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Effect of Salinity Stress on Germination of *Matricaria comomilla* and *Thymus deanensis*

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Abstract

Salinity is one of the environmental factors that have a critical influence on the germination of seeds and plant establishment. Salinity affects imbibition, germination and root elongation. In this study, the germination characteristics of *Matricaria comomilla* and *Thymus deanensis* were studied. The purpose of this study was to investigate the effect of salinity on germination of these species. Seeds were treated with 0, 100, 200, 300 and 400mmol of NaCl. Daily and final germination percentages were recorded. The results showed that high salinity caused decrease in final germination percentage and Higher concentration of NaCl was germination inhibitor. Finally, results suggest that *Thymus deanensis* was more tolerant to salinity.

Keywords: *Thymus deanensis; Matricaria comomilla;* Salinity; Germination

1. Introduction

Environmental stresses such as drought and salinity are of most important factors that cause reduction of plant performance. Salinity is the basic problem of about 20 percent of agricultural lands and rangelands of the world (Owens, 2001, adapted from Azarnivand *et al*, 2005).

Iran is an arid and semi-arid country. Limitation of precipitation and it's unsuitable distribution provides a harsh environment to range plant establishment, so cultivation of resistant plant in arid and semi-arid region of the world is very important (Mobayen, 1983). Saline soils in Iran have much soluble salts and low organic matter. One of the reclamation methods in saline region is drainage or use of modern irrigation system but these methods are expensive. Use of resistant range plant is an economic way to reclamation and improvement of saline soils (Hasheminia and Kochaki, 1997). using suitable plant resources, can improve arid and semi-arid lands. In addition to salinity resistant, to select a species physiological, morphological and anatomical indices should be considered (Jones and qualset 1984). Germination is a fundamental and important stage in the life cycle of many plants (Khan and Rizvi, 1994). Tolerance to salinity during germination is critical for the establishment of plants growing in saline soil of arid regions (Ungar, 1995). Khan et al (2002) studied the effect of salinity and temperature on germination of *Salsola iberica*, Thy found that high salinity decreases germination rate. Ghoulam and Fares (2001) studied the effect of salinity on germination of 5 varieties of beet root, their result showed that high salinity decreases germination and germination velocity.

Katembe *et al.* (1998) studied the effect of salinity on germination and seedling growth of *Atriplex prostrata* and *Atriplex patula* , they suggested that the influence of NaCl is a combination of osmotic and ionic effects.

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Shahriary (2003) studied the effect of salinity stress on germination of *Atriplex veruuciferum* and *Atriplex lentiformis*, he reported high salinity inhibited Atriplex seed germination. Kamali *et al*. (2011) studied the germination of *Prosopis juliflora* and *P.specigera* under saline condition, and concluded that increasing salinity delayed germination and reduced both germination velocity and percentage. This study was undertaken to determine the effect of salinity stress on germination of *Matricaria comomilla* and *Thymus deanensis*.

2. Material and Methods

Germination assays were performed in 9-cm diameter petri-dishes containing one disk of Whatman No. 1 filter paper (Azarnivand *et al*, 2003).

Seeds were disinfected with commercial bleach (50 g l-1 active Cl) at a concentration of 1% for 15 min (Karimi *et al*, 2004), and then rinsed three times with distilled water (Azarnivand *et al*, 2005). Each dish was moistened with 5 ml of 0, 100, 200, 300 and 400 mmol NaCl solutions. Assays were performed at 25°C in germinator, and factorial with completely random statistical design with four replications of 25 seeds per treatment were used. Seeds were considered to be germinated with the emergence of the radicles (Al-Sherif *et al*, 2007; Villagra, 1997).

Petri dishes were monitored every day and the number of germinated seeds in each dish recorded. Data analyzed using Minitab software. Prior to statistical analysis, Kolmogorov-Smirnov and Levene tests were applied to determine normality and homogeneity of data, respectively. Finally, one-way ANOVA was performed to evaluate the effects of salinity on germination and Tukey's test was used for means comparison.

3. Result

In both species, high salt concentrations delayed the beginning of germination, and reduced the final germination percentage.

Data analysis showed significant difference of germination between species also among salinity treatments ($p<0.05$) (Tables 1- 2). High salinity concentrations reduced germination of both *Matricaria comomilla* and *Thymus deanensis* due to osmotic changes according to Tukey multiple comparison, showed significant difference ($p<0.05$). Comparison of germination among treatments showed significant difference in species and treatments (Table.3).

Table 1. Analysis of variance of germination data

SOV	df	SS	MS	F
Species	1	99.22	99.22	73.96*
Salinity	4	712.65	178.163	132.79*
Species* Salinity	4	7.65	1.91	1.43ns
Error	30	40.25	1.34	
Total	39	859.775		

Table 2. Comparison of Species final germination with Tukey test ($p<0.05$)

species	Mean
Thymus deanensis	0.75 a±17.05
Matricaria comomilla	1.408 b±16.65

Table 3. Comparison of mean germination percentage in salinity treatments with Tukey test ($p<0.05$)

Salinity Treatment(mmol)	*Matricaria comomilla*	*Thymus deanensis*
0	0.27 a±19.125	1.1 a±20.75
100	b 0.75±16.75	b 1.05±17.25
200	1 c±12.5	1.19 c±14.5
300	0.5 d±10.05	1.03 d±12.125
400	e 0.042±7.125	e 1.035±8.37

4. Discussion and conclusion

Result of this study showed effect of salinity on seed germination. As expected, both species showed lowered germination percentages due to high salinity. As the highest germination percentages were observed at low NaCl concentrations, and a strong decrease was observed at 400 mmol NaCl. This agrees with the observations of Azarnivand *et al.* (2003, 2005) and Karimi *et al.* (2004) on different *Atriplex* species. Redman *et al*. (1994) reported that salinity stress decreases the germination, leaf area and number of leaves in *Brassica*. In high salinity osmotic potential is high and seeds can not absorb water, so it causes low germination. In general, Salt stress, as an environmental factor influencing germination, causes toxicity for plants, and disturbs seed imbibition. Higher salt concentration, leads to

faster and more damages (*Karimi et al.*, 2004). If germination ability at different salt concentrations, assumed as an indicator of seeds resistance (Karimi *et al*, 2004), according to higher germination percentages in *Thymus deanensis* at all NaCl concentrations, it can be concluded that this species is more tolerant to salinity rather than *Matricaria comomilla.*

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