A221: Microbiology

Problem 9: Treat or Threat

WORKSHEET

Question 1

You have used taxonomy principles and Bergey's manual to correctly identify the identity of bacteria in problem 7.

a) To recap, what are the 5 Kingdoms?
-animal
-plant
-fungi
-prokaryotes
-protoctista

b) Which Kingdom do you think is the focus of today's problem?
Fungi

Question 2

Refresh your memory on the difference between prokaryotic and eukaryotic cells. Complete the table below and compare the **characteristics of fungi** and determine if fungi are considered eukaryotic or prokaryotic?

Characteristic	Eukaryotic Cell	Prokaryotic Cell	Fungi
Chloroplasts (present/absent)	Present (in plants)	Absent	Absent
Intracellular membrane bound organelles (yes/no)	Yes	No	Present
Ribosomes (Size)	80S	70S	70S
Nucleus (present/absent)	Present	Absent	Present
Cell wall material	Cellulose in plants	Peptidoglycan	Chitin

Question 3

Listen to the audio and fill in the blanks below to summarise the **role of fungi in the ecosystem**.

86879-024-FA67E77A.mp4

Fungi are decomposers. They are important as decomposers that break down dead and decaying organic matter (such as plants) into simple substances. The moisture present makes it favourable for decomposition. Decomposition of dead plants and animals benefits the ecosystem as this result in return of nutrients?, hydrogen, nitrogen and minerals back into the ecosystem in a form usable by the plants and other living beings.

Question 4

Review the short video clip at the Problem Statement carefully and you will realise that the ant is not dead when the fungi infected it. What is term used to describe the **group of organism that lives on living host**? Briefly describe this group of organism

Parasites. A parasite is an organism that lives on or in a host and gets its food from or at the expense of its host. Parasites can cause disease in humans.

Question 5

Complete the table below for comparison among **saprobes**, **parasites** and **plants**.

	Saprophyte /Saprobes	Parasites	Plants
Type of Nutrition	Chemoheterotrophs	Chemoheterotrophs	Photoautotroph
Chlorophyll	Absent	Absent	Present
Examples	Rhizopus Yeast Agaricus	Malaria Lyme disease Flea	Trees, Shrubs
Source of nutrients	Dead organic matter	Directly from the body of the host	Self-generated Photosynthesis
Dependence on living host	No	Yes	No
Releases nutrients into the environment	Yes	No	Yes
Nutrient absorption	Obtain nutrient from non-living organic material by absorbing soluble organic compound	Internal digestion through complex mechanism	Soil
Methods of reproduction	Sexual and asexual reproduction via spores	Simple OR complex reproduction dependent OR independent of host	Sexual reproduction via flowers, seeds

Question 6

Based on the comparison above, is the *Cordyceps* fungus a parasite, a saprobe or a plant or all of the above?
All of the above.

Question 7

When a piece of bread was left for more than a week in open air, the result in Figure 1 can be observed below, which shows the growth of the common bread mold *Rhizopus nigricans*.

Figure 1

A closer examination of the bread mold fungus shows the following details.

