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Response of chili (*Capsicum annum* L. var. *Shihab*) plants to some environmental variables(salinity stress and water deficit)

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Water stress
Drought stress
Chili plant

A B S T R A C T

Drought and salinity are two of the foremost environmental stresses which affecting seriously plant growth and productivity worldwide. these stresses limited water supply results in disturbance of osmotic balance, impaired metabolic activity at cellular level and excessive reactive oxygen species (ROS). The influences of different levels of salinity and drought applied on pepper plant during germination and seedling development stages. Exposure of *Capsicum annum* L. during germination period to different levels of drought increased in germination parameters (germination percentages, mean germination time…...et), whereas sea water concentrations were decreased these parameters. In addition, all investigated traits of chili seedling were impaired by higher levels water stress. Irrigated after 6 days had highest average values of almost seedling measurements. the higher concentrations (50 and 70%) of sea water were greatly inhibited of seedling development. The response patterns of chili plants to different environmental stresses used in this study were varied with different growth stages. Where, sea water had strong effects on chili plant at seed germinated and seedling development periods, whereas water stress had more response at seedling development stages.

استجابة نبات الفلفل الحار الى بعض المتغيرات البيئية (اجهاد الملوحة ونقص الماء)

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الكلمات المفتاحية:
الاجهادات الاحيوية
إجهاد الجفاف
إجهاد الملوحة
ماء البحر
نبات الفلفل.

الملخص

الجفاف والملوحة من اهم الاجهادات البيئية التي تؤثر بشكل كبير على نمو النباتات وانتاجيتها في الكثيرمن مناطق العالم. تؤثر المستويات المختلفه من الملوحة ونقص الماء على نبات الفلفل اثناء مراحل الانبات ونمو البادرات. تعرض نبات الفلفل الحار خلال فترة الانبات لمستويات مختلفه من الجفاف أدى الى زيادة في قياسات الانبات المختلفة (النسبة المئوية للانبات؛ زمن الانبات....الخ), في حين ان تركيزات مياة البحر المستخدمة في هذه الدراسة كانت تؤدي لانخفاض هذه القياسات. بالإضافة الى ذلك ، فان جميع القياسات بادرات الفلفل الحاركانت تتاثر بارتفاع المستويات المختلفه الاجهاد المائي، كما ان التراكيز العالية (50 و 70 %) من مياة البحر كانت تثبط بشكل كبير نمو البادرات. تنوعت أنماط الاستجابة لنبات الفلفل الحارللضغوطات البيئية المختلفة المستخدمة في هذه الدراسة باختلاف مراحل النمو. حيث ان ماء البحر له تاثير قوي على نمو نبات الفلفل الحار عند مرحلة الانبات و تطور البادرة. في حين ان النبات كان اكثر استجابة للاجهاد المائي في مرحلة تطور البادرات.

1. Introduction

Soil salinity is the major and most important stress that adversely affects the overall metabolism of plant and leads to land deterioration and production reduction [1], [2]. A considerable large amount of land earth in the world is affected by salinity and more than 230 million hectares of irrigated land which account to 20% of total land have been damaged by salt [3].The ability of seeds to germinate at high salt

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concentrations in the soil is therefore of key importance for the survival of plant species [4].The high Na+ concentrations in saline soils often reduce the soil water potential to slow down water absorption of plants from soils, therefore, suppressing seed water imbibition and embryo growth. Moreover, excessive accumulation of Na+ often leads to inhibition of cell survival, growth and cell division [5]. Under salt conditions, sodium toxicity may cause a number of disorders which affects germination, protein synthesis, lipid metabolism, leaf chlorosis, and senescence [6].High salt concentrations may lead to various events that negatively impact plant growth and development, inhibition of enzymatic activities and a reduction in the photosynthetic rates [7].Drought being the key factor environmental stress leads to a series of physio - morphological and molecular changes that severely impairs plant growth and development more than any other environmental factor [8], [9].Usually drought stress occurs when the available water in the soil is reduced and the atmospheric conditions cause continuous loss of water by transpiration or evaporation. Drought stress is primarily considered a osmotic stress resulting in the disruption of and distribution of ions in the plant cell. Invitro conditions, polyethylene glycol (PEG), a non-ionic water polymer which is not likely to penetrate into plant tissue rapidly is widely used to induce water stress[10].Chilli (*Capsicum annuum* L.) is one of the most significant crops it belongs to the family solanaceae [11].*Capsicum* genus have huge variability in its major morphological characteristics such as form, color, size, and position of flowers and fruits [12],[13].The present study aimed to investigate the response of chili (*C. annuum* L.) to different abiotic variables in term of seed indices and seedling development. Aim of this research to investigate the response of chili (*C. annuum* L.) to different abiotic variables in term of seed indices and seedling development and study some morphological traits of this plant under the selected environmental variables.

2.Materials and methods:

2. 1. Plant materials: this study was conducted in the laboratory of Botany department of Benghazi University using a completely randomized design with three replications of each treatment with every experiment. Seeds of chili pepper (*C. annum* L.) were obtained from nursery, were provided by (SAKATA) already a factory prepared for study.

