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Department : Microbiology

Paper : Microbial Ecology

Date : 17/4/ 2020

Exam : spring 2020

Semester :4th

Q..No 2 : Difference between ;

i) Microbial ecology & Macro ecology :

Microbial ecology is the science that examines relationship between microorganism their natural biotic (virus, bacteria, eukaryote) and abiotic (soil, water) environment . Microbes are the tiniest creatures on earth , yet they have a huge impact on all of us .

Macroecology is subfield of ecology that deals with the study of relationships between organisms and their environment at large spatial scales to characterize and explain statistical patterns of abundance, distribution, and diversity.

ii) Ecosphere and ecological niche :

Ecosphere is part of the earth and atmosphere in which living organism live . It does not exchange matter with any part outside the system . Such system is scientifically interesting and can potentially serve as a life support system during space flights, in space station or space habitats .

Ecological niche is the position that animal occupies in habitat. It includes It includes physical space where the organism is found and its role in that habitat in terms of feeding relationship and other interactions with other species .

iii) Nitrogen fixation and nitrification :

Nitrogen fixation is the conversion of nitrogen into ammonia . It is a chemical process in which atmospheric nitrogen is converted into organic compounds. It is the 1^{st} step which fixes atmospheric nitrogen into ammonium ions.

While nitrification is the biological oxidation of ammonia or ammonium ion to nitrite followed by the oxidation of the nitrite to nitrate . It is performed by soil living bacteria and other nitrifying bacteria .

Iv) carbon cycle and sulfur cycle :

Carbon cycle is a process in which carbon is circulated in various forms through nature . The source of carbon in living matter is CO2 in the air or dissolved in water .

Bacteria plays an important role in sulfur cycle . Sulfur reducing bacteria during decomposition and reduce sulfate compounds to hydrogen sulfide. Photosynthetic sulfur bacteria grow anaerobically, oxidize hydrogen sulfide and release sulfur element .

v) CFU & BOD :

Colony forming unit (CFU) is a unit used for measuring number of bacteria or microorganism in a given sample.

While Biochemical oxygen demand (BOD) is a the amount of oxygen that would be consumed if all the organic matter in one liter of water were oxidized by bacteria.

Q.No 3 : Pathogen-host Interaction ;

It is defined as how microbes or viruses maintain themselves within host organism on a molecular, cellular or population level. These organism may cause disease in some host , however they may not cause disease in all host .So a pathogen that causes disease is called virulent while pathogen that does not cause disease is termed as avirulent. Knowledge of pathogen-host interaction is important to understand of the infectious disease and its treatment .

Types of interaction :

Interaction has the following types .

i) **Commensalism :** It is a relationship in which one symbiont called the commensal benefits while the host is neither harmed nor helped. The commensal is not directly dependent metabolically and causes no particular harm to it .

Example : In nitrification , the oxidation of ammonium ion to nitrite by microorganism such as Nitrosomonas and the subsequent oxidation of nitrite to nitrate .

ii) **Predation :** It is a phenomenon in the predator attacks the prey .The prey can be larger or smaller than predator which results in the death of the prey.

Example : bdellovibrio, vampirococcus and Daptobacter . Each of these has a unique mode of attack against a susceptible bacterium .

iii) Amensalism : It tells us about the negative effects of one organism on other . It is a unidirectional process based on the release of a specific compound by one organism which has a negative effect another organism.

Example : Production of antibiotics that inhibit or kill a susceptible microorganism .

iv) **Parasitism :** It is of the complex interactions that is the line between parasitism and predation is difficult to define . In such relation one pair benefits from other and the host usually harmed .

Example : parasitic fungi including Rhizophydium sphaerocarpum with an alga

V) Competition : This type of interaction arises when different microorganism within a community try for the same source. It may be physical location or particular limiting nutrient .

Example : In Chemostates competition is ssen for a limiting nutrient among microorganism .

Q.No 1 : Methods of microbial population estimation in soil :

There are five classes of analytical techniques which are used for finding microbial community in soil**.**

i) Ex situ germs enumeration (plating and MPN)
ii) Direct microscopy
iii) Kinetic methods (biomass of specific microbial group is calculated from kinetic data on instant response of natural samples to added substrate
iv) Biochemical methods (detection of specific microbial metabolites – ATP,DNA , muramic acid , chitin , phospholipids profile)
v) Methods based on DNA sequencing (FISH- Fluorescence in Site Hybridization)

Method used for isolation of microbial population from the water :

Microbial pathogens are of great risk associated with water. Current methods used for water purification of pathogens are tend to be inaccurate, time consuming and expensive. Method which is currently used for microbial organism detection and removal is polymerase chain reaction (PCR) .This method has been proved as one of the quick, sensitive and accurate methods. It has been already been used experimentally to detect pathogens, virus, bacteria and protozoa in water .