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# Effect of sodium chloride on the seedlings of *Cressa cretica* L.

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**Abstract**
*Cressa cretica*
Salinity
NaCl

**Abstract**
The effect of different concentrations of sodium chloride on growth and organic components of *Cressa cretica*, has been made. *Cressa cretica*, could survive a wide range of NaCl (0-400 mM) salinity. The upper limit for the survival of seedlings to NaCl salinity was 400 mM. However, optimal growth responses by the seedlings were confirmed to 200 mM NaCl. There was depressed growth in the absence of salt and at extreme salinity. Under NaCl salinity accumulation of ions and organic components such as starch and protein increased with increasing salt concentrations upto optimal level and decreased at higher concentration. On the otherhand, free amino acid and total sugar decreased with increasing concentrations of NaCl upto optimal level and increased at higher concentration. The proline content increased with increasing concentration upto the extreme level of NaCl salinity.

## 1. Introduction

Salinity is one of the major environmental stresses that can limit the growth and development of salt sensitive plants. Halophytes survive salt concentration equal to or greater than that of seawater and posses physiological mechanism that maintains a lower water potential than in the soil (Ungar, 1991). Halophytic environments though dominated by NaCl contain a variety of other salts $Na_2So_4$, $CaSO_4$, $MgCl_2$, KCl and $Na_2CO_3$. A variety of mechanism contributes to the salt tolerance of halophytes. Adaptation of halophytes to the saline environments includes high tolerance for the negative effect of salinity as well as positive reaction towards it. It is suggested that compartmentation of ions in vacuoles and accumulation of compatible solute in the cytoplasm, as well as presence of genes for salt tolerance, confer salt resistance to halophytes (Gorham, 1995).

## 2. Materials and Methods

The uniform sized one month old seedling were collected from the mangrove belt of Pitchavaram. The seedlings were washed thoroughly with tap water and they were planted in the polythene bags. Polythene bags (9" × 7") were filled with homogenous mixture of red earth, sand and farmyard manure in the ratio (1:2:1). The uniform sized seedlings were selected and kept it for 5 plots and they treated with various concentration of NaCl ranging from 0 to 400 mM. The treatment was continued until the plants received the required millimolar concentration of NaCl. After completion of saline treatment the plants allowed it for freshwater. The samples were collected at 60$^{th}$ day after salt treatment the plants allowed it for freshwater. The following methods were used a) Estimation of amino acids (Moore and Stein, 1948), b) Total sugar (Nelson, 1944), c) protein (Lowry *et al.,* 1951), d) starch (Summner and Somers, 1949) and e) proline (Bates *et al*., 1973).

## 3. Results and Discussion

NaCl treatment enhanced the shoot and root length and fresh and dry weight had increased with increasing concentration upto 200 mM NaCl. Beyond these concentration the growth parameters gradually reduced (Table 1). Similar observation have been observed in certain other halophytes such as *Chenopodium quinoa* (Prado *et al*., 2000*), Kandelia candel* (Hwang and Chen, 2001) *Aegiceras corniculatum* (Manikandan and Venkatesan, 2004) and *Arthrochnemum indicum* (Nagarajan *et al*., 2008). The starch and protein content increases with increasing salinity upto 200 mM and decreases with higher salinity. On the other hand, the amino acid and sugar content decreases with increasing salinity upto optimal level. Beyond this level, it gradually increases(Table 1). Rao and Rao (1981) have report that certain halophytes under moderate salinity accumulate free amino acids and it is believed to be in response to change in the osmotic adjustment of cellular content and the increase in the amino acids at higher salinity level may be due to degradation of protein. An increasing sugar content and corresponding decrease in the starch at higher salinity have been reported in several halophytes (Prado *et al*., 2000). The proline content increase with increasing salinity upto 400 mM NaCl. Similar observation has been made in *Ipomoea pescaprae*, which shows an increasing proline content upto the extreme level of 500 mM NaCl (Venkatesan and Chellappan, 1998). Plants accumulate proline and other soluble nitrogenous compounds under salinity stress in order to maintain the osmoregulation (Abbas e*t al.,* 1991). So it is concluded that this species could be recommended for cultivation of salt affected soils to reduce the soil salinity level and the reclamated soil can be utilized for cultivation of crop species.

