ForHeal

Mihi cura futuri

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FOREST PATHOLOGY

Erasmus+

What is Plant Pathology (Phytopathology)?

Plant pathology is the study of the biotic and abiotic agents that cause disease in plants; of the mechanisms by which these causal agents induce disease in plants and of the methods of preventing or controlling disease and reducing the damage caused.

What is Plant Disease?

A plant disease is usually defined as abnormal growth and/or dysfunction of a plant. Diseases are the result of some disturbance in the normal life process of the plant.

Diseases of the forest-tree species

Causal agents

Diseases induce organisms called a pathogens.
Pathogen can be only living organism such as a virus bacterium or fungus.

According to the way of nourishment,
we can divide them into three groups:

saprophytic
parasitic
symbiotic

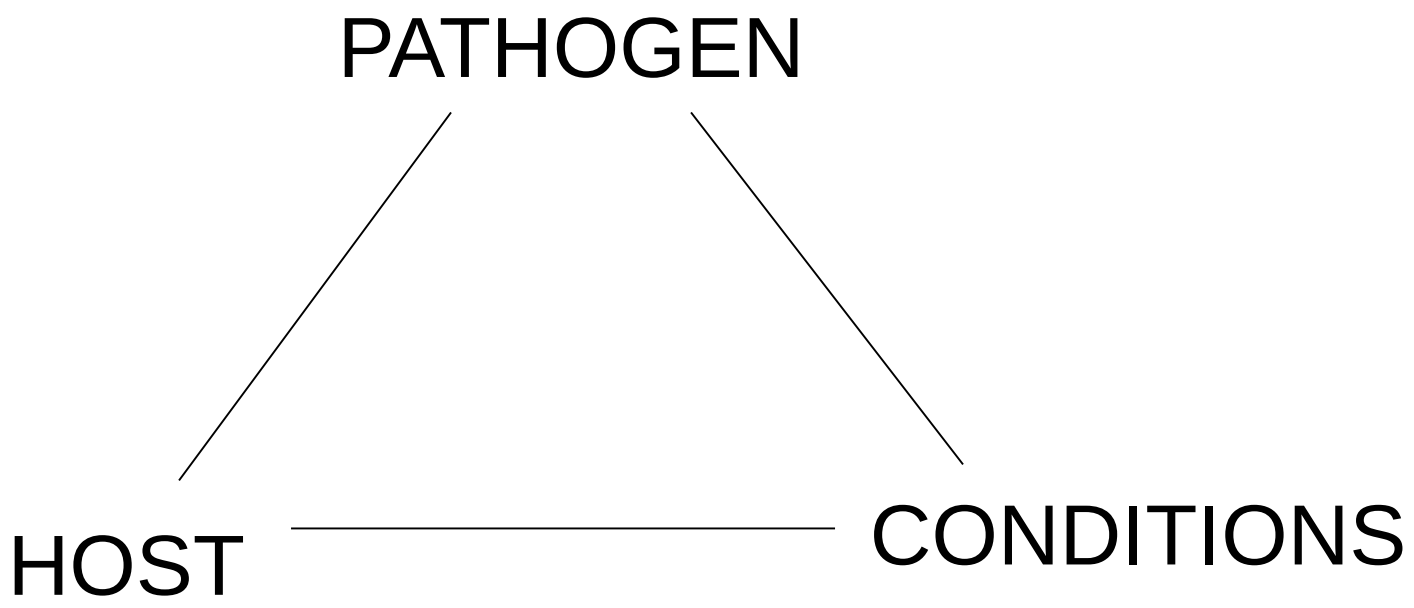
- **Obligate saprophyte**
  - decays dead organic matter

- **Facultative saprophyte**
  - an organism that is usually parasitic but may also lives as a saprophyte

- **Obligate parasite**
  - a parasite that can only feed on the living tissues of the host
  - does not grow on artificial culture medium

- **Facultative parasite**
  - an organism that is usually saprophytic but which under certain conditions may become parasitic e.g. a fungus capable of operating at two trophic modes - decomposer and consumer

DISEASE
(Triangle of pathogenicity)



What are fungi?

