# Isolation and Preliminary Characterization of Phosphate-Solubilizing Rhizobacteria Associated with *Annona muricata* and *Phyllanthus emblica* Rhizospheres in North Central Province of Sri Lanka

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The excessive and prolonged application of chemical fertilizers has led to significant deterioration of soil health, compromised environmental sustainability, and reduced long-term agricultural productivity, thereby driving the increasing demand for environmentally friendly nutrient management strategies. Among essential macronutrients, phosphorus is frequently a limiting factor for plant growth due to its low bioavailability in soil caused by fixation and immobilization processes. Phosphate-solubilizing rhizobacteria (PSRB) play a crucial role in enhancing phosphorus availability by solubilizing inorganic phosphates and mineralizing organic phosphorus compounds, thereby promoting plant growth and soil fertility. This study aimed to isolate and preliminarily characterize native PSRB associated with underutilized fruit crops in the North Central Province of Sri Lanka. Rhizospheric soil samples were collected from the active root zone (0-15 cm) of healthy soursop (*Annona muricata)* and amla (*Phyllanthus emblica)* plants at eight locations, including five sites in Anuradhapura district and three sites in Polonnaruwa district, where crops exhibited vigorous growth under minimal external fertilizer inputs. Isolation was performed on Pikovskaya medium, and distinct colonies with clear halo zones indicative of phosphate solubilization were selected and purified by repeated subculturing. Morphological and biochemical characterization was conducted for preliminary characterization. Genomic DNA was extracted from all isolates, followed by amplification of the 16S rRNA gene to confirm bacterial DNA. Functional gene analysis was performed using PCR targeting the *phoD* gene, which encodes alkaline phosphatase responsible for the mineralization of organic phosphorus into plant-available forms. A total of eight distinct phosphate-solubilizing bacterial isolates were obtained. All isolates successfully amplified the 16S rRNA gene (~1500 bp), confirming their bacterial identity, while positive amplification of the phoD gene (~400 bp) indicated their genetic potential for organic phosphorus mineralization. These findings highlight the significant potential of native rhizobacterial strains associated with underexplored rhizosphere niches of underutilized fruit crops to enhance phosphorus bioavailability and soil fertility. The consistent detection of the *phoD* gene across all isolates highlights their functional capability in organic phosphorus mineralization. Therefore, these isolates represent promising candidates for the development of locally adapted microbial biofertilizer formulations, contributing to sustainable nutrient management and environmentally resilient agricultural systems in Sri Lanka.

**Keywords:** phosphate-solubilizing bacteria, phosphorus bioavailability, rhizosphere soil, sustainable agriculture

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