BASTARD TOADFLAX- COMANDRA

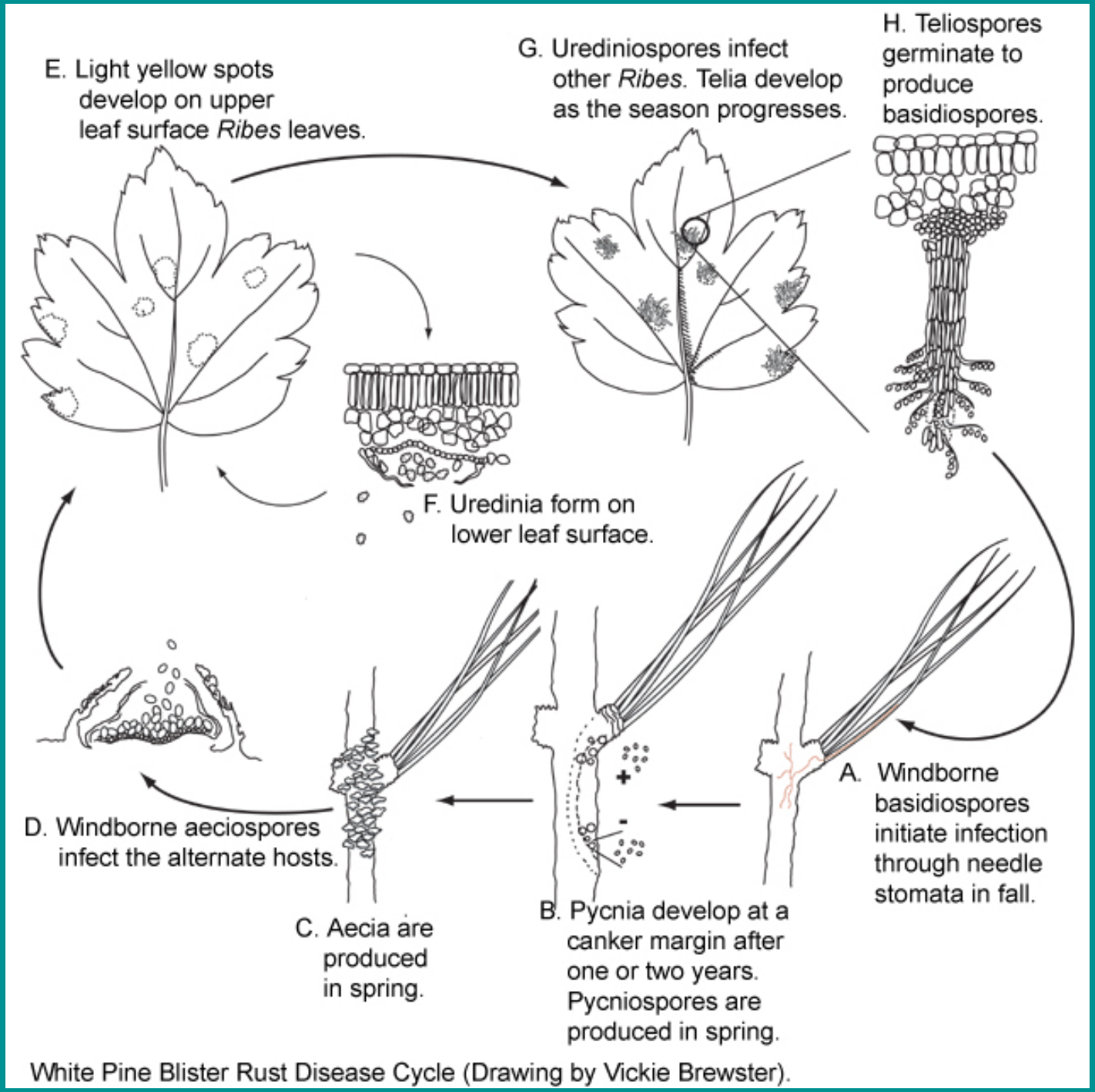
Fat Bastard
Toadflax

White pine blister rust, a nonnative invasive pathogen

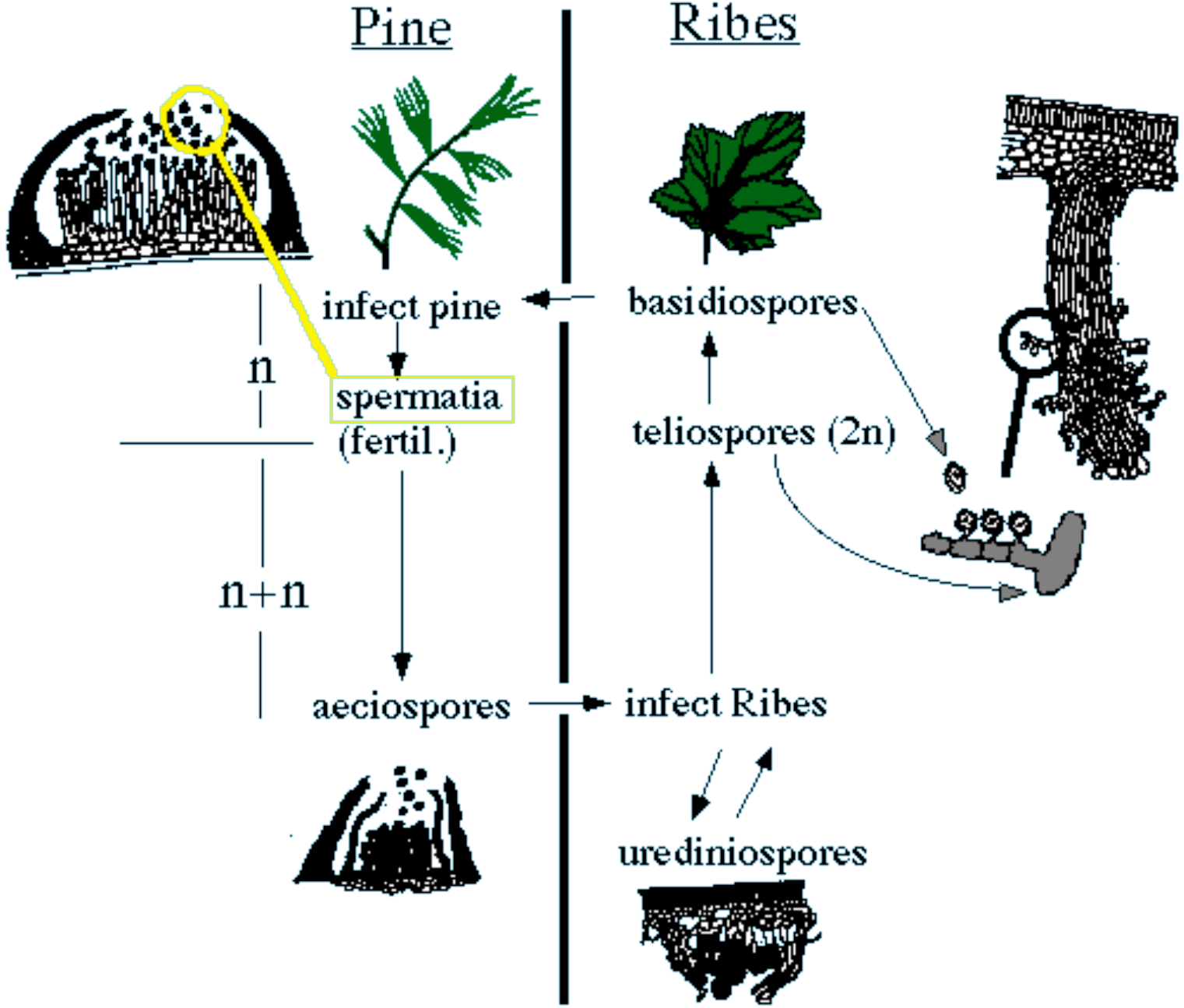
Aecial pustules of Cronartium ribicola on western white pine

