Abstract

According to NASA reports about atmospheric earth conditions, through the 30 years later, 45 countries will face severe droughts and Iran is in the fourth place in this list. Water shortage is one of the most important factors limiting production that affected on growth by changing physiological conditions. Shortage of water and its conjunction to high temperature degrees has made products fertility limited and basing on the fact that the main agriculture part of consumer is water, the knowledge of drought stress effects and choosing the cultivars, resistant to drought, seems important. Transfer of agricultural pattern to the plants compatible is a proper strategy to deal with the effects of water shortage on the status of water restrictions. This study was carried out in Research greenhouses, laboratory and field of Birjand University in 2014 and 2015. A factorial arrangement of treatments in completely randomized in laboratory and a randomized complete block design (Due to the lack of uniformity of light) in greenhouse and a split-plot arrangement of treatments in a randomized complete block design with four replications was used. The factors were drought stress with three levels including 100, 75 and 50 percent of plant water requirement (non-stress, moderate and severe stress respectively) and millet cultivar with three levels (including Bastan, promising lines KFM5 and KFM20). The main factor was drought stress and the sub-factor was millet cultivar in field. Relative water content, stomata conductance, electrolyte leakage, osmolyte regulator and photosynthesis pigments was measured 30and 45 days after drought stress. Antioxidant enzyme activity (including SOD, CAT and APX) and membrane peroxidation were measured 30 days after drought stress. Seed yield and its components and morphological traits were measured after plant maturity. Software SAS software (ver 9.1 windows edition) was used for statistical analysis and means were compared using tukey test. Results showed that drought stress reduced morphological traits (including plant height, internode length, leaf area, flag leaf area, panicle height and diameter, peduncle height) compared to control treatment but had no effect on the number of nodes per plant and stem diameter in all three cultivars. Relative water content (RWC) and stomata conductance was decreased as intensity and duration of drought stress increased in all three varieties. All three varieties had similar status in stomata conductance and leaf relative water content in 30 days after stress. Although among the varieties, Bastan had higher stomata conductance and was less affected under moderate and severe stress (50 and 33 percent respectively compared to control) in 45 days after stress but Bastan had an appropriate relative water content (0.43 and 0.41 respectively) and had not significantly different with other lines. Drought stress at different growth stages reduced photosynthesis pigment content (a, b, a/b and total chlorophyll) compared to control treatment but carotenoid showed different changes. Drought stress at different growth stages reduced quantum yield but was not significant. Membrane lipid peroxidation, permeability of membranes and electrolyte leakage increased and membrane stability was decreased as intensity and duration of drought increased in all three cultivars. The malondialdehyde content (MDA) was low in Bastan compared to other cultivars and the membrane lipid peroxidation was less affected by increasing drought stress indicating that the variety is of more potential to protect membrane integrity. Drought stress at 30 and 45 days after stress increased proline content and soluble carbohydrates. Antioxidant enzyme activity was increased as intensity of drought increased in all three cultivars. Among the varieties, Bastan had highest antioxidant enzyme activity. MDA low level in Bastan compared to other cultivars indicating that this variety is of more potential to scavenging of reactive oxygen spices and was less affected under moderate and severe stress. Drought stress also reduced number of ears panicle per square meter, number of grains per panicle, 1000 seed weight and seed yield compared to

control treatment but had no effect on the biomass. Highest and lowest seed yield was observed in control treatment (461.88 $g.m^{-2}$) and severe stress. The results showed that water use efficiency (WUE) for seed was significantly decreased as intensity of drought stress increased in all three varieties but not for yield biological. Stress had not a similar effect in different varieties.

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A study on some metabolites associated with drought tolerance and its effect on physiological and morphological indices in a cultivar and two promising lines of Millets

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