Eukaryotic, spore-bearing, heterotrophic organisms that produce extracellular enzymes and absorb their nutrition.

Spores - a minute propagative unit functioning as a seed, but differing from it in that a spore does not contain a preformed embryo

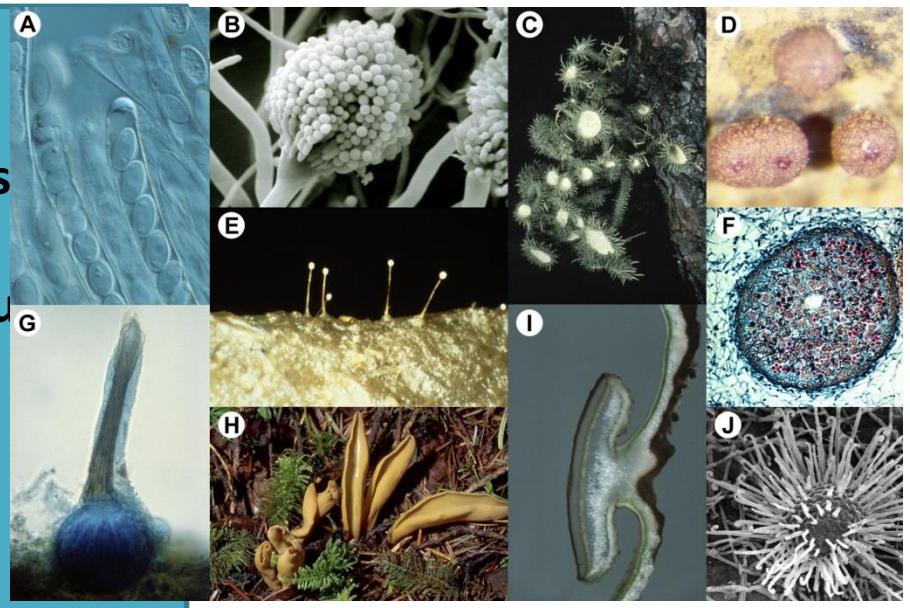
Fruiting body - any complex fungal structure that contains or bears spores; a sporocarp

Classification

- **Kingdom Fungi**
  - Division: Microsporidiomycota
  - Division : Chytridiomycota
  - Division : Zygomycota
  - Division : Glomeromycota
  - Division: Ascomycota
  - Division: Basidiomycota

Ascomycota:

- septate mycelium
- production of endospores (ascos
in an ascus
- often dominant asexual reprodu



Basidiomycota:

septate mycelium

- production of exospores (basidiospores) on a basidium
- production of complex sporocarps

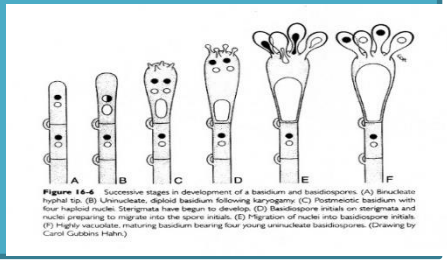
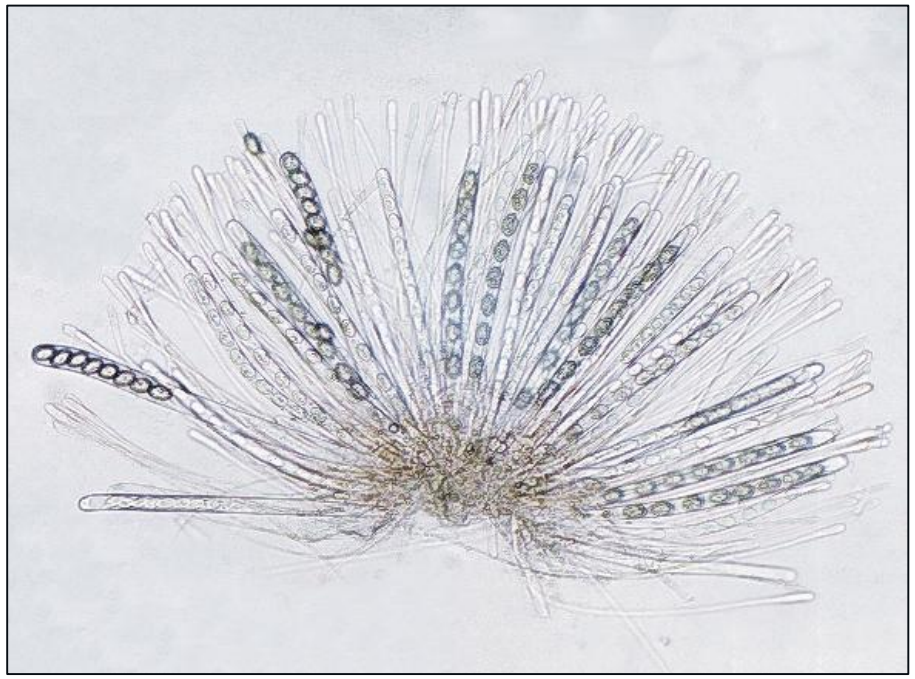


