 

**DIVERSITY OF PLANT GROWTH PROMOTING RHIZOBACTERIA IN CHILLI SOILS**

***(MRP(S)-0548/13-14/KAMY008/UGC-SWRO, Dated: 28/03/2014***

**A Minor Research Project Report submitted**

**To**

**University Grants Commission,**

South Western Regional Office,

PK Block, Palace Road, Gandhinagar,

Bangalore-560009

**By**

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**Certificate**

This is to certify that the minor research project entitled **“DIVERSITY OF PLANT GROWTH PROMOTING RHIZOBACTERIA IN CHILLI SOILS ” (UGC approval letter No. and Date: MRP(S)-0548/13-14/KAMY008/UGC-SWRO, Dated: 28/03/2014)** submitted by Ms. Shruthi Prakash H P, Assistant Professor, Department of Microbiology, SBRR Mahajana First Grade College, Mysore – 12 to University Grants Commission, South Western Regional Office, PK Block, Palace Road, Gandhinagar, Bangalore-560009, during **2014-2017.**

I further certify that the present embodied work here presented is original and carried out according to the plan in the proposal and guidelines of the University Grants Commission.

K.V.Prabhakara

**Declaration**

I, Ms. Shruthi Prakash H P, Ms. Shruthi Prakash H P, assistant Professor, department Of Microbiology, SBRR Mahajana First Grade College, Mysore – 12 hereby declare that the Minor Research Project Report entitled **“DIVERSITY OF PLANT GROWTH PROMOTING RHIZOBACTERIA IN CHILLI SOILS ”(MRP(S)-0548/13-14/KAMY008/UGC-SWRO)** submitted by me to University Grants Commission, South Western Regional Office, PK Block, Palace Road, Gandhinagar, Bangalore-560009, during **2014-2017** is the result of the bonafied research work.

I further declare that the results here presented are original and carried out according to the plan in the proposal and guidelines of the University Grants Commission.

(Ms. Shruthi Prakash H P)

**Executive summary**

A tremendous interest has emerged with respect to the importance of microbial diversity in rhizospheric soil which depends on soil health and quality. The objective of this study was designed using an annual crop Chilli (*Capsicum annuum* L) and the diversity was constantly monitored and studied for the species dominance, richness and evenness of plant growth promoting microorganism. Expecting such an empirical relationship from the single Chilli is useful to test diversity predictions in natural sites. Although there appears to be a great deal of work on plant growth promoting microorganism, there are very few reports on such associations with Chilli plants. The findings of the present investigation will highlight the plant growth promoting microorganism from the local soil of chilli plants.

The purpose of this study was to investigate the diversity of plant growth promoting rhizobacteria associated with the roots of Chilli plants (Capsicum sp.) The rhizosphere soil samples were collected from different chilli plant cultivating areas: Mysore, Hassan regions of Karnataka, India. Soil samples were collected from chilli plant rhizospheres in order to isolate, characterize and investigate the diversity of PGPR associated with the roots of chilli plants. The soil samples were serially diluted (10-1 to 10-10) in triplicates and plated on 8 different media such as

PGPR populations were valuated by using colony forming unit (CFU).Fungal identification was done by observing the macroscopic and microscopic structures. Microscopic observations were performed to investigate the some characteristics of microorganisms isolated from rhizospheric region of chilli plant soils.

Diversity of plant growth promoting microorganism in chilli soils collected from various places includes 7 different criteria’s such as *Bacteria, Azospirillum, Azotobacter, Pseudomonas, Actinomycetes, Rhizobia, and Fungi.* Diversity indices was analysed using Pearson’s correlation matrix. Among all the 7 different criteria the most significant was *Rhizobia* and *Actinomycetes* respectively in the soil samples collected from different region.