2. 2. Preparation and sterilization of seeds: Seeds were surface sterilized for three minutes with 5 % sodium hypochlorite (NaCLO) and washed with distilled water, the sterilized seeds of chili were placed in glass covered bottles and primed in distilled water (control) for 24 h at 25 °C in darkness. These primed seeds were used for all experiments in this work. Glass petridishes were sterilized and used three replications. These seeds were used for determination of the priming effect on seed germination indices and seedling parameters in (*C. annum* L.) [14]

2. 3. Germination bioassay: Concentrations of sea water were used for salinity test (sea water was collected from the Tocra sea) and draught stress was made by application of three water regime (3, 6 and 9 days). Primed seeds were put in petridishes (9 cm 13 diameter) lined with double layer filter papers. Ten seeds were placed in each replicate (3 replicates) for every treatment with addition of five ml of different concentrations of sea water and applied treatments of water regime. Petridishes were put in a seed germinator (Binder) at 30°C and seed germinated were checked every 24 h for two weeks. Germination was counted as indicated by the emergence of radical through the testa [15] [16] [17]. The data of all parameters measured under different environmental variables used for calculation of germination % [18], Inhibition % [19], germination index [20], mean daily germination [21], mean germination time [22], peak value [23] and germination value [24].

2.4. Seedling development: Germinated seeds of chili (*C. annum* L.) under different environmental variables (salinity and drought) were allowed to grow for another two weeks after germination period. All seedlings for each replication were separated into roots and shoots. Length (cm) and fresh weight (mg) of each seedling were measure to get fresh parameters. Then shoot and root were put on distilled water for 1 h to take saturated weight for each organ. Separated seedling parts were then oven-dried at 60°C for 24h. Then the dry weight (mg) of shoot and root of seedlings were recorded in all experimental to calculate relative water content [25], specific shoot length, specific root length [26], root /shoot ratio and water deficit (WD) [27].

2. 5. Statistical analysis: The data of all experiments were statistically analysed using computer software of Minitab version 19.11. for the determination of the significance within and between treatments. One Way Analysis of variance was used of determine the significance within treatments. Turkey's pairwise comparison tests were carried out to indicate significance between individual means of different treatments used in this research. Analysis of variance was significant and not significant analysis were conducted to determine the relationships between concentration and treatments.

3. Results:

3. 1. Effect of different concentrations of sea water on chili (*Capsicum annum* L. var. *shihab*) seeds.

3. 1. 1. Seed germination

The effect of different concentrations of sea water (%) was investigated for germination percentage of *C. annum* L. seeds in **Fig. 3.1.** One - way analyses of variance recorded significant differences ($F_{29} = 5.01$; $P < 0.001$) within means germination percentages of chili seeds. This parameter was not affected up to 30 % of the same substance. Tukey's pairwise comparison tests reveals significant differences between concentration 10 % and higher concentrations (50 and 70 %) of sea water. It is evident that increasing sea water concentrations was associated with marked reduction in seed germination percentage. The data given in **Fig. 3.2** indicate the impact of sea water on the inhibition percentage. Analysis showed highly significant impact ($F_{29} = 10.97$; $P < 0.001$) within treatments. Where observed the differences between lowest concentration (10 %) and higher concentrations (50, 70 %) of sea water.

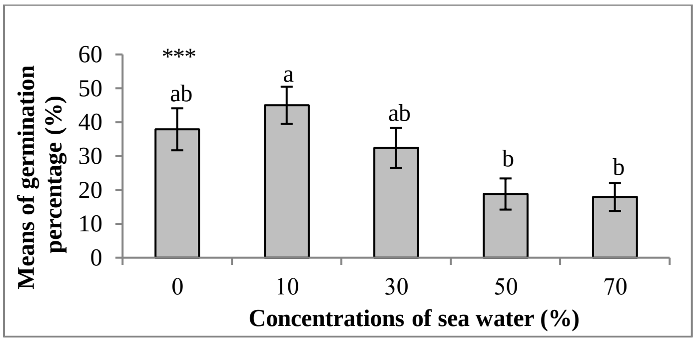


Fig. 3.1: Effect of different concentrations of sea water on the mean values of germination percentages of Chili (*Capsicum annum* L.) seeds.
*** = Significant $P< 0.001$ Bars = SEMean. different letters = Significant. same letters = Not Significant.

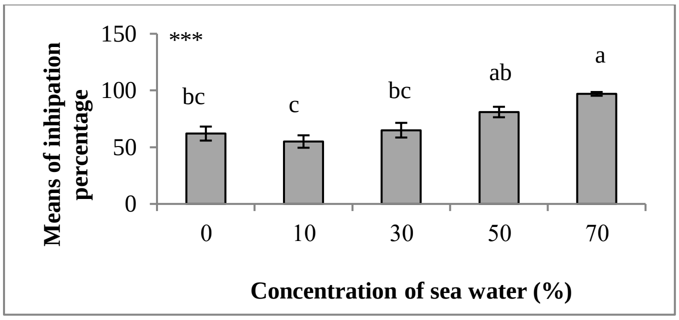


Fig. 3.2: Effect of different concentrations of sea water on the mean values of inhibition percentage of chili (*Capsicum annum* L.) seeds.
*** = Significant $P< 0.001$. Bars = SEMean. different letters = Significant. same letters = Not Significant.

