Tree Disease

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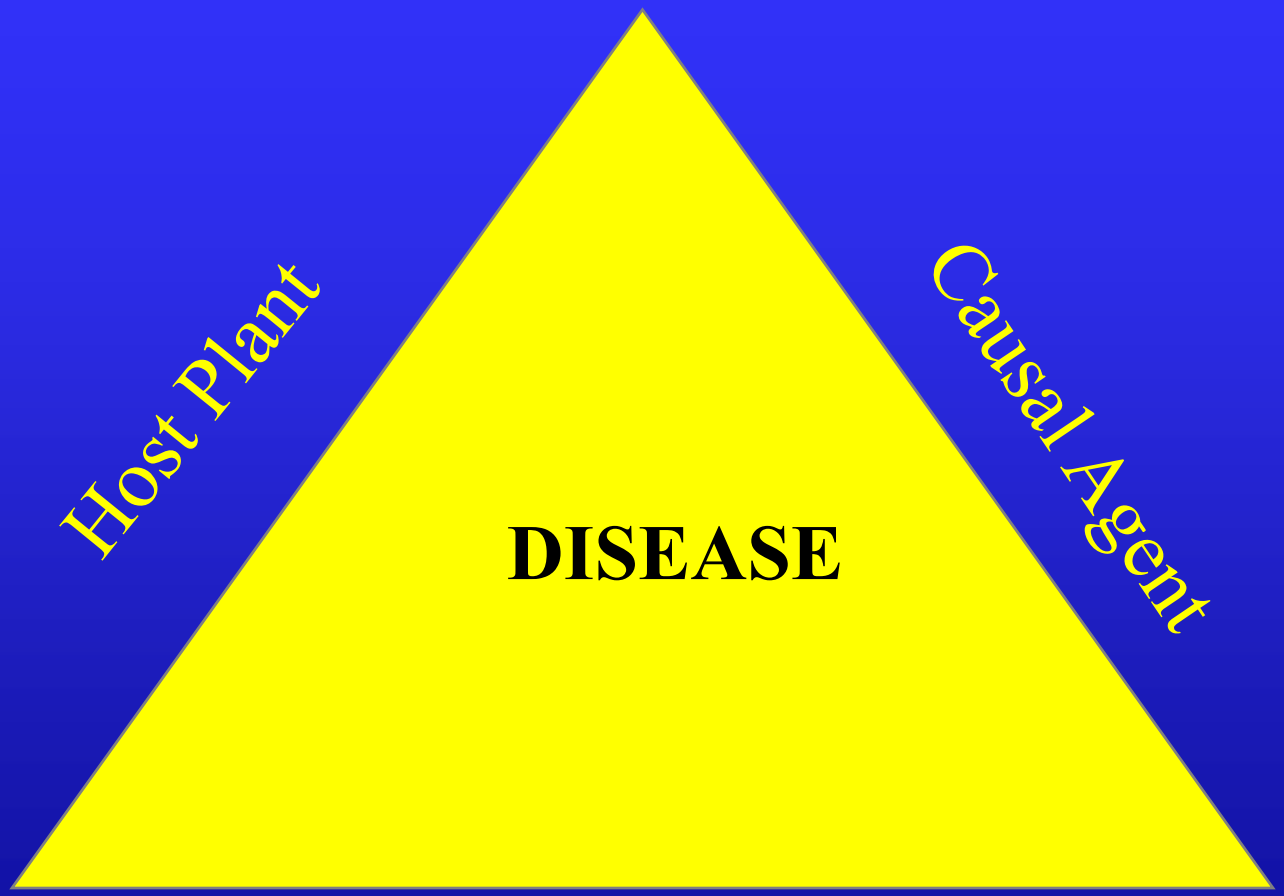
What is Disease?

An ongoing condition caused by a biotic or abiotic factor(s) that interferes with normal growth and or development.

DISEASE TRIANGLE



Disease	Host	Pathogen	Symptoms	Signs	Management & Notes
Anthracnose	**Sycamore etc**	**Apiognomonia**	**Leaf lesions, defoliation, twig and shoot blight, cankers**	**Black pycnidia**	**Disease in wet springs, maintain vigor, prune and remove inoculum Fungicides at budbreak**

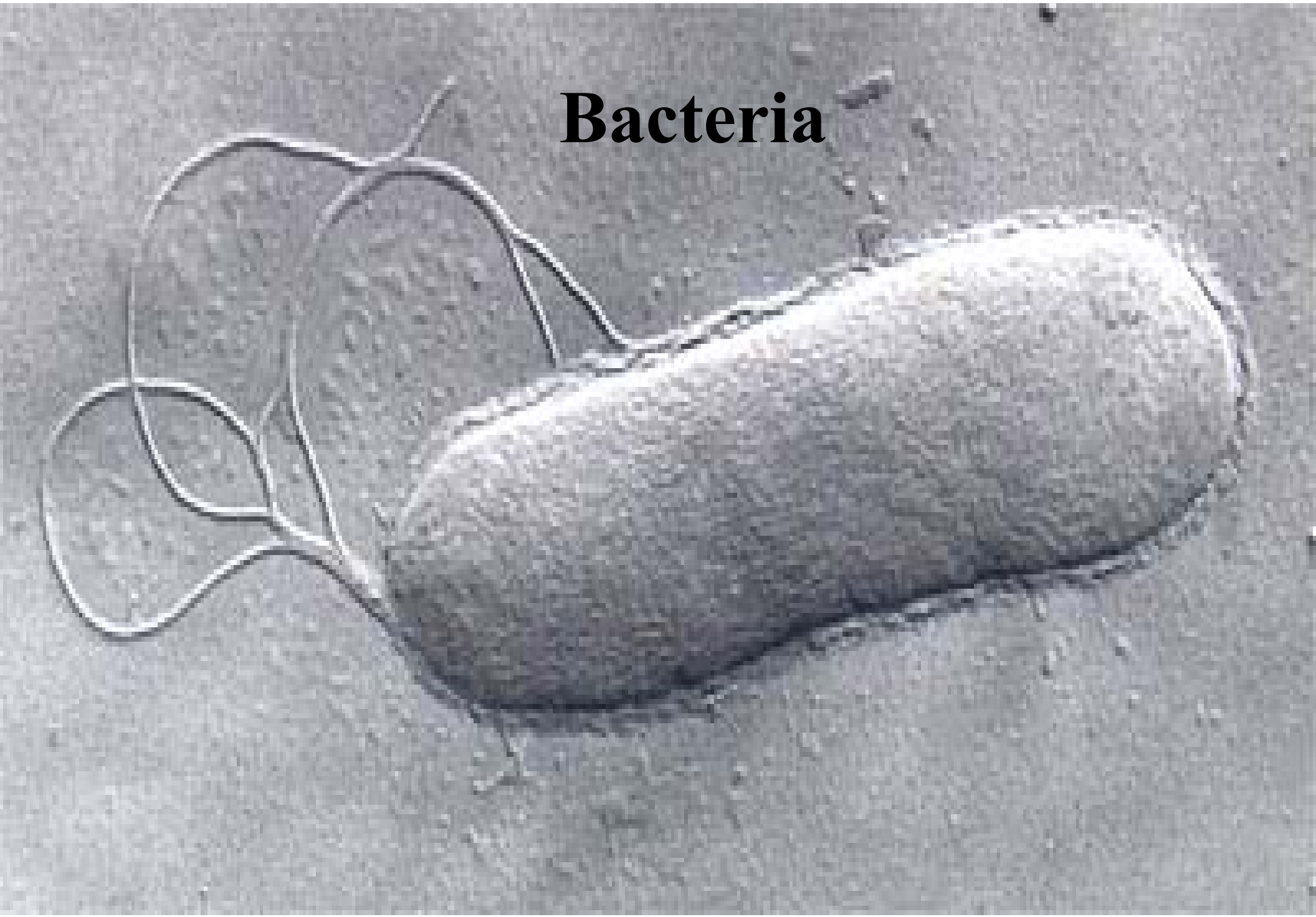
Don’t expect to learn everything in a short time!

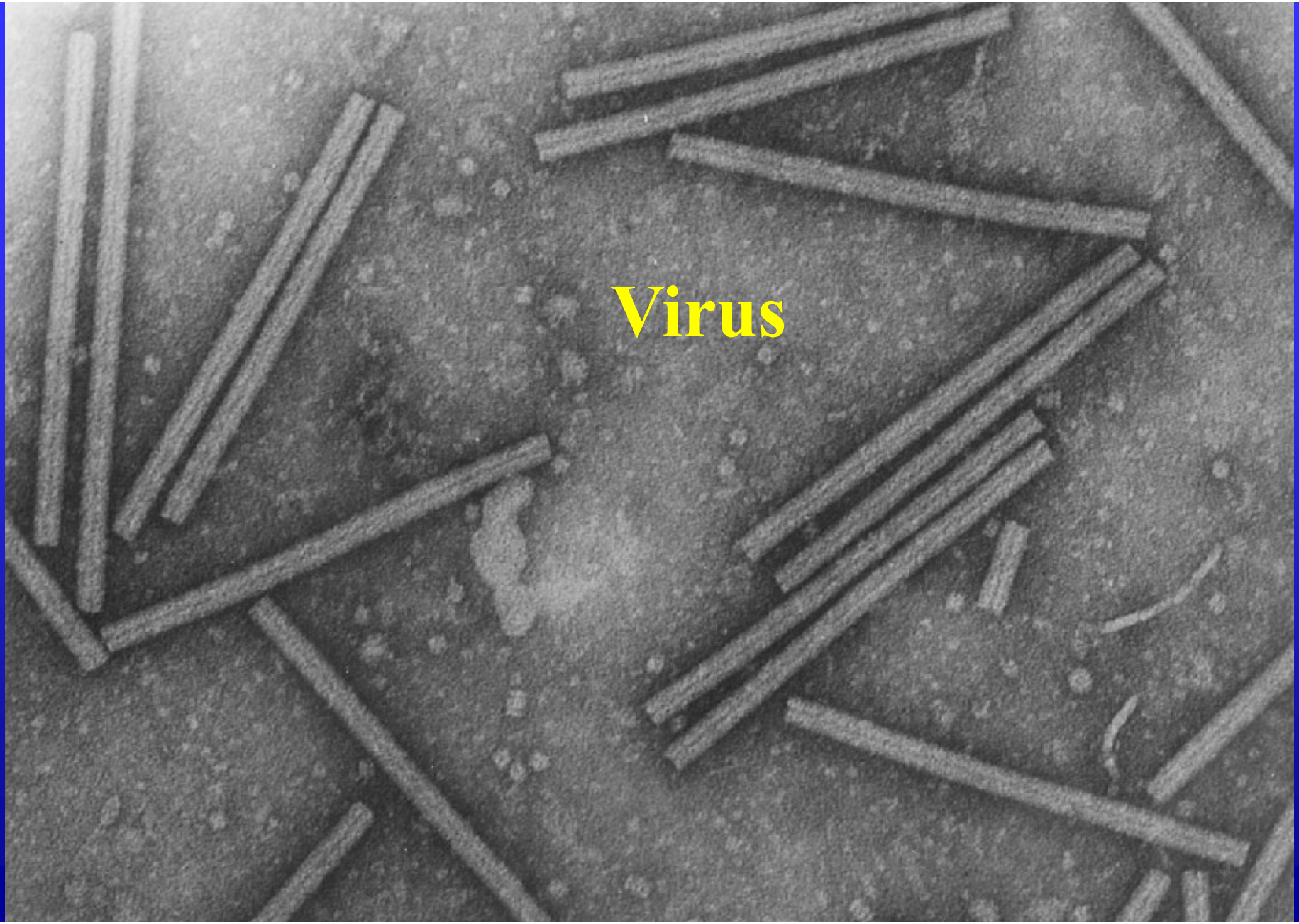
What organisms are pathogens?

