Physiological Changes in Mungbean [*Vigna radiata* (L.)Wilczek] Seedlings under Heat Stress

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Abstract—*High temperature stress causes multifarious, and often adverse, alterations in plant growth, development and yield. Several studies indicate that the tolerance to heat stress may be acquired by prior exposure to a conditioning pre-treatment, which can be a short but sub-lethal high temperature. The combination of high temperature and water deficit is quite common in dry and semi-dry regions across the world and claims extensive agricultural losses. The present experiment was conducted to study the effect of heat stress on growth and physiological parameters of seedlings of mungbean cultivar Pusa 031 along with the possibility of acclimation with sub-lethal temperature and to study the effect of combined stress of heat and drought stress. Artificial heat shock was applied by exposing the seedlings to 42°C for 4 hours and drought stress was applied by PEG-6000 (12% solution) in laboratory condition. The pre-treatment was applied by exposing the seedlings to 36°C for 2 hours before final exposure to extreme temperature of 42°C. The seedling growth decreased under all treatments in comparison with the control. But less reduction was recorded when the seedlings were exposed to extreme temperature after prior exposure to a sub-lethal temperature of 36°C. Of all the plant parts, the root was found to be the most sensitive to high temperature. The root and leaf of the seedlings showed very high content of proline under temperature treatments and recorded substantial increase over control. The pre-treatment with sub-lethal temperature effectively reduced the drastic dehydration effect of high temperature the direct exposure of the seedlings to 42°C caused maximum reduction in NR activity in root and leaf. Pre-treatment made the cell membrane ready for next exposure to lethal shock and hence recorded less change in electrolyte leakage and lipid peroxidation of root and leaf membrane. The pre-treatment also successfully triggered the antioxidative enzyme activity for detoxification of ROS generated under high temperature stress. The non-enzymatic antioxidant system involving phenolics exhibited contrasting response in root and leaf under heat stress. In the present experiment, the combined heat and drought stress caused more reduction of seedling growth than the individual stress. The root showed most sensitivity to stresses. Both the stress treatments applied individually or in combination caused an increase in root and leaf proline content over control. The activity of SOD enzyme in root and leaf revealed more sensitivity to combined stress than the individual tress. While, the activity of GPX showed less sensitivity to combined heat and drought stress. The application of stress either singly or in combination, triggered increase in phenol content over the control.*