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MORPHOLOGICAL ANALYSIS OF PLANT GROWTH PROMOTING STRAINS FROM MANGROVE RHIZOBACTERIA

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ABSTRACT

Natural cultivating has become critical in current times because of the drawn out manageability of horticulture and the rising interest for protected and good food. Bio-composts are the vital components of natural cultivating. Therefore, natural cultivating has become fundamental for agro-environment creation, protection, and maintainability. The Focal and State legislatures are supporting the utilization of bio-manures through ranch level expansion and advancement programs as the bio-compost market in India is still in its early stages. Giving deals endowments, helping to direct creation in open area firms, agreeable gatherings, and subsidizing at schools and exploration establishments are instances of monetary help for business visionaries. The greatest hindrances to the advancement of bio-composts in India, nonetheless, are their short time spans of usability, low degrees of interest and rancher mindfulness, and an absence of current storage spaces.

KEY WORDS: Plant Growth Promoting Strains, Mangrove, Rhizobacteria, Growth.

INTRODUCTION

The oceanic domain, which makes up 70% of the world's surface and is one of the three fundamental territories of the biosphere, offers the most living region, especially for microbes. From beach front to seaward regions, and from the overall sea to explicit specialties like blue waters of coral reefs to dark smokers of hot warm vents at the ocean floor, marine organisms live not just in the surface waters of the ocean yet additionally in the more profound and deep profundities. By 2030, 8.5 billion individuals are supposed to possess the planet. The Assembled

Countries' (UN) 2030 plan for supportable improvement incorporates annihilating craving, accomplishing food security, and upgrading worldwide nourishment as its primary goals to meet one of the crucial necessities of the huge populace around the world. The horrible impacts of worldwide environmental change, which affect rural result and, subsequently, food security, make it challenging to accomplish this point. Accomplishing the goal relies upon raising farming efficiency, strength, and manageability. Around 800 million individuals overall are experiencing hunger. Based on the 2015 Worldwide Appetite File Scores, India, the second-most crowded country on the planet, is evaluated 80th out of 104 countries, with 15.2% of its whole populace experiencing extreme under nutrition. It's fascinating to take note of that India has enormously expanded its creation of food grains over the long haul.

The country's "green unrest" brought about the presentation of early developing, high yielding assortments (HYVs) of wheat and rice in the last part of the 1960s. It made it workable for food grain creation to become independent, making "boat to mouth" old. Be that as it may, the over the top and thoughtless utilization of fake composts during the green transformation subverted the nature and soundness of the dirt. As well as expanding local and social difference, it adversely affected groundwater quality and soil ripeness. Also, the substance manures utilized during the green transformation were risky to individuals when they ate grains. To keep up with the manageability of agrarian creation, substance composts were generally utilized, which was negative to human wellbeing. Information from different sources major areas of strength for offers for the adverse consequences of exorbitant utilization of compound composts in ordinary cultivating rehearses as seen. Subsequently, new thoughts should be integrated into the making of a second green upset that really focuses on the maintainability of farming creation with less risky nourishment for people. It is all around perceived that the primary green upset assisted with decreasing territorial improvement variations. It's fascinating that eastern India is viewed as a planned area for the second green upset to be carried out to ensure future food security. Furthermore, with regards to the second green transformation, the supportability of horticulture and the low utilization of synthetic composts or potentially relinquishment have been offered top consideration.

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REESTABLISHING SOIL RIPENESS THROUGH THE FOUNDATION OF SOIL GREENERY

Substance manures' negative impacts on crop fields by corrupting soil richness have ignited interest in a more exhaustive and sensitive comprehension of soil elements. It has been significant to battle the issues with soil fruitfulness by protecting a sound biology underneath the dirt utilizing the great many microorganisms that live there normally.

Organisms can shield plants from biotic and abiotic stressors and energize plant development. The microbial inoculants that are useful to horticultural fields are biofertilizers and biocontrol specialists. Biofertilizers comprise of plant development advancing rhizobacteria that upgrade the plant development by different plant development advancing components, including simple accessibility of supplements to the host plants and creation of phytohormones. These supportive microorganisms that are associated with plants can assume a major part in rural methods to create economical plant harvests.