Fungi, bacteria, phytoplasmas, virus, nematodes, plants, abiotic agents

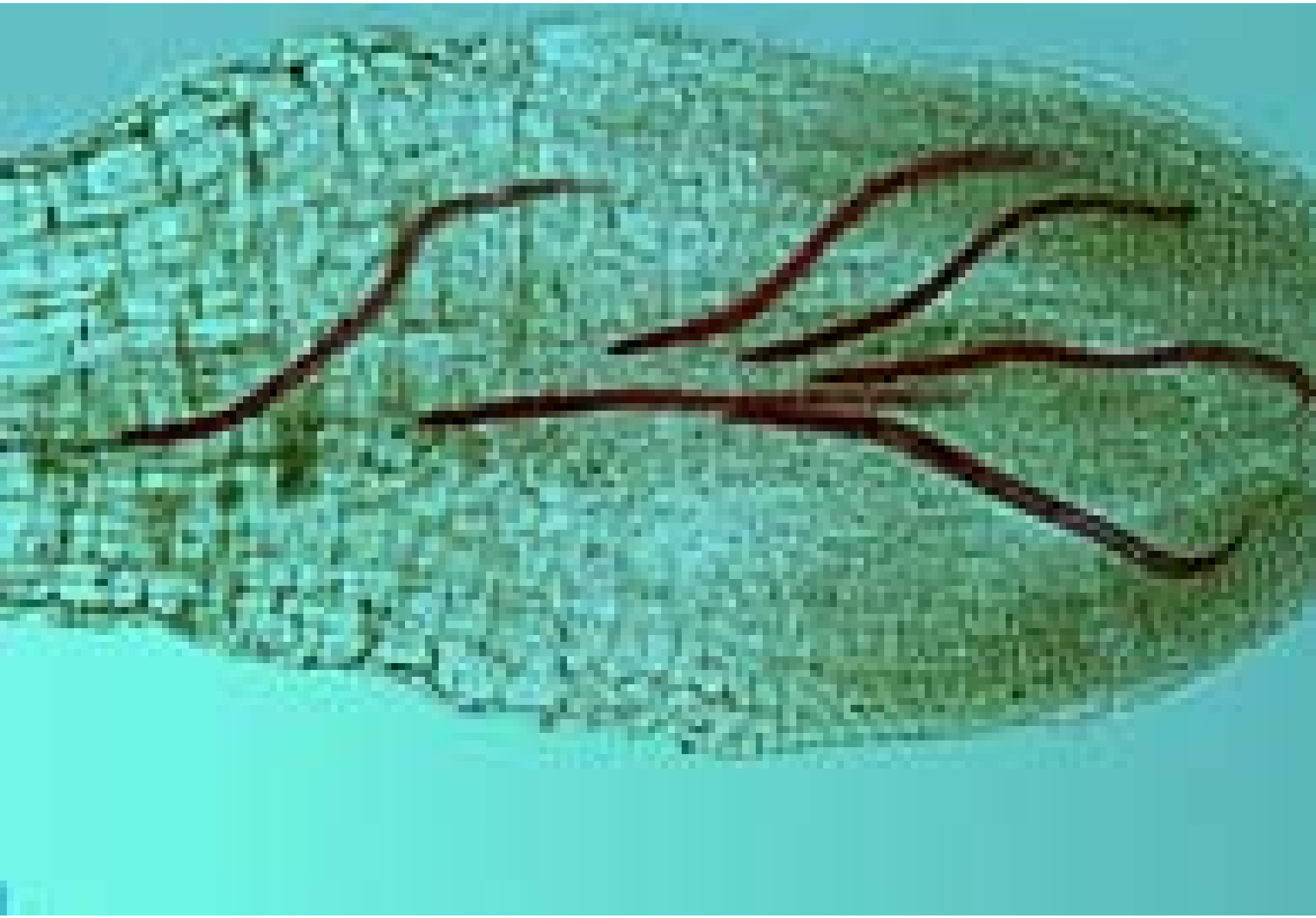
Fungi

Bacteria

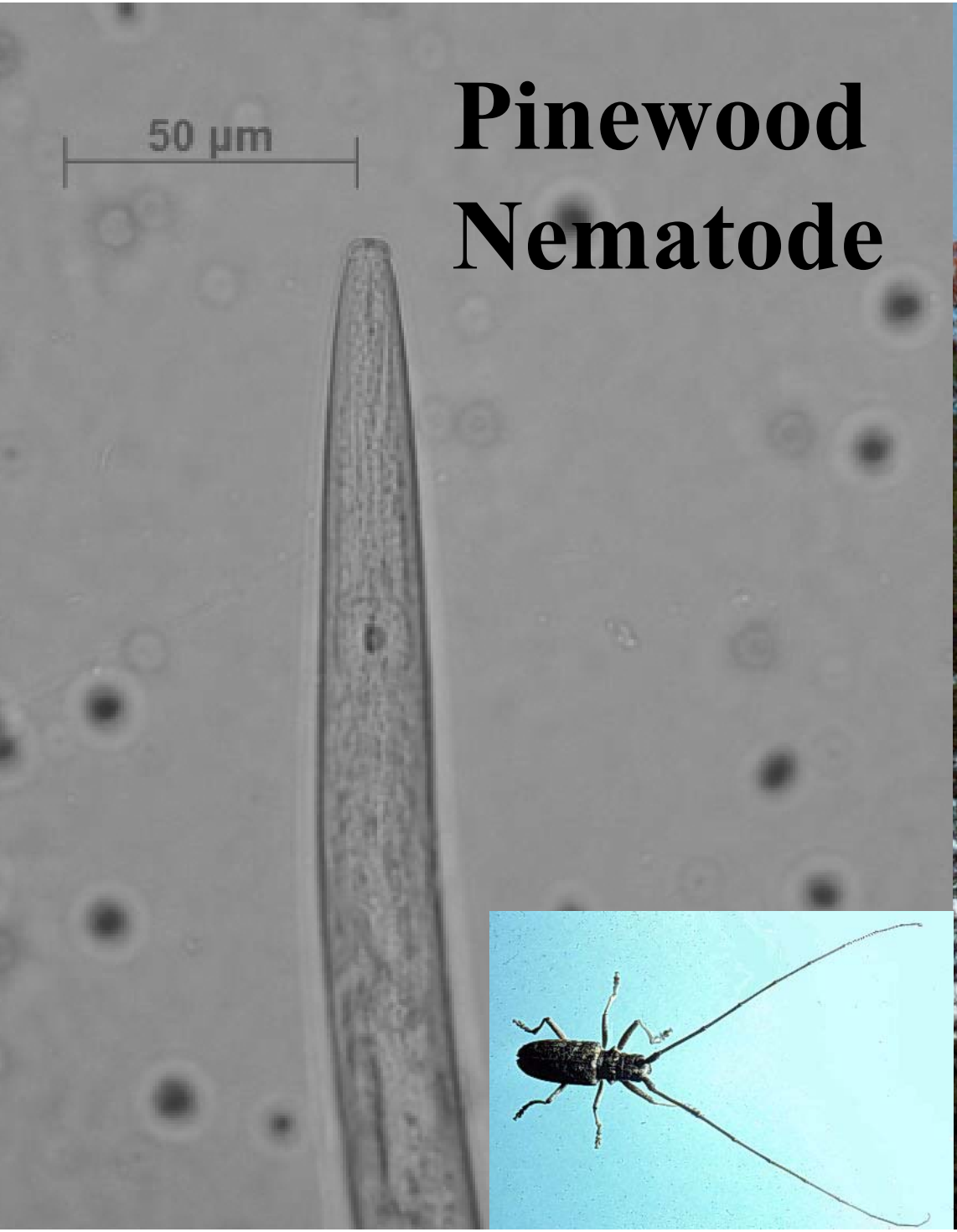



Virus

Nematodes



Pinewood Nematode

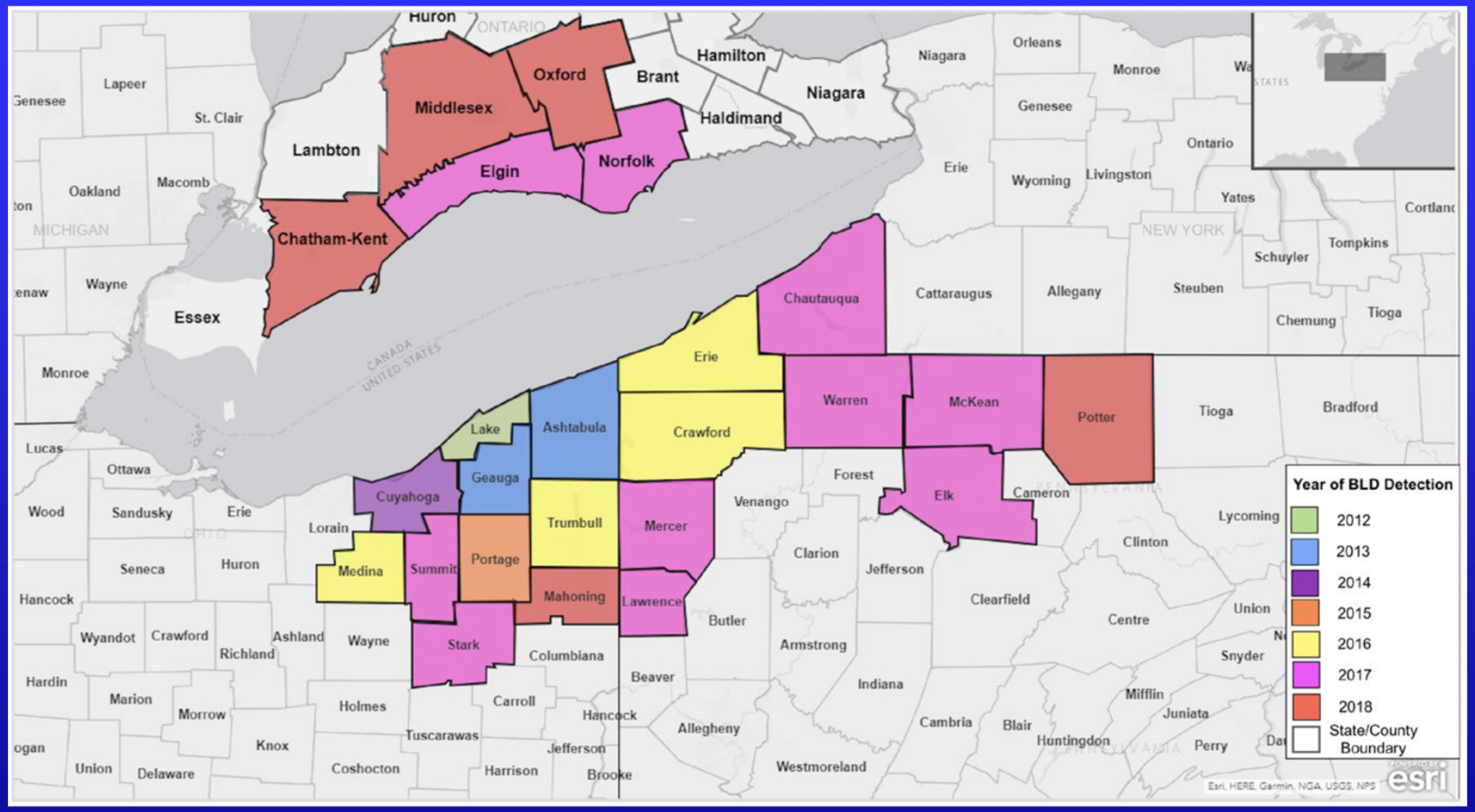


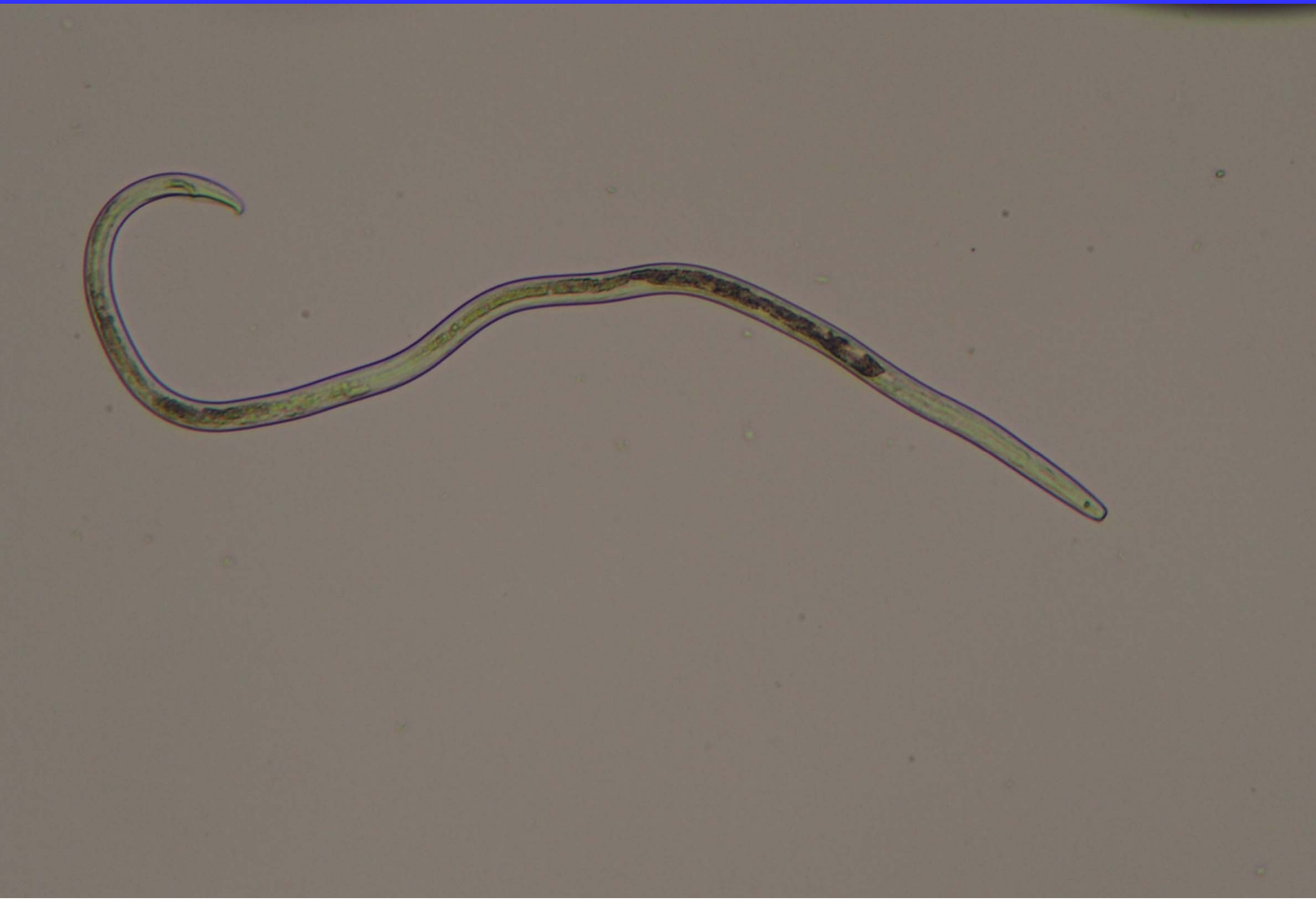
Beech leaf disease in Connecticut

Ohio (2012), Pennsylvania, Ontario

Litylenchus crenatae mccannii

2019 Distribution: Long Island, Blauvelt NY and Stamford CT





Witches Broom - mistletoe

Abiotic

Abiotic

What makes an organism a pathogen or parasite?

