

Diagnosing Those Dang Diseases



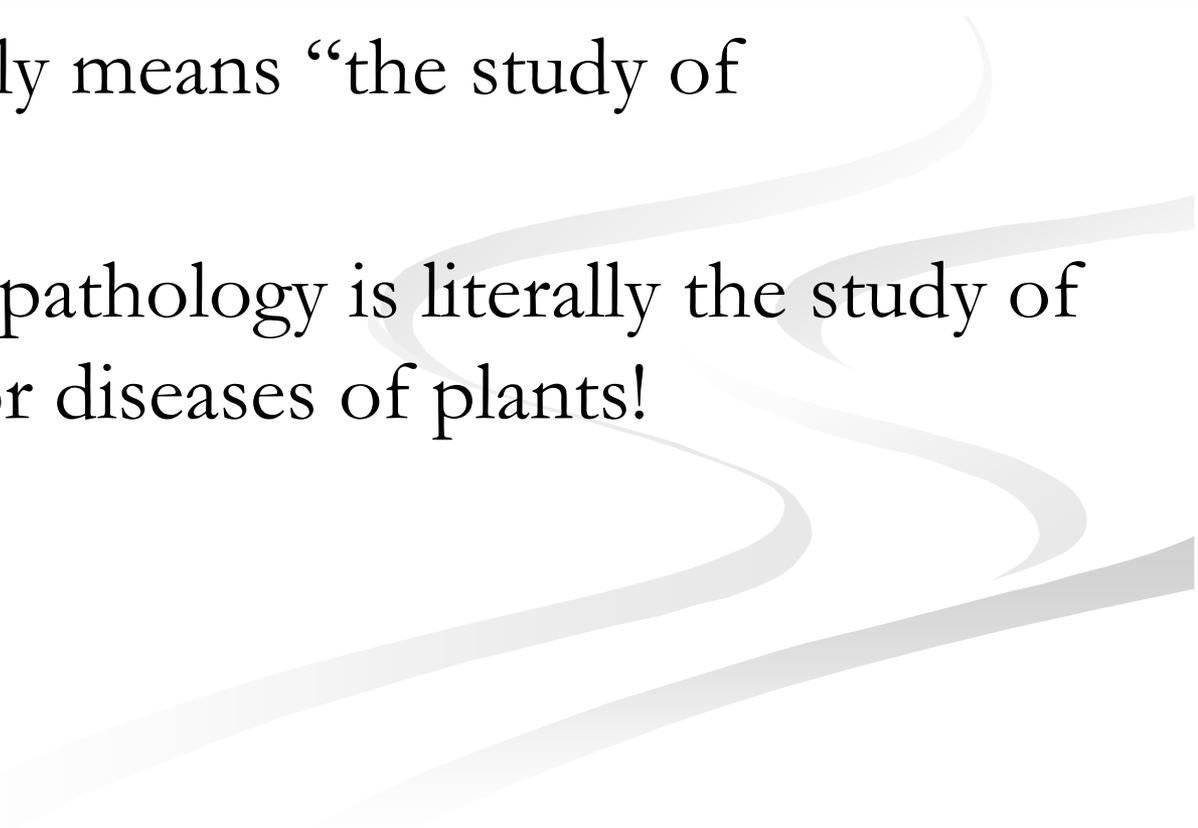
**THE OHIO STATE
UNIVERSITY**

COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES

Erik Draper, Commercial Horticulture
The Ohio State University Extension-
Geauga County



What is Plant Pathology

- From Greek: pathos = suffering
 - Logos = to study
 - Pathology literally means “the study of suffering”
 - Therefore plant pathology is literally the study of plant suffering or diseases of plants!
- 

Pathology Changed the World...

- Irish Potato Famine...1845... Late Blight...1.5 million people killed... Irish dispersed
- Downy Mildew of Grape...19th century (1878) accident...destroyed almost all vineyards in France, Germany, and Italy
- Salem Witch Trials...Ergot of rye...”Stark raving mad” in Medieval times also
- Chestnut blight...NYC-1904... wiped out most American chestnut trees...major lumber source

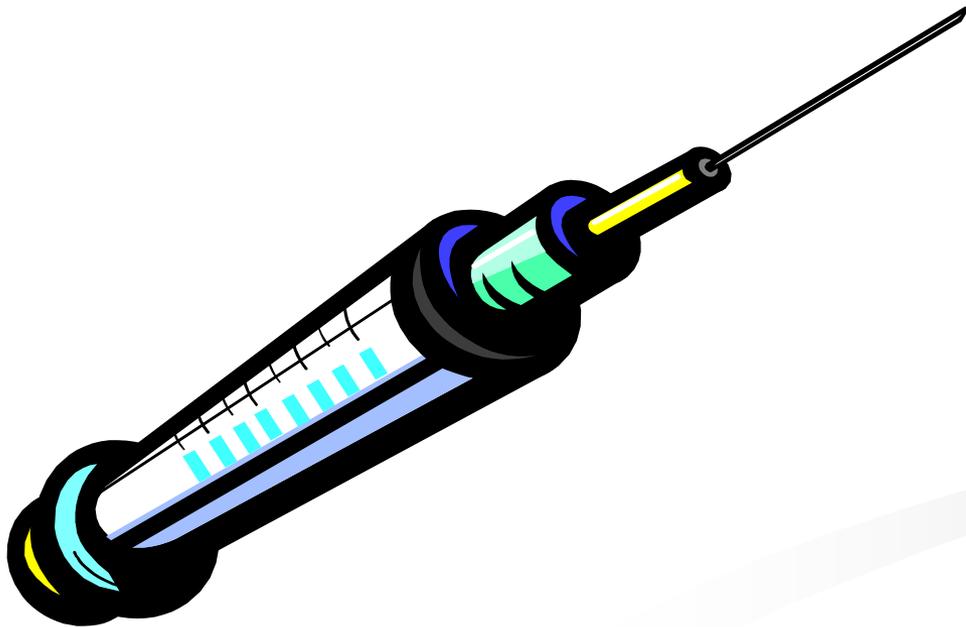
Pathology Changed the World...

- Dutch Elm Disease...1930's eliminated millions of mature American elm in continental US
- Italian Tomato Famine... spread pizza and spaghetti to save the rest of the world on Fridays
- Sudden Oak Death...first discovered in Mill Valley, California 1995... not properly identified until 2000 as *Phytophthora ramorum*... killing oaks, tanoaks and over 100 susceptible host species

In horticulture, as in medicine,
treatment of plant
symptoms/problems without
correct diagnosis...

is MALPRACTICE!

-Alan Siewert, ODNR Forester



'SHROOMS



Calvatia gigantea
© A.J. Silverside

'SHROOMS



2006- Full of Fungi



Fungi Require Moisture

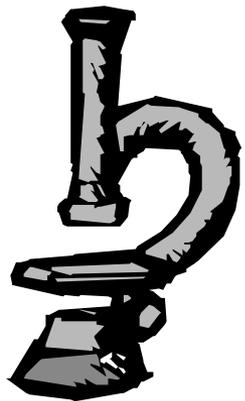
- High Humidity
- Heavy Dews
- Fog or Mists
- Intermittent Rains
- Cloudy & Overcast

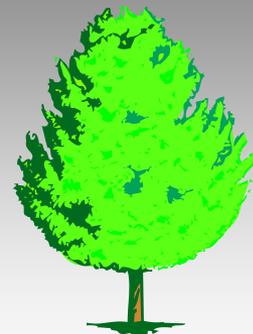


Plant Disease Defined...

“A malfunctioning of host cells and tissues that results from their continuous irritation by a pathogenic agent or environmental factor and leads to the development of symptoms. Disease is a condition involving abnormal changes in the form, physiology, integrity or behavior of a plant. Such changes may result in partial impairment or death of the plant or its parts.”

From: “Plant Pathology” - Agrios



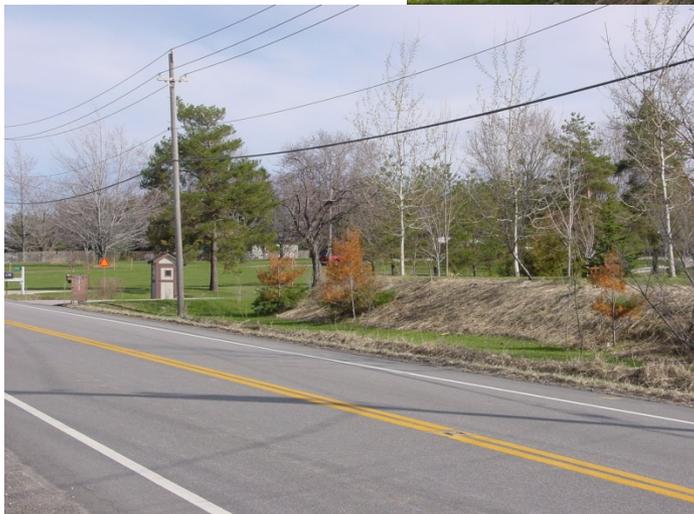


“Any disturbance of a plant that interferes with its normal structure, function or economic value.”

