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Isolation, characterization, and application of phosphate-solubilizing fungi as a biofertilizer for plant growth promotion

Jayathilake K. M. P. I.^{1,2}, Manage P. M.¹ and Idroos F. S.^{1*}

¹Centre for Water Quality and Algae Research, Department of Zoology, Faculty of Applied Sciences, University of Sri Jayewardenepura, Sri Lanka.

²Faculty of Graduate Studies, University of Sri Jayewardenepura, Sri Lanka.
sumaiyaidroos@sci.sjp.ac.lk*

Plants require major nutrients such as nitrogen and phosphorus for their optimal growth. Phosphorus is an essential macronutrient, yet its availability in soil is often limited due to its insoluble form. Soil microbes can convert insoluble phosphate into soluble phosphate through various mechanisms. Phosphate-solubilizing fungi (PSF) play a vital role in this process, contributing to the phosphorus requirements of plants. Hence, the present study aimed to isolate, characterize, and utilize PSF as a biofertilizer. The PSF strains were isolated from compost soil in Karadiyana (6°48' 51.8" N, 79° 54' 17.0" E) using Pikovskaya's agar (PVK) medium. The phosphate solubilizing index (PSI) was determined by observing halo zone formation after a 7-day incubation period. Phosphate solubilizing efficiency was assessed using PVK broth supplemented with 0.5% tricalcium phosphate following 7 days of incubation at 160 rpm (28 °C). The isolated fungal strains were introduced to a developed potting medium containing compost, coir dust, and soil in a 1:1:1 ratio. Mung bean (*Vigna radiata*) was selected as the experimental plant. Plant growth parameters (shoot length, root length, wet weight, and dry weight) were measured to determine the effect of the isolated fungal strains. These parameters were recorded after 30 days. Genotypic identification of the isolated strains was performed using the Internal Transcribed Spacer (ITS) region. The strains were confirmed as *Fusarium proliferatum*, *Aspergillus niger*, and *Aspergillus flavus*. *A. niger* demonstrated the highest phosphate solubilizing efficiency ($296.8 \pm 0.2 \mu\text{g/mL}$) after 6 days of incubation, with a PSI of 2.15 ± 0.1 . Fungi-inoculated pots showed a significant increase in shoot length, root length, wet weight, and dry weight compared to the control ($n = 9$, $p < 0.05$). Potting media inoculated with *A. niger* showed the best results, with the highest root length (11.8 ± 0.5 cm), shoot length (16.7 ± 0.5 cm), wet weight (0.6381 ± 0.03 g), and dry weight (0.1060 ± 0.02 g) was recorded. This study suggests that the potting media containing *F. proliferatum*, *A. niger*, and *A. flavus* exhibited significant roles in phosphate solubilization and plant growth promotion, indicating their potential to be used as an effective biofertilizers.

Keywords: Biofertilizer, Compost soil, Fungi strain, Phosphorus, Plant growth

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