

MICROBIAL DIVERSITY

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The invention of magnified lens by Anton van Leeuwen hock (1677) has revealed the existence of microbes. He identified major classes of bacteria, protozoa, algae etc. Pasteur (1857) observed the microbes which are associated with different kinds of alcoholic fermentation and smaller rods (lactobacilli) in the lactic fermentation. During this experiment, Pasteur established the study of microbial metabolism and in particular he showed that life is possible with out air.

Microbes are highly diversified. They occur in different habitats soil, water, air and even in extreme habitats like hot springs, glaciers etc.

soil microbes

Soil is the outer region of earth crust, formed by gradatioal weathering of rock. Soil is a unique' habitat gives mechanical and nutritional support to the plants. The ratio of soil particles governs the porosity, soil water, pH, inorganic, organic matters and microorganisms. The sources of inorganic material in soil are the parent rocks.

soil includes organic matter, soil water, air and soil microbes. Microbes decompose the organic matter and it is converted into humus. soil water and air influence the metabolic activities of soil microbes. Microorganisms which live in soil are algae bacteria, actinomycetes, fungi, protozoa nematodes etc.

1) **Soil algae.** Both prokaryotic and eukaryotic soil algae grow well where adequate amount of moisture and light present. Blue green algae as they are biofertilizers play important role in the field of agriculture. The prominent genera are Anabaena, Oscillatoria, Nostoc, Scytonema etc.

2) Bacteria: These unicellular prokaryotes and more in numbers which varies between 100000000 and 10000000000 cells per gram soil. Based on regular presence, bacteria are divided into two groups. 1.Soil indigenous and 2.soil invader .

The number and types of bacteria are influenced by soil types and their micro environment. They found more in cultivated land, maximum in rhizosphere due to aeration and nutrient availability. Bacteria do not occur freely in the soil solution but are closely attached to soil particles embeded in organic matter. They play a role in organic matter decomposition , biogas production, nitrogen fixation etc. Ex1) Agrobacterium, Nitrosommas, Rhizobium etc.

1.**Actinomycetes.** They exhibit the characters of both of bacteria and fungi, but having close affinity with fungi. They release antibiotic substances. Actinomycetes are more in grassland than in the cultivated land. pH of soil governs their abundance in soil. Ex. Actinomyces,



Actinoplanes, Micromonospora, Microbispora, Nocardia etc.

4) Protozoa : They remain in encysted form. The role of soil protozoa is predatory, as they eat upon bacteria ,Ex colpoda, Heterometa etc .

5) Fungi : They grow more in aerated soils, fungi derive nutrients for their growth from organic matters, living animals and living plants. The soil inhabiting fungi are characterised by the ability to survive indefinitely as soil saprophyte. Ex: Aspergillus, cladosporium., Alternaria etc. Fungi associated with plant diseases Fusarium, Phytophthora, Pythium etc.

Rhizosphere is the area of intense microbiological activity that extends several millimeter from the root system of the growing plant. Rhizosphere in subterranean habitat for microorganisms. Rhizosphere microbes differs from plant to plant both qualitatively and quantitatively Rhizoplane denotes the root surface .

The phenomenon of loss of organic and inorganic compounds from root surface is known as root exudation, it becomes food base for microbes. Hence there is increased microbial activity in rhizosphere. Root exudates contain carbohydrates, organic acids, enzymes, amino acids, vitamins.

The rhizosphere region is highly favourable for microbes. The dominant fungi of rhizosphere are Aspergillus flavus, A. niger, A. fumigatus, Fusarium oxy sporum etc. The dominant fungi of rhizoplane are A.niger, cladosporium herbarum, Fusarium oxysporum, , F.solani.

Cysts of nematodes, blue green algae, and protozoa are conspicuous in the rhizosphere region Bacteria like Arthro bacter, Pseudomonas, Bacillus polymixa, Agrobacterium radiobacter,

A. tumi faciens, Azato bacter, Rhizobium, Micrococcus etc. are reported from the rhizosphere and rhizoplane regions.

The rhizosphere microbes have either beneficial or harmful effects on the development of plant.

