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Microbial Mapping: Perspective and Opportunities in Tea Soil Of N. E. India

Microbiology

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ABSTRACT

Tea [Camellia sinensis (L.) O. Kuntze], belongs to the family Theaceae, is an economically important non-alcoholic, aromatic beverage yielding perennial crop, extensively cultivated in India. The present report indicates the perspective of mapping microbial biodiversity in tea ecosystem with special reference to region specific beneficial microorganisms like plant growth promoting microorganisms (PGPMs). The present focus on microbial mapping in tea is important to improve our understanding on soil microbial diversities as well as their functional properties more precisely than earlier, since the knowledge on native or putative beneficial microbial categories can directly affect wide range of ecosystem processes relating to the assessment of the quality of our environment.

Introduction

India is one of the important mega biodiverse countries. Northeast India is the bio geographical gateway of greater India that can be considered as one of the richest biodiversity hot-spot zone (Myers et al. 2000) and is known for its potential genetic resources all over the world. Being one of the important parts of biodiversity hot-spot zone, the region has been regarded as an active centre of evolution of many novel gene pools. North east India is also considered as one of the important priority ecoregion in India (Chatterjee et al. 2006) and is known for its potential microbial resources all over the world (Bhattacharyya et al. 2011). Tea [*Camellia sinensis* (L.) O. Kunze] is one of the oldest, non-alcoholic, beverage yielding perennial crop, widely consumed all over the world. Tea is grown in India in a wide amplitude of climatic variables at latitudes from 8° 12/ N in Nagercoil in Tamilnadu to 32° 13/ E in Kangra in Himachal Pradesh (Source: Limca Book of Records) (Barua 2008). The Indian teas are appreciated all over the world as beneficial health drink for its unique flavour, aroma and several medicinal properties (Gurusubramanian et al. 2008). The evergreen and long-lived (over 100 years of cultivation) tea plantations are genetically diverse (Deka et al. 2006), that usually provides a steady microclimate and food supply for various microorganisms associated with the tea ecosystem. However, information related with exploitation of region specific microbial inoculants in a variety of applications like reducing the disease severity in tea plants along with their mechanism of action with special reference to plant protection and crop yield is still scarce. It is thus, essential to explore the knowledge on quantitative as well as qualitative distribution of region specific microbial populations in different tea growing areas of Assam in the context of the variations in geographical position and geological and geochemical habitats by constructing maps.

The present research highlights the perspective of mapping microbial-biogeography of tea ecosystem to improve the knowledge and understanding on soil microbial diversities as well as their functions healthier, since the later can directly affect wide range of ecosystem processes relating to the assessment of the quality of our environment.

Mapping: perspective and opportunities in tea soil

Microbial diversity of tea soil is extremely complex. Approximately 1.1 x 10^{10} prokaryotes residing in tea soil can thrive in diverse soil habitats. Annual consumption of agro-chemicals in tea plantation soils is about six litres/hectare, which are several folds higher than the national average. Exploitation and conservation of beneficial microbes in tea growing areas is essential in minimizing the use of toxic chemical substances as the latter is known for its potentiality in creating soil quality deterioration, environmental pollution, undesirable residues and escalating costs, pest resurgence, variation in susceptibility, residue problems in made tea, impedance for natural regulatory agents and lethal and sub-lethal effects on non-target organisms, including humans (Gurusubramanian et al. 2005). Biological control through antagonistic microbes and promotion in plant growth and development through plant growth promoting (PGP) microbes is a promising, non-chemical, eco-friendly approach for managing the incidence and severity of plant diseases as to improve the bush health and quality of final product (Harman et al. 2004). Beneficial microorganisms are able to perform numerous important functions like maintenance of biogeochemical cycles, promotion of plant growth, inhibition of destructive pests and pathogens etc. Growth promoting substances are likely to be produced in large quantities by these beneficial microorganisms that influence indirectly on the overall morphology of the plants (Bhattacharyya and Jha 2012).

Investigations from Mycology & Microbiology Department regarding exploitation of plant growth promoting (PGP) microbes for the improvement of tea plant growth and pest suppression revealed that PGP strains like *Pseudomonas corrugata*, *Aspergillus niger*, *Bacillus subtilis*, *Rhizobium* sp. *Streptomyces nojiriensis* were found as effective in controlling the severity of pest and disease in tea (Phukan et al. 2012) as well in improving the tea bush health. However, rigorous investigations concurrently on both microbial diversity and its distribution patterns in tea ecosystem, using the latest technology of mapping by geographic information system (GIS) and accessories is still in its infancy. Mapping microbial biodiversity has important implications for the stability and functioning of overall ecosystem processes (Bhattacharyya et al. 2015). The continual and dynamical development of faster sequencing techniques, together with the advancement of methods to deal with the exponentially increasing amount of data generated, are expanding gradually for the analysis of microbial communities from an unlimited variety of habitats and environments. Mapping beneficial microbial biodiversity with the assists of Geographic information system (GIS) and supportive internet accessibility system is of utmost importance which would benefit scientific research and resource management strategies in future.

Conclusion and Future prospects

To improve our understanding on the spatial and temporal patterns of microbial diversity in tea growing soils of Assam, mapping microbial biodiversity with the assists of GIS and internet accessibility system is of utmost importance which would benefit scientific research and resource management strategies in future.

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