Pure cultures of 4 Fast growing colonies were prepared and subjected to Gram staining, H2O2, phosphate solubilization, siderophore and IAA production. The diversity of microorganism that occurred in different samples were subjected to Pearson’s Correlation matrix (Statistical analysis). Phosphate- solublization was detected qualitatively by spot inoculation of isolates on Pikovskaya medium,

Microscopic observation (x 10 and x 100 magnification) after Gram-staining revealed the shape of the microorganism. Other morphological characteristics such as colony features, type of areal hyphae, growth of vegetative hyphae, fragmentation pattern and spore formation. Fungal identification was done by observing the macroscopic and microscopic structures. Mycorrhizal fungi were identified as *Penicillium sp., Fusarium sp., Pythium sp., Cladosporium sp., Tricoderma sp., Curvularia sp., Rhizopus sp., and Aspergillus.* Different direct plant growth promoting activities of other 24 isolates viz. phosphate solubilization, siderophore production, IAA production were studied. It was found that out of 24 isolates, 1 bacterial isolate and 1 strain of ***Pseudomonas*** showed positive for siderophore production.

**Conclusion**

It can be concluded that there is diverse soil micro flora well adapted to the environment. The PGPR isolate are very efficient Phosphate solubilizer and could be very effective to be used as bio-inoculant to induce plant growth under drought condition as well as in phosphorous deficient soil. The PGPR Ps4 which were siderophore producers can also be used as biocontrol agent against plant pathogens.

In this study, an increase in the plant growth can be attributed to the ability of the isolate to produce IAA, as IAA positively influences root growth and development, thereby enhancing nutrient uptake (F. Ahmad *et al.,* 2008). It is a well-established fact that improved phosphorous nutrition influences overall plant growth and root development parameters could be attributed to the enhancement of the root growth and development.

The property of synthesizing IAA is considered as effective tool for screening beneficial microorganisms suggesting that IAA producing bacteria have profound effect on plant growth (Wahyudi *et al.,* 2011). Inoculation with IAA producing bacteria induces the proliferation of lateral roots and root hairs. Fatima *et al.,* (2009) also showed that germination rate, roots, shoot growth of plant were increased by IAA and PGPR.

Recent growing interest in PGPR is due to their efficacy as biological control and growth promoting agents in many medicinal crops **[**Mehamood Z, 1999**].** Hence, the present work was aimed to find the alternative approaches like investigating indigenous PGPR for the presence of plant growth promoting traits and to select those PGPR which can be used for increasing the growth and yield of crop plants.

One of the immediate reasoning to improve agricultural productivity and development is the use of more chemical fertilizers. However, with the resultant effects of heavy fertilizer use in many regions of the world, it is compelling to look for alternatives. The use of fungicides, bactericides, and pesticides generally continue to generate concerns, so biological control is still as relevant as it was many decades ago. The reason for the inconsistencies reported in some regions with biological control of diseases is not yet well understood though its relevance as a major limitation to widespread acceptance of biofertilizers and commercial PGPR products has been reducing as compared to almost two decades ago when an observation of inconsistencies was made by Weller and Thomshow (1993).

This study also indicates the siderophore production ability by these microbes is in good amount, which are universally recognized biocontrol agents and plant growth promoting agents. Modern application of siderophore in agriculture, medical science and environment science are increasing. This study may help for more production of siderophore in commercial way and more application of it in modern science.

Drought tolerance is a multi gene activity and has a complex signal transduction pathways (Nakashima *et al.,* 2000, Kidokoro *et al.,* 2009). The PGPR isolates from semi-arid area of low soil moisture when used as bio inoculants increase plant growth and resistance to soil water deficit. These PGPR inocula provided tolerance against drought stress. The solubilization of P in the rhizosphere is the most common mode of action implicated in PGPR that increase nutrient availability to host plants (Richardson, 2001). Iron is an essential nutrient of plants, but it is relatively insoluble in soil solutions. According to Salisbury & Ross (1992) plant roots absorb iron preferably in reduced ferrous (Fe2+) ion, but the ferric (Fe3+) ion is more common in well aerated soil although it is easily precipitated in iron-oxide forms. Soluble organic compounds siderophores are generally excreted by a plant which binds Fe3+ and mediates its delivery to the root surface where it is reduced to Fe2+ resulting in quick absorption.

These observations reserve the fact that the rhizospheric region of chilli plant harbors a wide range of microorganisms which are highly antagonistic through their secondary metabolites like siderophore, to one or more rhizospheric microorganism and IAA also show an effective promotion of chilli plant growth. Hence, the use of rhizospheric microorganisms to promote chilli plant growth offers an attractive way to replace chemical fertilizers and reduce the use of pest control agents.