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IMPROVING *BRASSICA JUNCEA* (L.) DEFENCES AGAINST HERBIVORY THROUGH PHOSPHATE-SOLUBILIZING BACTERIA

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ABSTRACT

Phosphate solubilising bacteria (PSB) are safe alternatives to synthetic fertilisers due to their ability to mobilise bound phosphorus reserves. To evaluate the possibility of using PSB, not only to improve plant growth but also to provide fortification against herbivores, we studied morphological responses (trichome density, leaf thickness and biomass) in PSB-supplemented *Brassica juncea,* post damage by *Spodoptera litura*. Furthermore, the preference and performance of late-arriving herbivores on these plants were determined. A systemic increase of both adaxial and abaxial trichome density was observed in PSB-supplemented plants, especially in the newly emerging leaf. However, herbivory negatively affected the biomass of these plants. Moreover, the late-arriving herbivore showed reduced preference for the PSB-supplemented plants and showed a decline in consumption index and efficiency of conversion of ingested and digested food. Our study, therefore suggests that PSB supplementation shows a priming effect through elevated morphological responses which in turn deters herbivory on these plants.

Keywords: Induced Defence, Nutritional Indices, Priming Effect, *Spodoptera litura*, Trichome density

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Low soil phosphorus availability is a major constraint to plant growth worldwide, principally due to slow soil diffusion and its high ability to bind soil constituents making it unavailable to plants (Ryan et al., 2001; Langhans et al., 2022). In agricultural systems, low phosphorus availability was earlier overcome through the application of concentrated chemical phosphorus fertilizers. However, these synthetic fertilizers have many disadvantages, such as chemical immobilization of phosphorus in the soil, depletion of non-renewable sources of phosphorus ore, cost of fertilizer processing and runoff pollution (Bates and Lynch, 2000). Therefore, the response of plants to soil phosphorus availability is of considerable interest in agriculture and ecology.

The use of microorganisms has generated global interest which plays a crucial role in the acquisition and transfer of nutrients in soil (Rodríguez and Fraga, 1999; Mishra et al., 2014; Lhungdim and Devi, 2015). Soil microorganisms play a crucial role in phosphorus transformation, influencing its availability to plant roots by converting it into accessible phosphate forms. Bio-fertilizers are safe alternatives to the current problem as they employ naturally occurring rhizosphere microbes to mobilize the unused phosphorus reserves and convert them into soluble forms for plant absorption. Various phosphorus solubilizing micro-organisms, including bacteria, fungi and actinomycetes, such as Vesicular-Arbuscular Mycorrhiza (VAM), *Aspergillus niger*, some sp. of *Penicillium* and Phosphate Solubilizing Bacteria (PSB) like *Pseudomonas fluorescens* and *Burkholderia cepaciae* have been identified as effective contributors to this process (Smith and Smith, 2010; Singh et al., 2011; Sarmah and Sarma, 2023; Cheng et al., 2023). Among these, PSBs are known to contribute to 68–78 % of total phosphorus biomass (Fan et al., 2018). Although there is clear potential for developing such inoculants, their widespread application is limited by a lack of understanding of microbial ecology and population dynamics in soil, as well as their inconsistent performance across diverse environments.

To counter biotic stressors, plants utilize a combination of constitutive and induced defence strategies (Bhuva et al., 2024). Constitutive defences are always present in the plant, acting as a first line of defence against potential threats. These defences

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