


## Basic Plant Pathology & Troubleshooting Plant Problems


Department of Plant Pathology  
University of Georgia

Paul Pugliese, MPPPM  
Agriculture & Natural Resources Extension Agent  
Bartow County Cooperative Extension Coordinator




## Learning Objectives

- Define plant pathology
- Economic importance of plant diseases
- Pathogenic and Non-pathogenic diseases
- Disease triangle
- Fungal diseases, fungi reproduction and fungal infection
- Viruses and how viruses are spread
- How diseases are caused by nematodes




## History of Plant Pathology

- American Phytopathological Society – 1908
- Irish Potato Famine – 1844
  - intro. potato in 1760 & pop. grew from 2-9m
  - 2m died; 2m emigrated to America
- Chestnut Blight – 1904 – 1940
  - Chestnuts once composed 50% of eastern hardwoods
- Dutch Elm Disease – 1930 – Present
- Sudden Oak Death – 2000 – Present

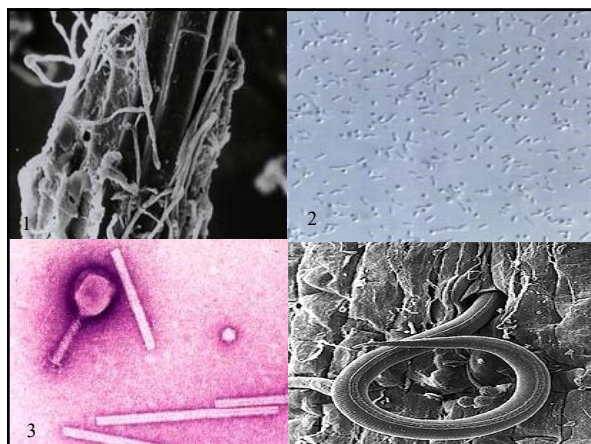



## Plant Diseases




- Fungi (80%)
- Bacteria (10%)
- Viruses (5%)
- Nematodes (5%)
- Phytoplasmas (<1%)

- Over 10,000 species of fungi can cause disease in plants!!
- Over 100,000 fungi are beneficial – strictly saprophytic.

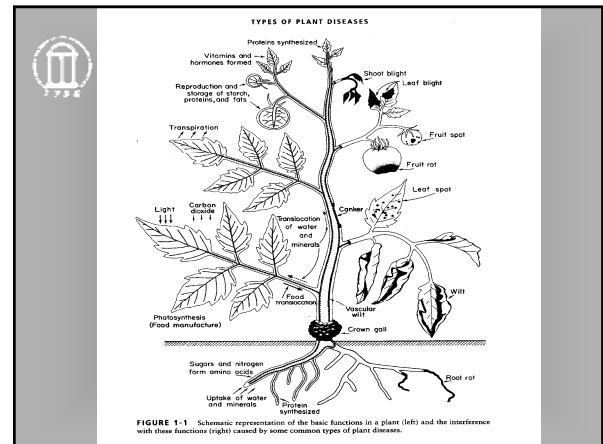




## Disease Disorder Terminology

- **DON'T BE FOOLED - DO NOT ASSUME THAT ALL SIGNS AND SYMPTOMS OBSERVED ARE CAUSED BY A DISEASE ORGANISM!**
  - Biotic (pathogenic) – living disease with random symptoms\*\*
  - Abiotic (non-pathogenic) – environmental/chemical stress with uniform symptoms\*\*
- A positive diagnosis of a plant disease is often difficult or nearly impossible on the basis of symptoms alone...


 **Disease Symptom Terms**

- Canker
- Chlorosis (yellowing)\*\*
- Concentric leaf spot
- Damping off
- Decline
- Dieback
- Galls
- Leaf Curl
- Necrosis
- Root rot
- Scab
- Scorch
- Soft rot
- Wilt
- Witches' broom
- Anthracnose




 **I. Foliage Diseases**


- Generally are not considered lethal
- Primarily an aesthetic issue
- Usually not practical to treat large trees
- Prevention is the key to managing:
  - Sanitation
  - Proper pruning
    - Adequate sunlight and good air circulation
  - Proper watering and drainage
  - Maintain tree/shrub vigor and health

 **II. Stem & Branch Diseases**


- Can cause significant damage to trees/shrubs
- May result in total defoliation
- Cankers may weaken stems/trunks
- Dieback of entire branches or canopy
- Often spread to adjacent plant hosts
- Chemical treatments are limited
- Early Detection is the key to management!
- Vascular wilt diseases cannot be treated!
- If in doubt, cut it out!!!