Figure 16-6 Successive stages in development of a basidium and basidiospores. (A) Binucleate hyphal tip. (B) Uninucleate, diploid basidium following karyogamy. (C) Postmeiotic basidium with four haploid nuclei. Sterigmata have begun to develop. (D) Basidiospore initials on sterigmata and nuclei preparing to migrate into the spore initials. (E) Migration of nuclei into basidiospore initials. (F) Highly vacuolate, maturing basidium bearing four young uninucleate basidiospores. (Drawing by Carol Gubbins Hahn.)

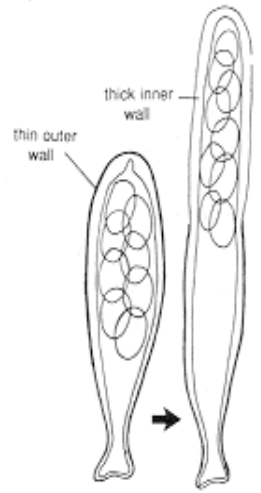
Ascomycota (Sac fungi)

- Sexual spore (ascospores) are in **ascus** and asci are usually (but not always) encased in ascocarps
- Asexual conidiospores are common

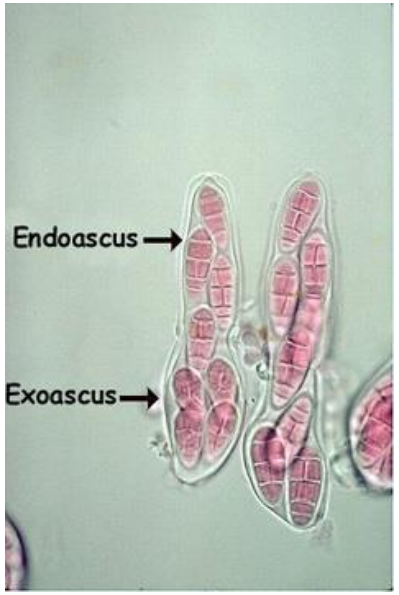


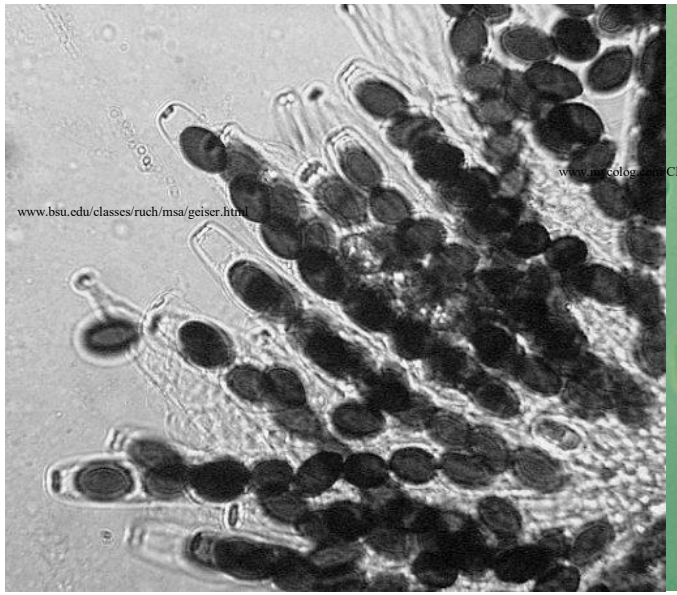
Ascus

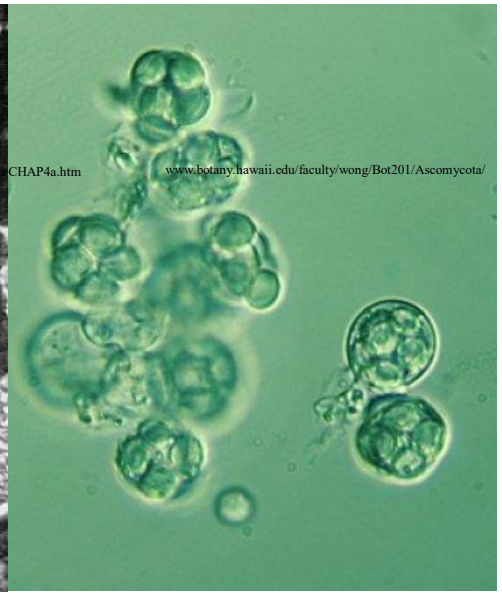
- round to clavate to cylindrical



Bitunicate asci





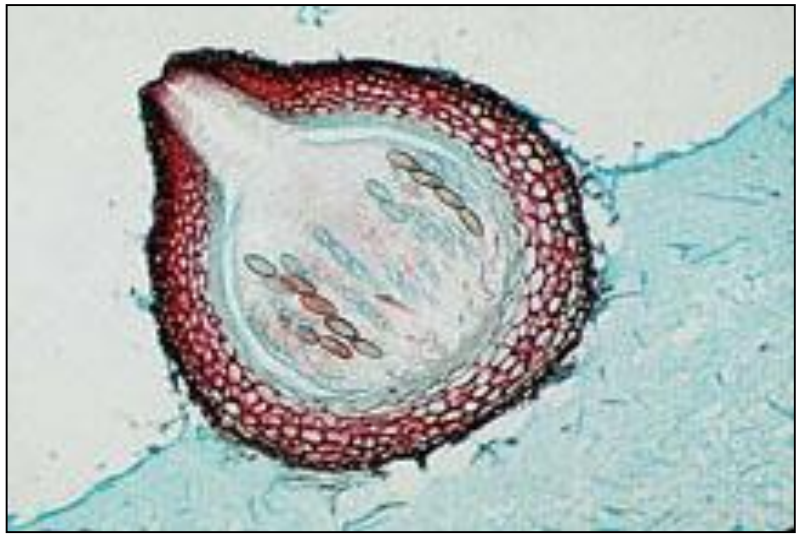


Hymenium

- fertile tissue of ascocarp

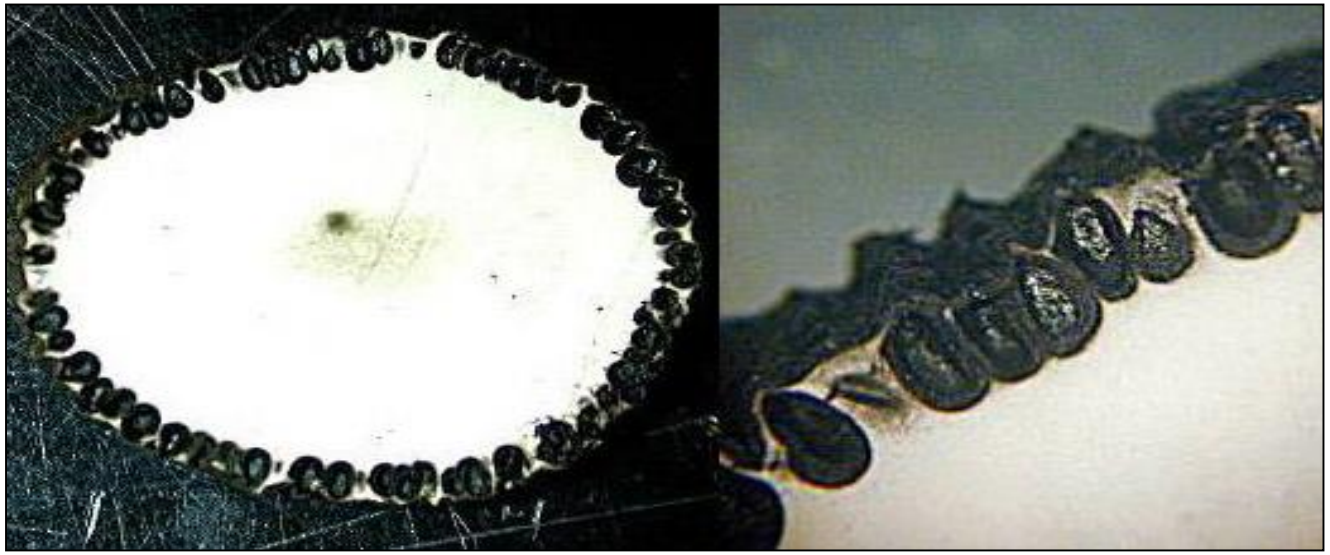
Perithecium

- **flask-shaped sporocarp**



Stroma

- mass of fungus hyphae containing fruiting-bodies with spores(pl. stromata)