The data given in **Table (3.1)** indicate the impact of different concentrations of seawater (%) on seed germination parameters of the chili (*C. annum* L.) plants. Seawater had high significant effect ($F_{29} = 7.49$; $P < 0.001$) within means of germination index of chili seeds. Tukey's pairwise comparison test reveals significant differences between concentration 10 % sea water and higher concentrations. Maximum mean germination index was at concentration 10 % sea water compared with control. Mean daily germination, mean germinations time, peak value and germination value of *C. annum* L. seeds had highly significant differences by sea water factor. One -way ANOVA indicated that means of these parameters were highly significant for the mean of daily germination (F_{29} =10.97; P < 0.001), mean germinations time (F_{29} =7.93; P < 0.001), peak value (F_{29} =10.97; P < 0.001) and germination value (F_{29}=8.12; P < 0.001) within treatments. Tukey's pairwise comparison test reveals high significant different between control and highest concentrations, where observed highest average value was at concentration 10% seawater and lowest average value was at concentration 70% sea water. Additionally, significant differences of mean germinations time were between highest concentrations (70 %) sea water comparison to control and lower concentrations (10 and 30 %).

Table 3. 1: Effect of different concentrations of sea water on the mean values of different germination parameters of chili (*Capsicum annum* L.) seed.

Concentrations (%)	Germination index	Mean daily germination	Mean germination time	Peak value	Peak value
0	*** 0.38 [ab] ±0.053	*** 2.70 [ab] ± 0.44	*** 3.04 [a] ± 0.55	*** 0.27 [ab] ± 0.044	*** 1.53[ab] ± 0.29
10	0.59 [a] ± 0.053	3.21 [a] ± 0.39	3.30 [a] ± 0.52	0.32 [a] ± 0.039	1.66 [a] ± 0.29
30	0.31 [b] ± 0.054	2.50 [ab] ± 0.46	2.93 [a] ± 0.58	0.25 [ab] ± 0.046	1.50 [ab] ± 0.32
50	0.15[b] ± 0.036	1.34 [bc] ± 0.33	1.69 [ab] ±0.43	0.13 [bc] ± 0.033	0.62 [bc] ± 0.18
70	0.13 [b] ± 0.12	0.17 [a] ± 0.12	0.13[b] ± 0.12	0.0170 [c] 0.012	0.06[c] ± 0.042

*** = Significant P< 0.001. Bars = SE
Mean. Different letters = Significant. Same letters = Not Significant.

3. 2. 2. Early seedling development:
3. 2. 2. 1. Fresh measurements:
Seedling development of chili plant were inhibited under highest concentrations of (50 and 70 %) sea water of all fresh parameters used in this experiment. The result of effect sea water on length of shoot and root of chili pepper (*C. annum*L.) seedlings were given in **Table (3.2).** The one- way analyses of varies showed that the increase in concentrations of sea water had adverse impact on shoot length (F_{29}=185.41; P < 0.001), root length (F_{29} = 339.89; P < 0.001). The shoot length of chili seedlings was adversely affected by increasing salinity level up to 30 % with no seedling's development under highest concentrations (50 and 70 %) sea water. Highly significant differences were between different concentrations means of seawater. Root length measurements showed differences between control and other concentration up to 30% sea water. One- way analyses of varies showed highly negative impact on fresh weight of shoot (F_{29} = 393.88; P < 0.001) and fresh weight of root (F_{29} = 236.14; P < 0.001) within treatments. Tukey's pairwise comparison test showed high significant different between control and lowest concentration (30%) as comparison to other concentrations.

Table 3. 2.: Effect of different concentrations of sea water on fresh measurements of chili (*Capsicum annum* L.) seedlings.

Concentrations (%)	Shoot Length (cm)	Root Length (cm)	Fresh weigh of shoot (mg)	Fresh weigh of root(mg)
0	*** 4.13[b] ± 0.26	*** 7.28[a] ± 0.32	*** 0.028 [b] ± 0.0013	*** 0.023 [a] ± 0.001
10	4.89[a] ± 0.26	7.12[a] ± 0.28	0.045[a] ± 0.0016	0.017[b] ± 0.0009
30	2.29[c] ± 0.14	3.42[b] ± 0.14	0.027[b] ± 0.0017	0.007[c] ± 0.0007
50	0.0[d] ± 0.0	0.0[c] ± 0.0	0.0[c] ± 0.0	0[d] ± 0
70	0.0[d] ± 0.0.0	0.0[c] ± 0.0	0.0[c] ± 0.0	0[d] ± 0

