Identification of a Phosphorus-Solubilizing *Tsukamurella Tyrosinosolvens* Strain and its Effect on the Bacterial Diversity of the Rhizosphere Soil of Peanuts Growth-Promoting

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Abstract

Phosphate Solubilizing Microorganisms widely exist in plant rhizosphere soil, but report about the P solubilization and multiple growth-promoting properties of rare actinomycetes are scarce. In this paper, a phosphate solubilizing *Tsukamurella tyrosinosolvens* P9 strain was isolated from the rhizosphere soil of tea plants. Phosphorus-dissolving abilities of this strain were different under different carbon and nitrogen sources, the soluble phosphorus content was 442.41 mg/L with glucose and potassium nitrate as nutrient sources. The secretion of various organic acids, such as lactic acid, maleic acid, oxalic acid, etc, was the main mechanism for P solubilization and pH value in culture was very significant negative correlation with soluble P content. In addition, this strain had multiple growth-promoting characteristics with 37.26 µg/mL of IAA and 72.01% of siderophore relative content. Under pot experiments, P9 strain improved obviously the growth of peanut seedlings. The bacterial communities of peanut rhizosphere soil were assessed after inoculated with P9 strain. It showed that there was no significant difference in alpha-diversity indices between the inoculation and control groups, but the P9 treatment group changed the composition of bacterial communities, which increased the relative abundance of beneficial and functional microbes, which relative abundances of Chitinophagaceae and Beijerinckiaceae at the family level, and of *Flaviumicrobium*, *Ramlibacter* and *Microvirga* at the genus level, were all significant increased. Specially, *Tsukamurella tyrosinosolvens* were only detected in the rhizosphere of the inoculated group. This study not only founded growth-promoting properties of *T. tyrosinosolvens* P9 strain and its possible phosphate solubilizing mechanism, but also expected to afford an excellent strain resource in biological fertilizers.

Full Text

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Figures

Figure 1

Colony and cellmorphologiesofP9strainisolatedfromthetearhizosphere (a) transparent halo of P9 on PVK medium, (b) colony morphology on TSA, (c) microscopic image of Gram positive bacilliinpairs and groups(×100).

Figure 2

Phylogenetic analysis of the 16S rRNA gene sequence of strain P9 isolated from the tea rhizosphere. The scale bar indicates the number of nucleotide changes per base position analyzed. *Segniliparu rotundus* was used as the outgroup. GenBank accession numbers are in parentheses.

Figure 3

phosphate solubilization ability of *T. tyrosinosolvens* P9 strain under different carbon and nitrogen sources. The different letter indicates significantly difference at the $p \leq 0.05$ level, values are given as means $\pm$ S.E. for each sample

Figure 4

GC-TOF-MS of NBRIP culture under non-inoculation and inoculated with P9 strain Leftis CK and right is P9, labelled are the top four organic acids in culture

Figure 5

Morphology of peanut seedling after 30 days of treatments. A means P9 inoculation group, B means control group.

Figure 6

Principal component analysis (PCA) of bacterial communities in peanut rhizosphere soil. A1, A2 and A3 were CK, B1, B2, B3 were P9 inoculation group, respectively

Figure 7

The top 10 phyla of bacterial communities in peanut rhizosphere soil. A was CK, B was P9 inoculation group

Figure 8

The top 10 family of bacterial communities in peanut rhizosphere soil. A was CK, B was P9 inoculation group.

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