

Phenotypic and genotypic identification of Phosphate solubilizing bacteria with PGPR activity and their efficiency on the growth of Banana

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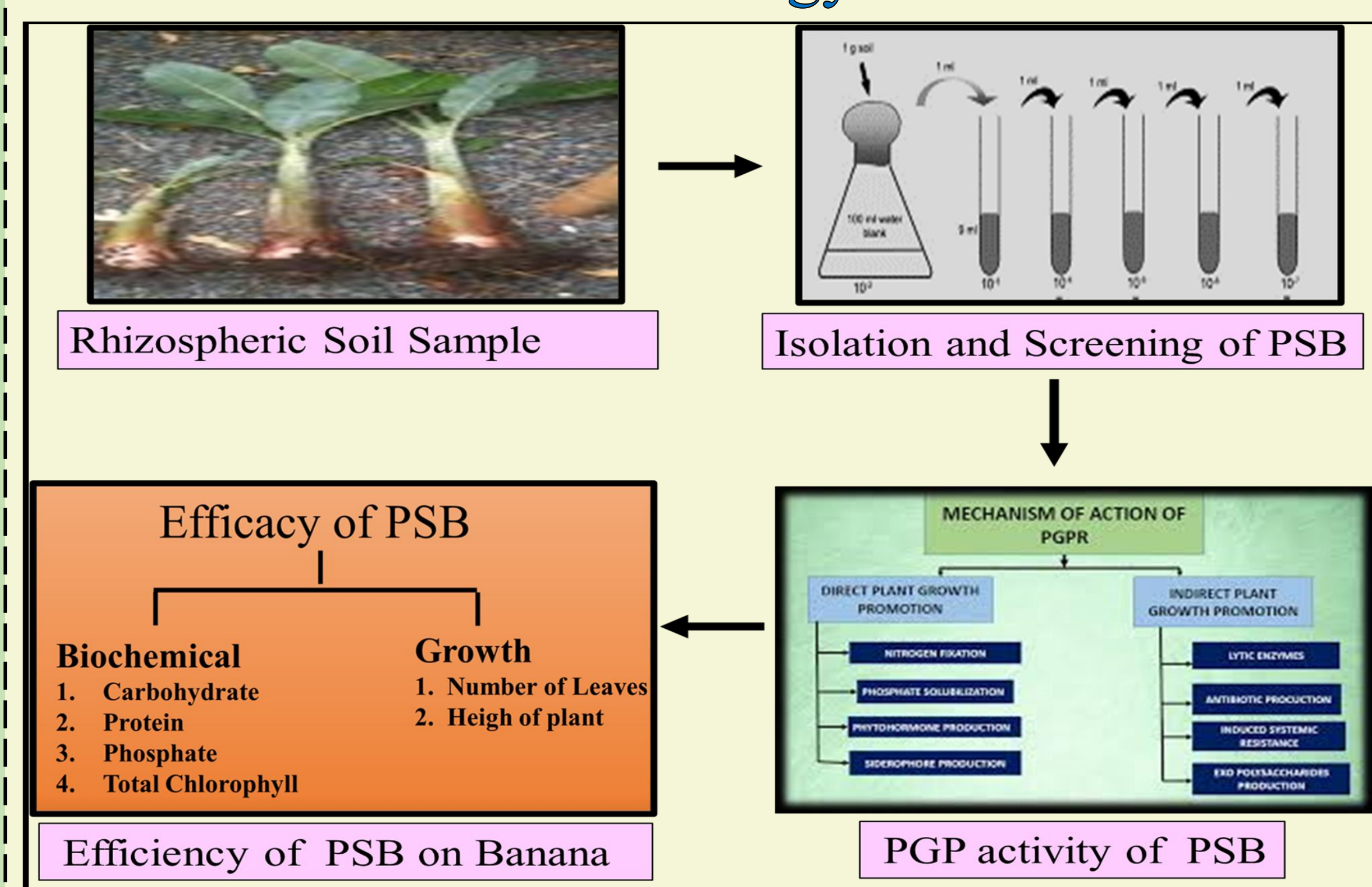
Abstracts

