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Short Communication

ANTIOXIDATIVE RESPONSE OF *GLYCINE MAX* UNDER SALT STRESS

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Abstract Soil salinity is a prevalent abiotic stress that limits the productivity and geographical distribution of plants. Plants have generated adaptation strategies to prevent oxidative damage caused by salinity. In this study we evaluated the effect of salinity on peroxidation and antioxidant enzymes in leaves of Soybean (*Glycine max* (L) *Merill*). Plants of 30 days and 50 days old were subjected for to saline solutions (50mM, 100mM and 200mM NaCl) while the fourth one (irrigated with distilled water *i.e.*0mM NaCl) was used as control. Salinity caused a significant increase in amount of ascorbic acid and peroxidase. The activity of superoxide dismutase (SOD) was also significantly greater in all treatments.

Key words: Salt stress, *Glysine max,* Peroxidase, ascorbic acid, SOD.

Introduction

Excess salts in the soil adversely affect the crop growth and yield (Strognov, 1974). However, the magnitude of the salinity effect varies with the plant species, types and the levels of salinity (Bishnoi *et al*., 1987). Salinity causes a decrease in the growth of cultivated plants, since salts affect a number of physiological processes such as photosynthesis, stomatal conductance, osmotic adjustment, ion absorption, protein and nucleic acid synthesis, enzymatic activity, and hormone balance (Hernandez *et al*., 2000). It also affects transport of ions and water, which promotes ionic toxicity and nutritional imbalance (Munns and Tester, 2008). The effects of salinity also have an oxidative component derived from the limitation of the photosynthetic rate which occurs in conditions of drought and salinity (Lawlor, 1995; Filella *et al*., 1995; Munns, 2002).

Materials and Methods

For study, a locally grown cultivar of Soybean (*Glycine max cv.* Punjab-1) was selected. Plants were exposed to salinity from 5th day onwards. For salinity treatment plants were divided into four sets. Out of four, three sets were exposed to three different concentrations of saline solutions (50mM, 100mM and 200mM NaCl) while the fourth one (irrigated with distilled water *i.e.*0mM NaCl) was used as control. The plants were given the treatment of NaCl solutions per day. The observations for various attributes were recorded in 30days and 50 days old plants. Ascorbic acid was determined with help of titration method (Sadasivam and Manickam, 1992). Leaves (0.2-0.5 g of raw weight) were be grinded with liquid nitrogen in porcelain vessel with 0.1 M Sodium-phosphate buffer pH 7.0. After centrifugation at 7000 g for 10 minutes supernatant will be used for determination of the activity of soluble peroxidase (PO). PO activity will be determined by the initial speed of O-dianizidine oxidation (l =460 nm e =30 $mM^{-1}cm^{-1}$) by hydrogen peroxide in 0.1 M sodium-phosphate buffer at pH 7.0 /3/. The amount of O-dianizidine (mcmol) oxidized in 1 minute per root per 1 g of raw substance per 1 mg of protein will be taken as a unit of PO activity. SOD activity was determined by measuring inhibition of the photochemical reduction of nitroblue tetrazolium (NBT) using the method of Beauchamp and Fridovich (1971). All the data on growth yield and biochemical parameters were statistically analyzed applying t-test so as to observe whether the difference under the study were significant or non-significant.

Results and Discussion

In comparison to control, the ascorbic acid content was significantly increased in all treated plants. Higher increase was observed in 200mM NaCl treated plants. For example, in 30-days old plants, increase in plant height were 9, 24 and 27 percent in 50mM, 100mM and 200mM NaCl treated plants respectively in comparison to control and in 50d old plants, these increase were 5, 125 and 187 percent (Table 1).

