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*Shaping Lives...
Empowering Communities...*

ASAC 1101 : FUNDAMENTALS OF SOIL SCIENCE (2+1)

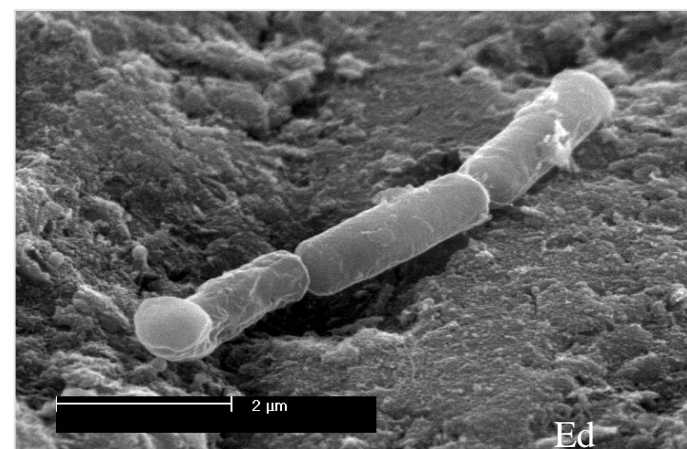
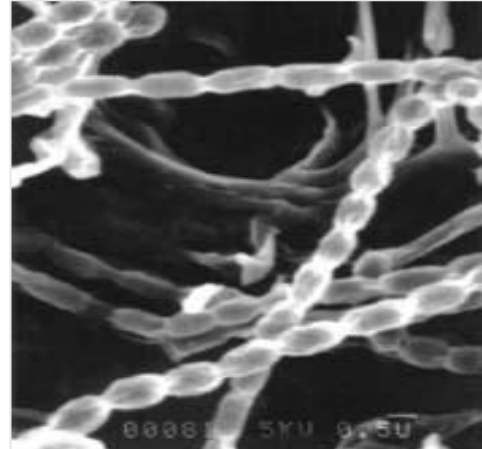
Level : B.Sc (Ag), I semester

Dr. Bishnuprasad Dash

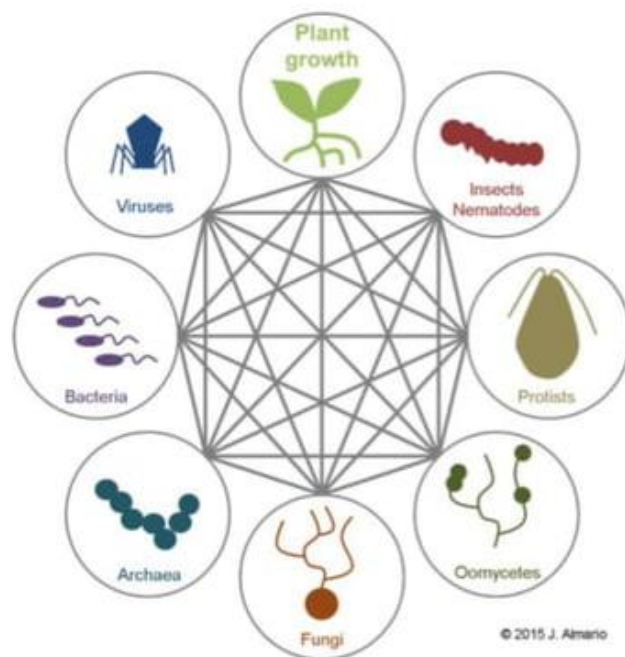
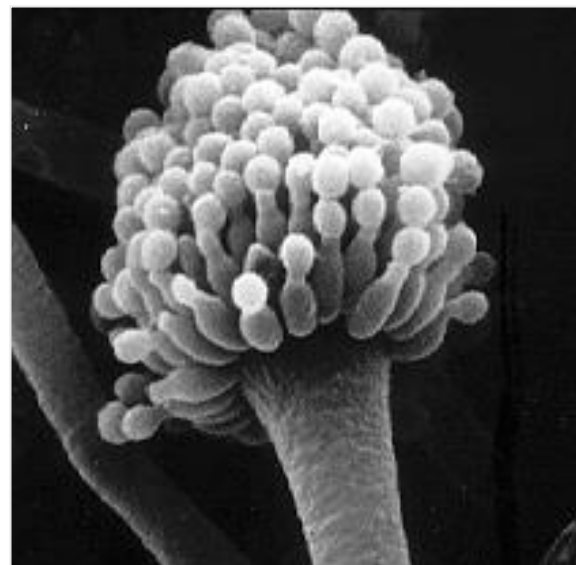
**SOIL SCIENCE AND AGRICULTURAL CHEMISTRY
M.S.SWAMINATHAN SCHOOL OF AGRICULTURE,CUTM,
PARLAKHEMUNDI**

