IOCAG 2025 Conference

The 3rd International Online Conference on Agriculture

22–24 October 2025 | Online

MDPI

Promoting Sustainable Agriculture: PGPR-Driven Enhancement of Plant Growth and Salinity Stress Tolerance

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INTRODUCTION & AIM

Soil salinity is a major constraint to agriculture, particularly in arid and semi-arid regions like Algeria, where it severely limits wheat productivity by disrupting water uptake, nutrient balance, and plant metabolism. To overcome these challenges, sustainable approaches such as the use of Plant Growth-Promoting Rhizobacteria are gaining attention for their ability to enhance nutrient availability, produce phytohormones, and improve plant stress tolerance. This study aims to isolate and characterize a native PGPR strain from Algerian saline soils and to evaluate its potential to enhance the growth, physiological performance, and salt stress resilience of durum wheat (Triticum durum L.) through nutrient mobilization, hormonal regulation, and improved physiological responses.

RESULTS & DISCUSSION

Table 1. Results of PGP traits of selected bacteria strain *Kushneria* sp.; Concentration of NaCl, PSI: phosphate solubilization index, N-f: free nitrogen fixation, Am: ammonium prd, Prteas: protease, Cellase: cellulase; Ant-F: anti-fongus activity.

Bac-strain	Origine	NaCl	PSI	N-F	Am	Sidero	Amylase	Prtease	Cellase	ACC	Biofilm	IAA	Anti-F
Kushneria sp.	Endophyte	0-5,1M	+++	++	++++	+++	+++	+++	+++	+++	+++	++++	++++

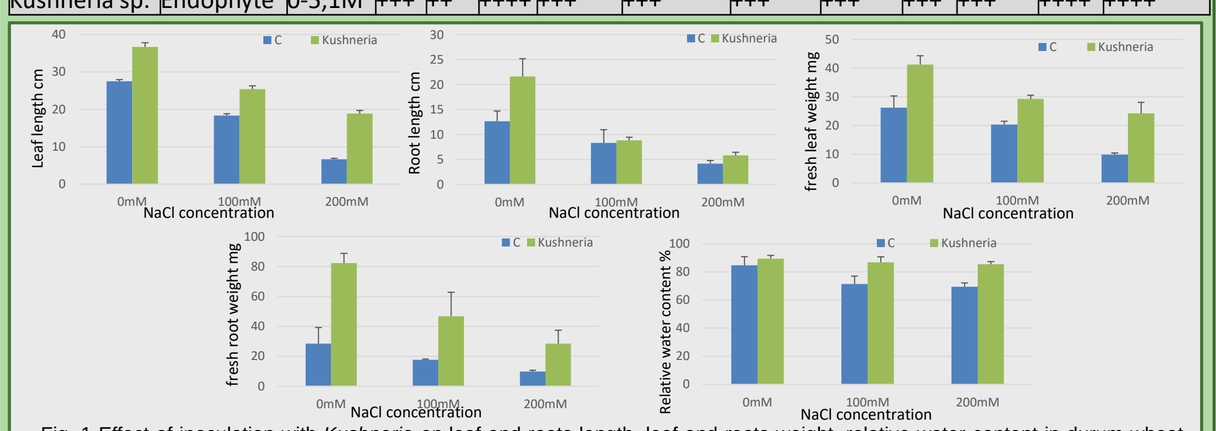

Fig. 1 Effect of inoculation with *Kushneria on* leaf and roots length, leaf and roots weight, relative water content in durum wheat under different salinity levels. Errors bars are the standard deviations of means. Different letters above the bars indicate significant differences at P < 0.05

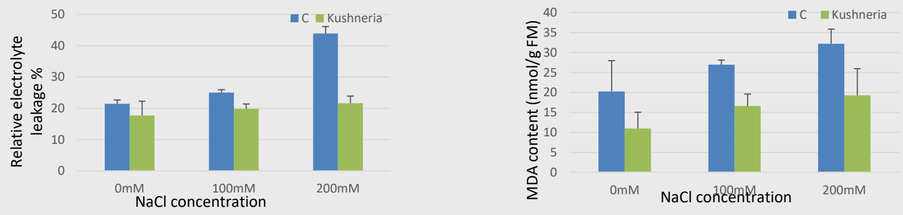

Fig. 2 Effect of inoculation with *Kushneria* on relative electrolyte leakage and MDA content in durum wheat under different salinity levels. Errors bars are the standard deviations of means. Different letters above the bars indicate significant differences at P < 0.05