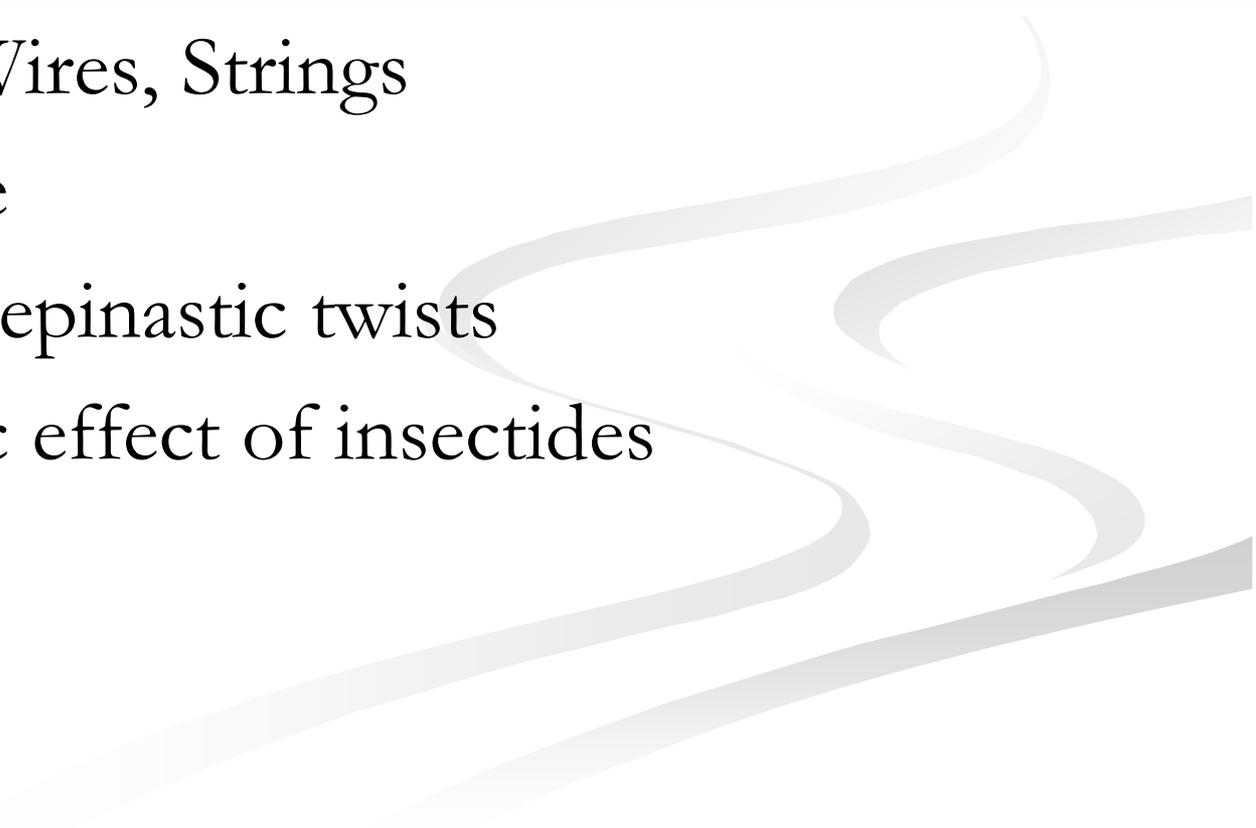
From: “Plant Health Care for Woody Ornamentals”

- Lloyd (Rane, Pataky)

Is this a disease?



Abiotic Diseases

- Road Salt Damage
 - Nutrient Deficiencies
 - Girdling Wires, Strings
 - Big Ozone
 - Herbicide epinastic twists
 - Phytotoxic effect of insecticides
 - Soil pH
- 
- A decorative graphic consisting of several thick, light gray, wavy lines that flow from the bottom right towards the top right, partially overlapping the text area.



Why Are Plant Diseases So Difficult to Control?

1. Disease control is preventative, not reactive.
2. The weather is unpredictable.
3. Inoculum is microscopic.
4. Pathogens change.
5. There are so many host plants.
6. Not all diseases are devastating or need to be controlled .



Signs vs. Symptoms

- Physical evidence of any disease causing agent
- Mushrooms (fruiting bodies of fungus)
- Mycelium on leaf surface
- Any perceptible change in host structure or function caused by a disease
- Dead (necrotic) tissue
- Lesions
- Cankers

Signs:



Signs:



Signs:



**Honeydew = Black Sooty
Molds**



Sign:



Symptom:



Symptom:



Symptoms: Apple Scab

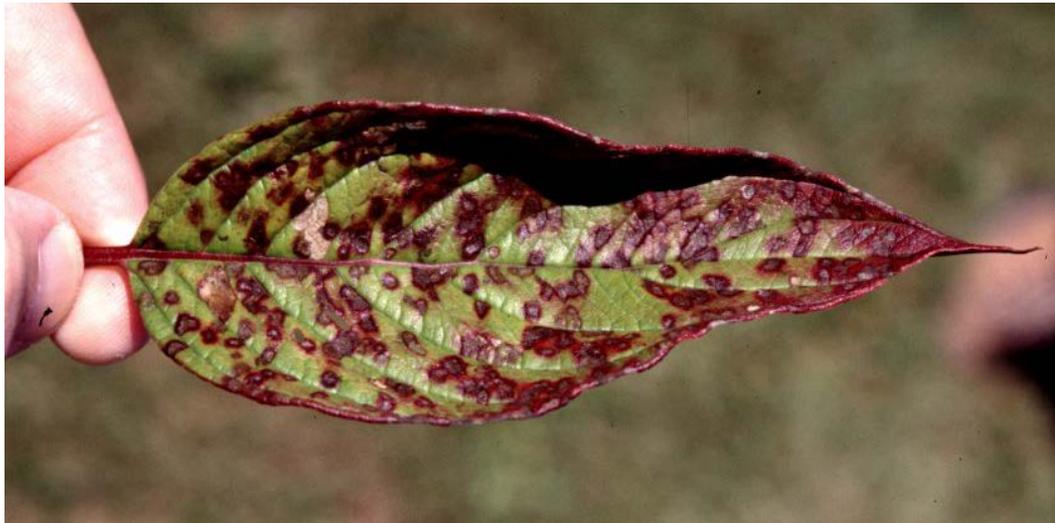


Symptoms: Apple Scab



Symptoms:

Leaf Spot and Leaf Blotch



Symptoms:

Leaf Spot and Leaf Blotch



Symptoms:

Branch and Stem Dieback



Symptoms:

Tip Blight and
“Shepherds
Crook”



Symptoms:

Cankers



Bleeding Canker



Dry Canker



If you see symptoms...

**It is already too late to do anything to
control that disease!!**

The bottom right portion of the slide features several thick, light gray, wavy lines that curve and flow across the page, creating a decorative, abstract background element.

Pathological Terminology

- Fungi vs. Fungus
- Spores/Inoculum
- Hyphae
- Fruiting Bodies or ‘Shrooms
- Molds, Mildews, Blights

Spores / Inoculum



Infectious Insights

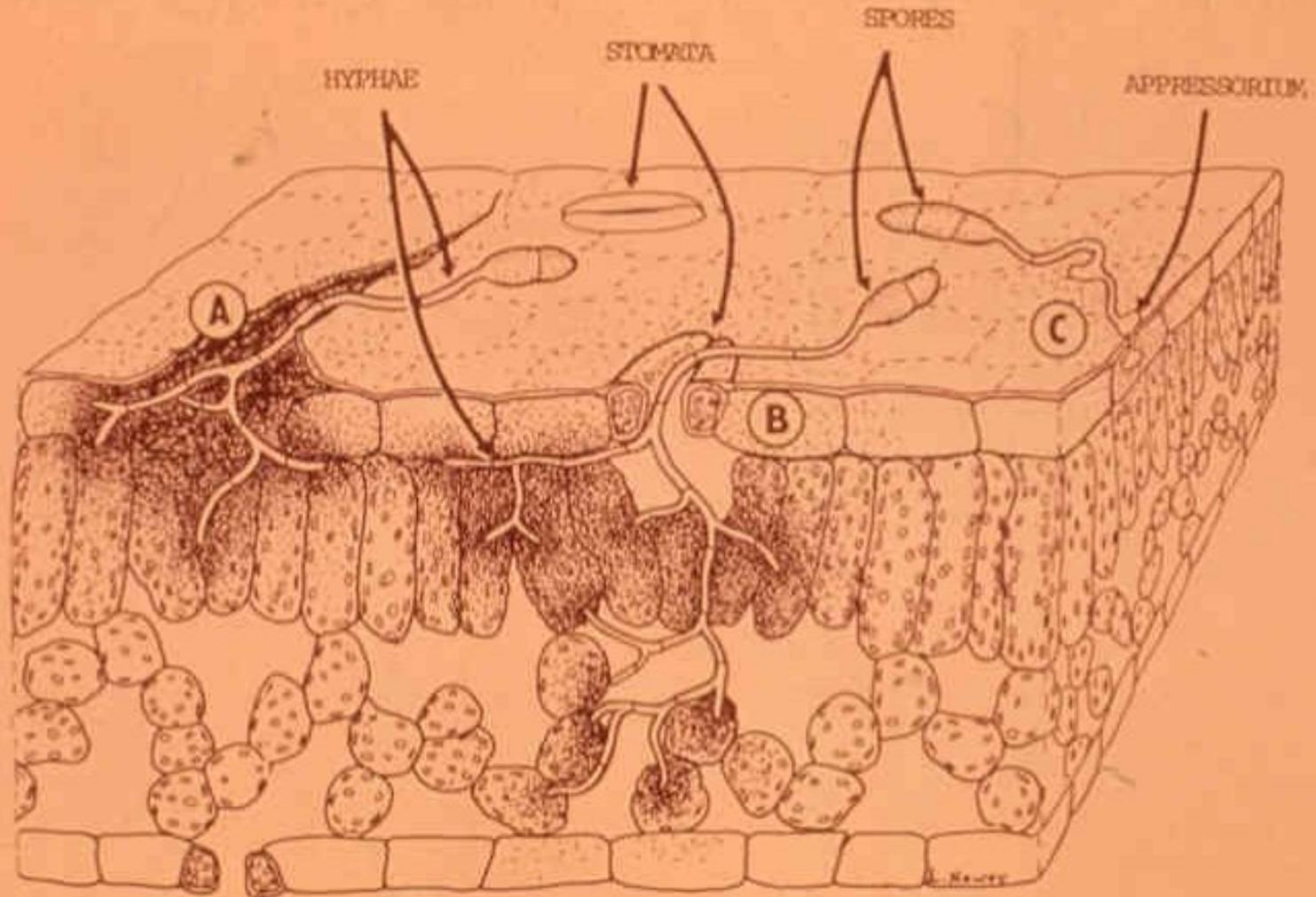
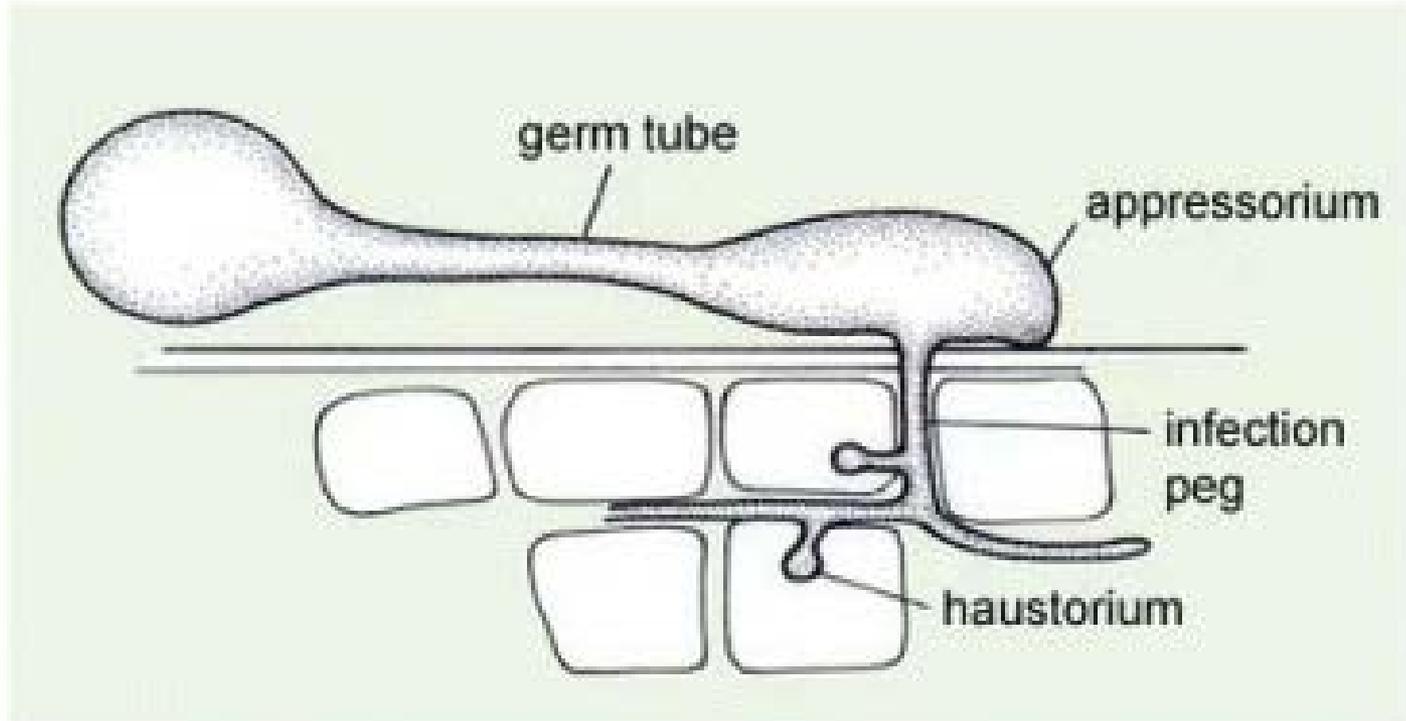