*** = Significant P < 0.001. Bars = SEMean.
Different letters = Significant. Same letters = Not Significant

2. 2. 2. Dry measurements: Dry weight of shoot and root under sea water levels indicated in **Fig.3.3.** There were significant differences of dry weight shoot (F_{29} =36.07; P <0.001) and root (F_{29} = 236.14; P<0.001) within treatments. Tukey's pairwise comparison test of dry weight of shoot reveals differences between control and concentration up to 30 % concentrations of sea water and also dry weight root had differences between control and other concentrations. Specific length of shoot and root and root /shoot ratio of chili (*Capsicum annum* L.) seedlings represented in **Fig. 3.4 and 3.5.** One-way analyses of varies showed high significant differences of specific length of shoot (F_{29} = 20.51; P< 0.001), root (F_{29} = 173.19; P< 0.001) and root /shoot ratio (F_{29} = 19.29; P< 0.001) within concentrations. Tukey's pairwise comparison test of specific length of shoot showed high significant were between control and concentrations up to 30 % sea water while high significant differences of specific length of root were between control and other concentrations of sea water. Root / shoot ratios showed significant differences between control and high concentrations up to 50 % sea water and concentration 10 % different with concentrations sea water up to 30%.

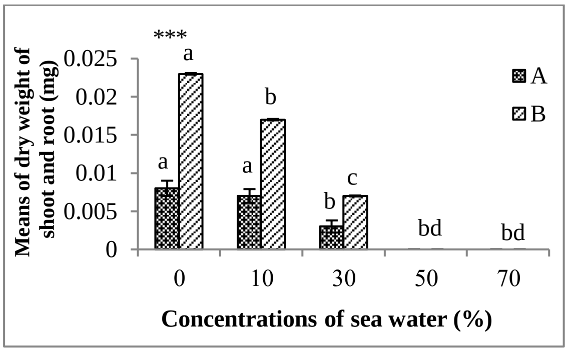


Fig. 3.3: Effect of different concentrations of sea water on the mean values of dry weight of shoot (A) and root (B) of chili (*Capsicum annum* L.) seedlings.
*** = Significant P< 0.001. Bars = SE Mean.
Different letters = Significant. Same letters = Not Significant.

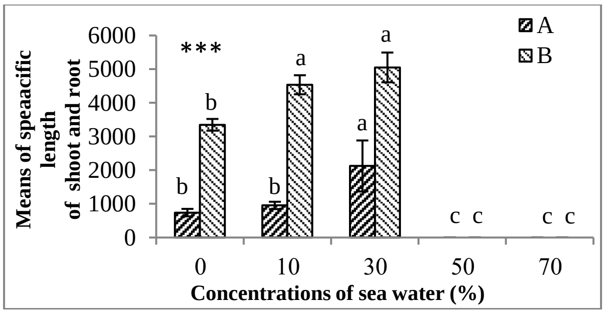


Fig. 3.4: Effect of different concentrations of sea water on the mean specific length of shoot(A) and root (B)of chili (*Capsicum annum* L.) seedlings.
*** =Significant P< 0.001. Bars = SEMean. Different letters = Significant. Same letters = Not Significant.

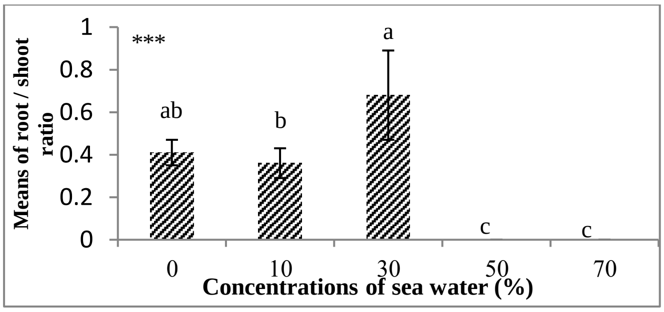


Fig. 3.5: Effect of different concentrations of sea water on the mean root / shoot ratio of chili (*Capsicum annum* L.) seedlings.
*** =Significant P< 0.001. Bars = SEMean.
Different letters = Significant. Same letters = Not Significant.

Result of relative water content of shoot and root showed significant differences with concentrations of sea (F_{29} = 2640.10; P < 0.001) and root (F_{29} = 819.97; P < 0.001). Highly significant differences were found between highest concentrations (50 and 70%) and other concentrations of sea water **Fig.3.6.** It is obvious from the results in

(Fig 3.7) the effect of different concentrations of sea water on water deficit of shoot and root of chili (*C. annum* L.) seedlings. General linear model revealed high significant differences of water deficit of shoot ($F29 = 40.53$; $P < 0.001$) and root ($F29 = 37.61$; $P < 0.001$) measurements within treatments. Tukey's pairwise comparison test reveals highly significant differences of water deficit shoot between high concentrations with other concentrations of sea water. However, differences of water deficit of root were between control and high concentrations up to 10 % sea water.

