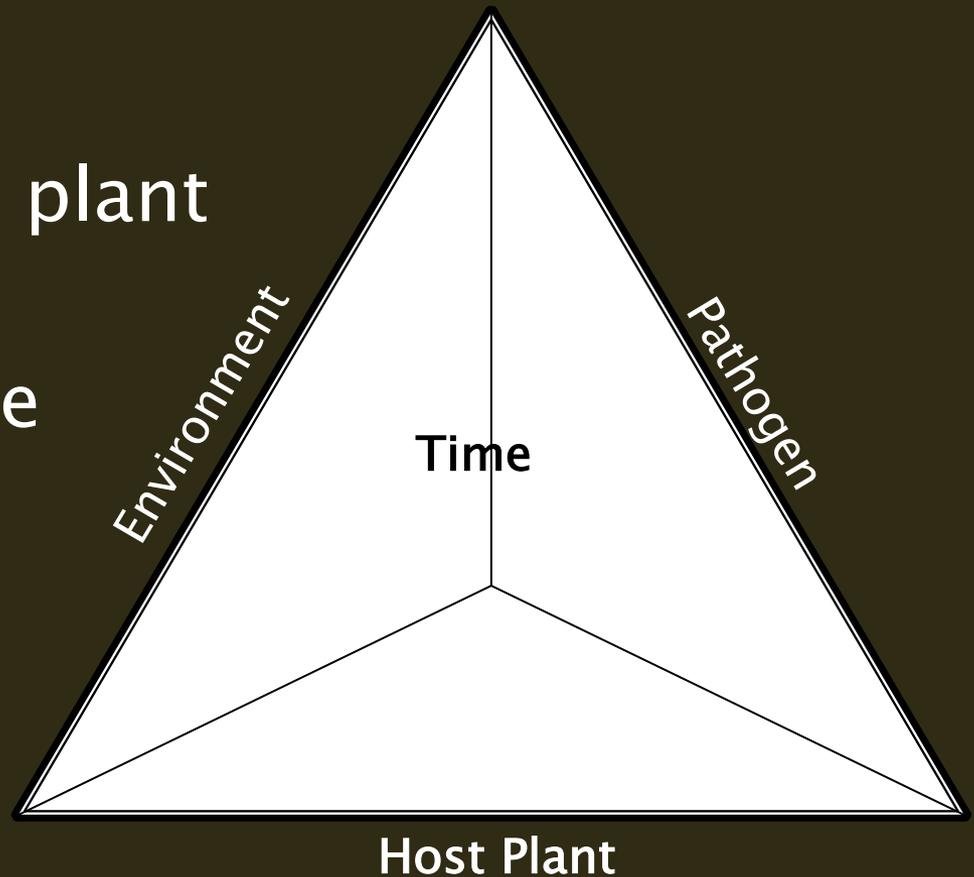


CONIFER DISEASES

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The Disease Triangle

1. Susceptible host plant
2. Pathogen
3. Favorable climate
4. Time

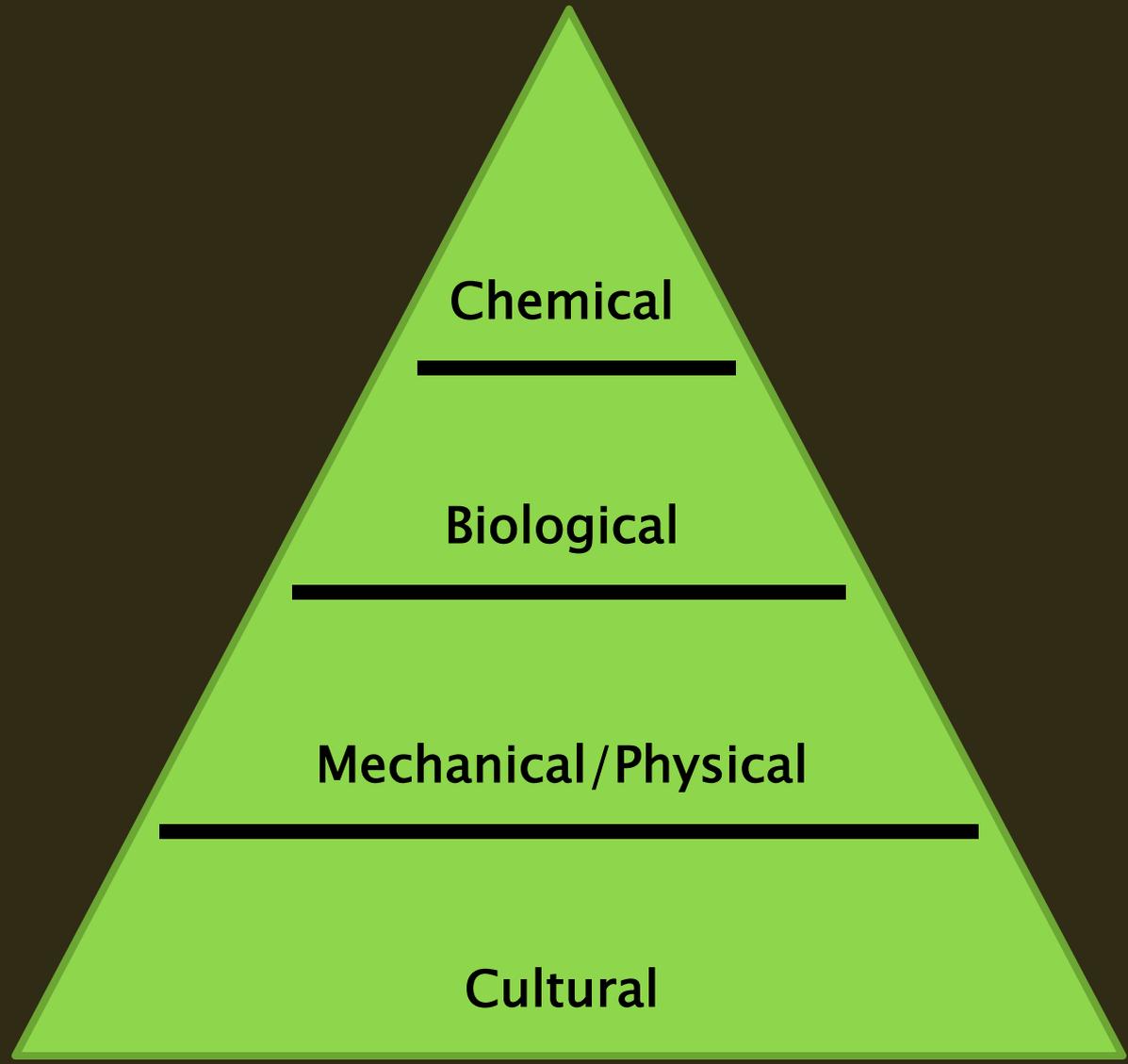
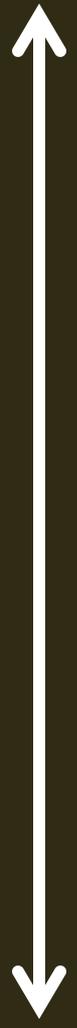