FIGURE 61.—Portion of a typical leaf, in cross-section, showing three ways in which fungi enter the tissue. A) Entry through injury. B) Entry through stoma. C) Entry through uninjured leaf surface.

A little bit closer...



germ tube

hypha resulting from an outgrowth of the spore wall and cytoplasm after germination

Fruiting Bodies or “Shrooms”



Fruiting Bodies or “Shrooms”



Fungus or Blight... Who cares?

- **Mold**- breaks down dead material and recycles nutrients in the environment. For molds to grow and reproduce they need only a food source such as leaves, wood, paper, or dirt - and moisture.
- **Mildew** -Small parasitic fungi forming a loose growth of filaments on the host plant.
- **Blights**- Common name for a number of different diseases on plants characterized by the rapid death of plant tissue e.g. leaf blight, blossom blight, shoot blight.

Saprophytic vs. Parasitic

- **Saprophytic**- describes fungi or bacteria that live on decaying or decomposing organic matter. They secrete digesting enzymes to break down organic materials and absorb the products of digestion for continued growth.
- **Parasitic**- describes fungi or bacteria that get their nutrients by absorbing minerals, sugar and moisture from living organisms (plant or animal host) on which they grow.

In order for any plant disease to occur, 3 things are necessary...



Can you name them?

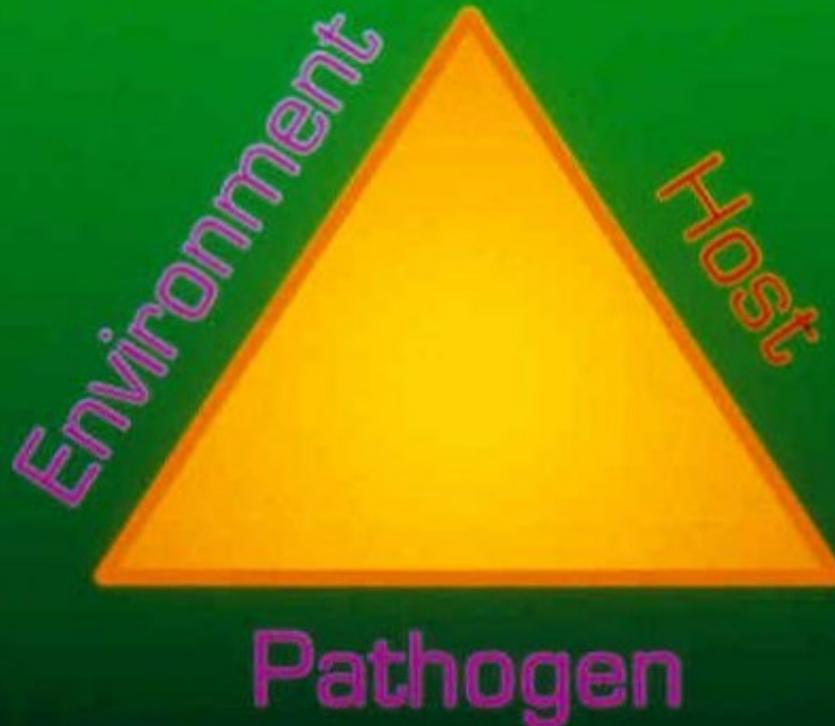
- *A susceptible host plant...
- *An environment conducive to disease development...
- *A virulent pathogen



The Power of the Triangle

Common Insect, Mite & Disease Pests of Ornamental Trees & Shrubs

The Disease Triangle



Disease tolerant vs Disease resistant

- **Disease tolerant** plants will be infected but retain a good appearance & produce a good crop
- **Disease resistant** plants are resistant to that specific disease and **NOT ALL DISEASES!** These plants can be infected under severe disease pressure
- **Disease resistance** is not **IMMUNITY**

Plant Host Defenses...

- Physical characteristics: waxy cuticle or epidermis, pubescent leaf (hairy or fuzzy leaf)
- Chemical defenses, like enzymes, that inhibit, repel or inactivate the attacking pathogen
- Growth patterns that can wall, seal or block off area being attacked or merely outgrow the damage



Affected leaflets fall to the ground in spring.

Ash Anthracnose

Maple Anthracnose





Leaf blotch, shoot blight, twig canker, and tree defoliation. The anthracnose fungus is most active during wet spring weather, causing twig cankers during cool weather and leaf blight during warmer weather.



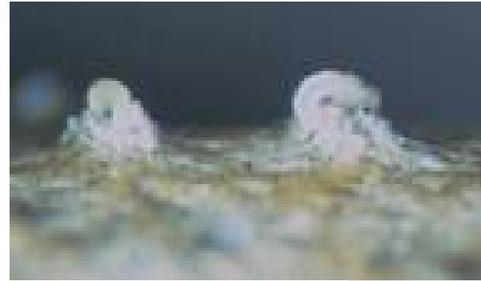
Sycamore anthracnose



Infected shoots with dead leaves hanging down are visible in the canopy. Twig canker and close-up of leaf infection along the vein are shown.

Oak anthracnose

Dogwood
Anthracnose
caused by
Discula
destructiva



Anthracnose Leaf Blights

The time is late June. You have positive confirmation of anthracnose on samples of ash, oak and sycamore that you sent in to the Ohio State Plant Pest Diagnostic Clinic. You have tall tree spraying equipment and chemicals. Should you spray? FUNGICIDE choice?



Benzimidazoles

- thiophanate-methyl

Cavalier 2G; 50WSP; Flowable, Cleary's 3336, Domain, Fungo Flo, Fungo 50 WSB, Systec 1998, Topsin-M 70WP, WSB

These systemic fungicides are used for powdery mildew, scab, leaf spots, and anthracnose diseases.





NADA TUNNEL

GATEWAY TO RED RIVER GORGE. NADA TUNNEL (MEASURING 13'x12'x900') WAS CONSTRUCTED TO HAUL LOGS VIA NARROW GAUGE RAILROAD FROM TIMBER OPERATIONS IN THE GORGE. CONSTRUCTION BEGAN IN DEC. 1910 AND WAS COMPLETED IN SEPT. 1911. ROCK AND DIRT WERE REMOVED BY DYNAMITE, STEAM DRILLS AND HAND TOOLS. ONE MAN WAS KILLED DURING THE TUNNEL CONSTRUCTION WHEN HE ATTEMPTED TO THAW FROZEN DYNAMITE WHICH EXPLODED WHEN HE SET IT NEAR A FIRE.

A 25 TON AND A 35 TON CLIMAX LOCOMOTIVE WERE USED TO HAUL LOGS THROUGH THE TUNNEL STARTING IN 1912. THE FIRST LOAD OF LOGS BECAME JAMMED IN THE TUNNEL AND HAD TO BE DYNAMITED FREE. IT WAS ENLARGED TO ACCOMMODATE THE LARGE LOGS COMMON TO THE AREA.

