Plant and Lawn Diseases

Lush and Lean Workshop
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http://plantclinic.nmsu.edu/

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Workshop Goals…

• Learn about how the environment impacts the development of plant diseases
• Learn about some common diseases on ornamental, vegetables and turfgrass (symptoms, conditions for disease and management strategies)
• Learn how to submit a sample to the NMSU Plant Diagnostic Clinic
  – Importance of sample quality
  – Importance of accurate information
But first.........A quick review of a couple important concepts in Plant Pathology......
Important Definitions

• Plant disorder and plant disease
  – What is a plant disorder?
    • Any abnormal growth or development in a plant
  – What is a plant disease?
    • Any abnormal growth or development in a plant specifically caused by an *infectious* *microorganism* (pathogen)
### Causal Agents

<table>
<thead>
<tr>
<th>Biotic</th>
<th>Abiotic</th>
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</thead>
<tbody>
<tr>
<td>• Fungi</td>
<td>• Temperature extremes</td>
</tr>
<tr>
<td>• Bacteria</td>
<td>• Moisture extremes</td>
</tr>
<tr>
<td>• Viruses and viroids</td>
<td>• Soil problems</td>
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<tr>
<td>• Nematodes</td>
<td>• Nutrient deficiency or toxicity</td>
</tr>
<tr>
<td>• Phytoplasmas</td>
<td>• Wind / Air pollution</td>
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<tr>
<td>• Parasitic higher plants</td>
<td>• Pesticide toxicity</td>
</tr>
<tr>
<td>* Insects and weeds</td>
<td>• Improper cultural practices</td>
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The Plant Disease Triangle

- Susceptible Host
- Disease
- Pathogen
- Conductive Environment
How Moisture Impacts Plant Diseases

• Plant pathogens require water for growth and activity
  – How much water is needed is variable
• Soil moisture is a key factor for soil-borne diseases (invade through the roots)
• “Leafwetness” is a key determining factor for foliage diseases caused by fungi
• Frequent showers and high humidity, generally, increase diseases
How irrigation can impact disease

- Improper irrigation is a common predisposing condition for plant diseases
  - Wrong amount
    - Too much
    - Not enough
    - Inconsistent
  - Wrong location
    - Poor distribution
  - Applied at the wrong time
  - Etc...
Common Landscape and Garden Diseases

- Powdery Mildew
- Fungal Leaf Spots
  - Black Spot of Rose
- Vascular Wilts (Verticillium and Fusarium)
- Bacterial Leaf Scorch (Chitalpa)
- Beet Curly Top Virus
- Rose Mosaic Virus

- Turfgrass diseases:
  - Brown patch
  - Pythium
  - “Melting-out”
  - Fairy ring
Powdery Mildew

• One of the most common and damaging plant diseases worldwide

• Common name for diseases which produce whitish, powdery growth on surface of the plant

• Almost all plants can be infected by powdery mildew

• Most powdery mildew fungi have a relatively limited host range
  – Many different species
Powdery Mildew

• Only the above ground plant parts are affected
  – Obligate parasite
• Reduces leaf growth and photosynthetic efficiency, weakens plants, reduces flowering and decreases aesthetic beauty
• Vast majority of the pathogen is on the outside of the plant
• Massive amounts of conidia survive as “repeating spore” and spread disease in season
Powdery Mildew

- Overwintering structures, cleistothecia, may be produced late in the season
  - Spores produced from cleistothecia start new infections the following spring
- In “mild” winters, the fungus can overwinter as mycelium on stems and in rudimentary leaves or bud scales
Powdery Mildew

- Spores germinate when humidity is very high (97-99%)
- Infection develops under conditions of high humidity at night (>90%), moderate humidity during the day (>40%) and warm temperatures (60-80 F)
- Germination to new spore development can occur in as little as 72 hours
- Other factors that influence disease development include:
  - poor air circulation (over-crowding, planting location)
  - cloudy conditions
  - heavy shade
  - Overall condition of plant at the time of infection
  - Cultivar
Management of Powdery Mildew