Topic

Microbial Interaction



Microbial Interaction



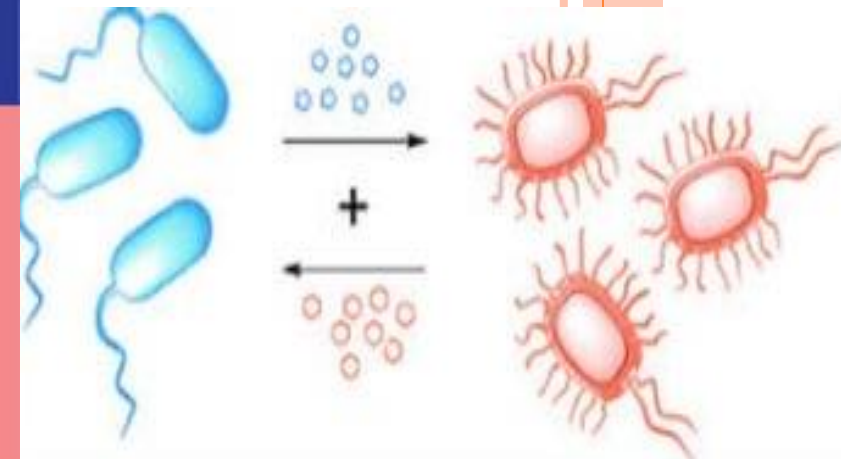
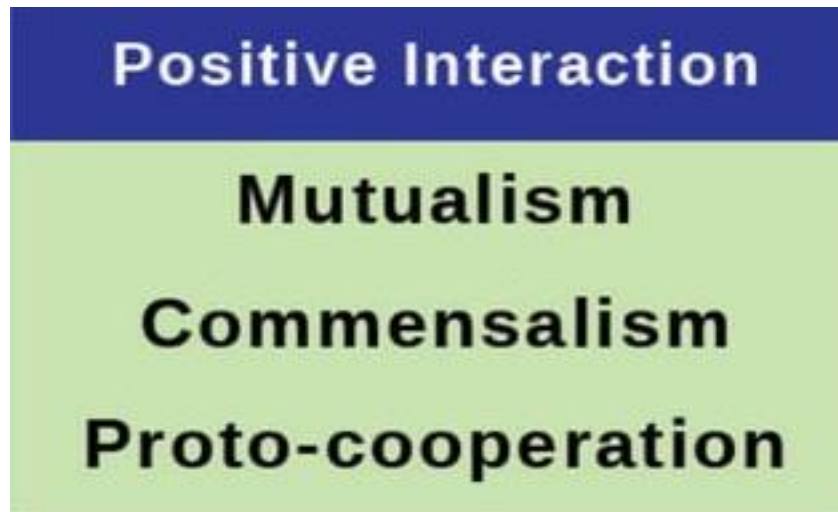
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Introduction:

- ❖ In addressing microbe–microbe interactions, it is important to determine whether the interaction is between cells of different genera or within the same species.
- ❖ Various types of interaction of a microorganism with another microorganism and specific examples of the processes associated with microbe–microbe interaction.

Microbe-Microbe Interactions

The interaction between the two populations are classified according to whether both populations or one of them are beneficated from associationship or both are negatively affected.



Mutualism:

- ❖ Mutualism defines as **an obligatory association that provides some reciprocal benefit to both partners.**
- ❖ This is an obligatory relationship in which the mutualist and the host are metabolically dependent on each other.
- ❖ **Lichen** is an excellent example of microbe-microbe mutualism interaction. Lichen is the association between specific ascomycetes (the fungus) and certain genera of either green algae or cyanobacteria.
- ❖ Two organism of different species are mutually benefited.

