

Winning the Battle Against Boxwood Blight and Other Diseases of Woody Ornamentals

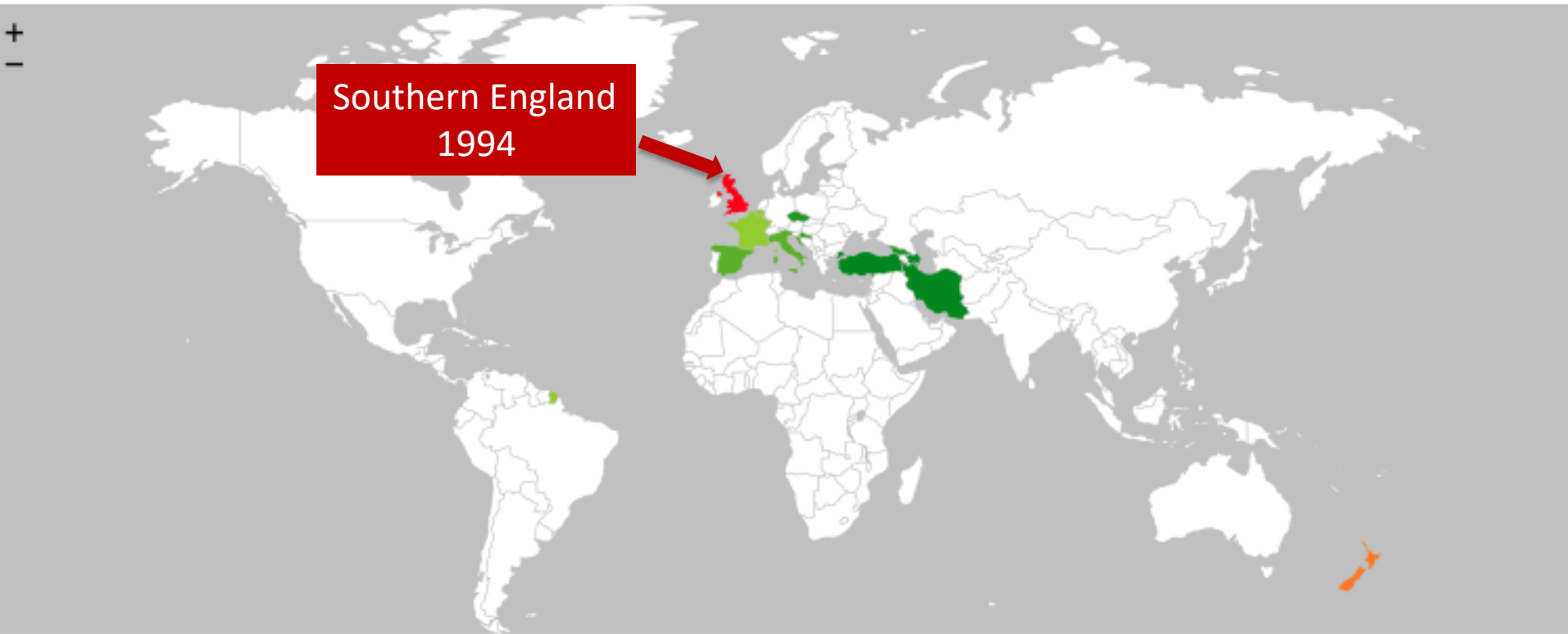


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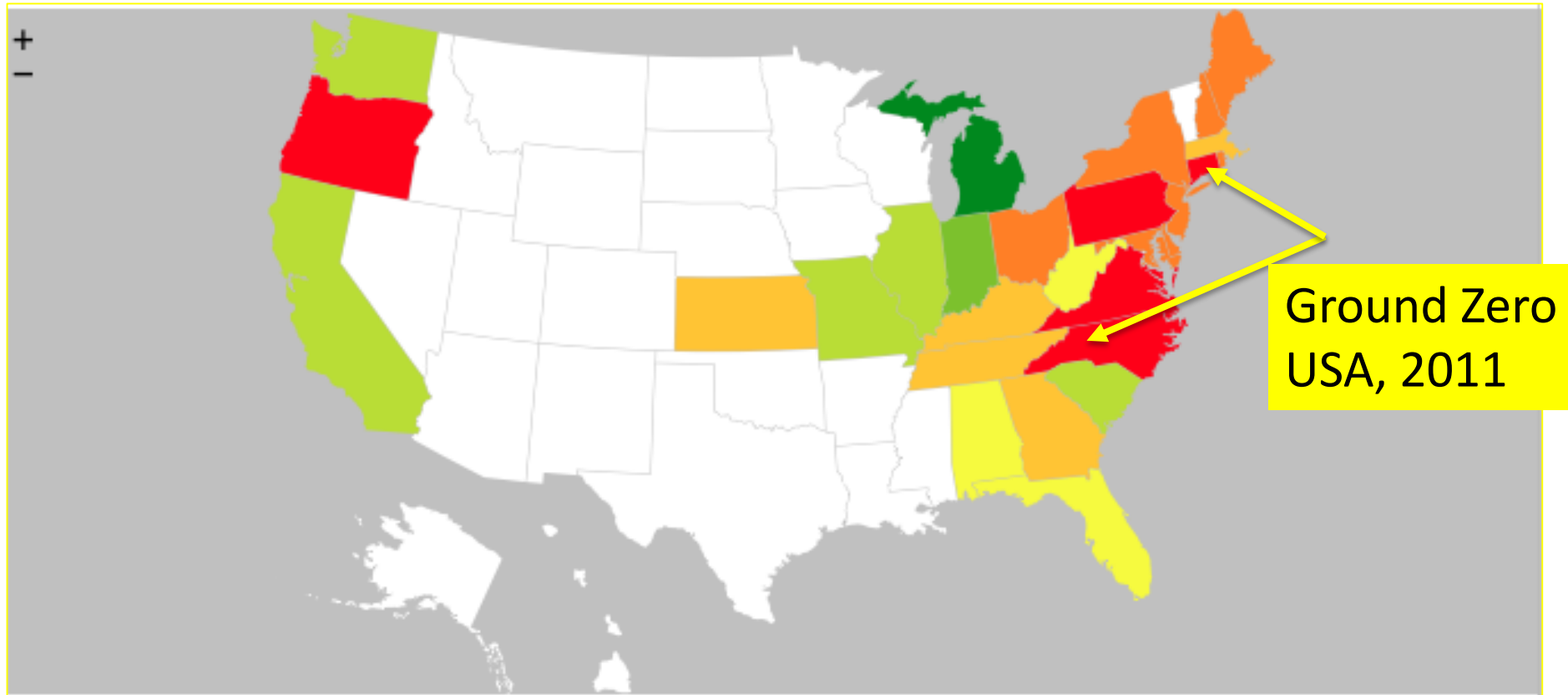
Presentation Game Plan

- Boxwood Blight Overview
 - Brief history of the disease
 - Disease diagnostics
- Boxwood Blight Management
 - Integrated management strategies
- Boxwood Research Updates
 - Fungicide Research Trials
 - Future Work
- *If time.....*Leyland Cypress twig and branch dieback

How we got here.... *A brief history of the blight*



Feb 2019: 28 states with confirmed boxwood blight



Why is there so much concern surrounding Boxwood Blight?

