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RESEARCH ARTICLE

FRESH WEIGHT CHANGES EFFECT OF HALOPHYTE *Bruguiera cylindrica* ON NaCl

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ABSTRACT

The plants that can be naturally established in saline soil is termed the halophytes. Halophytes shape the environments they live in, changing the surface of the earth in the process. The seedlings of *Bruguiera cylindrica* were selected during September month for the present study and they were collected from mangrove forest in Pichavaram, Tamilnadu. This was growing in the tidal forest mangrove belt. These seedlings were washed and planted in polytene bags separately. Before this bags were filled with Sand, Humus and Red sand in 1:2:1 ratio. Various concentrations of Sodium Chloride solution (100,200,300,400,500,600 and 700mM) were prepared using distilled water. Plants treated with distilled water were maintained separately. Plants were separated into groups and irrigated with various concentration treatment separately. After the completion of salt treatment, the seedlings were collected periodically at one month intervals upto four months and utilised for the study of fresh weight. From the results the fresh weight increased in 100mM than control. While the concentration increased from 200mM and 300mM fresh weight also increased. The maximum fresh weight of seedlings of *Bruguiera cylindrica* were observed in 400mM concentration treatment. While the concentration increase upto 400mM the fresh weight of seedlings were decreased in 500mM, 600mM and very low fresh weight were observed in 700mM treated seedlings of *Bruguiera cylindrica*. Seedlings of halophytes are known to tolerate high salinity during their presence in the soil and germinate when soil salinity are reduced.

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INTRODUCTION

Mangroves form unique communities in tropical region and tidal low lands. They are considered as an ecologically essential component. The total mangrove area along the Indian coast has been estimated to be about 3.5 lakhs has occupied by halophytes. Tamilnadu state alone, about 15,000 ha of coastal land is occupied by mangroves of this Pichavaram, which is about 10 km East of the Annamalai University consists of 1,100 ha of mangrove vegetation, with a large number of salt marsh halophytic herbs and twenty principle species. It consists of heterogenous group of plants which are mostly restricted in their distribution due to the tidal zone. Halophytes have evolved characteristics to adjust to the stress conditions in their native habitats by means of a number of adaptive responses at the germination stage of development. Certain halophyte species can be used as animal fodder, an advantage in some communities. Halophytes offer a possibility of using them as alternative crop, an understanding of their physiology of salt tolerance is essential. The name halophyte was suggested by Pallas (Schrader, 1809) to a group of plants growing in the saline environment. Halophytes have evolved characteristically to adjust to the stress conditions in the native habitats by means of a number of different adaptive responses at the germination stage of development (Waise, 1991). A variety of mechanism contributes to the salt tolerance of halophytes. Salt tolerance in halophytes is brought about by a variety of structural, biochemical and physiological adaptations. *Salicornia begelovii* grows optimally in broad range of Na+ concentrations between 100 to 400mM NaCl (Ayala and O'Leary, 1995). Dry mass halophytes decrease with increasing salinity (Ungar, 1991). High NaCl concentration is probably not essential for optimal growth of most halophytes. The growth decreased in high salinities at *Atriplex grosifolia* (Mohmood *et al*., 1987). In the present investigation, effect of different concentrations of NaCl on the commonly occurring halophyte in the Pichavaram mangrove area *Bruguiera cylindrica*, with regard to its fresh weight changes was studied. The upper limit of the salt for the

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survival of the seedlings of *Bruguiera cylindrica* and the optimal level of salinity for its favourable growth and development were also assessed for their utility in cultivation of the species in salt – prone barren coastal environment.

MATERIALS AND METHODS

The plant material used for the present study was the seedlings of *Bruguiera cylindrica* is a halophyte plant belonging to the family Rhizophoraceae has been collected from the mangrove forest is located in Tamilnadu. Pichavaram mangrove forest is located in the southeast coast of india, at about 225 Km south of Chennai and 5 Km north east of Chidambaram, Cuddalore district, Tamilnadu.One month old uniform sized seedlings of *Bruguiera cylindrica* were collected and washed throughly with tap water. Polytene sleeves were filled with Red earth, Sand and Form yard manure in the ratio of 1:2:1.Undamaged seedlings were selected and planted in polythene sleeves. Seedlings were irrigated with tap water and allowed established well for a month. Different millimolar concentrations of Sodium Chloride solution (100,200,300, 400,500,600 and 700mM) were prepared in distilled water. Control were maintained as distilled water separately. After the completion of salt treatment, the seedlings were irrigated with tap water. Samples were collected periodically at monthly intervals for fresh weight analysis. For the estimation of fresh weight, shoot and root portions were separated and weighted. To estimate the fresh weight ,the shoot and root portions were weighted by using electronic balancer.

RESULTS

Observations on the fresh weight of *Bruguiera cylindrica* on various concentrations of NaCl were recorded in the Table. The maximum increase in fresh weight was observed on 400 mM NaCl treatment. In the optimum concentration becomes decrease gradually upto 700mM. Fresh weight of the seedlings were decreased with increasing salinity for halophyte *Bruguiera cylindrica*.

The fresh weight loss was proportional to the concentration of the NaCl. In the 30th day fresh weight of stem indicates increased value (±0.420) in 400mM concentration than control (± 0.311). Similar increased values (± 0.17) of root also shows higher than control value (± 0.11). After sixty days treatment of 400mM concentration increases in stem (± 0.525) and root values (± 0.206) than control values (± 0.364) and ± 0.164) respectively. After 120th day treatment control values of stem and root in 400mM shows higher ±0.672 and ±0.302 respectively, When compared with control ± 0.512 and ±0.211 regardingly. Upto 400mM concentration this increased values becomes decreased gradually. In the treatment of 700mM concentration very low fresh weight value (±0.264) in stem and (±0.141) in root during 30th day treatment. This very low fresh weight continues in stem (±0.355) and root (±0.301) after 60th day treatment. Similarly (±0.301) and (±0.161) in treated stem and root seedlings of *Bruguiera cylindrica* respectively after 90th days treatment. Concentration of 700mM shows decreased values of fresh weight in both stem (±0.511) and root (±0.200) in 120th days observations of *Bruguiera cylindrica* seedlings than control. Present investigation supports the other researchers.

