

Microbial Biodiversity: Innovative Strategic Initiatives

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Abstract: Biodiversity is one of the earth's greatest treasures. Compared to plants and animals, microbes are least explored since they are mostly considered as pathogens and very little is known about their beneficial potentiality. Hence, there arises an urgent need to raise the public awareness about its economic value by taking effective measures in exploiting and conserving the microbial diversity. An attempt has been made to discuss about the strategy of microbial screening and its applications along with future innovative practices that has to be undertaken in order to conserve its diversity. Microbiologists have just begun to isolate and study microbial life for a better understanding of its role in ecology. Only <1% of microbes in the world have been explored. Proper strategy has to be followed to study the microbial diversity which includes habitat selection, microbial isolation methods, polyphasic taxonomy studies and its application in varied fields. Apart from ex situ and in situ conservation, several innovative initiatives such as new long-term infrastructure funding mechanisms to foster multidisciplinary involvement of microbial biodiversity research centers in collaboration with collections, education and training programmes on taxonomic studies in schools and colleges, creation of repository for cultivated collections and a reference library creation of integrated center for data management and analysis, ultimately leading to national microbial diversity management policy creation.

Keywords: application, innovative initiatives. polyphasic taxonomy, screening, strategy, management policy.

I. INTRODUCTION

Biodiversity is one of the earth's greatest treasures. Microorganisms represent a largely untapped source of novel bioactive compounds and metabolic pathways which could be exploited for new biotechnological applications and products. Microbes and their activities may also promote or alleviate climate change apart from its application in pharmacy, agriculture and industrial fields. Microbes can perform numerous functions essential for biosphere like nutrient recycling and environmental detoxification. Exploitation of microbial diversity has an important role in sustainable development worth millions of rupees.

Compared to plants and animals, microbes are least explored since they are mostly considered as pathogens and very little is known about their beneficial potentiality. There is a lack of understanding especially in microbial interaction with the environment [2]. Hence, there arises an urgent need to raise the public awareness about its economic value by taking effective measures in exploiting and conserving the microbial diversity.

An attempt has been made to discuss about the strategy of microbial screening and its applications along with future innovative practices that has to be undertaken in order to conserve its diversity.

II. PURPOSE

Research in microbial biodiversity helps in exploiting the limitations of microbes that are in extreme conditions. Studies about their diversities can be used to monitor environmental changes and conservation of higher organisms. As mentioned in Fig 1, the microbes are the major sources of beneficial potential.

Discovery of several novel genes isolated from new microbes provided phylogenetic similarities and evolutionary relationship among divergent groups of microorganisms which nurture the environment on which human society depends.

Determination of actual genes involved in causing disease by gene function studies and discovery of novel therapeutic products targeting these genes would be better nested approach rather than to know the whole genome of a microbe [1]. Thus deciphering the essential genes (genes that produce proteins required for growth and survival of bacteria) would elicit the process of production of new antimicrobial compounds inhibiting the growth process [1].