- Historical plantings with highly susceptible cultivars
- Popular in landscapes
 - Very little disease management traditionally
- “Retirement Income”
 - Christmas wreaths and decorations
- Without management: Often death on susceptible cultivars



Susceptible Boxwood Cultivars



Buxus sinica var. *insularis* 'Justin Brouwers'



Buxus sempervirens 'Suffruticosa'

Photos:
Saunders's
Brothers



Buxus sempervirens



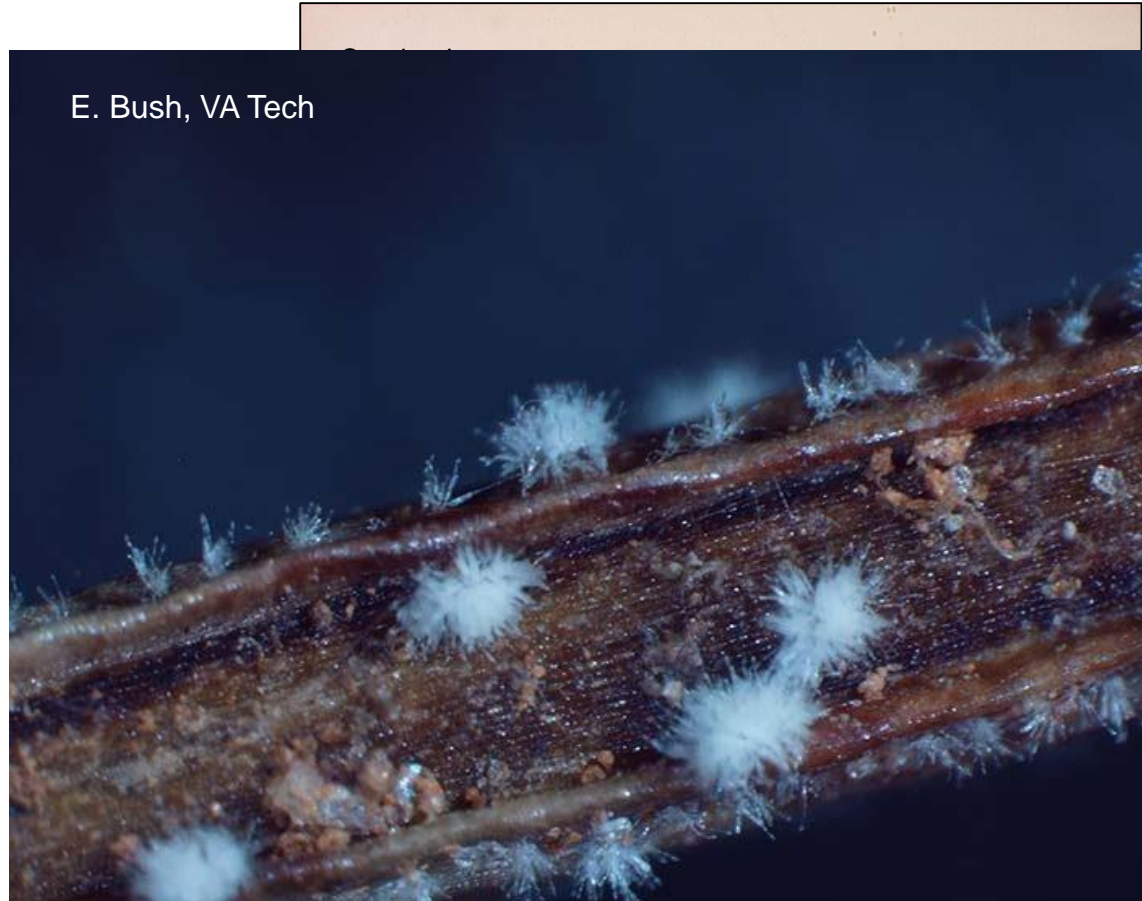
Buxus microphylla var. *japnoica*
'Morris Dwarf'



Buxus microphylla var. *japnoica*
'Green Beauty'

Boxwood Blight Pathogen: *Calonectria pseudonaviculata* (Cps)

- Thrives in humid, warm environments
- Produces overwintering structures
 - Microsclerotia (hard mass of fungal mycelium) that survive on leaf litter



Symptoms of Boxwood Blight

- Leaf lesions/spots: Initially observed in lower canopy and shaded areas
 - Circular to irregular; Darker border with lighter brown to purple center



