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Exploring Plant Growth Promoting Salt-Tolerant Microorganisms Associated with *Salicornia brachiata*

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Abstract

Salicornia brachiata, a halophyte native to the regions extending from the Indian subcontinent to Myanmar. It is well established in salt marshes along the Northwest and Southeast coastlines of Sri Lanka. This plant stabilizes coastal ecosystems and hosts a rich diversity of salt-tolerant microorganisms, including endophytic and rhizosphere bacteria and fungi. These microbes are vital for the plant's growth under saline stress, aiding in nutrient uptake, growth promotion, and overall ecosystem resilience. Therefore, the aims of this study were to isolate salt-tolerant root endophytic and rhizosphere microorganisms and to explore the plant growth promoting microbial diversity associated with *S. brachiata*. Rhizosphere soil and root samples of *S. brachiata* were collected from Karative, along transects perpendicular to the shoreline. The samples were initially cultured on marine agar for isolation of the rhizosphere and root endophytic bacteria, on PDA amended with 20 g/L NaCl for rhizosphere fungi, and Hagem minimal medium for root endophytic fungi. A total of 73 morphologically distinct bacteria and fungi were subcultured on 20 g/L NaCl salt-amended nutrient agar and PDA plates, respectively. Pure cultures were tested for their growth-promoting abilities, including phosphate solubilization on Pikovskaya's agar containing 0.5% $Ca_3(PO_4)_2$, Indole-3-acetic acid (IAA) production using Salkowski's reagent, and biofilm formation using crystal violet assay in a microtiter plate. Molecular identification of potential endophytic bacterial and fungal isolates was performed by comparing their ITS and 16S rDNA sequences using BLASTn. *Aspergillus* sp., *Aureobasidium* sp., *Geotrichum candidum*, *Proteus mirabilis*, and *Stagonosporopsis cucurbitacearum,* produced IAA concentrations ranging from 5.72±0.24 µg/mL to 32.41±0.96 µg/mL. One-way ANOVA indicated significant differences ($p < 0.05$) in IAA concentrations among the endophytic isolates, with *Proteus mirabilis* exhibiting the highest concentration. *Aspergillus* sp., *Meyerozyma* sp., *Talaromyces* sp., and *Virgibacillus* sp. were among the best phosphate solubilizers. *Brevibacterium* sp. exhibited the highest biofilm formation (OD600=0.3754± 0.028) among the endophytic bacterial isolates, and it is significantly different ($p<0.05$) from all other isolates. In conclusion, these findings underscore the vital role of microbial communities in plant growth and resilience of *S. brachiata,* a vulnerable salt marsh species in the coastal line. Conserving these microbial communities is essential for ensuring the long-term sustainability of Sri Lanka's coastal biodiversity.

Keywords: *Salicornia brachiata, Plant growth-promoting microorganisms, Salt-tolerant, Rhizosphere, Endophytes*