- Application of PSB along with PGPR activities as biofertilizer increase the availability of phosphate and other metabolites uptake for growth of plant without degrading the environment like chemical fertilizer.
- In the present study from the rhizospheric soil of banana, total seven PSBs were isolated based on Phosphate Solubilizing Index (PSI). Three isolates were selected and characterized for PGPR activities.
- According to the molecular identification, bacterial strains belonged to *Bacillus stratosphericus*, *Bacillus haynesii*, and *Staphylococcus pasteurii* as PSB01, PSB02, and PSB03 respectively. Out of them, *B. stratosphericus* and *S. pasteurii* were noted for the highest P solubilization activity in PVK broth 21.387 ± 0.154 - 27.203 ± 0.154 $\mu\text{m}/\text{ml}$, with 35 carbohydrate utilization by Hi-carbohydrate™ Kit and other PGPR activities.
- Therefore, these two isolates were selected to study their effect on the Banana plant for pot experiment under natural (unsterile) soil condition. After the incubation period of 70days, Biochemical and morphological parameters were recorded.
- From the parameters, PSB03 (*S. pasteurii*) significantly enhances the growth of the plant in comparison to both PSB01 and uninoculated control. The biochemical parameter carbohydrate for T3 ranges $0.334 \pm 0.002\text{mg}/\text{ml}$, protein $15.97 \pm 0.100\text{mg}/\text{ml}$, Phosphate $58.50 \pm 0.11\text{um}/\text{ml}$ and Chlorophyll 103.32 ± 0.35 in compare to control range C $0.246 \pm 0.003\text{mg}/\text{ml}$, P $10.62 \pm 0.08\text{mg}/\text{ml}$, phosphate $31.02 \pm 0.02\text{um}/\text{ml}$ and Chlorophyll 58.87 ± 0.49 .

