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*Short Communication*

# Responses of Exotic and Indigenous Halophytes under Simulated Salinity Stress*

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Seed germination is one of the basic aspects of eco-physiological studies. It consists of various steps, such as imbibitions of water, hydration of tissue, increased enzymatic activity, initiation of cell division and cell enlargement, reducing sugar content and embryo emergence [1]. It is an endogenous process, affected by several environmental factors, particularly in arid regions where seed has to face several environmental constraints like salinity. Salinity decreases and delays germination of most of the crops. However, lower levels of salinity delays germination [2] while, higher levels in addition reduce the final percentage of germination [3] because of accumulation of cations ($Na^+$, $K^+$, $Ca^{++}$ and $Mg^{++}$) in seeds. Generally halophytes show reduction in germination when subjected to salinities above 1% NaCl. In Indian desert, salinity or alkalinity and water stress are the most important factors responsible for limiting seed germination and plant growth. The distribution of halophytes in a saline environment is in some way may be correlated with their germination potential because the degree of salt tolerance varies for each species, which in turn is influenced by osmotic effects of ions or specific ion toxicity or because of combined influence of both these factors [4]. Therefore the present investigation was conducted to study the germination and growth responses of exotic and indigenous halophytes to salinity.

*Atriplex nummularia* (exotic species) and *Suaeda nudiflora* (indigenous species) were tested with five salinity levels i.e. 0.0, 0.5, 1.5, 2.5, 3.5 and 4.5 % with corresponding electrical conductivity (EC) of 0.9, 10.6, 22.0, 31.5, 47.4 and 64.5 $dSm^{-1}$, respectively.

Various salinity levels were prepared by supplementing half strength one litre modified Hoagland's nutrient solution with 0.0, 0.5, 1.5, 2.5, 3.5 and 4.5g salt mixture of NaCl and $CaCl_2$ in the ratio of 20:1 (w/w), respectively. Solution without NaCl + $CaCl_2$ salts was considered as control. Uniform sized seeds of both the species were surface sterilized with 0.2 % $HgCl_2$ and 50 seeds of each species were placed on sterilized germination papers in Petri plates under different simulated salinity solutions in triplicate and allowed to germinate at room temperature (25±2°C). The solutions were added to the plates uniformly as and when required. The observations were recorded on 10th day after sowing. Completely randomized design (CRD) was used for statistical analysis of the data.

Number of seeds germinated was counted at final count for each treatment and germination percentage was calculated. It decreased significantly (except at 0.5% level) with increasing levels of simulated salinity stress in both halophytes (Table 1). There was net reduction of 20% over control in germination (54.17% control, 34.33% salinity) with salinity of 3.5 % in *A. nummularia* while it was 21.3% over control (84.81% control, 63.58% salinity) in *S. nudiflora* at the same level of salinity. However, maximum reduction was at 4.5 % level of salinity (25.5% in

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**Table 1. Effect of various levels of external salinity on seed germination and seedling growth of *Atriplex nummularia* and *Suaeda nudiflora***

| Species | Salinity level (%) | Germination percentage | Seedling length (cm) | |
|---|---|---|---|---|
| | | | Shoot | Root |
| *Atriplex nummularia* | 0.0 | 51.17 (47.41) | 1.18 | 0.79 |
| | 0.5 | 51.36 (45.80) | 1.07 | 0.74 |
| | 1.5 | 47.55 (43.57) | 0.91 | 0.61 |
| | 2.5 | 45.00 (42.13) | 0.76 | 0.52 |
| | 3.5 | 34.33 (35.85) | 0.67 | 0.39 |
| | 4.5 | 28.69 (32.39) | 0.61 | 0.31 |
| *Suaeda nudiflora* | 0.0 | 84.81 (67.05) | 2.19 | 1.15 |
| | 0.5 | 82.86 (65.57) | 2.07 | 1.10 |
| | 1.5 | 79.25 (62.87) | 1.86 | 0.96 |
| | 2.5 | 75.91 (60.60) | 1.73 | 0.85 |
| | 3.5 | 63.58 (52.89) | 1.61 | 0.68 |
| | 4.5 | 58.44 (49.84) | 1.54 | 0.59 |
| SEm± | | 1.03 | 0.03 | 0.006 |
| CD (P = 0.05) | | 3.03 | 0.09 | 0.04 |

Arcsine values in parenthesis

*A. nummularia* and 26.4% in *S. nudiflora*). Thus adverse effect of ions or specific ion toxicity drastically reduced germination percentage. This is in agreement with some earlier findings in some halophytes such as in *Atriplex orgentian* [4], in *Haloxylon salicornicum* [5], in some desert halophytes [6] and in *Acacia* seeds [7].

Decrease in shoot length ranged from 1.18 – 0.61cm in *A. nummularia* and from 2.19 – 1.54cm in *S. nudiflora* (Table 1). Although the decrease in shoot length was significant at the initial level of salinity (0.5%) in both the species but it was highly significant among all the successive salinity levels and more pronounced in *A. nummularia*. Net reduction of 35.6% in shoot length over control (1.18 cm control, 0.76 cm salinity) in *A. nummularia* and 21% (2.19cm control, 1.73cm salinity) in *S. nudiflora* observed with the salinity of 2.5%. However, maximum decrease over control was (48.3 % in *A. nummularia* and 29.68% in *S. nudiflora*) at 4.5% salinity level.

Similar trend was also observed in root length in both the species (Table 1). Decrease in root length was comparatively more at higher levels of salinity. The most pronounced decrease over control (60.76% in *A. nummularia* and 48.70% in *S. nudiflora*) was at 4.5% salinity. Moreover, net reduction of 50.63% in root length over control (0.79 cm control, 0.39 cm salinity) in *A. nummularia* and 40.87% (1.15 cm control, 0.68cm salinity) in *S. nudiflora* was at the salinity of 3.5%. Decrease in root length ranged from 0.79 to 0.31cm in *A. nummularia* and 1.15 to 0.59 cm in *S. nudiflora*.

Decrease in these parameters might be due to low water uptake (physiological drought conditions), reduction in enzymatic activities responsible for cell division and elongation (ionic toxicity) and lower sugar availability because of the more use of sugars in germination process under adverse conditions of salinity stress. These inferences are paralleled to the reports [8] in *Suaeda fruticosa*, [9] in *Salicornia bigelovii* and [10] in *Salvadora persica*. Thus *S. nudiflora* performed better than *A. nummularia* at all the salinity levels. Comparatively higher germination percentage and less decrease in seedling length of the indigenous halophyte at all the salinity levels prove that it is relatively salinity tolerant at germination and early seedling growth stage.

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