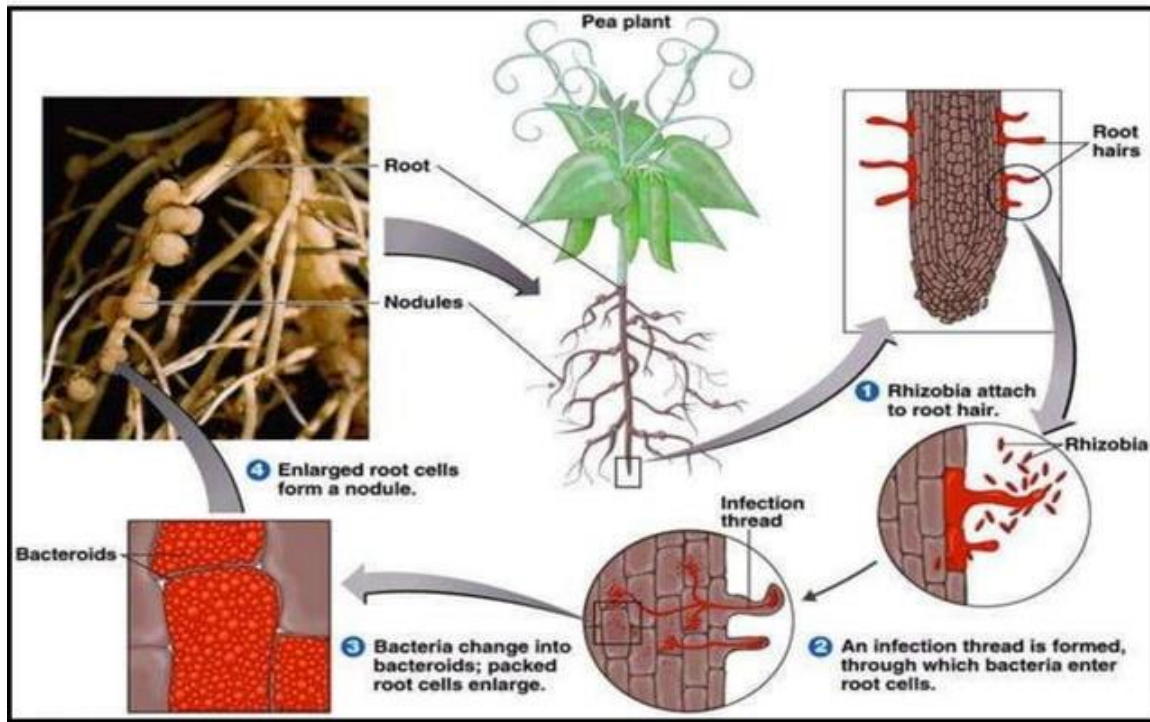


Examples of Mutualism:

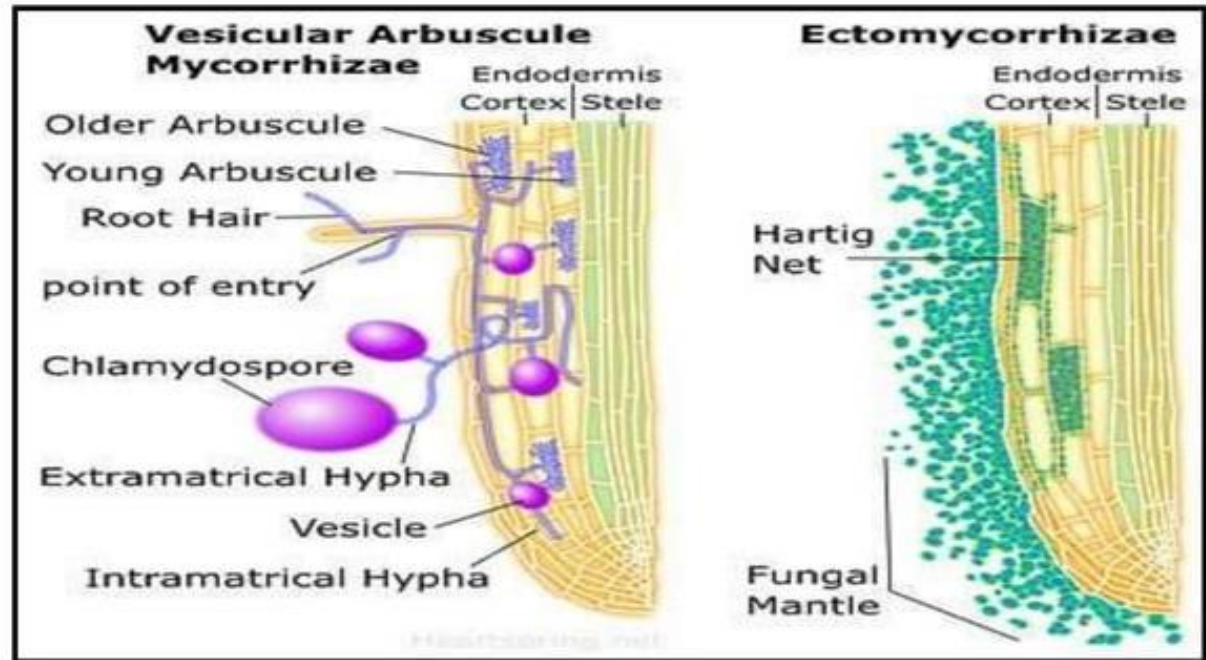
- Rhizobium-legume association
- Mycorrhizae
- Lichens
- Herbivore-Microbial interaction
- Clown fish and sea anemone