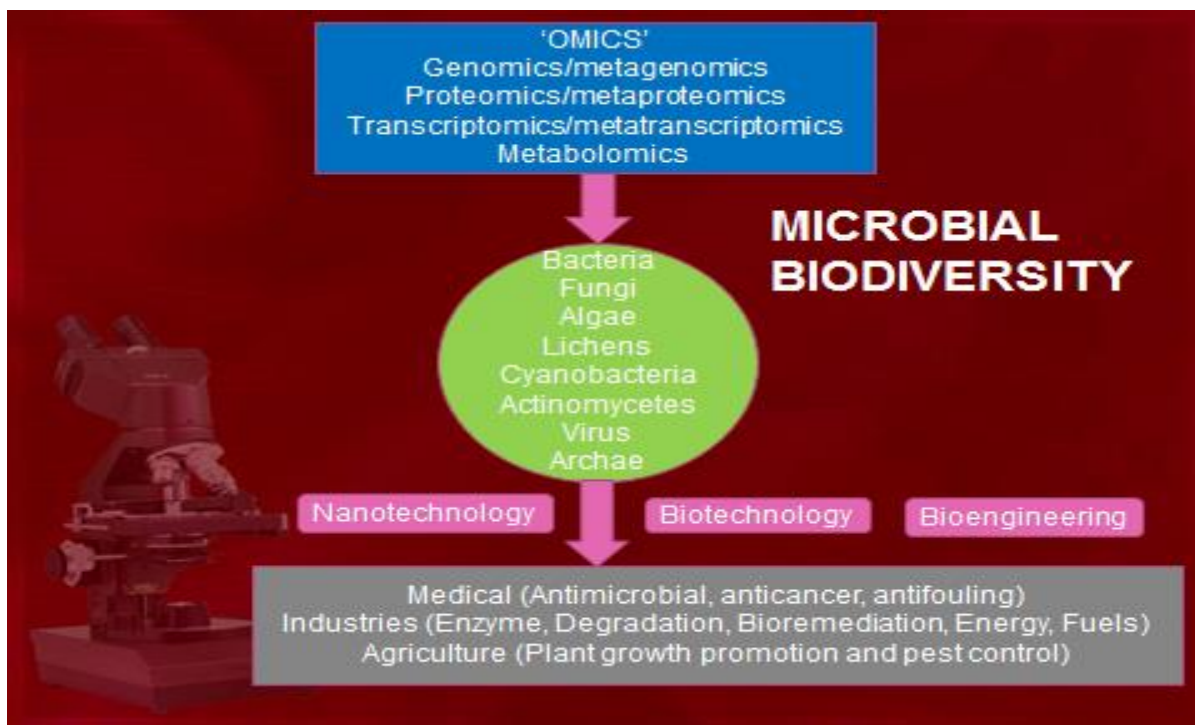


Fig. 1 Microbial Diversity

III. STRATEGIES

Microbiologists have just begun to isolate and study microbial life for a better understanding of its role in ecology. Only <1% of microbes in the world have been explored. Proper strategy has to be followed to study the microbial diversity which includes varied habitat selection, novel isolation methods, polyphasic taxonomy studies and its application in varied fields.

1. Ex situ and in situ conservation (Gene bank, Cryopreservation, Lyophilization and Robotic preservation).

Significant international collection centers like National Collection of Plant Pathogenic Bacteria (UK), CABI Genetic Resource Collection (UK), USDA ARS Culture Collection (USA), and American Type Culture Collection (USA) were prominent worldwide in pure culture maintenance.

In India, this work has been carried out by Ministry of Environment and Forestry and the Ministry of Science and Technology that includes various departments such as the Department of Agriculture Research and Education, Indian Council of Forestry Research and Education, Department of Biotechnology. The level of the Microbial Type Culture Collection section of IMTECH, Chandigarh has now been upgraded to an International Depository Authority (IDA) and it involves the culture collection and maintenance as well as distribution of pure cultures internationally [1].

2. Conservation of habitats with rare microbial species.
3. New long-term infrastructure funding mechanisms to foster multidisciplinary involvement of microbial biodiversity research centers in collaboration with collections.
4. Education and training programmes on taxonomic studies in schools and colleges.
5. Creation of new repository for cultivated collections and a reference library creation of integrated center for data management and analysis.
6. Promotion of metagenomic approaches to study microbial diversity in various niches.
7. Creation of national microbial diversity management policy.

8. Enhance the public's awareness of the vital role microbial diversity plays in their lives and the frontier this field offers.
9. Involve researchers from other fields, especially computer science, optics, electronics, device engineering, chemistry, remote sensing, and microbial ecologists and systematists.
10. Conduct research leading to the preservation of mixed communities, e.g., consortia, natural communities

IV. CONCLUSION

The role of microorganisms in maintaining the dynamic equilibrium and integrity of the biosphere is important because the existence of life is dependent upon the sustained, microbial mediated transformation of matter in both terrestrial and aquatic environments [1]. Hence, the present era thus demands the better conservation and utilization of these bioresources. Compulsory enforcement of the proposed measures has to be implemented in order to preserve GREENERY. Microorganisms are significant gene pools and so must be regarded as cultural heritage and should be transferred to next generation in a normal and healthy condition. Advances in the molecular, chemical, optical, computer and information sciences have now made the exploration of this frontier practical.

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