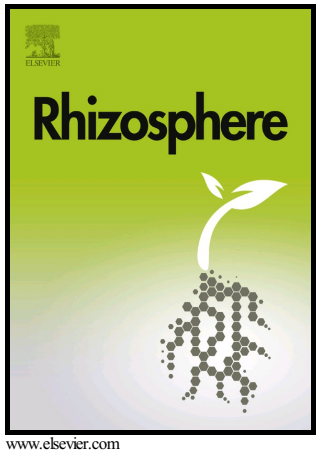

Zinc solubilizing bacteria from the rhizosphere of rice as prospective modulator of zinc biofortification in rice

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Zinc solubilizing bacteria from the rhizosphere of rice as prospective modulator of zinc biofortification in rice

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Abstract

The present study was designed to isolate and characterize zinc solubilizing bacteria (ZSB) from the rhizosphere of rice and subsequent evaluation of these isolates for plant growth promotion of rice seedlings. ZSB proficiently solubilized both the insoluble zinc compounds although ZnO was effectively solubilized in comparison to $ZnCO_3$. The soluble Zn concentration was determined in the culture supernatant using atomic absorption spectrophotometer (AAS). Isolate Zn 3 (62.48 mg/l) registered highest solubilization of Zn in culture broth. A positive correlation between Zn solubilization and reduction in pH of the culture medium was noted for most of the isolates. The ZSB also exhibited multiple plant growth promoting (PGP) traits such as 1-aminocycloproparane-1-carboxylic acid (ACC) utilization, exopolysaccharide (EPS) production, phosphate and potassium solubilization. ZSB were identified using 16S rRNA gene amplification and sequence analysis. The nine ZSB were isolated, which falls into 4 distinct genera belonging to two phyla γ-proteobacteria and β-proteobacteria. The isolates were identified as Pseudomonas aeruginosa. Ralstonia picketti, Burkholderia cepacia and Klebsiella pneumoniae. To best of our knowledge this is the first report on zinc solubilization potential of genera Ralstonia. Our findings suggest that application of ZSB enhanced and promoted the growth of rice seedlings. Additionally, ZSB could aid in Zn biofortification of rice and other cereals. ZSB could be used as Zn mobilizers for sustainable agriculture.

Keywords: Zinc solubilization; Pseudomonas; Biofertilizer; Biofortification; Rice

Introduction

Rice is an important staple food crop for most of the population around the world. It is one of the major cereal crops of India. India is one of the leading producers of this crop. Micronutrients such as zinc, copper, iron, molybdenum, boron and manganese play vital role in plant growth at different stages (Uchida, 2000). Zinc (Zn) is an essential micronutrient required by plants for better growth and nutrition. It is necessitate as important component of several enzymatic reactions, carbohydrate metabolism, maintenance of the integrity of cellular membranes, protein synthesis, auxin synthesis. It also play vital role in regulation of the gene expression needed for the tolerance of environmental stresses in plants (Cakmak, 2000). Zn deficiency is very common in rice cultivation and it stands next to nitrogen and phosphorus (P) deficiency. Zn deficiency symptoms are synonymous with P deficiency symptoms.