young branch canker

White Pine Blister Rust uredinial spore stage on underside of Ribes leaf

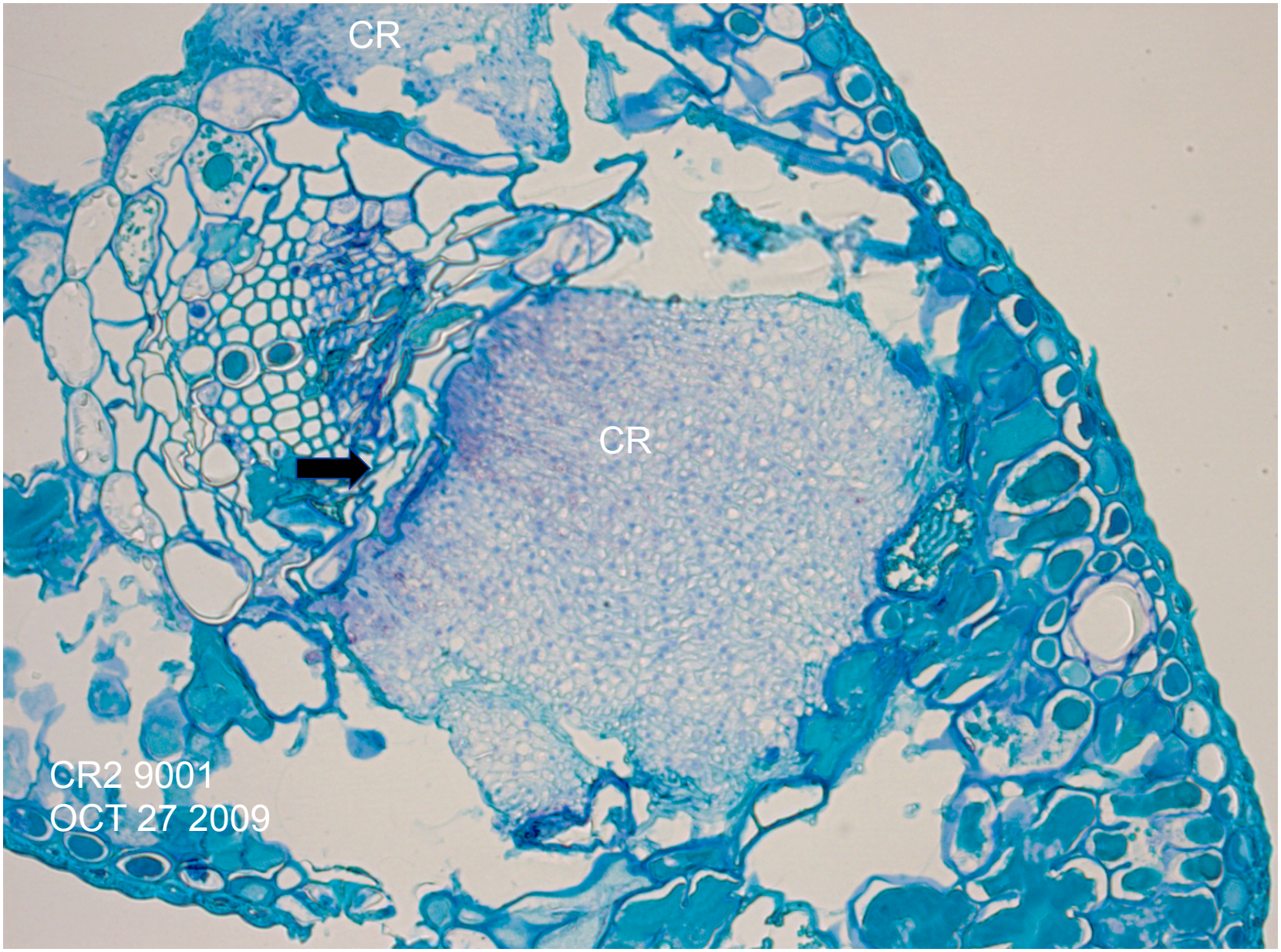


White Pine Blister Rust Disease Cycle (Drawing by Vickie Brewster).