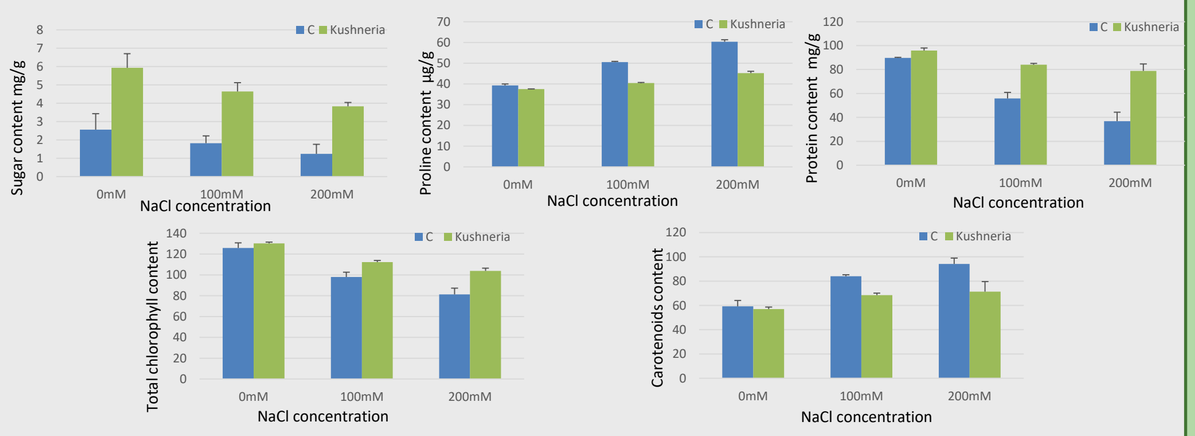

Fig.3 Effect of inoculation with *Kushneria* on Sugar content, proline content, protein content, total chlorophyll and carotenoids content in durum wheat under different salinity levels. Errors bars are the standard deviations of means. Different letters above the bars indicate significant differences at P < 0.05

Table 2. Results of effect of *Kushneria* sp. on phytohormons contente in wheat seedling under salt stress.

		IAA-Shoot	IAA-Root	ABA	SA	JA
0M	C	1,88 ± 0,17 cd	2,94 ± 0,17 d	25,54 ± 4,02 bc	187,52 ± 14,42 d	93,06 ± 16,43 c
	Kushneria	3,06 ± 0,17 a	4,12 ± 0,17 bc	11,46 ± 0,7 d	132,83 ± 21,36 d	7,62 ± 0,44 e
0,1 M	C	1,53 ± 0,17 cd	1,65 ± 0,17 ef	34,4 ± 3,07 ab	812,43 ± 62,92 b	408,5 ± 23,11 b
	Kushneria	2,94 ± 0,33 a	4,83 ± 0,17 ab	14,57 ± 1,51 d	255,32 ± 41,74 d	10,68 ± 0,8 e
0,2 M	C	1,3 ± 0,17 d	0,94 ± 0,17 f	38,93 ± 5,76 a	297,1 ± 62,64 cd	586,3 ± 37,74 a
	Kushneria	2,59 ± 0,17 ab	5,06 ± 0,17 a	16,67 ± 0,24 cd	660,6 ± 262,98 bc	44,73 ± 3,26 cde