Symptoms of Boxwood Blight

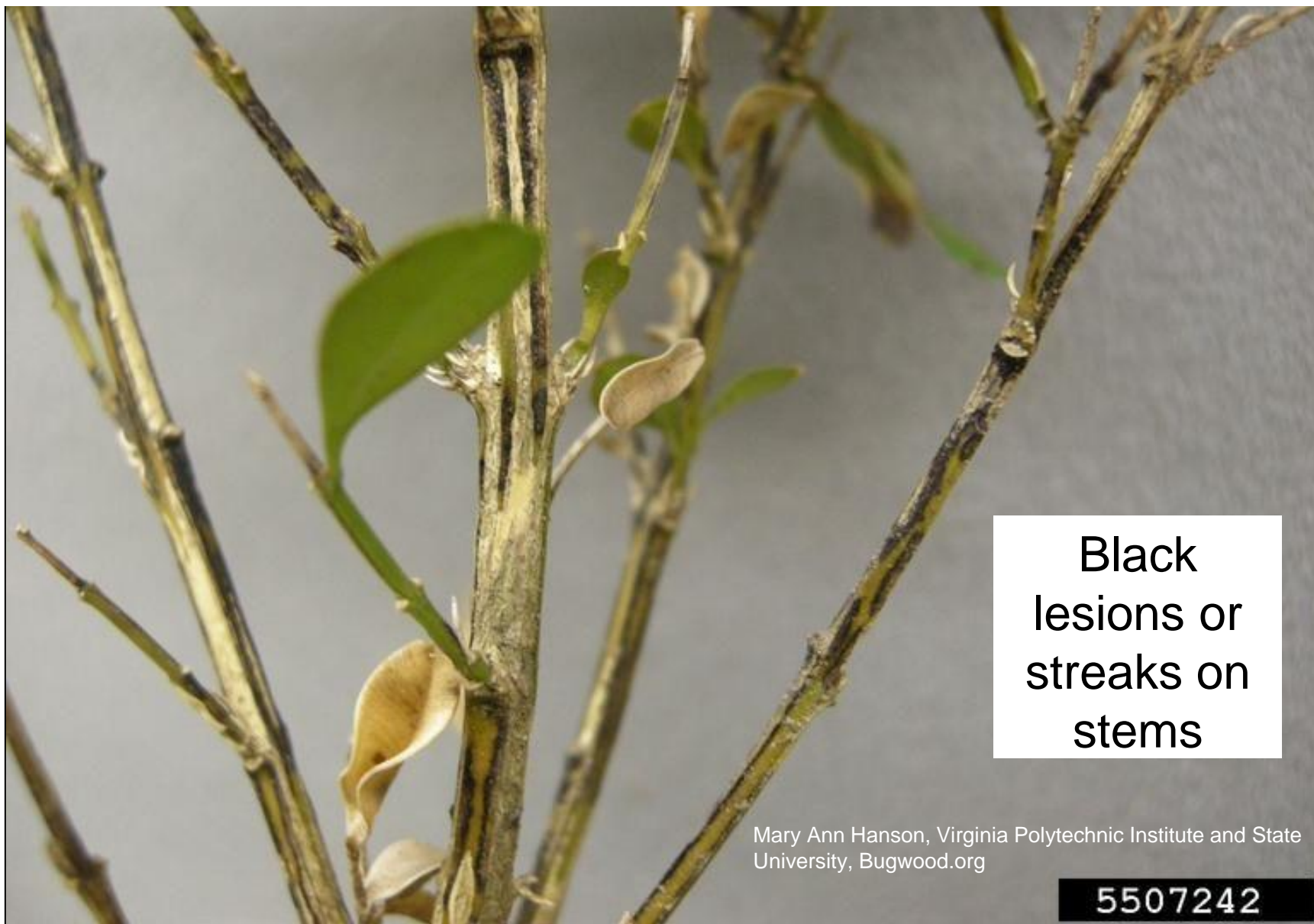


Symptoms of Boxwood Blight

Gray to white, sticky fungal spores during warm, humid conditions



Symptoms of Boxwood Blight



Black
lesions or
streaks on
stems

Mary Ann Hanson, Virginia Polytechnic Institute and State
University, Bugwood.org

5507242





Leaf drop and defoliation:
Symptoms often begin on
shady side of boxwood



Look-a-Like Boxwood Problems: Volutella Blight

Mary Ann Hansen, VT



Symptoms

- Leaves: Light green to tan
- Leaves remain on plant > box blight
- Salmon color spores

David L. Clement, University of Maryland, Bugwood.org



- Occurs when boxwood is under abiotic or biotic stress

Look-a-Like Boxwood Problems: Boxwood Leafminer

Lee Townsend, U. Kentucky



M. J. Raupp



- Lesions or swellings on leaves
- May have a blistered appearance
- Leaves turn yellow and can defoliate

Look-a-Like Boxwood Problems: Boxwood Leafminer

- Typically see immature larva of small, orange fly
- Flies seen in the spring when they lay eggs
- The larva mine around in the leaf, feeding on plant tissue
- Overwinter and emerge as adults the following spring
- One generation per year



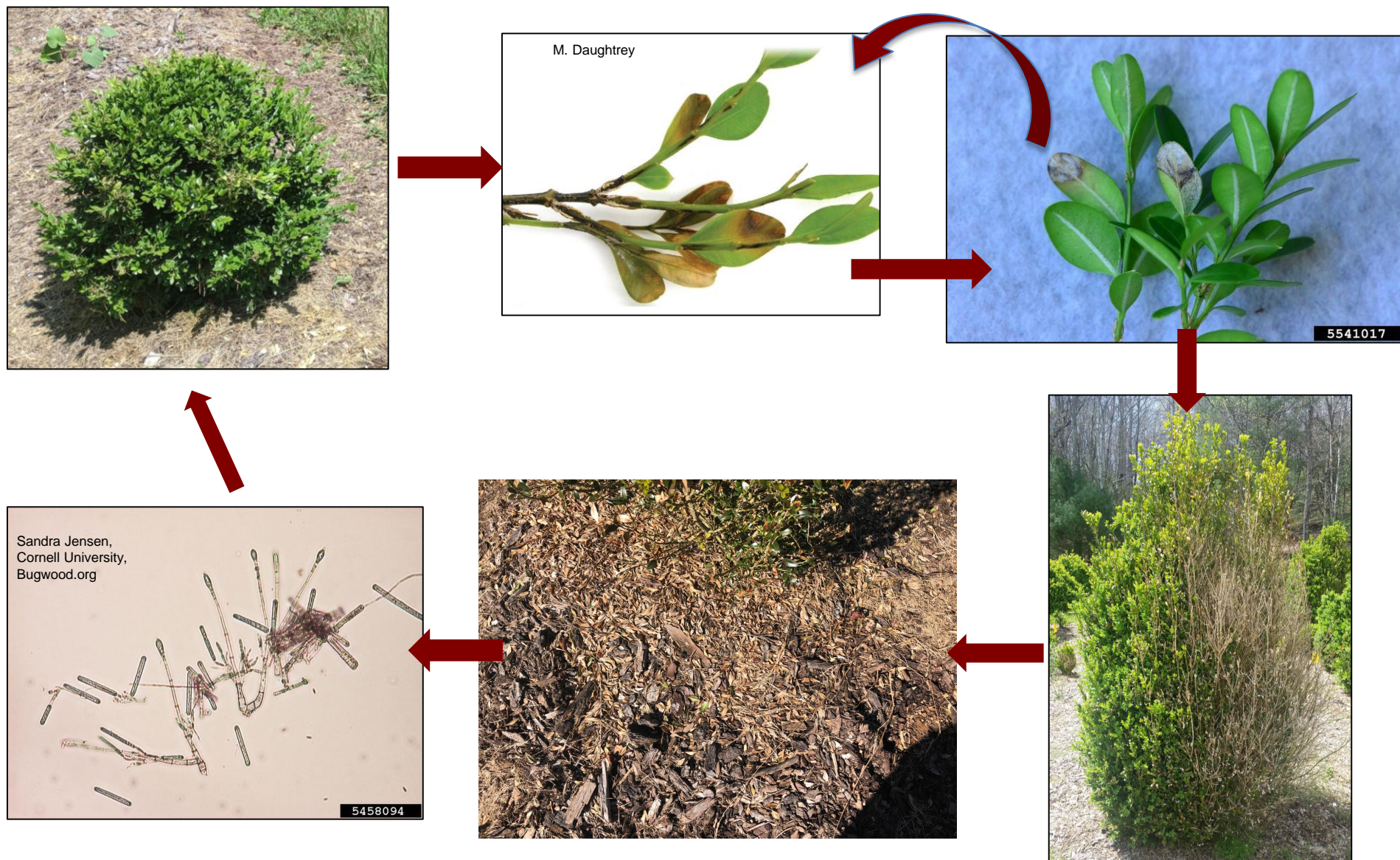
Rachel Kreis, NC State University

Look-a-Like Boxwood Problems: *Phytophthora* Root Rot

Photo: NCSU PDIC



Boxwood Blight Disease Cycle



How does boxwood blight spread?

Short Distances (within/surrounding plant)

- Abundant production of sticky spores
 - Rain/water splashed; not spread easily by wind
- Overwintering structures in leaf debris (organic matter) and soil



How does boxwood blight spread?

