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EFFECT OF VARIOUS SODIUM CHLORIDE CONCENTRATIONS ON THE DYNAMICS OF indolyl-3-acetic ACID SYNTHESIS BY SALT-TOLERANT SOIL BACTERIA

Zakiryaeva Saidaxon Ikramovna, Karimov Husniddin Xolmamatovich, Khamidova Xursheda Mo‘minovna, Shakirov Zair

Institute of Microbiology, Academy of Sciences of the Republic of Uzbekistan, Tashkent

Soil salinity is a major factor limiting the growth and productivity of agricultural crops. Elevated salt concentrations in the soil solution disrupt plant water balance, reduce nutrient availability, and negatively affect the development of soil microorganisms. Under these conditions, salt-tolerant rhizobacteria – capable of maintaining physiological activity amidst high salinity and producing phytohormones that regulate plant growth – assume particular importance.

Indolyl-3-acetic acid (IAA) is a key growth-promoting compound synthesized by bacteria. It plays a role in regulating cell division and elongation, as well as root system formation and lateral root development. The ability of bacteria to synthesize IAA under saline conditions is of interest for the development of microbial preparations aimed at enhancing plant tolerance to salt stress.

The aim of this study was to investigate the effect of various sodium chloride concentrations on the synthesis of indolyl-3-acetic acid by salt-tolerant soil bacteria during the course of cultivation.

The study investigated 11 strains of soil bacteria: *Brevibacillus fluminis* 1A, *Bacillus subtilis* 7A, *B. rugosus* 8A, 9A, 10A, 14A, *B. endophyticus* 12A, *B. halotolerans* 27A, *B. axarquiensis* 28A, *B. proteolyticus* 33S and *B. pumilus* 40S. IAA synthesis was examined at four NaCl concentrations: 0%, 3%, 5%, and 7%. Metabolite production was measured after 3, 5, and 7 days of cultivation. The experimental data obtained were used to comparatively assess the effects of salt stress and cultivation duration on the rate of IAA synthesis by the strains under study.

The results demonstrated that IAA synthesis depended on the sodium chloride concentration, the duration of cultivation, and the individual characteristics of the strains. Overall, extending the cultivation period from 3 to 7 days led to increased IAA production in the majority of the bacteria; however, the extent of this trend varied depending on the salt concentration.

On the third day of cultivation, the highest IAA synthesis levels were observed in *B. rugosus* 9A in the absence of NaCl (15.50 mg/L) and in *Brevibacillus fluminis* 1A at 5% NaCl (13.37 mg/L). No IAA synthesis was detected at 7% NaCl for several strains, including *B. rugosus* 8A, *B. rugosus* 10A, *B. endophyticus* 12A, *B. rugosus* 14A, *B. halotolerans* 27A, *B. axarquiensis* 28A, and *B. proteolyticus* 33S. This indicates a pronounced inhibitory effect of high salt concentrations during the early stages of cultivation for certain members of the studied group. Meanwhile, *B. pumilus* 40S showed no detectable IAA production on the third day in any of the experimental conditions.

By the fifth day, an increase in IAA synthesis was observed in the majority of strains. The maximum value in the absence of salt was recorded for *B. rugosus* 9A (30.44 mg/L), whereas at 3% NaCl, the highest level was observed in *B. rugosus* 8A (24.32 mg/L). Strain *B. proteolyticus* 33S also exhibited high IAA production at 3% NaCl (24.22 mg/L). At 5% NaCl, a relatively high level was noted for *Brevibacillus fluminis* 1A (18.22 mg/L), and at 7% NaCl, for *B. pumilus* 40S (16.86 mg/L). The results indicate that some strains retained the ability to synthesize IAA even under high salt stress, although production levels varied. On the seventh day, the highest rate of IAA synthesis

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in the absence of NaCl was recorded for *B. rugosus* 9A, amounting to 39.05 mg/L. High values were also observed for *Brevibacillus fluminis* 1A (30.34 mg/L) and *B. subtilis* 7A (29.92 mg/L). At 3% NaCl, the maximum level was observed in *B. rugosus* 9A (21.90 mg/L) and *B. rugosus* 10A (19.57 mg/L). At 5% NaCl, the highest IAA production was noted for *B. endophyticus* 12A, with a value of 18.80 mg/L. At 7% NaCl, relatively high values were recorded for *B. rugosus* 9A (17.25 mg/L), *B. subtilis* 7A (13.47 mg/L), and *Brevibacillus fluminis* 1A (12.89 mg/L).

Strain *B. rugosus* 9A is of particular interest, as it demonstrated the highest levels of IAA synthesis throughout the experiment. On the seventh day, its production at NaCl concentrations of 0%, 3%, 5%, and 7% was 39.05, 21.90, 15.79, and 17.25 mg/L, respectively. Although production decreased as salinity increased compared to the salt-free control, the strain retained its ability to synthesize IAA at all tested NaCl concentrations. This makes it a promising candidate for further study regarding growth-promoting potential under saline conditions.

Thus, the study revealed a marked dependence of indole-3-acetic acid production on sodium chloride concentration, cultivation duration, and the species of the soil bacteria. For most strains, the highest levels were observed on the seventh day of cultivation; however, high NaCl concentrations limited IAA synthesis in a number of isolates. *B. rugosus* 9A and *Brevibacillus fluminis* 1A appear the most promising in terms of IAA production levels and the retention of synthetic activity under saline conditions. These results may serve as a basis for the further selection of salt-tolerant bacteria – potential components of microbial inoculants for crops grown on saline soils.

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