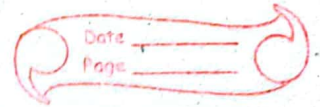


Fungi



Kingdom Fungi

- Term 'Fungus' derived from latin word which means Mushroom.
- Study of fungi is Mycology / Mycetology.
- Father of Mycology - P. Michelli
- Father of modern mycology → Anton De Bary
- Father of Plant Pathology

General facts of fungi.

- Heterotrophic, thallophyte.
- eukaryotic, achlorophyllous, decomposer
- non-vascular, spore bearing
- reserve food is glycogen and oil drops.
- cell wall is chitin / fungal cellulose. $[C_{22}H_{34}N_4O_{21}]_n$ made up of

Plant body

- Thallus, filamentous, branched plant body is called Mycelium.
- The unit structure of Mycelium is Hyphae.

Mycelium :- on the basis of septa, it is 2 types:-

- multinucleated in Ascomycetes.
- aseptate → uninucleated in Basidiomycetes and Deuteromycetes.

Note

by aseptate and multinucleated :- Phycomycetes. (coenocytic hyphae)

Septa contain pore which may be

- i) Simple - ascomycetes
- ii) Doliopore - basidiomycetes

JOY

Modification of Mycelium :-

Plectenchyma :- mycelium is interwoven to form web like structure.

If woven is

tightly / compact structure - Pseudoparenchyma.

loose arranged - Prosoplectenchyma.

Rhizomorph

Mycelium ^{interwoven} to form > thick cord like structure (root) called rhizomorph

Rhizomorph helps in absorption and support.

Sclerotium :- Mycelium forms penetrating or compact resting structure.

Similarities between algae and fungi :-

plant body not differentiated called thallus.

Vascular tissue (xylem and phloem) absent.

Sex organs (gametangia) are unicellular, non-jacketed.
@ GUNJA

embryo formation absent

asexual reproduction occurs by asexual spores called mitospores.

characters

Algae

Fungi

Habitat → mostly aquatic → mostly terrestrial.
→ well exposed / light condition → dark and moist condition (moisture loving).

chlorophyll present absent

mode of nutrition autotrophic heterotrophic.

reserve food material starch glycogen.

cell wall cellulose ~~cell~~ chitin.

Types of parenchyma true parenchyma pseudoparenchyma.

Sex organs gradual elaboration of sex → reduction in sex-organ from
organ from lower to higher lower to higher fungi.
plants (cyanophyceae to chlorophyceae) (phycomycetes to deuteromy-
cetes).

Habitat of fungi

- fungi occurs in variety of habitat - ubiquitous.
- most of fungi are moisture loving, terrestrial.
- fungi found on
 - dung - coprophilous fungi
 - wood - saprophytic fungi
 - hair and nail - keratinophilous fungi
 - aquatic condition - monoblepharis and saprolegnia.

water moulds.

Nutrition in Fungi

→ mostly heterotrophic mode in nutrition bcoz chlorophyll is absent. Its types are:-

a) Saprophytic :- grow on dead and decaying organic matter.

Eg) dung :- mucor

bread :- Rhizopus (bread mould)

fruit/jellies/jam :- Penicillium (blue mould)

b) Parasitic :- depends on host body for nutrition. Its types are:-

* Obligate parasite :- Eg. Puccinia

* Facultative parasite :- Eg. Rhizopus (mp)

→ are actually saprophyte, but can also live as parasite.

c) Symbiotic

→ Ascomycetes and basidiomycetes live in symbiotically association with algae :- lichen.

→ fungal hyphae + root of higher plant - Mycorrhizal root present in pinus.

→ Mycorrhizal root ^{helps} ~~present~~ to uptake mineral (mainly phosphorus).

→ Fungal hyphae mainly helps in absorption of phosphorus.

Its 2 types are:-

a) Endomycorrhiza :- penetrates the root of cortex and produce swollen structure called vesicles and branched structure called arbuscules.

→ common fungi - Ascomycetes.
→ common plants: lower plants like orchids, cereals.

→ endomycorrhiza also known as VAM (vesicular arbuscular mycorrhiza)

b) Ectomycorrhizal.

→ ~~fungi~~ fungi resides on outer surface of roots.

