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The Role of Time-Dependent Treatment of Exogenous Salicylic Acid on Endogenous Phytohormone Levels under Salinity Stress

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Abstract : World climate is changing. Millions of people in the world still face chronic undernourishment for conducting a healthy life and the world's population is growing steadily. To meet this growing demand, agriculture and food systems must adapt to the adverse effects of climate change and become more resilient, productive and sustainable. From this perspective, to determine tolerant cultivars for undesirable environmental conditions will be necessary food production for sustainable development. Among abiotic stresses, soil salinity is one of the most detrimental global fact restricting plant sources. Development of salt-tolerant lines is required in order to increase the crop productivity and quality in salt-treated lands. Therefore, the objective of this study was to investigate the morphological and physiological responses of barley cultivars accessions to salinity stress by NaCl. For this purpose, it was aimed to determine the crosstalk between some endogenous phytohormones and exogenous salicylic acid (SA) in two different vegetative parts (leaves and roots) of barley (Hordeum vulgare L.; Poaceae; 2n=14; Ince-04) which is detected salt-tolerant. The effects of SA on growth parameters, leaf relative water content (RWC), endogenous phytohormones; including indole-3-acetic acid (IAA), cytokinins (CKs), abscisic acid (ABA), jasmonic acid (JA) and ethylene were investigated in barley cultivars under salinity stress. SA was applied to 17-day-old seedlings of barley in two different ways including before (pre-treated for 24 h) and simultaneously with NaCl stress treatment. NaCl (0, 150, 300 mM) exposure in the hydrophonic system was associated with a rapid decrease in growth parameters and RWC, which is an indicator of plant water status, resulted in a strong up-regulation of ABA as a stress indicator. Roots were more dramatically affected than leaves. Water conservation in 150 mM NaCl treated-barley plants did not change, but decreased in 300 mM NaCl treated plants. Pre- and simultaneously treatment of SA did not significantly alter growth parameters and RWC. ABA, JA and ethylene are known to be related with stress. In the present work, ethylene also increased, similarly to ABA, but not with the same intensity. While ABA and ethylene increased by the increment of salt concentrations, JA levels rapidly decreased especially in roots. Both pre- and simultaneously SA applications alleviated salt-induced decreases in 300 mM NaCl resulted in the increment of ABA levels. CKs and IAA are related to cell growth and development. At high salinity (300 mM NaCl), CKs (cZ+cZR) contents increased in both vegetative organs while IAA levels stayed at the same level with control groups. However, IAA increased and cZ+cZR rapidly decreased in leaves of barley plants with SA treatments before salt applications (in pre- SA treated groups). Simultaneously application of SA decreased CKs levels in both leaves and roots of the cultivar. Due to increasing concentrations of NaCl in association with decreasing ABA, JA and ethylene content and increments in CKs and IAA were recorded with SA treatments. As results of the study, in view of all the phytohormones that we tested, exogenous SA induced greater tolerance to salinity particularly when applied before salinity stress.

Keywords : Barley, Hordeum vulgare, phytohormones, salicylic acid, salinity
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