DISCUSSION

Naturally occurring salinity problems are caused by excessive levels of Sodium salt especially Nacl. Halophytes survive high concentration of electrolytes in their environment. A productive approach to the salinity tolerance of plants is to study the mechanism by which naturally occurring halophytic flora survive. Such knowledge seems fundamental to way attempt to develop further crops combining both adequate tolerance and yield characteristics. From the results on various concentrations of NaCl solution treatment on seedlings, fresh weight of *Bruguiera cylindrica* observations revealed that both positive and negative effects are obtained on these *Bruguiera cylindrica* halophytic plant. The *Bruguiera cylindrica* seedlings shoot and root fresh weight increasing from 100mM upto 400mM concentrations of NaCl solution treatment. From

Table 1. Effect of NaCl on Fresh Weight (g plant-^{l}) of the Shoot and Root of *Bruguiera cylindrica* at 30,60,90 and 120 Days of Treatment

NaCl(mM)	Fresh weight of shoot (days after treatment)				Fresh weight of root (days after treatment)			
	30	60	90	120	30	60	90	120
0(control)	6.228 ±0.311	7.281 ±0.364	8.222 ±0.411	10.255 ±0.512	2.258 ±0.113	3.288 ±0.164	3.928 ±0.196	4.220 ±0.211
100	6.359 ±0.317 (2.10)	7.925 ±0.396 (1.85)	9.128 ±0.456 (11.01)	11.215 ±0.560 (9.36)	2.328 ±0.116 (3.10)	3.345 ±0.167 (1.73)	4.210 ±0.211 (7.17)	4.888 ±0.244 (15.82)
200	6.905 ±0.345 (10.87)	8.210 ±0.410 (5.51)	10.518 ±0.525 (27.92)	11.922 ±0.596 (16.25)	4.525 ±0.126 (11.82)	3.724 ±0.186 (13.26)	4.925 ±0.246 (25.38)	5.125 ±0.256 (21.44)
300	7.288 ±0.364 (17.01)	9.155 ±0.457 (17.65)	11.210 ±0.560 (32.34)	12.152 ±0.607 (18.498)	3.150 ±0.158 (39.50)	3.910 ±0.196 (18.91)	5.125 ±0.256 (30.47)	5.855 ±0.273 (29.26)
400	8.510 ±0.425 (36.64)	10.516 ±0.525 (35.14)	12.615 ±0.630 (53.42)	13.450 ±0.672 (31.15)	3.525 ±0.176 (56.11)	4.125 ±0.206 (25.45)	5.912 ±0.296 (50.50)	6.055 ±0.302 (43.48)
500	7.920 ±0.396 (27.16)	9.215 ±0.460 (18.42)	11.121 ±0.556 (32.25)	12.650 ±0.632 (23.35)	3.218 ±0.161 (42.51)	3.888 ±0.194 (18.24)	4.505 ±0.225 (14.68)	4.916 ±0.246 (16.49)
600	6.158 ±0.370 (-1.12)	8.050 ±0.050 (3.45)	10.550 ±0.527 (28.31)	11.220 ±0.561 (9.41)	3.001 ±0.150 (32.90)	3.505 ±0.175 (6.59)	3.810 ±0.191 (-3.00)	4.210 ±0.211 (-10.23)
700	5.280 ±0.264(-15.22)	7.165 ±0.358 (-7.91)	9.258 ±0.301 (-13.25)	10.228 ±0.511 (-0.26)	2.810 ±0.141 (24.44)	3.125 ±0.156 (-4.95)	3.210 ±0.161 (18.27)	4.210 ±0.211 (-5.07)

the results fresh weight of *Bruguiera cylindrica* seedlings was maintained upto 400mM NaCl concentration. Increasing NaCl concentration, increases the fresh weight of shoot and root seedlings of *Bruguiera cylindrica* upto 400mM. The growth of several halophytes stimulates at some levels of salinity. The treatment increase could be largely attributed to cell enlargement by water absorption (Ayala and O'Leary, 1995). Some of the findings supports the present studies. Hwang *et al*. (2001) who reported that low NaCl concentrations stimulate the growth of some halophytic species, but an excess of salt decreases growth and biomass production. The accumulation of salt may have positive functions. The optimum growth for seedlings observed in 400mM,while decreasing the shoot and root fresh weight above this optimum level of increasing concentrations 500mM,600mM and 700mM of NaCl solutions. High NaCl concentration is probably not essential for optimal growth of most halophytes. Reduced fresh weight was observed in 700mM of Nacl concentration. Dry mass halophytes usually decrease with increasing salinity (Ungar, 1991). Our results indicated that sodium and chloride concentration in shoot and root fresh weight increased with salinity. Fresh weight of *Bruguiera cylindrica* seedlings increase as peak at 400mM NaCl. Further concentrations (500,600 and 700mM) NaCl treatment caused the reduction in fresh weight of seedlings. Total fresh weight after 120^{th} day salinity treatment was also greatest in the 400mM NaCl treatment. The fresh weight increasing was proportional to increasing concentrations of NaCl solution upto optimum level concentration. Above the optimal level the decreasing fresh weight was proportion to increasing NaCl solution concentration. Lower concentrations of NaCl shows positively effect on fresh weight values and higher concentration of NaCl shows negatively effect on fresh weight.

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