THE RAILROAD CARRIED THE LOGS 15 MILES TO A MILL AT CLAY CITY. AT ONE TIME, IT WAS THE LARGEST SAWMILL IN THE EASTERN UNITED STATES

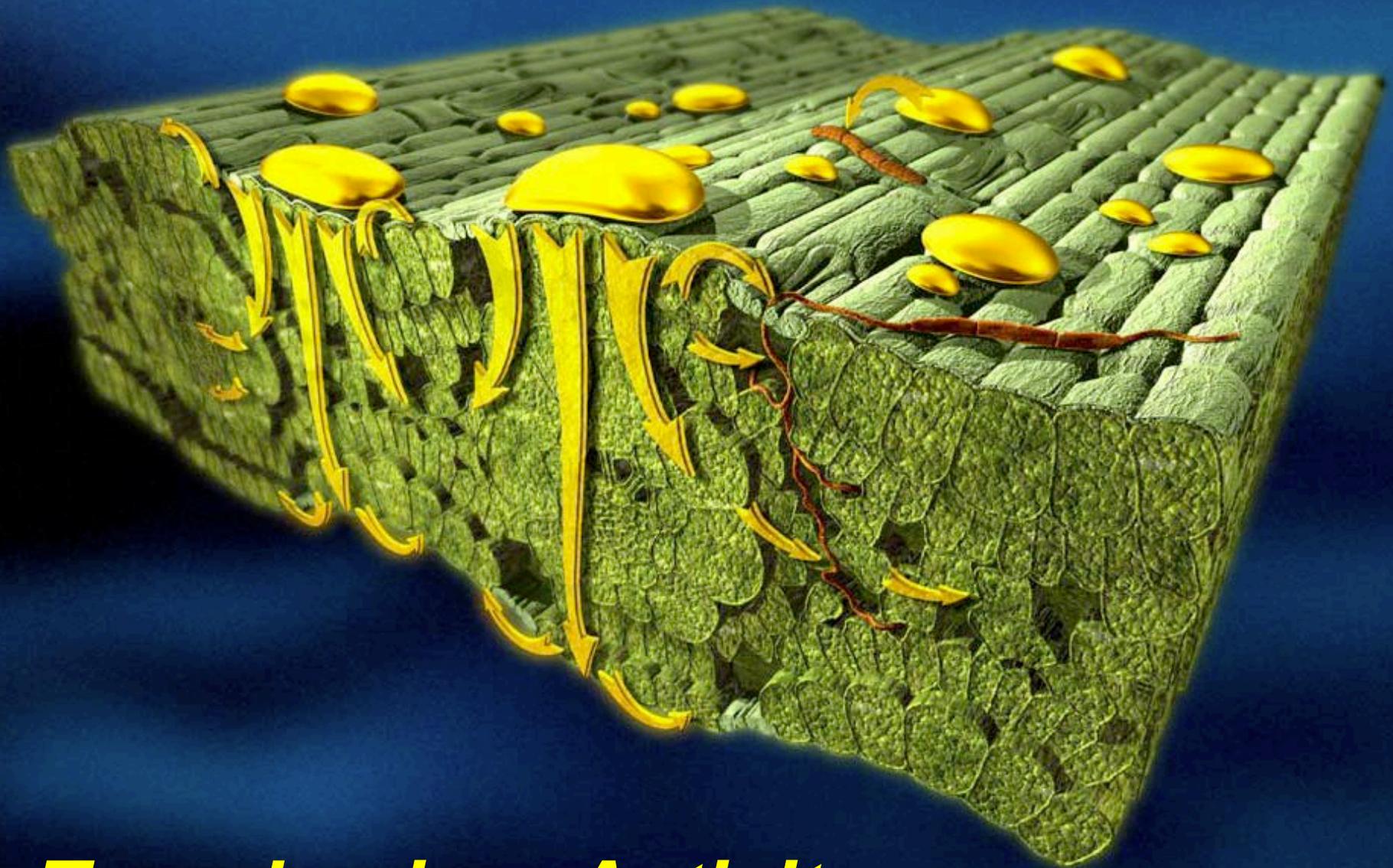
Read and Follow
Label Directions!

Fungicide modes of action

- Protectant – needs to be present on plant surface before the fungal spore arrives.
- Systemic – is translocated in the plant via xylem or phloem.
- Translaminar – moves locally into the plant tissues; also called locally systemic.
- Eradicant – can arrest the fungal pathogen in the plant even after infection has begun.

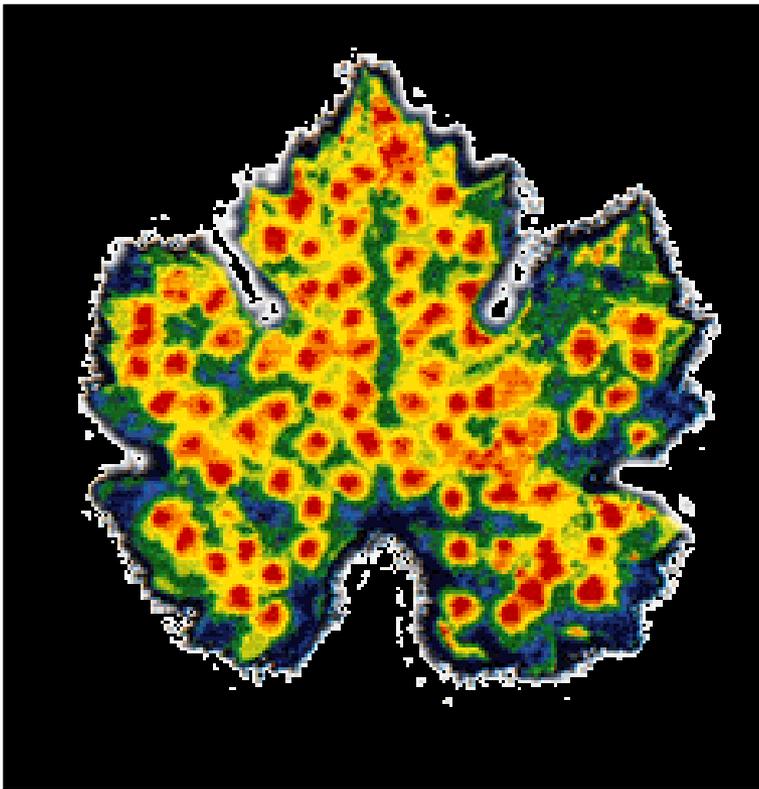
Fungicide “kickback”

- Eradicant fungicides have the ability to go in and ‘burn out/destroy’ a RECENT infection
- Azoxystrobins, EBDC’s, Sterol inhibitors
- Must know exactly when the application of fungicide ceased to function
- Must know when the infection occurred
- Regardless, ‘kickback’ only works on infections which occurred in that time frame of 24-72 (96?) hours immediately after fungicide ceased to protect the plant

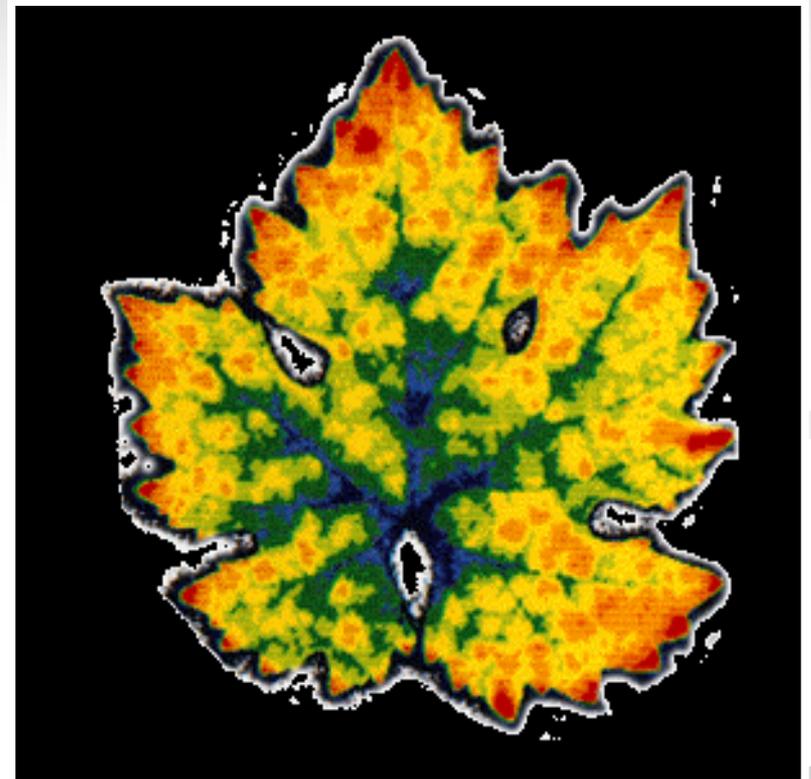


Translaminar Activity

*Physical Properties:
Comparative Movement of C-14 Labeled
Fungicides, 7 days After Treatment*



Azoxystrobin



Metalaxyl

Many systemic and eradicant fungicides have very specific modes of action, making it possible for fungi to develop resistance to the fungicide.

To avoid development of fungicide resistance, rotate among fungicide families... MINIMIZE MUTANTS!

Q_oI fungicides (Strobilurins)

Strobilurin fungicides are reduced-risk fungicides with unique trans-laminar activity and a fairly broad range of activity that often includes both downy and powdery mildews and rust.

- azoxystrobin

Heritage 50W, Quadris 2.1F (Christmas trees)

- kresoxim-methyl

Cygnus 50W (commercial use only)

- trifloxystrobin

Compass 50WDG

Fungus Fighting Fungi







10 Things You Need to Know About Diplodia Tip Blight of Pine

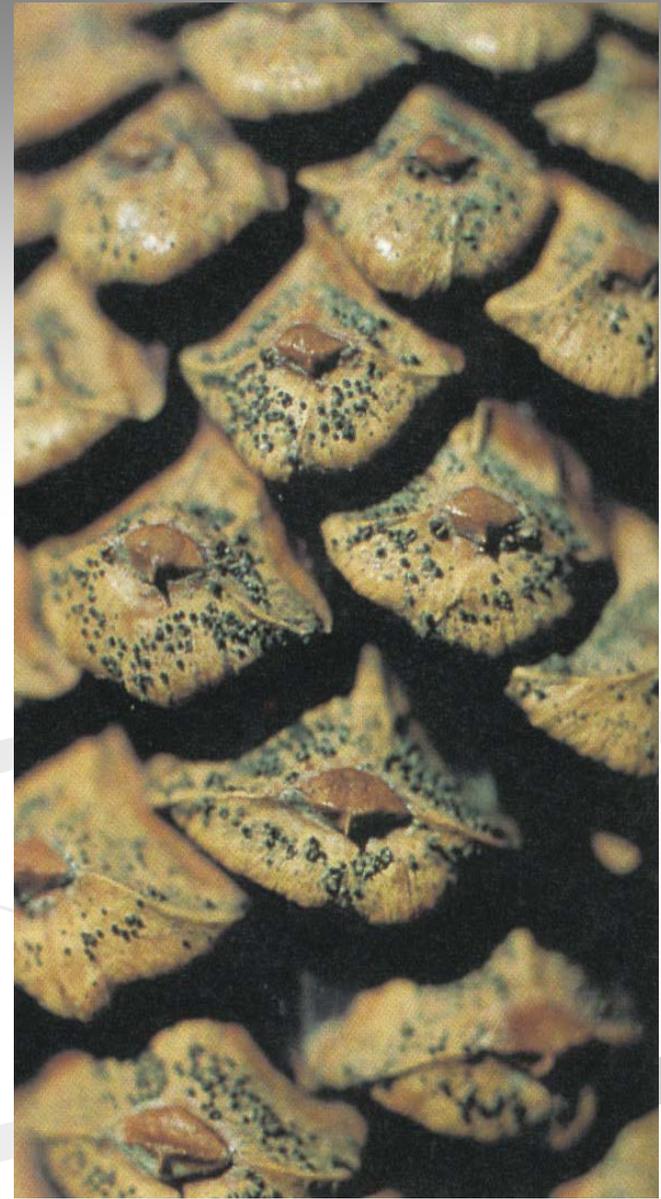
1. *Diplodia* = *Sphaeropsis* = *Diplodia*
2. Hosts: Mostly Scots, Austrian, red, mugho pines (i.e. 2-3 needle pines)
3. Infections: Greatest on 15-25 year-old trees
4. Infections: Just before new candle growth in spring
5. Symptoms: Dieback and stunting of new candle growth.