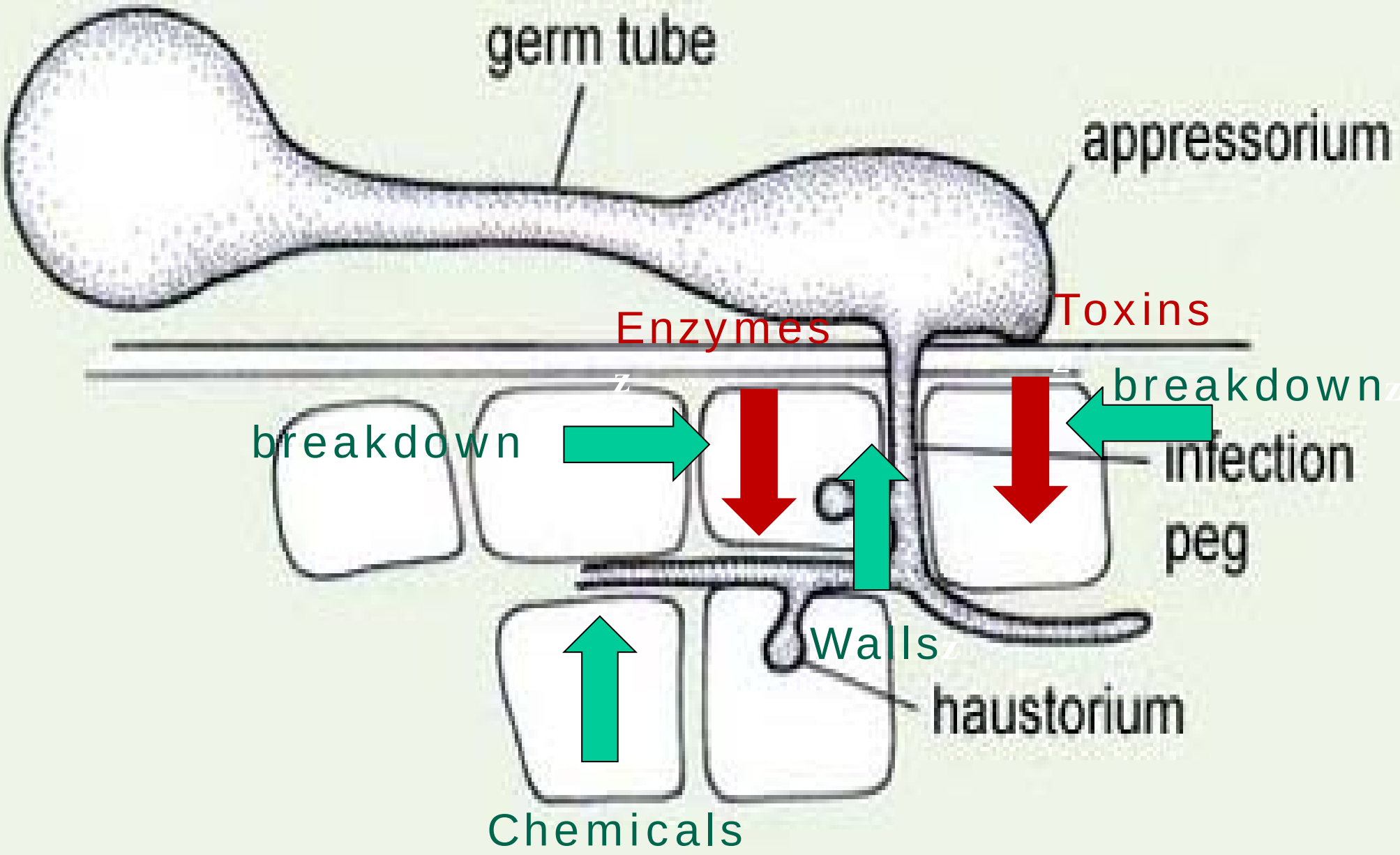
How do trees respond to defend themselves?

What makes an organism a pathogen or parasite?

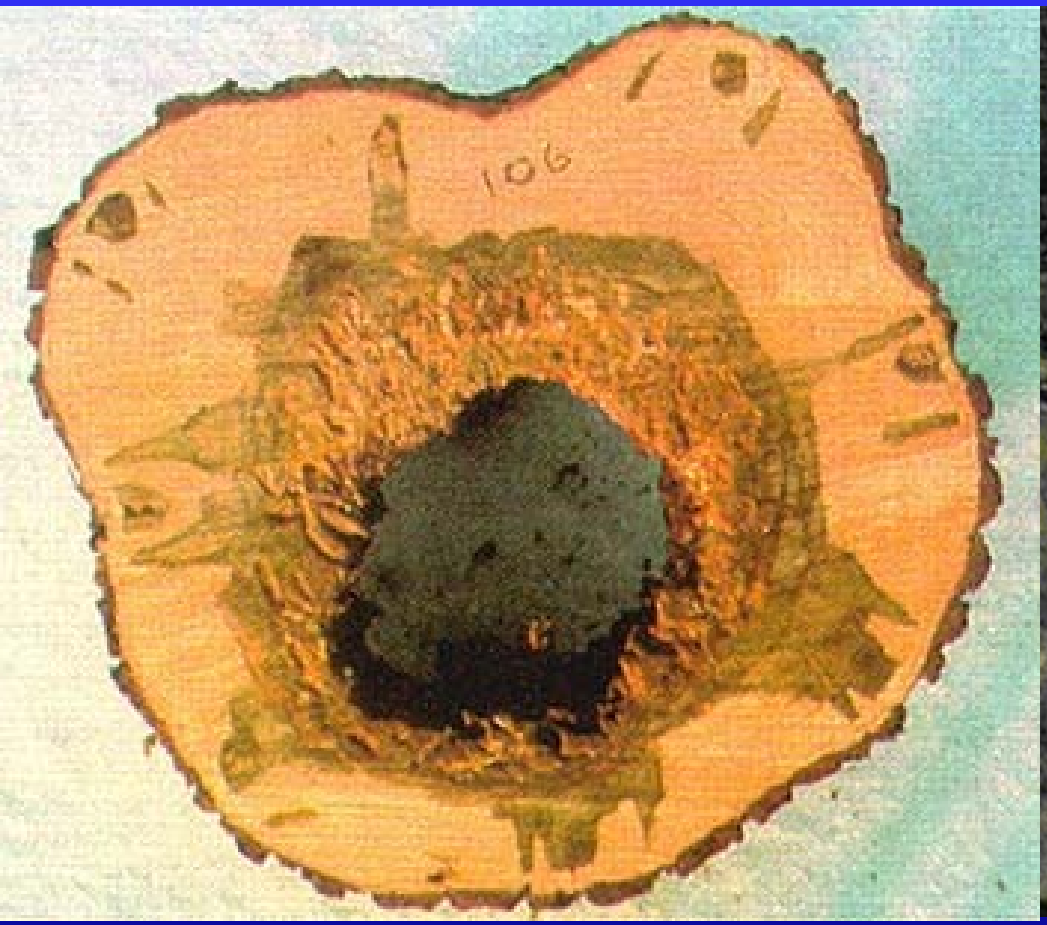
Genes: attributes for pathogenesis
host recognition, (appressoria),
enzymes, (cellulose digesting), toxins,
growth regulators (= symptoms)

Why are all plants not affected by all pathogens?

Mechanistic resistance – walls; hypersensitivity; breakdown of pathogenic factor(s) toxins and enzymes; chemical response (phenols, phytoalexins, toxins)

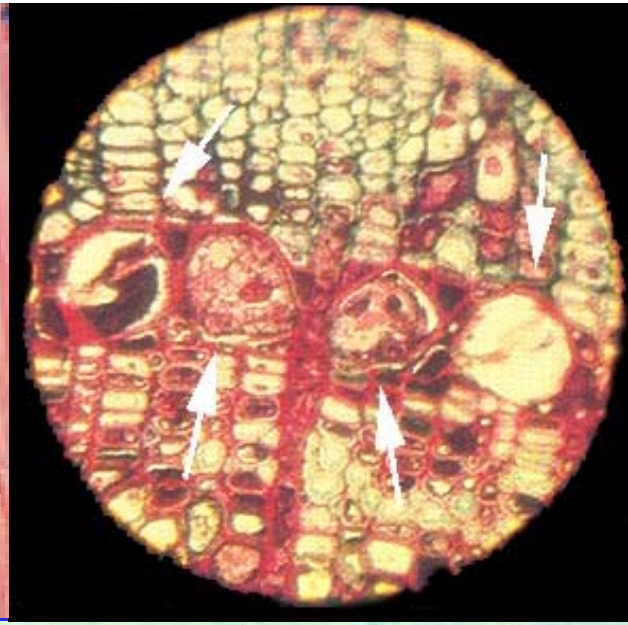

germ tube
appressorium
Enzymes
Toxins
breakdown
breakdown
infection
peg
Walls
haustorium
Chemicals

A tree is defended like a fortress



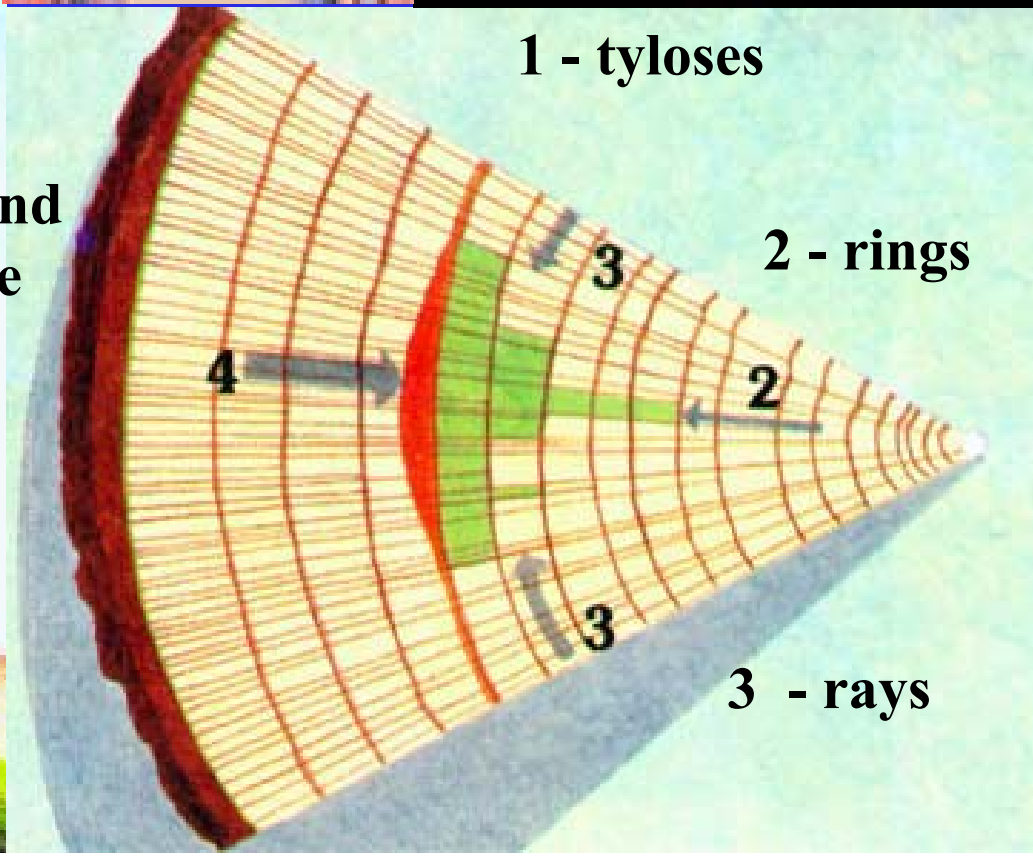
CODIT – defend a breach

Wall 1: vascular plug (above below)
Wall 2: xylem growth rings (inward)
Wall 3: ray cells (side)
Wall 4: wound response



