

**Isolation and characterization of plant growth-promoting
endophytic diazotrophic bacteria from traditional and new improved rice varieties
grown under organic conditions**

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Endophytic diazotrophic bacteria have a potential role in promoting plant growth through the production of Indole Acetic Acid (IAA), by phosphate solubilization and by nitrogen fixation. These endophytic bacteria can be used as a biofertilizer to improve plant growth. In this study, putative plant growth-promoting (PGP) endophytic diazotrophic bacteria were isolated from surface sterilized shoots and roots of BG359 and Kaluheenati rice varieties at two different growth stages of the plant (tillering stage (20 days after planting) and reproductive stage (75 days after planting)) grown under three levels of organic fertilizer in the soil (0, 10% (w/w), 20% (w/w)). Population size of these endophytic diazotrophic bacteria was enumerated by using Most Probable Number (MPN) technique. Isolated bacteria were characterized based on the morphological and biochemical features. Bacterial population in the shoots and roots of BG 359 and Kaluheenati rice varieties grown in the presence of organic fertilizer was found to be significantly high ($P \leq 0.05$) near tillering stage compared to the plants grown in the absence of organic fertilizer. A total of five putative plant growth-promoting (PGP) endophytic diazotrophic bacteria were isolated and found to belong to *Azospirillum* sp. (IS002), *Azoarcus* sp. (IS003), *Flavobacterium* sp. (IS008), *Enterobacter* sp. (IS009), and *Serratia* sp. (IS014). Among them, three bacterial isolates (IS003, IS008, and IS009) were obtained from Kaluheenati rice variety. Four bacterial isolates (IS002, IS003, IS009, and IS014) were capable of producing cellulose degrading enzymes but isolate IS008 tested negative for both cellulase activity and pectinase activity. All isolates were tested for their plant growth-promoting (PGP) activities. Bacterial isolates IS009 and IS014 indicated significantly high ($P \leq 0.05$) Indole Acetic Acid (IAA) production in the presence of tryptophan. Highest IAA production ($39.02 \times 10^{-6} \pm 1.91 \text{ kg l}^{-1}$) was shown by isolate IS009. Four isolates (IS002, IS003, IS008 and IS009) were able to solubilize inorganic phosphate. Endophytic bacterial isolate IS009 with cellulase activity, IAA production and ability to hydrolyze mineral phosphate can be developed as a biofertilizer to enhance rice plant growth.