10 Things You Need to Know About Diplodia Tip Blight of Pine - continued

6. Symptoms: Lower branch dieback, possible tree death.
7. Signs: black pycnidia on needles, cones
8. Control/Prevention: Site and plant selection
9. Control/Prevention: Proper plant care
10. Control/Prevention: Fungicides





Diplodia (Sphaeropsis) Tip Blight Prevention & Management

- Site susceptible pines in moist, well-drained sites.
- Promote root health.
- Provide for good air movement.
- Time sprays just before new growth develops.



Key Factors in Cytospora Canker of Spruce

- A. Especially severe on Colorado blue spruce.
- B. Rare in natural range of CBS (Rockies)
- C. Cankers more common and severe on drought-stressed plants
- D. Other predisposing factor: wounds, such as hail damage





Phytopathological Paradigms:

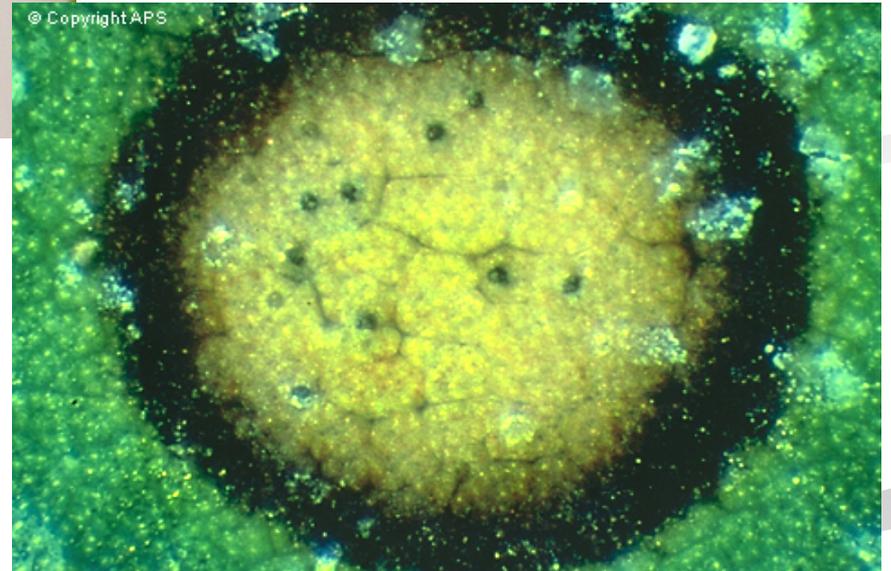
- “Timing is everything” for chemical disease control.
- Most plant problems are not infectious diseases.
- Most infectious diseases cause little plant harm.
- Symptoms develop well after infection.
- Many pathogens have narrow host ranges.
- Cosmopolitan diseases are rare.



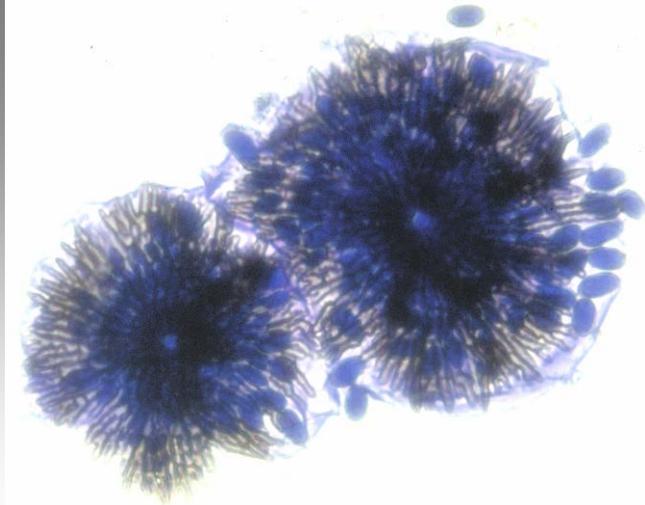


“Tar spot of maple is one of the most spectacular—and least damaging—diseases of maple.”

- Wayne Sinclair



Maple purple eye spot – *Phyllosticta*



Tubakia (Actinopelte) leaf spot of oak

Infections of Tubakia and anthracnose on the same leaf. Fungal fruiting body with conidia. This disease tends to occur in trees that are under stress such as those with iron deficiency.

Oak leaf blister does little lasting damage to infected leaves.



Oak leaf blister , caused by *Taphrina caerulescens*.



Flowering crabapple scab caused by the fungus *Venturia inaequalis*

Scabs can Scar `Scapes

- Wet leaves in Spring doth the Scab Dog bring
- 2006- An excellent year of the Dog
- Could be confused with Frogeye leaf spot early in the spring

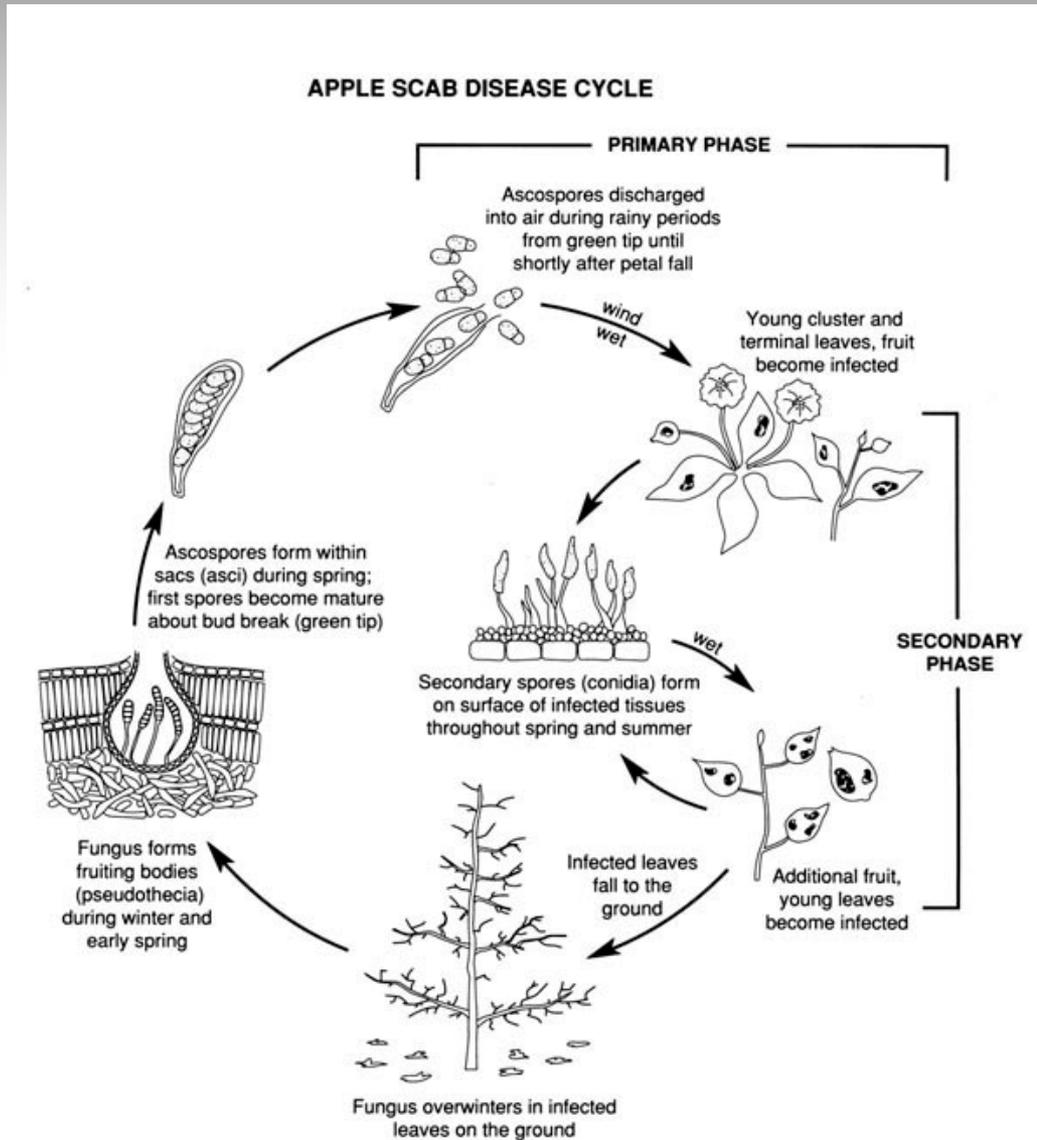


Scabs can Scar `Scapes

- Wet leaves in Spring doth the Scab Dog bring
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- Could be confused with Frogeye leaf spot early in the spring



Cyclic (sick-lick) Fungus



Apple Scab Prevention & Management

- Use crabapple selections with good scab resistance and good horticultural qualities.
- Early-season sprays, as soon as petals fall.
- Proper pruning and sanitation.

