ABSTRACT

With the aim to explore the possible role of mineral phosphate solubilizing bacteria (PSB) in phosphorus (P) cycling in acidic soils, we conducted a survey of PSB from the different rhizosphere soils of Kerala, India. A total of 81 bacterial isolates showing different degrees of mineral tricalcium phosphate (Ca$_3$(PO$_4$)$_2$) solubilizing activities were isolated using Pikovskaya’s (PV) media. The 19 best Ca$_3$(PO$_4$)$_2$-solubilizers were further screened for their phosphate solubilizing potential with NBRIP-BPB medium. The most efficient isolates, designated as PSB 12 and 73 were identified as *Gluconacetobacter* sp. (MTCC 8368) and *Burkholderia* sp. (MTCC 8369) based on phenotypic features, whole cell fatty acid methyl ester (FAME) profile, and 16S rDNA typing. Random amplified polymorphic DNA (RAPD) finger prints of these bacteria were produced using a bacteria specific 20 mer RAPD primer. The selected isolates do not harbour any plasmids. Different physiological factors like pH, temperature, carbon sources, nitrogen sources, glucose concentration, salt concentration and incubation period were optimized for efficient phosphate solubilization. The extent of phosphate solubilization was significantly decreased when the medium was supplemented with buffer and pesticides. High performance liquid chromatography (HPLC) revealed the production of gluconic acid by the isolates. Acidification of the medium along with the production of gluconic acid seemed to be the main mechanism of P solubilization. *Gluconacetobacter* sp. was detected as a diazotrophic bacterium and the isolation of this strain is reporting for the first time from rubber rhizosphere soil. *Burkholderia* sp. was unique with respect to the production of indoleacetic acid (IAA), hydrogen cyanide (HCN) and siderophores. Both isolates also exhibited antifungal activity against phytopathogenic fungi (*Phytophthora* sp. and *Fusarium oxysporum*) in Pertidish assays. A pot experiment was designed to evaluate the biotechnological application of isolates on growth, nutrient uptake and yield of *Oryza sativa* L. cv. PTB 39. All the RP$_{60}$ amended inoculated series showed significantly higher yield over their respective RP unamended treatments. The best effect on yield was detected with the mixed culture inoculated (*Gluconacetobacter* sp. + *Burkholderia* sp. + RP$_{60}$) treatment. Identification and characterization of these two indigenous phosphate solubilizing bacteria for the effective plant growth promotion broadens the spectrum of phosphate solubilizers available for field application.

Key words: Rhizobacteria, FAME analysis, 16S rDNA typing, RAPD fingerprinting, High performance liquid chromatography