PLANT DISEASE CONCEPTS

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Azalea petal blight

Azalea Petal Blight

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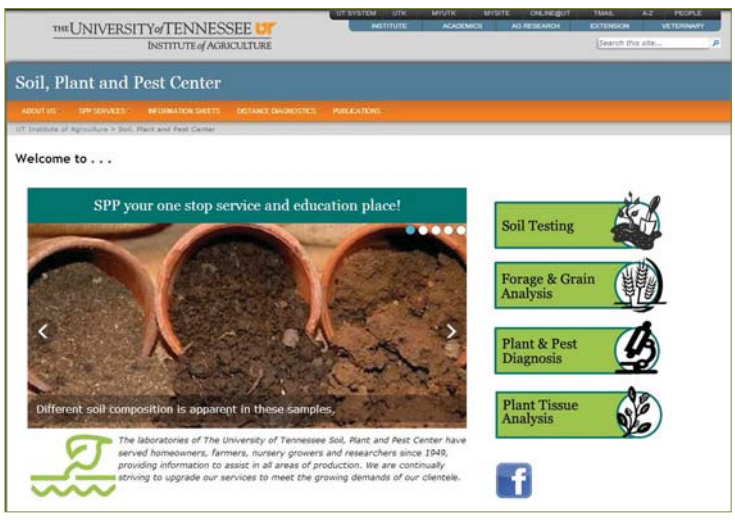

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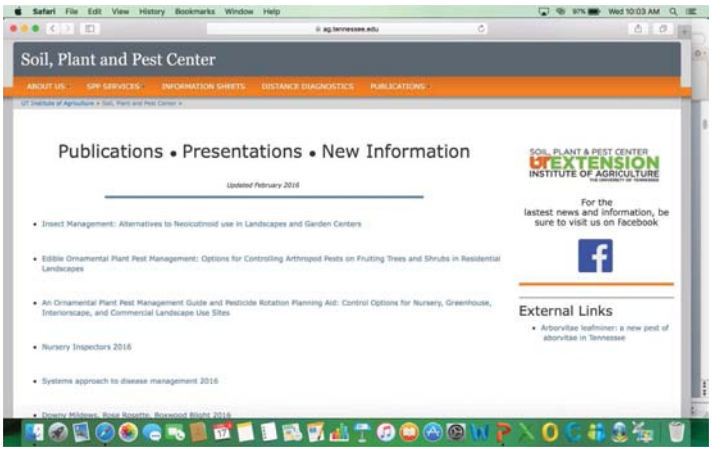

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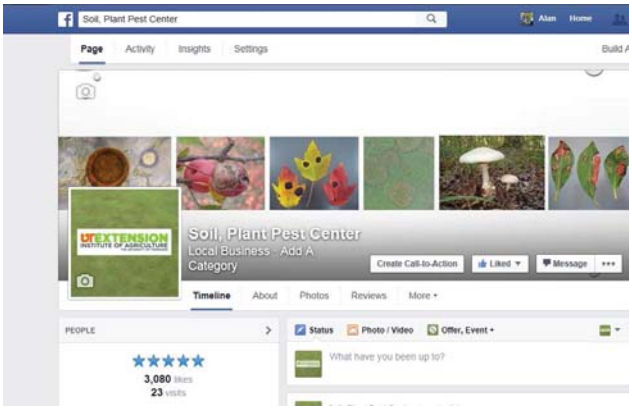
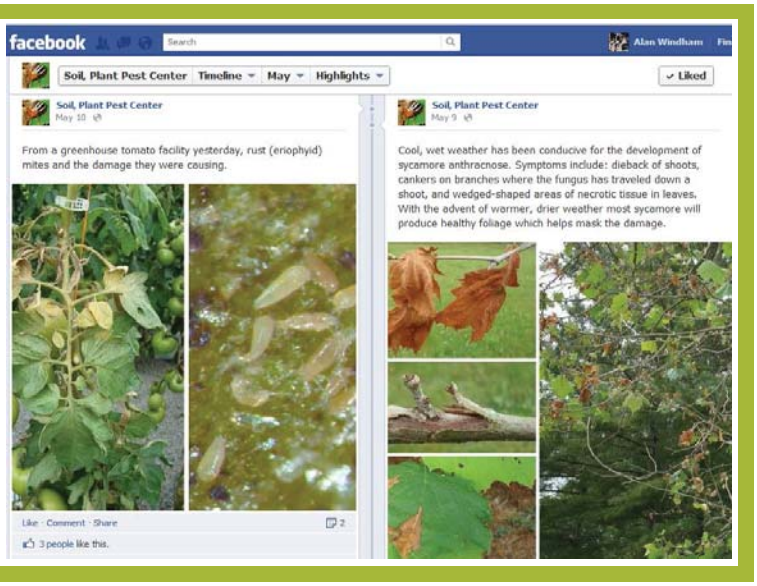




PLANT DISEASES- THE BASICS

How do we diagnose Plant Diseases?