Moderate to Long Distances

Photo: Green Mountain Nursery



Photo: Gail Ruhl, Purdue

Prevention and Management of Boxwood Blight in the Landscape

Management of Boxwood Blight

There is no silver bullet- Integrated approach is best!

- Avoid introducing the pathogen on infected boxwoods
 - Purchase plants from a reputable source: Are nurseries/grower participating in the “Boxwood Cleanliness/Compliance Program”?
 - Know the symptoms! Inspect plants (particular inner + lower foliage) for leaf spots and stem lesions
 - Be careful of holiday greenery
 - Asymptomatic introduction through more tolerant varieties

Boxwood Blight: Cultivar Susceptibility

Most Susceptible

Most
Resistant
(Tolerant)

- *B. sempervirens* 'Suffruticosa'
- *B. sinica* var. *insularis* 'Justin Brouwers'

- *Buxus* 'Green Mountain'
- *B. microphylla* 'Jim Stauffer'

- *Buxus* 'Green Gem'
- *B. microphylla* 'John Baldwin'

- *B. sinica* var. *insularis* 'Nana'
- *B. microphylla* 'Green Beauty'

Boxwood Blight: Tolerant Cultivars

- Avoid planting near alternate hosts and susceptible cultivars

Moderately resistant

B. microphylla 'Winter Gem'

B. sempervirens 'Dee Runk'

B. sempervirens 'Fastigiata'

Buxus 'Green Gem'

B. microphylla 'John Baldwin'

Most resistant (recommended for new plantings)

B. microphylla 'Golden Dream'

B. harlandii

B. sinica var. *insularis* 'Nana'

B. microphylla var. *japonica* 'Green Beauty'

Be careful of 'Trojan Horse' introductions!

Boxwood Blight: Tolerant Cultivars



- “Better tolerance to boxwood blight, better resistance to leaf miner....”
- Saunders Bros. evaluated over 150 cultivars for tolerance to boxwood blight in cooperation with universities and private industry

Boxwood Blight Management: Sanitation

- Sanitation of equipment, clothing/boots, pruning shears, shovels, vehicles
 - Be mindful of “order” in which you work
 - Wear disposable booties/shoe covers, tyvek suits, gloves



Photo: Saunders Brothers

Boxwood Blight Management: Sanitation

- Pruning tools: 70% ethanol or Lysol Disinfectant Spray
Brand III: 10 seconds to five minutes

Product	Remarks
Green-Shield	Highly corrosive; contact time: 10 minutes for most surfaces
ZeroTol 2.0	Product foams; good for hard to reach areas; Contact time: 1 to 10 min.
Chlorox	Inactivated by organic matter, corrosive to metal; Contact time: 10 to 15 min

Boxwood Blight Management: Cultural

- Prune out disease stems/foliage, remove from planting and destroy/double bag
- Do NOT compost diseased tissue: Double bag and destroy
 - Do not leave to “rot” on side of road
- Remove top layer of soil (especially if replanting)
- Mulch around base of plants, bury microsclerotia



Boxwood Blight Management: Cultural

Minimize leaf wetness

- Promote airflow: Choose cultivars w/ more open growth habit
- Promote airflow: Maximize spacing between plants
- Avoid overhead irrigation
- Be mindful of planting in excessively shaded area



Boxwood Blight Management: Fungicides

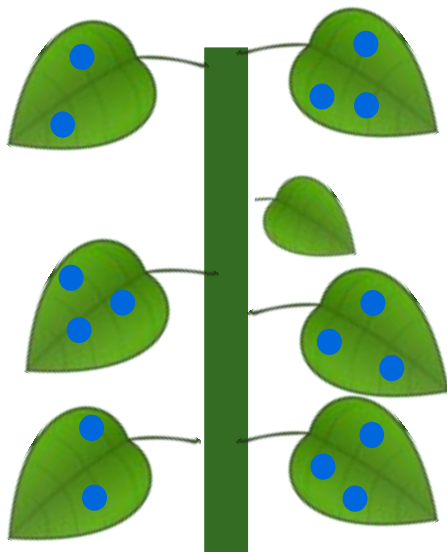
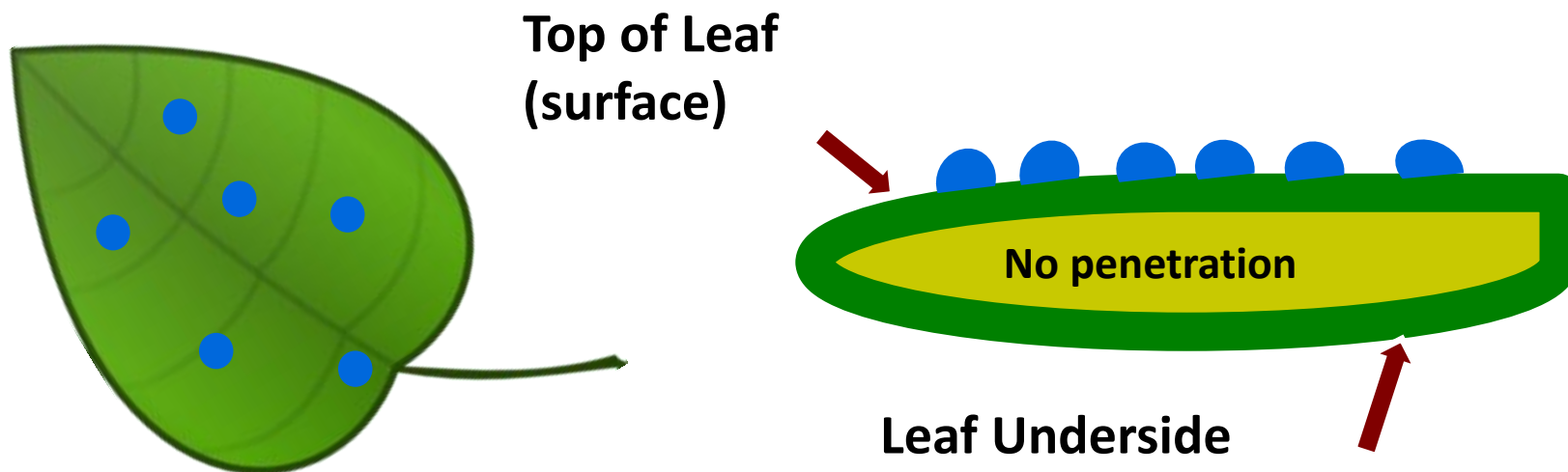
- Boxwood blight cannot be cured by fungicides
- Fungicides CAN help management of boxwood blight through protective applications
- In NC: Fungicide applications ~14 day intervals:
Mid April to Early October
- Many fungicides labeled for boxwoods, but not specifically boxwood blight

Boxwood Blight: Fungicide Management

- Multi-site fungicides: Chlorothalonil (protectant)
 - Prohibit fungal spore germination
 - (-) Application by prediction, schedule, gut feeling
 - (-) Risk of harming non-targets: Phytotoxicity
 - (+) Low risk for resistance development