Introduction

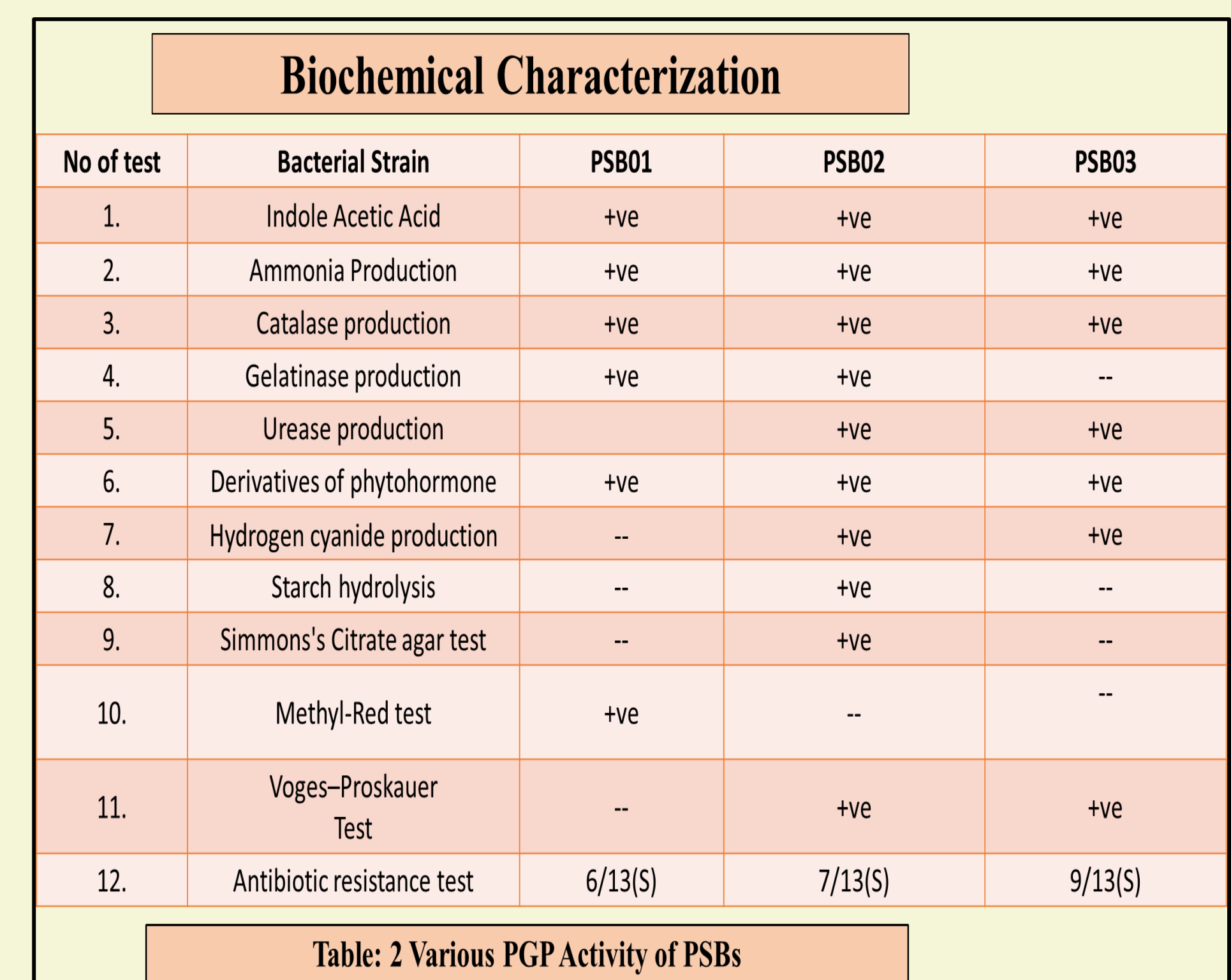
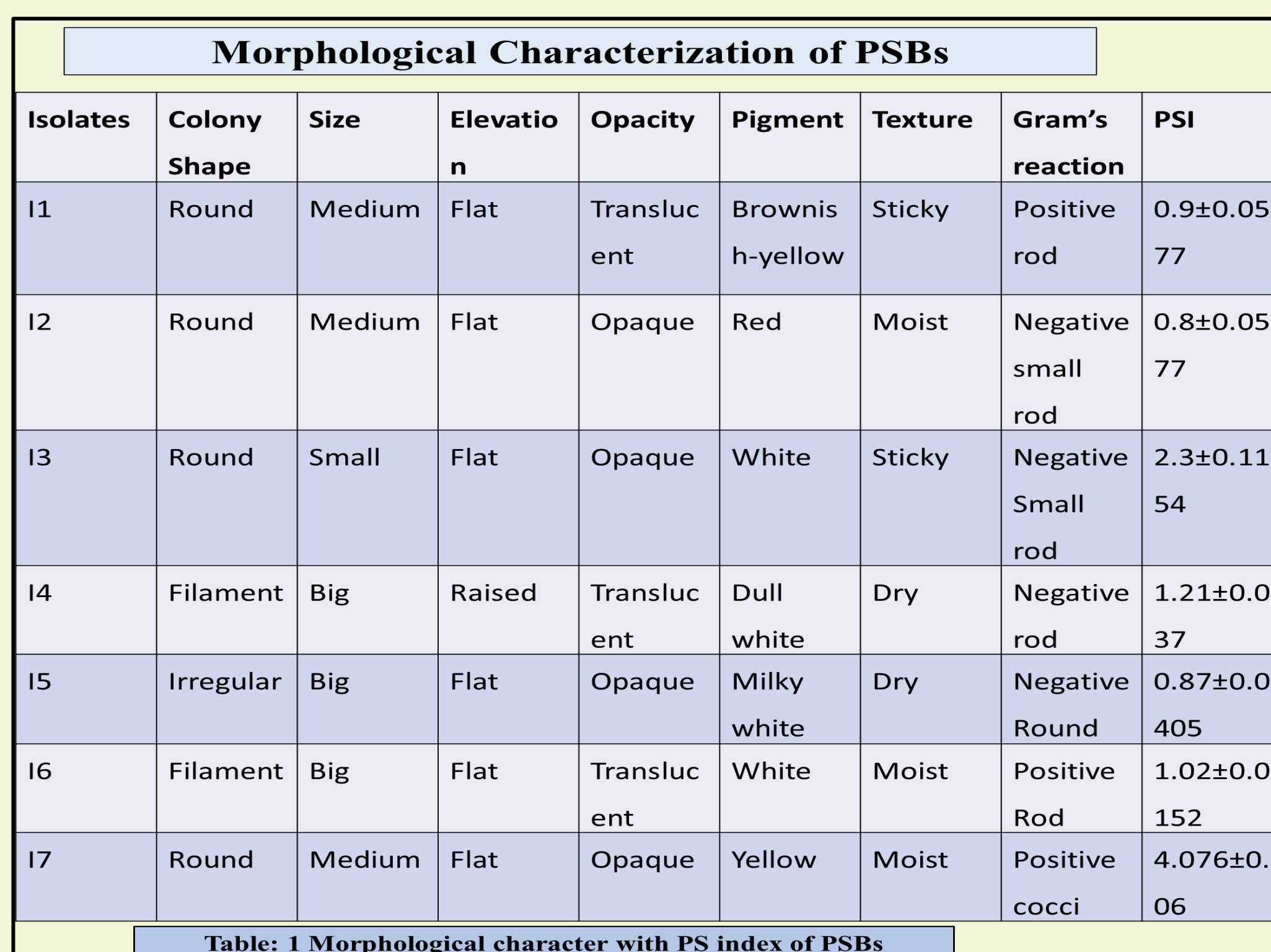
- Nutrient uptake by higher plants is a complex phenomenon, especially for elements such as Phosphorous and Nitrogen.
- Plant roots are not capable to uptake phosphate from the soil directly due to poor solubility of high molecular weight phosphate compounds i.e. apatite, hydroxyl-apatite &, fixations with other elements Fe, Al, and Mn.
- To fulfill the demand of nutrients excess amount chemical fertilizers with high P being used, which is being washed off by water and bind with other elements and health hazards to living flora.
- Alternative of chemical fertilizers are the biofertilizers which includes living organisms like bacteria, fungi, algae and some nematodes. These living organisms combinedly called PGPR (plant growth-promoting rhizobacteria).
- Phosphate solubilization is one of the most important and desirable function of plant growth promoting rhizobacteria (PGPR).
- The insoluble and bound phosphate is solubilized by certain soil microorganisms using different cellular mechanisms and they are called phosphate solubilizing micro-organisms (PSMs).