Table 1. Effect of sodium chloride on growth and organic constituents of *Cressa cretica* on 60th day after treatment

| Concentration of NaCl (mM) | Growth parameters | | | | Organic constituents (mg g $^{-1}$ fr.wt.) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Shoot length (cm/plant) | Root length (cm/plant) | Fresh weight (g/plant) | Dry weight (g/plant) | Aminoacid | Sugar | Starch | Protein | Proline |
| 0 (control) | 8.5 | 10.2 | 3.10 | 0.89 | 14.22 | 8.44 | 5.32 | 4.32 | 2.02 |
| 100 | 9.1 (+7.05) | 12.9 (+26.47) | 3.23 (+4.19) | 1.03 (+15.73) | 12.33 (-14.69) | 7.11 (-15.75) | 5.65 (+6.20) | 4.75 (+9.95) | 2.08 (+2.97) |
| 200 | 11.2 (+34.76) | 15.6 (+52.94) | 3.68 (+25.16) | 1.21 (+35.95) | 10.25 (-27.91) | 6.82 (-19.19) | 5.86 (+10.15) | 5.23 (+21.06) | 2.16 (+6.93) |
| 300 | 10.6 (+24.70) | 13.2 (+29.41) | 3.42 (+10.32) | 1.10 (+23.59) | 11.72 (-17.58) | 7.26 (-13.98) | 5.27 (+0.93) | 5.01 (+15.97) | 2.25 (+11.38) |
| 400 | 8.2 (-3.52) | 9.7 (-4.90) | 3.04 (-1.93) | 0.62 (-30.33) | 12.31 (-13.43) | 7.79 (-7.70) | 4.82 (-9.39) | 4.26 (-1.38) | 2.55 (+26.23) |

(+,-) percentage increase or decrease over control are in parentheses

## References


Abbas, M.E. Younis and W.M. Shukry, 1991. Plant growth, metabolism and adaption in relation to stress condition. XIV. Effect of salinity on the internal solute concentrations in *Phaseolus vulgaris*. *J. Plant Physiol.*, **138**: 722-727.

Bates, L. S., R. P. Waldren and I. D. Teare, 1973. Rapid determination of the free proline in water stress studies. *Plant and Soil*, **38**: 205-208.

Gorham, J. 1995. Mechanism of salt tolerance of halophytes. In: Halophytes and biosaline agriculture. CR Choukr Allah, C.V. Malcom and A. Hmaby, (Eds.), pp. 207-223.

Hwang, Y.H. and S.C. Chen, 2001. Effects of ammonium phosphate and salinity on growth gas exchange characteristics and ionic contents of seedlings of mangrove *Kandelia candel* (L.) Druce. *Bot. Bull. Acad. Sci.*, **42**: 131-139.

Lowry, O.H., N.J. Rosenbrough, A.L. Farr and R.J. Randall, 1951. Protein measurement with the Folin-phenol reagent. *J. Biol. Chem.*, **193**: 265-275.

Manikandan, T. and A. Venkatesan, 2004. Influence of NaCl on growth, organic constituents and certain antioxidant enzymes of *Aegeceras corniculatum* Blanco. *Geobios*, **31**: 30-33.

Moore, S. and W.H. Stein, 1948. Photometric method for use in the chromatography of aminoacid. *J.Biol. Chem.*, **176**: 357-388.

Nagarajan, D, S.Sivasankaramoothy and A.Venkatesan 2008. Salinity tolerance of growth and organic content of *Arthrocnemum indicum* Moq. *Plant Archives* Vol. 8. No.1. pp.245-248.

Nelson, N., 1944. A. photometric adaptation of the Somogyi' s methods for the determination of reducing sugar. *Anal. Chem.*, **31**: 426-428.

Prado, F. E., C. Bocern, M. Gallardo and J.A. Gonzalez, 2000. Effect of NaCl on germination growth and soluble sugar content in Chenopodium quinow Willd. Seeds. *Bot. Acad. Sin.*, **41:** 27-34.

Rao, G. G and G. R Rao, 1981. Pigment composition and chlorophyllase activity in pigeon pea (*Cajanus indicus* Spreng) and gingelly (*Sesamum indicum* L.) under NaCl salinity. *Indian J. Exp. Biol.*, **19**: 768-770.

Summner, J.B. and C. F. Somers, 1949. Laboratory Experiment in Biological Chemistry, 2nd Ed., Academic Press, New York, p.173.

Ungar, I. A., 1991. Ecophysiology of vascular halophytes. CRC Press, Boca Raton, IL.

Venkatesan, A. and K.P. Chellappan, 1998. Accumulation of proline and glycinebetaine in Ipomoea pes-caprae induced by NaCl. *Biologia Plantarum*.**41**(2):271-276.