SOIL MICRO ORGANISMS

Soil Microbiology: Soil microbiology is the study of organisms in soil, their functions, and how they affect soil properties.

Soil microbiology is the scientific discipline that is concerned with the study of all biological aspects of the life that exist in the soil environment. Microorganisms in soil are important because they affect soil structure and fertility. Both plants and microorganisms obtain their nutrients from soil and change soil properties by organic litter deposition and metabolic activities, respectively. Microorganisms have a range of direct effects on plants through, e.g., manipulation of hormone signaling and protection against pathogens.

Importance of Microorganism For cycling of C, N and other nutrients. Affect the structure and fertility of different soils. Responsible Maintain soil quality and health. Increase soil aeration and penetrability. Involved in disease transmission and control. Benefits of soil microbes a) Disease control. b) Availability of soil nutrients. c) Interaction between plants and soil microbes.

The role of soil microorganisms are Soil microbes fix nitrogen. Soil microbes recycle nutrients. Soil microbes recycle nutrients. Soil organisms promote plant growth. Soil microbes control pests and diseases. Soil microbes create soil structure.

Living organism present in the soil are grouped into categories as follows 1. Soil flora Bacteria, Fungi, Actinomycetes and Algae. Practices which cause a decline in soil organic matter cause CO2 release, in addition to damaging soil resilience and often, agricultural productivity. The soil micro-organisms (collectively the soil microbial biomass) are the agents of transformation of soil organic matter, nutrients and of most key soil processes. Their activities are much influenced by soil physico-chemical and ecological interactions.

Soil fauna [micro fauna]: Protozoa, Nematodes, earthworm, Moles, Ants and Rodents. Relative proportion/percentage of various soil microorganism are: Bacteria-aerobic (70%) anaerobic (13%), actinomycetes (13%), fungi (3%), and (algae, protozoa, viruses) 0.2-0.8%.Soil organism play key role in the nutrient transformation.

One gram of topsoil may contain a) As many as one billion bacteria. b) Up to 100 million actinomycetes. c) One million fungi. d) 100 nematodes. Soil flora : Bacteria, Fungi, Actinomycetes, Algae. A. Bacteria Bacteria are the smallest independently living, single-celled organisms on earth.

Typical cells range from 0.5 to 1.0 μm in diameter. Prokaryotic (simple cell structure with no internal organelles). Role of Bacteria in Soil: Bacteria are important in agricultural soils because they contribute to the carbon cycle by fixation (photosynthesis) and decomposition. There are many types

of bacteria but the focus here is on those that are important for agriculture, e.g., Rhizobium and actinomycetes.

Biochemical process of bacteria a) Nitrogen fixation (Nitrobacter sp.) b) Degradation (sulphur degradation and hydrocarbon degradation) c) Used for remediation (Pseudomonas sp.) B. Fungi Fungi are eukaryotic and hence more closely related to plants and animals than to bacteria. They also have membrane bound organelles such as mitochondria. Fungi have a cell wall composed of glucans and chitin.

Role of Fungi in Soil: Release nutrients from soil minerals. Saprotrophic fungi play a critical role in the global carbon cycle. Help trap nematodes that are harmful to plants. Produce plant hormones. Dominate the soil biomass. Mycorrhizae - live in or on plant roots. a) Increase uptake of water and nutrients by roots. b) Produce hormones and antibiotics that help plant growth and prevent diseases. c) The fungi benefit by taking in the nutrients from the roots they live in. Saprotrophic fungi play a critical role in the global carbon cycle. Arbuscular (AM) and ectomycorrhizal (EM) fungi form symbioses with the broadest range of host plants. Lichens are symbiotic mutualistic associations between a fungus and a green alga (bipartite symbiosis), and sometimes also with cyanobacteria (tripartite symbiosis).

Factors affecting growth of fungi a) Fungi Quality as well as quantity of organic matter in soil has a direct correlation to the growth. b) Fungi abundant in acidic area compared to bacteria. c) Fungi also grows well in dry, arid soils C. Actinomycetes Actinomycetes are gram-positive aerobic bacteria that belong to the order of Actinomycetes known by its substrate and aerial mycelium production. Optimal growth at alkaline pH.

Role of Actinomycetes in Soil: Actinomycetes inhabit the rhizosphere of agricultural crops, where they increase soil fertility through recycling of organic matter and solubilizing phosphate. They form associations with some non-leguminous plants and fix N, which is then available to both the host and other plants in the near vicinity. D. Algae The term algae are used to describe a large collection of photosynthetic, eukaryotic organisms.

Algae are a very wide and varied group of simple, usually autotrophic organisms. Algae can make its own nutrient through a process known as photosynthesis. Reproduction in algae occurs in both asexual and sexual forms. Asexual reproduction occurs by spore formation. Role of Algae in Soil They also play a significant role in the soil where they are used as biofertilizer and soil stabilizers. Its play an important role in the maintenance of soil fertility especially in tropical soils. By joining up soil particles in a manner that eliminates and avoids soil erosion, the algae help improve the potential for preservation of water in soils over longer periods of time.

Soil fauna : Protozoa, Nematodes, Earthworm, Moles, Ants and Rodents. A. Protozoa Protozoa are single-celled, eukaryotic microorganism. When protozoa eat bacteria, they speed up the

cycling of nitrogen, making nitrogen more available to plants. They are larger than bacteria, varying from a few microns to a few millimeters. Role of Protozoa in Soil They play an important role in maintaining microbial/bacterial equilibrium in the soil. Some protozoa have been recently used as biological control agents against organisms that cause harmful diseases in plants. Their population in arable soil ranges from 10,000 to 100,000 per gram of soil and they are abundant in surface soil.

B. **Nematodes** Nematode, also called roundworm. The number of named species is about 20,000. Nematodes are bilaterally symmetrical, elongate, and usually tapered at both ends. Nematodes range in size from microscopic to 7 metres. This speeds up nutrient recycling. Role of Nematode in Soil: Nematodes enhance soil quality in four major areas: regulate the populations of other soil organisms, mineralize nutrients into plant-available forms, provide a food source for other soil organisms and consume disease-causing organisms. Nematodes are important nutrient mineralizers. When nematodes consume bacteria or fungi, they release excess ammonium (NH4 +).

C. **Earthworm** Earthworms are commonly found in soil, eating a wide variety of organic matter. Earthworms are one of the most important soil animals; they have the capability to maintain the fertility of the soil and therefore play a key role in sustainability. They are also known as farmer's friend, ploughman of the field, intestines of the earth, ecological engineers, and biological indicators. Earthworms are functionally very important and diverse, and therefore potentially useful for the management of biodiversity and ecosystem services.

Species: a) Eisenia fetida b) Lumbricus rubellus c) Eudrilus Eugenie. **Role of Earthworm in Soil**: New Zealand research shows that worm casts release four times more phosphorus than does surface soil. EWs influence the supply of nutrients through their tissues but largely through their burrowing activities; they produce aggregates and pores (i.e., biostructures) in the soil and/or on the soil surface, thus affecting its physical properties, nutrient cycling, and plant growth.

Benefits of Earthworm a) Improved productivity b) Improved soil structure c) Improved drainage d) Improved nutrient availability D. Moles Any burrowing, often blind insectivore in the family Talpidae. Most species have short legs and tail, a pointed head, velvety greyish fur, no external ears, and a strong odour. They range from 3.5 to 8 in. (9 to 20 cm) long. Moles are active day and night, digging surface tunnels in search of earthworms, grubs, and other invertebrates. Roles of Moles in Soil: Mole activity is a sign of healthy soils. Because moles prefer loamy, rich soils that harbor their prey.