Soil Biology And Biochemistry (SOIL-506)

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MICROBIAL INTERACTIONS

1. Positive

- Cooperation
- Commensalism
- Synergism
- Mutualism
- Endosymbiosis

2. Negative

- Competition
- Amensalism
- Parasitism
- Predation

3. Neutralism

1. Cooperation

Microbial population is more successful than individual organisms for colonization of natural habitats

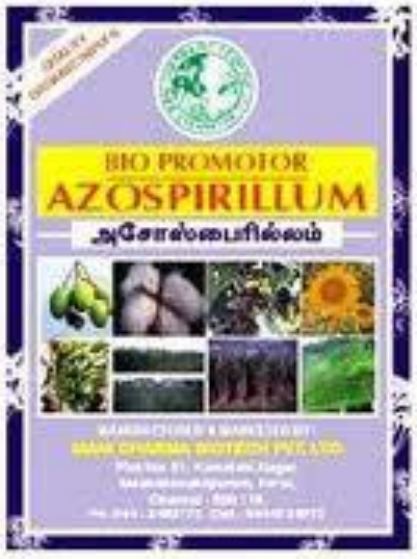
Semi-permeable membrane of microorganisms tends to leak low molecular weight metabolic products that is essential for biosynthesis and growth

Eg. Slime mold, Dictyostelium

Adverse conditions, it colonizes

2. Commensalism

Unilateral relationship results when unaffected population modifies the habitat so that another population benefits.



Associative Symbiotic N Fixer

Banana – Azospirillum

20g at Planting and 5th Month after Planting

3. Synergism

Proto-cooperation is a non-obligatory relationship between two organisms which satisfy each other's needs

Both organisms allow the completion of a metabolic pathway that otherwise would not be completed

Eg. Nocardia and Pseudomonas together can degrade cyclohexane wherein Nocardia acts on cyclohexane and supplies metabolic products to Pseudomonas and in turn the bacterium supplies biotin to Nocardia

4. Mutualism

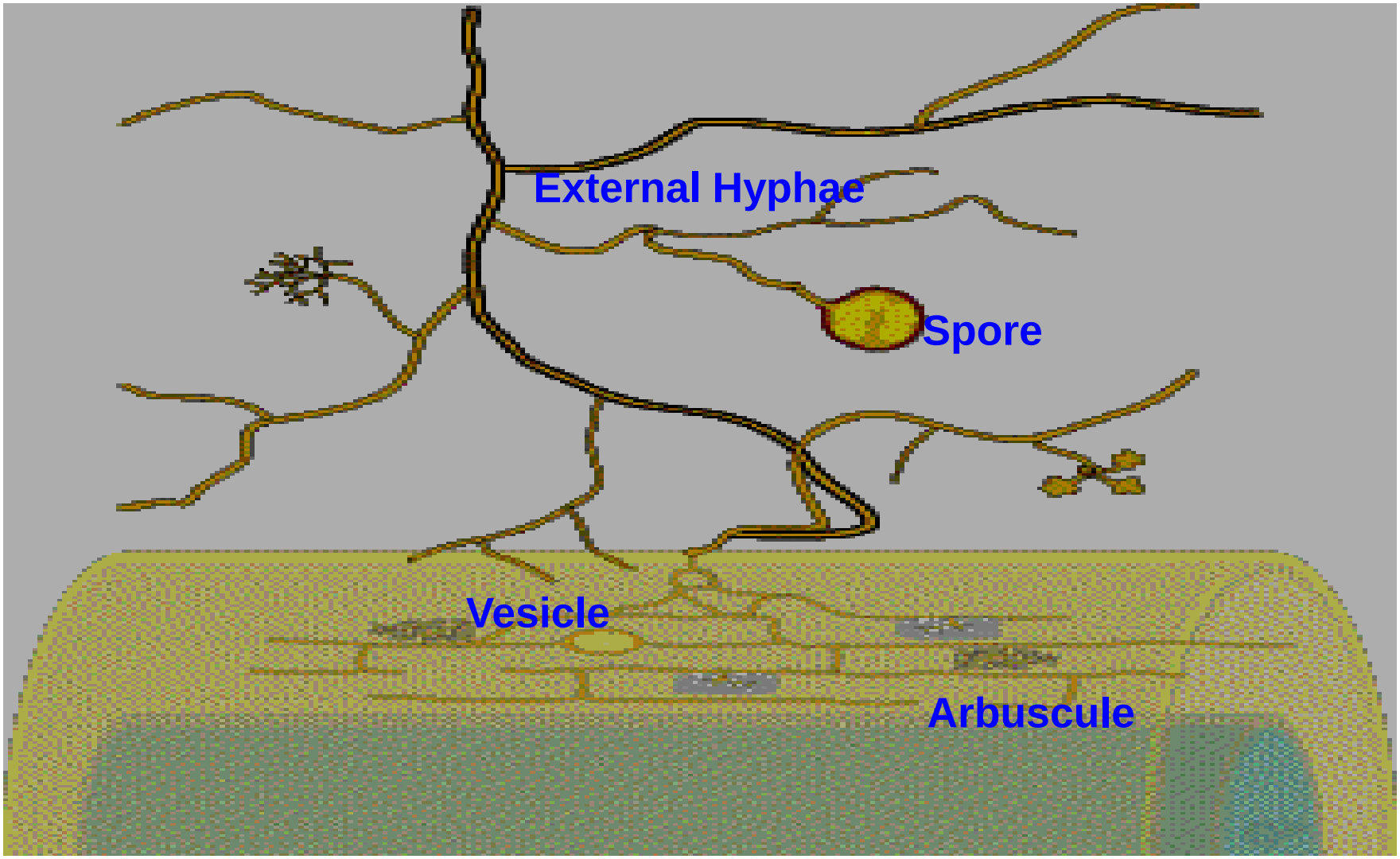
It is an extended synergism which shows a highly specific and obligatory relationship