Integrated Pest Management (IPM)

- Long-term prevention of problems by managing the micro-environment
- Correct monitoring and identification
- Combine control measures to produce desired results
- Control measures: cultural, mechanical/physical, biological, and chemical

Intervention

Toxic



Chemical

Biological

Mechanical/Physical

Cultural

Prevention

Benign

Disease prevention

- Don't plant susceptible host in areas where the disease has been previously found
- Right tree – right place
- Know environmental requirements of the tree species
- Keep plants healthy and vigorous

Conditions for conifers

- Soils – prefer sandy, well drained
- Water – no excess water
 - Perched water tables in spring
- Light – need full sun
- Space – air flow, light, shading–overlap
- pH – prefer acidic soils
- Exposure – salt tolerance varies

Conifers to site carefully in Illinois

- Colorado spruce (*Picea pungens*)
- Austrian pine (*Pinus nigra*)
- Red pine (*Pinus resinosa*)
- Scots pine (*Pinus sylvestris*)
- Mugo pine (*Pinus mugo*)
- False cypress (*Chamaecyparis*)
- Ponderosa pine (*Pinus ponderosa*)
- Balsam fir (*Abies balsamea*)
- Fraser fir (*Abies fraseri*)

Common Conifer Diseases

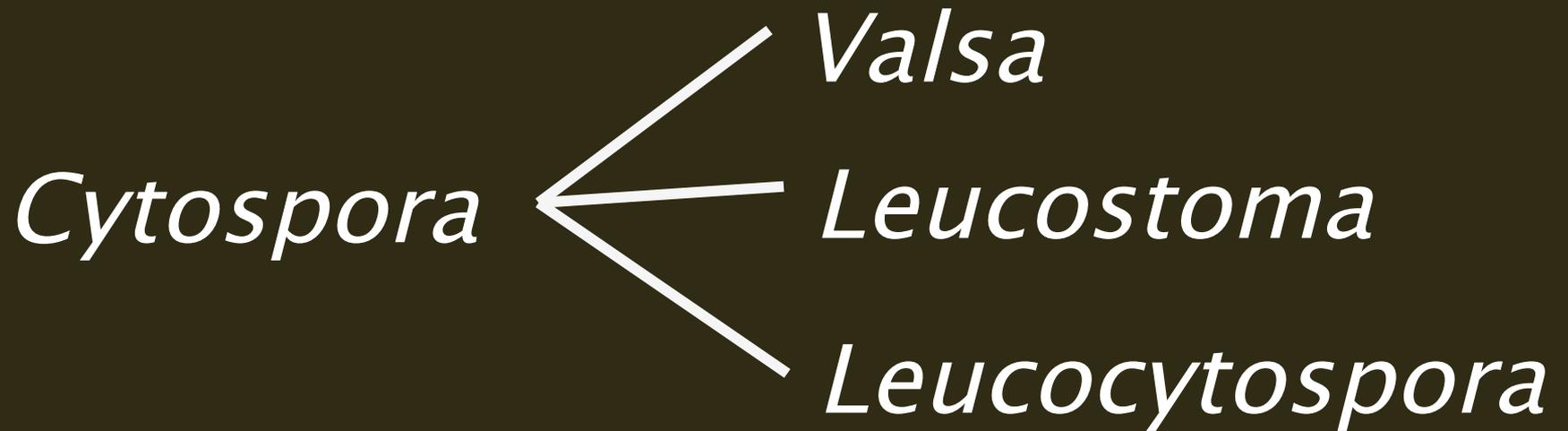
- Canker diseases
 - Main stem, branches, twigs
- Needle and tip blights
 - Needle diseases more serious evergreens cannot refoliate
- Root rots
 - Fungal and bacterial
- Stem rots
 - Conks, mushrooms, softwood