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

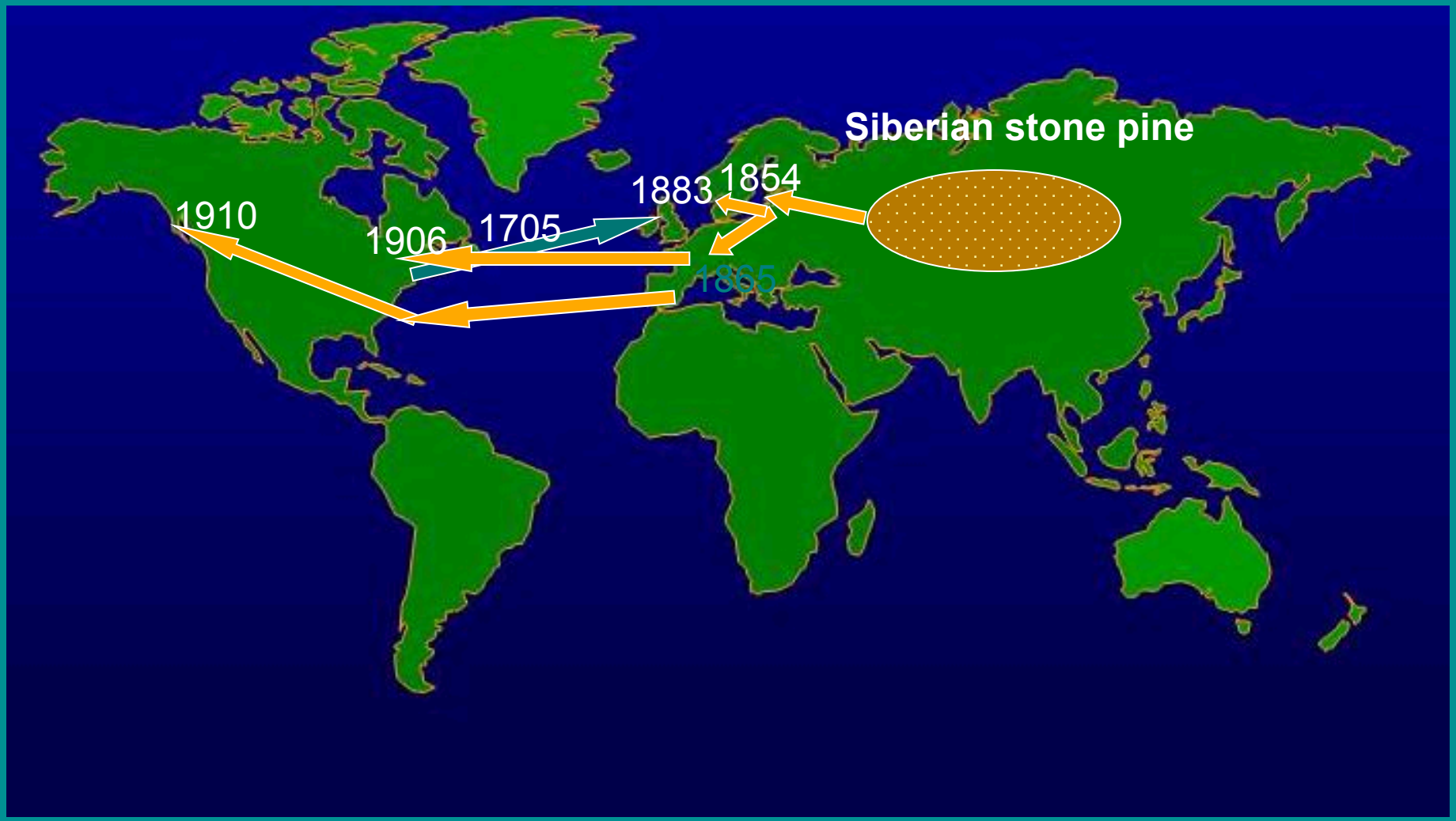
Spots on needles are sites of White Pine Blister Rust infection by basidiospores