Rhizobium-legume association



Mycorrhizal association



Protocooperation (Synergism)

- ❖ Protocooperation is a mutually beneficial relationship, similar to that which occurs in mutualism, but in protocooperation, this relationship is **not obligatory**.
- ❖ The beneficial complementary resources are provided by each of the paired microorganisms.
- ❖ The organisms involved in this type of relationship can be separated, and if the resources provided by the complementary microorganism are supplied in the growth environment, each microorganism will function independently.
- ❖ Association of **Cellulomonas and Azotobacter**.
- ❖ Azotobacter uses glucose provided by a cellulose-degrading microorganism such as Cellulomonas, which uses the nitrogen fixed by Azotobacter.

Commensalism

- ❖ The commensalistic relationship involves two microorganisms where **one partner (the commensal) benefits while the other species (the host) is not harmed or helped.**
- ❖ Commensalistic relationships between microorganisms include situations in which the waste product of one microorganism is the substrate for another species.
- ❖ An example is **nitrification**, the oxidation of ammonium ion to nitrite by microorganisms such as *Nitrosomonas*, and the subsequent oxidation of the nitrite to nitrate by *Nitrobacter* and similar bacteria. *Nitrobacter* benefits from its association with *Nitrosomonas* because it uses nitrite to obtain energy for growth.

Negative interaction:

Predation

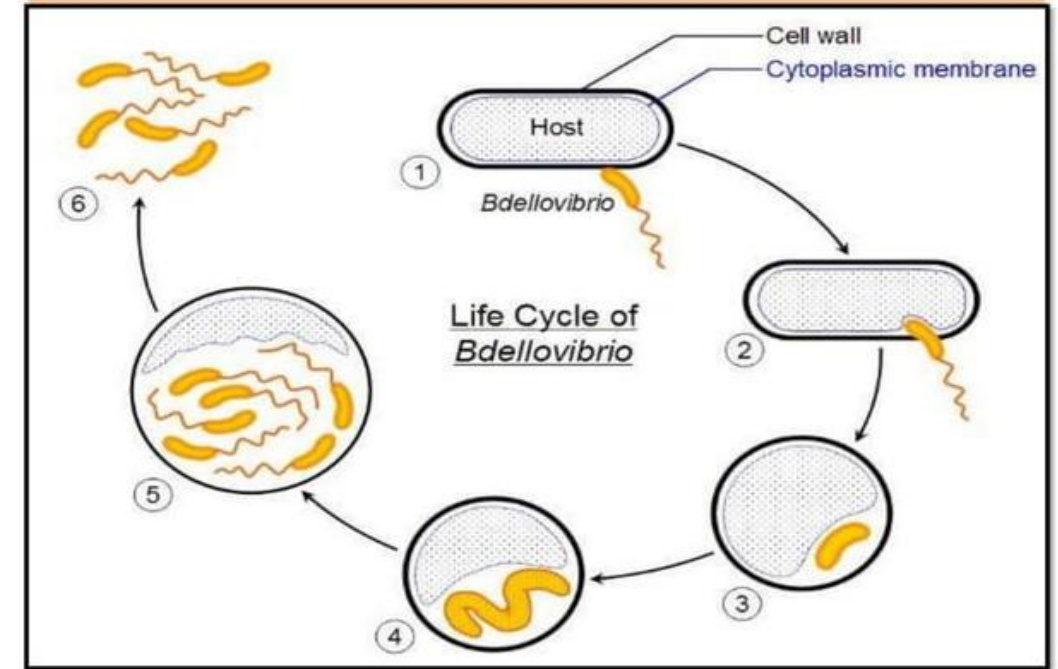
- ❖ Predation is a widespread phenomenon where the predator engulfs or attacks the prey.
- ❖ **Epibiotic predator** with growth on the surface of the prey.