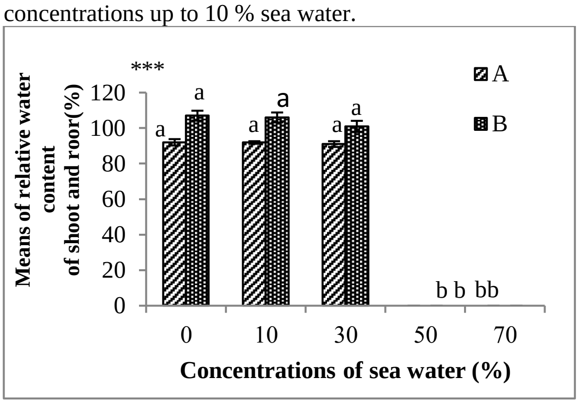


Fig. 3.6: Effect of different concentrations of sea water on the mean values of relative water content percentage of shoot (A) and root(B) of chili (*Capsicum annum* L.) seedlings.
*** =Significant $P< 0.001$ Bars =SEMean.
Different letters = Significant. Same letters = Not Significant.

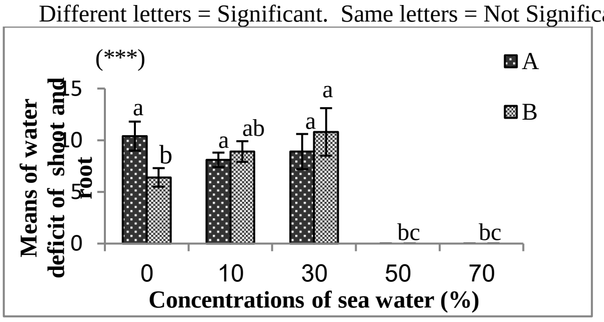


Fig. 3.7: Effect of different concentrations of sea water on the mean values of water deficit of Shoot (A) and root(B) of chili (*Capsicum annum* L.) seedlings.
*** =Significant $P< 0.001$ Bars = SEMean.
Different letters = Significant. Same letters = Not Significant.

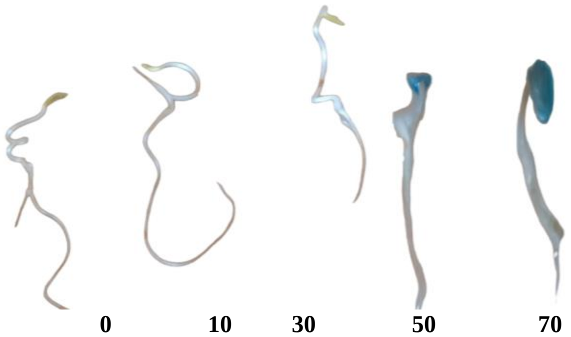


Fig. 3.8: Effect of different concentration of sea water on chili (*Capsicum annum* L.) seedlings.

3. 2. Effect of different irrigation levels (day) of water stress on chili (*Capsicum annum* L.)

3.2.1. Seed germinations

Effect of seed germination of chili (*Capsicum annum* L.) under water deficit stress assessed by measurement germination parameters in **Fig. 3.9 and 3.10**and **Table (3. 3).** The ANOVA exhibited that no significant difference observed in all measurements throughout the treatment period. A decline in germination parameters was recorded at treatments 3 days and 9 days compare as treatments day 6.

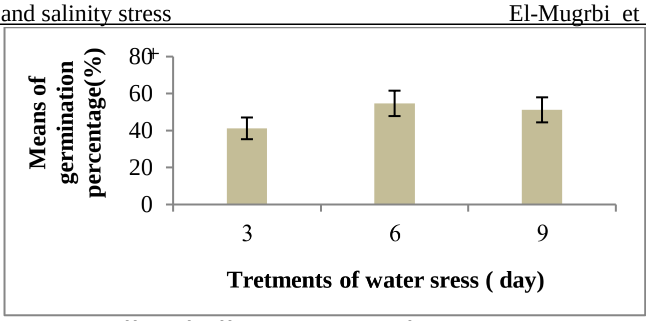


Fig. 3.9: Effect of different treatments of water stress on the mean values of germination percentages of chili (*Capsicum annum* L.) seeds.
+ = Not significant. Bars = SEMean.

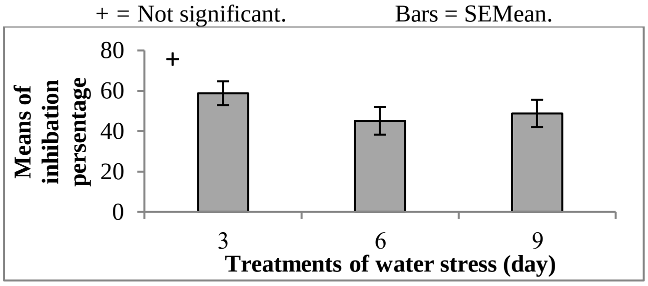


Fig.3.10: Effect of different treatments of water stress on the mean values of inhibition percentages of chili (*Capsicum annum* L.) germination seeds.
+ = Not significant. Bars = SEMean.

Table 3.3: Effect of water stress on mean values of germination parameters Chili (*Capsicum annum* L.) seeds.

