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A STUDYING ABOUT THE SOIL MICROBIOLOGY

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ABSTRACT

In the last few years, resistance developed by microorganisms against antibiotics has rapidly increased. The global health sector faces a huge obstacle for the treatment of various diseases. There is a need to look at alternate sources like microorganisms from which new and useful substances against various diseases can be obtained. Aim: To screen the soil surrounding medicinal plants possessing antimicrobial activity in order to find soil bacteria capable of producing useful antibiotics across various regions of Saurashtra. The name Actinomycetes is derived from Greek word kites (a ray beam) and mykes (mushroom or fungus) and is used for fungus like prokaryotic microorganism.

They are highly diverse and found in most of the natural environments (Kresk 2000). They are prokaryotes with extremely diverse metabolic possibilities and produce a range of substances essential for health, such as antibiotic, enzymes and immune modulators. In the present study, 11 medicinal plants and 3 regions of Saurashtra were selected. Several microscopic and morphological methods were used for studying colony characteristics.

Cross streak, agar well and disk diffusion methods were used for screening. TLC, bio autography, various biochemical tests, enzymatic activity, 16S rDNA sequencing, gel electrophoresis were done followed by optimization study. Extraction and characterization was done of most potent isolate using UV, FTIR, NMR, MASS, and in vitro microbial assay.

Keywords: - Microbiology, Soil, Medical, Plant, Microscopic.

I. INTRODUCTION OF SOIL MICROBIOLOGY

Microbiology is based on science field; include detail understanding of several of microorganisms in every aspect. Soil microbiology branch is focused on microbes found in soil.

Soil is the outermost layer of earth, basically soil forms by complex process from rocks with combined effects of biological, physical and chemical forces that rocks initially convert rubbles and thereafter soil.

Many times, initially available primary component material, environmental and biological activities are major factors for soil formation.

Soil supports plants by mechanical and nutritive manners. From microbiological point of view, soil is vibrant (in terms of living nature of various organisms in soil) site in which various nature's biochemical interactions occur. Fig.1 represents various functions of soil.

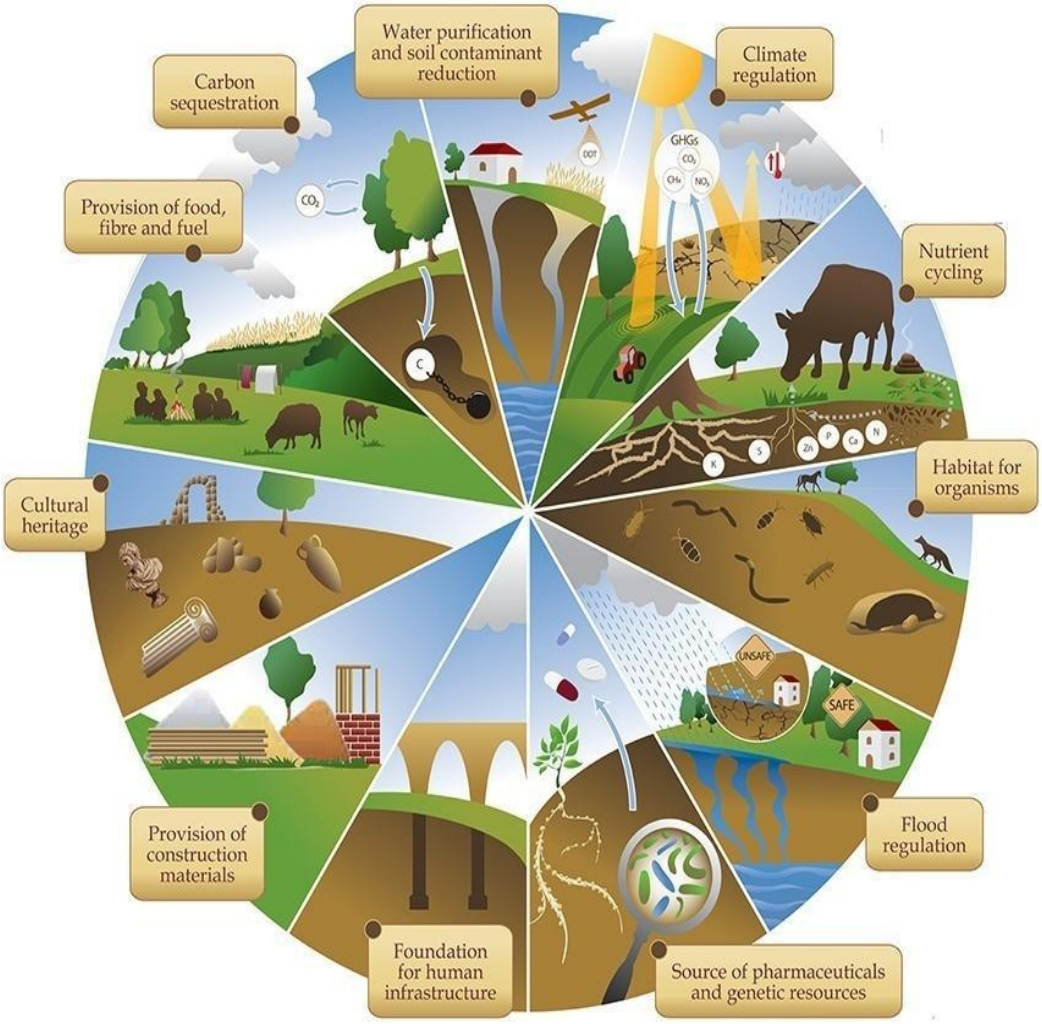

FIGURE: 1 FUNCTIONS OF SOIL

II. SCOPE OF SOIL MICROBIOLOGY

Three ecosystems: soil, plants and animals must be considered in an account of the scope of microbiology.

