

ABSTRACT

Soil salinity poses a major threat to crop production and causing a significant yield loss. Sodium chloride constitutes a main component of saline soils and hence negatively impacts some of the plants. Present study was conducted on five varieties of *Vigna radiata* L. (Mung bean) for their screening against applied NaCl stress. For which two experimental set-ups were established. First having five concentrations of NaCl i.e., 3, 6, 9, 12, 15 dSm⁻¹ (30, 60, 90, 120 and 150 mmol) and one control lacking any application of NaCl. The second set-up had the application of same concentrations of NaCl along with the isolated and screened bacterial strain's (*Bacillus pseudomyoides*) inoculum. This bacterial strain was isolated from saline soils of Sahiwal, Punjab, Pakistan which was further cultured on nutrient broth having different concentrations of NaCl ranging from 100 ppm - 30,000 ppm, for its NaCl tolerance. Among the total thirteen isolated bacterial stains, nine strains showed tolerance up to 10,000 ppm of NaCl, three could tolerate 20,000 ppm of NaCl and only one strain was able to grow at 30,000 ppm of NaCl concentration. This highly salt-tolerant bacterial strain was selected for its utilization for *Vigna radiata* varieties being exposed to NaCl stress. The isolated strain was identified using 16S rRNA, based upon its features it was found to be *Bacillus pseudomyoides*.

The pot experiments were carried out in a completely randomized order following the factorial experimental design. For the first experiment, six treatments of NaCl were applied and labelled as; T₀=0, T₁= 3dSm⁻¹, T₂= 6dSm⁻¹, T₃= 9dSm⁻¹, T₄= 12dSm⁻¹, T₅= 15dSm⁻¹, each treatment had four replicates and lacking any application of bacterial inoculum. While, the second experiment also had the six treatments of NaCl along the inoculation of *Bacillus pseudomyoides* inoculum and labelled as; T₀B = 0+B, T₁B = 3dSm⁻¹ + B, T₂B = 6dSm⁻¹ + B, T₃B = 9dSm⁻¹ + B, T₄B = 12dSm⁻¹ + B, T₅B = 15dSm⁻¹ + B). The experiments were conducted both in the summer and winter seasons and results were compared to determine the effect of seasonal variation on mung bean growth as well. The field trial was also carried out in Bahawalnagar, Punjab Pakistan in saline soil. The physiological parameters like maximum rate of photosynthesis, stomatal conductance, transpiration, and chlorophyll contents were determined before harvest. After harvesting yield traits, such as number of rood nodules, pods, seeds, weight of seeds and 100 seeds weight,

above and below ground biomass and up-take of Na^+ and K^+ in both the above and belowground parts were determined. The nutrient profile i.e. protein, carbohydrate and soluble sugar contents were also assessed.

The results showed a significant reduction in germination, growth, yield, physiological parameters, ion uptake (more Na^+ and less K^+) and nutrient contents of all mung bean varieties under the salt stress as compared to control as well as the plants having application of *Bacillus pseudomycoides* inoculum. It was also found that nutrient contents i.e. protein, carbohydrate and soluble sugar were significantly higher in seeds than roots and shoots. Among all nutrients, protein contents were found higher than others and it ranged from 2.04 to 0.0093 mg g⁻¹ across all the varieties. The maximum sodium accumulation was found in roots which was ranging from 0.67 to 2.77 g kg⁻¹ and lowest in seeds with the range of 0.09 to 1.90 g kg⁻¹ across all the sodium chloride treatments with and without inoculum of *Bacillus pseudomycoides*. The data of summer and winter season revealed that summer crops showed better results of the studied parameters than winter crop among all five studied varieties.

Based upon the data of all the studied traits of five varieties, Inqelab mung showed more resistance to NaCl stress while Ramzan mung showed least resistance. It was also observed that field trial enhanced crop production than pot experiment due to continuous availability of natural environment. Over all, the five studied varieties responded in following order regarding their screening against applied NaCl stress; V1>V2>V3>V4>V5. These findings provide novel information regarding the response of five *Vigna radiata* varieties against NaCl stress and its amelioration using *Bacillus pseudomycoides*. This study is useful to understand the impact of salt stress on mung bean and its amelioration by using microbes. It provides avenues to overcome salt toxicity in eco-friendly way.