Early colonization in HR phenotype Western White Pine



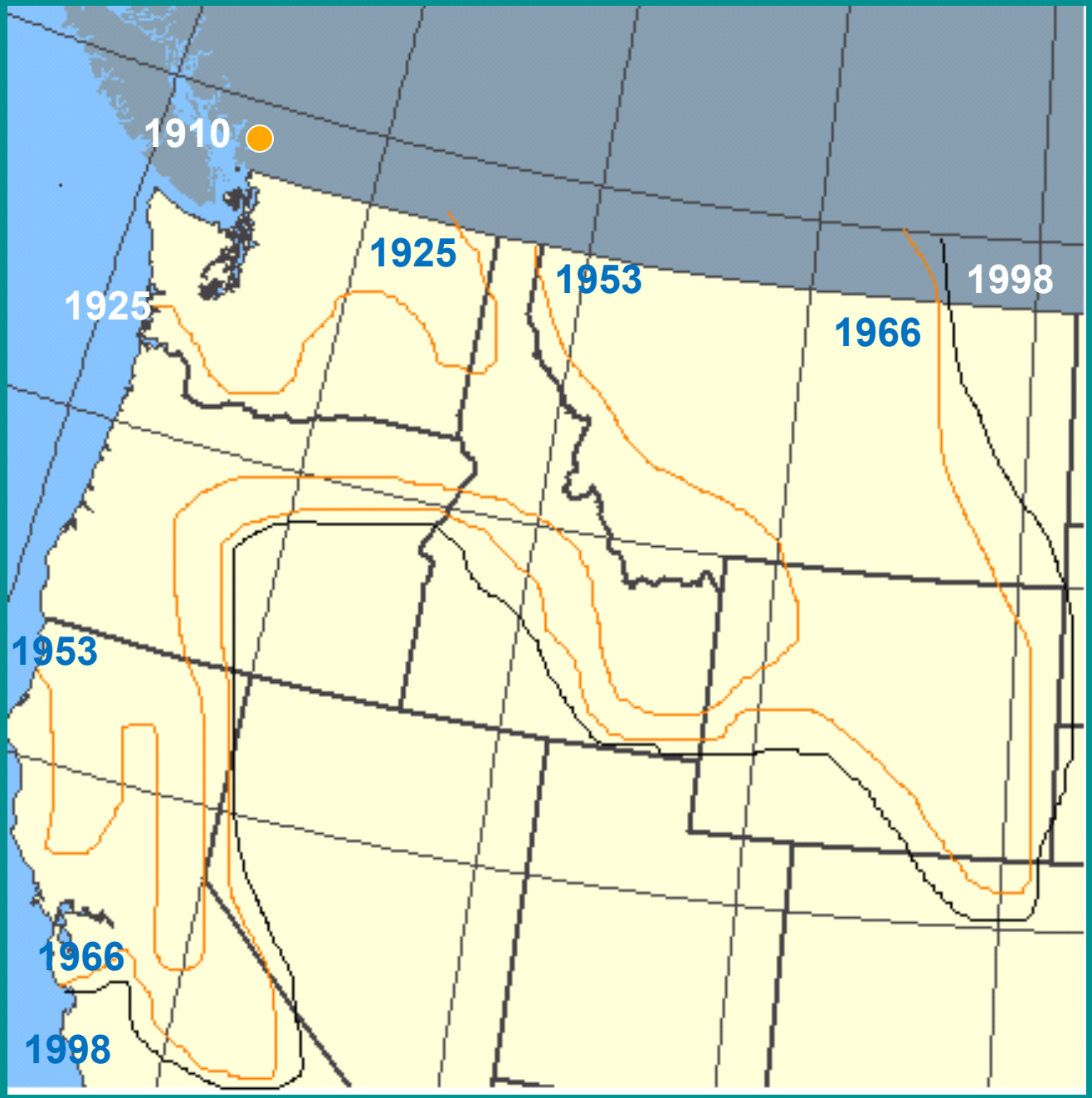
PYCNIA—not infective spores, function is sexual reproduction

A Ribes plant next to a young white pine tree killed by white pine blister rust



1705 *Pinus strobus* introduced to Europe
Blister rust found in Estonia in 1854, Finland 1861, Germany 1865, Denmark 1883.
Established throughout Europe by 1900.

