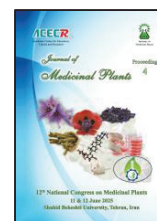




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Evaluating the Role of *Bacillus subtilis* in Alleviating Salt Stress in *Lallemantia iberica*

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ABSTRACT

Lallemantia iberica, commonly known as dragon's head, is a medicinal plant belonging to the Lamiaceae family, widely distributed across various regions of Iran. Traditionally cultivated for its seeds in southwestern Asia and southeastern Europe, its native range includes the Middle East and the Caucasus, later expanding across Europe and Eastern countries. The seeds of *L. iberica* are particularly valued for their high mucilage content, which has significant pharmaceutical and industrial applications. Given the increasing soil salinity challenges in many cultivation regions, enhancing the plant's tolerance to salinity through biological amendments offers promising solutions. To evaluate the impact of *Bacillus subtilis* on dragon's head under saline conditions, a factorial experiment was conducted under greenhouse conditions using a randomized complete block design (RCBD). The study consisted of 14 treatments, integrating seven salinity levels (0, 2, 4, 6, 8, 10, and 12 dS/m) and two bacterial conditions (presence and absence of *Bacillus subtilis*), with four replications per treatment. The bacterial inoculation was applied via irrigation water to potted plants. Key physiological and biochemical parameters—including plant height, fresh and dry biomass, seed yield, mucilage content, and ionic balance (Na⁺ and K⁺ uptake)—were measured to assess plant response to varying salinity conditions. Findings indicate that *Bacillus subtilis* significantly improves the salinity tolerance of *L. iberica*, enabling it to maintain optimal growth up to 10 dS/m. Quantitative analysis revealed enhancements in biomass production, seed yield, and mucilage content under saline conditions with bacterial inoculation. Additionally, ion balance assessments demonstrated reduced sodium accumulation and improved potassium uptake in inoculated plants, contributing to overall stress alleviation. These results highlight the potential of biological inoculants in mitigating salt-induced stress and promoting the sustainable cultivation of medicinal plants in Iran.

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