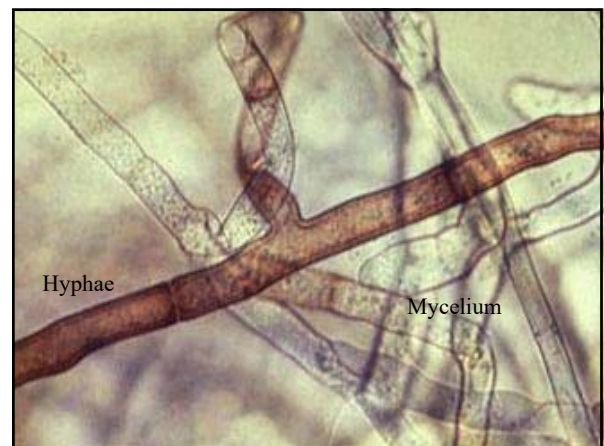
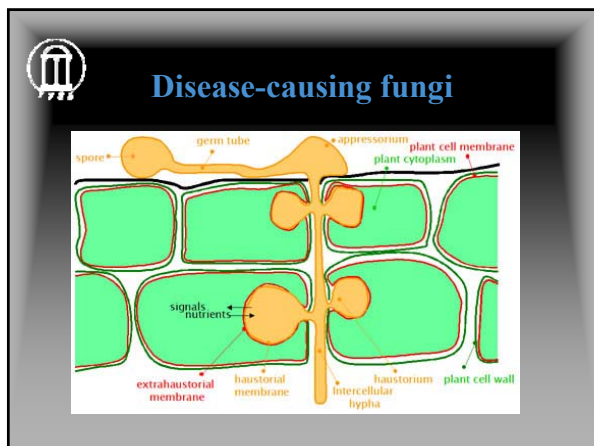
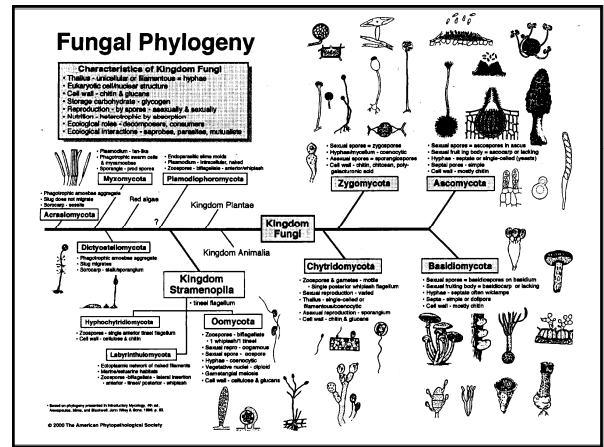
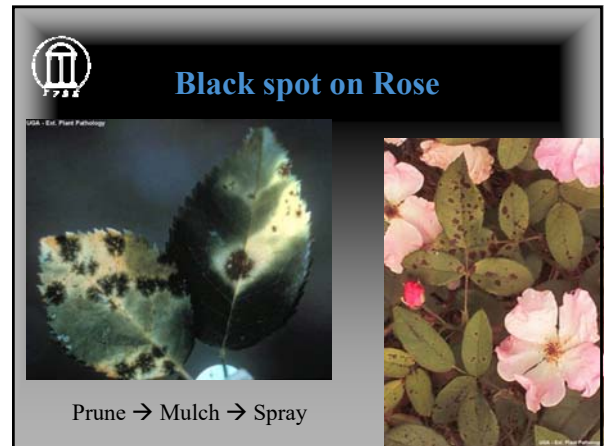
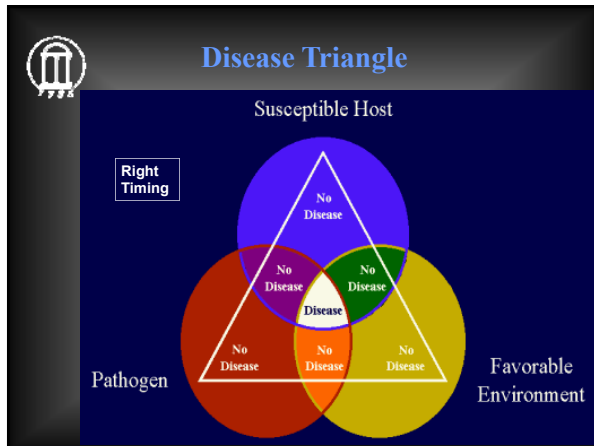
 **III. Root Diseases**

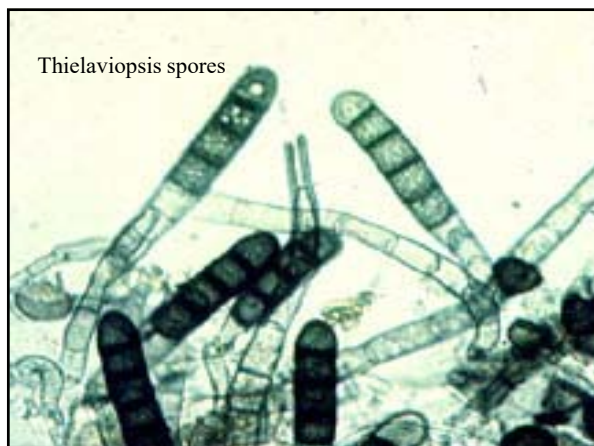
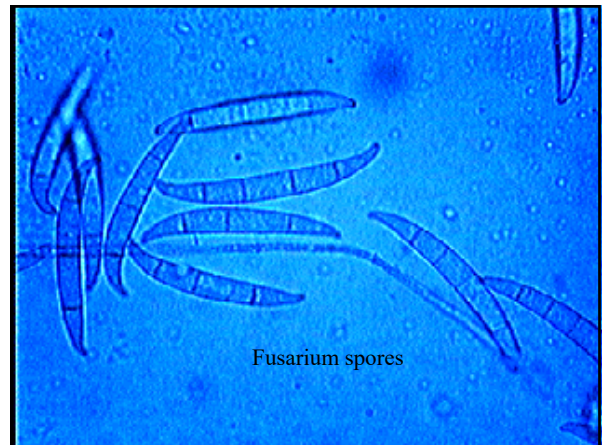
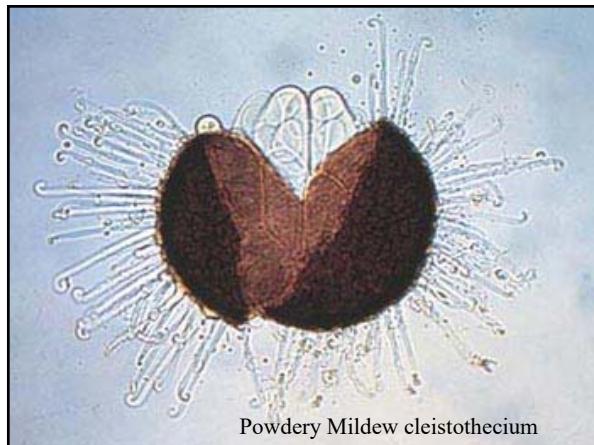
- Often cause roots to decay or rot
- Results in reduced uptake of water and nutrients
- Trees can become susceptible to wind throw
- Often very difficult to diagnose
- Management options are limited
- Prevention is the key to managing
- Almost always the result of environmental stress\*\*