Geneva, NY in 1906 traced to nurseries in Germany and France
Vancouver, BC 1921, from *P. strobus* seedlings from France, 1910



Spread of White Pine Blister Rust in Western North America 1910-1998

WPBR spread in episodic pulses (wave years)

affects all 5-nedle pine species

Whitebark pine, one of the last species to be affected by the spread of White Pine Blister Rust

Figure 6—Whitebark pine is frequently infected and killed by white pine blister rust. (Photo by Robert Danchok.)

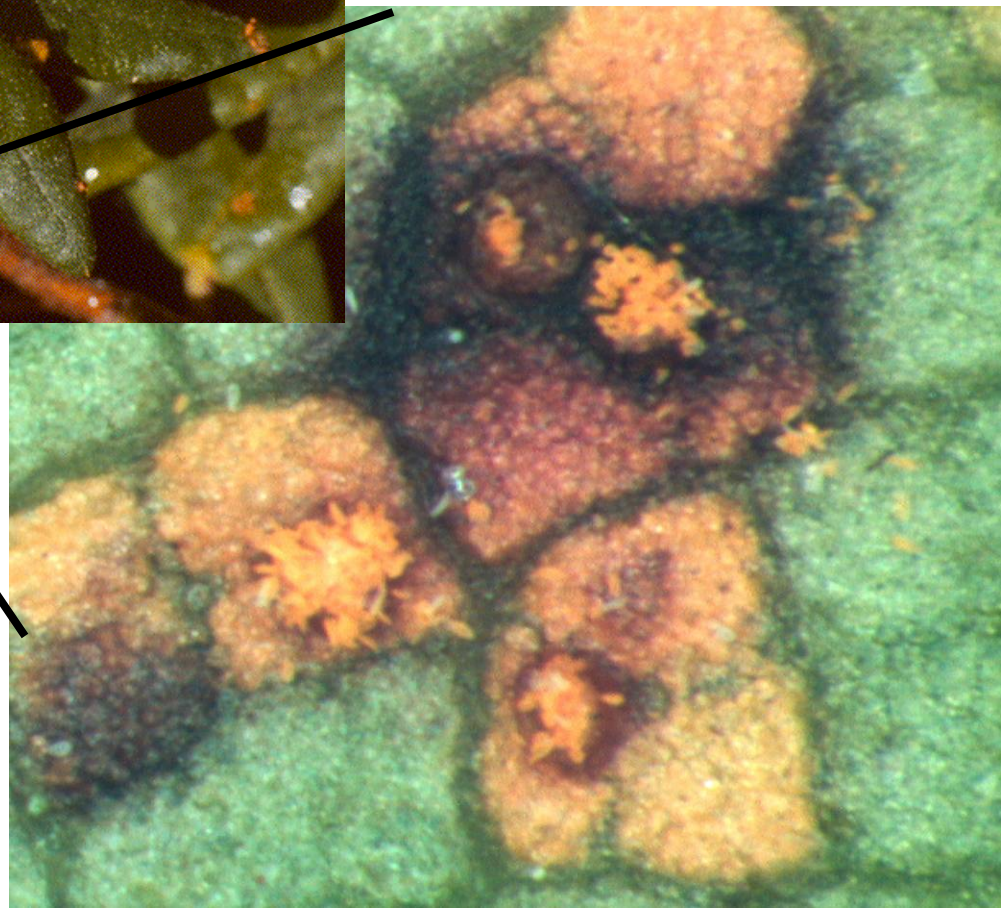
Figure 11—Tops of about a third of the whitebark pine in the Umpqua Pacific Crest National Scenic Trail survey were killed by white pine blister rust. (Photo by Ellen Goheen.)

Goheen et al 2002. USDA FS PNW GTR 542

Foliage Rusts

Chryosomyxa piperiana aecia on sitka spruce

Pucciniastrum vaccinii aecia on hemlock



Uredinia of

Chrysomyxa piperiana on

Rhododendron

Pucciniastrum goeppertianum
Fir – blueberry rust, witches broom rust of blueberry

Telia cause abnormal growth on Vaccinium spp.

