Evolving Urban Landscapes:
Trees, Bees and IPM Strategies,
City of Seattle 2018 IPM Seminars

Common Tree Decays

presented by,

Bess Bronstein

Horticultural Consultant & ISA Certified Arborist

bess2@centurytel.net

Photo: Jay W. Pscheidt,

Plant Pathogenic Fungi

Symptoms

- cankers
- galls
- leaf spots
- leaf blotches
- root rots
- stem rots
- wilts
- deformity

Signs

- mycelia
- spores
- fruiting bodies

Fruiting Bodies

mushrooms

puffballs

conks

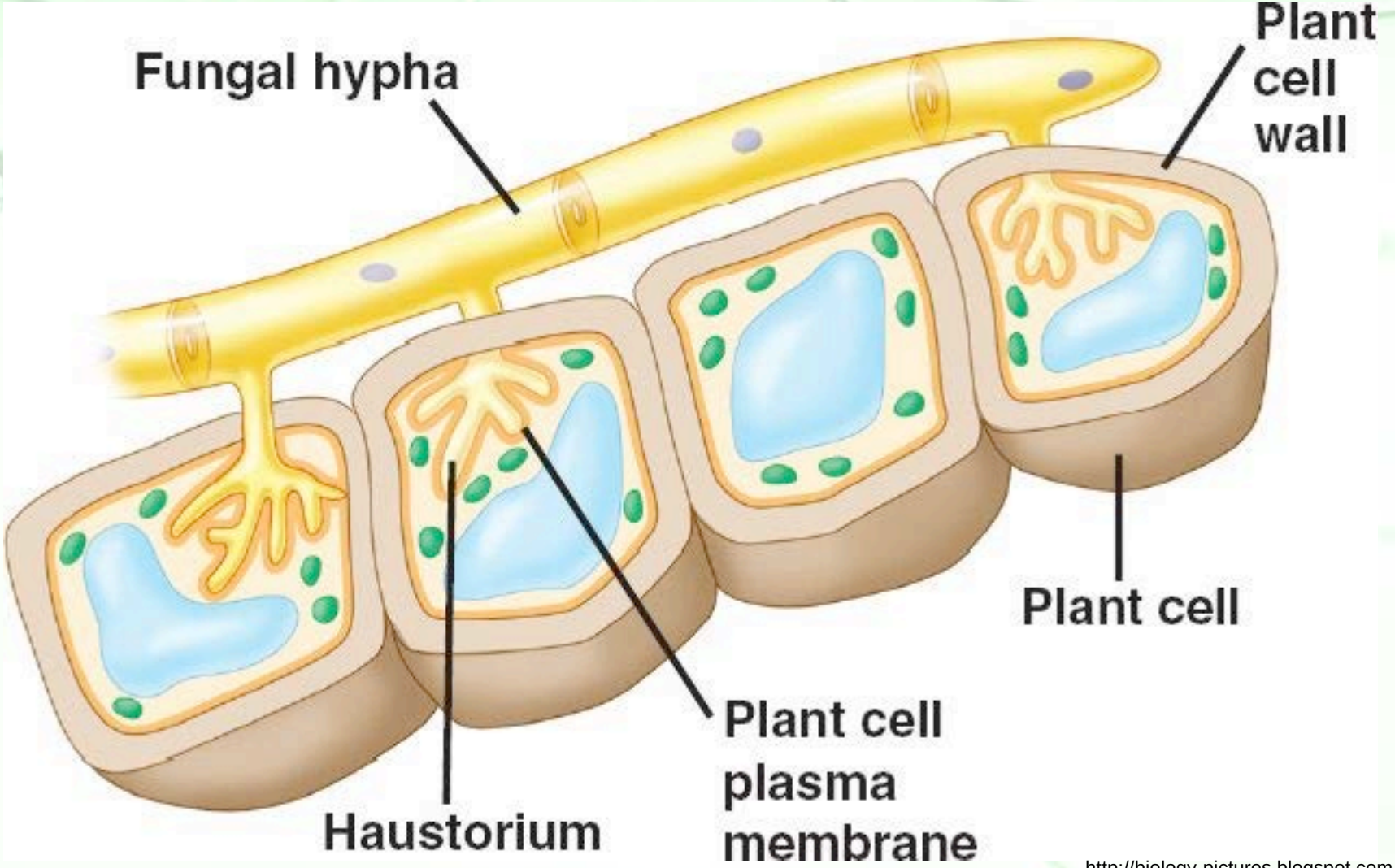
Fungi Characteristics

hypha (pl., hyphae)

