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Physiological and biochemical parameters of triticale shoots under NaCl-stress in the light of PCA method

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Abstract

The application of a statistical method (principal component analysis – PCA) for analyzing the results of physiological and biochemical characteristics of triticale shoots under short-term NaCl stress made it possible to come to a number of unconventional conclusions. The importance of maintaining the redox state in the cell for the adaptive responses of triticale shoots under experimental conditions was noted for the first time. In this case, the processes of electron transfer associated with the functioning of photosynthetic pigments, apparently, are not important for the overall redox potential in plant cells. The application of the method of principal component analysis showed that under conditions of short-term chloride stress in triticale shoots, the water content is the most variable characteristic, which, apparently, has other regulatory pathways, in addition to the main mechanisms of transpiration and osmotic potential. The values of the correlation coefficients between different characteristics indicate that, under conditions of short-term NaCl-stress in triticale shoots, the presence of chlorophyll ($r = –0.73$) and carotenoids ($r = –0.75$) is apparently more effective against the accumulation of hydrogen peroxide than ascorbate ($r = –0.18$) and, moreover, proline ($r = 0.01$), but the protective role of membranes against LPO is provided to a greater extent by ascorbate ($r = –0.70$) and proline ($r = –0.69$) than by glutathione ($r = –0.40$) and photosynthetic pigments ($r = –0.29$ and $r = –0.33$ – for chlorophyll and carotenoids, respectively). The experimental data speak for the first time about the effectiveness of membrane protection with ascorbate and glutathione. Under conditions of short-term NaCl stress in triticale shoots, the most effective enzyme for the decomposition of hydrogen peroxide is guaiacol peroxidase (judging by the value of the correlation coefficient, $r = –0.73$). In this case, the role of ascorbate peroxidase in the protection of membranes from lipid peroxidation turns out to be more significant. Under the experimental conditions, catalase did not perform the function of protecting membranes from lipid peroxidation ($r = 0.94$). High molecular weight antioxidants

(enzymes) play a more significant role in the adaptation of triticale shoots to short-term NaCl stress than low molecular weight substrates.

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