1 - tyloses

4 – wound response



2 - rings

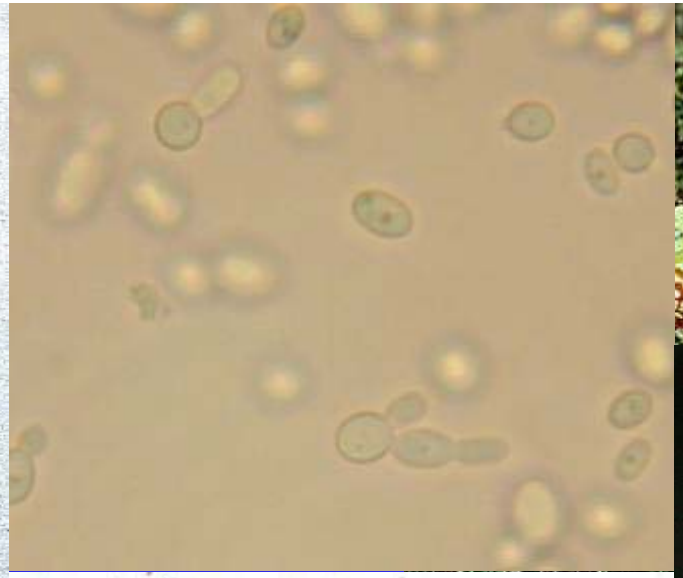
3 - rays

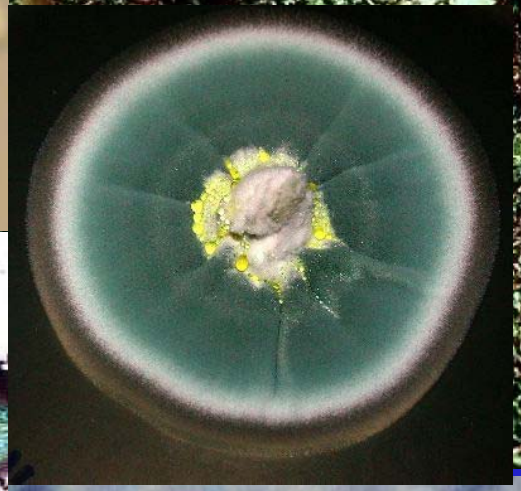
Pathogenesis - process

Source of inoculum; dispersal; penetration; infection; growth and reproduction of pathogen; overwintering; and interaction with the environment (disease cycles)

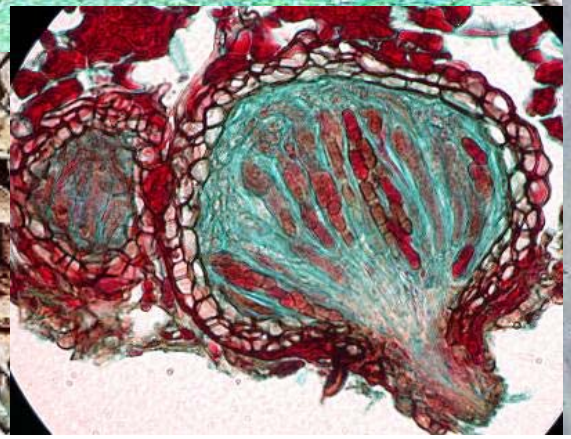
A day in the life of a fungus

Most plant pathogens are fungi.
What are they and how do they do what they do so successfully?
(Most fungi not pathogenic)





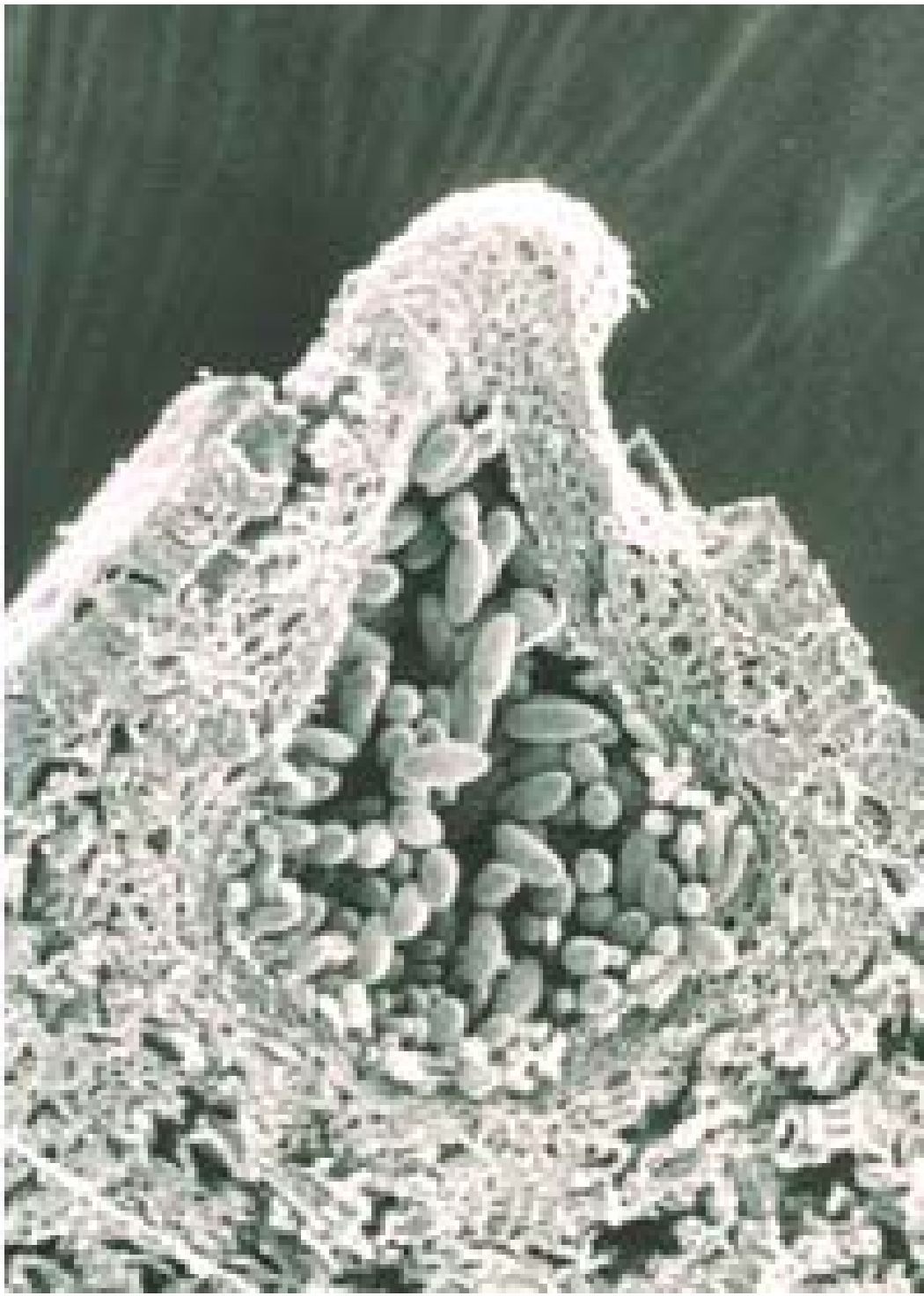



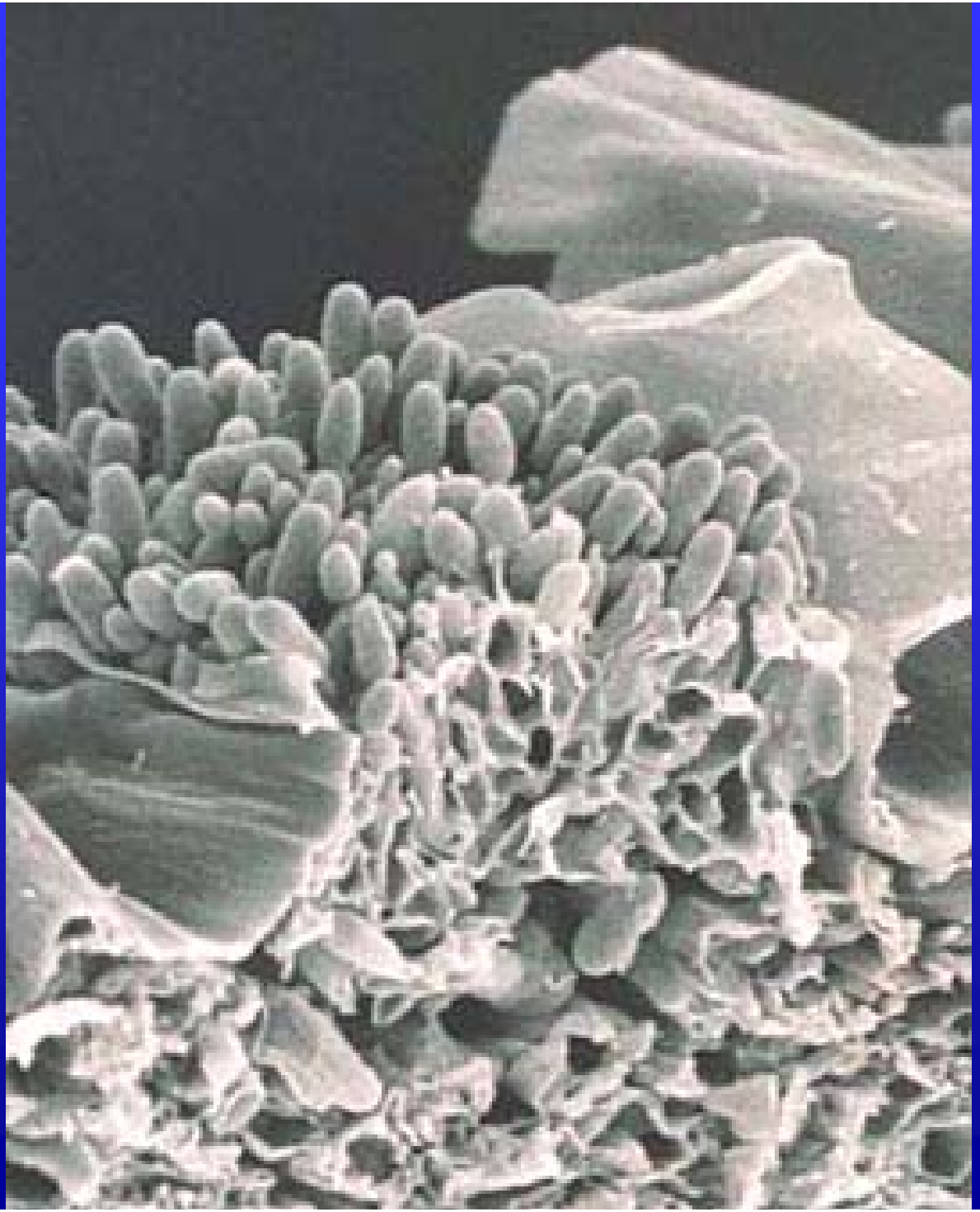

Pathogenesis

Source of inoculum:
Dispersal
Infection
Disease - # cycles

Pathogenesis

Source of inoculum:
soil, dead or infected plant parts, planting stock, weeds, vectors, implements





Pathogenesis

Dispersal:
wind, water, insects, persons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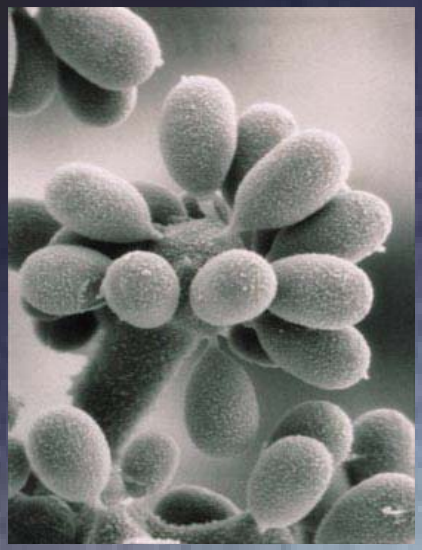