Cytospora canker

- Common fungal disease
- Spruces (*Picea*)
 - Colorado (blue) spruce and Norway spruce
- Fir (*Abies*)
- *Pseudotsuga*
- Other species



Other names



Treat them the same as far as
symptoms and management

Cytospora canker

- Affects older trees
 - 15 years old and 20 feet tall
- More common on stressed trees
 - Mechanical injury, de-icing salts, poor nutrition, freezing, heat, other stressors or diseases



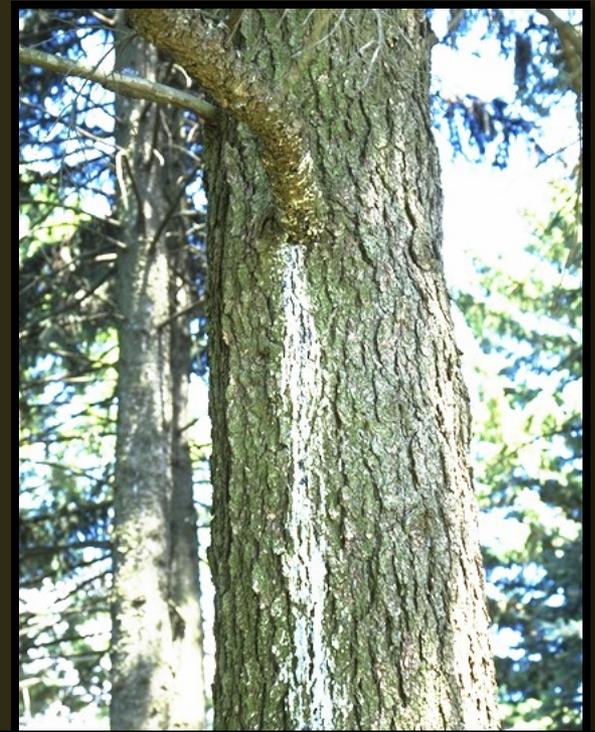
Cytospora canker

- Fungus invades branches, twigs, and main stem
- In spring, needles turn purple, brown and fall off



Cytospora canker

- White resin seen on infected branches and stem (not associated pruning wound)



Cytospora cultural and preventative management

- Identify the underlying stressor and manage it
- Keep trees healthy and vigorous
- Plant healthy trees (nurseries)
- Right tree, right place
- Chemical treatments...



Arboriculture & Urban Forestry 2012. 38(3): 112–116



Control of Apple Scab and Cytospora Canker with Paclobutrazol

Gary Watson and Karel Jacobs

Abstract. Forty *Malus* 'Radiant' crabapples, a variety known to be highly susceptible to apple scab disease, were field-planted then treated three months later with paclobutrazol (PBZ) as a basal drench, at rates of 0, 0.8, 1.6, and 2.4 g a.i./cm caliper. Apple scab was significantly reduced for two years post treatment by all rates of PBZ applied. However, significant growth regulation occurred through the third and final year of the study. Thirty *Picea pungens* (Colorado spruce) trees in containers were treated with PBZ, applied as a basal drench, at rates of 0, 1.6, and 3.2 g a.i./cm caliper. Cytospora canker development from subsequent branch inoculations was significantly reduced by both PBZ treatment rates and persisted through the end of the two year monitoring period. Cytospora canker disease control with only moderate growth regulation indicates that a PBZ basal drench could be developed into a viable landscape treatment.

Key Words. Colorado Spruce; Crabapple; Disease Control; Growth Regulation; Paclobutrazol; *Picea pungens*.

Paclobutrazol (PBZ) and *Cytospora*

- Sixty 22–29 L container Colorado spruce
- 2004 treated with 0, 1x, and 2x rates
 - (1.6 g a.i. is recommended label rate)
- 2005 trees inoculated with *Leucostoma kunzei*
- Disease severity and tree growth regulation measured 2005–2006

Paclobutrazol (PBZ) and *Cytospora*

Disease severity rating (DSR):

0 = healthy

1 = some resin and/or slight browning or purpling of needles around inoculation point

2 = substantial browning of needles beyond inoculation point, resin still visible and more pronounced

