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Induction of oxidative stress in mung bean (*Vigna radiata* L.) leaves in response to NaCl stress

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SUMMARY

Mung bean (*Vigna radiata* L.) seedlings were treated with various concentrations (0.5, 1, 2, and 3 mM) of NaCl for 24 hr resulted in oxidative damage occurs in the seedlings. Chlorophyll content was decreased while carotenoids content increased with the increase in the concentrations of NaCl. Proline accumulation was observed, at the same time degradation of total soluble protein also recorded. Total peroxide content increased with a simultaneous increase in lipid peroxidation in terms of malondialdehyde (MDA) with the increase in the concentrations of NaCl. An enzymatic antioxidative system, catalase (CAT) activity was suppressed whereas the activities of peroxidase (POX), superoxide dismutase (SOD), and glutathione reductase (GR) were increased. Non-enzymatic antioxidants, such as ascorbate and glutathione showed higher concentration with the increase in the concentrations of NaCl. The objective of the present study was to investigate the NaCl-induced oxidative damage occur in mung bean leaves correlated to lipid peroxidation.

Key words : Antioxidative systems, Lipid peroxidation, Mung bean, NaCl-salinity.

Oxidative stress occur in plant cells due to imbalance between production and elimination of variety of reactive oxygen species (ROS) like superoxide radical (O_2^-), hydrogen peroxide (H_2O_2) molecule, hydroxyl radical (OH^-), alkoxy radical (RO^-), etc (Halliwell and Gutteridge, 2000). These ROS have the ability to degrade all the macromolecules such as pigments, proteins, lipids and nucleic acids finally its leads to cell death. Plant cells are well equipped with both enzymatic (catalase (CAT), peroxidase (POX), superoxide dismutase (SOD), and glutathione reductase (GR)) and non-enzymatic (ascorbate, glutathione, carotenoids, and α-tocopherol) antioxidative systems which protect plant cells from toxic ROS (Mishra *et al*., 1997). Plants are exposed to a series of biotic and abiotic stresses, of which salt stress is one of abiotic stress which is known to affect the plant growth by low water potentials, ion imbalance, and ion-toxicity (Greenway and Munns, 1980) and cause several biochemical and molecular lesions including oxidative stress (Ashraf and Harris, 2004). As very little is known about the salt stress-induced oxidative damage in legumes, so the present study was interested to investigate the NaCl-induced oxidative damage occurs in mung bean seedlings.

MATERIALS AND METHODS

Plant material and growth conditions:

Uniform mung bean (*Vigna radiata* L. obtained from TNAU, Coimbatore, India) seeds were germinated aseptically after surface sterilization with 70% ethanol, followed by a treatment with 0.1% $HgCl_2$ solution for 5 min each. Subsequently, seeds were thoroughly washed 5 times in sterile double distilled water, and germinated in Petridishes in the darkness containing Whatman No. 1 filter paper moistened with Hoagland nutrient solution (Hoagland and Arnon, 1950). After 48 hr of germination, seedlings were transferred to plastic glasses containing Hoagland nutrient solution at pH 5.8 and kept in growth chamber. The growth chamber was maintained at 25 ± 1°C with 16hrL/8hrD and 150 µmol $s^{-1}m^{-2}$ light intensity. Relative humidity was 35% during day time and 60% at night. Various concentrations (0.5, 1, 2, and 3 mM) of NaCl were supplemented along with the Hoagland nutrient solution. Seedlings with water-treatment served as the control of this experiment.

Estimation of contents of chlorophyll, carotenoids, and Na^+ and K^+ ions:

Estimation of chlorophyll and carotenoids were carried out by following the methods of Arnon (1949) and Mackinney (1941), respectively. One hundred mg of leaves were homogenized with mortar and pestle in 15 ml of 80% acetone and homogenate was centrifuged at 3,000 rpm for 15 min. Absorbance of the supernatant was measured at 645, 663, and 470 nm, and the contents were

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