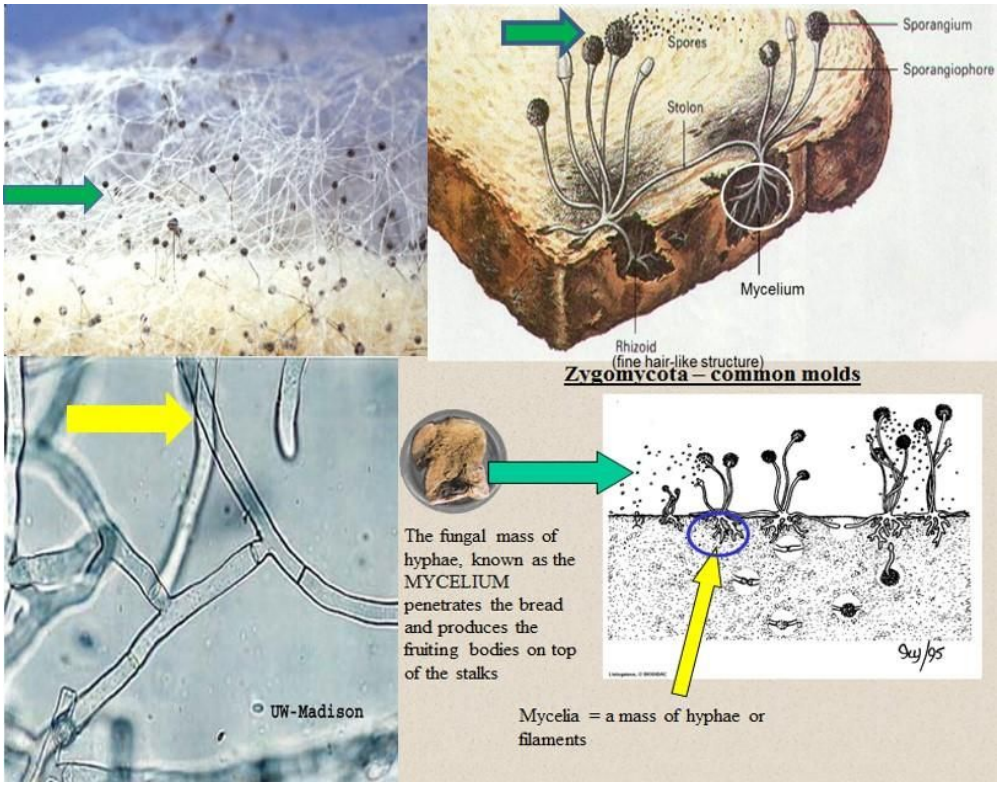


Figure 2

Identify the structures pointed by the green and yellow colour arrows in the Figure 2 above. With reference to this link, describe the functions of the structures.

Mycelium (the vegetative part of the fungus, consisting the mass/ group of branching thread-like hyphae) allows fungi to communicate and absorb nutrients so that they can grow.

A hyphae. It contains the cytoplasm containing genetic materials

It also absorb and break down nutrients from the environment and transport them to other parts of the thallus.

The hyphae will differentiate to form fruiting bodies (top to bottom), which produces spores. Sporangium: the bud that releases spores, sporangiophore: the stalk

Question 8

As you have learnt bacterial endospores are a form of adaptation and are formed when the surrounding conditions are unsuitable for the bacteria.

a) Figure 3 shows bacterial **endospore and fungal spore**. What are the differences between bacterial spore and fungal spore?

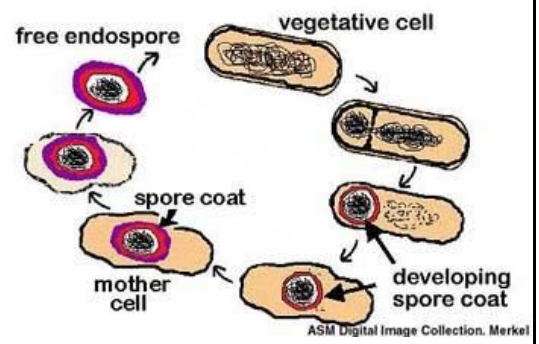
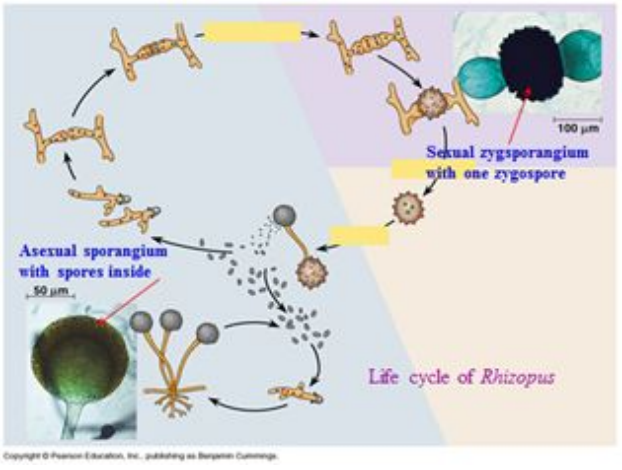
Bacterial Endospore	Fungal spore
	

Figure 3

Bacterial endospores are formed as a protectivesurvival measure while fungal spore are formed/produced for reproductive purposes.

b) Fungal spores are generally small and light. How would this help in their reproduction and spread?

Reproduction through spores would allow the fungal spores to be **dispersed and spread out** over a wide area more easily as they are small and light and carried easily through air.