mycelium (pl., mycelia)

- made up of **hyphae**, which form **mycelia**
- cell wall is mostly **chitin**, sometimes has **cellulose**
- reproduce by **spores** (sexual/asexual), **budding** (asexual), and **fragmentation** (asexual)

Fungi Characteristics



http://biology-pictures.blogspot.com

Plant Pathogenic Fungi

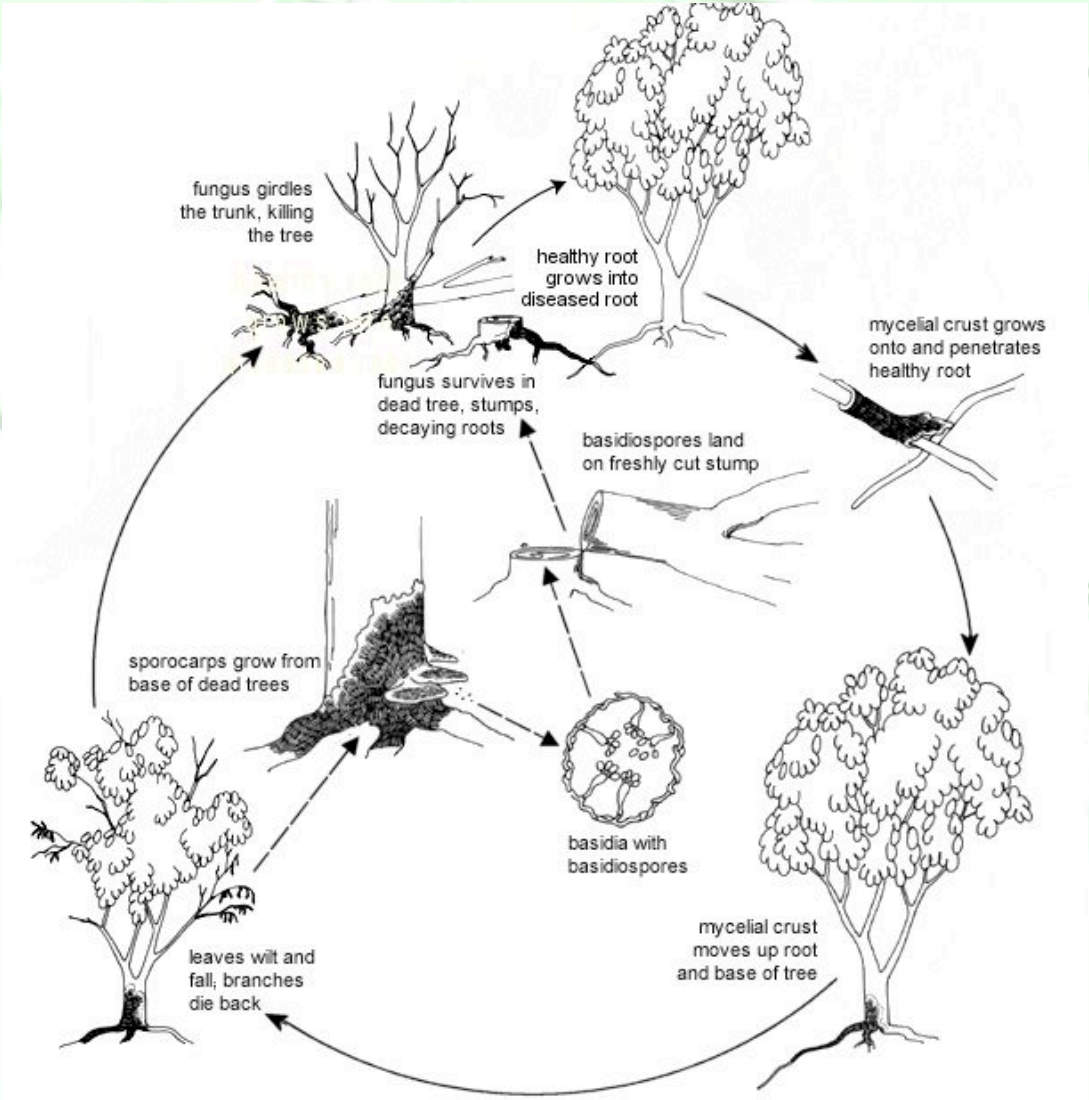
How do they survive?