3 = branch completely browned

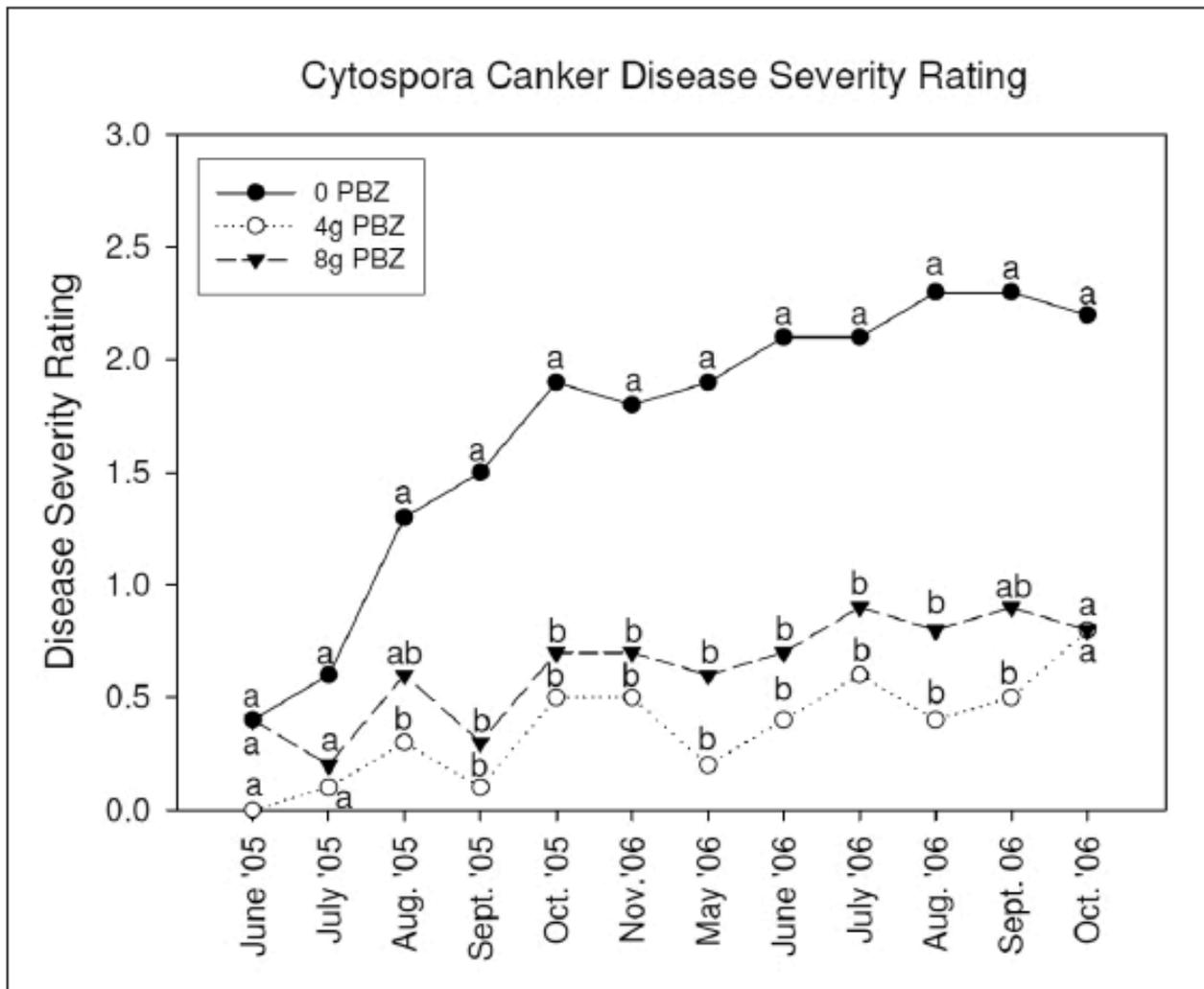


Figure 2. Monthly average DSR for 30 Colorado spruce trees treated with two rates of Paclobutrazol or Control. Values represent means of 10 trees. Within each month, different letters indicate a significant difference between treatments.

Paclobutrazol (PBZ) and *Cytospora*

2005

- No growth regulation
- Disease suppression compared to untreated inoculated controls

2006

- Central leader only moderately regulated, lateral branches not regulated (pot bound)
- Significant disease suppression

Paclobutrazol (PBZ) and *Cytospora*

- Using PBZ as a protectant before artificially inoculating tree significantly controlled disease development for two years with only minor growth regulation
- Authors speculated that PBZ had promise for *Cytospora* canker control in natural infections

Diplodia tip blight (i.e. *Sphaeropsis*)

- Fungal disease of 2–3 needled pines
- Austrian, Scots, mugo, and red pines
- Other conifers

