Biology I Lecture Outline 10 Kingdom Fungi


Major Characteristics

Classification

Division Myxomycophyta (slime molds)

Division Eumycophyta (true fungi)

1. Class Phycomycetae
   A. Characteristics
   B. Rhizopus

2. Class Ascomycetae
   A. Characteristics
   B. Examples

3. Class Basidiomycetae
   A. Characteristics
   B. Examples

4. Class Deuteromycetae
   A. Characteristics
   B. Examples
Major Characteristics

1. *Most* fungi are *multi-cellular eukaryotes*; but, a *few* are *unicellular* like *yeast*

2. *Fungi* are *non-motile*

3. *Most* are *heterotrophic* and consume *organic matter*. They *lack* chlorophyll
   A. Those that obtain *nourishment* from *non-living* (dead) *hosts* are called *saprophytes*
   B. Those that obtain *nourishment* from *living hosts* are called *parasites*

4. *Most fungi are decomposers* that produce *powerful digestive enzymes* that they *introduce* into their *immediate environment* to *break down* organic *matter*
   A. They can *destroy* and *damage* stored *food* and *goods*
   B. They can *damage* *live* *timber*
   C. In *partnership* with *bacteria*, fungi are considered the earth's *decomposers*

5. In the *vegetative condition*, the *fungus body* (thallus) is called a *mycelium*

6. The *mycelium* is the *food-absorbing portion* of the *fungal body*

7. The *mycelium* is actually a *network* of *filaments* called *hyphae*

8. There are 2 *kinds* of *hyphae*
   A. *Septate – hyphae* that are *divided* into *successive compartments* by *cross walls* or *septa*
   B. *Coenocytic (or nonseptate) – hyphae* that are *continuous* and are *without* *cross walls*

9. *Unlike plant cells, fungal cell walls* contain *chitin* rather than *cellulose* (recall *chitin* is *found in the exoskeleton of insects and other arthropods*)
10. The energy reserves of fungi is not starch-like plants; but, is glycogen-like animals.

11. Reproduction is by motile- or non-motile spores that may be produced sexually or asexually.

12. Some uses of fungi:
   A. Baking
   B. Cheese production
   C. Brewing of beer
   D. Wine making

13. There are approximately 200 species of edible fungi and about 70 poisonous species.

14. Fungi include over 80,000 species.

15. Fungi are found in a wide variety of habitats; but, seem especially adapted to dark, moist environments.

16. Mycology is the study of fungi and a mycologist is one who studies mycology.

Classification

1. Fungi may be classified as follows:

   Kingdom Fungi

   Division Myxomycophyta – slime moles
   Division Eumycophyta – true fungi
   Class Phycomycetaceae – algal fungi
   Class Ascomycetaceae – sac fungi
   Class Basidomycetaceae – club fungi
   Class Deuteromycetaceae – imperfect fungi
Division Myxomycophyta (slime molds)

1. Out textbook, Mader, 10th Ed., (page 388) classifies slime moles in the Kingdom Protista and not Kingdom Fungi. This is based on the 2 characteristics of slime moles
   A. Slime moles lack cell walls
   B. Slime molds possess flagellated cells at some time in their live cycle

2. However, we will follow the classification scheme provided in Dr. Williams Lab Manual 4th Ed. (pages 86 and 116) and include slime molds in the Kingdom Fungi

3. Slime molds are important decomposers in woodlands

4. The vegetative state of slime molds is mobile and amoeboid

Division Eumycophyta (true fungi)

1. Class Phycomycetae (algae fungi)
   A. Characteristics
      1) Are called *algal fungi* because some members of this Class reproduce sexually like green algae
      2) They are sometimes called zygospore fungi
      3) There are approximately 1,050 species
      4) Some are parasites of soil protozoans
      5) Many (like Rhizopus) live on food, especially bakery goods like bread
B. Rhizopus and its Life Cycle

(See Handout of Figure 15.2, page 197 of Mader Lab Manual, 10th Ed.)

1) *Rhizopus* is commonly used as an example of Class Phycomycetae

2) It is a filamentous mold called black bread mold

3) Its mycelium (body) is composed of mostly non-septate hyphae

4) There are 3 types of hyphae associated with *Rhizopus*
   a) *Sporangiophores* – aerial hyphae that extend out and bear many small black sporangia
   b) *Rhizoids* – root-like structures that embed into the food substrate on which the mold is growing
      - rhizoids carry out digestion and anchor the mycelium
   c) *Stolons* – filaments running parallel to the surface of food

5) Life cycle
   a) Windblown spores are produced during both sexual and asexual reproduction
   b) Asexual Reproduction
      - Asexual reproduction is the norm
      - See very bottom of Figure 15.2
      - All structures involved in asexual reproduction are haploid (N)
      - This is the organism (mycelium) you can see growing on bread
      - In a sense – you can call this the “adult” organism
      - During asexual reproduction, a sporangium (N) that is black and ball shaped produces haploid spores (N)
• These spores are windblown and may fall on the same host (piece of bread) or be dispersed elsewhere

• Spores that fall on a new host will germinate into a new individual fungus

c) Sexual Reproduction

• Hyphae (N) of opposite mating types are called + and - mating types (note they are not called male and female)

• Opposite mating types are chemically attracted to each other

• The end of each mating hyphae swells to form a gametangia (N)