- survival spores
- mycelial pieces
- fruiting bodies (mushrooms, brackets, conks)
- saprophytes in plant debris

How do they spread?

- infected plant debris
- infested seeds
- spore dispersal in air
- splashing water
- tools
- insects

Basidiomycete Life Cycle



http://www.cals.ncsu.edu Courtesy V. Brewster

Basidiospores

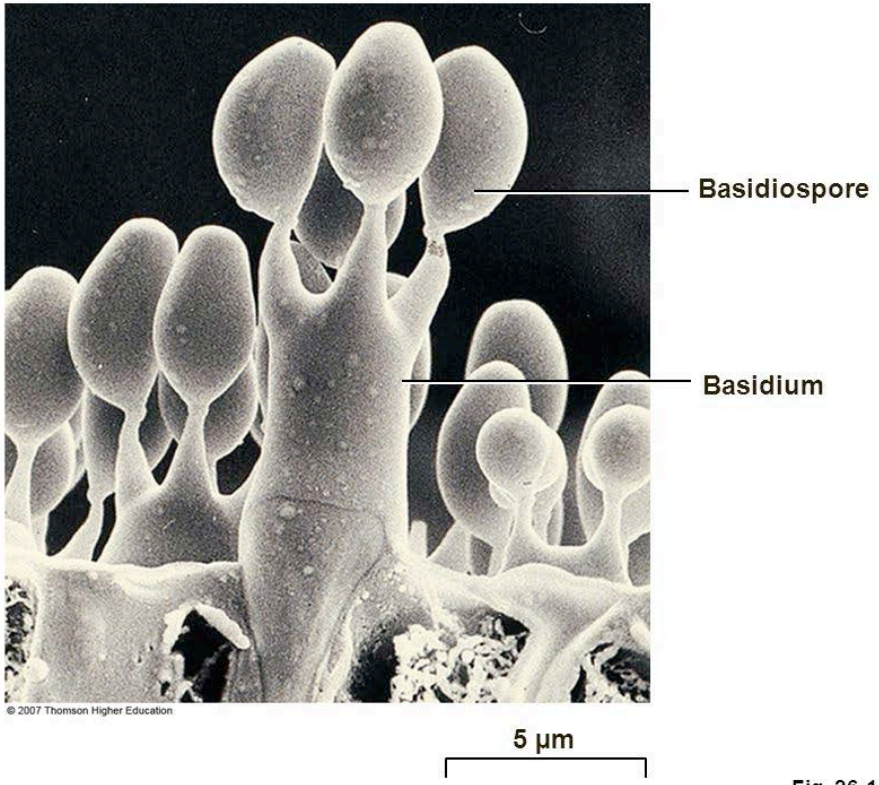


Fig. 26-16, p. 570

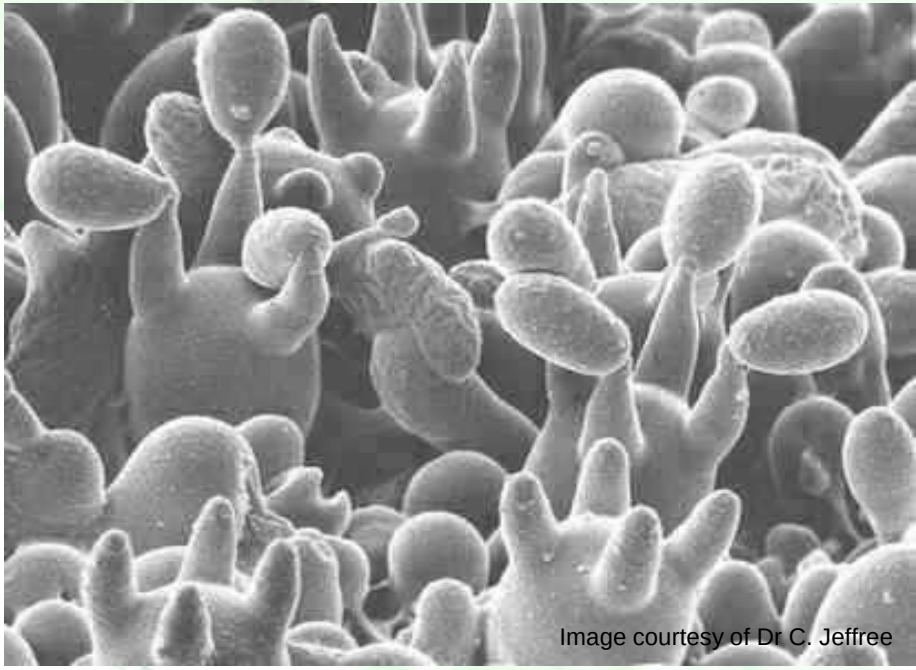


Image courtesy of Dr C. Jeffree

Wood Decay Fungi

white rot: fungus decays cellulose and lignin (decayed wood appears bleached and is often spongy or stringy)

brown rot: fungus decays cellulose, but leaves lignin (decayed wood appears as brown cubes)

soft rot: decays cellulose, and leaves microscopic cavities in wood; seen in higher moisture/low lignin wood

incipient decay: beginning stages of decay, wood may only look discolored

advanced decay: later stages of decay, typical wood breakdown present

armillaria root rot (*Armillaria spp.*)

DISEASE TYPE: root and butt rot
DECAY TYPE: white rot
HOSTS: conifers and hardwoods; attacks both live and dead tissue
FRUITING BODY: yellow gilled annual mushroom with stem ring, in fall