stroma

stroma

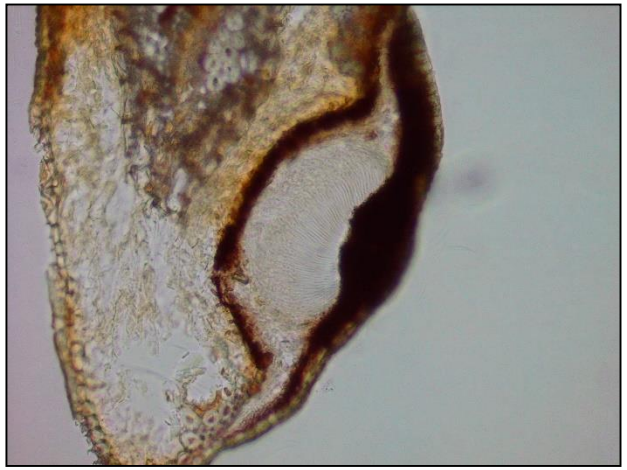
Xylaria hypoxylon

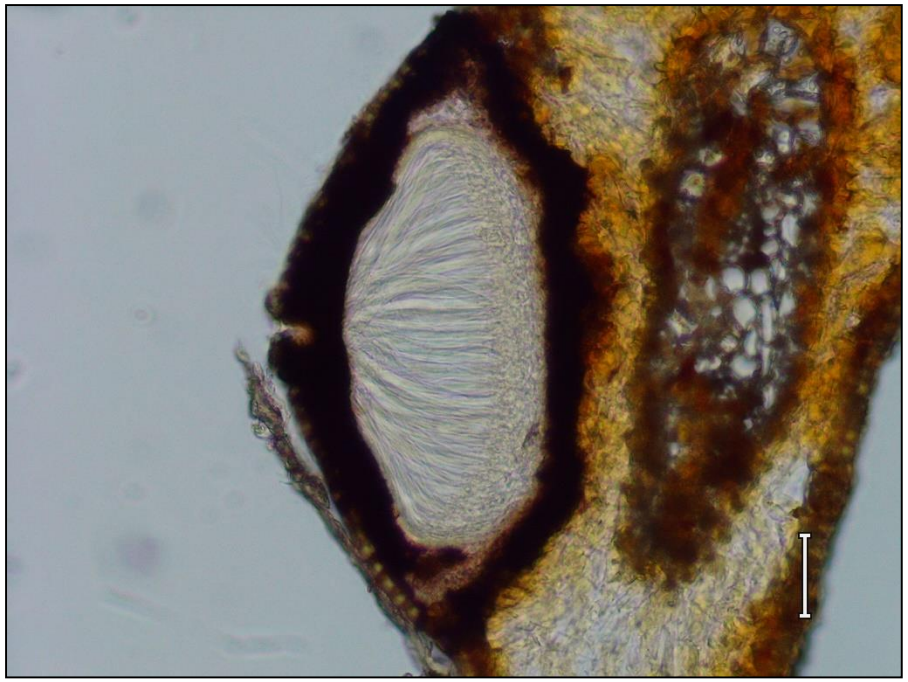
Apothecium

- cup-shaped sporocarp

hysterothecium

hysterothecium





Open hysterothecium with sacs (asci)

Terminology

Ascomycetes may have two distinct reproductive phases

- **sexual: with asci and ascospores = Teleomorph**
- **asexual: with conidia = Anamorph**

- Ascomycetes classification is based on teleomorphs

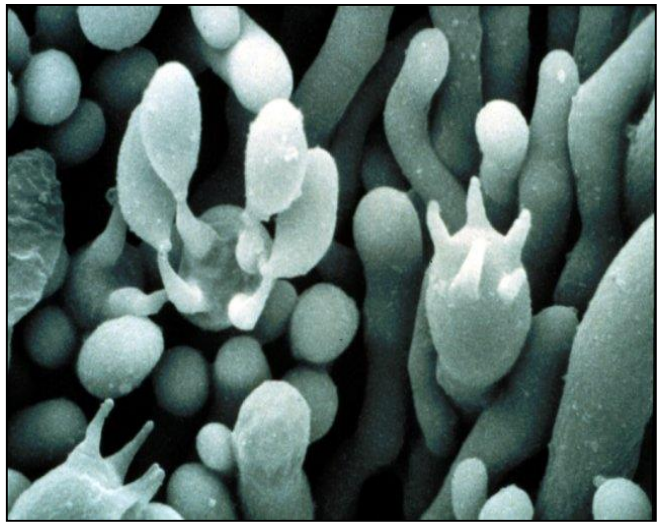
- Many ascomycetes are known only by their asexual stages

Basidiomycota

(Club Fungi)

- **Sexual spores are produced on the ends of club-like hyphae (basidia)**

- **Basidia are usually located in specialized regions or tissues**
- **(gills or pores)**
