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Rhizosphere Effect of Soil Microorganism in the Botanical Garden of Saharpuram

[1]V.Jeyanthi kumari & [2]V.Sorna Lakshmi
[1]Department of Zoology
[2]Department of Botany
A.P.C.Mahalaxmi College for Women, Thoothukudi

Abstract

The rhizosphere is a dynamic region governed by complex interactions between plants and the organisms that are in close association with the root. The rhizosphere effect is beneficial to the plants in two ways. Firstly, it helps in providing nutrients to the plants and secondly, it helps the plants in combating root diseases. The quantitative comparative analysis of rhizosphere effect between rhizosphere soil and non rhizosphere soil of the botanical garden was done based on R : S ratio (Root-Soil ratio). The results revealed that the greater rhizosphere effect was seen in rhizosphere soil also the quantification studies explored that the rhizosphere effect among the microbes was more in bacteria than in the actinomycetes and fungi during the plate count on various media used.

Key words: Rhizosphere soil, R:S ratio, Bacteria, Actinomycetes

Introduction

The rhizosphere is a nutrient-rich region that is present around the soil and this region is highly dynamic and supports a dense and diverse fauna (Baath *et al*., 1995). The diversity of microbial association with plant roots is enormous, in the order of tens of thousands of species. This complex plant-associated microbial community referred to as the second genome of the plant, is crucial for plant health (Chtman and Wagner, 2008). Soil, which is essential for plants, is an ocean of microorganisms that affect plants largely through roots and on aerial surroundings. The study of microbiomes helps in the identification of new groups involved in plant diseases from the rhizosphere microbiome (Lugtenberg and Kamilova, 2009). Number of studies have revealed that many plant-associated microorganisms have profound effects on seed germination, seedling vigor, plant growth and development, nutrition, diseases, and productivity (Inceoglu *et al*., 2013). Plants can be viewed as superorganisms that rely in part on their microbiome for specific functions and traits. In return, plants deposit their photosynthetically fixed carbon into their direct surroundings, that is, the spermosphere, phyllosphere, rhizosphere, and mycorrhizosphere (Mark *et al*., 2005) thereby feeding the microbial community and influencing their composition and activities.

Materials and Methods

Sample collection

The rhizosphere and non rhizosphere soil were collected separately in sterile conical flasks and transported immediately to the lab for further microbiological analysis.

Isolation of rhizosphere and non rhizosphere microflora

One gram rhizosphere and non rhizosphere soil were dissolved in 100 ml 0f sterile water separately and kept in a shaker for about 15 minutes. Then one ml of sample was taken and serially diluted up to 10^{-7} dilutions. From the respective selected dilution, one ml of sample was plated by pour plate method in the nutrient agar, Rose Bengal agar , and Glycerol yeast agar medium separately. These plates were incubated at 37^{o} C for 48hrs for bacteria and 7 days for fungi and actinomycetes.

Results

Microbial counts of rhizosphere and non rhizosphere soil colonies were counted and the R:S ratio was calculated by the following formula

$$\text{R:S ratio} = \frac{\text{Number of microorganisms (bacteria or fungi) in the rhizosphere soil}}{\text{Number of microorganisms (bacteria or fungi) in the non-rhizosphere soil}}$$

$$\text{Number of microorganisms/gram of soil} = \frac{\text{Number of colonies/plate} \times \text{dilution factor}}{\text{Dry weight of the soil taken}}$$

The results revealed that the rhizosphere soil consist of more microbial population than non rhizosphere soil (Table 1) and among the microbial population bacterial population influenced (3.2×10^{4}) more than other microbial population in the soil in both rhizosphere and non rhizosphere soil.

Table 1: Plate Counts on Various Media

S.No	Microbes	Number of colonies present in rhizosphere soil CFU/ml	Number of colonies present in non rhizosphere soil CFU/ml	R:S ratio
1.	Bacteria	$3.2\times10^4 \pm 0.07$	$2.2\times10^2\pm0.06$	66:1±0.08
2.	Fungi	$6.9\times10^6 \pm 0.10$	$5.5\times10^4\pm0.09$	22:8±0.01
3.	Actinomycetes	$3\times10^4 \pm0.02$	$1.8\times10^3\pm0.05$	16:6±0.06

Discussion

The diversity of microbes associated with plant roots is enormous, in the order of tens of thousands of species (Barata *et al*., 2012**)**. This statement coincided with the present investigation that the greater microbial population was observed in the rhizosphere region than the non rhizosphere region also the rhizosphere effect was greater in the bacteria than in the actinomycetes and fungi. The rhizosphere effect increased with the age of the plant and normally reached its maximum at the stage of greater vegetative growth. Following the death of the plant, the microbial population reverted gradually to the level as that of the surrounding soil.

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