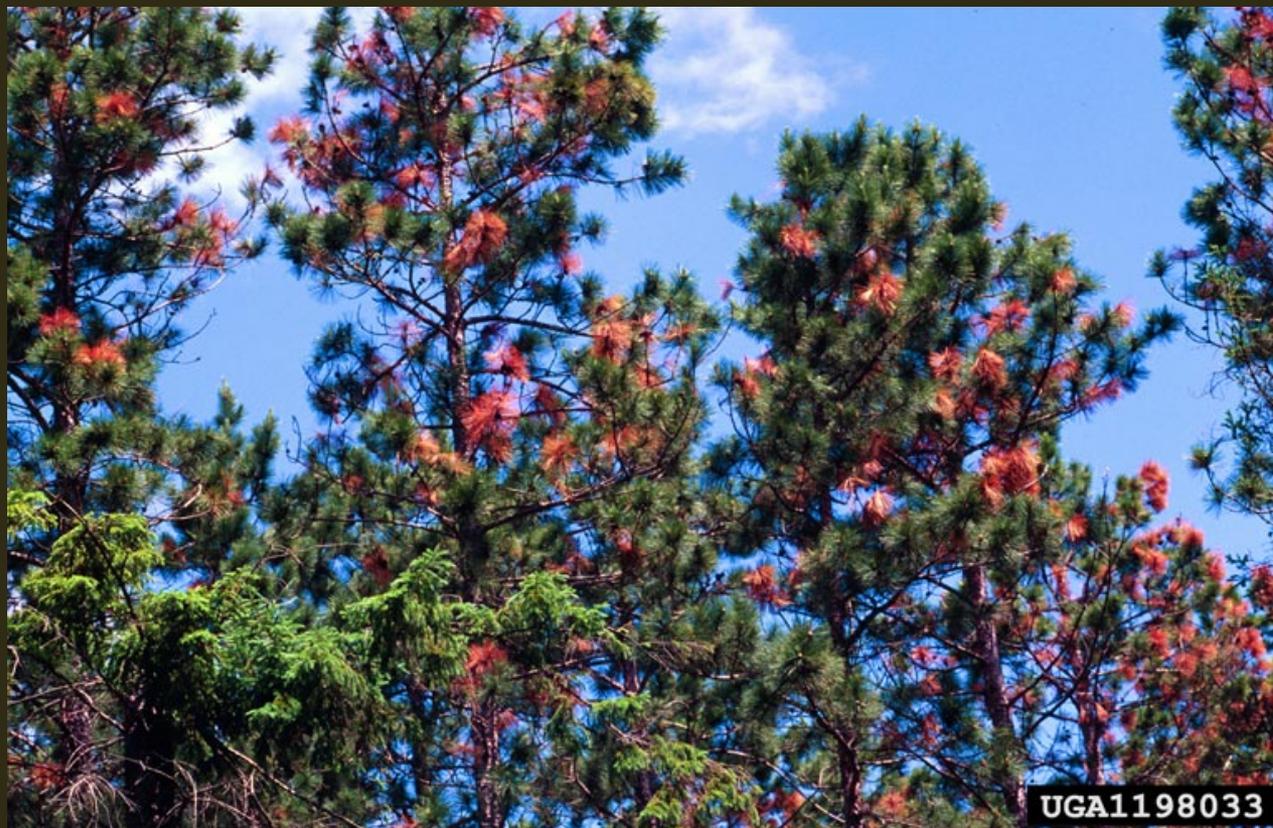


Diplodia tip blight (i.e. *Sphaeropsis*)

- New needles are stunted, twisted, and killed
- Fruiting bodies found on needle or under needle sheath



- Disfiguring – kills new shoots during expansion
- Can move into shoots and branches killing entire trees as a perennial canker



Physical damage can spread the fungus (hail)

Diplodia tip blight management

- Reduce stress
- Fungicides available and effective
- Spray three times during candle elongation
- Azoxystrobin, chlorothalonil + thiophanate-methyl, copper-based, and propiconazole

Dothistroma needle blight

- Affects Austrian and ponderosa pines
 - Red and Scots are resistant



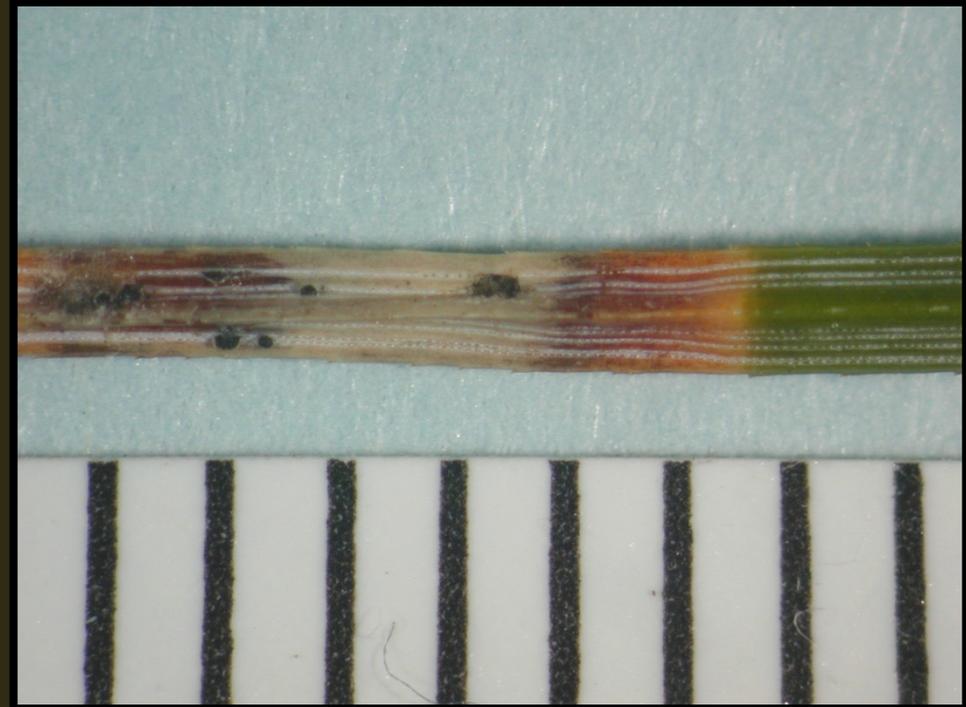
Dothistroma needle blight

- Brown – copper colored spots and bands on needles
- Eventually needle turns brown from band to top, with base remaining green



Dothistroma needle blight

- Fungal spores are released and moved by wind and rain any time during the growing season from May to October
- New infections occur May–October



Dothistroma management

- Minor infection one to two applications of fungicides
 - Timing is critical
- If wet weather continues additional applications may be needed
- Copper, copper hydroxide, copper + mancozeb, copper sulfate

Pine wilt

- Most common in Scots pine, but found in all pines (extremely rare in white pines)
- Caused by pine wilt nematode (PWN), which is moved by the pine sawyer beetle



Pine wilt disease cycle

- Beetles lay eggs in dying trees
 - Larvae overwinter in trees
 - PWN infests beetles before they emerge
- Beetles carry nematodes to live pine
 - Feed on twigs
- Nematodes enter feeding wounds
 - Move into resin canals, destroying cells
 - Reproduce quickly and clog vascular system