Eg. Lichens – fungus (Phycosymbiont – Mycosymbiont)

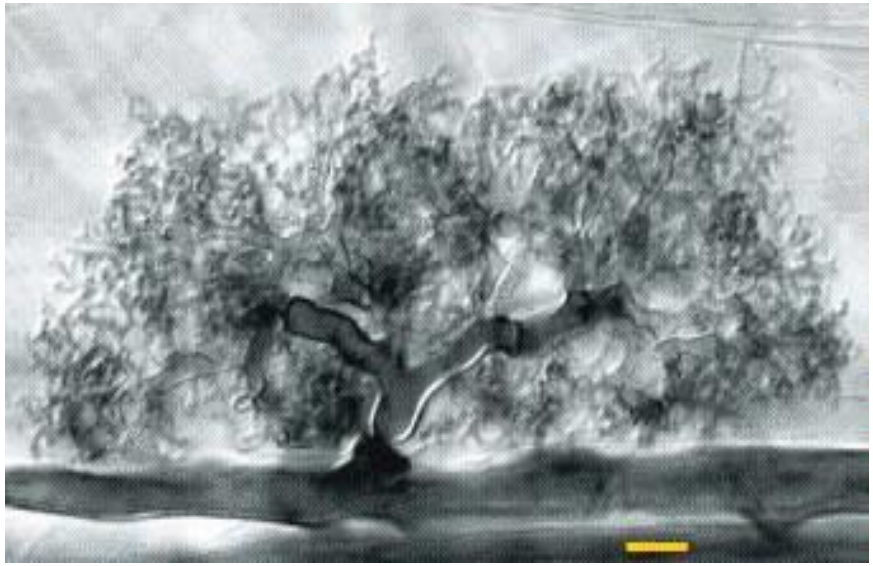
Legume – Rhizobium

Plants – Mycorrhiza

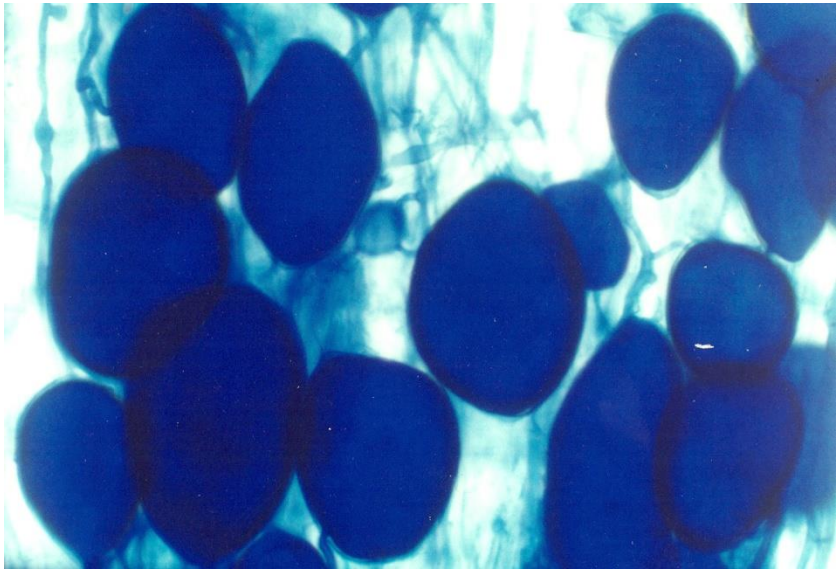
Structure of Mycorrhizas

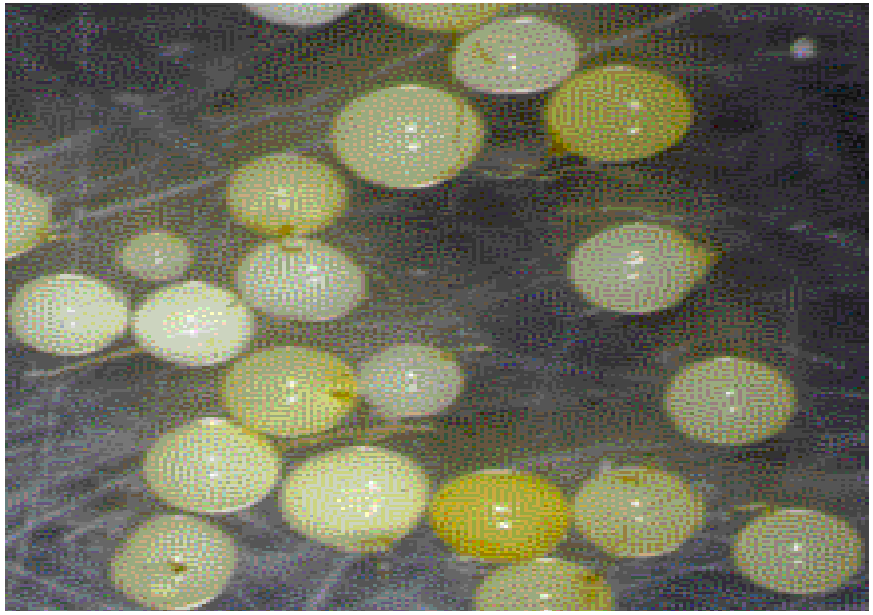


Arbuscule



Vesicles





VAM Spores

Colonized roots

5. Endosymbionts

Endosymbionts of protozoa

Algae and protozoa exhibit mutualism

Paramaecium hosts Chorella within its cytoplasm.

Presence of Chlorella allows the protozoan to move into anaerobic habitats as long as there is sufficient light.

1. Competition

Occurs when two populations use the same source of nutrition

Brings about ecological separation of closely related population (competitive exclusion principle). Thus no two population can occupy the same niche

Eg. At high substrate concentration, competition between a marine Spirillum and E.coli results in competitive exclusion of Spirillum whereas at low concentration of substrate, the reverse occurs and the E.coli is excluded.

2. Amensalism

One microbial population growing on a substrate is inhibitory to the other population.

Based on the production of anti-microbicidal chemicals (allelopathic substances) or antibiotics

Eg. Oxidation of sulphur by Thiobacillus thiooxidans which produces sulphuric acid that inhibit other microbes.

Production of oxygen by algae detrimental to obligate anaerobes.

3. Parasitism

Organisms which eventually kill one population (host) and they can be either attached outside the host (ectoparasite) or can be found within the host (endoparasite).

Normally, parasitic interactions are very specific.

Eg. Virus population that parasitises a range of hosts

Bacteria (bacteriophage)
Algae (phycophages)
Fungi (mycophages)
Actinomycetes (actinophages)

4. Predation

Negative interaction wherein one organism engulfs the other.

The populations are known as predator (bigger) and the prey (smaller).

Usually, the predator engulfs the prey and it is a short-term interaction in contrast to parasitism.

Predator-prey relationship is cyclic and in each cycle, prey population increases.