• PREVENTION
• Tolerant Cultivars
• Reduce humidity/increase air circulation – reduce canopy, reduce over-crowding, increase light
• Good sanitation practices: prune out infected canes, remove fallen leaves, and destroy all infected plant material
• Good cultural practices – proper watering (avoid water on leaves at night) and fertilizer (especially avoid excessive nitrogen)
• Rinse plants with water*
Management of Powdery Mildew

• PREVENTION

• Use of protective (contact) and systemic fungicides* – timing is critical for good control and repeat applications may be necessary depending on environmental conditions

<table>
<thead>
<tr>
<th>Organic</th>
<th>Inorganic</th>
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<tbody>
<tr>
<td>Sulfur</td>
<td>Myclobutanil (Immunox®)</td>
</tr>
<tr>
<td>Oils: Horticultural oils (dormant season); neem oil, jojoba oil</td>
<td>Propiconazole (Systemic Fungicide®)</td>
</tr>
<tr>
<td>Beneficial microorganisms (Serenade® - a bacterium)</td>
<td>Tebuconazole (Disease Control of Roses, Flowers and Shrubs®)</td>
</tr>
<tr>
<td>Baking soda (sodium or potassium bicarbonate) (GreenCure®) or homemade</td>
<td>Triforine (Rose &amp; Shrub Disease Control®, Funginex)</td>
</tr>
<tr>
<td></td>
<td>Thiophanate-methyl (3336®, Halt®)</td>
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*Fungicide list is provided only to give an idea of registered products. It is not all inclusive. No endorsement of products is given nor are recommendations being made. Always read and follow all label instructions when using any pesticide.
Fungal Leaf Spots

• Caused by many different species of fungi
• Disease appears in summer (after a wet spring)
• Damage can be confused with abiotic stresses and insect damage
• Iron deficient plants are more susceptible
Fungal Leaf Spots

• Begins as small spots
  – Random distribution
  – May have a yellow halo

• With continued wet conditions, the spots enlarge into irregular lesions (leaf blotch or blight).

• Over time, spots may develop necrotic center and thick, dark margins without well defined edges

Photos: Jason French, NMSU
Photo: Natalie P. Goldberg, NMSU
Fungal Leaf Spots

- Infection is usually restricted to the foliage
  - Usually an aesthetic problem
- Infection several years in a row can lead to twig infections and branch dieback
Management of Fungal Leaf Spots

• Looks bad, but damage usually doesn’t warrant fungicide treatments
• Clean up fallen leaves
• Prune out dead and dying branches
• Avoid sprinkler irrigation that wets the foliage
• Allow for good air movement around plants
• Good water and nutrient management
Black Spot of Rose

• Caused by the fungus, *Diplocarpon (= Marssonina) roseae*
  – Very host specific
  – Pathogenic races
• Occurs worldwide
• Significant problem in nursery, field and garden grown plants (lesser problem in greenhouses)
Black Spot

- Characteristic black spots, 2-12 mm in diameter on upper leaf surface
  - Mostly circular
  - Coalesce to form irregular blotches
  - Characteristic feathery, radiate, margins
  - Black fruiting bodies may appear in the center of the spots

- Leaves turn yellow and drop prematurely
Black Spot

• Reddish-black lesions may appear on canes
• Spots darken and become blistery with age
• Spots on canes rarely kill the canes, but are important in the overwintering of the pathogen

Photo: Walter Reeves
Black spot

- Leafwetness (7 hrs) is required for germination and infection and high humidity aids disease development
- Favorable temperature range is 60 – 80 F
- Fruiting bodies are produced on leaves and stems 10-18 days after infection
- During periods of moisture, fruiting bodies release characteristic 2-celled spores
- Spores are spread by water, people and insects
- Fungus overwinters in the host tissue either on the plant (canes) or in fallen leaves
Management of Black Spot