Spore numbers, survival, proximity to hosts

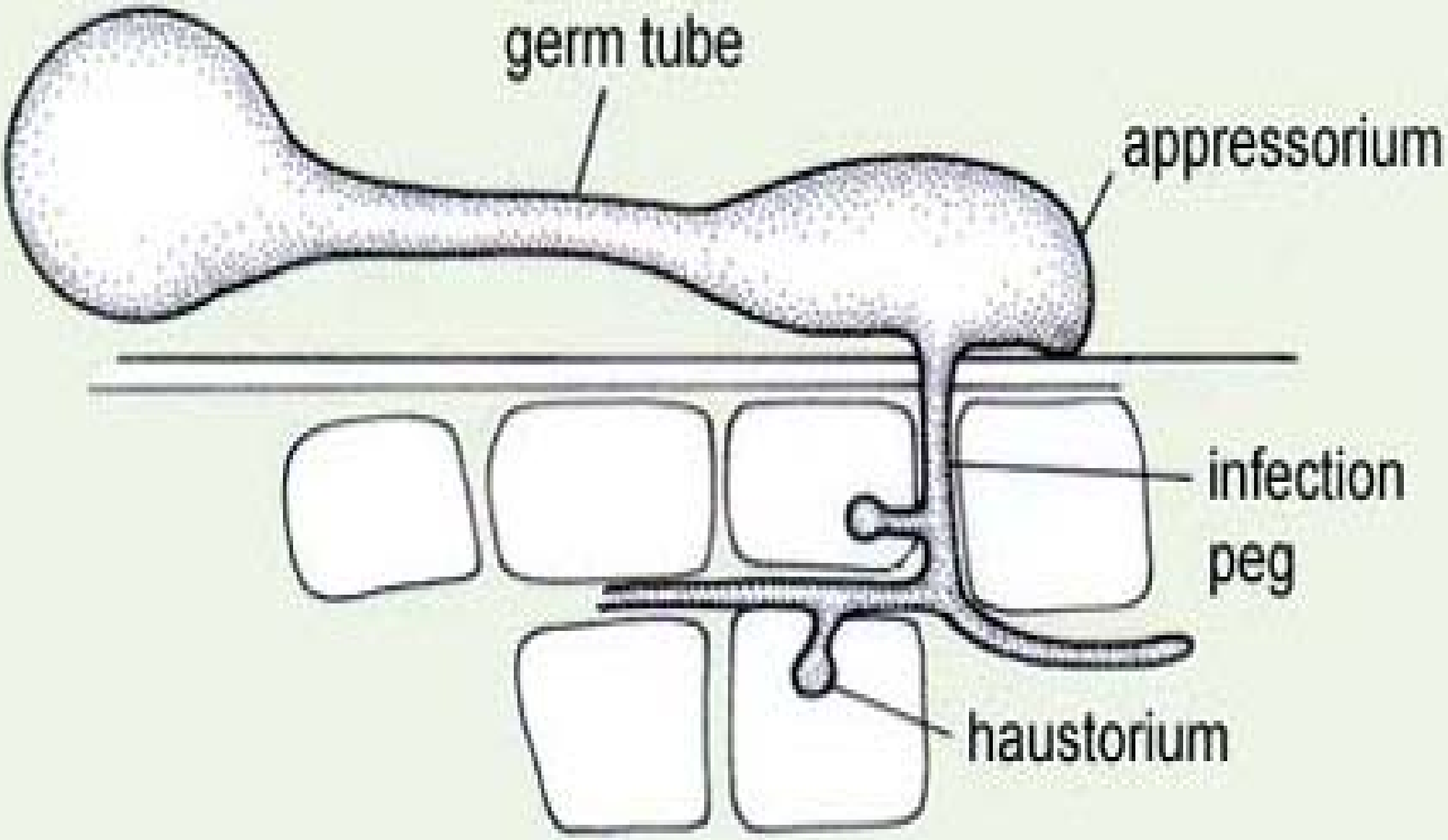
Ophiostoma ulmi

Insects can spread pathogens

Pruning cuts can spread pathogens

Pathogenesis

Infection: direct penetration, wounds, natural openings.
Affected by environment

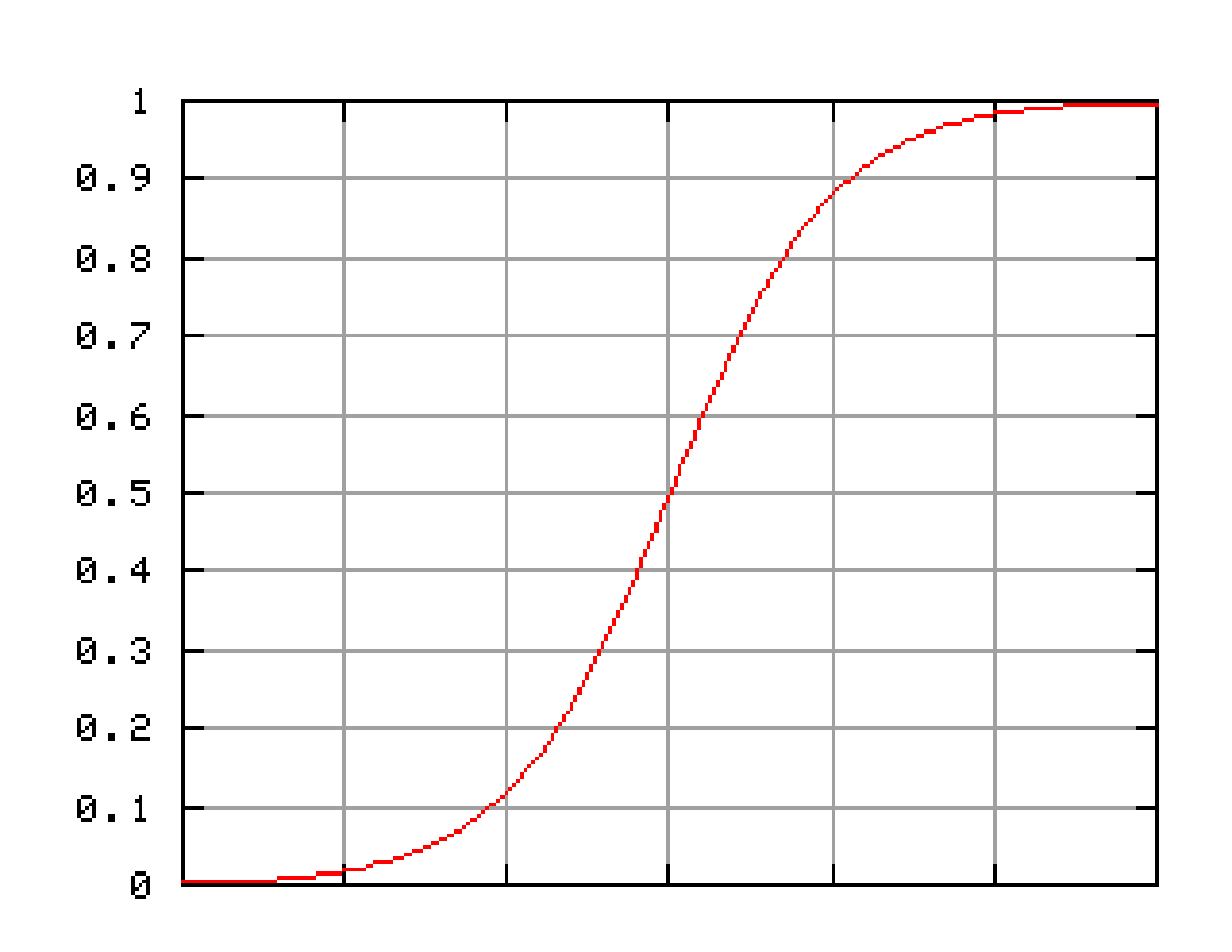

germ tube
appressorium
infection peg
haustorium

Pathogenesis

growth and reproduction of pathogen: depends on pathogen – spores, etc. interaction with the environment (disease cycles)

Disease cycles: Monocyclic vs. polycyclic

Mono: one cycle per year
Verticillium; Armillaria, black knot
Poly: multiple cycles, powdery mildew, anthracnose


1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0

Disease can affect all plant parts and common names are often descriptive of the symptom and affected area.

Symptoms: Manifestation of the disease in the plant – often nonspecific.

Signs: Visible structure(s) of the pathogen.

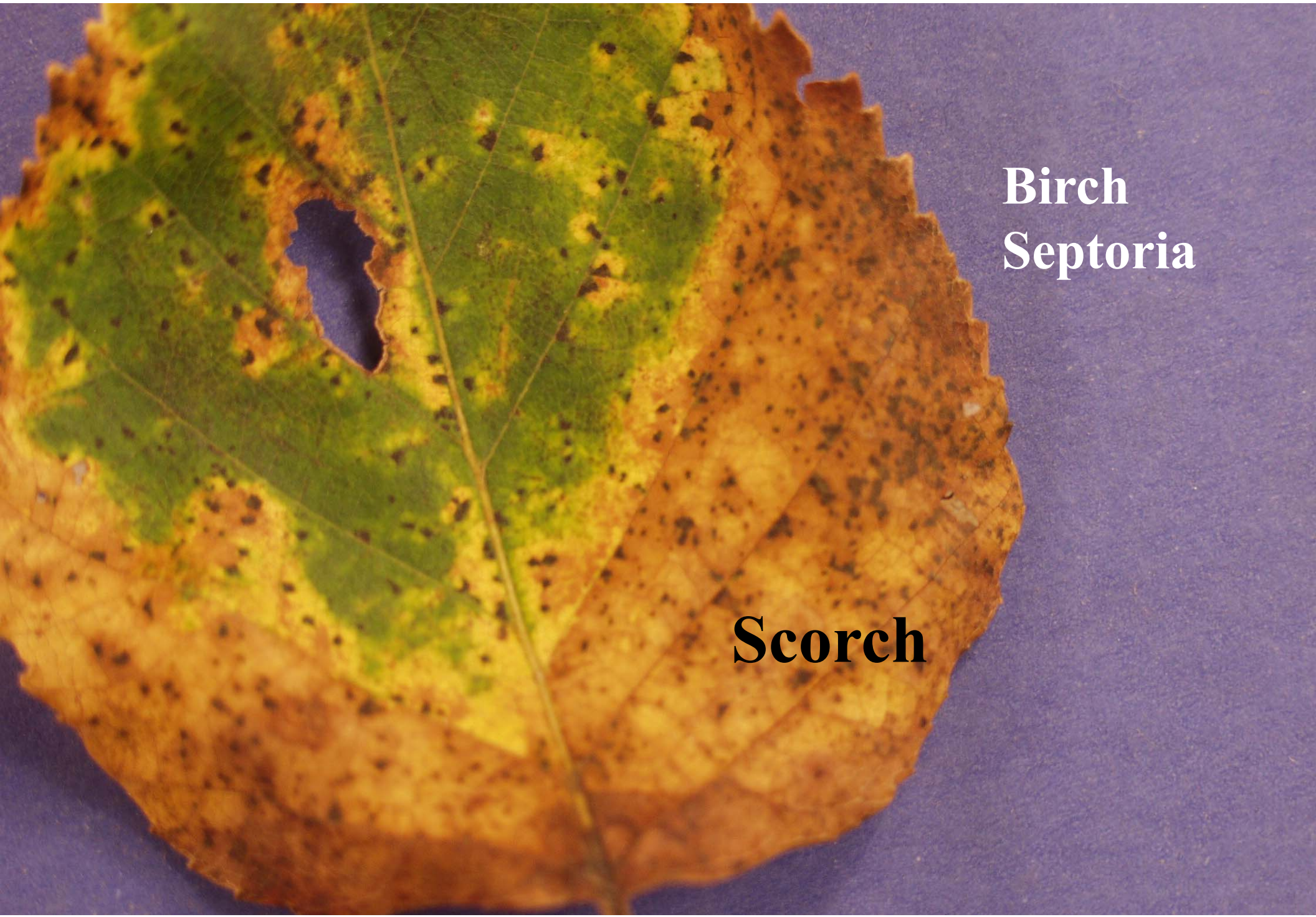
Leaf / foliage

Spot, blotch, blight, scorch, chlorosis, necrosis and rust.