- **Asexual spores can (but don‘t have to) occur**



Basidiomycota: Agaricomycetes

- basidioma(ta) is the formal term used to designate the basidiocarp or the sporocarp (= fruiting body) of basidiomycetes

- basidiomata are quite variable in a shape (the mushroom, puffball, bracket, etc.)

3 Major Classes of the Basidiomycota

Urediniomycetes
rusts

Ustilaginomycetes
smuts

Agaricomycetes
mushrooms, shelf fungi
jelly fungi, coral
crusts, puffballs

Urediniomycetes (rust fungi)

- To complete the life cyklus, very often they need 2 hosts

Spores:

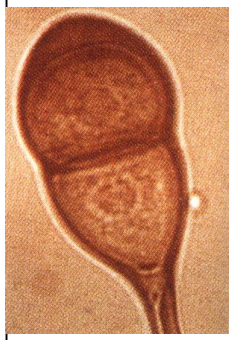
Spermacie – in spermogonia

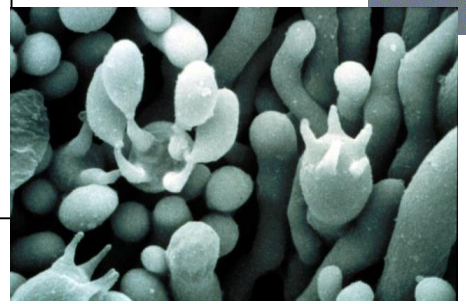
Aeciospores – in aecia (pustules) mostly orange or yellow