Pine wilt

- First symptom is gray green needles that turn yellow, then brown
- Trees die in less than one season
- Occurs midsummer – late fall; or late winter – spring



Natasha Wright, Florida Department of
Agriculture and Consumer Services



Pine wilt management

- Identification
- Sanitation is the key
- Insecticides and nematicides impractical or ineffective
- Best management unchanged from 20 years ago
- Prevent or slow the spread of the disease in an area, if proactive

Rhizosphaera needle cast

- Colorado (blue) and Engelmann spruces highly susceptible
- White, black hills, black, Sitka, and Serbian spruce intermediate
- Norway spruce relatively resistant



http://oregonstate.edu/trees/conifer_genera/spp/spruce_spp.html

Rhizosphaera needle cast

- Infects year-old needles May-June
- Likes warm, wet weather
- Symptoms seen late summer-early fall, or following spring
- Infected needles turn yellow, fungal fruiting bodies (black bumps)
- Needles turn purple to brown and drop

Rhizosphaera needle cast



Smooth black bumps found in rows on bottom of needles

One-year needles die leaving alive and healthy growth at tips



Rhizosphaera management

- Branches defoliated 3–4 yrs may die
- Treatment effective if caught early
- Two years of treatment, at least
- Copper–based fungicides, copper hydroxide, mancozeb, chlorothalonil, chlorothalonil + thiophanate–methyl

Stigmina needle cast

- First identified in 2006
- Colorado, Norway, and white spruces
- Found on 2nd–3rd yr needles
- Current year needles unaffected
- Symptoms similar to *Rhizosphaera*
 - Purple and loss of older needles
 - Works way up canopy

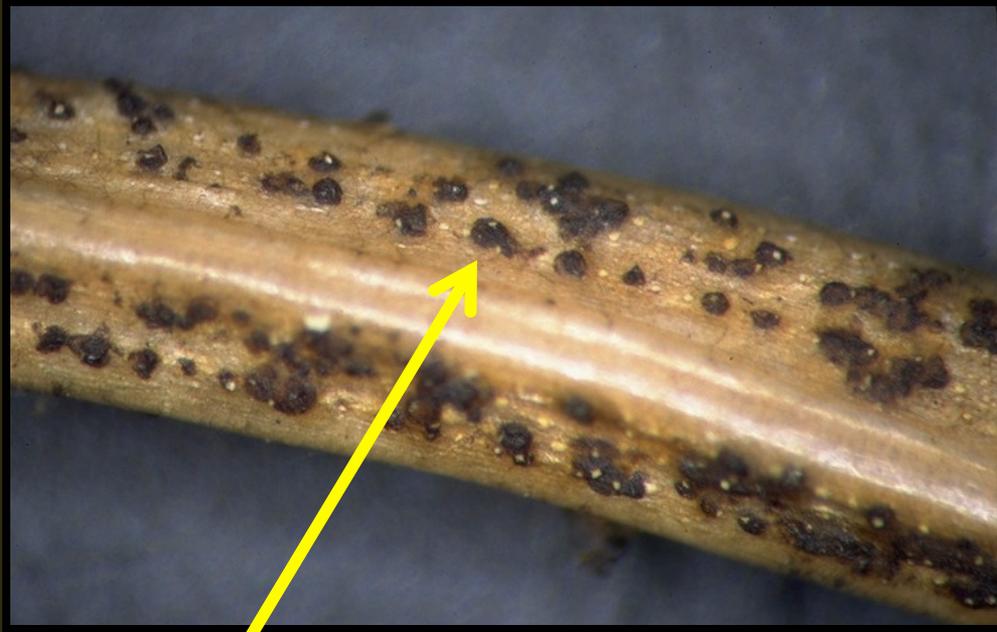
Stigmina needle cast

- Needles turn yellow to brown, then purple
- Needles fall from branches leaving green current year growth at tips
- Inside of canopy is bare