The five stars of microorganisms are free-living microbes, which under ideal conditions communicate solely with plants. The subsequent gathering comprises of people of rhizospheric and phyllospheric organic entities that can hardly get by without a host and are situated in soil zones close to roots or on the epidermal surface of plants. The third classification shows the ability to infiltrate explicit plant tissues and organs through intercellular space (endophytes), which can't stay beyond their host's living tissues for a drawn out timeframe. This recommends that they foster close, commonly gainful connections.

The principal concentrate on PGPR was directed in 1950, denoting the start of the field's examination. From that point forward, various PGPR strains have been found, analyzed, and tried in fields, net homes, and polyhouses everywhere. These microorganisms were critical in horticulture since they worked with the section of supplements among plants and diminished the requirement for synthetic compost. The utilization of PGPR inoculants as biofertilizers is a promising substitute for customary manures and pesticides.

There are at present approximately 7 billion individuals living on the planet, and it is anticipated that number will increment to 10 billion in the following 50 years (Joined Countries 2021). The issue of taking care of the whole total populace is an incredible one for present horticulture. It is critical to survey the ongoing rural procedure and make it feasible to take care of the extending scene. Instances of this incorporate the use of substance composts, fungicides, pesticides, herbicides, and so forth. Notwithstanding, the efficiency of horticultural developments is affected by various abiotic and biotic natural variables. Dryness, the pH of the ground, different weighty metals, radiation, water, salt, ecological temperatures, flooding, and so forth are instances of various abiotic stresses.

The rural creation is significantly diminished by biotic stressors, which are different plant diseases welcomed on by microbes, infections, growth, and parasites. Growths cause 66% of all plant sicknesses. In most farming fields in Asia, compound manures, fungicides, and herbicides are often utilized to support crop yield. Despite the fact that they are incredibly viable, agrochemicals affect the dirt and human wellbeing and diminish crop quality. Soil microorganisms have been treated with impressive consideration during the biological rebuilding process. It is presently perceived that these microorganisms assume a vital part in reestablishing biodiversity and carrying out their fundamental roles in corrupted environments. Various kinds of soil vegetation are fundamental parts of soil environments and participate in different biotic cycles. The yield of plants is extraordinarily impacted by the elements of soil microorganisms. The microbial populace is higher in rhizospheric soil than mass soil. The microorganisms of the rhizosphere are incredibly liable for have plant development and natural wellness.

Besides, on the grounds that they are engaged with various cycles, including soil development, the debasement of natural materials, the evacuation of poisons, and the corruption of xenobiotic compounds, for example, pesticides and carbon cycling, bioremediation, and phosphorus and sulfur, microorganisms assume a huge part in both normal and oversaw horticultural soil biological systems. Moreover, soil-based rhizosphere microorganisms support supplement preparation and solubilization as well as the control of plant illnesses sent through the dirt.

Furthermore, fiber actinobacteria have been viewed as one of the fundamental phytopathogens and biocontrol life forms in the rhizosphere microbiota.

RESEARCH METHODOLOGY

Isolation of PGPR (Plant Growth Promoting Rhizobacteria) from mangroves

Study area

Three enormous marine worlds—the Indian Ocean, the Arabian Sea, and the Bay of Bengal—join at the research locations in Kanyakumari. The Manakkudi estuary is situated at 8.1160 latitude and 77.4882 longitude. Rajakkamangalam is situated at 8.0926 latitude and 77.5032 longitude, which puts it even closer to Kanyakumari.

The samples for the current experiment were taken from the mangrove plants' rhizosphere soil at the estuaries of Manakkudi and Rajakkamangalam. Rhizosphere soil samples were taken from the halotolerant plants Rhizophora and Avicenia at these two sites.

Screening of bacteria from mangroves

Following sample collection, bacterial strains were tested on several media, including Pikovskoyas agar, chitinase agar, skim milk agar, and carboxyl methyl cellulose agar, for their various enzyme activities, including phosphatase, chitinase, protease, and cellulase, respectively.

Morphological characterization

The isolated culture's morphological and biochemical characterization was completed using the methods.