Protectant/Contact Fungicides



- Fungicide remains on surface where applied
 - Rain can **redistribute** (move it to other surface parts)
- Plant tissue (i.e. leaves) emerging after application or tissue missed during application not protected
 - Unless material redistributed

Protectant/Contact Fungicides

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- Surface active/contact fungicide that is not/should not be absorbed by plant tissue (surfactant/mixing partner)
 - **Phytotoxic** if absorbed
- Work by direct contact with pathogen on the plant surface:
Coverage is critical
- Physical M.O.A.: Usually protective
 - Inhibits spore germination



Boxwood Blight: Fungicide Management

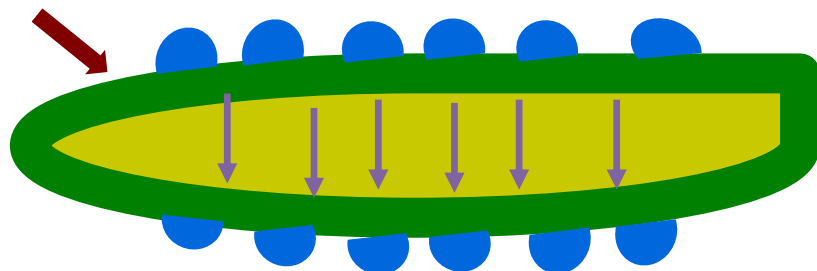
- Single-site fungicides
 - (+) Manage number of phytopathogenic fungi
 - (+) Minimize harmful effects to non-targets and environment
 - (+) High level of protective and curative(?) activity
 - (-) Specificity fosters development of resistant populations with repetitive use

Locally Systemic/Single Site Fungicides

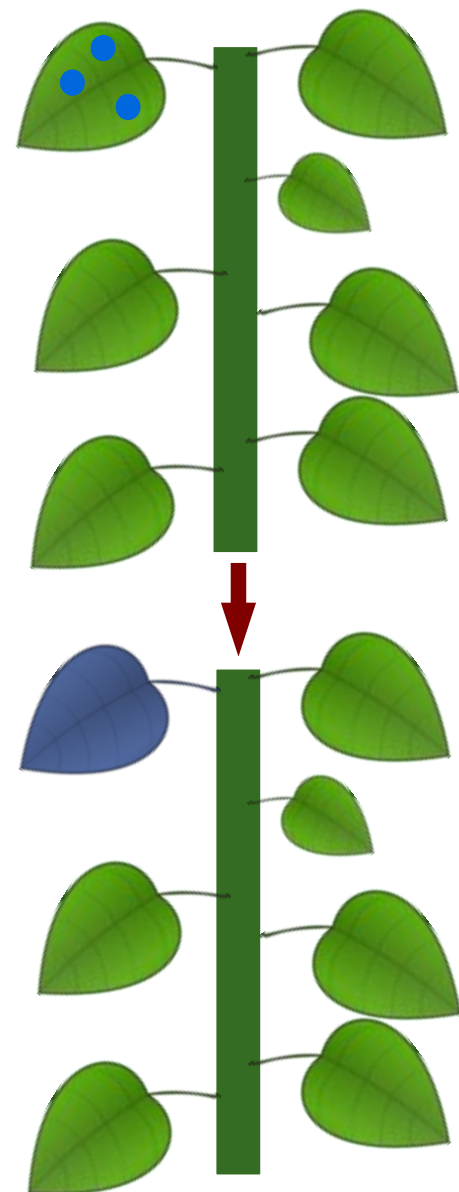
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- Absorbed by plant but do not travel far
 - Move within a treated plant organ (primarily leaf)
- Interfere with fungal growth, have post-infection/curative/kick-back activity
- Movement of most modern fungicides

Leaf Surface



Leaf Underside



Boxwood Blight Chemical Control: MHCREC Container Pad

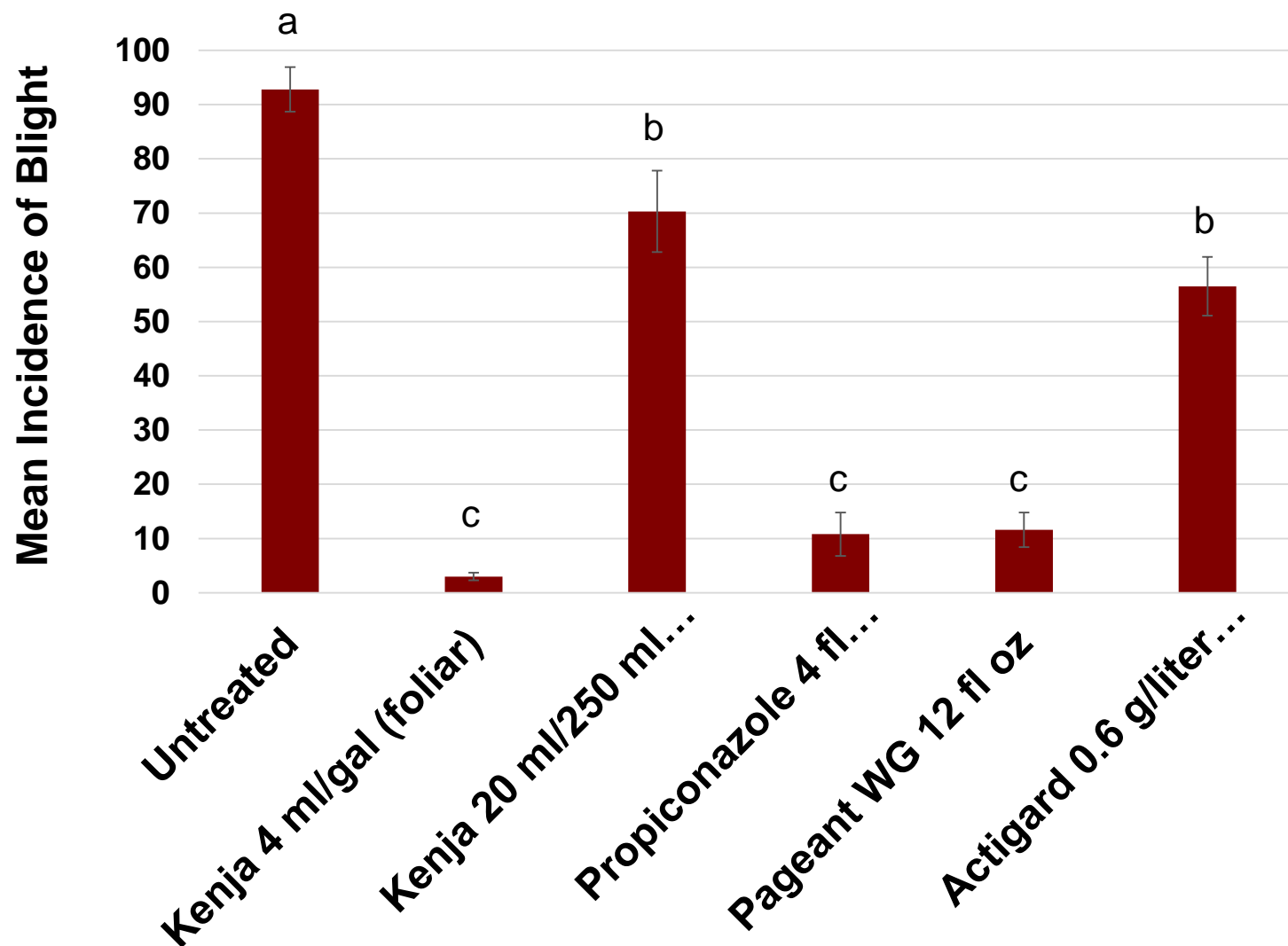
- Applications: 14 day intervals: Jul 13-Aug 10, 2018
- Inoculated with 1×10^4 : Jul 14, 2018
- Covered with plastic for 24 hours
- Watered with overhead irrigation