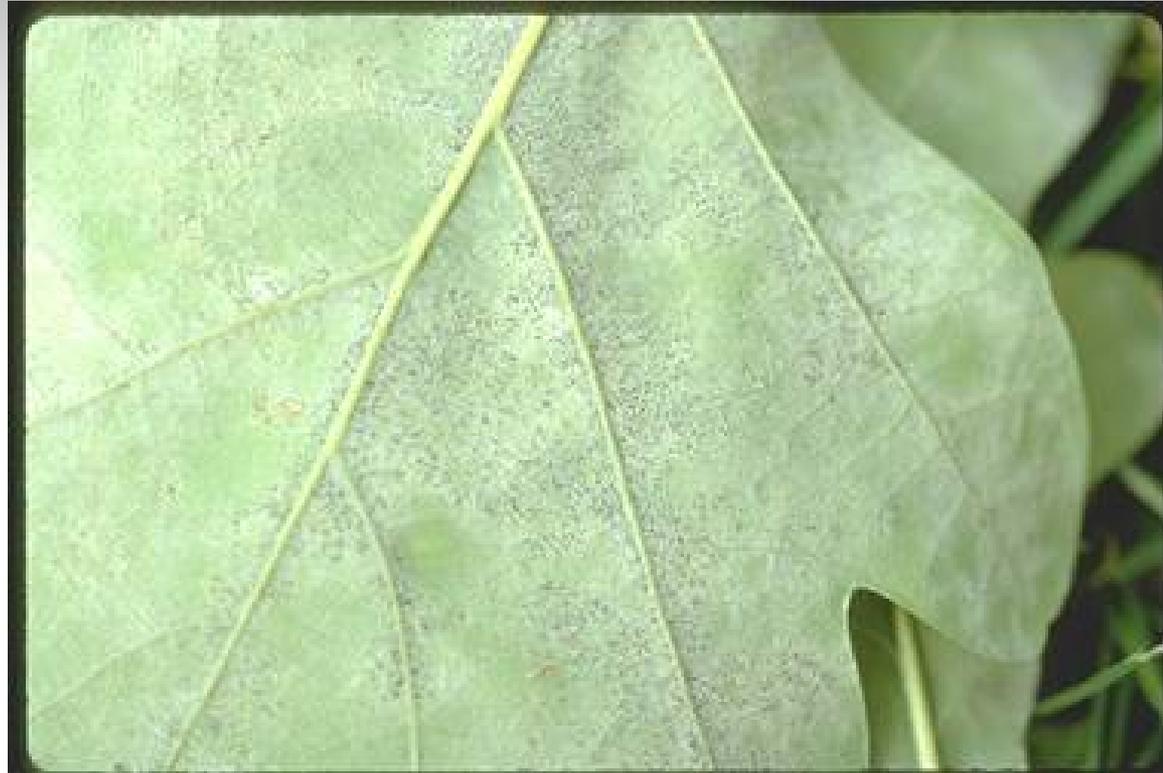


Which of the following are ways that fungi and bacteria spread?

- Contaminated seed
- Wind-blown rain
- Pruning shears
- Animals
- All of the above
- None of the above



Powdery mildew diseases



Powdery mildew of oak, caused by *Phyllactinia guttata*. Black dots are clesithothecia.



Powdery mildew of sycamore (*Microspheera platani*) and of tuliptree (*Phyllactinia guttata*)

Powdery mildews of most landscape woody plants develop late in the season and do little lasting damage to the plants.



Dogwood powdery mildew caused by *Microsphaera pulchra* and *Phyllactinia guttata*



Dogwood powdery mildew







Which of the following diseases is caused by the same fungus that causes powdery mildew of rose?

- Powdery mildew of bluegrass.
- Powdery mildew of lilac.
- Powdery mildew of zinnia.
- All of the above.
- None of the above.



Which of the following would be considered powdery mildew fungicides?

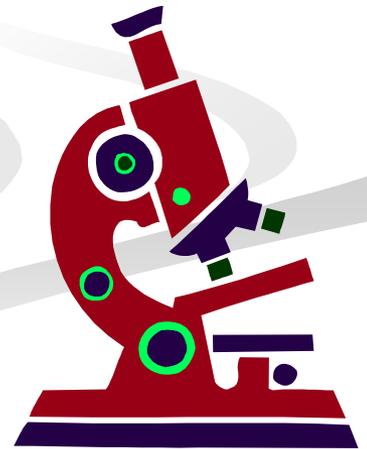
- Rubigan
- Banner Maxx
- Cleary's 3336, Topsin M
- Bayleton, Strike
- Triforine, Funginex
- Eagle

True or False?

To control diseases with fungicides, applications must be made before the fungus enters plant tissue.

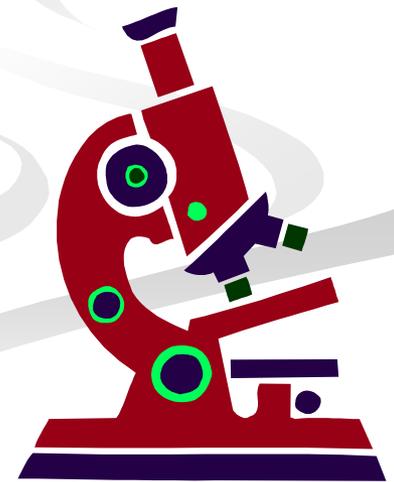
Juniper Pathogens

- *Alternaria* spp.
- *Botryosphaeria dothidea*
- *Botrytis cinerea*
- *Cercospora sequoiae*
- *Cerrena unicolor*
- *Coniothyrium fuckelii*
- *Dendrothele nivosa*
- *Didymascella tetraspora*
- *Gymnosporangium bethelii*,
G. clavariforme, *G. clavipes*, *G.*
confusum, *G. effusum*, *G.*
fuscum, *G. globosum*, *G.*
juniperi-virginiana, *G.*
kernianum, *G. nidus-avis*, *G.*
speciosum



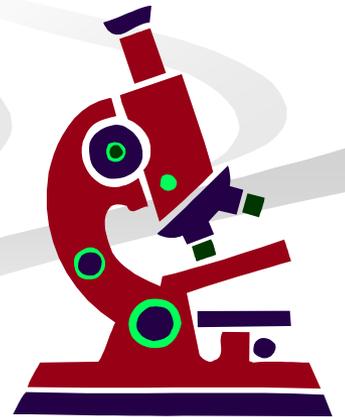
Juniper Pathogens - Cont'd

- *Heterobasidion annosum*
- *Kabatina juniperi*
- *Lophodermium juniperi*
- *Metacapnodium juniperi*
- *Microsphaeropsis olivacea*
- *Perinniporia fraxinophila*
- *Pestalotiopsis funerea*
- *Phellinus pini*
- *Phytophthora* sp.
- *Phomopsis juniperovora*



Juniper Pathogens - Cont'd

- *Phoradendron juniperinum*
- *Pratylenchus sp.*
- *Schizophyllum commune*
- *Seiridium cardinale*
- *Stigmina sp.*
- *Valsa fresii*
- *Uredo apacheca*
- *Xiphinema americanum*



“Junipers would have to rank as the toughest of evergreen plants. -- There is no limit to the use of junipers in landscape situations. -- If you cannot grow junipers, then do not bother planting anything else.”

- Michael Dirr

Key Infectious Juniper Diseases in Midwest Landscapes and Nurseries

- Cedar rusts (pathogens: *Gymnosporangium clavipes*, *G. globosum*, *G. juniperi-virginianae*)
- *Kabatina* blight (pathogen: *Kabatina juniperi*)
- *Phomopsis* blight (pathogen: *Phomopsis juniperovora*)

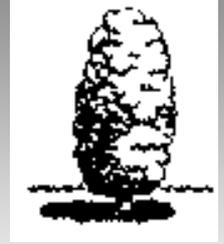
Things to Know About Juniper Blights



- Most Common: *Phomopsis* and *Kabatina* blights.
- Symptoms: Foliar discoloration, twig dieback of new growth (“6”)
- Symptoms: *Phomopsis* all season; *Kabatina* - March-June
- Infections: *Phomopsis* - spring, summer, fall; *Kabatina* - fall.
- Black, pimple-like fungal fruiting bodies visible with hand lens.



Control of Juniper Blights



- Genetic resistance of Junipers to these blights.
- Grow Junipers in sunny sites with good air movement.
- Prune out infected tissue, but avoid heavy pruning; avoid pruning in wet weather.
- Fungicides: Coppers (e.g. Phyton-27), benzimidazoles (e.g. Cleary's 3336)

Juniper Tip Blights

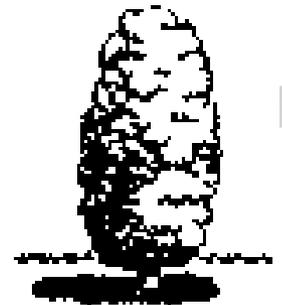
Thiophanate-methyl is recommended for control of *Phomopsis* tip blight disease. Which of the fungicides below contain thiophanate-methyl?

- A. Cleary's 3336
- B. Domain
- C. Benefit
- D. Zyban
- E. Duosan



More Information About Juniper Blights

- “Juniper Diseases”, Bulletin C-711, Kansas State University. CES, Manhattan, KS 66506
- “Diseases of Landscape Plants”, Bulletin 614, Ohio State University Extension.



Cedar Rusts



- Cedar apple rust -- *Gymnosporanium juniperi-virginianae*.
- Cedar hawthorn rust -- *Gymnosporangium globosum*.
- Cedar quince rust -- *Gymnosporangium clavipes*.



Cedar Rusts



- Alternate between junipers and rosaceous hosts.
- Most common: cedar-apple rust, cedar hawthorn rust, cedar quince rust.
- Typically two year cycle.
- Once spurred eradication legislation.



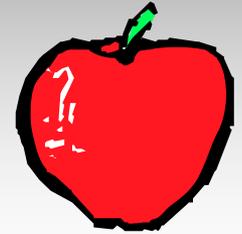






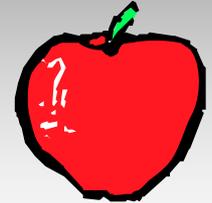


Cedar Rusts: Typical Two Year Cycle



1. Juniper hosts infected in summer and fall.
2. Swelling of tissue occurs by next spring.
3. Continues to grow on juniper the following season.
4. Produces and disseminates gelatinous mass of orangish spores on juniper in second spring.
5. Infects rosaceous hosts as new growth emerges.