Tar spot


Septoria leaf spot


Blotch - anthracnose


Birch
Septoria
Scorch

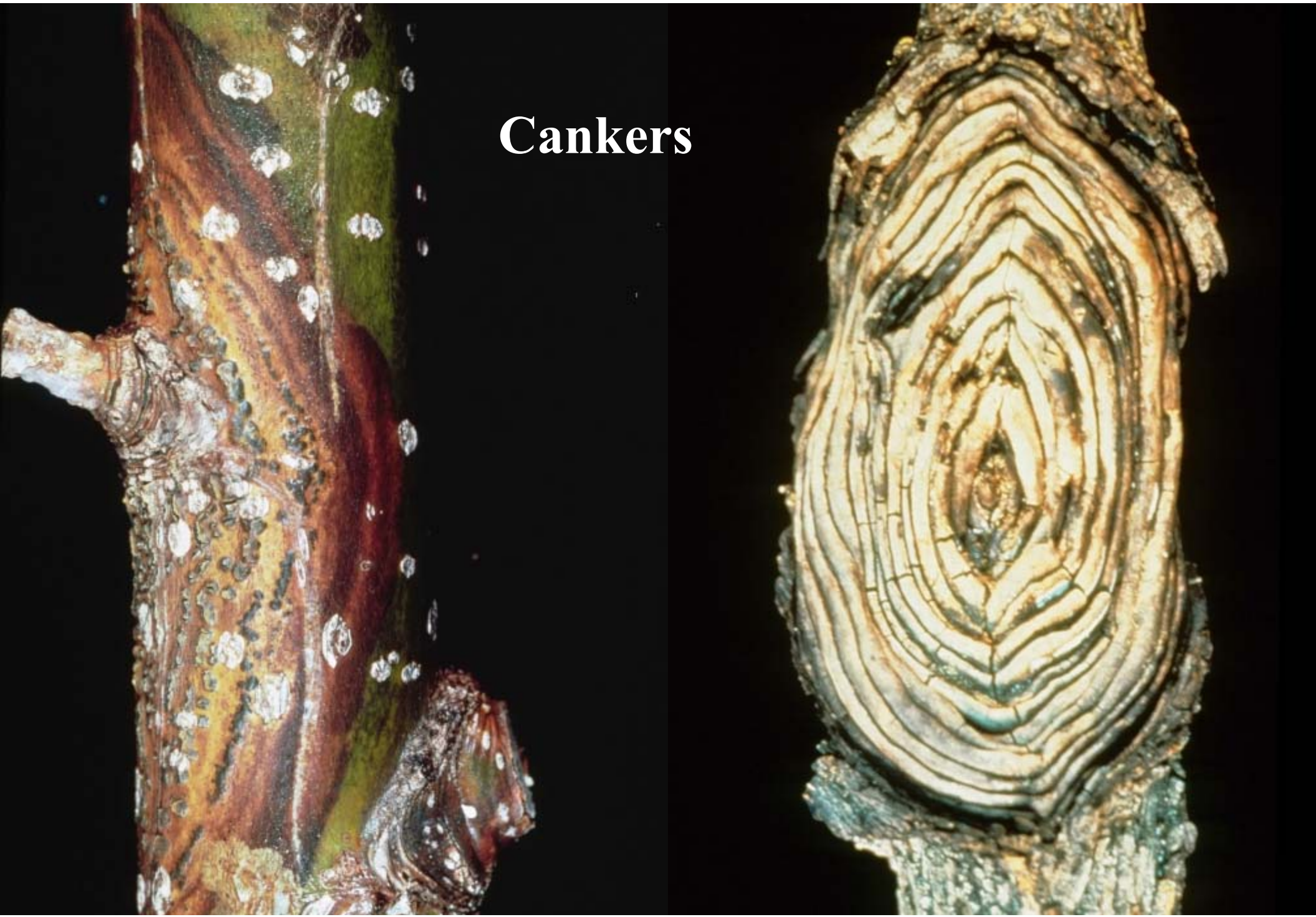

Phytophthora


Poplar rust

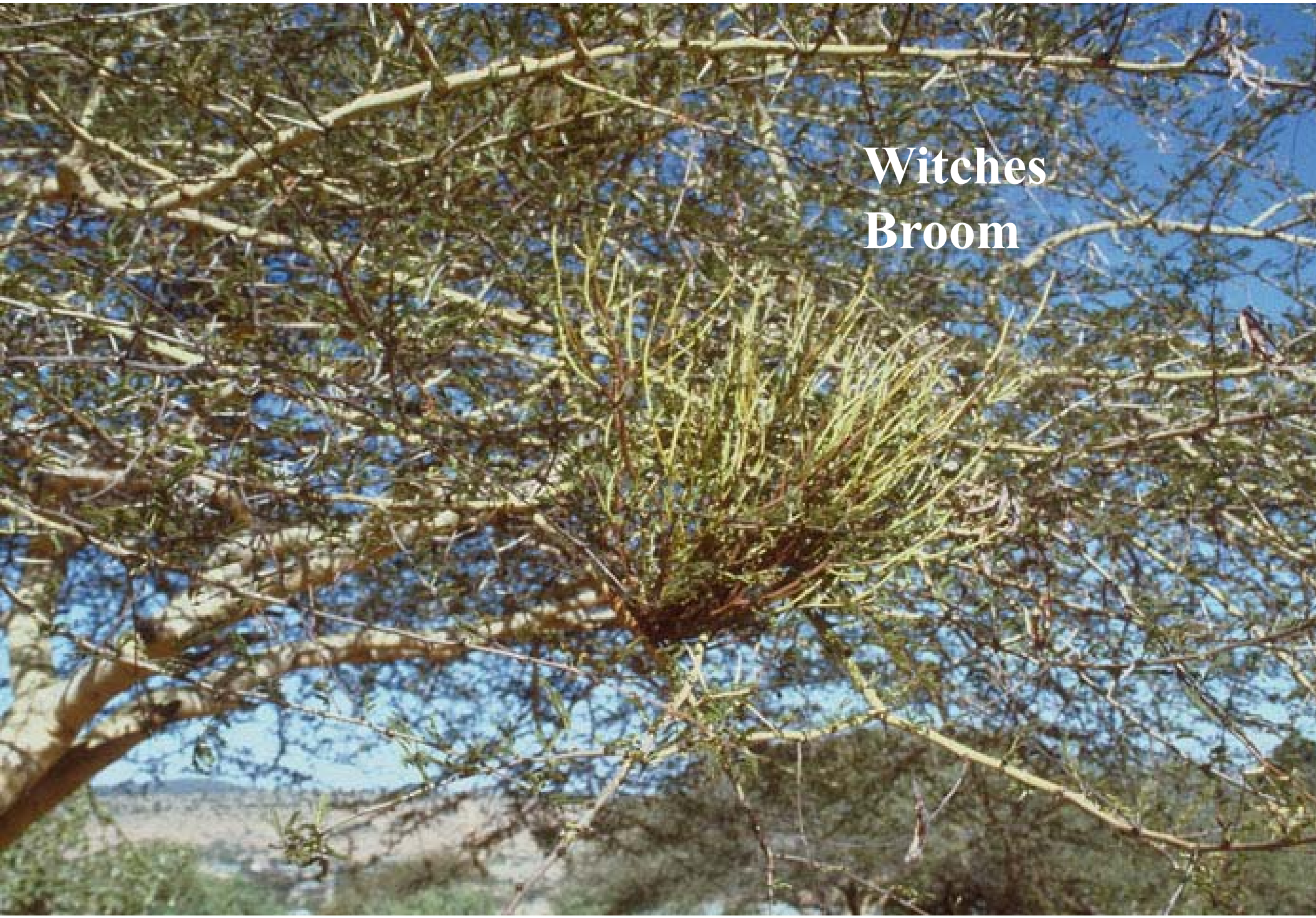
Twig / branch / trunk

blight, dieback, canker, stunting gummosis, brooming, flagging and galling.
Wilt and vascular discoloration.

Cankers




bacterial
gummosis
Pseudomonas
syringae
UGA136115


Witches
Broom


Flagging –
White Pine
blister rust


Gall Rust

Verticillium wilt

Management Options:

- Cultural
- Sanitation
- Resistance
- Biological
- Chemical

Chemical Management:

- Fungicides
  - Protectant
    - Broad spectrum
  - Systemic
    - Specific
- Resistance management

Chemical Management:

- How do you know which fungicide to use?
- For a particular pathogen or host?

Chemical Management:

- How do you know which fungicide to use?
- For a particular pathogen or host?
- Read the Label

Examples of Diseases

Examples of Diseases
Foliar

Anthracnose

- *Platanus, Acer, Quercus, others*
- *Apiognomonia, Discula, Kabatiella*

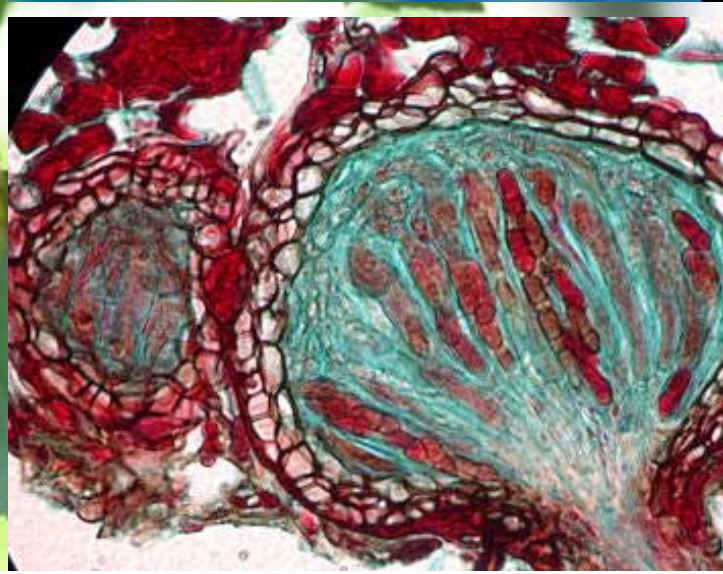
Anthracnose Management

Dormant pruning, preventative fungicide sprays (young, or specimen trees) sanitation, vigor.

Oak Leaf Blister

Taphrina

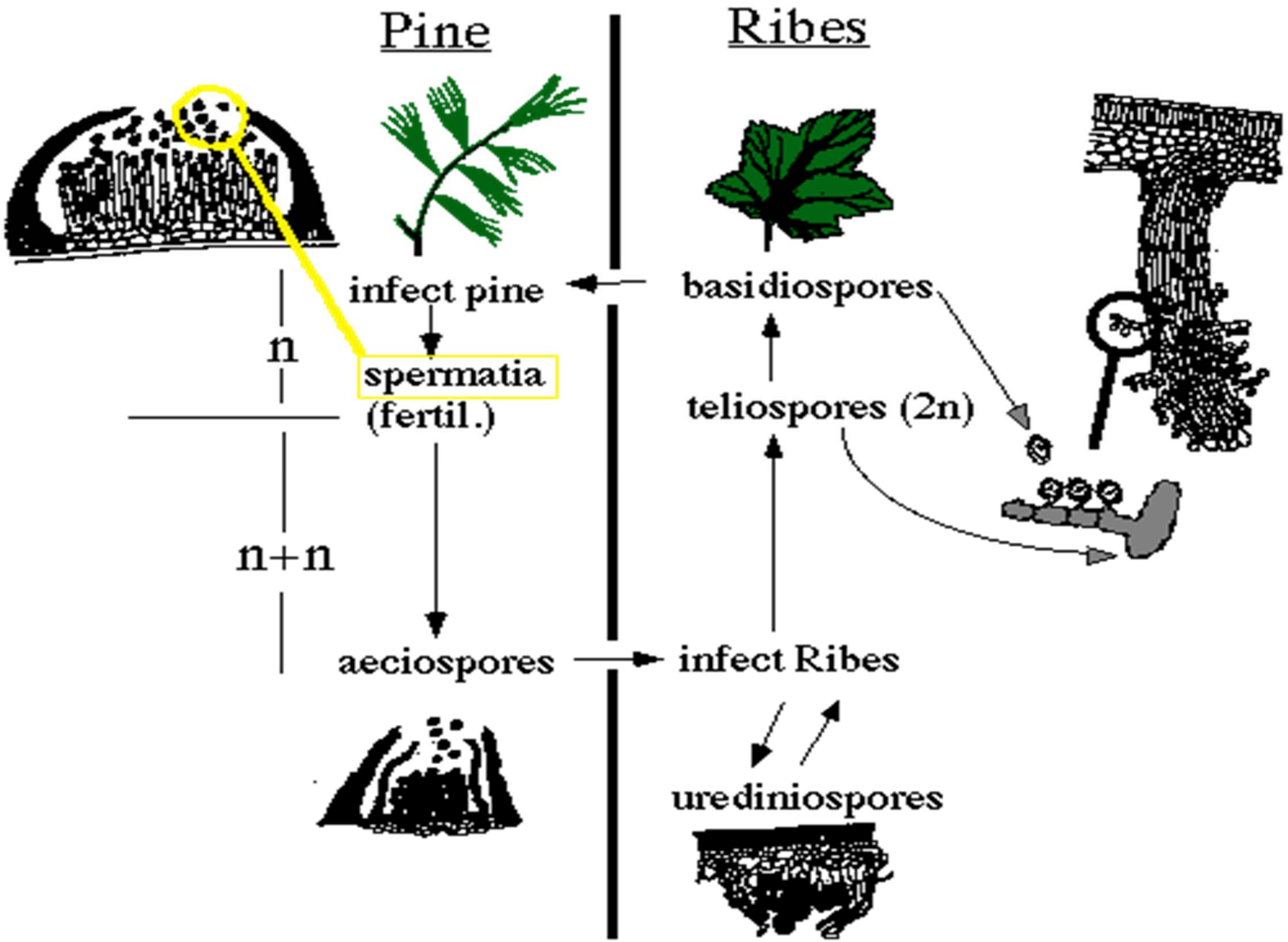
Apple Scab



Apple Scab Management

Dormant pruning, preventative fungicide sprays (young, or specimen trees), resistance, sanitation, vigor.