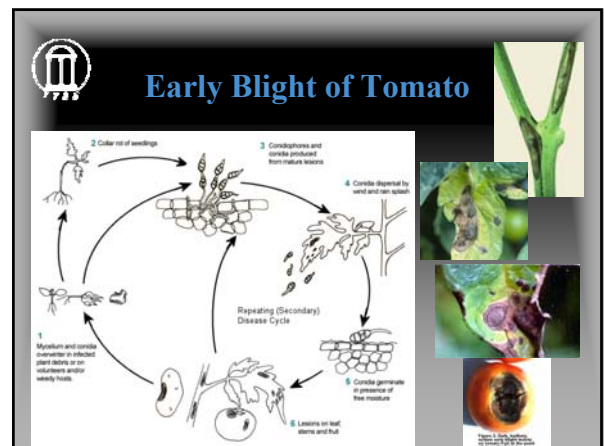
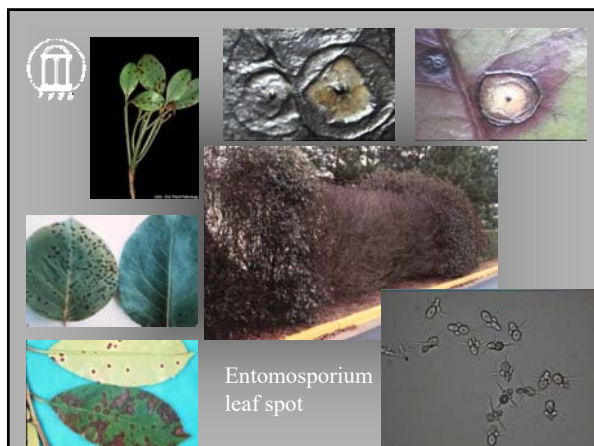
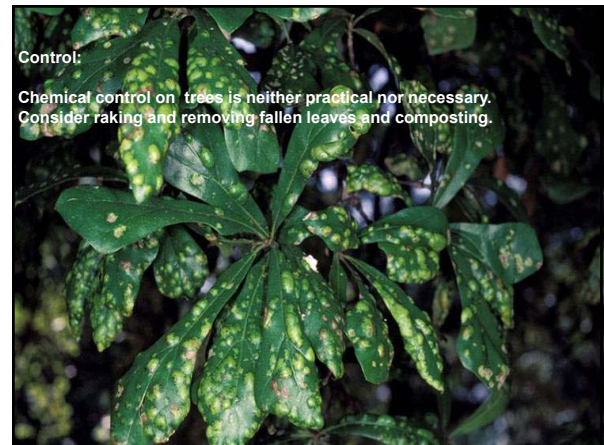
 **Troubleshooting Tip:**


- **DO NOT ASSUME THAT JUST BECAUSE YOU FIND AN INSECT OR A DISEASE THAT THEY ARE THE SOLE REASON FOR THE PLANT'S DECLINE!**
  - Secondary Diseases – saprophytic, beneficial, or “weak” pathogens
  - Primary Diseases – parasites
  - Combination of primary and secondary diseases
  - Other Stress Factors.... “complex”



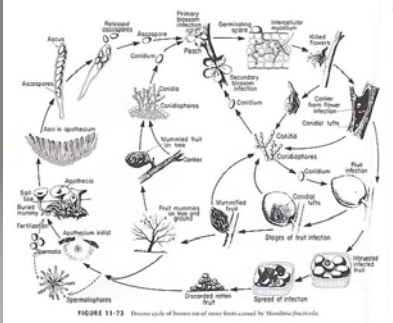










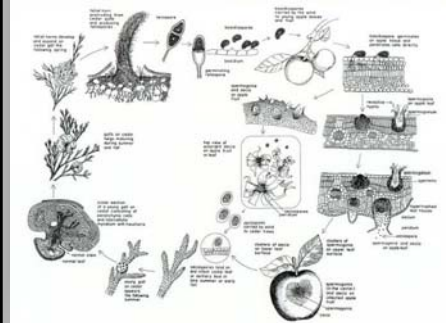

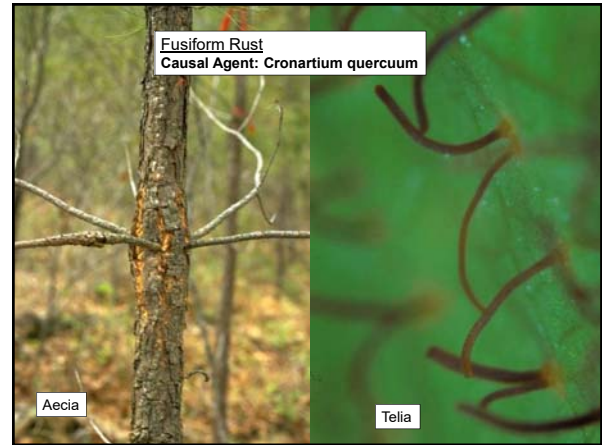


### Brown rot of Peach

**FIGURE 11-73** Disease cycle of brown rot of stone fruits caused by *Botrytis cinerea*.



### Cedar-Apple Rust








### Black Knot

Common gall on cherries, plums, and peaches.