SPREAD: rhizomorphs, root to root contact, airborne spores

armillaria root rot (*Armillaria spp.*)

SYMPTOMS

- smaller than normal foliage
- chlorotic foliage, followed by leaf/needle drop
- branch dieback
- leader dieback
- eventual death of plant

SIGNS

- resin flow at base of trunk
- white mycelia beneath bark at base of trunk
- rhizomorphs at or below soil surface
- honey-colored annual mushrooms at tree base in fall

armillaria root rot (*Armillaria spp.*)

MANAGEMENT

<u>Cultural/Mechanical</u>

- fertilize and water to maintain plant health
- if dead, remove entire plant, stump and root system
- if infection is mild, remove soil and dry out roots and trunk

armillaria root rot (*Armillaria spp.*)

Resistant Plants:

- white fir (*Abies concolor*)
- madrone (*Arbutus menziesii*)
- smoke tree (*Cotinus spp.*)
- Leyland cypress (X *Cuprocyparis leylandii*)
- Scotch pine (*Pinus sylvestris*)
- crabapple (*Malus spp.*)
- pear (*Pyrus spp.*)

tinder fungus (*Fomes fomentarius*)

DISEASE TYPE: trunk rot (sapwood and heartwood)
DECAY TYPE: white rot
HOSTS: hardwoods, rarely Douglas fir; attacks both live and dead tissue
FRUITING BODY: perennial poroid conk
SPREAD: airborne spores through stem and branch wounds