Treatments (day)	Germination index	Mean daily germination	Mean germination time	Germination value	Peak value
	+	+	+	+	+
3	0.40 ± 0.051	2.94 ± 0.42	3.22 ± 0.52	1.59 ± 0.27	0.29 ± 0.042
6	0.55 ± 0.066	3.91 ± 0.49	4.11 ± 0.59	2.52 ± 0.36	0.39 ± 0.049
9	0.51± 0.063	3.66 ± 0.48	3.90 ± 0.58	2.30 ± 0.35	0.37 ± 0.048

+ = Not significant Bars = SEM

3.2.2 Early seedling development

3.2.2.1. Fresh measurement

Seedling development of chili plant were inhibited under highest concentrations of (50 and 70 %) sea water of all fresh parameters used in this experiment. The result of effect sea water on length of shoot and root of chili pepper (*C. annum*L.) seedlings were given in **Table (3.2).** The one- way analyses of varies showed that the increase in concentrations of sea water had adverse impact on shoot length ($F29=185.41$; $P < 0.001$), root length ($F29 = 339.89$; $P < 0.001$). The shoot length of chili seedlings was adversely affected by increasing salinity level up to 30 % with no seedling's development under highest concentrations (50 and 70 %) sea water. Highly significant differences were between different concentrations means of seawater. Root length measurements showed differences between control and other concentration up to 30% sea water. One- way analyses of varies showed highly negative impact on fresh weight of shoot ($F29 = 393.88$; $P < 0.001$) and fresh weight of root ($F29 = 236.14$; $P < 0.001$) within treatments. Tukey's pairwise comparison test showed high significant different between control and lowest concentration (30%) as comparison to other concentrations.

Table 3.6: Effect of water stress on mean values of fresh measurements of chili *Capsicum annum* L.) seedling**.**

Treatments (day)	Shoot length (cm)	Root length (cm)	Fresh weight of shoot (mg)	Fresh weight of root (mg)
3	** 4.67^{a} ± 0.17	+ 8.35 ± 0.49	+ 0.054 ± 0.016	*** 0.014^{a} ± 0.0010
6	3.68^{b} ± 0.21	7.38 ± 0.44	0.033 ± 0. 013	0.10 ^{b} ± 0.0009
9	3.93^{b} ± 0.19	8.31 ± 0.36	0.033 ± 0. 016	0.13^{a} ± 0.0006

+ = Not significant ** = Significant $P< 0.01$ Bars = SEMean.
Different letters = Significant. Same letters = Not Significant

3.2.2.2. Dry measurements

Dry weight of shoot and root measurements of chili (*Capsicum annum* L.) seedlings under water regime levels were showed in **Fig. 3.11.** Where there are highly significant differences within the dry weight of shoot (F_{29} =14.70; P< 0.001) and root(F_{29} =6.09; P< 0.001). Tukey's test showed the significant differences between irrigation level after 9 days and other levels of dry weight of shoot, while measured dry weight of root showed the significant differences between irrigation level after 6 days and other levels of water stress.

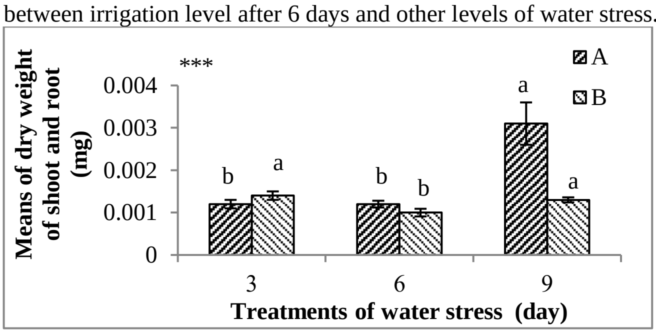


Fig.3.11: Effect of different treatments of water stress on the mean values of dry weight shoot(A) and root (B) of chili (*Capsicum annum* L.) seedlings.
*** = Significant P< 0.001 Bars = SEMean.
Different letters = Significant. Same letters = Not Significant.

Response of specific length of shoot and root of chili (*Capsicum annum* L.) seedlings were illustrated in **Figure (3. 12).** ANOVA analysis showed high significant of specific length of shoot (F = 4.99; P = < 0.001) within treatment, whereas specific length of root was not significant under same conditions. Tukey's pairwise comparison test presented significant difference between irrigation level after 9 days and other treatments of specific length of shoot under water stress treatments.

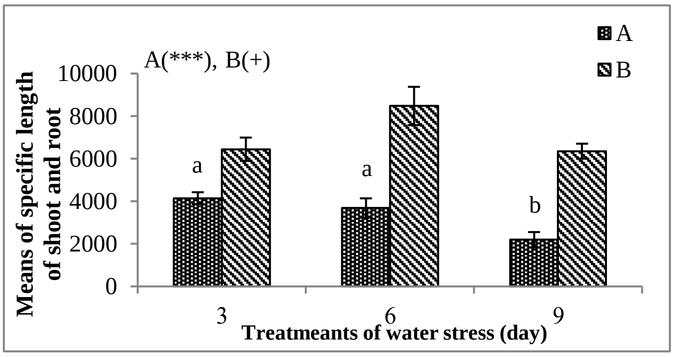


Fig. 3.12: Effect of different treatments of water stress on the mean values of specific length (A)and root (B) of chili (*Capsicum annum* L.) seedlings.
+ = Not significant *** = Significant P< 0.001
Bars = SEMean
Different letters = Significant. Same letters = Not Significant.