Symptoms include dieback of branches, thin crowns, and gnarly black galls on trunk or branches.

Control: Prune branch galls six to eight inches below infection. It is impractical to remove trunk galls.






**Dutch Elm Disease DED**  
Yellowing, flagging and branch dieback

Staining under bark

**VASCULAR WILTS**

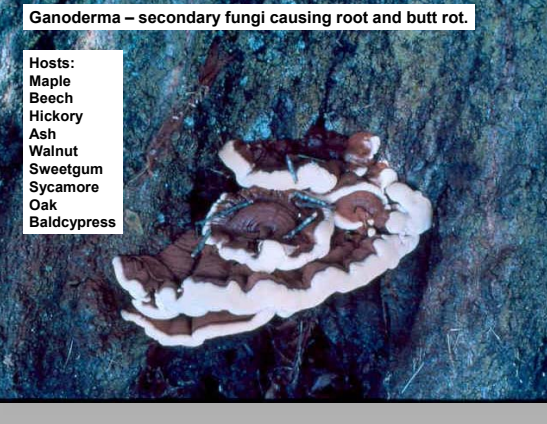


**Verticillium Wilt**

**Sample Hosts:**  
Maple  
Ash  
Elms  
Magnolia  
Redbud  
Yellowwood  
Tuliptree, Yellow Poplar


Symptoms include curling, drying, intervencinal chlorosis or reddening, defoliation, wilting, dieback and death.

Infection occurs on stressed trees and is initiated through the roots and wounds.



**Ganoderma – secondary fungi causing root and butt rot.**

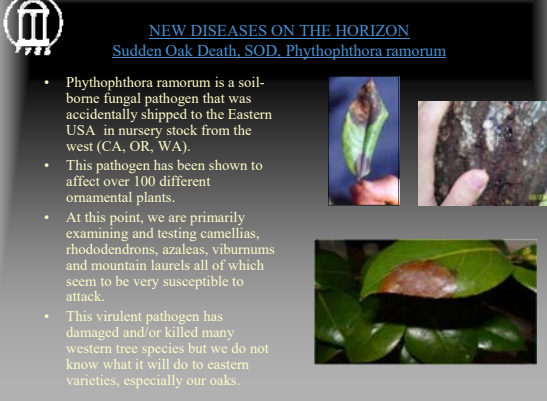
**Hosts:**  
Maple  
Beech  
Hickory  
Ash  
Walnut  
Sweetgum  
Sycamore  
Oak  
Baldcypress



**Dealing with Trunk and/or Root Decay Problems**

- In most cases, refer clients to certified arborists for a proper, on-site evaluation.
- Certified arborists can be located by using the ISA web site: [www.isa-arbor.com](http://www.isa-arbor.com)

Visual examinations of soft spots, wounds or actual decay fungi are only indicators. Devices that take actual cores or use other methods to evaluate the extent of fungal damage are preferred.



**NEW DISEASES ON THE HORIZON**  
Sudden Oak Death, SOD, *Phytophthora ramorum*

- Phytophthora ramorum* is a soil-borne fungal pathogen that was accidentally shipped to the Eastern USA in nursery stock from the west (CA, OR, WA).
- This pathogen has been shown to affect over 100 different ornamental plants.
- At this point, we are primarily examining and testing camellias, rhododendrons, azaleas, viburnums and mountain laurels all of which seem to be very susceptible to attack.
- This virulent pathogen has damaged and/or killed many western tree species but we do not know what it will do to eastern varieties, especially our oaks.



**Stop the Spread of Sudden Oak Death**

**This county is under quarantine.**

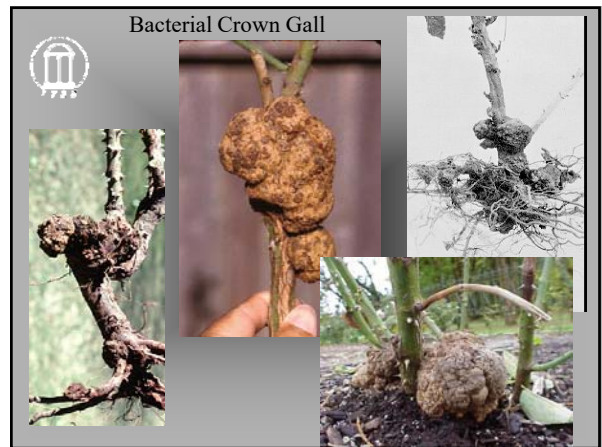
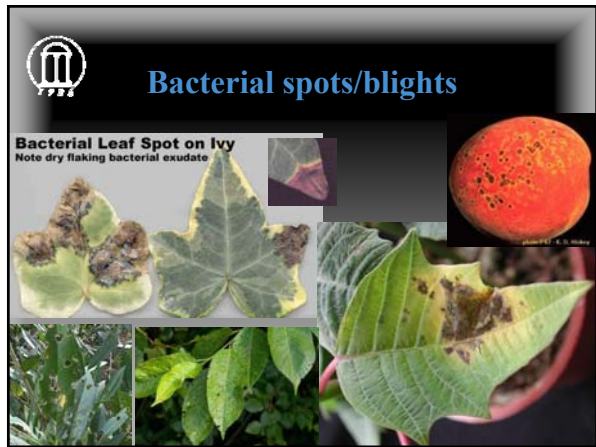
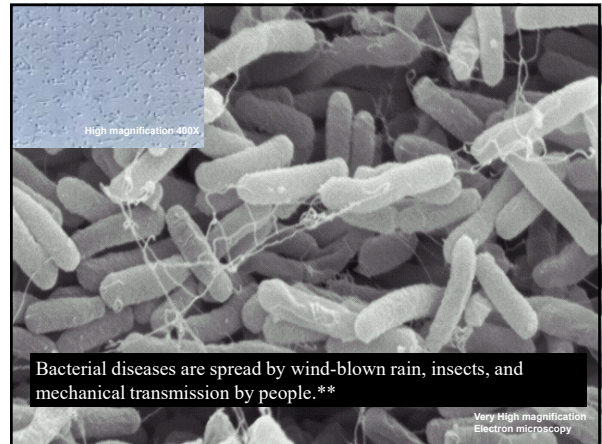
**What can you do?**