SYMPTOMS

- dieback or decline in crown

SIGNS

- perennial poroid hoof-shaped gray to brown woody conk (lower surface is light creamy brown and concave); enlarges yearly

tinder fungus (*Fomes fomentarius*)

How to differentiate from look a-likes:

- add a drop of potassium hydroxide onto a small piece of the fruit body from the upper surface - it will turn a dark red if the chemical fomentariol is present

red belt fungus (*Fomitopsis pinicola*)

DISEASE TYPE: trunk rot (heartwood)
DECAY TYPE: brown rot
HOSTS: old growth conifers, sometimes hardwoods
FRUITING BODY: perennial poroid conk
SPREAD: through wounds on trunk

SYMPTOMS

- leader dieback
- stem and trunk breakage
- fruiting bodies common on dead trees

SIGNS

- perennial poroid conks along trunk, lower surface white, reddish rings on top, matures to grayish-black

artist conk (*Ganoderma applanatum*)

DISEASE TYPE: trunk rot (sapwood and heartwood), butt rot
DECAY TYPE: white rot
HOSTS: conifers and hardwoods; attacks both live and dead wood
FRUITING BODY: perennial poroid conk
SPREAD: airborne spores

artist conk (*Ganoderma applanatum*)

SYMPTOMS

- smaller than normal foliage
- slower growth than normal

SIGNS

- flat hard leathery perennial bracket conk; upper surface is brown, lower surface white when growing, brown when older; scratches on underside will discolor
- decayed tissue white and spongy
- brown powder (spores) near active conk

Curtis E. Young, The Ohio State University, Bugwood.org

http://gurneyjourney.blogspot.com

annosus root & butt rot (*Heterobasidion occidentale*)

DISEASE TYPE: root and butt rot
DECAY TYPE: white rot
HOSTS: conifers and hardwoods; attacks live tissue, but survives in dead trees
FRUITING BODY: poroid perennial conk
SPREAD: root grafts, airborne spores

annosus root & butt rot (*Heterobasidion occidentale*)

SYMPTOMS

- dead and declining trees (often in stands)
- wind-thrown trees and stumps nearby
- resinosis at root collar
- sparse and smaller than normal foliage
- slower than normal growth

SIGNS

- perennial conks at base of tree, brown with white margin
- white mycelium under bark at root collar
- decayed wood stringy with black flecks, sometimes laminated

annosus root & butt rot (*Heterobasidion occidentale*)

MANAGEMENT


Photo: Chal Landgren, OSU

Cultural/Mechanical

- avoid wounds
- leave resistant species (western red cedar, pines, maples, alders) when removing trees
- remove and destroy infected trees, stumps and root systems when possible

Biological

- *Trichoderma spp.* (parasitic fungus)

Chemical

- apply borax to newly cut uninfected stumps

Photo: Dave Shaw, PNW Handbook


NCSU Plant Pathology Dept Slide Collection

laminated root rot (*Phellinus sulphurascens*)

DISEASE TYPE: root and butt rot
DECAY TYPE: white rot
HOSTS: conifers (pines, western red cedar, incense cedar are resistant); attacks live wood, survives in dead wood for long periods
FRUITING BODY: annual flat poroid conk hidden in decayed roots and buttress
SPREAD: root to root contact

laminated root rot (*Phellinus sulphurascens*)

SYMPTOMS

- decrease in growth
- yellowing of needles
- crown declines from top
- often see a distress cone crop
- roots appear ‘amputated’ on wind thrown trees

SIGNS

- wood separates along growth rings once decayed
- decayed wood has many tiny elliptical pits
- reddish mycelium seen between laminated layers of wood
- flat thin annual poroid conk found in buttress roots of fallen trees

MANAGEMENT

<u>Cultural/Mechanical</u>

- identify infection centers and remove both infected trees and susceptible hosts at least 50 feet beyond the infection center
- remove all stumps and roots of infected trees if possible
- replant with resistant species (western red cedar, incense cedar, Alaska yellow cedar, hardwoods)

red ring rot (*Porodaedalea pini*)

