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The Physiological and Biochemical Responses of four Local Squash Landraces under Drought stress

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Abstract

For the last two decades, climate change shows its consequences all over the globe as a result of global warming and has induced the drought stress which is considered as one of the most serious environmental stresses occurring extremely in arid and semi-arid regions. It is considered as one of the most serious environmental stresses occurring especially in arid and semi-arid regions. Therefore, it is a necessity to make development of species and varieties which are tolerant to drought or being economic efficiency with less water availability. The present study was carried out to assess the water stress tolerance among four local squash (Cucurbita maxima Duchesne) landraces selected for their tolerance to salinity among a previously studied collection. These tests were performed using D-Mannitol with four concentrations of 0, 100, 200 and 300 mM. At the plant stage, 4-6 true leaves (source leaves), the following parameters were recorded: chlorophylls, carotenoids, chlorophyll fluorescence, PAR and evapotranspiration. In addition, the analysis of some osmolytes such as malondialdehyde, proline, phenols, flavonoids and DPPH activity were performed on both roots and leaves. The results show that Upon stress, the chlorophyll fluorescence parameters of all landraces was severely affected, with the effects of stress being in general analogous to its level. At 100 mM D-Mannitol, “Bejeoui green” and “Galaoui” proved to be the most landraces affected representing a quantum ration (Fv/Fm) (0.85 and 0.75, respectively) out of range (0.79 and 0.82). Moreover, at 200 and 300 mM D-Mannitol, all landraces (Karkoubi orange, Bejaoui green, Galaoui and Batati orange) presented a quantum ration (Fv/Fm) out of range (0.79 and 0.82). The most sensitive accessions to this stress is ‘Bejaoui green’ and ‘Galaoui’ which, beyond 100mM, its germination is almost absent. This behavior was confirmed by a decrease of PAR for all landraces upon stress and by an increase of osmoprotectants on both roots and 177 leaves. The photosynthetically active radiation values ranged from 957.83 to 1790.84 μmol m- 2 s-1. The osmoprotectants in terms of MDA, free proline, total phenols, total flavonoids and DPPH, increased significantly by 23.27 %, 63.33 %, 16.13 %, 16.24 % and 19.69 %, respectively at 100 mM D-Mannitol compared to control treatment. Nevertheless, the application of 200 mM D-Mannitol, increased the contents of MDA, free proline, total phenols, total flavonoids and DPPH by 39.77 %, 86.66 %, 25.60 %, 26.02 % and 28.54 %, respectively in comparison to the corresponding control. Under highest level of D-Mannitol (300 mM), the increases were 41.18 %, 127.77 %, 31.77 %, 27.62 % and 32.27 %, respectively for MDA, free proline, total phenols, total flavonoids and DPPH compared with the respective control.

Keywords : Chlorophyll fluorescence, cucurbita sp, evapotranspiration, landrace, osmoprotectants, PAR, Water stress.