Factors affecting microbial community in soil

Soil moisture, PH, Temperature, Gases, Organic and inorganic Chemicals, Organic matter etc, are the major external factors influence the microbial community in soil.

Organic matter alters the composition of soil microflora and microfauna.

Types of vegetation: The dominance of microbes is related to the type of vegetation. For eg. There is an increased population of fungi in the rhizosphere of soyabean. In rhizosphere

Aspergilli, Fusaria, Penicillia were dominant in addition to the other fungal species.

Biogeochemical cycles and organic matter decomposition also influence the population of microbes.

Microbes in water

There are thousands of microbes live in water and transported through it. They include saprophytes. Water receives microbes from soil ,air, sewage, organic wastes, dead plants and animals, which fall under the group like bacteria, fungi, algae, protozoa and nematodes.

The bacteria found in water are Pseudomonas, E. coli, Aerobacter etc. Some of the aquatic fungi are Achyla americana, Chytridium brevipes, Pythium undulatum , Sapromyces indicus etc.

Water borne pathogenic bacteria are Vibrio cholerae, Salmonella enteriditis, Pseudomonas aeruginosa etc. water borne pathogenic protozoa are Giardia lamblica, Cryptosporidium,

Entamoeba histolytica.

Marine microbiology: Marine microbiology deals with microbes living in sea water. The bacteria growing in vertically differentiated marine environment can be categorised in to 3 groups.

a) Baro tolerant bacteria – growing between 0 and 400 atm.

b) Moderate barophiles – bacteria growing optimally at 400 atm.

c) Extreme barophiles - bacteria growing only at higher pressure i.e,6000 to11,000 meter depth. some bacteria are living in gut of deep sea invertebrates. In the marine system, the major source of organic matter is from phyto planktons. Pico cyanobacteria may represent 20 to 80% of total phytoplankton biomass, Inturn these act as a source of food for marine fish and other animals.

Fresh water microbiology:

Lakes and rivers provide the major fresh water bodies. Phytoplanktons, decomposition of organic matter animal activities influence the nutrient level water bodies. The nutrient poor lakes are known as oligotrophic lakes, where as the nutrient rich lakes are

eutrophic lakes.The nutrient rich lakes contain high amount of bottom sediments containing organic matter and eutrophic lakes support luxuriant growth of bacteria and algae. Some of the fast growing algae at optimum condition showing their maximum population and cause water bloom .

The microorganisms growing in lakes are Anabaena Microcystis, Nostoc, Oscillatoria, Oedogonium, Spirulina, Diatoms,protozoa etc.



The capacity of rivers and streams to process the added organic material is limited. If too much organic material is added, the water becomes anaerobic. Untreated and inadequately treated wastes and other organic materials are discharged into the streams and rivers, These organic wastes cause changes in microbial community. When the amount of organic materials added is not too high, it supports the growth of algae. Algae produce oxygen during photosynthesis . streams,

The natural water bodies such as lakes, rivers contain sufficient amount of nutrients that support the growth of microbes. By inappropriate treatment and broken sewage line, microbes enter into water supply

Coliform groups are present in water due to faecal contamination. (Coliforms are the members of the family enterobacteria real includes E. coli, Enterobacter aerogens and Klebsiella pneumoniae }

Air microbes (Aerobes)

Aeromicrobiology that deals with the study of air-borne microbes and viruses along with particulate matter of air like smokes, dust etc. The important gases that affect the microorganisms are hydrogen sulphide, sulphur dioxide , carbon monoxide, chlorine etc. The microbial forms are bacteria, fungi, spores of bacteria, fungi, spores of actinomycetes, algae, spores of bryophytes and pteridophytes, pollen grains micro insects and viruses.

Air containing foul smelling and pathogenic microbes which are not fit for human health. such air cause diseases including allergy. The allergy causing air-borne agents are called aeroallergens that include biotic and abiotic factors.

