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Opinion

Note on Scope and Importance of Soil Microbiology

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DESCRIPTION

Living creatures of all kinds, both plant and animal, are a vital component of soil. Even though these creatures make up a small percentage of total soil mass (less than 1%), they play a significant role in maintaining plant ecosystems on the planet's surface. The soil-plant-animal ecosystem as a whole must be considered when researching the scope and importance of soil microbiology. Thus, considering aspects such as soil as a living system, the breadth and value of soil microbiology may be better appreciated. Plant growth and soil microorganisms Soil microbes and soil structure, breakdown of organic materials, husus formation, biogeochemical cycling of components Microbes in the soil as biocontrol agents, Microbes in the soil and seed germination N_2 fixation by living organisms, pesticide degradation in the soil.

Micro-flora (fungi, bacteria, algae, and actinomycetes) and micro-fauna (bacteria, algae, and actinomycetes) coexist in soil (protozoa, nematodes, earthworms, moles, ants). The density of living creatures in soil is extremely high, up to billions per gram of soil; however, the density of organisms in cultivated soil is often lower than in uncultivated/virgin land, and population falls as soil acidity rises. Because it is well supplied with oxygen and nutrients, top soil, or the surface layer, includes a greater number of microorganisms. Because the lower layer or subsoil lacks oxygen and nutrients, it has fewer species. Both autotrophs (algae, BOA) and heterotrophs (bacteria) make up the soil ecosystem (fungi, bacteria). Heterotrophs use organic carbon and are decomposers/consumers, whereas autotrophs use inorganic carbon from CO_2 and are "primary producers" of organic matter. Because microorganisms are so little and minuscule, they can be found in soil, water, and the air. Soil and soil microbes serve as the optimum medium for plant growth, in addition to promoting the growth of diverse biological systems. Complex organic nutrients are converted by soil fauna and flora into simpler inorganic forms that are easily absorbed by plants for growth. Furthermore, they create a number of chemicals such as IAA, gibberellins, antibiotics, and others that boost plant growth directly or indirectly.

Stable aggregates of soil particles are required for soil structure, and soil organisms play a key role in soil aggregation. Organic matter, polysaccharides, lignins, and gums, which are produced by soil bacteria, play a vital role in cementing and binding soil particles. Furthermore, cells and mycelial threads of fungi and actinomycetes, as well as vormicasts from earthworms have been discovered to have a part in soil aggregation. Fungi, actinomycetes, gum-producing bacteria, and yeasts are the several types of soil microorganisms with soil aggregation/soil binding capabilities. Organic matter not only provides food for microbes, but it also provides energy for the important metabolic activities that are unique to living creatures. Fungi, actinomycetes, bacteria, protozoa, and other microorganisms, as well as macro creatures such as earthworms, termites, and insects, play a vital part in the breakdown of organic matter and the release of plant nutrients in soil. Thus, organic matter supplied to the soil is changed to simpler nutrients/chemicals for plant growth by oxidative decomposition, and the remainder is transformed into humus. Cellulose, lignins, and proteins (in plant cell walls), glycogen (animal tissues), proteins, and lipids are examples of organic matter/substances (plants, animals). Bacteria, particularly those of the genus *Cytophaga* and other genera (*Bacillus, Pseudomonas, Cellulomonas,* and *Vibrio Achromobacter*), as well as fungal genera (*Bacillus, Pseudomonas, Cellulomonas*, and *Vibrio Achromobacter*), breakdown cellulose (*Aspergillus, Penicilliun, Trichoderma, Chactomium, Curvularia*). Fungi, protozoa, and nematodes partially breakdown lignins and proteins. Fungi, actinomycetes, and *Clostridium* are the principle degraders of proteins into individual amino acids. Methane is the principal carbon-containing product produced by the bacterial genera *Methanococcus, Methanobacterium*, and *Methanosardna* under anaerobic conditions in waterlogged soils.

Humus is an organic residue in soil formed by the decomposition of plant and animal residues, or it is a highly complex organic residual matter in soil that is not easily degraded by microorganisms, or it is a soft brown/dark coloured amorphous substance made up of residual organic matter and dead microorganisms.

The cycling of elements from their organic/elemental state to inorganic molecules, organic compounds, and back to their elemental states is essential for life on Earth. Mineralization, or the microbial conversion of complex organic molecules into simple inorganic compounds and their constituent elements, is a biogeochemical process in which organic substances are broken down to inorganic compounds or their constituent elements. Soil microbes play a critical part in the biochemical cycling of elements in the biosphere, where key elements such as carbon,

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phosphorus, sulphur, nitrogen, and iron undergo chemical transformations. Organic carbon, nitrogen, phosphorus, sulphur, iron, and other elements are made accessible for reuse by plants through the mineralization process. Biological nitrogen fixation is the conversion of atmospheric nitrogen to ammonia and nitrate by microorganisms.