RESULTS AND DISCUSSION

Morphological appearance

Results on the morphological appearance of the suspected colonies are provided in Plate 1. In total, ten different groups of colonies with varying morphology were screened and the details are given below:

- *Rod shaped granular colonies with waxy edge and membranousconsistency*
- *Rod shaped bright yellow convex elevation with irregular margin*
- *Circular umbonate elevation translucent colourless with entiremargin*
- *Circular translucent colourless with entire margin Round, irregular convex elevation with circular marginWhite irregular smooth elevation with lobate margin Circular smooth elevation slightly raised margin*
- *Creamy white circular non transparent colonies form with flatelevation and curled margin*
- *Round yellow colonies convex elevation with entire marginCircular in form with flat elevation and entire margin*

Plate 1: Enumeration of bacteria by pour plate technique

Avicennia sp. and Rhizophora sp. from Manakudi in the Kanyakumari area of India are the two plants whose total viable colonies are shown in Table 1. The colony numbers were higher in the 10 -2 dilution across the six various dilutions. Less colonies were collected in other dilutions, and it was discovered that the number of colonies decreased as the dilution increased from 10-3 to 10-7. (Plate 1). The colonies were too few at the highest dilutions of 10-8 to count (TLTC).

Plate 2: Pure culture of *Bacilllus sonorensis*

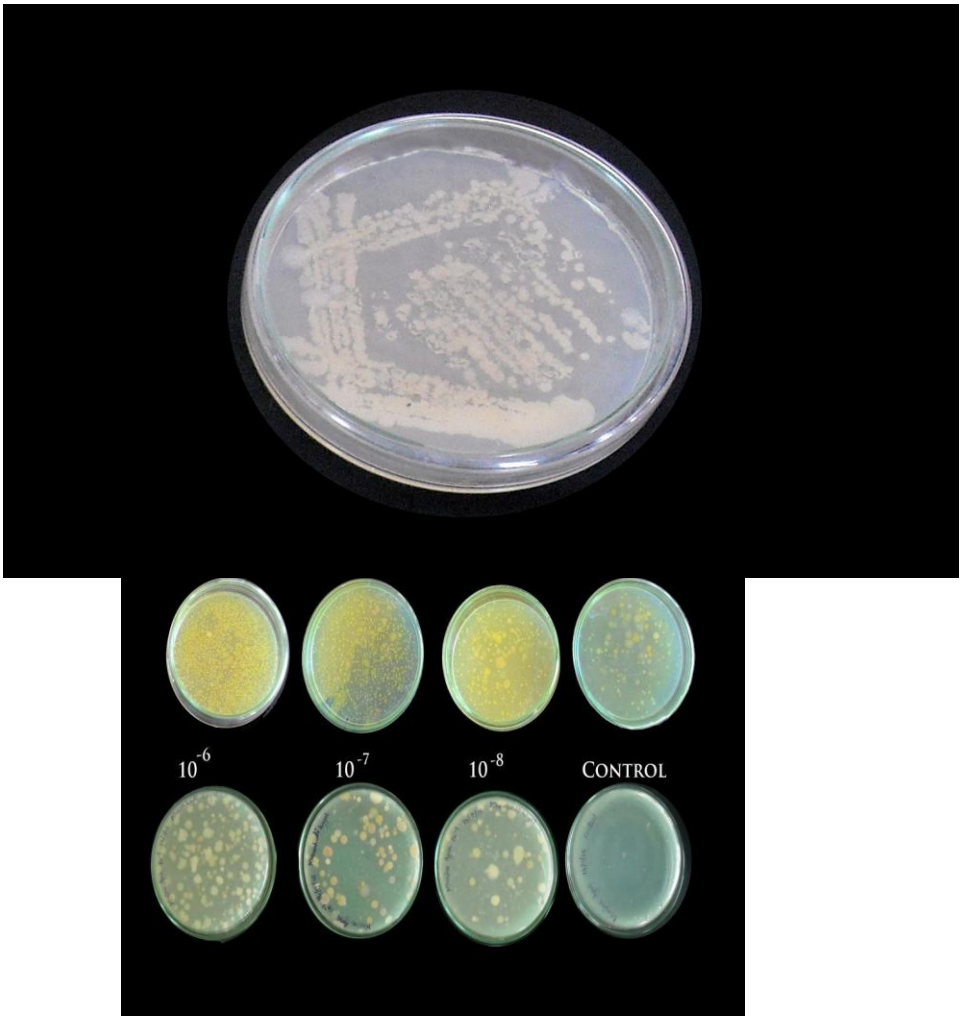

Plate 3: Screening of isolates for protease activity

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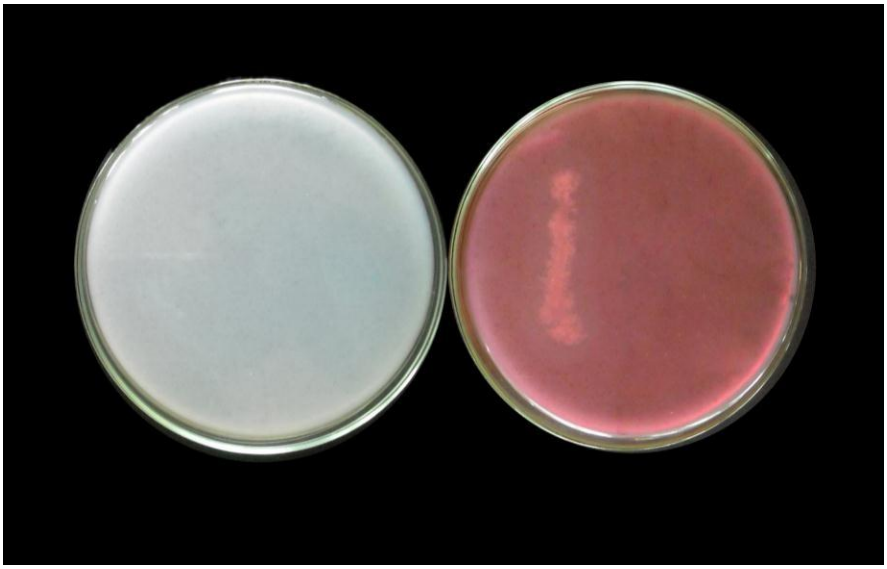
Plate 4: Screening of cellulase activity of *Bacillus sonorensis*



A. Control B. CMC agar

Plate 5: Screening of phosphatase activity of *Bacillus sonorensis*

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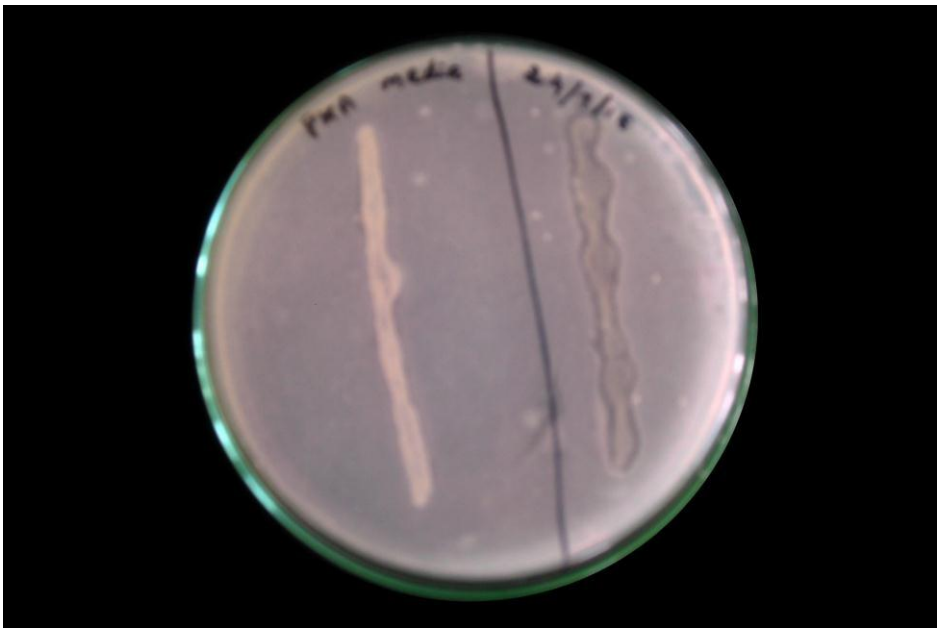