- Do not collect or market material including leaves, flowers, stems, twigs, wood and bark.
- Avoid muddy areas when parking your vehicle. Spores may collect in mud on your tires and spread to other areas.
- Stay on established trails - respect trail closures.
- Avoid areas of damp soil or mud when walking, hiking or mountain biking to prevent the pathogen from hitch-hiking.
- Clean soil and mud off shoes, boots, vehicles and horses before leaving to prevent spreading the pathogen to other areas.
- Check neighboring lots with neighbors.

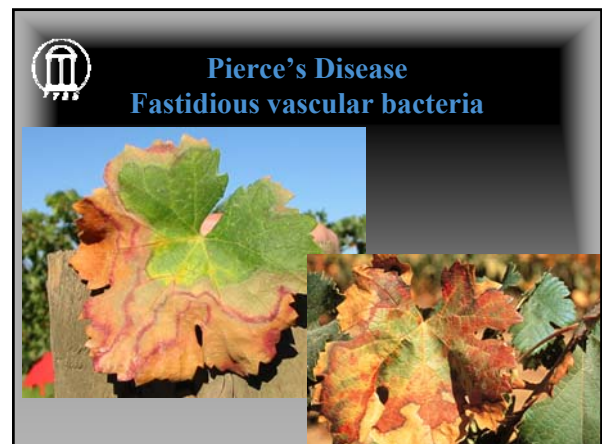
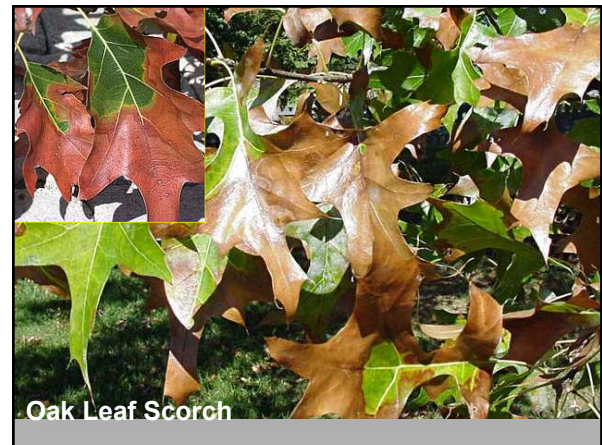
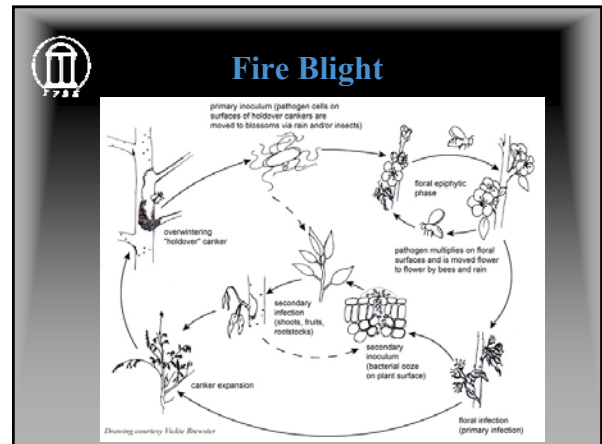
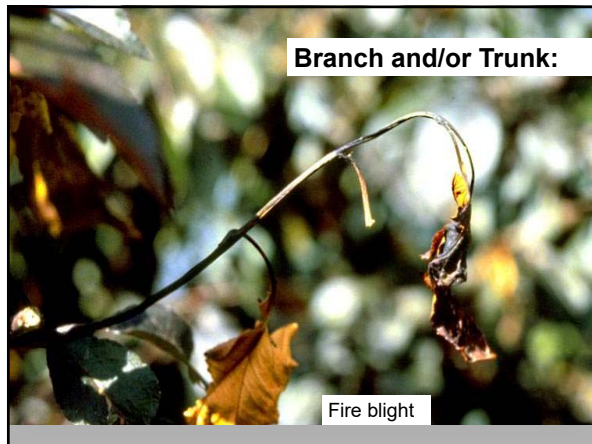
**Don't take it home!**

