly, psyllid, mite, nematode, fungus)
  - d. Mechanical (hands, clothing, equipment)
- 2. RNA or DNA, single or double stranded

### **B. Bacteria (singular: bacterium)**

- 1. Bacteria with epiphyte-phase on above-ground and below-ground plant parts; or saprophyte in soil, in debris

- a. Leaf spots, blights, cankers
- b. Vascular wilts
- 2. Bacteria infecting vascular tissue, xylem-feeding insect vectors
  - a. Xylem-limited bacteria vectored by sharpshooter/leafhopper insects (examples: Pierce's disease of grape; bacterial leaf scorch of oleander, red oak, sycamore, cedar elm, etc.)
  - b. Vascular wilt bacteria vectored by beetles
- 3. Bacteria infecting phloem tissue, phloem-feeding insect vectors
  - a. Zebra chip
  - b. Citrus greening
- 4. Bacteria that insert tumor-inducing plasmids into exposed plant cells) [*Agrobacterium tumefaciens* is often used on dicot plants as a vector for foreign genes in transgenic variety development]

C. Phytoplasmas (singular: phytoplasma) [procaryote]

- 1. Insect vectors (example: aster yellows)
- 2. Vegetative transmission (a desirable example: dwarfing and branching of poinsettias)

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Procaryote: any self-contained cell or organism that lacks internal unit membranes

D. Water molds (oomycetes) [eucaryote]

- 1. Protists; related to golden algae, brown algae, diatoms
- 2. Zoospores and oospores
- 3. Phytophthora
- 4. Pythium
- 5. Downy mildew pathogens

E. Parasitic plants

- 1. Mistletoe, dwarf mistletoe
- 2. Dodder
- 3. Broomrape

F. Fungi (singular: fungus)

- 1. Club fungi
  - a. smuts
  - b. rusts

2. Sack fungi
  - a. powdery mildew
  - b. many leaf spots, fruit & stem rots, root rots
    - i. Entomosporium leaf spot on Photinia, Indian hawthorne
    - ii. Cercospora leaf spots
    - iii. Black rot of grape
    - iv. Brown rot of peach & other stone fruits
3. Imperfect fungi
  - a. Rhizoctonia
4. Canker fungi

#### G. Nematodes

1. Plant parasites have stylet
2. Low damage threshold
  - a. Root knot
  - b. Cyst
  - c. Reniform
3. High damage threshold
  - a. Lesion
  - b. Ring
  - c. Sting

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Eucaryote: any cell or organism that possesses a clearly defined nucleus

#### H. Abiotic (non-parasitic)

1. Nutrient deficiency
  - a. Iron
  - b. Zinc
2. Salts
3. Temperature
4. Light
5. Soil moisture
6. Ozone