Uredospores – in uredia mostly yellow or brown

Teliospores – in telia mostly nearly black

Basidiospores – on basidia

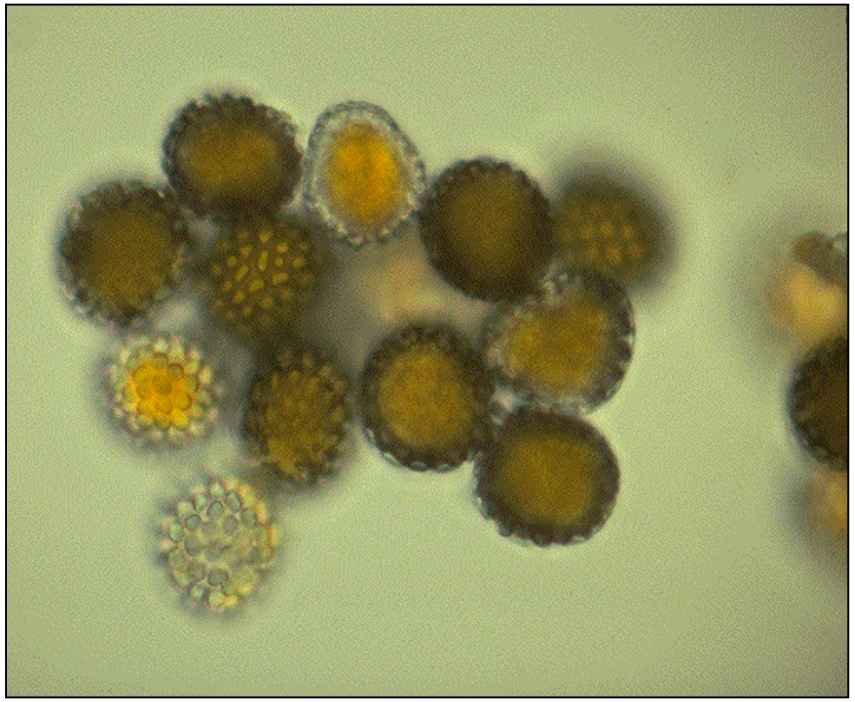




Uredinales: ***Chrysomyxa pirolata***

aeciospores produced beneath the cone scales of spruce cones

Chrysomyxa pirolata
urediniospores



Orange-yellow urediniospores produced in uredinial pustules

Phragmidium mucronatum

teliospores

Gymnosporangium sabinae (pear rust)

- Rust diseases are fungi with alternate hosts: pear trees and *Juniperus sabinae*
- On **pears** typical leafspot appears first
- From the leaf spots protrude **aecia**
- These aecia bear the **asexual aeciospores**
- Spores can be carried long distances in the wind and thus infect nearby junipers

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Gymnosporangium sabinae

- On **junipers** the rust causes the development of swollen twigs
- These swellings are **teliospore** masses also called telial galls
- **Telial galls** swell up to a few centimetres wide
- Teliospores produce the **sexual spores** on a basidium
- These teliospore masses eventually ooze an orange gelatinous substance

Disease symptoms

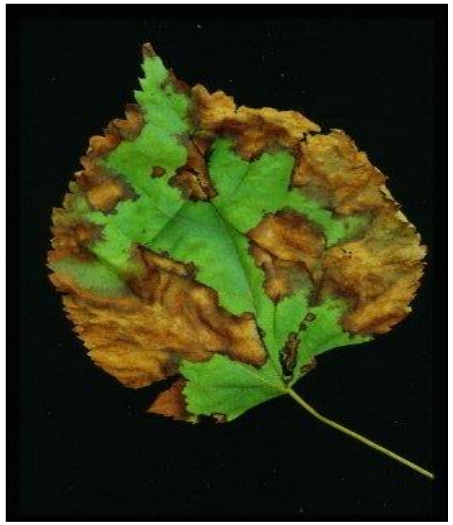
- **Necrosis**

- Tissue death resulting in scorch, shot hole or other symptom of dead tissue:

color changes, necrotic lesions, wilting, dieback

Color changes

Necrotic lesions



Damping off
necrosis of collar

Bark necrosis

Exudation

„bleeding canker“

Exudation of small droplets honey-yellow or milky-white ooze

Wilting and drying up

Dieback

Canker

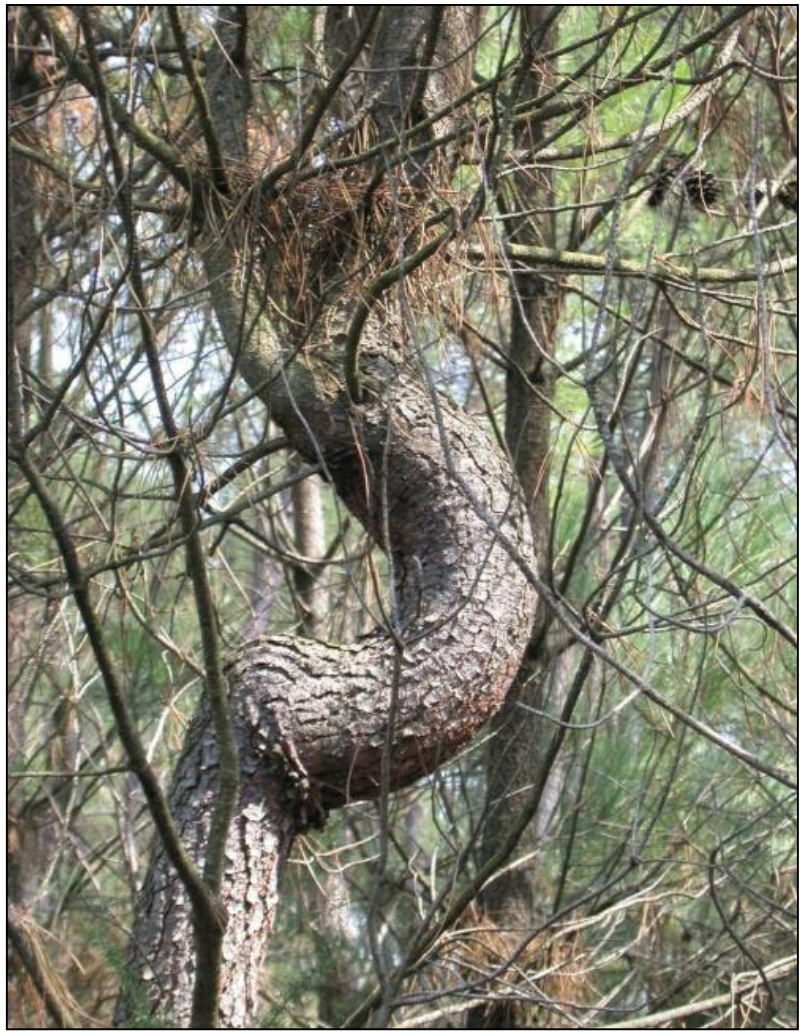
Canker

Swelling

Tumor disease

Witch brooms

Twisting



Deformation

Disease Control

- Protection
- Exclusion
- Eradication
- Therapy

Disease Control
- Protection -

- Surface
- Precludes a pathogen from contacting a potential host

- Systemic
- Introduce a chemical into the host to kill pathogens attempting to colonize them at some later time

- Silvicultural
- Maintain vigorous stands of trees which are better able to biologically exclude infection from occurring

Disease Control

- Exclusion -

- Vector Control
- Prevent vectors from attacking potential hosts

- Quarantine
- Prevent the spread of disease by not allowing movement of infected host material into or out of specific areas

- Chemical / biological treatment
- Fungicidal treatment of potential hosts or habitats, genetic manipulation of hosts or pathogens, culling of diseased stock prior to planting

Disease Control
- Eradication -

- Removal of diseased parts or individuals

- Pesticidal (chemical or biological) treatment
- Similar to exclusion – kills pest organism

- Habitat modification
- Removal of bark to kill vectors or dessicate pests, fumigation of soil or plant parts, dormant sprays of trees, destruction of infected host material by fire or other treatment, etc.

Disease Control
- Therapy -

- Generally involves the use of systemic selective chemicals - chemicals which are pest selective and host neutral or beneficial

- Physical or Environmental Methods - removal of an environmental element which is leading to disease or damage