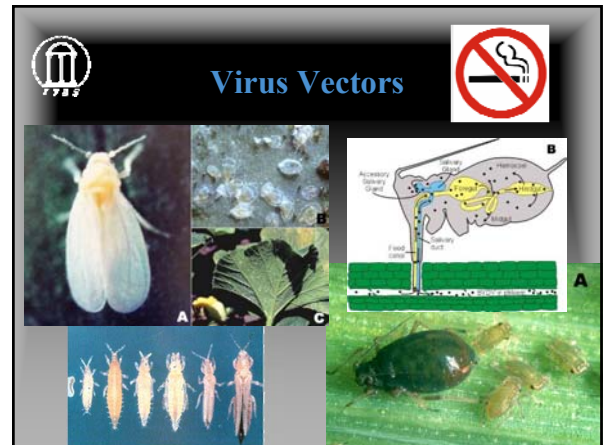
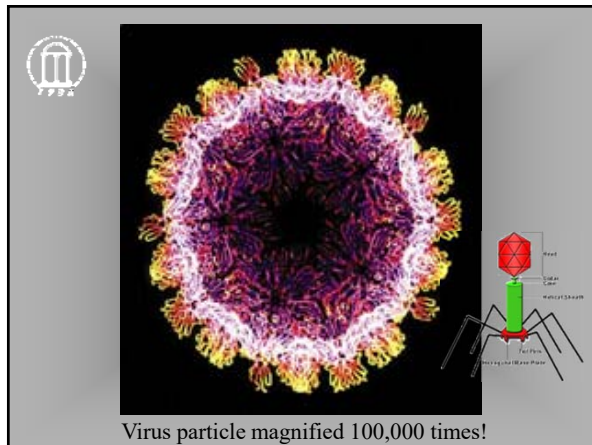
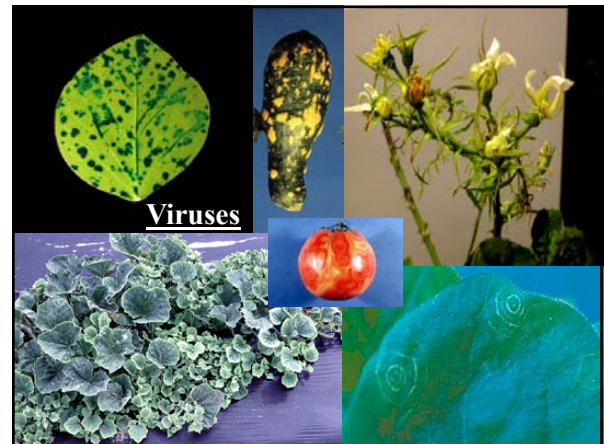
For further information visit the website at [www.sodquarantine.com](http://www.sodquarantine.com)

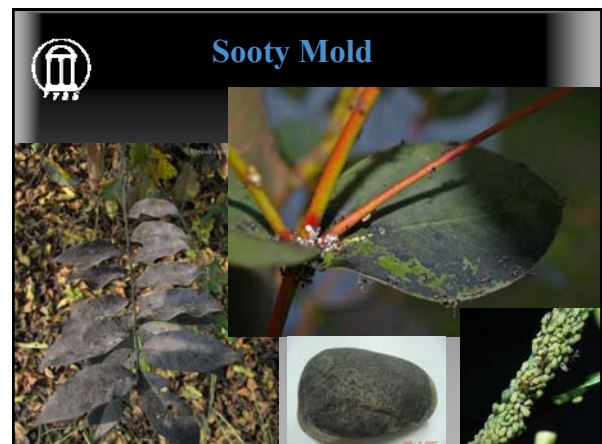
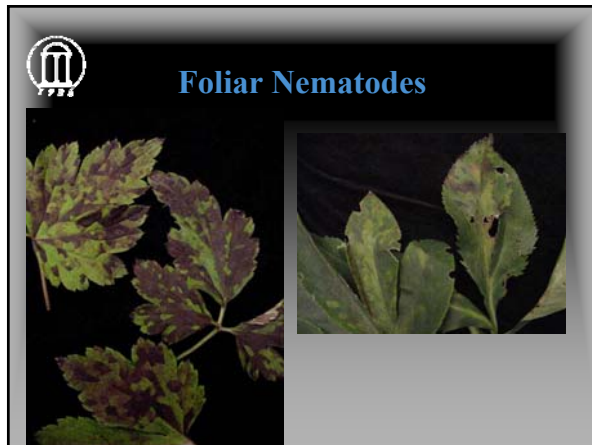
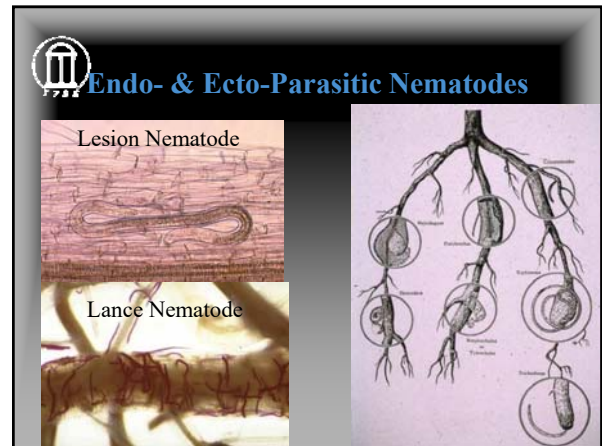
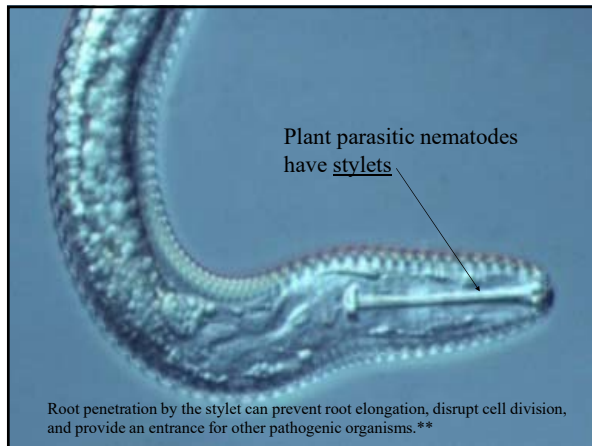
8/23/2006