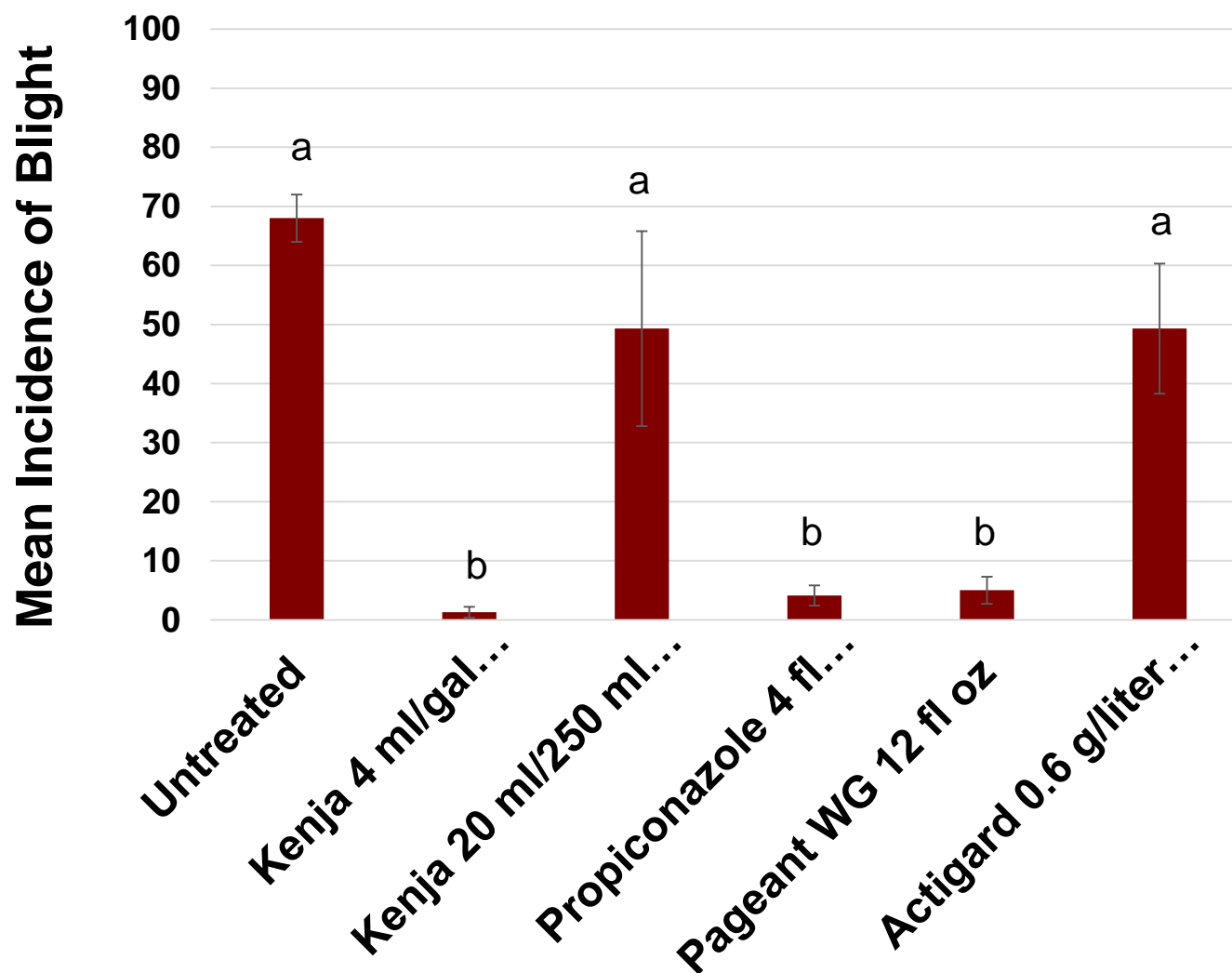
2018
Potted +
Inoculated
Fungicide
Trials