DISEASE TYPE: butt rot, stem rot (sapwood and heartwood)
DECAY TYPE: white rot
HOSTS: conifers; attacks both live and dead tissue
FRUITING BODY: perennial poroid conk
SPREAD: airborne spores

red ring rot (*Porodaedalea pini*)

SYMPTOMS

- decrease in growth
- general decline of tree

SIGNS

- woody reddish-brown flat to hoof-shaped perennial conk to 3”
- scattered single conks may indicate pockets of decay rather than columns; multiple conks more likely indicate decay columns
- red ring of incipient decay in heartwood


USDA Forest Service


Photo: Celina Montes


Wikipedia Commons

velvet top fungus (*Phaeolus schweinitzii*)

DISEASE TYPE: root and butt rot
DECAY TYPE: brown rot
HOSTS: mostly conifers, older garry oak; attacks live and dead tissue
FRUITING BODY: persistent annual poroid conk (initially velvety yellow, ages to dry and black
SPREAD: airborne spores

velvet top fungus (*Phaeolus schweinitzii*)

SYMPTOMS

- rarely show outward symptoms
- once a tree breaks or is wind thrown, begin to monitor nearby trees

SIGNS

- conks (velvety olive-brown when young, dry and black when old) either on soil, lower trunk or roots of wind-thrown trees
- brown cubical decay seen in lower part of trunk (up to 8 feet)
- smaller roots sometimes have dark red resinous heartwood

Photo by James W. Byler, USDA Forest Service, Bugwood.org

Photo by Susan K. Hagle, USDA Forest Service, Bugwood.org

velvet top fungus (*Phaeolus schweinitzii*)

Photo by Robert L. Anderson, USDA Forest Service, Bugwood.org

Photos by Susan K. Hagle, USDA Forest Service, Bugwood.org

MANAGEMENT:

<u>Cultural/Mechanical</u>

- avoid wounds
- remove or harvest trees before they become overmature

sulfur fungus (*Laetiporous conifericola, Laetiporous gilbertsonii*)

DISEASE TYPE: stem rot: heartwood
DECAY TYPE: brown rot
HOSTS: *L. conifericola* on conifers, *L. gilbertsonii* on hardwoods
FRUITING BODY: annual edible conks seen on hardwoods, rarely on conifers
SPREAD: airborne spores