Groups of aerobes:

Aerofungi: Studies on microbial components of air over crop fields are useful in understanding the plant pathogens and in establishing the forecasting system for disease control. The dominant fungi over potato field are Alternaria alternata , Aspergillus flavus, and penicillium eitrinum Aniger, Cladosporium herbarum. About 62 aerospora were recorded over rice field. The most dominant, fungal taxa was Aspergillus followed by Penicillium Alternaria and cladosporium. In general Aspergilli form a major component of aerospora including pathogenic species.

The species of fungi secreting aflatoxins A. flavus . (Afla toxins are the secondary metabolites which is injurious to human health.)

Aeroalgae: They found in air upto a height of 2 mtrs. The most common algae in air are chlorella,



chlorococcums Chlamydomonas, Aulosira, Nostoc and phormidium.

Lichens : The lichen component of aerospora have also been reported. The most common lichens are cladonia, Heteroderma, , Usnea, Parmelia etc.

Indoor acrobes :

It refers to the microbes present in air inside the houses. There are many microbes present in air inside the houses. There are many microbes which are responsible for biodeterioration of storage materials, equipment, Library materials and archives.

Microbes found in pharmacy, hospitals etc. are some examples of indoor aerospora.

1. **Aeromicrospora of Pharmacy:** Aerofungi were reported in the fermentation unit of a pharmacy. The environmental factors like relative humidity and temperature affected their occurrence. Dominant species are cladosporium , Alternaria sps., Penicillium cyclopium etc

2) **Aeromicroflora of hospitals.** Hospitals act as reservoirs of pathogens. They transmitted from patients to other individuals. The hospital transmitted pathogens are Mycobacterium tuberculosis, Staphylococcus aurens, Aspergillus flavus, candida albicans etc.

Papers get degraded by microbes in the library. The major constituent of paper is the cellulose. Therefore cellulose degrading microbes colonise and degrade the papers. common cellulose degrading fungi are Alternaria, Aspergillus cladosporium, Fusarium, Nigsospora, Rhizopus, Trichodermä etc. High moisture and low temperature increase the rate of cellulose decomposition by these fungi.

Aeroallergens and Aeroallergy

The term allergy is used to denote any altered capacity of body to react to a foreign substance.

Allergy is caused by certain biological and abiological agents present in the atmosphere. The allergy causing agents present in air are called aeroallergens and the allergy called aeroallergy. prominent aeroallergens are house dusts, pollen grains, cosmetics, micro spores or cells etc.

Some examples of common aeroallergens are

- a) Algae - Aulosira, Chlamydomonas , Lyngbya , Gloeoterchia , diatoms
- b) Fungi- candida, Monila, alternaria, Aspergillus .
- c) Pollen grains - Parthenium hysterophorus,, Argemone mexicana, Carica papaya.

House dust allergens:



House dust is a mixture of hairs, moulds, bacteria, decomposed parts of clothes, small insects, mites etc. Persons who inhaled these later on suffers from allergy. The common fungal allergens are Rhizopus, Fusarium, cladosporium etc.

Pollen grains:

The aeroallergenic pollen grains are contributed mainly from the plants belonging to the family Poaceae, Chenopodiaceae, Amaranthaceae and Asteraceae.

Pollen grains dispersed through water, wind and insects. Allergenic potential of pollen grains is governed by their chemical composition.

Cosmetics:

The examples of cosmetics are creams, powders lotions, oil dyes etc. These cosmetics show dermatological problems. The causes of allergies are

1. the quality of cosmetics
2. Spoilage of cosmetics by microbes
- 3 secretion 2 toxins by microbes
- 4 chemical ingredients of cosmetics etc

Phylloplane microflora

Kerling used the term Phylloplane to describe the leaf surface as the habitat of microbes. The spores present on leaf surface get nutrients from leaf and also from pollen grains present in Leaf surface. phylloplane microflora includes Pseudomonas trifoli, candida albicans, Saccharomyces cervisiae, Alternaria alternata etc.