Soil system

It contains a different collection of microfauna and microflora. The density of living organisms depends on many factors. Cultivated and uncultivated soil has a different diversity of living organisms.

Microbes in the growth of a plant

They serve as one of the best media for the development and growth of various plants. They convert the different organic molecule into simplified form which can be uptaken by plants.

Microbes in soil structure

There are many constitutes produced by soil microbes like organic matter, lignins, polysaccharides and useful for structure of the soil as a binder and cementing material with particles of soil. Various microorganisms have their own application in soil structure.

Decomposition of organic matter

Living organisms in both microflora and fauna play a significant role in the supply of nutrition into the soil by decomposing various organic matters.

Formation of humus

Humus is a complex organic residue produced by the decomposition of animal and plant components and very difficult to degrade. Generally, humus is brown in color, amorphous in nature and contains different organic matter and microbes.

Elements cycling

Earth cycle depends on the interconversion of an organic compound to inorganic and at the end, element level. There is the importance of microbes in this elemental cycling process like mineralization and reuse of essential elements.

Nitrogen fixing

Ammonia and nitrate converted from atmospheric nitrogen by microorganisms is known as a nitrogen-fixing process, which is vital for the soil ecosystem

Biocontrol agent and pesticide degradation

Nowadays, various bio formulations are used in agriculture which are eco-friendly and produced from microbes for overcoming diseases in plants, insects, weeds, etc. Microorganisms serve as scavengers in an ecosystem to maintain a system of the earth. Toxic chemicals are there in soil and affect each living organisms like plants, animals, and humans. Microbes overcome this toxicity of components by their scavenger's action, decompose those toxic components; microbes reduce toxic pesticides in the earth system.

III. TYPES OF ORGANISMS IN THE SOIL

Various plants and animals are important living organisms in the soil. Many researchers had done work to demonstrate the fact that soil is alive rather than considering static material.

Bacteria

Bacteria are small in size, prokaryotes, as compared with other types of microbes, and more in number. Each gram of soil contains about 10^6 to 10^{10} bacteria. However, this depends on types of soil and ecological system. Bacteria are found in almost every habitat like air, water, in the animal system and in soil.

Actinomycetes

- **Introduction**

Selman and Walkman had done their work in search of antibiotic from actinomycetes for treatment of tuberculosis. During their research, they noted some fungi were able to decrease the growth of bacteria. And further, on that direction of work it was possible to isolate antibiotics from actinomycetes, that was the discovery of streptomycin from microorganism and for that valuable research they got Noble prize in 1952 in the field of medicine. Name of this group of microbes came from the Greek word "Atkins" and "mykis" represent "a ray" and "fungus" respectively. So, this type of microbes contains characteristics of fungus and bacteria. Some unique characteristics are also observed in actinomycetes. They are Aerobic in nature**,** Filamentous**,** Largest in taxonomic division (amongst presently recognized 18)**,** Gram-positive (mostly)**,** Spore-producing**,** Mycelium observed in both ways (aerial and vegetative)**,** G+C ratio is More than 55 mol percentage of DNA. Found in different ecosystems like aquatic and soil, they perform the main function of recycling various biomaterials by decomposing those materials which come from the dead part of various organisms like a plant, animal and fungi.

- **Habitat**

The odor of fresh wet soil is due to the various volatile substances formed by actinomycetes. They are found in different habitat widely distributed in the soil of earth & marine ecosystem. Some reports also confirmed actinomycetes presence at Antarctica and the desert.

- **Structure**

Rods or threads branching are a characteristic property of actinomycetes. Some other structural characteristics like non-septate hyphae, septa (in a certain situation), mycelium sporulation branching (some conditions), spiral and straight sporulation of mycelium.

IV. CONCLUSION

In conclusion, soil microbiology is a fascinating field of study that explores the complex and diverse interactions between microorganisms and soil ecosystems. Microbes play crucial roles in the soil, participating in nutrient cycling, organic matter decomposition, plant-microbe interactions, and overall soil health. Through their metabolic activities, they influence the availability of nutrients, the stability of soil structure, and the overall fertility of the soil.

Research in soil microbiology has revealed the incredible diversity of microbial communities present in the soil, with countless species coexisting and interacting in complex networks. These communities are influenced by various factors, including soil type, land management practices, climate, and plant species. Advancements in molecular biology and sequencing technologies have enabled scientists to better understand the composition, diversity, and functional potential of these microbial communities.

The study of soil microbiology has also shed light on the essential roles of microbes in sustainable agriculture and environmental management. Microbes can contribute to crop productivity through their ability to enhance nutrient availability, control plant diseases, and promote plant growth. Furthermore, they play a crucial role in environmental processes such as carbon sequestration and mitigation of greenhouse gas emissions.

However, soil microbiology is still a rapidly evolving field, and there is much more to discover and understand. Future research efforts will focus on unraveling the functional potentials of different microbial groups, deciphering the intricate microbial interactions within soil ecosystems, and exploring innovative ways to harness the beneficial capabilities of soil microorganisms for sustainable agriculture and environmental remediation.

Overall, soil microbiology provides valuable insights into the intricate and dynamic world of microorganisms inhabiting the soil. Understanding the role of soil microbes is crucial for sustainable land management, ensuring food security, and mitigating environmental challenges. With continued research and technological advancements, we can further unlock the potential of soil microbiology for the benefit of agriculture, ecosystems, and the planet as a whole.

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