Cedar Rusts: Typical Two Year Cycle - Continued



1. Symptoms (leaf spots, fungal growth on fruit, stems and lower leaves, cankers) develop on rosaceous hosts in late spring and into the summer.
2. Spores disseminated back to junipers in the summer and fall.
3. **No repeating cycle on the rosaceous hosts.**

Cedar Apple Rust

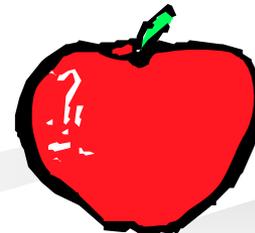


1. Rosaceous hosts: mostly apple and crabapple.
2. Juniper hosts: causes largest galls. (golf to tennis-ball size when swollen).
3. Infections result in spotting on leaves and fruits, some defoliation and pustules on apples.
4. Pathogen: *Gymnosporangium juniperi-virginianae*.
5. Most important cedar rust on apples; resulted in legislation.

Plant Pathology and the Law

To what disease do these quotes refer?

- “Cedar eradication is the cheapest form of orchard insurance that you can buy. The cost on the average is less than the cost of a single spray application.”
- “Cedar or Cider!”
- ‘Cider or Pencils!’



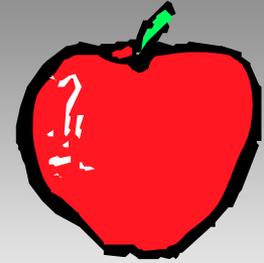


Cedar Hawthorn Rust

1. Broader rosaceous host range.
2. As with cedar apple rust, mostly Eastern red cedar and Rocky Mountain juniper hosts.
3. Mostly leaf and fruit spots on rosaceous hosts.
4. Smaller galls on junipers.
5. Pathogen: *Gymnosporangium globosum*.



Cedar Quince Rust



1. Over 480 rosaceous hosts. Broader host range for junipers as well.
2. Most damaging cedar rust of ornamentals.
3. Causes extensive fruit unsightliness and stem cankering on hawthorns.
4. Can cause extensive twig dieback, thinning and loss of vigor on junipers.
5. Pathogen: *Gymnosporangium clavipes*.

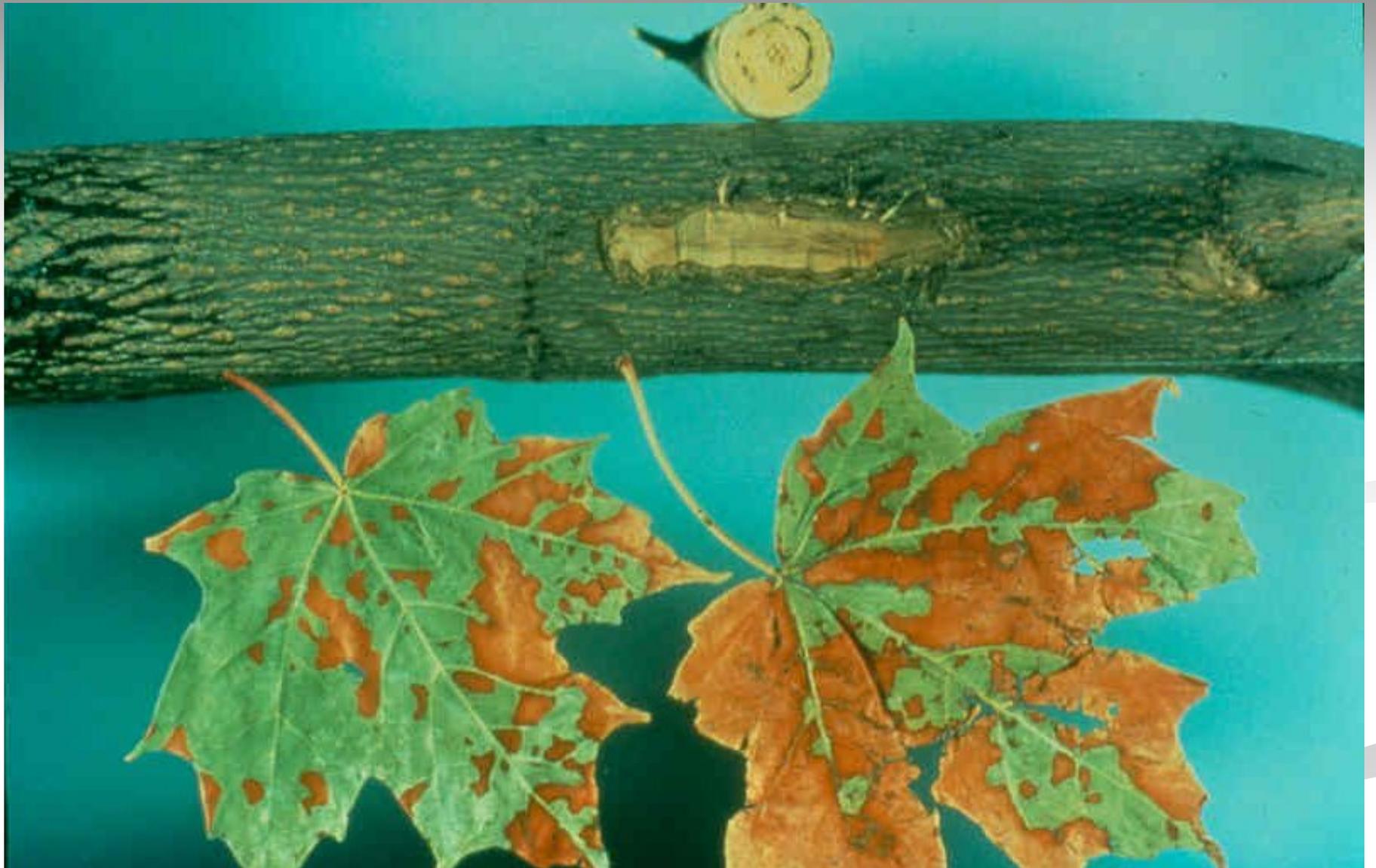




Stress Pathogens



- Cankers
- Invade wounds
- Pruning
- Winter injury
- Drought
- Flooding







Stress Factors in the Development of Verticillium Wilt Disease

- Moderate to extreme moisture stress
- Salt damage
- Transplant shock
- Nutrient imbalance



Verticillium Wilt Diseases

What about this list is relevant to a discussion of *Verticillium* wilt disease?

- All Conifers
- Birch
- Crabapple
- Dogwood
- Holly



- Oak
- Pear
- Planetrees
- Sweet Gum
- Willow

Verticillium Wilt Diseases

What about this list?

- Ash
- Barberry
- Catalpa
- Elm
- Magnolia
- Maple
- Redbud
- Russian Olive
- Tuliptree
- Viburnum

Verticillium Wilt Prevention & Management

- Purchase of Verticillium-free plant material.
- Water management
- Maintain root health
- Overall health management
- Use of resistant varieties



Which of the following are water mold fungi?

- *Pythium ultimum*
- *Phytophthora cinnamomi*
- *Fusarium oxysporum*
- *Rhizoctonia solani*
- *Thielaviopsis basicola*

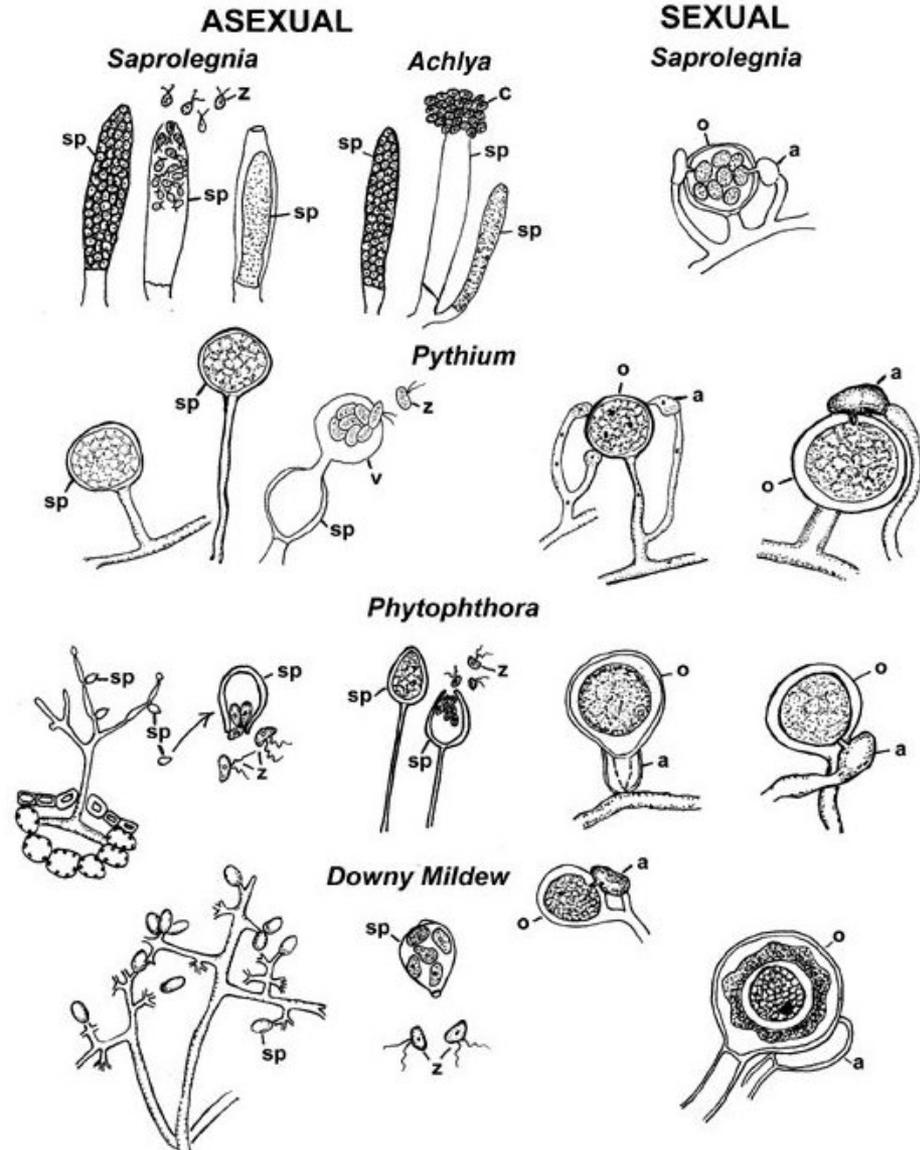


Water Molds...

Are Weird!