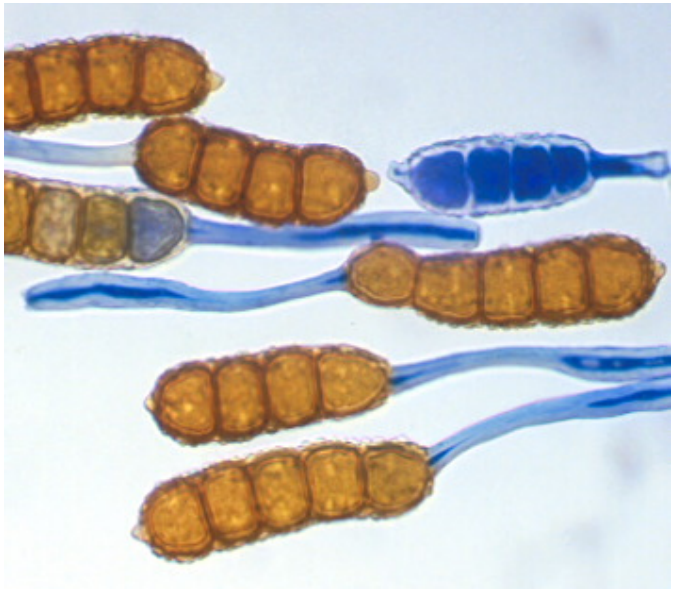
No Uredinia are produced – **demicyclic**

Aecia on Abies spp.

Gymnosporangium libocedri

Telia of Gymnosporangium libocedri

Rosacae are parasitized by species of *Phragmidium*



Phragmidium rosae

Phragmidium mucronatum

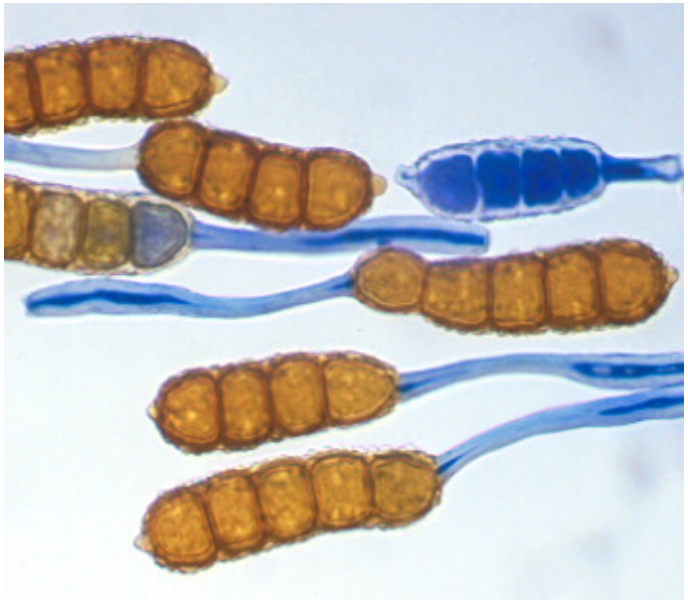
All Phragmidium species are autoecious, some spp are microcyclic

Blackberry rust, *Phragmidium violaceum*

Aecia on a stem

Aecia on a leaf (summer)

Telia on a leaf (Fall/Winter)



Telia magnified

Rusts of Broadleaved Trees

Foliage Rusts

Melampsora medusae

Hosts: Populus deltoides, Populus tremuloides

All conifers, esp. Douglas-fir, larch

Distribution: Mainly e North America

found in hybrid poplars in PNW in 1991

Melampsora occidentalis

Hosts: Populus trichocarpa

all conifers, esp. Dougals-fir, larch

Distribution: w North America

Melampsora larici-populina exotic, invasive

Hosts: Populus spp.