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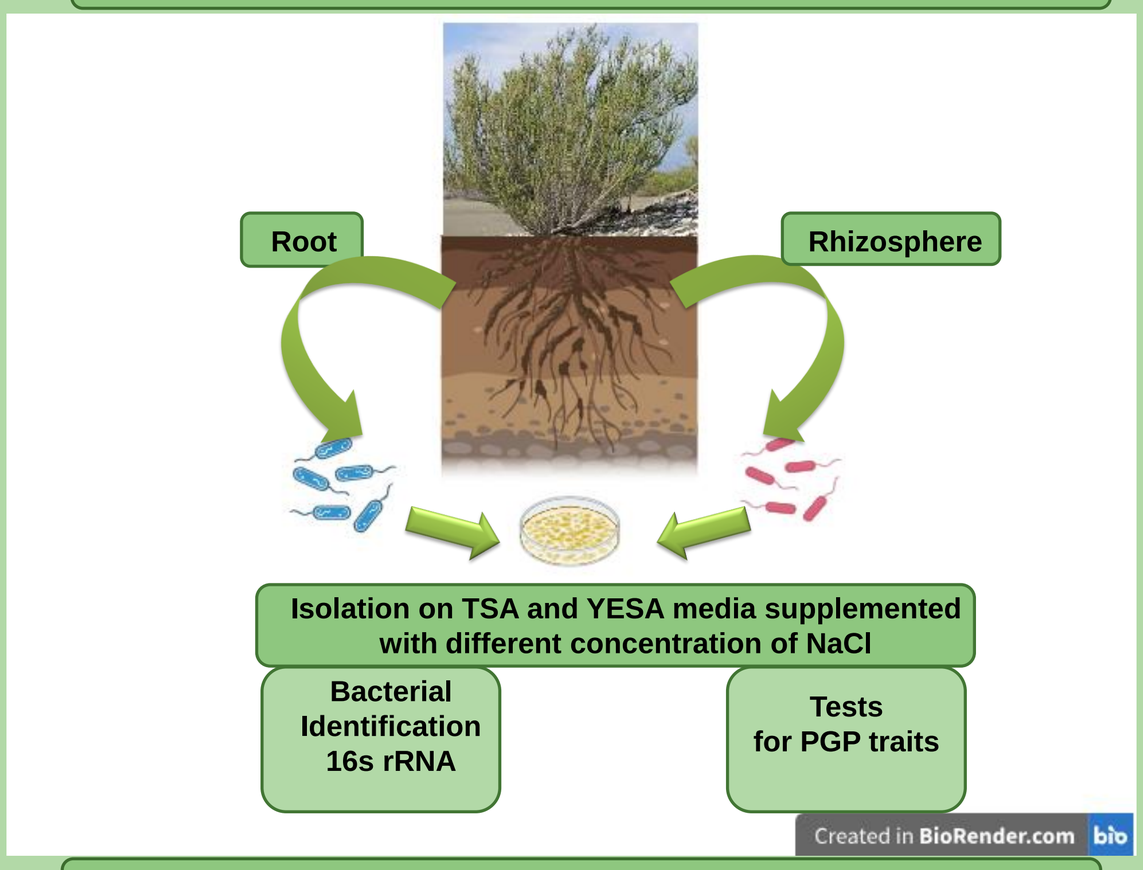
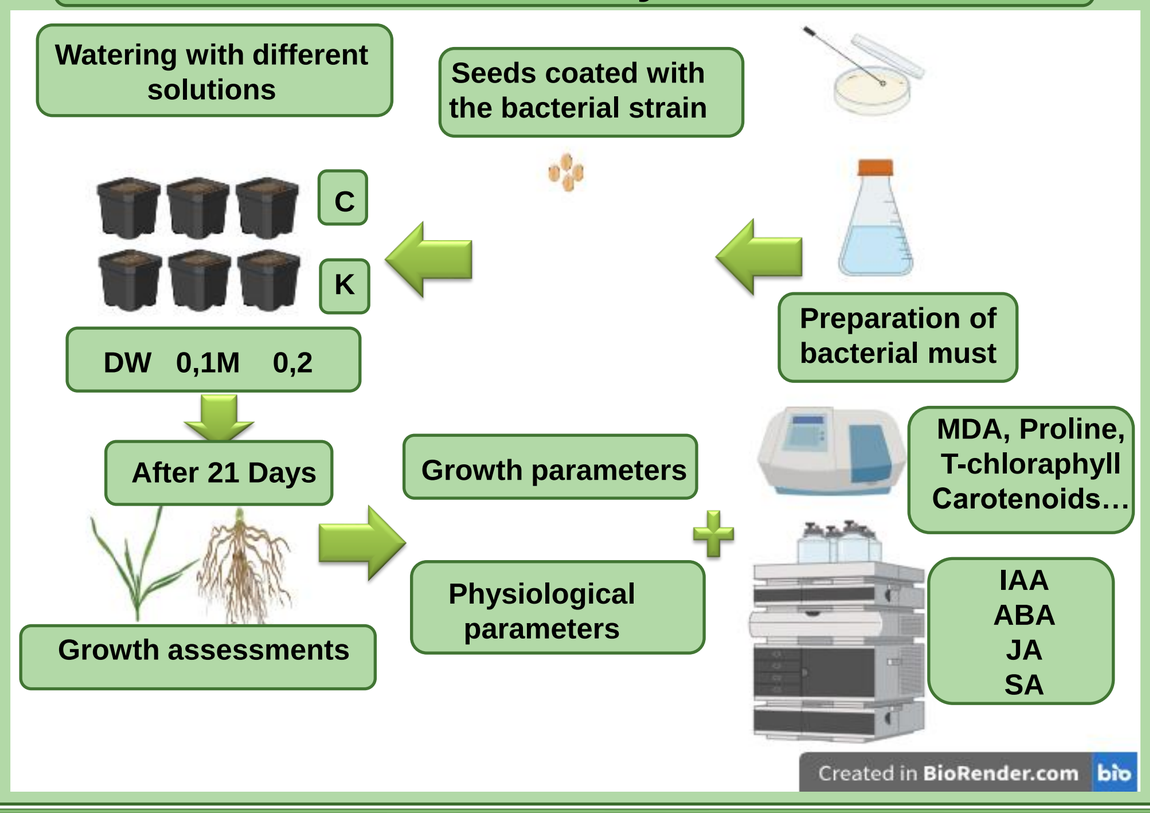
METHOD

Bacterial Strain Isolation and Characterization



Assessment PGP Ability in Durum Wheat



CONCLUSION

This study highlights the promising potential of *Kushneria* sp. as an efficient Plant Growth-Promoting Rhizobacterium (PGPR) for enhancing durum wheat tolerance to salinity stress. The inoculation of *Kushneria sp.* significantly improved root development, photosynthetic activity, and membrane stability, leading to better water and nutrient uptake under saline conditions. Its strong impact on the physiological and hormonal balance of plants suggests a multifunctional role in mitigating osmotic, ionic, and oxidative stress. These findings demonstrate that *Kushneria* sp. represents a valuable bioinoculant candidate for sustainable agriculture in arid and saline environments.

FUTURE WORK

Future research will focus on field validation of *Kushneria* sp. BSSM27 under natural saline conditions and its combined use with *Halomonas* sp. BSSM328 to assess potential synergistic effects. Molecular and genomic studies will help elucidate the mechanisms underlying salt stress tolerance, while formulation development will aim to produce an efficient biofertilizer suitable for arid and semi-arid agriculture.