Synopsis of the Proposed Research Project for the National Science & Technology

(NST) Fellowship, 2023-2024

Title of the Research

In English: Morphological, biochemical, and genetic variation analysis of rhizospheres bacterial isolates collected from soil samples under different stressed conditions

In Bengali: বিভিন্ন চাপযুক্ত অবস্থার অধীনে মাটির নমুনা থেকে সংগৃহীত রাইজোস্ফিয়ারিক ব্যাকটেরিয়ার রূপত্বাত্তিক, জৈব রাসায়নিক এবং জিনগত পার্থক্য বিশ্লেষণ

Introduction:

Rhizosphere bacteria are lucrative options in sustainable agricultural practices to replace chemical-based agronomic tools [1]. Bacteria play a vital role in the quality of soil, health, and the production of plants. This has led to several studies in understanding the diversity and structure of the plant rhizosphere [2]. The diversity of bacteria in the rhizosphere plays a key role in plant growth. Microbial diversity is increasingly recognized as being crucial to the function of microbial communities [3]. Microbial diversity has been an important facet of scientific research since microbes promise a plethora of biomolecules that are otherwise not found in nature. The biomolecules produced by these microbes as part of their defense or survival mechanism, are of importance for human and animal drugs and many other industrial and environmental applications [4]. Microbial communities in soil ecosystems provide many important functions like the decomposition of organic material, recycling of nutrients, biogeochemical cycling, and by constituting a major food source at the base of food webs. Thus, many microbial functions are critical to crop production, soil sustainability, and environmental quality and the effect of pesticides on the underlying structure and diversity of soil microbial communities becomes crucial in this regard [5]. They also have the potential to reflect the past history of a given environment. It is therefore essential to understand the interrelationships between bacteria and their environment by studying the structural and functional diversity of soil bacterial communities and how they would respond to various natural or man-made disturbances [6]. All life forms rely on bacterial processes for their survival. Bacteria are responsible for diverse metabolic functions that affect soil and plant health [7]. In this study, we will be able to isolate rhizosphere soil bacteria. And will be able to analyze of morphological, biochemical, and genetic variation of these isolated bacteria.

B. Objectives of the research:

- To isolates rhizosphere bacteria from different stressed soil.
- To study morphological diversity among these bacteria.
- To study the biochemical diversity of these bacteria.
- To study genetic diversity among these bacteria.
- To accumulates bacteria for the sound growth of plants.

C. Materials and methods:

Phase 1: Bacterial sample collection:

- Sample collected from mangrove area.
- Sample collected from submersed soil where plants are alive.

Phase 2: Isolation of bacteria from different stressed soil conditions:

- We isolate bacteria by gram staining, pour plate, and streaking methods.

Phase 3: Characterization of bacterial isolates from soil sample:

- Gram staining, spore staining, and phenotypic methods are done for bacterial characterization.

Phase 4: Analysis of morphological variation among the isolated bacteria:

- We use the gram-staining method to analyze bacterial morphology.

Phase 5: Study of biochemical variation:

- Ramen spectroscopy is used to analyze biochemical characterization.

Phase 6: Analysis of genetic diversity among the isolated rhizospheric bacteria:

- Genetic variation is analyzed by alignments and database homology, protein sequencing, and re-sequencing methods.

Phase 7: Data analysis and report preparation:

- Analysis of collected data.
- Report preparation based on a statistical analysis of collected data that provides detailed performance information of our project.

D. Expected result:

It is very much expected that we will be able to isolate rhizosphere bacteria from stressed soil. It is also hoped that we will be able to identify soil rhizosphere bacteria from stressed conditions. In addition, nitrogen fixation and plant growth-promoting activities also be identified. Finally, it is hoped that we will be able to assess morphological, biochemical, and genetic variation among these rhizospheres-stressed soil bacteria.

E. Socio-economic importance:

Rhizosphere bacteria play vital roles in plant nutrition, growth promotion, and disease interaction. Investigating morphological, biochemical, and genetic diversity may help us reveal how plants respond to this rhizosphere bacteria. And also help to develop innovative, sustainable, and eco-friendly agroecosystems. Their diversity study may also help grow plants in stressed soil areas as like as normal soil in the near future.

F. Time frame with activity chart for achieving the objectives (July 2022-June 2023)

Work/Activities	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Phase-1 (Bacterial sample collection)												
Phase-2 (Isolation of bacteria from different stressed soil conditions)												
Phase-3 (Characterization of bacterial isolates from a soil sample)												
Phase-4 (Analysis of morphological variation among the isolated bacteria)												
Phase-5 (Study of biochemical variation)												
Phase-6 (Analysis of genetic diversity among the isolated rhizospheres bacteria)												
Phase-7 (Data analysis and report preparation)												

G. Reference:

[1] Prashar, Pratibha, Neera Kapoor, and Sarita Sachdeva. "Rhizosphere: its structure, bacterial diversity, and significance." *Reviews in Environmental Science and Bio/Technology* 13 (2014): 63-77.

[2] Alawiye, Temitayo Tosin, and Olubukola Oluranti Babalola. "Bacterial diversity and community structure in typical plant rhizosphere." *Diversity* 11, no. 10 (2019): 179.

[3] Weidner, Simone, Robert Koller, Ellen Latz, George Kowalchuk, Michael Bonkowski, Stefan Scheu, and Alexandre Jousset. "Bacterial diversity amplifies nutrient-based plant–soil feedbacks." *Functional Ecology* 29, no. 10 (2015): 1341-1349.

[4] Sakhia, Nidhi, Sunil Prajapati, Vikram Shetty, Shreyas Bhatt, and Anasuya Bhadalkar. "Study of bacterial diversity of mangroves rhizosphere." *Open Journal of Marine Science* 6, no. 01 (2016): 23.

[5] Gupta, Sukriti, Rashi Gupta, and Shilpi Sharma. "Impact of chemical-and bio-pesticides on bacterial diversity in rhizosphere of Vigna radiata." *Ecotoxicology* 22 (2013): 1479-1489.

[6]. Zhang, Li, and Zhihong Xu. "Assessing bacterial diversity in soil: a brief review." *Journal of soils and sediments* 8 (2008): 379-388.

[7] Kennedy, A. C. "Bacterial diversity in agroecosystems." In *Invertebrate biodiversity as bioindicators of sustainable landscapes*, pp. 65-76. Elsevier, 1999.

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