Photos by Jim Walla

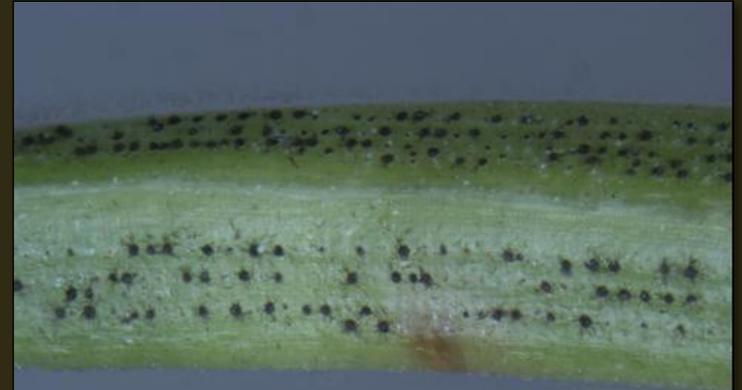
Rhizosphaera



Smooth

Fuzzy

Stigmina



A

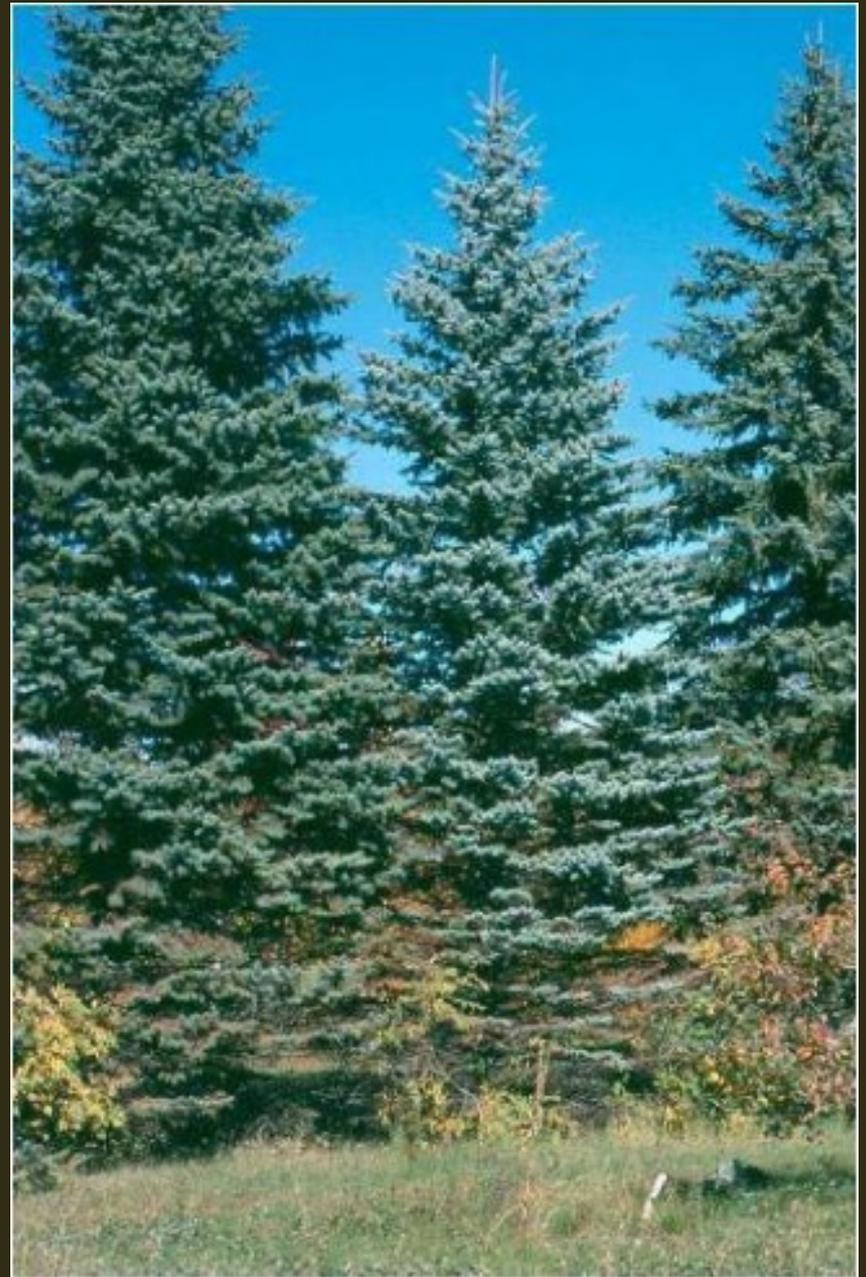


B

Photos by Justin Knott

Stigmina needle cast management

There are currently
no known
fungicides that
manage *Stigmina*



Phomopsis tip blight

- Junipers, arborvitae, Douglas fir, larch, yew, hemlock
- Only new growth is effected
- More serious on newly planted trees



Phomopsis tip blight

- Initially starts as yellow spots, progresses into shoots
- Tips become light green and then reddish brown, eventually straw-gray color



Phomopsis management

- Rarely kills or disfigures plants
- Chemical treatment only necessary on newly transplanted or young trees
- Remove blighted tips
- Chemical applications begin when new flushes of growth appear
- Azoxystrobin, chlorothalonil + thiophanate-methyl, copper-based, mancozeb

Root Rot Infections

- Symptoms
 - Uniform canopy dieback, leaf drooping, almost like drought stress, brown or black roots, sloughing roots
- Fungal pathogens
 - *Phytophthora*, *Pythium*, *Fusarium*, and *Rhizoctonia*
- Bacterial soft rot
 - Due to excess moisture
 - Soil will smell acrid and sour
- **Need to be properly identified for management**