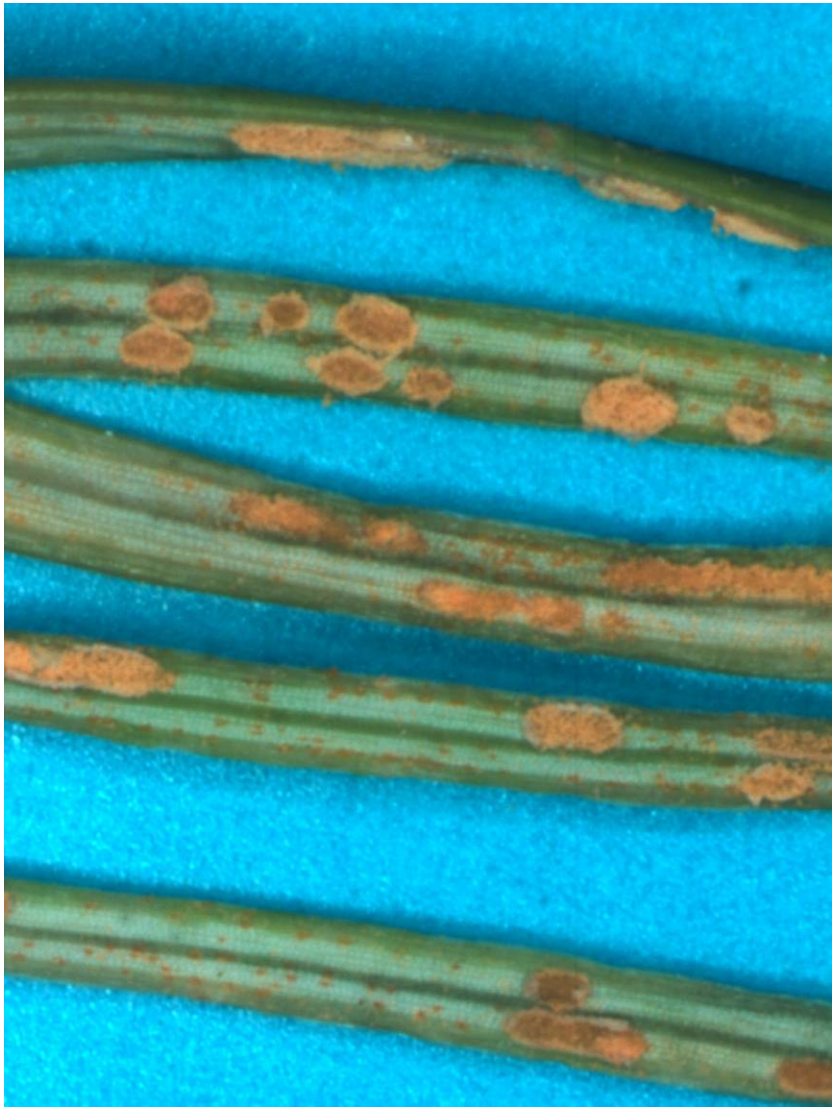
all conifers, esp. Douglas-fir, larch

Distribution: Eurasia, found in PNW in 1995

All Melampsora species macrocyclic, heteroecious

alternate between poplars and conifers

Melampsora occidentalis, M. medusae, and M. larici-populina



MELAMPSORA RUST- *MELAMPSORA OCCIDENTALIS*

DOUGLAS-FIR- COTTONWOOD

Hybridization in poplar rusts: new genetic combinations and new host ranges

Prior to 1991, no reports of any leaf rusts on P. trichocarpa x P. deltoides hybrid clones

M. occidentalis is not pathogenic on P. trichocarpa x P. deltoides even though it is virulent on P. trichocarpa

Since 1994, increasing poplar rust has been found on P. trichocarpa x P. deltoides clones

Hybrids between M. medusae and M. occidentalis have intermediate
characters (spore characters etc)

Resultant hybrids named M. x columbiana
have broader host ranges than either parent species

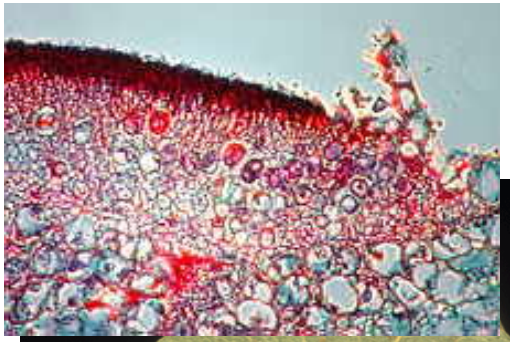
Hybridization between pathogen species brought together by human activity means greater pathogen diversity, more potential for disease on disease resistant trees

Eocronartium muscicola
Pucciniomycotina, Platygloeales

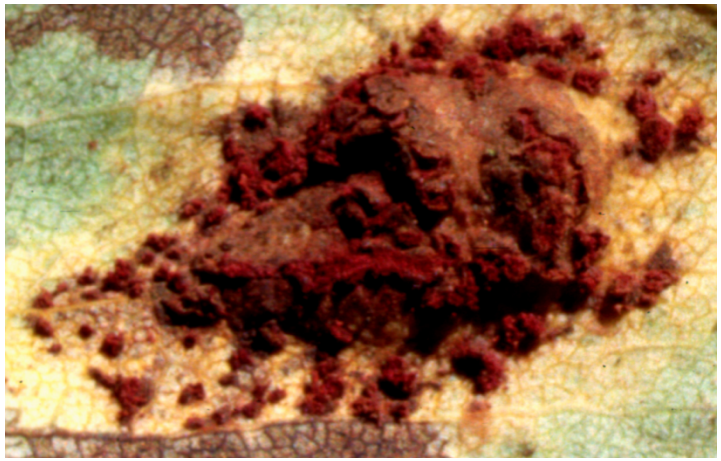
Tuberculina- Helicobasidium, rust parasites, rust relatives

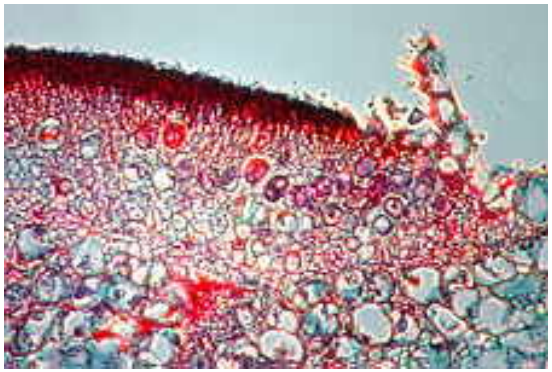
DNA sequence analysis, septal pore structure confirms that *Tuberculina* is closely related to rust fungi and is asexual state of Helicobasidium, a plant root parasite