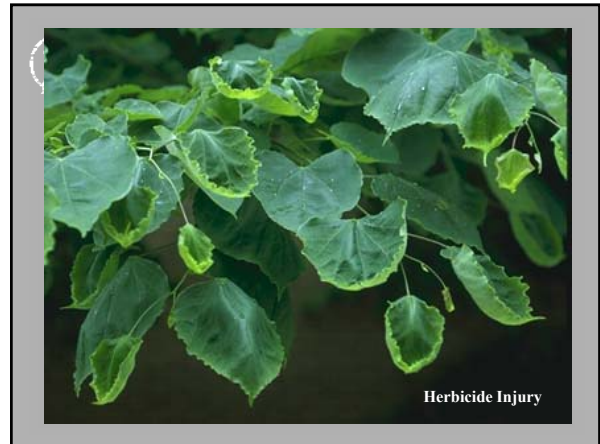













### Herbicide Injury - Oak





### Eastern Mistletoe –

parasitic plants that reduce tree vigor. They are primarily spread from tree to tree by bird droppings.




Hosts:  
 Ash Dogwood  
 Elm Maple  
 Oak Pecan  
 Walnut River Birch

 **Lichens**



Lichens obtain water and nutrients from air and the microbes on bark.

 **Improper Pruning**




 **Soil Compaction...**




Angel Oak, Charleston, SC – 1500 years old!

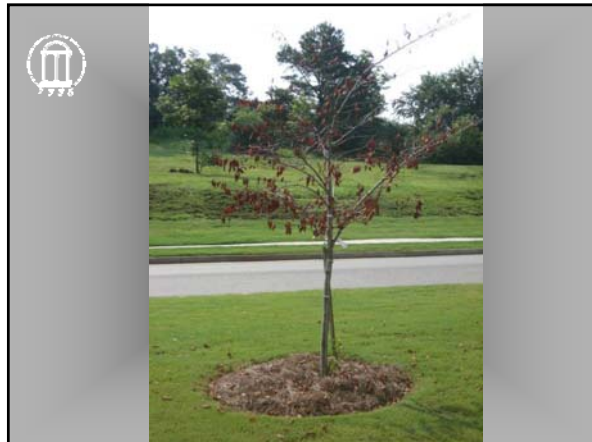
**Drought Stress –**  
on Maple, Pine,  
Poplar



 **Woodpecker Injury**




**Insect Leaf Galls**



### Applied Controls:

1. Host resistance\*\*
2. Cultural control
3. Mechanical control
4. Sanitation
5. Biological control
6. Chemical control

### Resistant Plants

ASK QUESTIONS!!!!

- Which disease?
- Are diseases in your area?
- Has it been tested?

PLANTS MAY LOSE RESISTANCE

Example: Do not plant Bartlett Pears in Georgia!

### Cultural Disease Controls

- Avoiding the pathogen
  - Buy seed and plants from a reputable source
  - Inspect plants prior to purchase
  - Control alternate hosts
  - Cultivation & deep plowing
  - Crop rotation
  - Mulching
  - Sanitation

### Cultural Disease Controls

- Sanitation
- Disinfect tools
- Remove diseased plants promptly
- Remove senescent plant parts promptly


### Cultural Disease Control

- Avoiding conducive environmental conditions
  - Moderate soil moisture; improve drainage\*\*
  - Reduce humidity and increase air circulation
  - Avoid over-head irrigation
  - Water early in the morning
  - Fertilize plants properly
  - Be aware of activities surrounding your plants:
    - Minimize Root disturbance
    - Avoid Soil compaction




## Chemical Disease Control

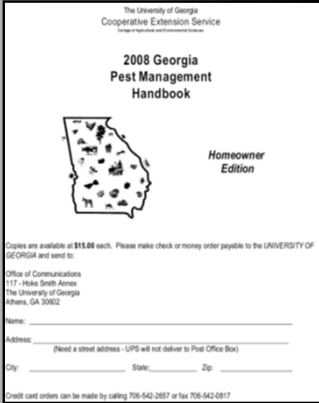
- Fungicides, bactericides, nematicides
- Protectants
- Systemics
- Fumigants

## Pest Prevention is Key!



- “REAP” what you sow...
- Resistance: use locally recommended varieties
- Exclusion: use disease-free (or certified) plants & seeds
- Avoidance: fall sanitation program to avoid potential inoculum for next year.
  - remove/destroy diseased plants and plant parts to reduce inoculum.
- Protection: optimal cultural conditions for plants to stay stress-free.
  - scouting/monitoring to catch problems early
  - preventative fungicides at regular intervals
  - manage for resistance; rotate or tank mix chemicals



## Georgia Pest Management Handbook

Homeowner Edition


[www.ent.uga.edu/pmh](http://www.ent.uga.edu/pmh)



## Troubleshooting Techniques



- The Process of Elimination:
  - Have client submit plant samples
  - Have client submit soil samples
  - Have client email pictures
  - Ask questions to investigate problem
- Site Visitations:
  - Rarely “diagnose” diseases in the field
  - Take hand lens or magnifying glass
  - Take sampling equipment i.e. bags, jars, etc.
  - Soil sample probe, bucket, shovel
  - Take digital camera
  - Pruners or pocket knife
  - Take both landscape pictures and close-ups



## Sampling Tips

- Advise client how to take a proper sample:
  - 6-8” section of symptomatic plant preferred
  - Include both healthy and unhealthy tissues
  - Keep sample cool and dry!!
  - Bag in a zip-lock bag to contain insects, etc...
  - Collect sample the same day you travel to office
  - If samples are stored, keep in a refrigerator
  - Some clients may need assistance with taking samples... only if *really* needed!