• Resistant (tolerant cultivars)
  – Pathogenic races make it difficult to develop resistant cultivars
• Keeping leaves dry is critically important
  – Avoid wetting leaves with irrigation water (water early in the day so that leaves dry quickly)
  – Provide good air circulation around plants (proper pruning and plant spacing)
  – Decrease humidity (increase sunlight)
• Good dormant pruning to remove infected canes
• Many fungicides are available to help manage but shouldn’t be necessary if leaves are kept dry!
Vascular Wilt Diseases

- Verticillium and Fusarium – two common soil-borne fungi
- Different organisms with similar affects on plants:
  - Impair the water conducting tissue (xylem)
- Common symptoms: yellowing, wilting, defoliation, and vascular discoloration

Photo: Natalie P. Goldberg, NMSU
Management of Vascular Wilts

- Management is very difficult – infected plants will eventually die
- Life of plants infected with a mild strain may be prolonged with good water and fertilizer management
- Prevention: use disease-free transplants, avoid injury to crown and roots when planting, provide adequate water and fertilizer
- Replant diseased areas with non-hosts
Bacterial Leaf Scorch of Chitalpa

Southern Catalpa
*Catalpa bignonioides*

Desert Willow
*Chilopsis linearis*
Chitalpa
A New Bacterial Disease in Chitalpa
Bacterial Leaf Scorch

• *Xylella fastidiosa*
• Bacteria that invades the xylem vessels and inhibits water movement in plants
• Also causes:
  – Pierce’s Disease in grapes
  – Pecan leaf scorch
  – Alfalfa dwarf
  – Periwinkle wilt
  – Oleander leaf scorch

Photos: Natalie P. Goldberg, NMSU
Bacterial Leaf Scorch

- In NM, first discovered in chitalpa in 2006

Photos: Natalie P. Goldberg, NMSU
Bacterial Leaf Scorch

• Bacterium was found in grapes (Pierce’s Disease) the same year
• Research showed the bacterium to be the same in both plants – suggesting transmission between hosts
  – Disease is vectored by xylem feeding insects
  – But, no specific vector has been determined in NM

Photos: Natalie P. Goldberg, NMSU
Photo: Don Pace, nathistoc.bio.uci.edu
Bacterial Leaf Scorch

Found in catalpa in 2008 (same as chitalpa strain)

Found in peach in 2010 (different strain)
Management of Bacterial Leaf Scorch

• Once infected, there is no cure
  – Remove trees that no longer provide aesthetic beauty
• No chemical treatments available
• Good water and fertilizer management will help to reduce the impact of disease on the plant
• Prune out dead and dying branches
Beet Curly Top Virus

- Occurs in arid and semi-arid regions of the world
- Wide host range – peppers, tomatoes, melons, beans, spinach, beets, many ornamentals, and weeds
- Transmitted in a persistent manner by the beet leafhopper

Photos: Natalie P. Goldberg, NMSU
Management of Beet Curly Top Virus

- Once infected, there is no cure – destroy infected plants
- Plant in slightly shady location
- Use protective netting
- Weed control!
- Resistance?
- Chemicals – Not yet
- Insect control – No
Rose Mosaic Virus

- Most common virus disease on roses
- Occurs worldwide
- Caused by isolates of Prunus Necrotic Ringspot Virus and Apple Mosaic Virus
- Found together or separately in rose bushes
- The disease is called Rose Mosaic Virus
Rose Mosaic Virus

- Symptoms are highly variable depending on virus, cultivar, and the environment
  - Wavy lines
  - Chlorotic bands
  - Ringspots
  - Yellow vein banding
  - General mosaic
Rose Mosaic Virus

- Symptom development on only a portion of the plant is common
  - A few leaves
  - One cane
- Color breaking and deformity may occur in flowers
- Some infected plants never exhibit symptoms
Rose Mosaic Virus

• Only proven transmission is through vegetative propagation of infected plant material
• Little evidence of spread in the garden
  – May be through pollen but spread is incredibly slow
• Infected plants have decreased vigor, poorer transplant and survival rates, and are more susceptible to winter kill
Management of Rose Mosaic Virus

• No control for infected plants
• Remove symptomatic canes or, if disease is systemic in the plant, remove infected plants
• Use certified virus-free propagative plants
• Heat treat buds before use
  – Hold buds at 100 F for 4 weeks
Turfgrass Diseases

