Department of biology

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((soil microbiology))

Stage (-3-)

LEC- ((1))

Introduction to sail microbiology

By

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Soil Microbiology is a branch of studies all microbial microbiology that groups in the soil (bacteria, fungi, algae, viruses, and protozoa). It explores the reactions and transformations these organisms perform—such as organic matter decomposition and the cycles of nitrogen, phosphorus, sulfur, iron, and manganese—as well as their mutual relationships.

Soil is defined by soil biology specialists as the upper layer of the earth, which is formed through a series of factors and processes.These factors, specifically called soil formation factors and processes, were identified by the scientist Yanni Tla as five: material, climate, biology, topography, and soil.

The interaction of these factors with each other is beneficial to a group of other processes, or the passage of sand, which results in soils that differ in their qualities, whether in the location of the soil or in its depth In general, all soils are made up of natural life, organic life, water, air, and micro-organisms the five components of any soil are in a state of constant dynamic change In general, the mineral matter organic

matter occupies about 51% of the soil volume, of which more than 49% to 44% is occupied by hostile matter as for metabolites, less than 1-6% are occupied with organic matter, while soil microorganisms are occupied with no more than 1% while air and water occupy about 51% .

Major Groups of Soil Microorganisms:

Soil is a suitable environment for various microscopic organisms, including:

1. Protozoa

• **Characteristics:** The simplest unicellular eukaryotes, ranging from a few micrometers to over a centimeter.

• **Feeding:** Most are chemoheterotrophs, often preying on bacteria, algae, and yeasts.

• **Classification by Movement:**

◦ **Flagellates (Mastigophora):** Move via flagella; most common in soil.

◦ **Amoebae (Sarcodina):** Move via pseudopodia (protoplasmic extensions).

◦ **Ciliates (Ciliophora):** Move via short, numerous cilia; least common in soil.

2. Algae

• **Characteristics:** Autotrophic organisms that perform photosynthesis.
• **Major Groups:** Green algae (Chlorophyta), Blue-green algae (Cyanophyta/Cyanobacteria), Diatoms (Bacillariophyta), and Yellow-green algae (Xanthophyta).
• **Importance:** They contribute to the biological weathering of rocks, increase soil organic matter, and provide oxygen in rice fields. Blue-green algae like *Anabaena* and *Nostoc* can also fix atmospheric nitrogen

3. Fungi

• **Characteristics:** Form dense networks of hyphae called mycelium. They represent the largest portion of microbial biomass in well-aerated soils.
• **Importance:** Primary decomposers of organic materials (cellulose, lignin, pectin) especially in acidic soils.
• **Symbiosis: Mycorrhiza** are fungi that live symbiotically with plant roots, helping them absorb water and nutrients in exchange for carbohydrates.

4. Actinomycetes

• **Characteristics:** Gram-positive filamentous bacteria with complex morphology. They share traits with both bacteria (prokaryotic, cell wall structure) and fungi (branching, spore formation).

• **Importance:** They degrade complex organic compounds like chitin and paraffin, produce the "earthy" smell of soil (**Geosmin**), and are a major source of antibiotics.

5. Bacteria

• **Classification:**

◦ **Autochthonous:** Native soil bacteria.

◦ **Allochthonous:** Foreign bacteria entering via rain or sewage.

◦ **Thermal requirements:** Divided into psychrophiles (cold-loving), mesophiles (moderate), and thermophiles (heat-loving).

• **Nutritional Types:** Includes photoautotrophs (using light and CO2) and chemoautotrophs (oxidizing inorganic compounds for energy, such as *Nitrosomonas* and *Nitrobacter*)