- What is the host?
- Imagine a healthy plant
- What plant functions are being disrupted?
- What plant parts are affected?
- What are the signs and symptoms of disease?

What plant part is affected? Functions disrupted?

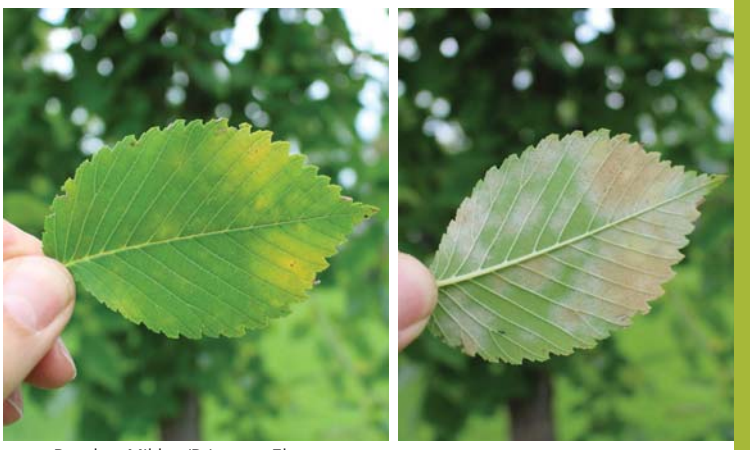
Root knot nematode injury on begonia. Deformed roots are inefficient at transporting water and nutrients.

Compare a healthy and diseased plant

How does the symptomatic plant on the right differ from the healthy plant?

Hosta 'August Moon' infected with hosta virus X

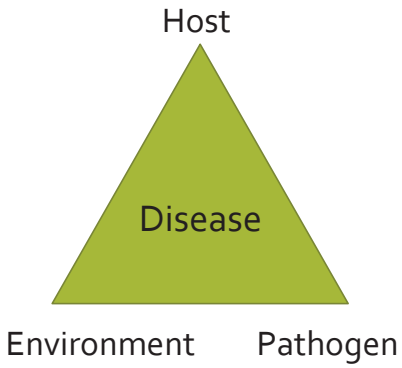
Symptoms and Signs of Disease



Powdery Mildew/Princeton Elm

The Plant Disease Triangle

If we can affect one of these elements, we can minimize damage from the disease.
Options:
- Disrupt the pathogen
- Modify the environment
- Alter the physiology or genetics of the host



Plant Disease Management

- Avoidance
- Exclusion
- Eradication
- Protection

Avoidance

- Choosing a planting location where the pathogen is not present
- Choosing a planting site not conducive to disease
- Crop Rotation

Exclusion

- Legal restrictions and quarantines
- Propagation of disease free cuttings
- Production of disease free seed in areas not favorable for disease

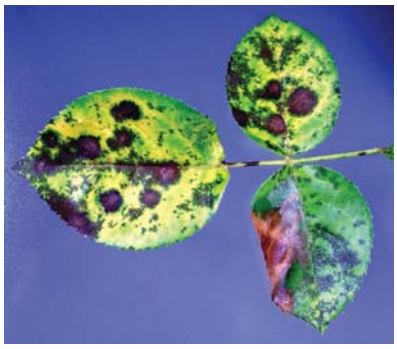
Eradication

- Removal of pathogens from infested soil and tools
- Removal of pathogens from infected seed or plant parts
- Removal of infected plants

Steaming soil to eradicate root knot nematode

Protection

- Cultural control
- Biological control
- Chemical control
- Genetic resistance



New Dogwoods from UT AgResearch

The UTIA Dogwood Team was established to bring the expertise of several scientists together to develop disease management strategies for dogwood anthracnose and powdery mildew. The Appalachian Series of Dogwoods is a product of this collaboration.