Results of statistical analysis showed not significant differences in root /shoot ratio and relative water content percentage of shoot and root. of *Capsicum annum* L. seedlings under different treatments of water stress **Fig. 3. 13 and 3.14**. Although, observed reduced in these parameters with increased water stress treatments.

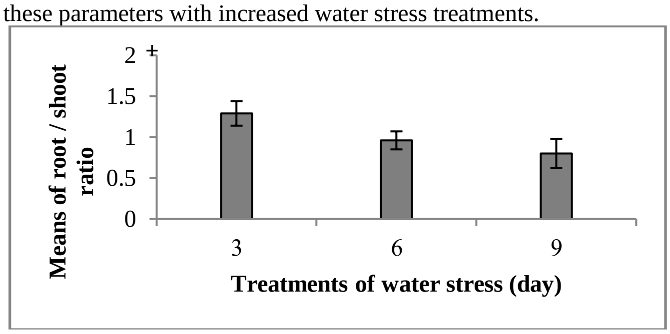
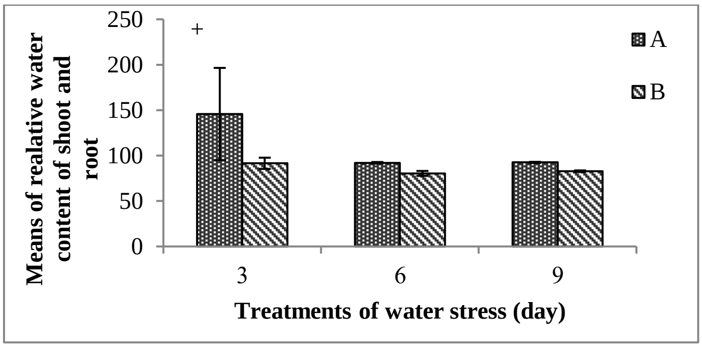


Fig. 3.13: Effect of different treatments of water stress on the means of root / shoot ratio of chili (*Capsicum annum* L.) seedlings.
+ = Not significant. Bars = SEMean.



`**Fig. 3.14**. Effect of different treatments of water stress on the mean values of relative water content of shoot(A) and root (B) of chili (*Capsicum annum* L.) seedlings.
+ = Not significant. Bars = SEMean.

Fig. 3.15 shows the effect of different treatments of water stress on water deficit of shoot and root. One-way ANOVA analysis presented not significant within treatments of these parameters under water stress. water deficit was decline with increased treatment respectively water deficit of shoot, where highest value was at 6days of levels irrigation while lowest value was at a level 9 days.

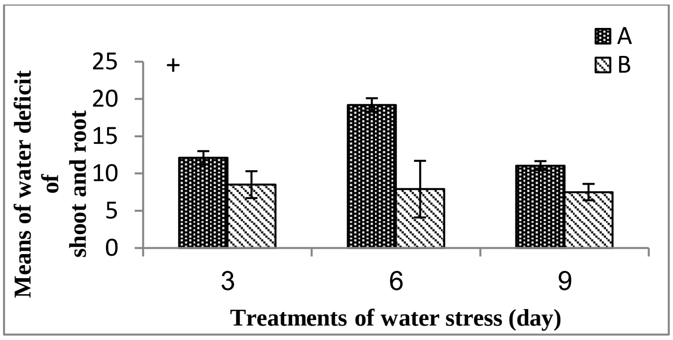


Fig. 3.15: Effect of different treatments of water stress on the mean values of water deficient of (shoot) and (root) of chili (*Capsicum annum* L.*)* seedlings.
+ = Not significant. Bars = SEMean.

3d **6d** **9d**

Fig. 3.16: Effect of different treatments of water stress on chili *Capsicum annum* L.) seedlings.