A. Control *B. PVK agar*

Table 1: Enumeration of bacteria

S. No.	Dilution	No. of Colonies
1.	10^{-2}	TNTC
2.	10^{-3}	TNTC
3.	10^{-4}	284
4.	10^{-5}	152
5.	10^{-6}	67
6.	10^{-7}	34
7.	10^{-8}	TLTC

TNTC: Too Numerable To CountTLTC: Too Low To Count

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Table 2: Morphological appearance of ten isolates

S. No.	Strain name	Morphological appearance	StrainName	Sampling site
1.	*Bacillus cereus*	Gram-positive rod-shaped	BH 2	Manakudi
2.	*Bacillus sonorensis*	Gram-positive rod-shaped	BH 3	Manakudi
3.	*Pseudomonas putida*	Gram-negative rod-shaped	BH 4	Manakudi
4.	*Pseudomonas plecoglossicida*	Gram-negative rod-shaped	BH 5	Manakudi
5.	*Bacillus licheniformis*	Gram-positive rod-shaped	BH 6	Manakudi
6.	*Halobacillustrueperi*	Gram-negative rod-shaped	SS.SNC 01	Rajakkamangalam
7.	*Halobacillusdabanensis*	Gram-negative rod-shaped	SS.SNC 02	Rajakkamangalam
8.	*Oceanobacillus iheyensis*	Gram-positive rod-shaped	SS.SNC 03	Rajakkamangalam
9.	*Cloacibacterium normanense*	Gram-negative rod-shaped	SS.SNC 04	Rajakkamangalam
10.	*Bacillus flexus*	Gram-positive rod-shaped	SS.SNC 05	Rajakkamangalam

Screening of plant growth promoting strains from mangrove rhizobacteria

Ten different types of morphologically distinct colonies were isolated from the soil of the mangrove rhizosphere for this study. The isolated bacteria were tested for characteristics that encourage plant growth, including the synthesis of IAA, siderophores, antimicrobial activity, and cell wall-degrading enzymes (protease, cellulase, and phosphatase) that can be dissolved in the appropriate medium. Ten separate bacterial isolates from the screened bacterial strains were found to be plant growth-promoting rhizobacteria, but only one of these strains was found to promote maximal zone development. This strain was then the focus of additional experimental testing (Plate 3 and 4).

CONCLUSION

As per the review's discoveries, rhizobacterial strains that advance plant development were found in mangrove plants and are fit for creating IAA, phosphatase, and cell wall-corrupting chemicals. In this examination, the absolute suitable count of mangrove plant rhizosphere tests went from 200 to 284 X roger that CFU per gram. Just a single microorganisms was distinguished to display greatest plant development supporting movement out of ten putative settlements that were analyzed, as proven by the unmistakable zone creation around it in the proper agar plates. They guaranteed that some endophytic microorganisms made new mixtures and antimicrobial properties that helped with the turn of events and development of plants. The adequacy of the 24 distinct kinds of phosphate-solubilizing bacterial settlements researched by Kathiresan and Selvam (2006) in the Parangipettai mangroves of the Vellar estuary was found to go from 0.01 to 0.141 mg/ml.

It has been shown that bacterial endophytes restrain the beginning of infection by working with the anew combination of new synthetic compounds and antifungal metabolites. Finding new drugs for the fruitful treatment of sicknesses in individuals, plants, and creatures might result from examination into the biodiversity of endophytic strains for novel metabolites. In hypersaline conditions, numerous hydrolytic action was as often as possible found, which is a charming point to make. Ecological detaches that can fabricate hydrolytic chemicals are Gram-

positive microorganisms and were given the family Bacillaceae assignment. This family incorporates species from the genera Bacillus, Halobacillus, and Thalassobacillus. The other portrayed separates were connected to Salinicoccus roseus, and simply two disengages were associated with the Gram-negative microbes Pseudomonas halophila. Our flow research unequivocally upholds past discoveries that make sense of the capacity of the microbes Bacillus sp., Pseudomonas sp., and Halomonas sp. to perform hydrolytic exercises in hypersaline conditions. The thickness of all out heterotrophic microbes (THB) differed between destinations from 2.8 to 3.1.

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