→ helps in absorption of moisture, N_2 , K, Ca, P, etc.

common fungi: Basidiomycetes.

common plants: Pinus, Oak, Peach, Eucalyptus @ POPE.

Reproduction in Fungi

1) Vegetative method

a) Fragmentation

hyphae → break into pieces → develop into new fungi

Eg) Rhizopus, Mucor, Aspergillus

b) cell division / binary fission

→ simplest method of reproduction

Eg) yeast (unicellular)

c) Budding

→ most common method of reproduction in yeast

YS → pseudomycelium is formed in yeast.

d) Oidia formation

Fungal hyphae break → numerous fragments called 'oidia'.

favourable condition → new hyphae. Eg) Rhizopus.

2) asexual method.

motile gamete

a) Zoospore :- Egs synchytrium.

b) Conidia :- thin walled, non-motile, exogenously produced on conidiophore.

Egs aspergillus and penicillium.

c) Aplanospore :- thin walled, non-motile

Egs Rhizopus, mucor.

d) Pycniospore :- small conidia-like body produced in flask shaped cavity called pycnia.

Egs Puccinia

e) Ascospore :- non-motile, ascus (usually 8 in no.)

Egs Ascomycetes.

f) Basidiospore :- club shaped basidium is produced exogenously.

Egs Basidiomycetes

3) Sexual method :- involves the fusion of protoplasm. retrogressive type.

a) Planogametic copulation :-

→ fusion of naked, non-motile

★ Plasmogamy :- fusion of protoplasm.

★ Karyogamy :- fusion of 2 haploid nuclei

★ Meiosis :- reduction division in zygote

Steps of sexual reproduction in fungi.

Types of plasmogametic copulation:-

- i) Isogamy :- most primitive type.
- ii) Heterogamy
→ anisogamy
→ oogamy

b) Gametangial contact

- 2 gametangia come close to each other but do not fuse.
- male gametangium
↓
tubular growth
↓
fertilization tube.
↳ through which non-motile male gametes migrate into female gametangium. Eg, oomycetes.

c) Gametangial copulation

- process of fusion of entire contents of 2 gametangia occurs by dissolution of common walls.
- Eg, zygomycetes

d) Spermatization :-

- spore like single celled structure is called spermatia which is non-motile male gamete.
- through water, wind, insect, spermatia or non motile male gamete goes to receptive hypha (female) and fertilization takes place. fusion hypha.
- Eg, Puccinia.

Somatogamy :- fusion of vegetative cell or hyphae.

Eg: Agaricus.

→ After karyogamy and meiosis, meiospore is formed.

Types of Meiospore :-

- | | | |
|-----------------|------------------|---------------|
| a) Basidiospore | - Basidiomycetes | → exogenous |
| b) Ascospore | - Ascomycetes | } endogenous. |
| c) Zygospore | - Zygomycetes | |
| d) Oospore | - Oomycetes | |

Classification :-

Kingdom Mycota

2 division

Myxomycota

↓ classes

Myxomycetes (Slime mould)

→ connecting link bet fungi and protozoa.

Eg: Synchytrium

↓ causes

wart disease

Eumycota (true fungi)