4.Discussion: The patterns of response to applications of different environmental variables were different with different growth stages of chili (*C. annum* L.) plants used in this study. Initial stages of growth parameters (germination parameters) of chili seeds under sea water levels had highly significant differences. Whereas, these parameters were declined with increasing levels of sea water with increased inhibition of germination percentages of target seeds. Response of seed germination parameters under drought stress recorded no significant differences within different treatments. Nevertheless, all germination parameters of chili were increased after six days of irrigated and decreased after 3 days of irrigated. The decrease of seed germination might be attributed to osmotic stress which reduce of the water uptake or to the accumulation of some specific toxic ions such as Na and Cl [28] [9]. Under conditions of salt stress Na+ influx into the root cells ameliorate the cytoplasm Na+ concentration and contrivances the toxicity symptoms; therefore, guide to the movement of some metabolic disorders curtailing the lessening in total seed germination [17]. On the other hand, this may be due to high accumulation of salts of the cells and low water potential that is unable to reactivate enzymes to recover germination, induces damage of the embryo death [28] [17] [29] [30]. Wahocho *et al*. [9] concluded that, seed germination had adversely affected with increased salt stress levels compared to control used for chilli (*Capsicum annuum* L.) seeds. Moreover,El Khaldi *et al*. [28] stated that, salinity stress declined the germination percentages, the germination index, and also delayed the emergence of seeds for the three chili pepper cultivars. Similar results were observed by Kaya [22]emerges seed of seven pepper cultivars reduced by increasing salinity levels. Moreover Loganayaki *et al.*[15]reported that, germination percentages were negatively influenced by the salinity treatments. According to AL bayrak *et al*. [31],drought stress reduced germination rate of wheat (*Triticum aestivum* L.). Furthermore Yigit *et al*. [32] affirmed that, germination percentage reduced in some plant species due to increasing water stress. During seedling growth stages of chili plant, the results indicated that salinity effected on early seedling development whereas observed clear reduction in fresh measurements with increasing concentrations of sea water. Different treatments of sea water even concentration 30 % had decreased gradually of these parameters, whereas high concentrations (50 and 70 %) inhibited of fresh measurements. Additionally, fresh parameters of shoot under water stress treatments reduction with increased this condition. length and fresh weight of root of this plant under water stress had promoted at 3 days and decrease at 6 days. On the other hand, markedly reduced of dry weight of shoot and root with increased concentrations of salinity. Sea water stress had inhibited of this parameter at 50 and 70 % levels. Furthermore, specific length of shoot and root and Root/shoot ratio were clearly increased even to 30% and inhibited at more than this concentration. Relative water content and water deficit of shoot were not affected under sea water levels but highest concentrations of this conditions had no seedling development. also, observed increased of water deficit of root with increased concentrations of sea water. Dry weight and specific length of shoot under water stress were promoted at irrigation treatment after 9 days while dry weight of root was enhanced at 3 days of water stress. Specific root length, root/shoot ratio, relative water content of shoot and root and water deficit were not significant under water stress treatments. The reason reduction length and fresh weight of seedling chili with increased salinity may be due to increase in osmotic potential with increasing salinity, which causes dehydration, ionic imbalance in transpiring leaves that lead to decrease in meristem activity and cell elongation, consequently inhibit the growth of plant. Salinity which can lead damage by the toxic ion accumulation leading to a suppression in the uptake of essential nutrients like phosphorus (P) and potassium (K) in plant. Decline in fresh weight decrease in the water contents of stressed plant cells and tissues, which lose their turgor and thus shrink. Moreover, injurious influence of salinity reduces the growth of roots this might be due to the effect on the cell wall structure, thereby increasing ethylene concentration [9][17][33]. Root/shoot ratio was increased with increasing in salinity levels. This could be due to reduced shoot growth where salinity induced water deficit so a greater proportion of plants assimilates can be allocated to the root system which supports its growth hence the ratio of root to shoot growth increases [15].The decline length of chili (*C. annum* L.) plant under salinity and drought stresses might be caused by the loss or reduction of water from the protoplasm, which contributes to reduced cell turgor pressure and cell division, expansion cell and limited division of assimilate to root organs, resulting in shorter root length and poor plant growth[34][35][36]. In this connection, the reduced in plant height under effects stresses may be led to influence on growth promoting hormones that reduce cell turgor [37]. Seth [38], indicated that, salinity inhibited overall growth reduction in shoot length, root length, fresh weight and dry weight in tomato cultivars. Salt stress drastically inhibits seedling growth and dry weight, showed a reduction in the fresh weight shoots and roots, as well as a decrease in root length, in response to salinity of tomato (*Solanum lycopersicum* L.) supported by Parvin *et al.* [39]. Ichwan *et al.* [40] Suggests that, increase drought stress reduced dry weight of shoot of red chili varieties. Moreover, water stress had negatively affected the growth characteristics on weed reported by singha *etal*. [41]. High concentrations and long-term stress led to more serious damage, of *Juglans microcarpa* L. seedlings [42]. Results obtained of this study were consistent with Rosmaina *et al.*[44] state that, stress conditions significantly affected on all morphological measurements. Additionally, Giorio *et al*. [43] found that, salinity induced adverse in plant length to variety of sweet pepper (*Capsicum annuum* L.). Furthermore, Yusuf and Hamed, [33] indicated that, water stress caused inhibit the height of *Capsicum frutescens* L.plant.

5. Conclusions: Based on regarding the responses of chili pepper to different environment variables we can conclude that the stresses used in this study were mostly promoters of seed germination and seedlings development of chili pepper plants. It is clear from the obtained results that, chili (*C. annuum* L.) plants showed more tolerance to water stress compart to salinity stress. Exposure of chili plants to water deficit stress during germination periods elucidated no effects in all germination measurements and almost seedling measurements. Accordingly, the results obtained that, germination parameters of chili seeds reduced at highest concentrations (50 and 70 %) of sea water. Measurements of chili seedlings under sea water stress were reduced even concentration 30 % and highest concentrations of sea water (50 and 70%) strongly prevented seedlings development.

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