- Disease resistant dogwoods released:
- Appalachian Spring – anthracnose resistant
- Appalachian Joy – mildew resistant
- Appalachian Blush- mildew resistant
- Appalachian Mist – mildew resistant
- Appalachian Snow – mildew resistant

Disease control with fungicides

- Fungicides protect healthy plants
- Fungicides do not cure sick plants!
- Fungicides represent only one disease management strategy

Control of Powdery Mildew on Dogwood

The dogwood on the right was sprayed once a week for six weeks when signs of powdery mildew were detected with copper octanoate (copper soap).

What are the causes of Disease?

- Fungi
- Bacteria
- Nematodes
- Viruses
- Parasitic plants
- Abiotic Factors

Fungi

- Fungi are composed of living filaments called hyphae
- Need an outside food source
- Pathogens of plants and animals, sometimes
- 300,000 species of fungi described; most are not plant pathogens

Powdery Mildew

Powdery mildew is a fungal disease. White, powdery fungal growth is most evident on the upper leaf surface.

Downy mildew on Garden Impatiens

Downy mildew of garden impatiens has damaged landscape plantings in the U.S. in 2011-2015. White fungal growth is on the lower leaf surface.

Bounce Impatiens (pink) resistant to downy mildew; white garden impatiens are at risk

Downy Mildew of Impatiens

Downy Mildew of Garden Impatiens

Impatiens alternatives

Begonia, New Guinea Impatiens, Divine series of New Guinea impatiens, SunPatiens, Coleus, Bounce and Big Bounce Impatiens, Torenia

Bounce Impatiens

Downy Mildew of Basil

Basil downy mildew was widespread in 2015 in the U.S. The causal fungus is unique to basil.

Do you know the symptoms of boxwood blight?

Boxwood Blight – leaf spots

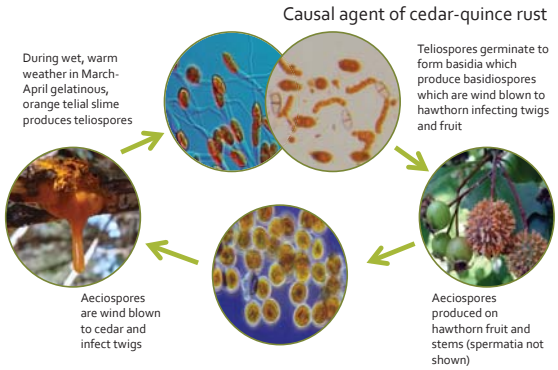
Boxwood Blight

Rusts

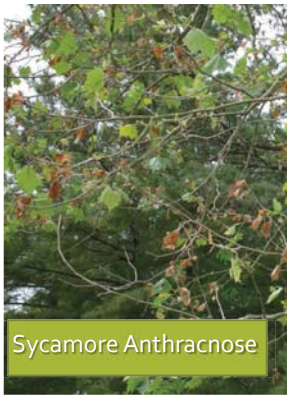
Cedar apple rust is a heteroecious rust, requiring two unrelated hosts to complete its lifecycle. Autoecious rusts only require one host to complete their lifecycle.

- Yellow leaf spots and rust colored pustules
- Numerous hosts including conifers, broadleaf plants
- May also cause galls, twig dieback

Life cycle of Gymnosporangium clavipes



Daylily rust



Fungal leaf spot/Indian hawthorn

Entomosporium attacks hawthorn, photinia, pear

Shot hole/Cherry

Shot hole disease of cherry

Fungal Canker disease

- Localized infection, often causing branch dieback
- May follow drought stress
- Prune out dead branches to stop spread

1 year Later- Canker has moved to main Stem

- To prevent: irrigate to minimize water stress
- Prune out dead branches when they are observed or you could lose the whole plant

Root rot diseases

- Affected plants may be stunted, wilted
- Discolored, decayed roots
- Poor drainage, standing water, excessive irrigation, favor disease development

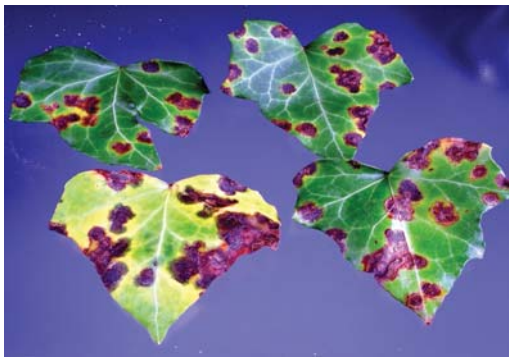
Phytophthora root rot/juniper

Bacteria

- Single celled organisms much smaller than fungal spores
- Not visible to the naked eye
- Shaped like rods, spheres, helical

Bacterial Leaf Spot

Xanthomonas leaf spot on English ivy. Symptoms of bacterial leaf spot: watersoaked, angular spots; yellow halos around lesion.



