


**BOXWOOD BLIGHT CAUSED  
BY *CYLINDROCLADIUM  
PSEUDONAVICULATUM***

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## Training Outline

1. Introduction, Biology, and Identification
2. Managing Boxwood Blight
3. Other Diseases and Insect Problems on Boxwood
4. Approaches to Diagnosis of Plant Problems



**BOXWOOD BLIGHT FIRST  
DETECTOR TRAINING:  
1. INTRODUCTION, BIOLOGY  
AND IDENTIFICATION OF THE  
DISEASE**

## History and Current Distribution

- First discovered in the UK in the mid-1990's
- Origin unknown
- Now spread throughout Europe
- First found in U.S. in 2011 (CT and NC)
- U.S. states with confirmed reports: Connecticut, Maryland, Massachusetts, New York, North Carolina, Ohio, Oregon, Pennsylvania, Rhode Island, and Virginia
- Also present in New Zealand and Canada

## Distribution of boxwood blight in US



## Regulations

- Not federally regulated by the USDA
- Some states have put regulations in place to try to limit disease spread
- Federal research money focused on preventing introduction to new areas and managing the disease once established

## Research Efforts

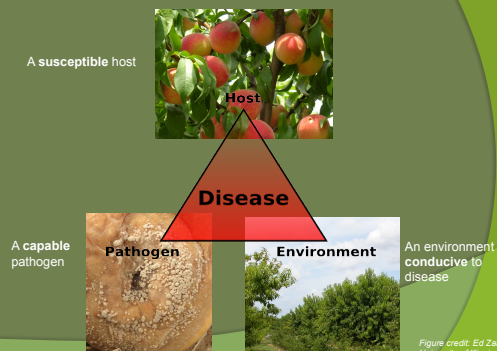
USDA Farm Bill Research funding for:

- Development of rapid diagnostics
- Studying fungal epidemiology
- Fungicide trials
- Studying effective cultural practices

USDA Agricultural Research Initiative funding for:

- Breeding for boxwood blight resistance

## Disease Triangle



## FUNGI AND OOMYCETES

Characteristics and spread:

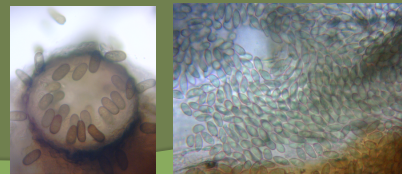
- Grow vegetatively by hyphae (tubular filaments)
  - ▣ Hyphae grow radially to spread within a plant and sometimes from plant to plant through root contacts or in soil



## FUNGI AND OOMYCETES

Characteristics and spread cont'd:

- Reproduce via sexual and asexual reproduction to produce spores
  - often produced in/on specialized structures, some of which are big enough to see, i.e. mushrooms
  - Dispersed by wind, animal, rain splash, soil water, equipment, or other means



## FUNGI AND OOMYCETES

Characteristics and spread cont'd:

- Produce survival structures including sclerotia, chlamydo spores, and rhizomorphs
  - Can be moved by soil water, equipment, rain



## Pathogen vs. Disease

- *Cylindrocladium pseudonaviculatum* = pathogen
- "boxwood blight" = disease

*Cylindrocladium pseudonaviculatum* is the scientific name of the fungal pathogen which causes "boxwood blight"

- May also see it under the names:
  - *Calonectria pseudonaviculata*
  - *Cylindrocladium buxicola*

## Symptoms

- Infects leaves and branches
- Causes:
  - Defoliation
  - Leaf spots (circular with dark brown margin)
  - Blight
  - Dieback
  - Cankers/lesions on stems (dark brown)
  - Death of the plant
- Roots remain healthy



## Foliar symptoms



## Foliar symptoms



## Foliar symptoms on Pachysandra



## Stem canker symptoms and signs

Symptoms = visible expression of plant response to disease  
 Signs = Physical evidence of the pathogen



