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Soil Microbiome - Simple Way of Defining It

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ARTICLE ID: 74

Abstract

The habitat with the most variety and complexity is soil, which is home to numerous macro creatures, including millions of fungus and billions of bacteria. The soil's microorganisms are crucial for the cycling of nutrients and for protecting plants from the damaging effects of biotic and abiotic stressors. Intensive farming techniques improve crop productivity, but they also have a negative impact on the biological and physical characteristics of soils. Agricultural practises change the variety and makeup of soil microbial communities, and these altered communities have an impact on the functioning of agricultural ecosystems, which is currently not well understood. Defining soil microbiome and its functions and importance may help in this regard.

Keywords: Microbiome, Microbiota, Relic DNA

Introduction

Soil microbiome is a Gold Mine for Soil Health. On conventionally tilled and untilled soils, the influence of soil microbes on plant productivity, nitrogen uptake, and ecosystem function varies. The soil microbiome supports a wide range of ecosystem processes that change depending on the environment and plays a significant role in the global nutrient cycle and plant nutrition. Numerous different microorganisms make up the soil microbiome, which supports crucial ecosystem functions as pathogen control, nutrient recycling, and soil structure protection. has the ability to have an impact on plant development and crop yield both favourably and unfavourably.

The words “micro” and “biome” are of Ancient Greek origin. “Micro” means small, while the term “biome” is composed of the Greek word bíos (life) and modified by the ending “ome” (Anglicization of Greek). Soil microbiome is defined as “set of genes found in association with the organisms that colonize a given environment”. Soil contains an interacting population of bacteria, archaea, viruses, fungus and protozoa, collectively known as the ‘soil microbiome’. Native microbial community is called “microbiome.” Soil contains

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an interacting population of bacteria, archaea, viruses, fungus and protozoa, collectively known as the 'soil microbiome'.

The currently most cited definition by Lederberg describes microbiomes within an ecological context, as a community of commensal, symbiotic and pathogenic microorganisms within a body space or other environment. The term microbiome, as it was originally postulated by Whipps and coworkers , includes not only the community of the microorganisms, but also their theatre of the action. The latter involves the whole spectrum of molecules produced by the microorganisms, including their structural elements (nucleic acids, proteins, lipids, polysaccharides), metabolites (signaling molecules, toxins, organic, and inorganic molecules), and molecules produced by coexisting hosts and structured by the surrounding environmental conditions. Therefore, all mobile genetic elements, such as phages, viruses, and "relic" and extracellular DNA, should be included in the term microbiome, but are not a part of microbiota. Microbiota - The words "micro" and "biota" are also of Ancient Greek origin. It is a combination of "Micro" (small), with the term "biota", which means the living organisms of an ecosystem or a particular area.

Members of the microbiome

The microbiota comprises all living members forming the microbiome. Bacteria, archaea, fungi, algae, and small protists should be considered as members of the microbiome. Bacteria and fungi are the most common microorganisms in soil, with archaea being less abundant, followed by protists and viruses. Microbiota is usually defined as the assemblage of living microorganisms present in a defined environment . As phages, viruses, plasmids, prions, viroids, and free DNA are usually not considered as living microorganisms , they do not belong to the microbiota. But microbiome includes all.

Factors Influencing the Soil Microbiome

- **Effect of plant genotype:** plants with different genotypes behave differently concerning root metabolism, the composition of root exudates, recognition systems, and innate immune response
- **Effect of bioinoculants**: Microbial inoculants efficiency depends on the inoculum traits and its ability the overpass native microbial competition and establishes in the rhizosphere

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- **Effect of a pathogen:** Inoculation of the phytopathogenic fungus Rhizoctonia solani increased the diversity of Gammaproteobacteria in lettuce.
- **Effect of agricultural practices :** Such as fertilizers, green manure, compost, vermicompost, agrochemicals, crop rotation, monoculture
- **Effects of abiotic factors:** Like drought, salinity, high temperatures, low temperatures, pH

Importance of Soil Microbiome

- Plays an important role in plant growth development and soil fertility for sustainable agriculture
- Plays a role in nutrient cycling through organic matter decomposition
- Resistance to abiotic stress
- Suppressing soil-borne plant pathogens
- Key player for conservation of soil health under changing climate
- Bioremediation: harmful organic substances such as polycyclic aromatic hydrocarbons (PAHs), pesticides and plastics. Microbes such as Pseudomonas, Corynebacterium and Staphylococcus use gene mutation, rearrangement and differential regulation to help them survive in unfavourable conditions such as contaminated environments.
- Ecosystem functioning

Conclusion

The many functions performed by soil microorganisms have a favorable impact on plant development, leading to high output and ultimately, meeting the world's rising food need. However, agitations brought on by climate change have an impact on soil microorganisms, which will impact normal nutrient cycles and other soil activities. In this case, the ecosystem services provided by soil bacteria won't be enough to maintain a healthy ecosystem for future generations. As a result, there is a constant need to improve how important processes carried out by soil bacteria are affected by a changing environment. In order to solve the challenge in agriculture, it is necessary to learn more about the diversity and functions of various microbial groups in soil in different agro-ecosystems.