Above-ground Root Rot Symptoms





Below-ground Root Rot Symptoms



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Pathogen Detection

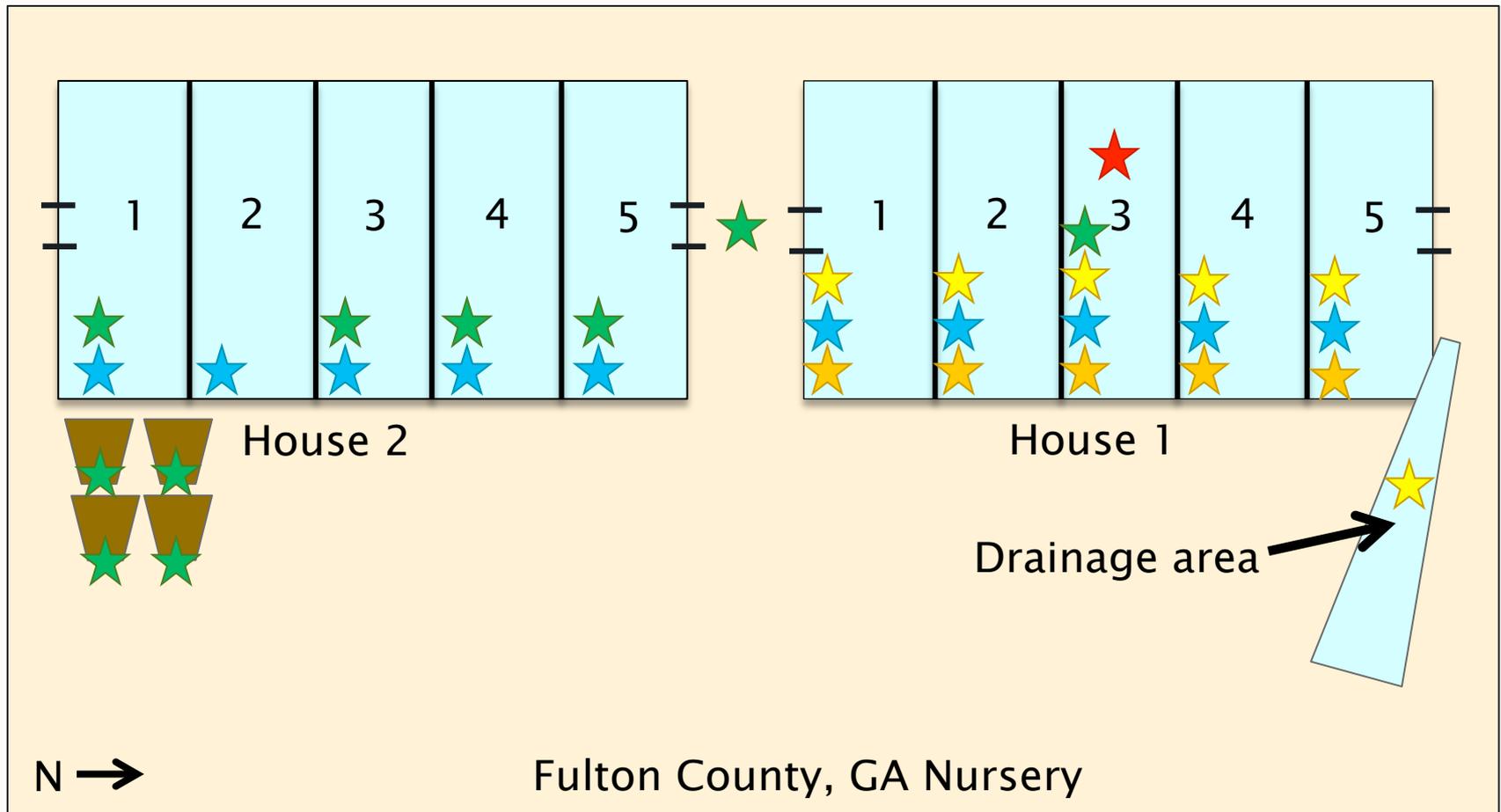
- Culture plant material
- ELISA tests (Agdia, Neogen, etc.)
- DNA tests



Soil-borne pathogen management

- Do not move soil from known infested plants or areas
- Do not replant infested area with known hosts, plant non-hosts
- Soil fumigation or soil sterilants
- **Prevention is cheaper, faster, and easier than managing root rot diseases**

Phytophthora ramorum spread



- ★ May 2005
- ★ September 2005
- ★ October 2005

- ★ November 2005
- ★ May 2006

Root rot management

- Prevention, plant healthy plants
- Quarantine plants
- Communicate with nurseries
- Manage stressors
 - good soil aeration, drainage
- Fungicide soil drenches are available

Tool Sanitation

- Must be in contact with alcohol for 2–3 minutes
 - 70 or 91% isopropyl alcohol at drug stores
 - Lysol™, most have 40% alcohol
 - 5% bleach solution
- Sterilized Pruning Tools:
Nuisance or Necessity? Dr. Linda Chalker–Scott; WSU Puyallup Research and Extension Center



Conifers native to Illinois

- Jack pine (*Pinus banksiana*)
- Shortleaf pine (*Pinus echinata*)
- White pine (*Pinus strobus*)
- Red pine (*Pinus resinosa*)
- Northern white-cedar (*Thuja occidentalis*)
- Eastern red-cedar (*Juniperus virginiana*)
- Bald cypress (*Taxodium distichum*)
- Tamarack (*Larix laricina*)

Spruces for Northern IL

- Oriental spruce (*Picea orientalis*)
- Norway spruce (*Picea abies*)
- White spruce (*Picea glauca*)



Pines for Northern IL

- Limber pine
(*Pinus flexilis*)
- Swiss stone pine
(*Pinus cembra*)
- White pine
(*Pinus strobus*)



Firs for Northern IL

- Manchurian fir (*Abies holophylla*)
- European silver fir (*Abies alba*)
- Concolor fir (*Abies concolor*)
- Nikko Fir (*Abies homolepis*)
- Rocky mountain Douglas fir
(*Pseudotsuga menziesii* var. *glauca*)
- Douglas fir (*Pseudotsuga menziesii*)

Conifers for Northern IL

- Hemlock (*Tsuga*)
- Dawn redwood
(*Metasequoia glyptostroboides*)
- Yews (*Taxus*)
- Giant arborvitae or western red-cedar
(*Thuja plicata*)