## Blight and dieback



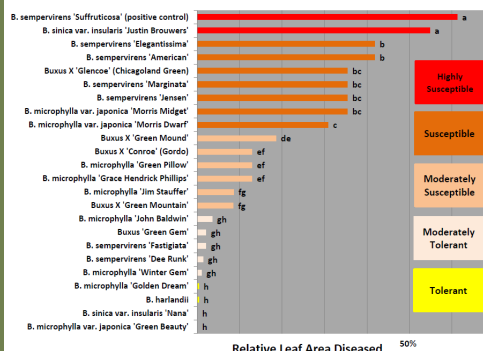
## Hosts

- All *Buxus* spp. (*Buxus sempervirens* types are more susceptible, esp. 'Suffruticosa' and 'American')
- *Pachysandra* spp.
- *Sarcococca* spp.
- Only plants in the Buxaceae family are affected



## Susceptibility of Commercial Varieties to Box Blight

(analysis based on final disease assessment)



Miranda Ganci, D. M. Benson and K. L. Ivors Department of Plant Pathology, North Carolina State University

## Classification of *C. pseudonaviculatum*

Kingdom: Fungi  
 Phylum: Ascomycota  
 Class: Sordariomycetes  
 Suclass: Hypocreomycetidae  
 Order: Hypocreales  
 Family: Nectriaceae  
 Genus: *Cylindrocladium*  
 Species: *pseudonaviculatum*

## Disease Cycle

- Asexual spores produced under warm, humid conditions in a sticky, slimy matrix (sexual stage unknown)
- Hyphae grow within and on leaf tissue and can survive up to 5 years on fallen, dead leaf material
- Microsclerotia are produced and can survive for many years (time unknown)



## Conditions Required for Infection

- Infection can occur very quickly in mild/warm (64 to 77°F), wet conditions
- High humidity levels and free water are needed in order for infection to occur
- No infections occur below 43°F
- The fungus can penetrate the leaf through the cuticle or enter through leaf stomata

## Disease Spread

- Spores spread in water or rain splash (wind-driven rain, overhead irrigation, water flowing on soil surface, water droplets in the air)
- Spores and mycelia spread via contaminated pruning tools
- Can travel on animals, shoes, equipment
- Transport of infected nursery stock or infected plant debris (responsible for long distance dispersal - spores are unlikely to travel long distances by wind)

## Disease Spread

- Unintentional spread of this pathogen occurs through the movement of apparently healthy plant material
- Some fungicides can suppress but not kill the pathogen, so plants appear healthy for some time
- When conditions are not conducive to disease, plants can harbor the fungus but appear asymptomatic



## BOXWOOD BLIGHT FIRST DETECTOR TRAINING: 2. MANAGING BOXWOOD BLIGHT

## Managing Boxwood Blight

- Prevent initial introduction by:
  - Buying plants from reputable sources and inspecting on arrival
  - Keeping new stock away from other plants for at least a week and inspect for symptom development



Photo credit: Kate Aitkenhead, USDA APHIS-PPQ

## Managing Boxwood Blight

- Sanitization practices
  - Sanitize pruning tools by soaking 10 sec. in 10% bleach or 70-100% ethanol
    - Sanitize between blocks of plants
    - Sanitize between field locations
  - Clean shoes and other equipment after leaving potentially infested areas

\*\*Because long distance spread of this disease occurs primarily by humans, sanitation, scouting, and removal efforts are essential for stopping the spread of this disease

## Managing Boxwood Blight

- Fungicide trials for preventing boxwood blight infection have been successful (chlorothalonil and fludioxonil are most effective)
- Fungicides have generally proved ineffective in controlling the disease on infected plants



## Managing Boxwood Blight

- It is currently recommended that any *C. buxicola* infected materials be destroyed
  - Burn plant material
  - Bury 2 ft. below ground
  - Do not compost
  - Do not reuse pots which contained infected plants
  - Sanitize clothing, equipment, and vehicles used to dispose of infected plants



## ANLA nursery recommendations

- Maintain detailed records of:
  - plants moving on and off site (sources and destinations)
  - plant propagation practices
  - fungicide treatments
- Inspect *Pachysandra*, *Sarcococca*, and *Buxus spp.* for symptoms



## ANLA nursery recommendations

- Apply field sanitation practices (use Tyvek® suits and booties in infested areas, don't work in potentially infected wet fields, sanitize tools)
- Avoid overhead watering
- After any infected plants are detected:
  - destroy them (burn or bury)
  - discontinue selling Buxaceae plants until stock is surveyed
  - continue inspecting after eradication

## Apply best management practices

- Plant in area with a little shade (morning sun and afternoon shade is best)
- Plant in well-drained soils
- Apply fertilizer just outside the drip line (boxwoods have shallow roots and can be damaged if fertilizer contacts roots)