New Order: Helicobasidiales



Helicobasidium, Pucciniomycetes, Helicobasidiales

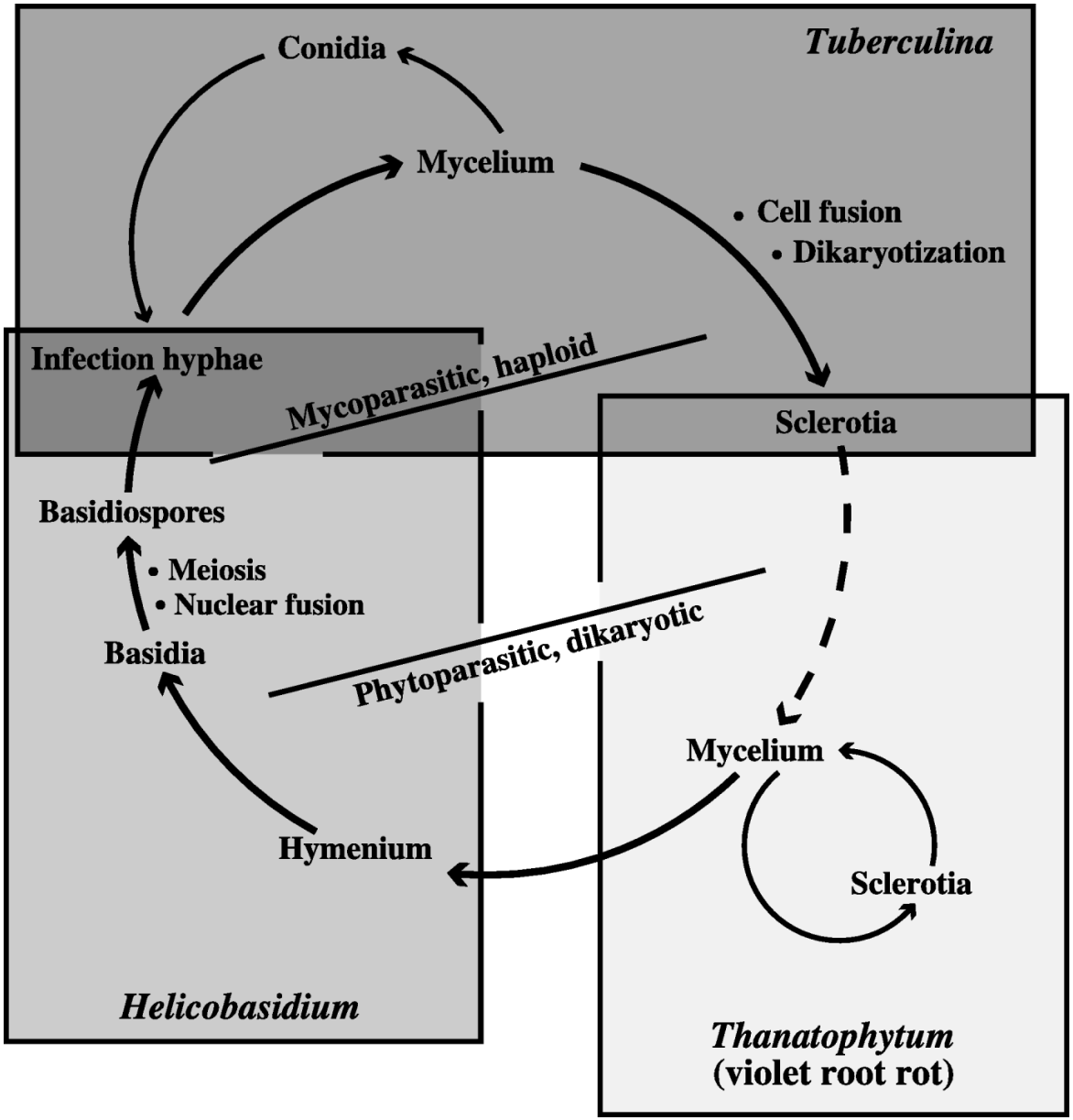




Tuberculina overgrowing a phytoparasitic rust

Helicobasidium/Thanatophytum violet root rot

Life cycle of Helicobasidium-Tuberculina



Basidiospores (n) of Helicobasidium can only infect the spermogonial (n) stage of the host rust.

Only one mating type of Helicobasidium is able to infect the complementary mating type of the host rust.

Alternates between plant parasitic and mycoparasitic phases.

Septobasidium, Pucciniomycetes, Septobasidiales

Basidiomycota

Pucciniomycetes (Urediniomycetes), Septobasidiales

about 170 species

Septobasidium is related to rust fungi

only group of Urediniomycetes that are insect parasites

- Basidia transversely septate
- Parasite of scale insects, which do not die but become sterile