REVIEW ON STUDIES OF MICROBIAL DIVERSITY IN INDIA

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Abstract:- Microorganisms are the life forms that appeared on this planet about three billion years before. These are most diverse than larger organisms. Microbes are more abundant and varied than any other group of organisms. Microorganisms have been studied widely and increased with the technological advancement such as microscopy and molecular techniques. In Indian context, initially more studies on fungi and bacteria were carried out and later with the development of molecular methods studies on virus were also carried out. In the present paper available literature published by Indian researchers is reviewed. More emphasis is given on recent works.

I. INTRODUCTION

Microorganisms due to their very minute size, clonal nature and massive diversity are difficult to describe and so is to define their species. Molecular methodologies that have revolutionized the understanding of microbial diversity have only recently been adapted to study eukaryotic diversity. Microbial diversity can be seen in many morphological forms, including cell size and cell morphology, physiology, motility, pathogenicity, developmental biology, adaptation to environmental limits, phylogeny and mechanism of cell division [1]. Microbes occupied almost every probable habitat on earth [13]. Air, soil, water, outer and inner body surfaces of other organisms are common habitats. These support life and also create problems including diseases in host organisms. Some of the microorganisms are termed as extremophiles because they can survive and flourish in environments like too hot or too cold, too acidic or too alkaline, or very salty. Such a group of microorganisms define the physiochemical limits to life [2].

In the order of 6000 species of prokaryotes and 100,000 species of protists have been formally described [3]. In the case of the diversity of microorganisms, even the right order of magnitude is unknown and the issue is highly controversial [4–6].

The defining microbial species is challenging in part because of their genetics and in part due to their ability to horizontal gene transfer. Further these organisms are too small to identify simply by morphological characteristics. Therefore one has to focus on variation in DNA rather than in their phenotype or morphological characteristics. So, for practical purpose, bacterial species is defined as a group of strains that share at least 70% DNA cross hybridization (DDH:DNA-DNA hybridization).

Microbes are classified as Prokaryotes (eg. bacteria) and Eukaryotes (eg. Fungi and protozoa). Bacteria are divided into two major groups: the eubacteria, which include all bacteria of medical importance, and the archaebacteria, a collection of evolutionarily distinct organisms [1].

II. Fresh Water Microbial Diversity

It is the diversity of microorganisms in fresh water resources (such as rivers, streams, rivulets, waterfalls, tanks, ponds, lakes, dams and reservoirs etc). On the basis of habitat or water body, fresh water microbial diversity is of two types: Lentic (still water bodies) and Lotic (in which water is running or moving). Microbial diversity (especially bacterial diversity) has some indications about ecology and nutrient level of water contained in that water body. Large number of bacteria in a body of water generally indicate high nutrient levels in the water. Water contaminated by inflows from sewage systems or from biodegradable industrial organic wastes is relatively high in bacterial numbers [7, 8]. In water, particularly water with low nutrient concentrations, microorganisms tend to grow on stationary surfaces and on particulate matter [7, 9]. A typical lake or pond serves as an example to represent the various zones. The kinds of microorganisms found in a body of fresh water vary in various zones. The littoral zone (along the shore) has considerable rooted vegetation, and light penetrates throughout it. The limnetic zone consists of the surface of the open water area away from the shore. The profundal zone is the deeper water under the limnetic zone. The benthic zone contains the sediment at the bottom [10]. The pseudomonads and species of *Cytophaga*, *Caulobacter*, and *Hyphomicrobium* are more diverse in oxygen rich limnetic zone. Photosynthetic algae are located in the limnetic zone [11]. Purple and green sulfur bacteria are found in the profundal (deep water) zone. These bacteria are anaerobic photosynthetic organisms that metabolize H_2S to sulfur and sulfate in the bottom sediments of the benthic zone. *Clostridium* species are common in bottom sediments and may include botulism organisms, particularly those causing outbreaks of botulism in waterfowl [8]. Communities of bacteria, archaea, protists, and unicellular fungi account for most of the biomass of freshwater bodies. These microscopic factories are responsible for 68% of primary production [7, 14]. Thus it can be concluded that microbial diversity is studied in India but has a lot of scope for further study.

III. Conclusion

Major microbial groups now recognized as abundant in the freshwater resources include Alpha- and Gamma proteobacteria, cyanobacteria, fungi and few species of protozoans. Freshwater microbial diversity is a promising field for research studies although it has some constrains also. Species identification and searching for suitable technology DNA, 16S RNA library are common among them. Study of microbial biodiversity is of dynamic importance to the understanding of the different processes of the lentic and lotic fresh water bodies.

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