Department of biology

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((soil microbiology))

Stage (-3-)

LEC- ((2))

The most important common bacterial species in agricultural soil

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Soils are generally characterized by their high bacterial content, and they vary in the numbers and types of bacteria that are dominant within them. This variation is not limited to different soil types however, this difference appears very pronounced within the same soil.

Percentages of bacteria presence in the soil:

Arthrobacter 60 -5

Bacillus 67 – 7

Pseudomonas 15 – 3

Agrobacterium 20

Alcaligenes 12 - 2

Flaavobacterium 10 – 2

Some factors affecting the growth and reproduction of soil bacteria:

Organic matter:

Upon the addition of materials, microbial numbers increase, provided that other environmental factors remain suitable. When organic materials, such as animal or plant waste, are added, the numbers of bacteria and fungi quickly increase first during the initial stages of organic matter decomposition. In contrast, the numbers of actinomycetes increase during the final stages of decomposition. This delay is due to the weak competitive ability of actinomycetes during the initial stages. However, in the final stages, the ability of bacteria and fungi to decompose complex organic compounds—such as

pectin and chitin—decreases, allowing .actinomycetes to dominate

Furthermore, the numbers of soil bacteria are higher in the surface layer of the soil compared to the lower layers. This increase in bacterial populations in the surface layer is primarily attributed to the higher percentage of organic matter found there compared to the layers beneath it. Additionally, this layer is enriched by root secretions (exudates) from growing plants, which include growth regulators, vitamins, and amino acids. Microbial activity and numbers generally reach their peak in these root distribution zones and tend to decrease significantly as soil depth increases. Similar to bacteria, the numbers of actinomycetes also decline with increasing soil depth.

Nutrients:

Nutrients such as nitrogen, phosphorus, potassium, calcium, sulfates, iron, and others are very important for the building, growth, and reproduction of bacteria. Some of these elements are essential for the formation of amino acids, nucleic acids, and the bacterial cytoplasm, while others are important in controlling cellular biological activities and in the formation of bacterial cell walls. Therefore, an increase or decrease in any of these nutrients has either a negative or positive effect. Experiments have shown that the addition of chemical fertilizers directly affects the growth and reproduction of .bacteria, especially soil bacteria

Soil Moisture:

Soil bacteria are greatly affected by soil moisture. Rainfall or irrigation is considered an important factor influencing soil moisture. If the moisture level remains high for a long period, this limits the growth of aerobic bacteria, while it encourages the growth of anaerobic bacteria. Suitable moisture for bacterial growth occurs when soil moisture ranges between 51–71% of the soil's water holding capacity (W.H.C.). As for actinomycetes, they can grow when moisture levels reach 85–100% of the soil's maximum water holding capacity. They are aerobic, yet they tolerate drought well and tend to colonize soil. Generally, they can withstand severe dryness, as their survival rate may reach up to 90% of living bacteria in desert regions.

Temperature

Temperature greatly affects bacterial growth and activity in soil and water. Most soil bacteria grow optimally at .25–35°C, with a tolerance range of 15–45°C

Soil pH

Soil bacteria generally prefer a neutral pH (~7). Lowering pH reduces bacterial numbers and increases fungi, while increasing pH toward alkalinity reduces fungi and increases the proportion of actinomycetes, .which may reach up to 95% of soil microorganisms

:Agricultural Practices

Tillage, irrigation, and other agricultural practices influence soil bacteria by affecting aeration, moisture,

nutrient availability, and organic matter decomposition. Cultivated soils usually contain more bacteria than .uncultivated soils

Soil Depth

Bacterial numbers are highest in the upper 15 cm of soil, especially in root zones, and decrease with increasing depth. Actinomycetes also decrease with depth, though .their relative proportion may increase

Soil Salinity

High soil salinity generally reduces microbial activity, but some bacteria can grow at salinity levels up to 8 $dS \cdot m^{-1}$, and actinomycetes may dominate under saline .conditions

Seasons

Bacterial populations increase in spring and autumn due to suitable temperature and moisture, while activity decreases and dormancy occurs in summer