2018 Inoculated Trial: 'Justin Brouwers'



2018 Inoculated Trial: 'Green Velvet'

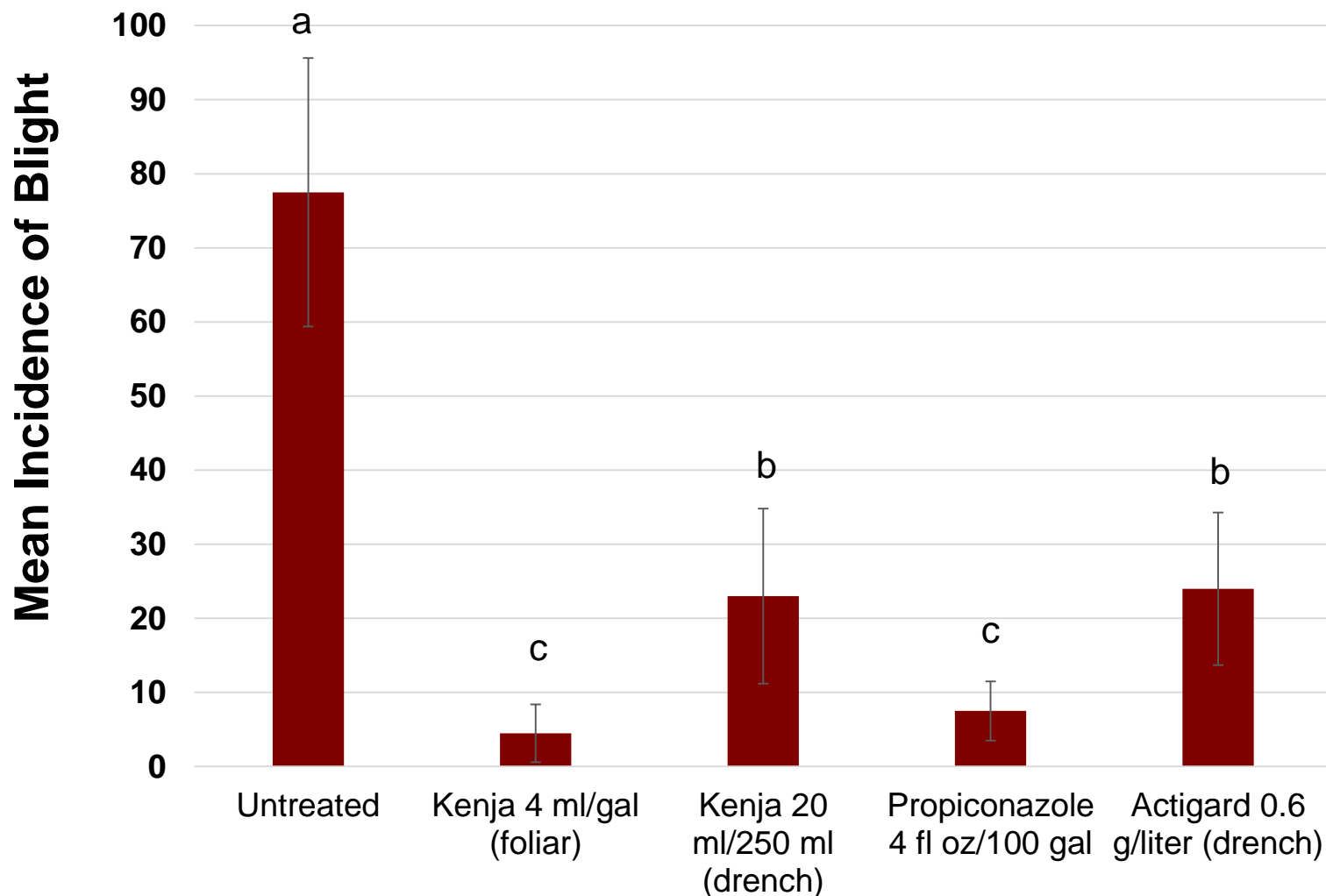


Boxwood Blight Chemical Control: Established Planting, Surry County, NC

- Applications: 14 day intervals: Jun. 5-Oct. 2, 2018
- Incidence Rating: Oct. 17, 2018
- Cultivars: 'Justin Brouwers' and 'Green Velvet'



2018 Natural Inoculum Trial: 'Justin Brouwers'



Boxwood Blight Management: Fungicides

Product	FRAC Group
Concert II (propiconazole + chlorothalonil)	3 + M5
Strike Plus 50WDG (trifloxystrobin + triadimefon)	11 + 3
Medallion (fludioxonil)	12
Daconil (chlorothalonil)	M5
Spectro 90WDG (chlorothalonil + thiophanate methyl)	M5 + 1
Palladium (cyprodinil + fludioxonil)	9 + 12

Boxwood Blight Chemical Control: A Few Reminders...

- Always read the label! Test small section for phytotoxicity if you haven't applied fungicide previously to particular cultivar
- Practice resistance management: Certain FRAC Groups are only allowed a certain number of sprays per season-Rotate!
- Regular applications are necessary for boxwood blight management.
- 60F to 86F and rain in forecast: Spray preventatively
- Good coverage is essential for good disease control

Future Research

- Collecting isolates for fungicide sensitivity monitoring
- Fungicide efficacy field trials with SDHI
- Plant Host Defense Inducers
 - Field Trials
 - Host Gene expression
 - Effects of fertilizers on defense inducer efficacy

Resources

- NCSU Plant Disease and Insect Clinic
- NC Cooperative Extension Website for Ornamental Pathology
- Virginia Tech
- Connecticut Agricultural Experiment Station



Twig and Branch Dieback on Leyland Cypress

Disease Challenges in Leyland Cypress

Steven Jeffers, ©2010, Extension Service, Clemson University



Passalora Needle Blight

Alan Windham, ©2010, University of Tennessee


Disease Challenges in Leyland Cypress: Passalora Needle Blight

- Pathogen: *Passalora sequoia*
- What to look for:
 - Needle Color:
 - Early: Light green/yellow (chlorosis)
 - Late: Red/brown with green tips on foliage/branches



Photo Credit: Colleen Warfield and Dennis Hazel

Disease Challenges in Leyland Cypress: Passalora Needle Blight

- What to look for:
 - Disease Progression:
Bottom and inner canopy
(near trunk) 
upward and outward
 - Reflects microclimate
and fungal overwintering
locations
 - Needle drop
 - Gray/black fruiting bodies
on dead tissue



Disease Challenges in Leyland Cypress: Passalora Needle Blight

Management Options

Cultural

- Minimize wetness throughout the canopy
 - If using irrigation, choose drip over overhead
 - Increase planting spacing
- Minimize spore spread
 - Prune diseased limbs, remove from planting, and destroy
 - Disinfect pruning tools when pruning disease limbs

Disease Challenges in Leyland Cypress: Passalora Needle Blight

Management Options

Fungicides

- Chlorothalonil (Daconil), Kocide, Eagle 20WP, mancozeb, azoxystrobin (Quadris, Heritage (check for ornamental/nursery stock vs Christmas tree labels))
- Initiate in late spring (mid-May) and continue throughout summer
- Ensure good penetration into canopy
- Non-systemic fungicides (e.g. mancozeb, Daconil, Kocide should be applied on 14 day schedule
 - If more than 2" rain, reapply on shorter interval

Disease Challenges in Leyland Cypress: *Seiridium* Canker (*Seiridium unicorne*)

- What to look for:
 - Random flagging of branches throughout canopy
 - Sunken dark brown/purple patches on bark
 - Resin flow (coming from cankers)



Photo Credit:
Colleen Warfield

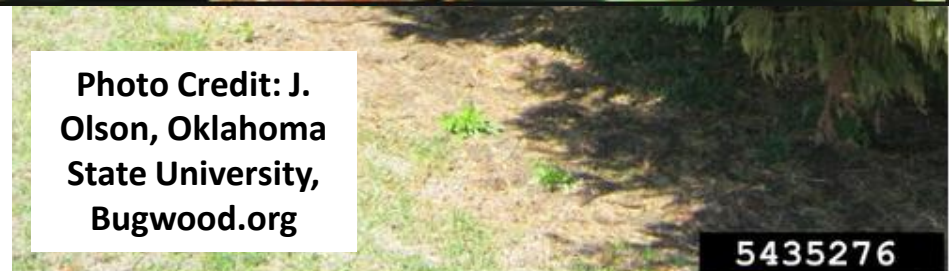


Photo Credit: J.
Olson, Oklahoma
State University,
Bugwood.org

Disease Challenges in Leyland Cypress: Seiridium Canker (*Seiridium unicorne*)

- Conditions favoring disease:
 - **Environmental stressors: Drought and spring freezes**
 - Mechanical damage
 - Overhead irrigation-conditions promoting slow drying
- Cultural management is best option
 - **Alleviate stress-Use drip irrigation regularly** (not effective for “catch up”)
 - Mulch to drip line to reduce water evaporation
 - Prune 3-4” past canker margin and destroy cuttings
 - Avoid over-fertilization, particularly during dry years

Disease Challenges in Leyland Cypress: Botryosphaeria Canker (*B. dothidea*)