Crown gall

- Tumors/galls on stems/roots
- Soft, spongy to wooden and corky with maturity
- Bacteria enter through wounds

Crown gall on a wisteria stem

Fire Blight

A bacterial disease of apple, crabapple and pear. Symptoms at right include a classic symptom for fire blight, a "shepherd's crook" and a stem canker.

Bacterial leaf scorch

Leaf hoppers are the insect vectors of bacterial leaf scorch. The xylem inhabiting bacterium that is the causal agent plugs those vessels that transport water to leaves resulting in leaf scorch.

Bacterial leaf scorch, vascular wilt disease of shade trees, especially pin oak

Bacterial Leaf Scorch-Sycamore/Sept 2014

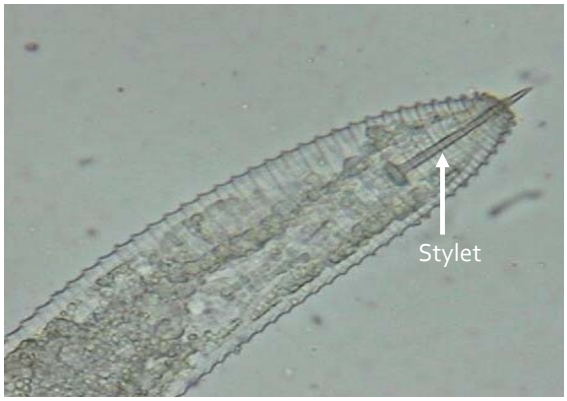
Nematodes

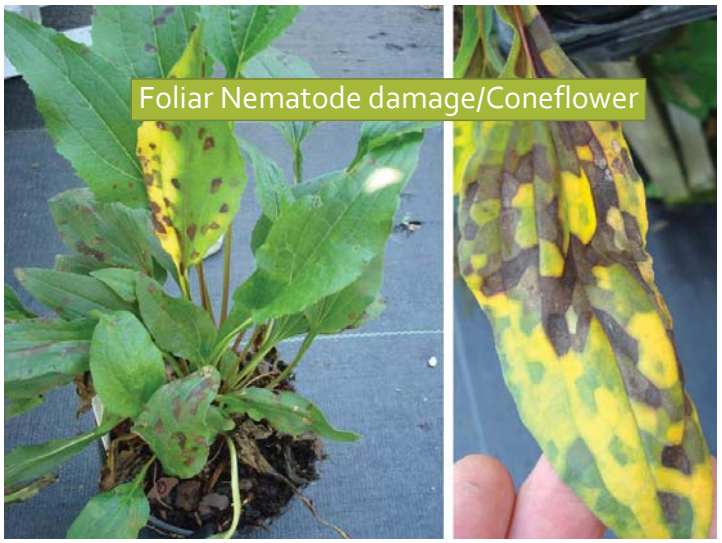
- Nematodes are non-segmented worms
- About 10% are plant pathogens
- All plant parasitic nematodes have a mouthpart called a stylet

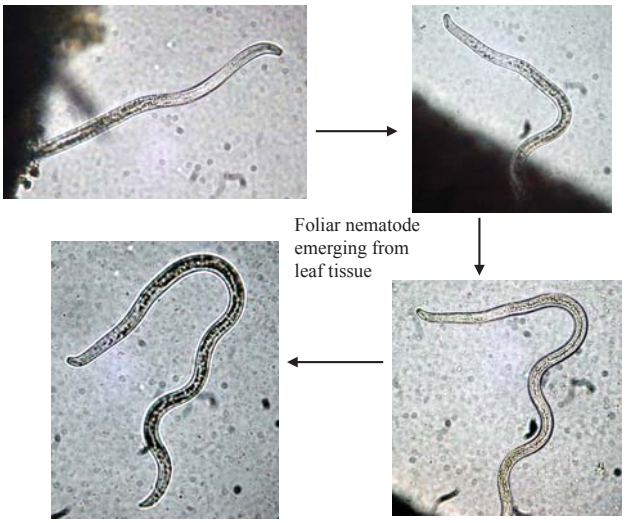
Pinewood nematode

Ring Nematode

Plant parasitic nematodes have a mouthpart called a stylet. They use it to rupture cell walls and feed on the content of the cell.







