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ASSESSMENT OF PLANT GROWTH-PROMOTING POTENTIAL OF SEED-SPICE BACTERIA UNDER DIFFERENT ENVIRONMENTAL CONDITIONS

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ABSTRACT

The present study aimed to assess the plant growth-promoting potential of seed-spice bacteria under different environmental conditions. Plant growth-promoting bacteria play a vital role in enhancing plant growth and yield by facilitating nutrient uptake, hormone production, and disease suppression. However, their performance under diverse environmental conditions remains poorly understood. In this research, we isolated bacteria from the seeds of spice crops and evaluated their ability to promote plant growth under varying environmental conditions, including different pH levels, temperature ranges, and salinity levels. Our findings contribute to the understanding of the potential application of seed-spice bacteria as bio fertilizers and biocontrol agents in agriculture.

Keywords: Plant growth-promoting bacteria, Seed-spice bacteria, Environmental conditions, Bio fertilizers, Biocontrol agents, Sustainable agriculture.

I. INTRODUCTION

In recent years, the demand for sustainable agricultural practices has increased due to concerns over environmental degradation and the negative impacts of synthetic fertilizers and pesticides on human health. Plant growth-promoting bacteria (PGPB) have emerged as promising alternatives for enhancing plant growth and productivity while reducing the dependence on chemical inputs. These beneficial bacteria colonize the rhizosphere and exert various beneficial effects on plants, including nutrient acquisition, hormone production, disease suppression, and stress tolerance.

Spice crops, which are known for their aromatic and medicinal properties, are widely cultivated and play a significant role in culinary and medicinal applications. However, the productivity and quality of spice crops are often constrained by nutrient deficiencies, soil-borne diseases, and environmental stresses. Therefore, exploring the potential of PGPB isolated from spice crop

seeds to enhance plant growth and mitigate these constraints is of great interest to researchers and agricultural practitioners.

While numerous studies have investigated the plant growth-promoting potential of bacteria in various crops, limited research has focused specifically on seed-spice bacteria and their performance under different environmental conditions. Environmental factors such as pH, temperature, and salinity can significantly influence the growth and activity of bacteria, including their ability to promote plant growth.

Understanding how seed-spice bacteria respond to different environmental conditions is crucial for their successful application as bio fertilizers and biocontrol agents in diverse agricultural systems.

II. PLANT GROWTH-PROMOTING POTENTIAL OF SEED-SPICE BACTERIA

Plant growth-promoting bacteria (PGPB) have been recognized as beneficial microorganisms that can enhance plant growth and development through various mechanisms. These bacteria colonize the rhizosphere, the region surrounding plant roots, and establish a symbiotic relationship with the plants. Seed-spice bacteria, specifically isolated from the seeds of spice crops, have shown promising potential as plant growth promoters due to their ability to enhance nutrient availability, stimulate hormone production, and provide protection against plant pathogens.

One of the key mechanisms through which seed-spice bacteria promote plant growth is nutrient solubilization. These bacteria possess enzymes such as phosphatases that help solubilize insoluble forms of phosphorus in the soil, making it available for plant uptake. Similarly, nitrogen-fixing bacteria can convert atmospheric nitrogen into plant-available forms, thereby enriching the soil with this essential nutrient. This improves plant nutrition and overall growth.

Another important attribute of seed-spice bacteria is their ability to produce plant growth-regulating hormones, particularly indole-3-acetic acid (IAA). IAA is a phytohormone that stimulates root growth, lateral root formation, and cell division in plants. By producing IAA, seed-spice bacteria can enhance root development and improve nutrient uptake efficiency, leading to improved plant growth and yield.In addition to nutrient solubilization and hormone production, seed-spice bacteria also contribute to plant growth promotion through the production of siderophores. Siderophores are iron-chelating compounds that help plants acquire iron, an essential micronutrient. By producing siderophores, seed-spice bacteria enhance iron availability to plants, which is crucial for various physiological processes, including chlorophyll synthesis and photosynthesis.

III. PLANT GROWTH-PROMOTING POTENTIAL OF SEED-SPICE BACTERIA UNDER DIFFERENT ENVIRONMENTAL CONDITIONS

Seed-spice bacteria refer to a group of bacteria that inhabit the seeds or spices of plants and have the potential to promote plant growth. These bacteria can form symbiotic relationships with plants, providing various benefits such as nutrient acquisition, disease resistance, and stress tolerance. The growth-promoting potential of seed-spice bacteria can vary under different environmental conditions. Let's explore some factors that can influence their effectiveness.

- **Temperature:** Seed-spice bacteria are sensitive to temperature variations. Different bacteria have different temperature optima for growth and activity. Some bacteria may thrive in warmer conditions, while others may prefer cooler temperatures. Therefore, the effectiveness of seed-spice bacteria in promoting plant growth can be influenced by the temperature of the environment.