Ex. – *Vampirococcus*

- ❖ **Periplasmic predator**, with growth in between the inner and outer membranes of bacteria. Ex. *Bdellovibrio*.

- ❖ **Cytoplasmic predator**, with growth in the cytoplasm of the prey.

Ex. *Daptobacter*



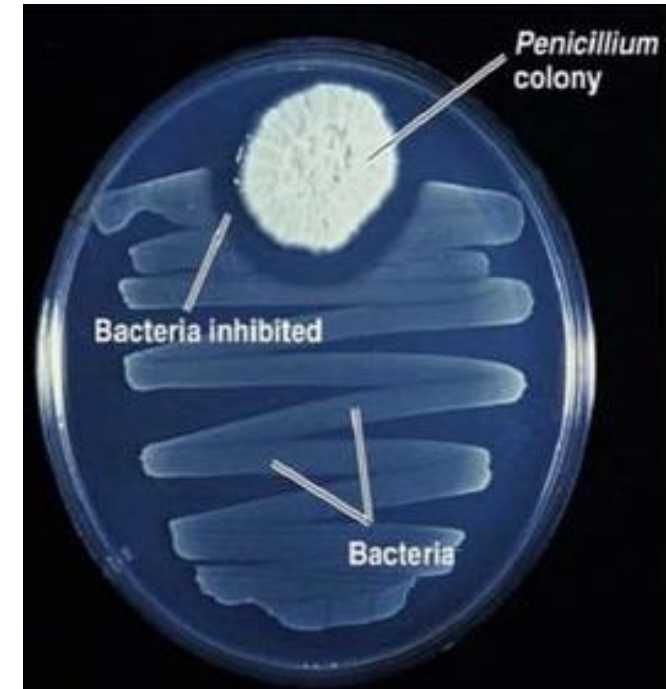
Parasitism

- ❖ Parasitism occurs when one species obtains nutrients from another for the purpose of cell growth.
- ❖ Parasites display two types: (1) direct lifecycle that does not require an intermediate host (2) indirect lifecycle that requires an intermediate host.
- ❖ In parasitism, **one organism (parasite) benefits from another (host)**; there is a degree of coexistence between the host and parasite.
- ❖ Example: **Bacteriophage**- A bacteriophage, also known as a phage, is a virus that infects and replicates within Bacteria and Archaea.
- ❖ **Bacterial mycophagy** - mechanisms by which bacteria feed on fungi. Ex.- Bacteria *Aeromonas caviae* feed on fungus *Rhizoctonia solani* and *Fusarium oxysporum*.



Amensalism

- ❖ Amensalism describes the **negative effect** that one organism has on another organism.
- ❖ This is a unidirectional process based on the release of a specific compound by one organism which has a negative effect on another organism.
- ❖ A classic example of amensalism is the production of antibiotics that can inhibit or kill a susceptible microorganism. Ex. - the destructive effect of the bread mold *Penicillium* on certain bacteria by the secretion of **penicillin**.



Competition

- ❖ When two or more species use **the same nutrients for growth, some of the populations** will be compromised.
- ❖ Competition between microbial species may be attributed to availability of nitrogen source, carbon source, electron donors and acceptors, vitamins, light, and water.
- ❖ Microbes also compete with their neighbors for space and resources.
- ❖ Competition for a limiting nutrient among microorganisms leads to exclusion of slower growing population.
- ❖ For ex. - during **decomposition of organic matter** the increase in number and activity of microorganisms put heavy demand on **limited supply of oxygen, nutrients, space, etc.** The microbes with weak saprophytic survival ability are unable to compete with other soil saprophytes for these requirements.

THANK YOU