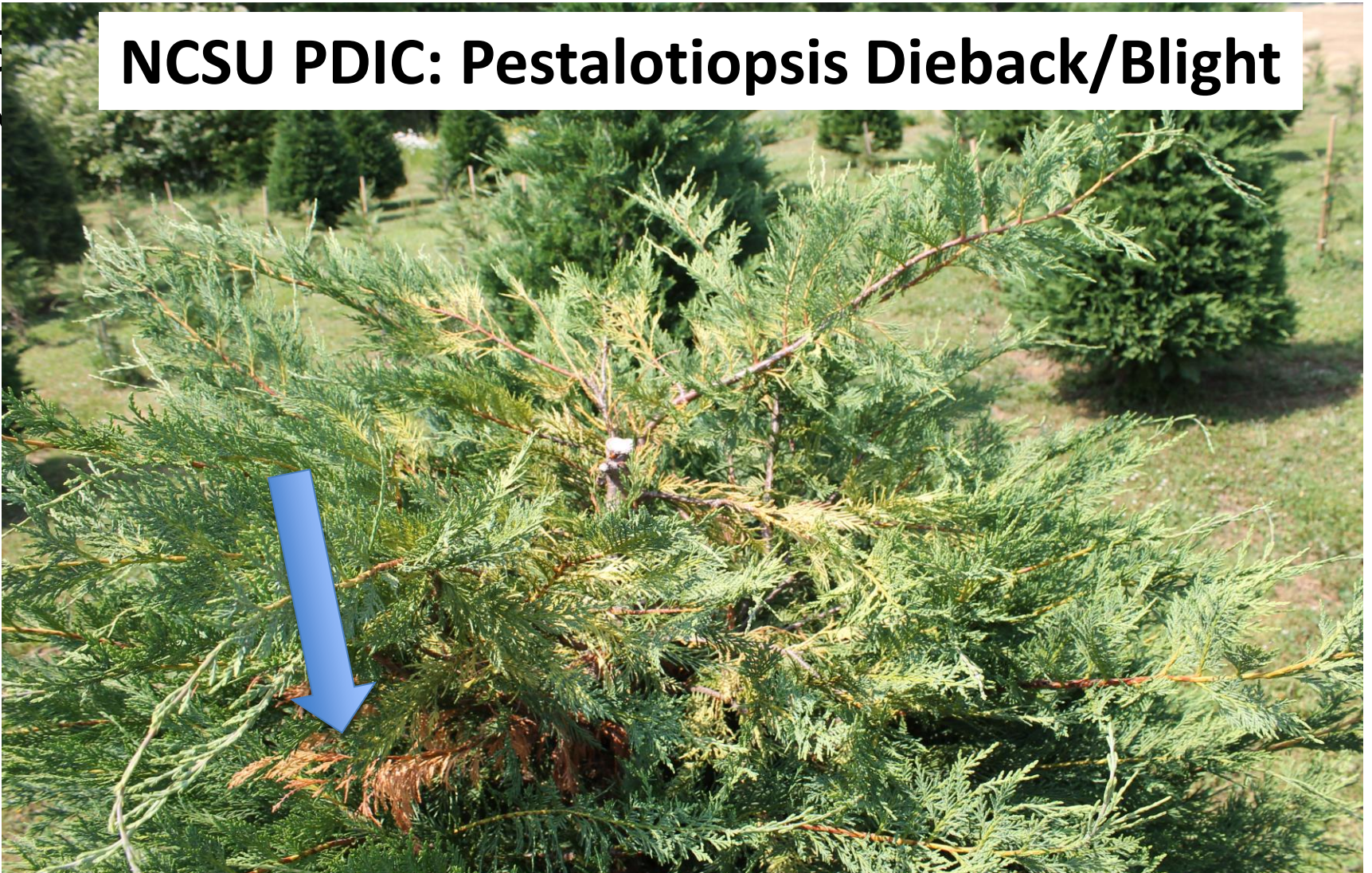
- What to look for:
 - Symptoms resemble those of Seiridium canker
 - Sunken girdling cankers on base of dead shoot/branch
 - Sloughing/cracking bark on cankered wood
 - **Little to no resin produced**
- Environmental conditions (esp. drought stress) and management similar to Seridium canker



A “New” Disease Challenge in Leyland Cypress?

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NCSU PDIC: Pestalotiopsis Dieback/Blight



Pestalotiopsis Dieback/Blight

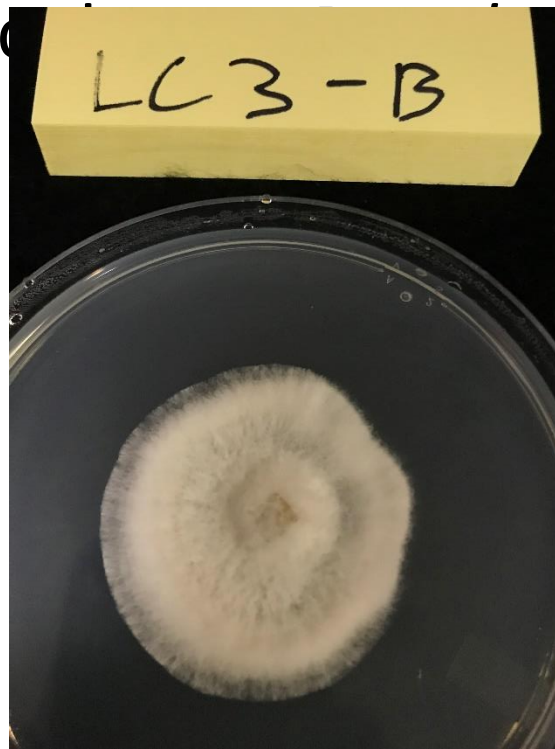
- May 31, 2018: Collected symptomatic shoots from 4 additional trees at same location in Lincoln Cty, NC



**Majority of symptomatic trees transplanted in past two years;
Decline of young trees more severe**

Pestalotiopsis Dieback/Blight

- Isolations made from dead/live tissue margin from all 4 samples
- DNA extracted and ITS region sequenced for pathogen confirmation



Pestalotiopsis Dieback/Blight: A Brief Overview

- *Pestalotiopsis* spp. is a relatively weak/opportunistic pathogen of conifers
 - Most problematic when trees are under stress
 - Remains dormant (lives as an endophyte) until conditions are ideal for symptom expression/disease
- **How does *Pestalotiopsis* infect?**
 - Usually at a site of mechanical injury such as pruning wounds
- **What parts of the Leyland Cypress are affected?**
 - Infection is primarily limited to needles, twigs, and shoots

Pestalotiopsis Dieback/Blight: A Brief Overview

- **Conditions/situations favoring infection:**
 - Drought stress
 - Establishment stress: “Transplant shock”
 - Mechanical injury (pruning, insect feeding, wind/hail damage, etc)
- **Management Strategies**
 - Prune and discard symptomatic shoots on a **cool, dry** day
 - Pathogen can overwinter on dead and pruned branches
 - Utilize drip irrigation
 - Fungicides: Chlorothalonil, mancozeb, T-methyl, copper
 - Most important early in season in young plantings

Thank you!

Questions?