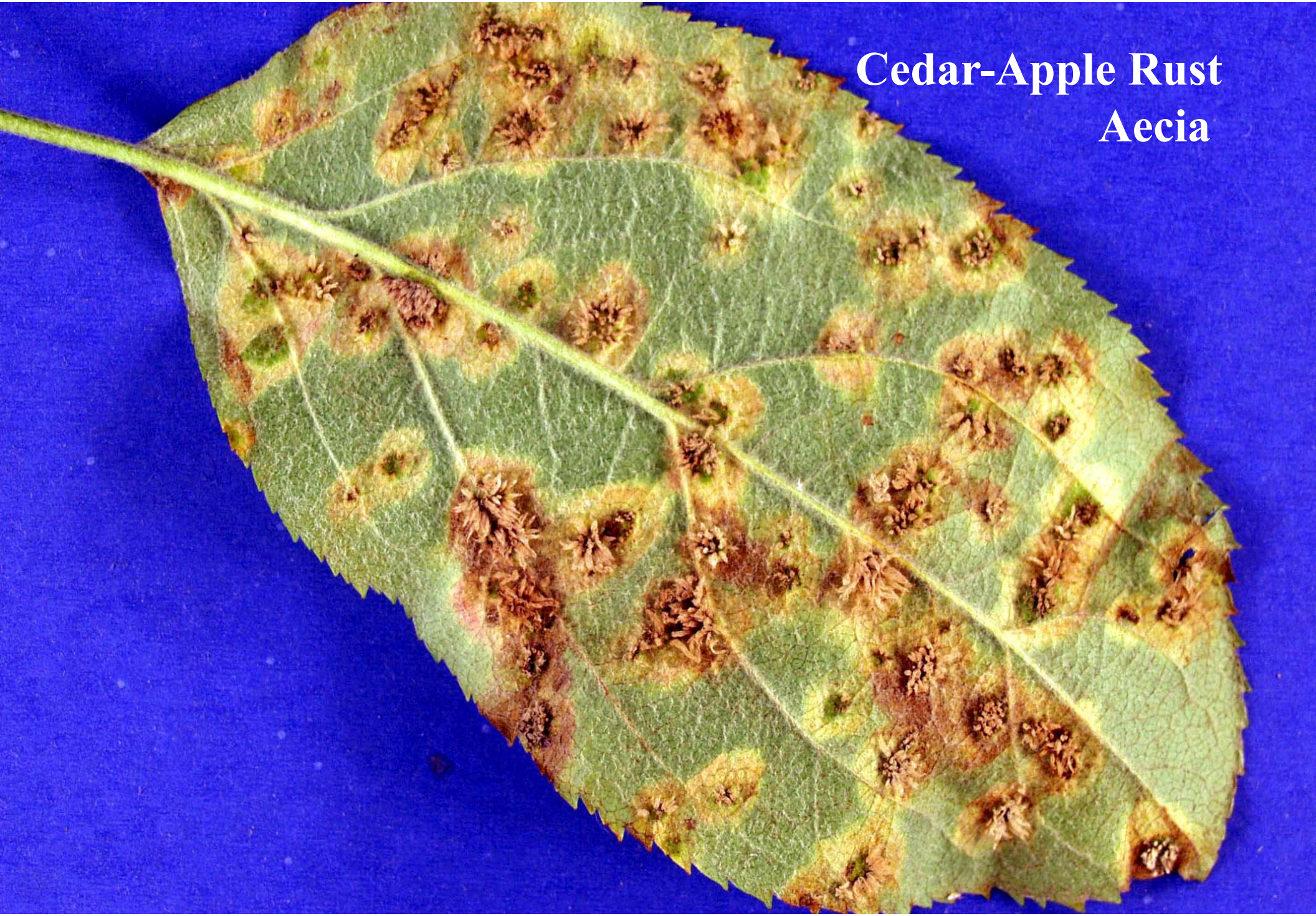

White pine blister
rust

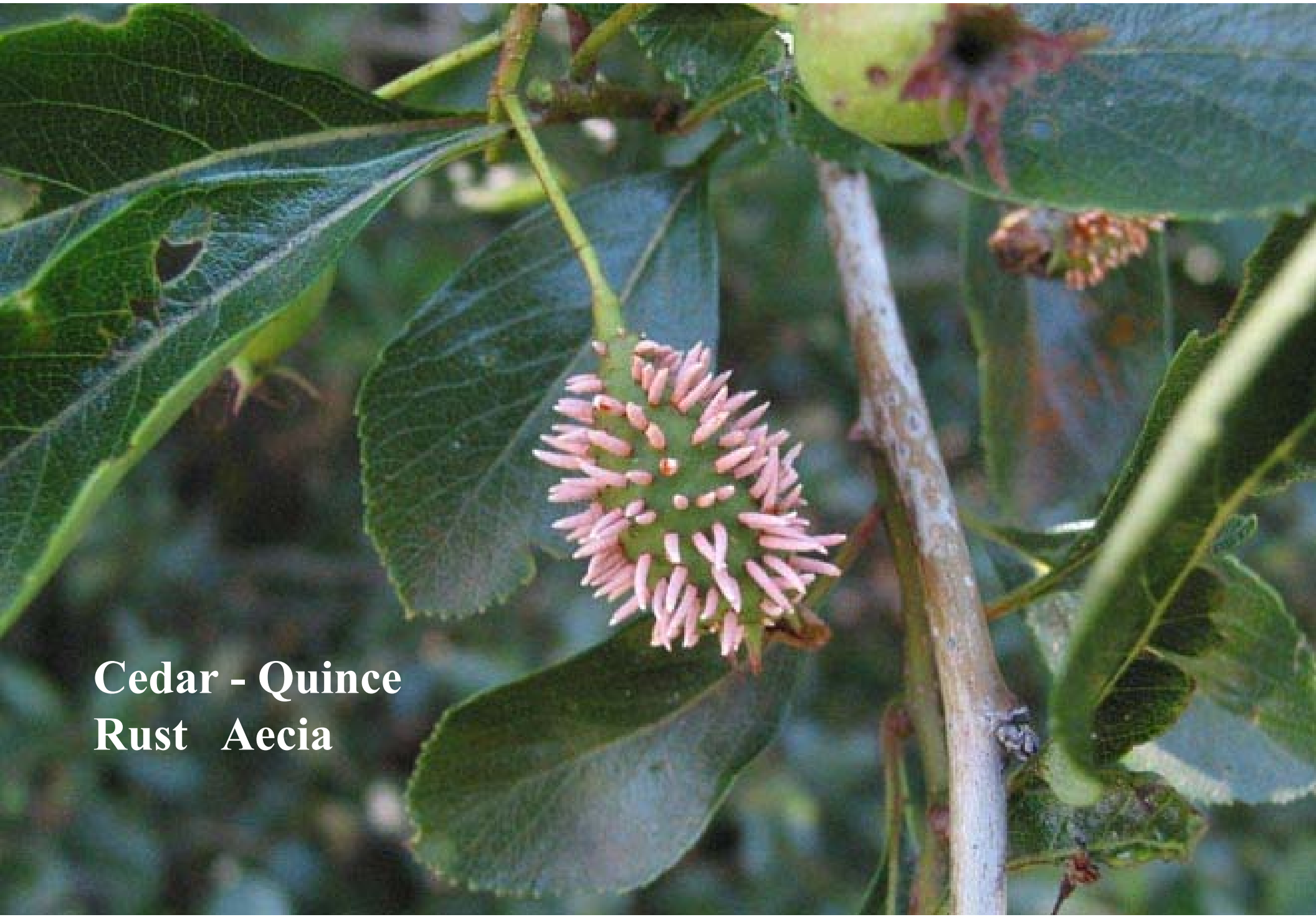

Pine
Ribes
infect pine
basidiospores
n
spermatia
(fertil.)
teliospores (2n)
n+n
aeciospores
infect Ribes
urediniospores

Cedar-apple rust gall

Cedar-Apple Rust

Telial horns


Cedar-Apple Rust
Aecia


Cedar - Quince
Rust Aecia

Cedar Apple Rust Management

Fungicide sprays in spring (young, or specimen trees), resistance, removal of alternate hosts, if practical.

Powdery Mildew

- *Cornus and others*
- *Microsphaera, Phyllactinia, Erysiphe, Sphaerotheca, Uncinula,*

Powdery Mildew Management

Apply preventative fungicides if necessary, sanitation, increase air circulation.

Rhizosphaera needlecast - spruce

Rhizosphaera Management

Pruning and remove when dry, Norway spruce more resistant, preventative fungicide sprays (especially in wet years), avoid drought stress, increase vigor.

Examples of Diseases
Foliar
Blight and Dieback

Fire Blight

- *Malus spp.*
- *Erwinia amylovora*

Fire Blight

Fire Blight Management

Dormant pruning (10-12”), disinfestation, preventative copper sprays, resistant cultivars, sanitation, vigor.

Sphaeropsis (Diplodia)

- *Pinus*
- *Sphaeropsis sapinea*

Sphaeropsis

Sphaeropsis Management

Dormant pruning, preventative fungicide sprays (young, or specimen trees) sanitation, vigor – avoid drought.

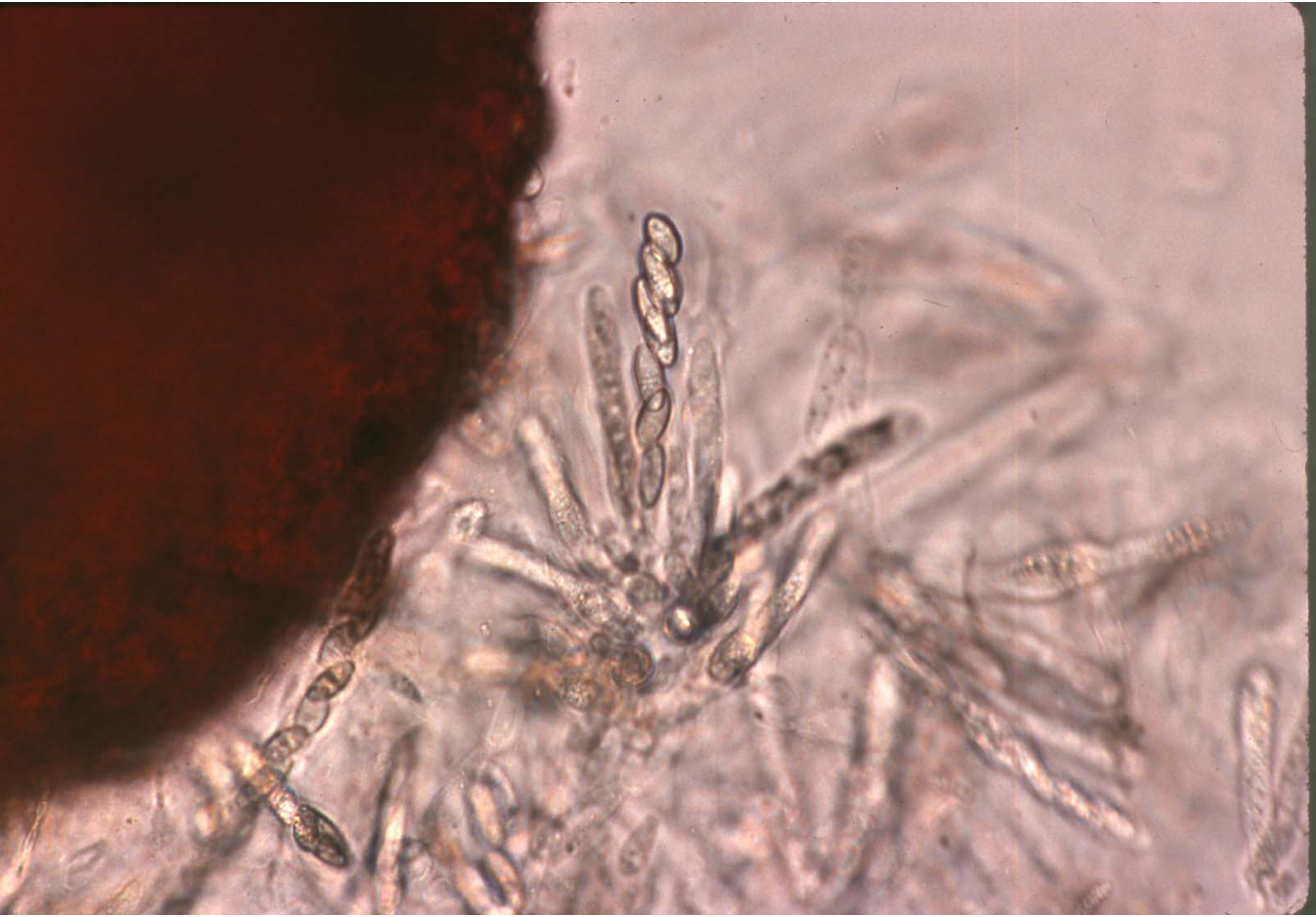
Examples of Diseases

Canker Diseases

Perennial (Nectria) Canker

- *Betula*
- *Nectria spp.*

Nectria



Nectria Canker Management

Dormant pruning, removal of hazard trees, maintain vigor, and avoid stress.

Bleeding Canker

- *Fagus*
- *Phytophthora spp.*

Bleeding Canker

Bleeding Canker

Bleeding Canker Management

Dormant pruning, removal of hazard trees, maintain vigor, fungicides? and avoid stress.


Beech Bark
Disease


Nectria coccinea


Beech Scale

Beech Bark Disease Management

Control Cryptococcus scale, sanitation, and maintain vigor.

Black Knot

- *Prunus*
- *Apiosporina morbosa*


Black Knot

Black Knot Management

Dormant pruning (6-8” below symptoms), preventative fungicide sprays (young, or specimen trees), sanitation, and maintain vigor.