Environment or Cultural Problem

Pathogen

Photos: Natalie P. Goldberg, NMSU
Common Turfgrass Diseases

Brown Patch
Common Turfgrass Diseases

Pythium
Common Turfgrass Diseases

Melting-out Diseases ("Helminthosporium")
Common Turfgrass Diseases
Turfgrass Disease Management*

• The key to disease management is prevention!
• Cultural Management is critical:
  – **Water**
  – Fertilizer
  – Mowing
  – Aeration/de-thatching
  – Chemicals

• An accurate identification of the disease (pathogen) is necessary for successful chemical control.

*Publication (“Lawn Care for Disease Control”) available at [http://plantclinic.nmsu.edu](http://plantclinic.nmsu.edu)
How does water impact disease?*

• Too much water
• Not enough water
• Inconsistent water

• Other conditions that impact soil moisture:
  – Drainage
  – Compaction (traffic)

*Can increase plant stress and susceptibility to disease
Too Much Water

• Favors succulent growth
• Causes root dysfunction
  – Lack of oxygen
  – Favors microbes that produce toxic metabolites
• Favors disease development

Photos: Natalie P. Goldberg, NMSU
Too Much Water (Biotic - non-pathogen)

- Black layer
- Moss
- Algal scum
- Slime mold

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Too Much Water (Fungal Diseases)

- Favors plant pathogenic fungi that tolerate low oxygen levels

- Pythium blight
- Brown patch
- Fusarium patch (pink snow mold)
How does water impact disease?

• Leaf wetness is required for disease development
  – Some diseases need as little as 3-4 hours of leaf wetness for infection.

• Prolonged high humidity and/or leaf wetness creates the perfect environment for disease development
Not Enough Water

• Produces a shallow root system that is unable to tolerate environmental extremes
• Reduces plant growth
• Plants are more susceptible to mechanical damage and temperature stress
• Desiccation of roots - death.
Managing Water

• Whenever possible water in the morning - reduce leafwetness.
• Water to wet the entire root zone – promote a deep root system.
• Amount and frequency of irrigation depends on:
  – Turf species.
  – Soil characteristics.
  – Slope (topography).
  – Environment – temperature and moisture.
Diagnosing Plant Disorders

- The process of determining the cause of an abnormality
- Diagnosis is a team effort
  - Grower/Consultant/Manager
  - Submitting agent
  - Diagnostic clinic
- Conclusions are derived from critical evaluation of the plant and the environment
- Requires a blend of good observational skills, science, and experience
Remember….Symptoms alone are usually insufficient for diagnosis

- Symptoms are not specific to the causal agent!
- Proper identification is important in developing management plans
Accurate Diagnosis (Gower/Submitter Responsibilities)

• Early detection
  – Routine observation
  – Observe the plant, the environment and the surroundings (including other plants of same and different species)

• Accurate information about the sample (submission form)

• Collect and submit a good, high quality, sample
Plant Specimen Submission Form

- Found in county extension offices or online (http://plantclinic.nmsu.edu)
- Helps to remind you of the information needed
  - How long the plant has been exhibiting symptoms
  - Specific description of symptoms
  - Information on symptom development (spread, patterns, etc.)
  - Growing conditions and cultural practices
  - Environmental conditions
  - Chemical use history
Good Quality Samples

- Are in the early to middle stages of disease
  - Dead plant tell no tales
- Are fresh and in good condition
  - Send or deliver to the Plant Diagnostic Clinic as quickly as possible after collection
- Are representative of the problem – range of symptoms and a range of severity
- Contain the margin of disease

Sorry, but it’s too late!
Diagnosing Plant Disorders

• Diagnosis is a team effort
  – Grower
  – Submitting Agent
  – Diagnostic Lab

• NMSU Plant Diagnostic Clinic:
  – http://plantclinic.nmsu.edu
  – Forms and information for submitting samples
  – Publications, presentations, links, etc.

• Diagnostic services provided at no charge when samples are submitted through the County Extension Agents

Photo: NMSU