fungi perfect
sexual rep. ⊕

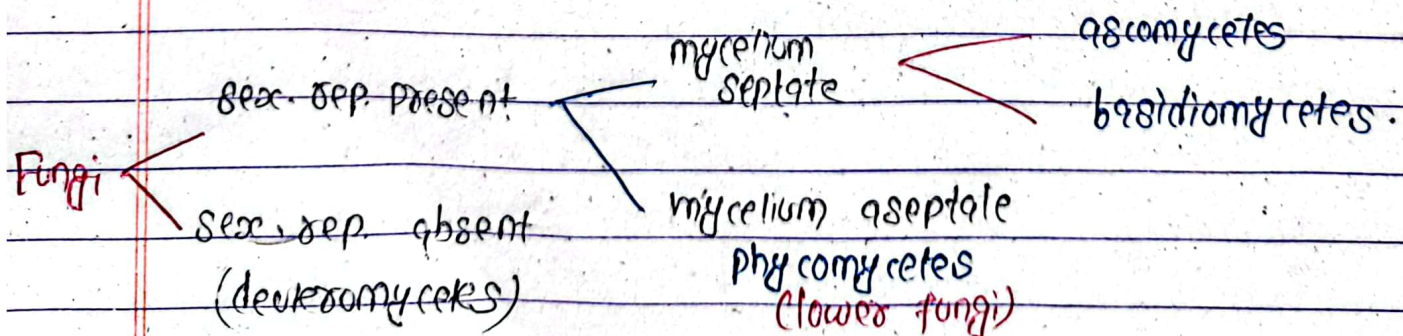
fungi imperfect
Sex. rep. ~~⊕~~ absent

Deuteromycetes

Phycomycetes
(Algal fungi)

Ascomycetes
(Sac fungi)

Basidiomycetes
(Club fungi)



1) Myxomycetes (Slime moulds)

- connecting link between protozoa and fungi
- cell wall is absent
- best material to study protoplasm.
- plant body is naked, amoeboid.
- vegetative phase is naked mass of protoplasm called pseudoplasmodium.

Note: pseudomycelium present in yeast.

2) Phycomycetes

- primitive type of fungi.
- primitive hyphae, aseptate and multinucleated hyphae called coenocytic hyphae.
- also called algal fungi / black moulds.
- divided into 2 subclasses:-

Characters	Oomycetes	Zygomycetes
Common name	egg fungi	conjugation fungi / zygosporic fungi
Asexual rep.	zoospore and conidia formation	sporangiospores
Sex. rep.	gametangial contact	gametangial copulation
Product of sex. rep.	oospore	zygospore
Eg.	<u>Pythium</u> , <u>Albugo</u> , <u>Phytophthora</u> @ <u>PAPoo</u>	<u>Mucor</u> , <u>Rhizopus</u> @ <u>MR Zygo</u>

3) Ascomycetes (Sac fungi)

- septate and multinucleated hyphae
- asexual reproduction: conidia exogenously.
- Conidiospores →
 - Branched Eg) Penicillium
 - unbranched Eg) Aspergillus.

→ Sexual reproduction :- gametangial contact → ascus →
 4-8 ascospores → ascocarp. mother cell.
 (endogeneous)

→ fruiting body of ascospore is Ascocarp. It is of 3 types:-

a) Apothecium :- cup shaped fruiting body

b) Perithecium :- flask shaped

c) Cleistothecium :- closed

Eg) Penicillium, Aspergillus, Neurospora, Yeast @ PANY

d) Hysterothecium - boat shape

4) Basidiomycetes (club fungi)

- most advanced fungi
- hyphae:- septate and uninucleated.
- Dolipore ~~on~~ septum and clamp connection is present.
- sexual spore:- basidiospore (exogenously).
- fruiting body:- basidiocarp.
- Sex organs are absent

Eg) Puccinia - rust

Ustilago - smut

Agaricus - mushroom

Amanita - poisonous

पूँजी Queen le afro King lai amanita
 Khungyao moridin

@ PUNA

5) Deuteromycetes (fungi imperfecti)

- Sexual stage is absent
- asexual rep. by conidia.

5g) Alteonaria, Fusarium, collectotrichum, Trichoderma. Fcat

Lifecycle of Nucor:

- Mucor also known as black mould / pin mould. / dung mould.
- saprophytic fungi
- vegetative structure:- Mycelium (aseptate, multinucleated)
- reproduction :- vegetative - fragmentation
 - asexual - sporangiospores / apogonospores
 - Sexual - gametangial copulation, isogamous.
- Mycelium isn't differentiated. i.e. having only one type of hyphae.

Note:- Rhizopus mycelium diff. into 3 types:-

- Stoloniiferous hyphae.
- Rhizoidal hyphae
- Sporangiospores

→ Columella is present in rhizopus and mucor.

↳ central sterile region of sporangium.

→ Central sterile region of Sporangium

(Imp) → budded stage in mucor is Torula stage

Reproduction in Mucor

- g) Vegetative reproduction :- by fragmentation
by asexual reproduction :-
by sporangiospore, oidiospore, chlamydospore.

c) Sexual reproduction

→ gametangial copulation.

Characters

Rhizopus

Mucor

Habitat

grows on bread

grows on dung.