Question 9

The following pictures show a special type of fungi called **yeast**, which has many uses in the biotechnology industry.

Figure 4. Yeast

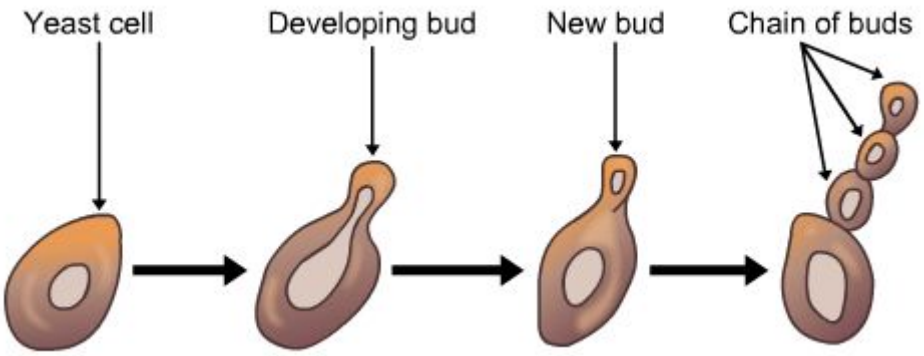
a) Compare and contrast the similarities and differences between **yeasts and molds**? Complete the table below.

	Yeasts	Molds
Domain	Fungi	Eukaryota
Cellularity	Unicellular (Single celled)	Multicellular
Nucleus	Single	one or more
Filamentous/ non-filamentous	Non-filamentous	Filamentous
Reproduction	Budding, reproduce asexually or sexually	Sexual or asexual spore

b) Briefly describe the process of **reproduction of yeasts**.

Budding is an asymmetrical division process

1. A small protuberance is produced on the parent cell that grows to a full size and forms a bud.
2. Nucleus of the parent cell split into a daughter nucleus and migrates into the daughter cell.
3. Bud detaches from parent's body by forming a constriction at the base
4. Budding repeats to form a chain of bud cells



c) Would you classify *Cordyceps*, *Aspergillus* and *Penicillium* in today's problem as mold or yeast? Briefly justify your answer.
Cordyceps, *Aspergillus* and *Penicillium* are all molds because these fungi grow in the form of multicellular filaments, which are hyphae.

Do you know?

There are about 99,000 known species of organisms of the kingdom Fungi. For ease of identification and study, it is important to organize and classify these species into smaller groups.

The Fungi Kingdom is divided into the following **4 main groups** primarily based on the different reproductive structures:

- Chytridiomycota
- Zygomycota
- Ascomycota
- Basiodiomycota,

Refer to the link below to find out more:
http://www.clarku.edu/faculty/dhibbett/TFTOL/content/1intropprogress.html.

The classification of fungi is an ongoing process. Currently, the Fungi Kingdom is classified into the following **7 different phyla** based on their phylogenetic relationship with one another.

- Chytridiomycota
- Blastocladiomycota
- Neocallimastigomycota
- Microsporidia
- Glomeromycota
- Ascomycota
- Basidiomycota

Refer to the link below to find out more:
http://www.britannica.com/science/fungus/Outline-of-classification-of-fungi.

Question 10

With your understanding of the different types of fungi and how they survive and reproduce, relate back to the problem statement on why the worker ants and humans have to resort to such drastic measures.
Fungus reproduces by budding. When an ant gets infected by a fungi, it will cast spores to the ground where it can be picked up by other ants (eventually leading to infection and death of other ants).

Going further:

Associations between different organisms can be grouped into different categories, depending on the way one organism affects the other. You have seen earlier that fungi can form parasitic relationships with their hosts. Fungi can also associate with other organisms to form a symbiotic relationship.

a) What is a symbiotic relationship?
   A symbiotic relationship is where both organisms benefit (mutualism), or where one organism benefits but the other organism is unaffected (commensalism)

b) Mycorrhizae are formed from the symbiotic relationship of fungi with plant roots. Likewise, lichens are formed when fungi develop a symbiotic relationship with algae or cyanobacteria.

   Why would each of these organisms choose to associate with the other? Does this association bring about benefits or disadvantages to each organism?

References:

http://microbiologyonline.org/about-microbiology/introducing-microbes/fungi

~End of Worksheet~