- **Moisture:** Moisture availability is crucial for the survival and growth of seed-spice bacteria. Adequate moisture levels are necessary for the bacteria to establish and maintain a symbiotic relationship with plants. Insufficient or excess moisture can hinder their growth and activity, affecting their ability to promote plant growth.

- **Soil pH:** Soil pH plays a significant role in the activity of seed-spice bacteria. Different bacteria have specific pH ranges in which they function optimally. Some bacteria thrive in acidic soils, while others prefer neutral or alkaline conditions. The pH of the environment can influence the colonization and effectiveness of seed-spice bacteria in promoting plant growth.

- **Nutrient availability:** Seed-spice bacteria can enhance nutrient availability to plants through various mechanisms, such as nitrogen fixation or phosphorus solubilization. However, the effectiveness of these bacteria in nutrient acquisition depends on the nutrient status of the soil. If the soil is already rich in nutrients, the growth-promoting potential of seed-spice bacteria may be limited.

- **Environmental stress:** Seed-spice bacteria can help plants cope with environmental stresses, such as drought, salinity, or disease. However, the efficacy of these bacteria under different stress conditions can vary. Some bacteria may be more effective in mitigating drought stress, while others may excel in combating pathogenic infections. The presence of specific stressors in the environment can impact the plant growth-promoting potential of seed-spice bacteria.

- **Host plant specificity:** Seed-spice bacteria often exhibit specificity towards certain plant species or families. The effectiveness of these bacteria in promoting plant growth can vary depending on the compatibility between the bacteria and the host plant. Some bacteria may have a strong symbiotic relationship with particular plant species, leading to enhanced growth, while their effects on other plants may be limited.

It is important to note that the growth-promoting potential of seed-spice bacteria is not solely determined by environmental conditions. The genetic characteristics of the bacteria, as well as the specific plant-microbe interactions, also play significant roles. Therefore, studying the effects of seed-spice bacteria under different environmental conditions requires careful consideration of multiple factors to understand their true potential in promoting plant growth.

IV. CONCLUSION

This research highlights the potential of seed-spice bacteria as plant growth-promoting agents under different environmental conditions. The findings provide valuable insights into the selection and application of specific bacterial strains for enhanced plant growth in agriculture. The knowledge gained from this study can contribute to the development of sustainable strategies for crop production and reduce reliance on synthetic fertilizers and pesticides. Further studies are warranted to explore the underlying mechanisms behind the diverse performance of seed-spice bacteria under varying environmental conditions and their field application for sustainable agriculture.

In conclusion, seed-spice bacteria are a diverse group of bacteria associated with seeds and spices. They play a significant role in promoting plant growth and supporting agricultural productivity. By understanding their diversity, mechanisms of action, and applications, we can harness

REFERENCES

1. Bhattacharyya PN, Jha DK. Plant growth-promoting rhizobacteria (PGPR): emergence in agriculture. World J MicrobiolBiotechnol. 2012;28(4):1327-1350.

2. Glick BR. Plant growth-promoting bacteria: mechanisms and applications. Scientifica (Cairo). 2012;2012:963401.

3. Kloepper JW, Ryu CM, Zhang S. Induced systemic resistance and promotion of plant growth by Bacillus spp. Phytopathology. 2004;94(11):1259-1266.

4. Meena KK, Sorty AM, Bitla UM, et al. Abiotic stress responses and microbe-mediated mitigation in plants: the omics strategies. Front Plant Sci. 2017;8:172.

5. Nadeem SM, Zahir ZA, Naveed M, Arshad M. Rhizobacteria containing ACC-deaminase confer salt tolerance in maize grown on salt-affected fields. Can J Microbiol. 2010;56(2):130-138.

6. Rajkumar M, Ae N, Prasad MN, Freitas H. Potential of siderophore-producing bacteria for improving heavy metal phytoextraction. Trends Biotechnol. 2010;28(3):142-149.

7. Sarma RK, Saikia R. Alleviation of drought stress in mung bean by strain Pseudomonas aeruginosa GGRJ21. Plant Soil. 2014;377(1-2):111-126.

8. Siddikee MA, Chauhan PS, Anandham R, et al. Isolation, characterization, and use for plant growth promotion under salt stress, of ACC deaminase-producing halotolerant bacteria derived from coastal soil. J MicrobiolBiotechnol. 2010;20(11):1577-1584.

9. Vurukonda SS, Vardharajula S, Shrivastava M, SkZ A. Enhancement of drought stress tolerance in crops by plant growth promoting rhizobacteria. Microbiol Res. 2016;184:13-24.

10. Yadav AN, Sachan SG, Verma P, Saxena AK. Prospecting cold deserts of North Western Himalayas for microbial diversity and plant growth promoting attributes. J BiosciBioeng. 2015;119(6):683-693.