Oomycetes

Water Molds (Oomycetes) Diagrams



Asexual structures: sporangium (sp), vesicle (v), zoospore (z), cyst (c)
Sexual structures: antheridium (a), oogonium (o)

Water Molds are not true fungi so...

Typical fungicides don't control
these sneaky devils!

Mefenoxam, metalaxyl- (Subdue), fosetyl-Al
(Aliette), Phosphorus acid

Examples of water mold diseases:

- Pythium blackleg of geranium
- Root and crown rot of rhododendron
- Pythium blight of turfgrass
- Phytophthora of collar rot of apple









Phytophthora Root and Crown Rots



True or False

If you have a plant with *Phytophthora* root rot it will ultimately be killed by this fungus.

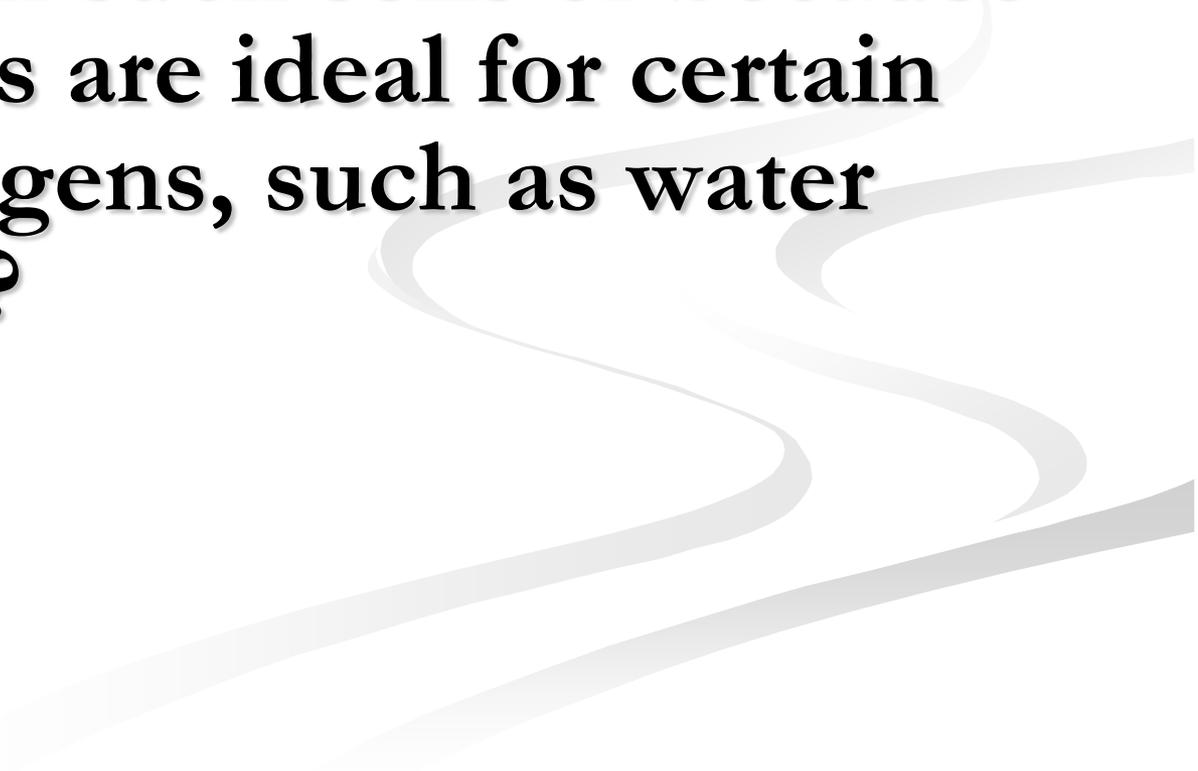


Taxus Decline: A Case Study

- A. Near record wetness -- 1991
- B. Near record drought -- 1992
- C. Foliar discoloration, stem dieback, plant death on large, mature *Taxus* -- 1992-1993
- D. Occurred throughout East & Midwest
- E. *Phytophthora cinnamomi* isolated from dead plants.
- F. Recovery of some plants since then.



Taxus (yew) does not thrive in overly wet, poorly-drained soil. Is this because its roots become unhealthy in such soils or because the wet soils are ideal for certain plant pathogens, such as water mold fungi?



Some Symptoms of Tree Decline, A Complex Disease

- Slow growth, including poor annual twig growth
- Sparse, undersized, distorted, often chlorotic foliage
- Browning of leaf margins
- Premature autumn color
- Large “distress” crops of seeds
- Subnormal storage of starch
- Progressive dieback of twigs and branches
- Adventitious sprouts where dieback occurred



From: “Diseases of Trees and Shrubs”
- Sinclair, Lyon & Johnson

Some Keys to Tree Decline and Complex Diseases:

- Predisposition by biotic and abiotic stress factors.
- Reduced ability to respond to favorable factors.
- Contributing effects of opportunistic pathogens and secondary insects.
- Chronic, cumulative effects may eventually result in irreversible decline.
- Initial stress factor may cease, but secondary factors may perpetuate progressive decline.

From: “Diseases of Trees and Shrubs” - Sinclair, Lyon and Johnson

Cumulative Stress Syndrome

- Time is relative
- Range of 2, 4, 6, 8+ years
- Environmental conditions during that time
- Chronic effects on growth



Acute Stress Adds to Cumulative Effects



“The Messenger” Speaks I



Oak study (Pedersen):

- Predisposing factors -- e.g. Competition
- Inciting factors -- e.g. Drought, defoliation
- Contributing factors -- weak pathogens, secondary woodborers

Tree death occurred typically 20 years after initially inciting stress.

From: Dan Herms article in *the Buckeye*, July 1998

“The Messenger” Speaks II

Other studies:



1. Light competition increased European beech sensitivity to drought stress
2. Honeylocust susceptibility to *Nectria* canker increased on moisture stressed plants.
3. Ozone exposure can result in lower photosynthesis, nutrient deficiencies, decrease in carbohydrate supply to roots, dysfunctional stomatal behavior.

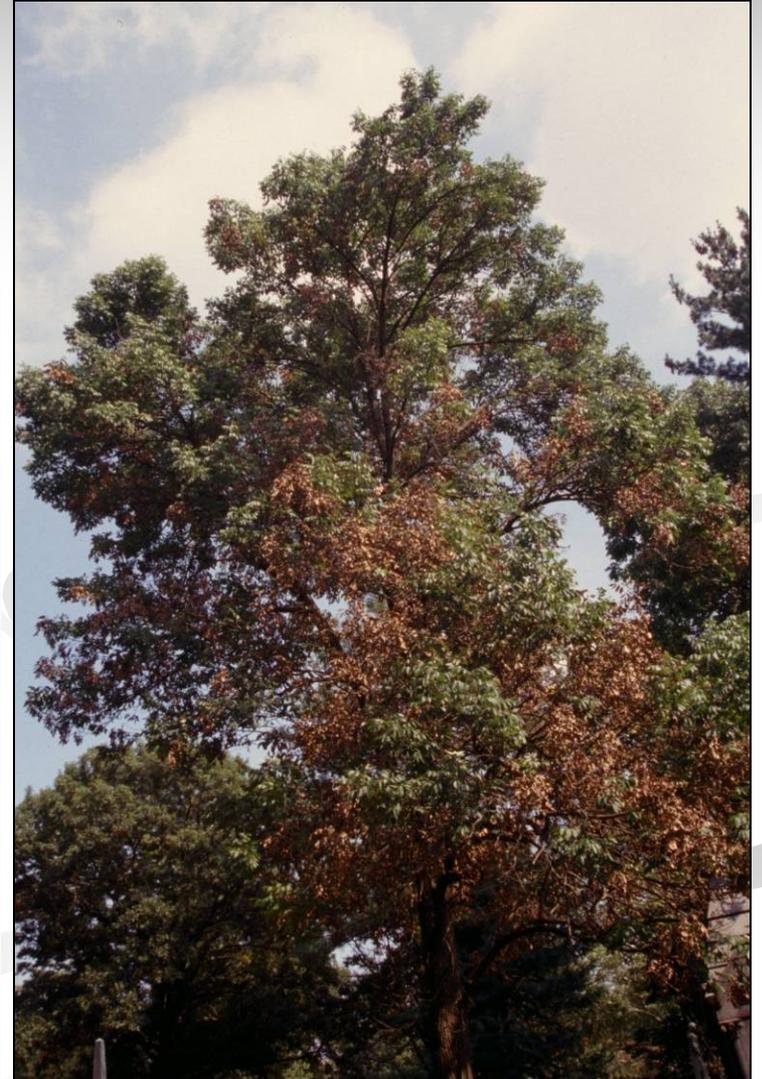
Latent Infection

- The pathogen is present, but the plant is not expressing symptoms
- Sphaeropsis (= Diplodia) Shoot Blight & Canker: 49% of Austrian pines without symptoms tested positive for the fungus (John Hartman, University of Kentucky)
- Botryosphaeria of Ash
- A real challenge to prevention



Botryosphaeria of Ash

**Late Summer 2002: twig
and branch dieback**



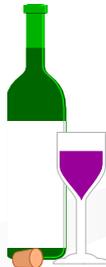
Botryosphaeria of Ash

Cankers



Sherlock Holmes & The Diagnostic Process...

Sherlock Holmes and Dr. Watson went on a camping trip. After a good meal and a bottle of wine they lay down for the night, and went to sleep. Some hours later, Holmes awoke and nudged his faithful friend.



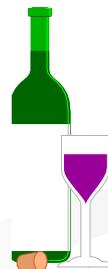
Sherlock Holmes & The Diagnostic Process...

“Watson, look up at the sky and tell me what you see.”

Watson replied, “I see millions and millions of stars.”

Holmes asked, “What does that tell you?”

Watson ponders a bit and replies...



Sherlock Holmes & The Diagnostic Process...

- Astronomically, it tells me that there are millions of galaxies and potentially billions of planets.
- Astrologically, I observe that Saturn is in Leo.
- Horologically, I deduce that the time is approximately a quarter past three.
- Theologically, I can see that God is all powerful and that we are small and insignificant.
- Meteorologically, I suspect that we will have a beautiful day tomorrow.

Sherlock Holmes & The Diagnostic Process...

Watson concludes: “So, Holmes, what does it tell you?”

**Holmes thought a minute, then spoke:
“Watson you idiot! Someone has stolen
our tent!”**



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