In comparison to control, the peroxidase was significantly increased in all treated plants. Higher

Table:1 Effect of NaCl on leaf Ascorbic acid, Peroxidase and Superoxide dismutase of *Glycine max* L. cv. Punjab1

Attribute	30 days old plant				50 days old plant			
	Concentrations of NaCl				Concentrations of NaCl			
	0mM	50 mM	100 mM	200 mM	0 mM	50 mM	100 mM	200 mM
Ascorbic acid (mg g^{-1} f. wt.)	0.255± 0.024	0.278± 0.023	0.317± 0.035	0.324± 0.023	0.223± 0.070	0.236± 0.017	0.503± 0.048	0.641± 0.048
Peroxidase [units g^{-1} (fresh mass)]	12.8±0.66	15.3±0.20	18.3±0.81	20.9±0.70	13.9±0.68	16.0±0.50	19.3±0.86	21.8±0.64
Superoxide dismutase [units g^{-1} (fresh mass)]	115±0.49	153±1.21	128±0.61	141±1.74	117±0.56	163±1.25	134±0.66	152±1.76

Values are in mean ± SD; Significance of difference from control

increase was observed in 200mM NaCl treated plants. For example, in 30-days old plants, increase in peroxidase content were 19, 42 and 63 percent in 50mM, 100mM and 200mM NaCl treated plants respectively in comparison to control and in 50d old plants, these increase were 15, 38 and 56 percent (Table 1).

In comparison to control, the superoxide dimutase was significantly increased in all treated plants. Higher increase was observed in 50mM NaCl treated plants. For example, in 30-days old plants, increase in plant height were 33, 11 and 22 percent in 50mM, 100mM and 200mM NaCl treated plants respectively in comparison to control and in 50days old plants, these increase were 39, 14 and 29 percent (Table 1).

The experimental studies showed that there is increase in ascorbic acid content, peroxidase and superoxide dismutase activity. These biochemicals are well known antioxidants. There is increase in reactive oxygen species (ROS) during stress which cause aging in plants and interfere with many metabolic activities of plant which cause reduction in growth and yield. Therefore, salt stress can provoke several metabolic alterations in plants such as the peroxidation of lipids, and anti-oxidative enzyme activity (Monteiro *et al*. 2011), to counter the stress effect in plants.

Conclusions

Form above study, it is clear that plant overproduce many biochemicals like ascorbic acid, peroxidase, SOD, etc under salt stress condition in *Glysine max*. These biochemicals, react with ROS and neutralize them. These biochemicals are called antioxidants. Due to different type of stress crop production decreases. From this study it may be suggested that the external application of ascorbic acid and other antioxidants like sodium benzoate may ameliorate the effect of stress.

References

Beauchamp C, Fridovich I. 1971. Superoxide dismutase: improved assays and an assay applicaple to acrylamide gels. *Analytical Biochemistry* 44: 151-155.

Bishonoi NR, Siddiqui S and Kumar S. 1987. Effect of salinity salinization and desalinization on the various aspects of dry matter production at vegetation satage in pea and gram. *Front Bot*.1:1-11.

Filella I, Serrano L, Serra J and Penuelas J. 1995. Evaluating wheat nitrogen status with canopy reflectance indices and discriminant analysis. *Crop Science* 35:1400-1405.

Hernandez JA, Jimenez A, Mullineaux P, and Sevilla F. 2000. Tolerance of pea (*Pisum sativum* L.) to long term salt stress is associated with induction of antioxidant defenses. *Plant Cell Environmental* 23:853-862.

Lawlor DW. 1995. The effects of water deficit on photosynthesis. p. 129-160. In N. Smirnoff (ed.) Environment and plant metabolism. Bios Scientific Publishers, Oxford, UK.

Monteiro CC, Carvalho RF, Gratao PL, Carvalho G, Tezotto T, Médici LO, et al.2011. Biochemical responses of the ethylene-insensitive *never ripe* tomato mutant subjected to cadmium and sodium stresses. *Environ. Exp. Bot*. 71: 306-320.

Munns R. 2002. Comparative physiology of salt and water stress. Plant, Cell and Environment 25:239-250.

Munns R and Tester M. 2008. Mechanisms of salinity tolerant. *Annual Review of Plant Biology* 59:651-681.

Sadasivam S and Manickam A. 1992. Phenalics: In biochemical methods for agricultural sciences. Wiley Eastern Limited, New Delhi, India pp. 187-189.

Strognov BP. 1974. Structure and function of plant cells in saline abitats. Wiley Publication London pp.284.