

PLP 3002
Rust and Smut Fungi

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- Obligate parasites
- Basidiomycetes

Historical implications

- Coffee rust
 - Sri Lanka / Brazil
 - Tamils / Sinhalese
- Wheat rust
 - Joseph (East wind)
 - Robigus (East wind)
 - Middle East conflicts

Historical implications

- Smut
 - Medieval baker
 - Saddam Hussein / “Dr. Germ”

Disease tetrahedron / triangle

- Host (monoculture)
- Pathogen (origin / races)
- Environment (moisture)
- Time
 - Rust / urediospores
 - Smut / germ warfare

Nuclear condition of Basidiomycetes

- Basidiomycetes (and *Rhizoctonia*, *Sclerotium*, Dikaryotic mycelium)
 - $1N + 1N$
 - Plasmogamy not karyogamy
- Ascomycetes (and most Deuteromycetes)
 - Haploid mycelium (1N)

Nuclear condition of Basidiomycetes

- Zygomycetes
 - Haploid mycelium (1N)
- Oomycetes
 - Diploid mycelium (2N)

Basidiomycetes

1. Meiosis takes place in basidium
2. Basidium forms four 1N basidiospores
3. Basidiospores form 1N hyphae
4. Anastomosis (plasmogamy, not karyogamy)
5. Dikaryotic (N + N) hyphae predominates

Wheat rust life cycle

- *Puccinia graminis f. sp. tritici*
- Long-cycled (= macrocyclic), heteroecious

Wheat
(Triticum / Poaceae)

1. Black teliospores in sori
($1N + 1N > 2N$)
2. Telia germinate to form basidium
($2N > 1N$)
3. Four basidiospores from each basidium
($1N$)

European barberry
(Berberis /
Berberidaceae)

1. Basidiospores germinate, infect barberry
2. Spermagonia / spermatia form
3. Cross-fertilization spermagonia /
spermatia ($1N + 1N$)
4. Aecia formed
5. Aeciospores infect wheat (primary cycle)

European barberry
(Berberis/ Berberidaceae)

6. Uredia formed on wheat
7. Urediospores re-infect wheat
(secondary cycle)
8. Teliospores appear in sori (uredia)

Coffee rust (Hemileia vastatrix)

- Life cycle like wheat rust
 - Heteroecious & macrocyclic (presumed)
 - Alternate host is unknown
 - Ethiopian origin (*Coffea arabica*)

Coffee rust impact on

- Sri Lanka politics
- British drinking habits

Chronology

- Tamil laborers (southern India)
- 1870 coffee rust introduced
- By 1900 impossible to grow coffee
- Coffee production shifted to Latin America
- Tea was substituted for coffee
- Tamil population never assimilated into Sinhalese society

Coffee rust in Ethiopia

1. Coffee rust now in South America
2. Coffee is grown as a monoculture in places like Brazil
3. Coffee species not exported
4. Genes for resistance to *H. vastatrix*
5. Loss of *Coffea* habitat