Methodology



Methodology and Results

Results



Molecular identification			
Strain	Accession number	Identified Name (NCBI database)	Identify %
PSB01	MK981647	Bacillus stratosphericus	99.22
PSB02	MN049545	Bacillus Haynesii	97.49
PSB03	MN049546	Staphylococcus pasteurii	96.81

Table: 3 Molecular identification with accession number

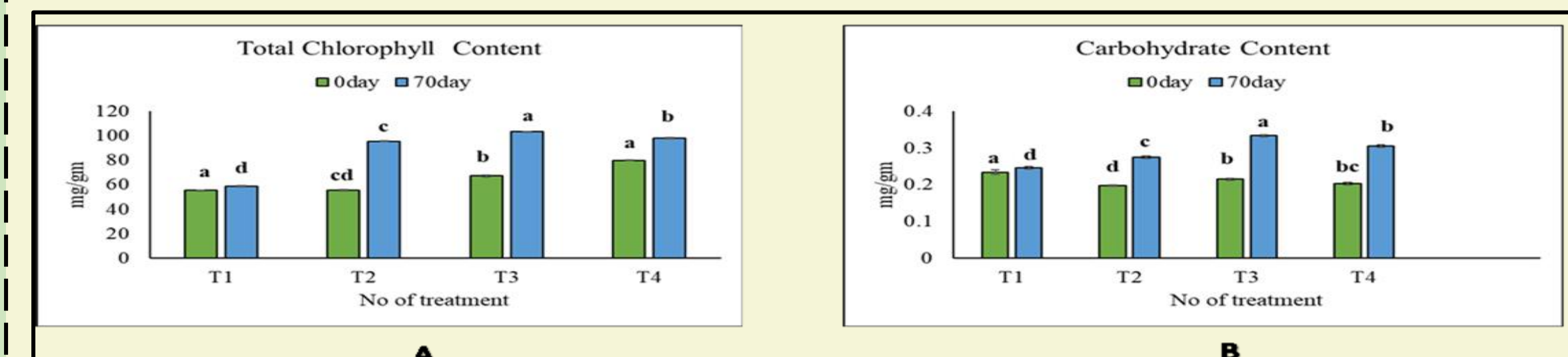


Figure: 3 Efficiency of the selected PSBs on the Banana plant under pot examination (A) Total Chlorophyll content (B) Carbohydrate content (C) Protein Content (D) Phosphate content (E) Height of plant and (D) a number of leaf.

Conclusion

- The present study identified seven potent phosphate solubilizing bacteria and further characterized for their various PGP-activity.
- Accordingly to molecular identification PSB01 and PSB03 the organisms belongs to *Bacillus stratosphericus* and *Staphylococcus pasteurii* respectively.
- The pot study, conclude that the organisms have efficiency to survive under unsterile soil condition.
- So far, the study conclude that the organisms have tendency to utilize as biofertilizers after field study.
- The future prospect is to understand the detailed molecular mechanisms and their efficiency for biofertilizers for Banana.

References

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