• Gametangia merge and nuclei pair and then merge to form a diploid (2N) zygote

• A thick wall forms around zygote to form a zygospore (2N) that is resistant to changes in the external environment

• A zygospore may undergo a period of dormancy and survive unfavorable growing conditions such as winter temperatures

• By meiosis, zygospores (2N) produce haploid (N) sporangiophores that produce haploid spores (N)

• Spores are dispersed by air currents and if they land on a suitable medium (like bread) they germinate and begin the life cycle anew

2. Class Ascomycetaceae (sac fungi)

A. Characteristics

1) There are about 50,000 species

2) Structure (See Handout of Peziza Life Cycle on page 122 of Lab Manual)

   a) They are mostly composed of septate hyphae
b) They are called *sac fungi* because they produce *modified hyphae* that bear 8 spores (called *ascospores*) in a *sac-like hyphae* (called an *ascus*).

c) The *fruiting bodies* are called *ascocarps*.

d) A *fruiting body* is a *reproductive structure* where *spores* are *produced* and *released*.

e) The *fertile layer* of a *fruiting body* is called the *hymenium*.

3) *Members* of this group are responsible for a *large number* of *plant diseases*. 2 examples are:

   a) *Disease* that caused the *extinction* or *near extinction* of the *American chestnut*.

   b) *Disease* that is causing the *American elm* to *disappear* in *forests* of the *U.S.*.

B. Examples

   1) *Examples* include *Peziza*, *yeasts*, *molds*, *mildews* and *pencillium*.

   2) Another *example sought* for its food value is the *morel* (genus *Morchella*). *Local names* for the *morel* include *truffles* and *woods chickens*.

   3) *Yeasts* are *different* from *most fungi* in that they are *not composed* of *hyphae* and are *unicellular*. However they *do produce* an *ascus* when they *reproduce sexually*.

3. Class Basidiomycetae (club fungi)

   A. Characteristics

   1) The *club fungi* include about 22,000 *species*.

   2) Their *body* is composed mostly of *septate hyphae*.

   3) They are called the *club fungi* because *during sexual reproduction* they produce *modified hyphae* that *resemble clubs* and usually *bear 4 spores*.

   4) These *modified clubs* are called *basidium*.
5) The life cycles of Basidiomycetae are similar to those for Ascomycetae

B. Examples

1) Two notable species used by humans as food are the portabella mushroom and shiitake mushroom

2) Other examples include mushrooms, toadstools, bracket fungi, bird's nest fungi, stinkhorns, earthstars, puffballs, coral fungi, jelly fungi, smuts and rusts

3) One particularly common rust in our geographic area is the cedar apple rust that can often be seen growing on cedar trees.

4. Class Deuteromycetaceae (imperfect fungi)

A. Characteristics

1) They are called imperfect because members of this Class lack a known sexual phase in their life cycle

2) They reproduce only by sexual spores or conidia

B. Examples

1) Examples include thrush, ringworm, and athletes foot
1. Hyphae of opposite mating types touch.

2. Gametangia form at the end of each hypha.

3. Gametangia merge and nuclei pair, then fuse.

4. A thick wall develops around the cell.

5. Sporangiohores develop, and spores are released from sporangium.

Figure 15.2
Black bread mold, *Rhizopus stolonifer*. Windborne spores are produced during both asexual and sexual reproduction.
A toadstool grows in Michigan ... and grows

NEW YORK (AP) — Squashed by hunters and nibbled by deer, the toadstool can't get any respect in the natural world. But a mass of tendrils threading the soil beneath a moist northern Michigan wood may put the humble fungus on the map.

Using genetic testing, scientists discovered a single, 1,500-year-old plant that fills 38 acres of soil.

That makes it the largest and one of the oldest organisms on earth, according to a report today in the journal Nature.

Scientists confirmed the existence of the subterranean behemoth through genetic testing of its slimy but edible progeny — the honey mushrooms that pop up by the hundreds after fall rains.

The mushrooms growing in a triangular area more than five football fields across had the same genetic fingerprint, meaning they came from one plant.

The largest part of the mushroom plant, called armillaria bulbosa, is an underground mass of cord-like tendrils called rhyzomes, which live under a few feet of soil and send up shoots that feed off dead or diseased wood. The mushrooms are the fruit of the plant.

The fungus at the Iron County, Mich., site probably weighs at least 100 tons — about the same as an adult blue whale, said Johann N. Bruhn, a Michigan Technological University research scientist who co-authored the study.

Giant sequoias can weigh as much as 1,000 tons, but much of that is deadwood. Among mushroom experts, the discovery is sweet vindication.

"Some of the major players in terrestrial ecosystems have been ignored by the scientific community," said Tom Bruns, assistant professor of plant pathology at the University of California at Berkeley.

He cited a recent study that only 5 percent of the 1.5 million estimated fungus species in the world have been identified. Some of the unknown organisms could cure diseases or play other important roles in the environment, Bruns said.

Scientists say armillaria bulbosa is a particularly vital player. The fungus' attacks on sickly hardwood trees are a barometer of declining forest health caused by insect defoliation, air pollution and other vectors.

"It will tell us how healthy the woods are," Bruhn said.
Figure 23.1 The "Big Picture" of the Fungi: A Generalized Scheme of the Habitat, Relative Size, and Evolutionary Status of the Various Groups.