Root knot Nema damage/Tomato

Root knot juvenile nematodes hatching from egg mass

Tomato disease Resistance Codes

- **V** Verticillium Wilt
  F Fusarium Wilt
  FF Fusarium, races 1 and 2
  FFF Fusarium, races 1, 2, and 3
  N Root Knot Nematode
  A Alternaria
  T Tobacco Mosaic Virus
  St Stemphylium (Gray Leaf Spot)
  TSWV Tomato Spotted Wilt Virus

Resistant to Verticillium wilt, Fusarium wilt, root knot nematodes

Solarization with clear plastic to reduce soil-borne pathogens such as nematodes

During summer months for 6-8 wks. Raise plastic an inch or two with sticks or small pipes. Seal edges with soil.

Straw bale gardening

Plant Viruses

- Infectious, submicroscopic, intracellular agent
- Composed of nucleic acid and a protein coat
- Tobacco mosaic virus was the first described
- Most plant viruses are named for the first plant in which they were found (or for an economically important host)
- Nearly 1,000 species of plant viruses

How do Viruses spread Plant to Plant?

- Insects (cucumber mosaic virus – aphids; tomato spotted wilt virus, impatiens necrotic spot virus- thrips)
- Nematodes (tobacco rattle virus)
- Mites (rose rosette virus)
- Sap (tobacco mosaic virus)
- Fungi (soil-borne mosaic)

Symptoms of Virus diseases

- Variety of symptoms including: mosaic, ringspots, oakleaf patterns, stunting, flower break

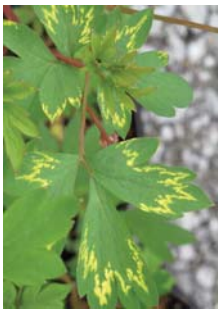
Flower break and ringspot symptoms on mountain laurel.

Mosaic virus symptom

Mosaic symptoms of plants may be caused by viruses such as: tobacco mosaic virus, cucumber mosaic virus, alfalfa mosaic virus, etc.

Viral Symptoms

Several plant virus cause ringspots symptoms on leaves and/or fruit. Two of the most common are: tomato spotted wilt virus and impatiens necrotic spot virus.



Line pattern or oak leaf pattern

Ringspots

Canna Yellow Mottle Virus

Infected canna is stunted and variegation is not true to type compared to healthy canna on right.

Rose rosette

Rose rosette virus causes a witches broom (rosette) symptom; infected plants die within 2-3 years. Many roses are susceptible. Eriophyid mites are vectors of the virus.

Rose Rosette

Rose Rosette Research

- Study Spread of disease in mass plantings
- Evaluation for resistance
- Management with pruning, miticides, barriers
- Develop a reliable test to assay roses

Diseases caused by abiotic factors

- Environmental factors
  - Temperature
  - Moisture
  - Light
  - Nutrients
  - pH
  - Chemicals- air pollutants, herbicides

Iron chlorosis

Iron chlorosis of willow oak caused by alkaline soil pH

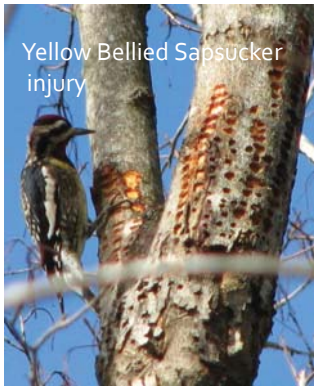
Water Stress can lead to leaf scorch

Leaf scorch due to drought stress/ dogwood

Poor Drainage; excess irrigation

Injury to Plants

Injury to plants is more immediate and not progressive over time as many abiotic problems like nutritional deficiencies. Pictured right are hail damage to dogwood and yellow bellied sapsucker injury to sugar maple.



In Review, Disease Management

- Research before you buy, choose disease resistant cultivar/species when available
- Choose healthy plants
- Plant in locations that favor optimum plant growth, not plant pathogens
- Irrigate and prune for canker disease control
- Drip irrigation to minimize foliar disease
- Don't propagate diseased plants

Disease Management Continued

- Crop rotation for soil-borne pathogens
- Add 4" of pine bark to soils before planting azaleas, rhododendron, other ericaceous plants
- Remove diseased plant parts, diseased plants
- Solarization for soil-borne pathogens
- Follow soil test recommendations for nutrition, adjust pH if needed
- Use fungicides wisely

Questions?