Chestnut Blight

- *Castanea*
- *Chryphonectria parasitica*

Chestnut Blight

Chestnut Blight Management
Plant Resistance or

Examples of Diseases
Vascular Diseases

Verticillium Wilt

- *Acer*
- *Verticillium spp.*

Verticillium Wilt

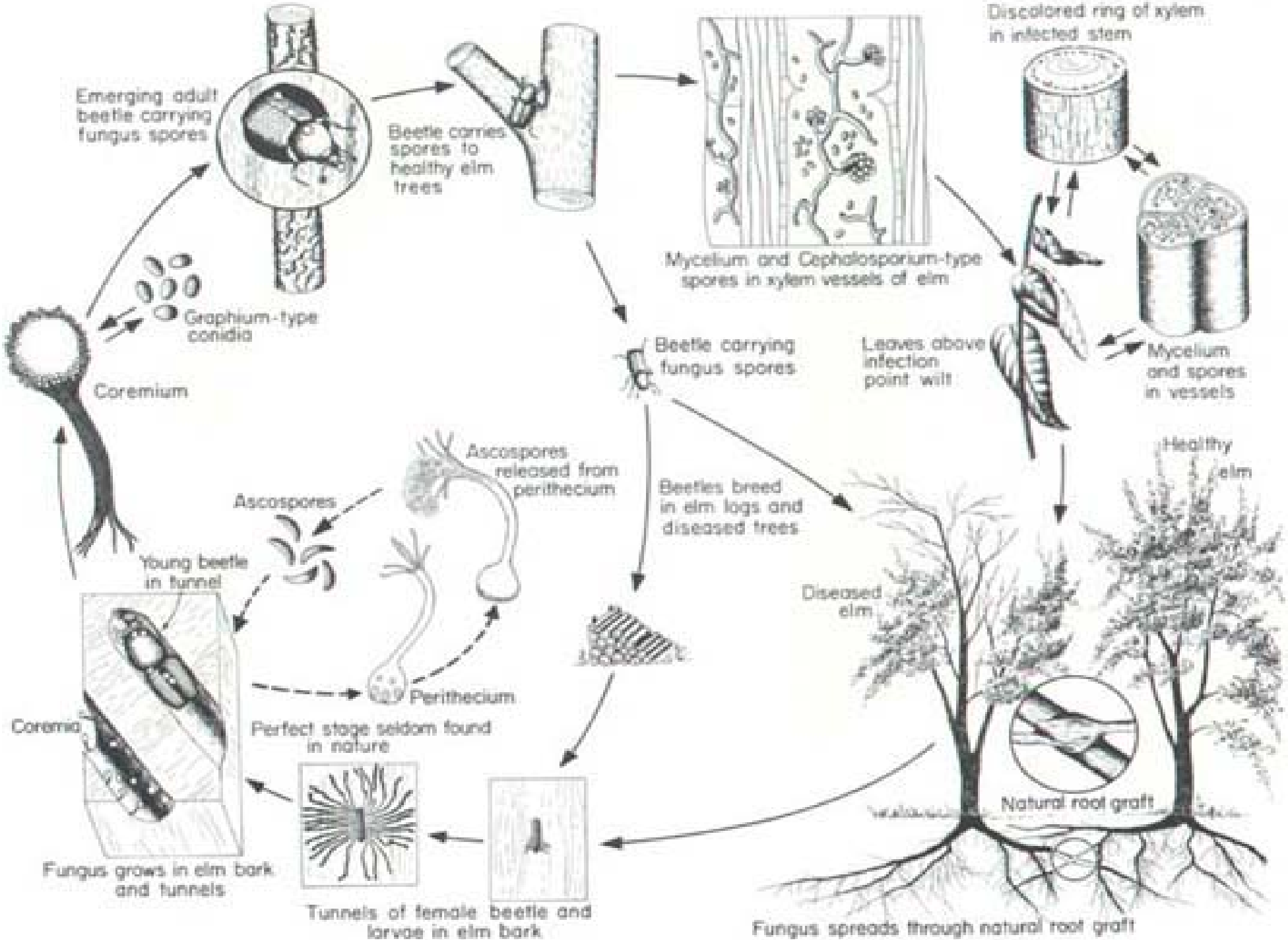
Verticillium Wilt Management

Dormant pruning, removal of hazard trees, maintain vigor, and avoid stress, avoid replanting susceptible trees.

Dutch Elm Disease

- *Ulmus*
- *Ophiostoma ulmi*

Dutch Elm Disease


Emerging adult beetle carrying fungus spores
Beetle carries spores to healthy elm trees
Mycelium and Cephalosporium-type spores in xylem vessels of elm
Discolored ring of xylem in infected stem
Graphium-type conidia
Coremium
Beetle carrying fungus spores
Leaves above infection point wilt
Mycelium and spores in vessels
Ascospores released from perithecium
Ascospores
Beetles breed in elm logs and diseased trees
Healthy elm
Young beetle in tunnel
Diseased elm
Perithecium
Coremia
Perfect stage seldom found in nature
Natural root graft
Fungus grows in elm bark and tunnels
Tunnels of female beetle and larvae in elm bark
Fungus spreads through natural root graft

Dutch Elm Management

Pruning, removal 5-10 feet below symptoms, resistant cvs, control bark beetles, remove dead trees, cut root grafts, apply fungicides to low severity trees, maintain vigor, and avoid stress.

Elm Phloem necrosis; elm yellows

MLO Transmission by leafhoppers

Examples of Diseases
Root Diseases

Shoe String Root Rot

- *Quercus*
- *Armillaria mellea* (species complex >10)


Armillaria

Armillaria – Worlds largest organism?

A single clone of Armillaria 'The Humungous Fungus' is estimated to cover over 2200 acres in an Oregon National Forest;
> 2,400 yrs old; >100,000 lbs.

Armillaria Management

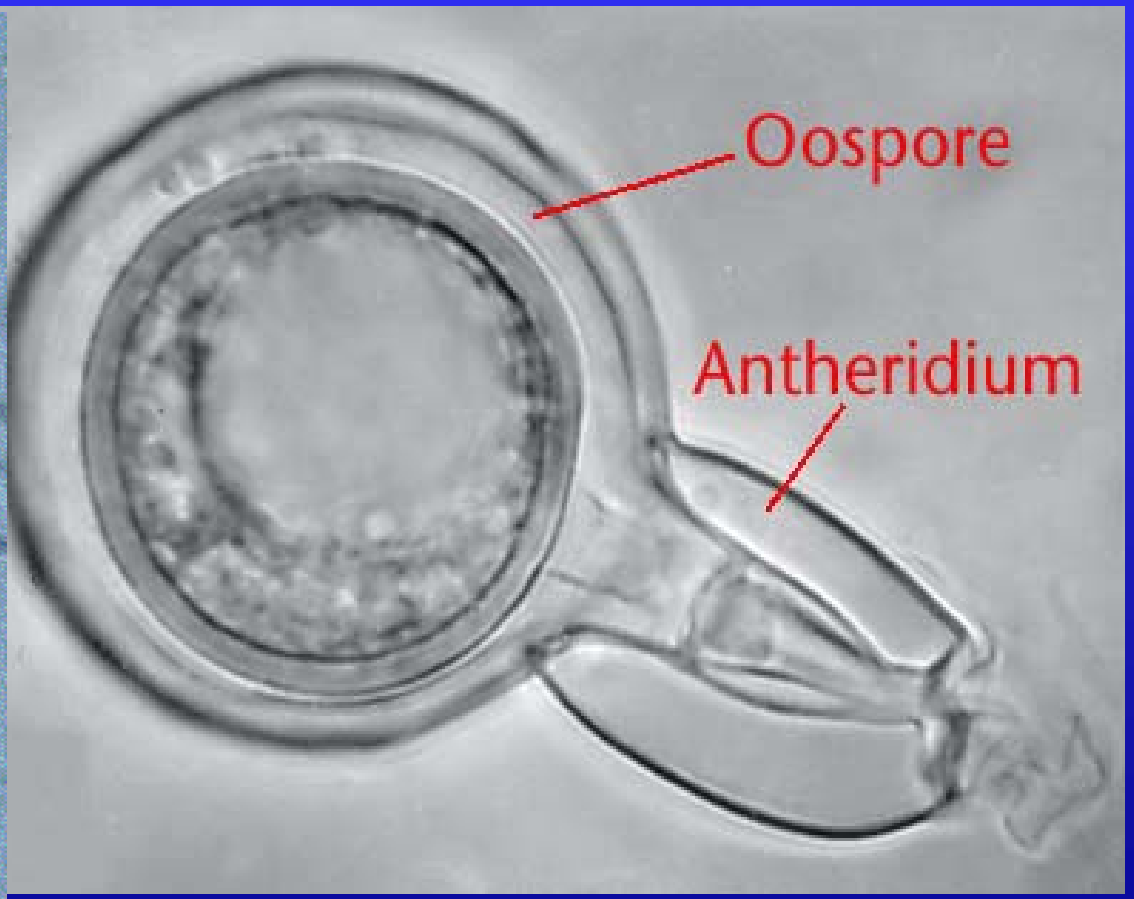
Dormant pruning, removal of hazard trees, maintain vigor, and avoid stress, pull stumps, avoid replanting susceptible trees.

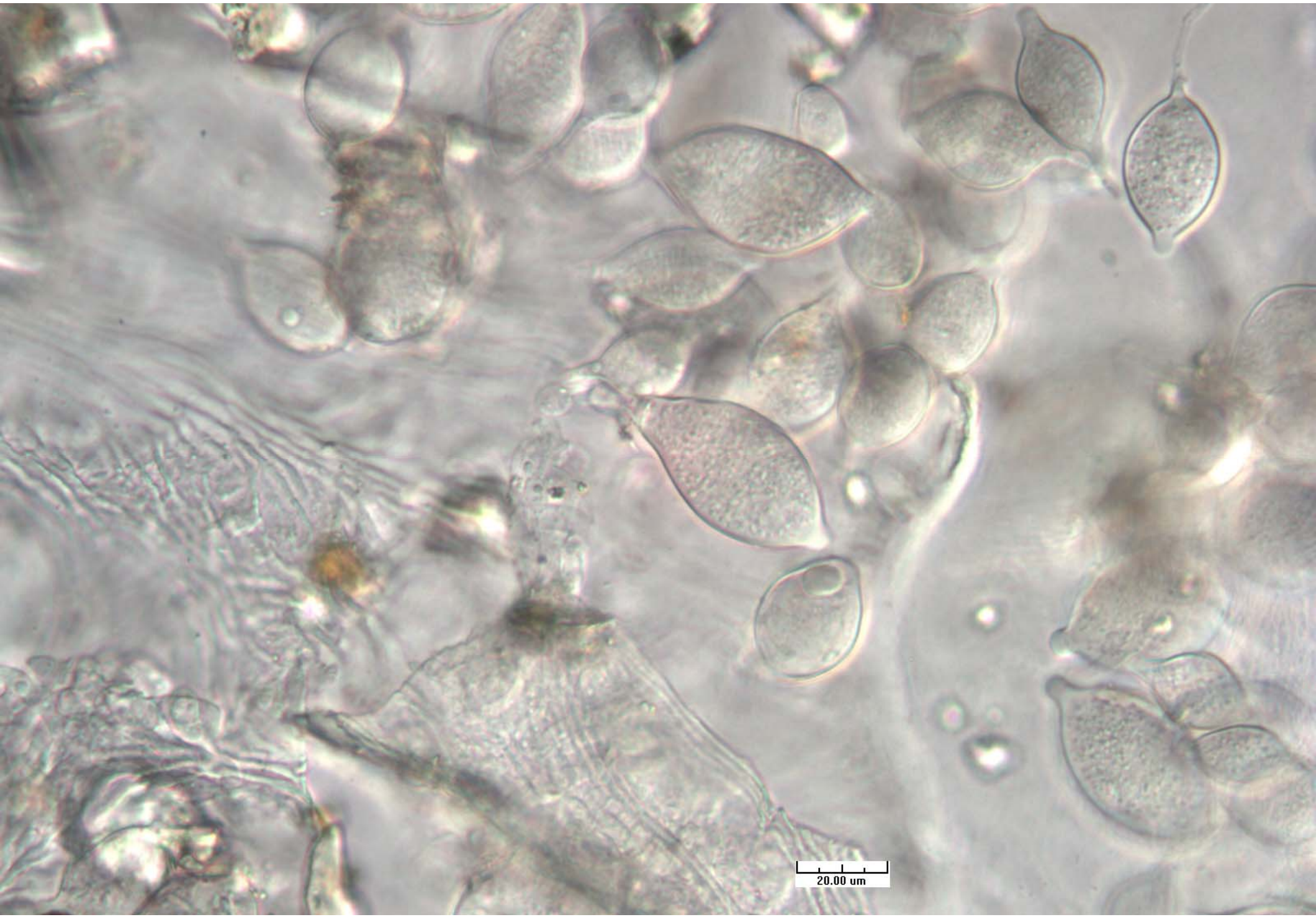
Phytophthora Root Rot

- *Picea*
- *Phytophthora spp.*


Phytophthora

Phytophthora




20.00 um

Phytophthora Management

Remove symptomatic trees and apply systemic fungicides as a preventative, avoid wet compacted soils, plant 1” above root collar or less.

Tree Disease

Diseases: Some level of disease is the norm in the forest.

Seedlings – high plant density.

Mature forest > 90% tree mortality and loss – gradual over years.

Tree Disease Diagnosis

Diagnosis is the most important component of tree health care

- Is it disease, injury, insect environment?

…….. or combinations?

Tree Disease Diagnosis

- What is the host (what are the possible or likely diseases).
- Symptoms and signs.
- Consider the environment and history - site and tree, stresses

Tree Disease Management

First, know which pathogen you need to manage.

Consider the environment and management alternatives.

Customer considerations.

Disease Diagnostics

Use references, experience.

Don’t be afraid to say I don’t know but will find out.

CAES diagnostic labs in New Haven and Windsor.

Disease	Host	Pathogen	Symptoms	Signs	Management & Notes
Anthracnose	Sycamore etc	Apiognomonia	Leaf lesions, defoliation, twig and shoot blight, cankers	Black pycnidia	Disease in wet springs, maintain vigor, prune and remove inoculum Fungicides at budbreak

The Connecticut Agricultural Experiment Station Valley Laboratory

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