## Apply best management practices

- pH 6.5-7 is ideal
- Can lime to increase pH or mulch with a 1 in. layer of hardwood mulch
- Inspect plants before you buy

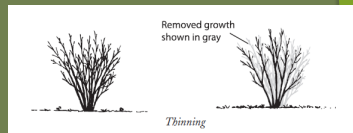


## Boxwood Pruning Practices

- "Thin" branches in winter or early spring (cut back to branch points)
  - Allows increased light and air circulation
  - reduces disease incidence

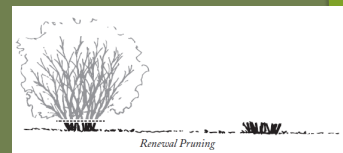
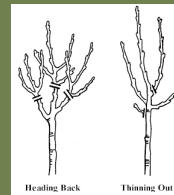


Boxwood in need of thinning (foliage restricted to outermost part of plant)



## Boxwood Pruning Practices

- Can "head back" to control size, promote new growth, and produce a fuller effect (cut ends back to a bud or node)
- Do not practice "renewal pruning" (cutting back almost to ground) - boxwood will not recover



**BOXWOOD BLIGHT FIRST  
DETECTOR TRAINING:  
3. OTHER DISEASE AND INSECT  
PROBLEMS ON BOXWOOD**

*Phytophthora* root and collar rot

- Foliage becomes chlorotic
- Roots necrotic and rotted under the bark
- Bark rotted and peeling at the crown
- Entire plant may die



*Volutella* Blight

(*Pseudonecrotia*)



*Volutella* blight

- Some branches or plants begin growth later in spring than others
- New growth not as vigorous
- Leaves become pale green then tan.
- Infected leaves turn upward and lie close to the stem instead of spreading out like the leaves on healthy stems.



*Volutella* blight

- Diseased leaves and branches show small, rose-colored, waxy fruiting bodies of the fungus.
- The bark at the base of an infected branch is loose and peels off readily from the gray to black discolored wood beneath.



Nematodes

*Buxus* spp. are susceptible to:

- root-knot nematodes
- ring nematodes
- lesion nematodes
- stubby root nematodes
- stunt nematode
- spiral nematodes
- lance nematodes



## Nematodes

### Symptoms:

- leaf bronzing
- stunted growth
- stunted root system resembling a witches' broom
- decline



## English Boxwood Decline

(English boxwood = *Buxus sempervirens* "Suffruticosa")

Slow progressive decline due to a complex of problems commonly involving:

- Drought\*\*
- *Paecilomyces buxi*\*\* (*Verticillium buxi*)
- Nematodes\*\*
- Cold injury
- *Volutella*
- *Macrophoma*
- *Phytophthora*
- Improper planting depth
- Winter wind injury
- Poor drainage
- Improper pH
- Improper nutritional management
- Improper mulch management



\*\* Most frequently associated with this problem

## English Boxwood Decline

### Symptoms:

- foliage becomes dull green, then yellow or straw colored
- bark separates from wood
- wood is discolored in both roots and above ground in stems (may be brown streaking in wood which may be continuous or discontinuous)

### Resistant Buxus:

- American boxwood (other *Buxus sempervirens*)
- Several cultivars of *Buxus microphylla*



## English Boxwood Decline



## *Macrophoma* leaf spot

(often *M. candollei*)

- A secondary pathogen - colonizes leaves when plant is under stress from other factor(s) (disease, environmental stress factors)
- numerous black fruiting bodies appear as dark spots on dying leaves





## Boxwood leafminer

(*Monarthropalus buxi*)

- The most serious insect pest that attacks boxwood.



## Boxwood leafminer

(*Monarthropalus buxi*)

### Appearance:

- Damage is caused by the larval stage of a small fly (both larvae and adults are orange and about 1/8-inch long)

### Symptoms:

- irregularly shaped swellings on the leaf
- blistered appearance on the leaf's undersurface (may not be obvious until late summer)
- Infested leaves typically turn yellow or brown in splotches, are smaller, and drop sooner than healthy leaves.