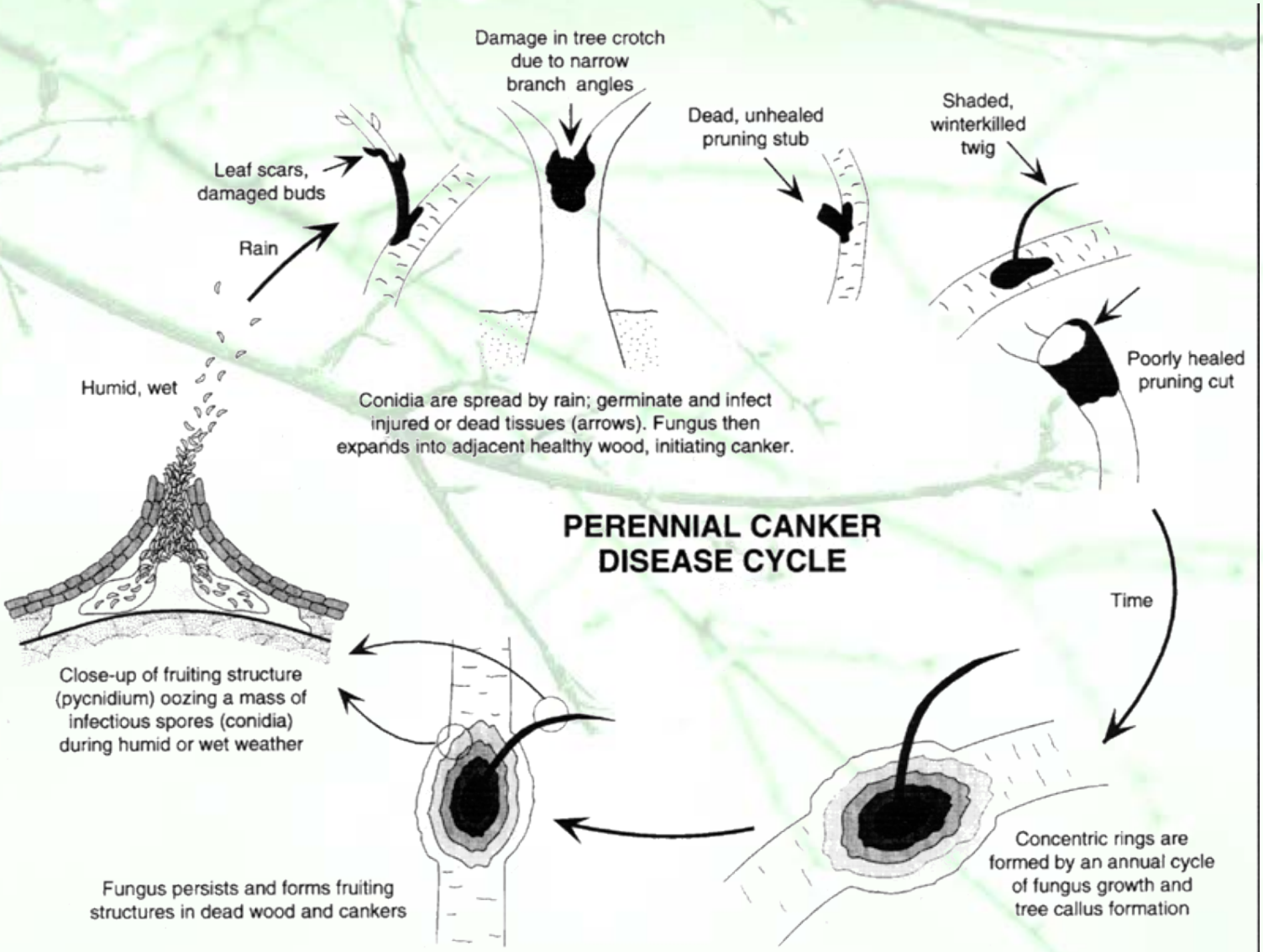
SYMPTOMS

- decrease in growth
- dieback

SIGNS

- fleshy conk with yellow orange upper surface and whitish-pink edges, yellow lower surface
- conks smell like sulphur when older
- brown cubical rot with white mycelia in decayed wood

Ascomycete Life Cycle



http://nysipm.cornell.edu/factsheets/treefruit/diseases/pc/pc_cycle.gif

brittle cinder (*Kretzschmaria deusta*)

DISEASE TYPE: root and butt rot, occasionally large branches
DECAY TYPE: soft rot
HOSTS: hardwoods, especially bigleaf maple; attacks both live and dead tissue
FRUITING BODY: perennial patch-like fruiting bodies
SPREAD: airborne spores colonize wounds

brittle cinder (*Kretzschmaria deusta*)


Photo: Patrick Harvey


Wood Decay Fungi of Living Trees

SYMPTOMS

- general decline due to decay columns

SIGNS

- white to gray to black crusty patches that crumble apart when touched, usually located at the root crown or even below the soil line
- fracture pattern at point of root/trunk failure

madrone canker (*Neofusicoccum arbuti*)

SYMPTOMS

- initial dieback in foliage and shoots
- dieback of larger branches in crown
- black necrotic tissue on stems and branches
- longitudinal or spiraled cankers, often sunken with callused margins

SIGNS

- spores in cankered area

Photo by Ralph Byther, PNW Disease Handbook

Mushroomobserver.org

madrone canker (*Neofusicoccum arbuti*)

MANAGEMENT

- initial dieback in foliage and shoots
- dieback of larger branches in crown
- black necrotic tissue on stems and branches

Mushroomobserver.org