Mycelium

mycelium is diff into 3 types

mycelium isn't differentiated

of hyphae:- stoloniferous,

-ie. only one type of hyphae

Rhizoidal, sporangiospores.

Rhizoids

present

absent

Lifecycle of Mushroom

- commonly known as fairy rings, club fungi, gill fungi.
 - Habitat:- saprophytic.
 - rich in vitamin (B, D and K), proteins, minerals so are edible.
 - Soliopore septum is present
 - 3 types of Mycelium present:-
 - a) Primary mycelium
 - b) Secondary mycelium :- binucleated (dikaryotisation) ^{same}
 - c) Tertiary mycelium
- ↓
fruiting body is basidiocarp.

A **Pileus** is fleshy stalk umbrella shaped cup shaped structure.

→ Mature basidiocarp has gills present

Gills

→ Trama (central region of gills)

→ Sub-hymenium

→ Hymenium

outermost fertile part

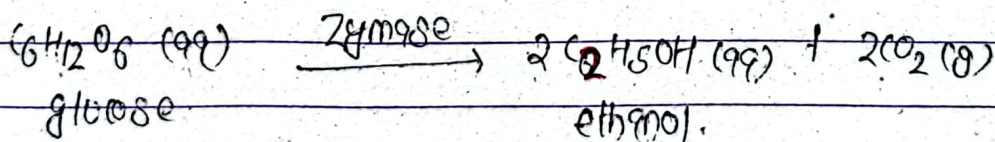
Lifecycle of Yeast Yeast is harmful to milk industry.

- saprophytic, unicellular, multinucleated, pseudomycelium.
- smallest fungi
- grows in sugary medium.
- yeast has capacity → change sugar into alcohol.
- ~~most~~ common method of reproduction is budding.
- ~~sexual~~ rep. is isogamous takes place by conjugation.
- ~~most~~ common yeast is Saccharomyces cerevisiae (also called as Baker's yeast or brewer's yeast).
- yeast has zymase and invertase enzyme.
- ~~Yeast~~ rich in vit B₂ (Riboflavin)
- Note Pseudomycelium is temporary association of hyphae during budding.

Nutrition:- Saprophytic, grows in sugary medium.

Fermentation in yeast

- 50M
- anaerobic, exothermic
 - contains invertase, zymase enzyme.



Reproduction in Yeast

1) Vegetative method / asexual method.

★ Budding :- most common method of reproduction in yeast.

2) Sexual method

plasmogamy, karyogamy, meiosis or RD.

Yeast	Sex. Rep.	veg. rep.
Saccharomyces cerevisiae	Haplodiplontic	budding
Schizosaccharomyces octosporus	Haplontic	fission
Saccharomyces ludwigii	Diplontic	Helobial

Notes:-

- Name
- i) Adelphogamy - fusion bet 2 sister cells
 - ii) Pedogamy - fusion bet mother and daughter cell.
 - iii) Parthenogamy - formation of zygote without fertilization.

Plant disease

white rust of crucifer
early blight of potato
late blight of potato
wilt disease of potato
black rust of wheat
loose smut of wheat
red rot of sugarcane

Fungi

Albugo candida
Alternaria solani
Phytophthora
Synchytrium
Puccinia
Ustilago
Colletotrichum

Human disease

Fungi

Ringworm

Trichophyton

Ootomycosis

Aspergillus

Athletes foot

Tinea pedis

Meningitis

Cryptococcus neoformans

→ bacteria, fungi, virus, etc.

Economic importance of fungi

→ Yeast is rich in Vit B₂ (Riboflavin)

→ Antibiotics ^{streptomycin} termed by Waksman. 1st discovered antibiotic is Penicillin by Alexander Flemming in 1929.

Penicillin also called wonder drug. Penicillium extracted from fungi penicillium notatum but commercially by penicillium chrysogenum. Alexander Flemming is father of antibiotics.

→ Ergotin and LSD (lysergic acid diethylamide) obtained from claviceps purpurea ^{used} during child birth.

→ Organic acid (citric acid) obt from Aspergillus niger.

→ ~~celastrol~~ celastrol is anticancer drug obt from fungi.

Amanita :- poisonous fungi, death cap, lord stools.

→ Roman king Claudius cesar was murdered by his wife by giving amanita.