## Tips on Making Recommendations

- Don't Forget the “Big Picture”
  - Avoid giving the quick/easy answers
  - Take the opportunity to teach...
  - Integrated Pest Management (IPM)
  - Sustainable Practices
  - Reducing Pesticide use
  - Conserving soil and water
  - Conserving beneficial insects
  - Tree preservation



## Know Your Limitations

- Master Gardener Volunteers are trained to assist with home horticulture issues/questions:
  - Be sure you know what your client's question is concerning...
  - Example: Bermudagrass lawn or pasture?
  - All commercial clients/questions should be deferred to the local Extension Agent
  - Don't try to give too much information over the phone... clients can only absorb so much through conversations.
  - It's okay to say "We have a great publication on that subject that I can send to you by email or regular mail, which ever you prefer."
  - Any questions clients may have regarding commercially contracted services and/or disputes should be referred directly to the County Extension Agent.



## Know Where to Find the Answer...

- It's okay to tell the client "I don't know"
- You are NOT expected to know the answer to every question... practically impossible
- Never make up an answer!!
- Let the client know that you will research their question and get back with them...
- Recommendations should be based on University or Government research
- Always look up pesticide recommendations!!



## Troubleshooting Tips

- #1: Ask most of your questions so that they cannot be answered by a yes or no.
- #2: Form your initial opinion, if you must, but keep it to yourself and try to eliminate everything else first. Don't jump at the obvious!
- #3: Don't be afraid to say you don't know, and don't feel that you have to apologize for not knowing.



## Troubleshooting Tips

- #4: Never be absolutely positive in your diagnosis- tell the client what you **think** is the problem.
- #5: If in doubt about any information, tell the client you will check on the control recommendation and call them back.



## Troubleshooting Tips

- #6: When a third party might be involved or there is a chance for legal repercussions - Remember we are **Government**. Do the taxpayers or your county really want you to get in the middle of something that might turn into a lawsuit? If you think "yes" in this particular situation, give it to your agent. A visit will need to be made. Such cases cannot be handled over the phone.


Example: Tree health questions involving a "target".  
Example: Misapplication of pesticides by a landscaper.



## Troubleshooting Tips


- #7: Use the plant diagnostic clinic whenever **you** have some doubt of what could be the problem.
- #8: Don't worry about telling a person what **they** don't want to hear. Tell them what **you** think, and **don't** let them put words in your mouth!






### Troubleshooting Tips

#9: If someone says they read or heard that you do something a certain way and they are asking if you agree, answer with your honest thoughts. However, never disparage the person or article being quoted. This will immediately destroy your credibility. Instead say, "Perhaps that's the experience of that person, but I feel (or the University feels) this \_\_\_\_\_." Never belittle an authority! NOTE: Quoting the University or a specialist and crediting them with the information gives **you** immediate credibility.



### Troubleshooting Tips

#10: If you pick up on the fact a person seems happy with the way they are doing something, no matter how foolish or wrong it might seem to you, don't come out directly and tell them they are doing something wrong! Only an **open** mind will accept suggestions to change.




### Troubleshooting Tips

#11: Don't work with Commercial Clients (i.e., Pesticide Companies, Nurseries, Lawn Care Maintenance People, Farmers, Bee keepers, etc.). Let the agent handle their **special** needs.

#12: Never make appointments for the Agent by saying: "I'll ask the agent to stop by and see you." or "The agent will return your call this afternoon" **unless** you know what you are saying is likely to happen. Let the office secretary make those statements.



## *Five Steps to Trouble-shooting Ornamental Plant and Site Problems*



## Step #1 Identify the Plant



## Step # 2 Learn About the Site

- Weather records
- Observe other plants in the neighborhood
- Structure/texture of the soil
- Drainage
- Soil pH and nutrients

### Step # 3 Ask Questions

- Never insult the client
- Never make rash statements until you have all the facts
- Take the lead during the conversation

### Step #4 Be Prepared to Ask for Samples

- Helpful Diagnostic tools:
  - Hand lens
  - White paper
  - Pocket knife
  - Zip-lock plastic bag
  - Container for insects
  - Soil Bags

### Step #5 Focus on the Plant

Above ground symptoms

Leaves:

- Leaf spots – possibly caused by diseases, spray damage or chemical injury
- Marginal burn – drought or excess fertilizer
- Shot Hole – insect feeding, disease
- Yellowing – deficiency, spider mites, lace bugs or root problems\*\*

### Step #5 Focus on the Plant

Above ground symptoms

Stems:

- Cankers
- Mechanical injury
- Insect wounds
- Borers
- Internal decay fungi
- Animal browsing


### Step #5 Focus on the Plant

Below ground symptoms


Roots:

- Are they healthy white or dark brown?
- Rotted, decayed appearance?
- Planted too deep?
- Internal bark browning?








80% of Plant Problems Result from the Inability of the Plant to Tolerate or Adapt to the Environment\*\*



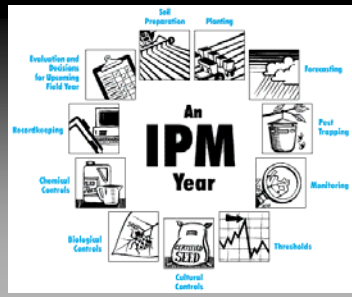
More plants are killed in Georgia from too much water than from the lack of water



Avoiding Plant Stress  
It's a Killer!!!



# Questions



An IPM Year

- Soil Preparation
- Planting
- Assessing
- Scouting
- Monitoring
- Thresholds
- Cultural Controls
- Biological Controls
- Chemical Controls
- Resistant/Resistant
- Evolution and Selection for Disrupting Field Year
- IPM
- Scouting
- Monitoring
- Thresholds
- Scouting
- Monitoring
- Thresholds
- Scouting
- Monitoring
- Thresholds