## Boxwood mite

(*Eurytetranychus buxi*)

### Appearance:

- green to yellowish brown, eight legs, about 1/64-inch long

### Symptoms:

- Stippling on the upper leaf surface
- Prefer young leaves, but damage is most obvious on second- and third-year leaves
- From a short distance, the infested boxwood appears unhealthy with a dingy silvery color



## Boxwood psyllid

(*Psylla buxi*)

### Insect appearance:

- Small, greenish insect (1/8 in. long)
- Has clear wings, jumps

### Symptoms:

- Cupping of leaves
- Stunting of twig and leaf growth
- Plants tend to outgrow the injury by midsummer



## Other problems

- Can have problems with voles if mulch too heavily
- Can get leaf burn- leaf tips and margins yellow and redden as leaves fall prematurely.
  - caused by water stress and low temperature (drought probably main cause of this symptom in Texas)
  - to control- protect shrubs from drought and drying winds in the autumn and winter
- Oystershell scale insect will cause branch dieback



<http://plantdiseasehandbook.tamu.edu/landscaping/shrubs/boxwood/>

## Pruned too late

- not enough time to harden off
- resulted in dieback from winter freeze damage





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EXTENSION


**BOXWOOD BLIGHT FIRST DETECTOR TRAINING:  
4. APPROACHES TO DIAGNOSIS OF PLANT PROBLEMS**

**Diagnosing Plant Diseases**

1. Identify the plant
2. Define the problem
3. Develop a suspect list
4. Refine diagnosis
5. Get help to confirm diagnosis


**3. Develop suspect list**

- **BIOTIC**
  - Symptoms are usually scattered
  - Symptoms develop gradually over time (on individual and whole plantings)
  - Signs of pathogen are observable
- **ABIOTIC**
  - Symptoms are uniform
  - Generally appear all at one time
  - Does not appear to spread
  - Affects more than 1 type of plant in immediate area






**Scenario 1**

- Gradual death of entire plant(s)
- No signs of pathogen above ground
- To help identify the cause:  
**WHAT NEXT??**

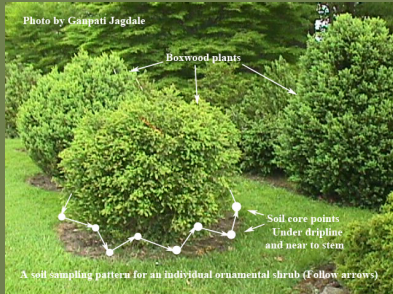


**Scenario 1 – Root problems**

- Gradual death of entire plant(s)
- No signs of pathogen above ground
- To help identify the cause:
  - Observe roots (under bark, healthy roots should be whitish)
  - Identify soil conditions (dry? low organic matter? heavy? remaining wet? sandy? Low lying area?)
  - Look at the pattern of spread (progression beginning at one corner?)
  - Are all plant species in area affected?

### Soil sampling for nematode assay



### Scenario 2

- Chlorotic spots on leaves randomly distributed on plant
- Loss of damaged leaves

### Scenario 2 – boxwood leaf miner

- Chlorotic spots on leaves randomly distributed on plant
- Loss of damaged leaves



### Scenario 3

- Roundish, necrotic lesions on leaves with tan center and dark margin
- Death of interior branches and foliage
- Close inspection reveals whitish material on lesions that rubs off (spores)
- Dark brown stem lesions

### Scenario 3 – boxwood blight

- Roundish, necrotic lesions on leaves with tan center and dark margin
- Death of interior branches and foliage
- Close inspection reveals whitish material on lesions that rubs off (spores)
- Dark brown stem lesions



### Boxwood Blight



## Boxwood Blight

Useful links:

[www.boxwoodblight.org](http://www.boxwoodblight.org)  
[http://go.ncsu.edu/boxwood\\_blight\\_links](http://go.ncsu.edu/boxwood_blight_links)  
<http://www.ct.gov/caes/cwp/view.asp?a=3756&q=500388&caesNavPage=%7C>

If you suspect that you have seen this pathogen, please contact:

Your county extension agent  
<http://agrillifeextension.tamu.edu/>

or

Texas Plant Disease Diagnostic Lab  
 1500 Research Pkwy, Suite A130  
 College Station, TX 77845  
 (979)-845-8032  
<http://plantclinic.tamu.edu/>  
 Email: [plantclinic.ag.tamu.edu](mailto:plantclinic.ag.tamu.edu)



## References

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## Photo credits

Photo credits:

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