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Rhizobacterium YMHJ8 Isolated From *Solidago Altissima* Roots Alleviate Salinity Stress and Arsenic Toxicity in Soybean (*Glycine max* L.)

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[Introduction]

Exposure to salinity stress and heavy metal such as arsenic (As) in agricultural land may induce severe abiotic stress and toxicity in crops. In general, salinity and heavy metal stress both alter the ionic interplay of sodium (Na^+) and chloride (Cl^-) generating reactive oxygen species causing oxidative stress and cell death. Since, rhizobacteria have been widely reported for their beneficial impact in mitigating biotic and abiotic stress, in the current study we isolated several rhizobacteria from *Solidago altissima* roots and selected the potent rhizobacterium to treat soybean plants subjected to salt stress and arsenic.

[Material and Method]

The rhizobacterium YMHJ8 having an innate ability to resist salt and arsenic was selected from the screening for the further experiment in soybean plants. The soybean seeds var williams 82 surface sterilized with 3% sodium hypochlorite, rinsed with distilled water (dH_2O), and sowed using the twice autoclaved horticultural soil. Two-weeks-old seedlings of soybean were transplanted in a pot (9 × 10 cm) filled with autoclaved horticultural soil. The experimental work plan was divided into two sets. **Set A**, without bacteria: (TR1); only dH_2O, (TR2): NaCl 1%, and (TR3): As 0.5mM. **Set B**, with bacteria: (TR4); YMHJ8 only, (TR5); YMHJ8+NaCl 1% and (TR6); YMHJ8+As 0.5mM. After seven days of treatment, the plant morphological parameters, biochemical properties were analyzed. The experiment was conducted in the glasshouse of Kyungpook National University with temperature and humidity ranging 25 ± 5 °C and 65 ± 10 % respectively.

[Result and Discussion]

Our results showed that YMHJ8 treatment on soybean seedlings under salinity and arsenic stress significantly improved plant morphological attributes and antioxidant properties. It was observed that the YMHJ8 inoculation increased shoot length by 18.3% in TR5 and 11.7% in TR6 when compared to TR2 and TR3 respectively. Similarly, root length was increased by 21.5% in TR4 and 7.6% in TR6. Shoot fresh weight was increased by 30% in TR5 and 37.3% in TR6 when compared to TR2 and TR3 respectively. Chlorophyll content was significantly increased by 4.5% in TR5 compared to TR2 and 15.8% in TR6 compared to TR3. The results of superoxide dismutase (SOD) and catalase (CAT) activities suggested that when the YMHJ8 was inoculated under stress conditions, the SOD activity increased significantly by 56.7% in TR5 compared to TR2 and by 79.7% in TR6 compared to TR3. The CAT activity increased significantly by 13.2% in TR5 compared to TR2 and 19.8% in TR6 compared to TR3, respectively. To determine the response to increased CAT activity, we measured the H_2O_2 content in the soybean seedling and found that the YMHJ8 treatment significantly reduced H_2O_2 by 23% and 8.6% under salinity and arsenic stress respectively. These results suggested that the strain YMHJ8 could be a potential biological tool to reduce salinity and arsenic stress in crops.

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