



# *Paenibacillus maysiensis* sp. nov., a Nitrogen-Fixing Species Isolated from the Rhizosphere Soil of Maize

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## Abstract

A novel bacterium SX-49<sup>T</sup> with nitrogen-fixing capability was isolated from the rhizosphere soil of maize. Phylogenetic analysis of *nifH* gene fragment and 16S rRNA gene sequence revealed that the strain SX-49<sup>T</sup> is a member of the genus *Paenibacillus*. Values of 16S rRNA gene sequence similarity were highest between SX-49<sup>T</sup> and *P. jamilae* DSM 13815<sup>T</sup> (97.0%), *P. brasiliensis* DSM 14914<sup>T</sup> (97.8%), *P. polymyxa* DSM 36<sup>T</sup> (97.5%), and *P. terrae* DSM 15891<sup>T</sup> (98.8%). The similarity between SX-49<sup>T</sup> and other *Paenibacillus* species was <97.0%. DNA–DNA hybridization values between strain SX-49<sup>T</sup> and the four type strains were *P. jamilae* DSM 13815<sup>T</sup>: 40.6%, *P. brasiliensis* DSM 14914<sup>T</sup>: 27.9%, *P. polymyxa* DSM 36<sup>T</sup>: 29.2%, and *P. terrae* DSM 15891<sup>T</sup>: 66.4%. The DNA G+C content of SX-49<sup>T</sup> was 46.4 mol%. The predominant fatty acids were anteiso-C<sub>15:0</sub>, C<sub>16:0</sub> and iso-C<sub>16:0</sub>. The predominant isoprenoid quinone was MK-7. The genome contains 5628 putative protein-coding sequences (CDS), 6 rRNAs and 56 tRNAs. The phenotypic and genotypic characteristics, DNA–DNA relatedness, and genome features suggest that SX-49<sup>T</sup> represents a novel species of the genus *Paenibacillus*, and the name *Paenibacillus maysiensis* sp. nov. is proposed.

## Introduction

The genus *Paenibacillus* was established by Ash et al. [1] based on the analysis of the 16S rRNA gene sequences of group 3 bacilli. Some species of the genus *Paenibacillus* were transferred from the genus *Bacillus*, and further descriptions of novel members increased the number of species of the genus *Paenibacillus* considerably. So far, there are > 110 now (<http://www.bacterio.cict.fr/p/paenibacillus.html>).

*Paenibacillus* species have diverse physiological characteristics. They have shown great advantage in agriculture, due to the various enzymes and antimicrobial substances

they produced, such as polymyxins and bacitracins [18]. Some strains of the *Paenibacillus* have the ability of nitrogen fixation [3, 10, 11, 19, 20]. So far, > 20 species of *Paenibacillus* have been found to be nitrogen-fixers [33]. A nitrogen-fixing strain SX-49<sup>T</sup> is described in this study, representing a novel species of the genus *Paenibacillus*.

## Materials and Methods

### Isolation

A sample of maize rhizosphere soil was collected in Shaanxi province of China (34°48'N, 109°53'E). 1-g sample was suspended in 9-ml sterile water, stirred for 30 min and heated at 80 °C for 15 min. After that, 100-μl suspension was spread on nitrogen-free medium agar plates in triplicate. The nitrogen-free medium consisted 20 g sucrose, 0.1 g K<sub>2</sub>HPO<sub>4</sub>, 0.4 g KH<sub>2</sub>PO<sub>4</sub>, 0.2 g MgSO<sub>4</sub>·7H<sub>2</sub>O, 0.1 g NaCl, 0.01 g FeCl<sub>3</sub>, and 0.002 g Na<sub>2</sub>MoO<sub>4</sub> per liter water. After incubation at 30 °C for 3 days, single colonies were isolated by streaking plating. Strains were routinely cultured in LD medium (per liter contains 2.5 g NaCl, 5 g yeast, and 10 g tryptone) at 30 °C for further identification and study.

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