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Original Article

Responses of Pishtaz Cultivar Seed Germination Treated with Gibberlic Acid (GA_3) and Poly Amines Under Salinity Stress

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ABSTRACT

Objective: In order to investigate effects of different concentration of gibberlic acid and poly amines on germination and early growth of Pishtaz cultivar under salinity stress. **Methods:** The experiment was carried out as factorial based on completely randomized design with four replicates in laboratory of agronomy and plant breeding of agricultural department, Islamic Azad University, Varamin-Pishva Branch in 2014. The first factor was salinity with four levels (S1:3.78, S2: 5.95, S3: 10.25 and S4: 12.87 ds/m) and the second factor was six level of hormones including H0: control, H1:GA3 (100mg/litr) ،H2:GA3 (150mg/litr) ،H3:GA3 (200mg/litr) ،H4: Putrescine (2.5m/mol)، H5: Spermidine (5m/mol) and H6: GA3(100mg/litr) + Spermidine (5m/mol). coleoptile and cleorhiza length, cleorhiza number, coleoptile and cleorhiza dry weight, germination percent and number of damaged seeds were measured. **Results:** Analysis of variance showed significant difference among salinity and hormone levels for coleoptile and cleorhiza length, cleorhiza number at 1% of probability level and no difference for the rest properties. It was concluded that following increasing salinity, application of different levels of GA3 had no significant effect on germination process of Pishtaz cultivar.

1.INTRODUCTION

Salinity emphasize presence of more than extreme of soluble ions in soil and water especially water irrigation, drainage and subsurface. Compounds of salinity of water and soil are kations of calcium, Mg, sodium and anions of cholor, sulfate and bicarbonate. Around thousands million of aridities of world are under salinity. 10-50% of water area exposes to salinity or reduces their production. In Iran, around 16-23 million hectare of areas is salty. Now days, the area of these salty area estimated around 25 million hectare and it is supposed that 50% of areas which irrigated by salty water or exposed to salinity (Kordovani, 1999). Most of crop plants could not grow in high concentration of salt and salty area in the world extent, gradually. So, In future, salinity is a threat for food preparation. Food requirement increased in the world up to 38% until 2025 and 57% until 2050 (Abasi, 2003). Salinity reduced quality and seed yield of crop plants (Rawson et al., 2002; Francois et al., 2000). Bread wheat (*Triticum aestivum* L.) is one of the most important crops in the world and the main food of arid and semi arid area. In these area, water limitation as a main and salinity as second factor, reduced the growth and seed yield (Munns et al., 2006). Now days, regarding the invention of new method and improvement in physiology, biochemistry science, it is necessary to get these improvements to reduce the negative effects of environmental stress. Application of plant growth regulators is on of these methods. Plant

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hormone activated in tissue which is far from their production tissue. A growth regulator is an organic compound (more than nutrient) which in very little concentration (lower than 1 mmol) causes accelerations, suppression, or changes in growth and improvement of plant. Growth suppressors are organic compounds which suppress the growth and had not concentration inducing range. Therefore, all of the hormones (natural production of plant) are plant growth material, but the contrast of this, is not true. There are hundreds of synthesized compound which act as growth regulators, but they are not hormone. Now, it is discussed that growth and improvement by hormones 1) to what extent depends on hormone concentration and 2) changes in tissues susceptibility related to second meaning are emphasized by Trewavas, 1981; Trewavas, 1983; Basalah & Mohammad, 1999; Hisamatsu et al., 2000.

1.1.Pishtaz Wheat

Pishtaz cultivar obtained by crossing an improved line (1-27-6275/Cf1770), which later named Alvand, with resistance to yellow rust line, A1dan/Ias58, which originated from Brazil, in 1999. Selection steps of Pishatz were implemented in two generation in year, between Iranshahr and Clardasht station. Resistance to disease and favorable baking quality, made Pishtaz named and introduced in 1381. Pishtaz had the highest yield, so that the average yields of 7396 kg and record of 9646 kg/ha reported for this cultivar.

2. MATERIALS AND METHODS

The experiment was conducted in the autumn of 2014 in Agronomy and Plant Breeding laboratory of agricultural department of Islamic Azad University, Varamin-Pishva Branch. The experiment was performed as factorial based on randomized complete block with four replicates. The treatments were four levels of salinity (S1:3.78, S2:5.95, S3:10.25 andS4:12.87 ds/m), and six levels of hormone including H0: control, H1:GA3 (100mg/litr), H2:GA3 (150mg/litr), H3:GA3 (200mg/litr), H4: Putrescine (2.5m/mol)، H5: Spermidine (5m/mol) and H6: GA3(100mg/litr) + Spermidine (5m/mol).

2.1. Germination Experiment

After weighting the above hormone, they poured in container volume: 50 ml. GA3 solved in NaOH (1N). An aliquot of control water (obtained from well) poured to each hormone treatments to reach the interested volume. Different levels of salinity were obtained from agricultural wells of Gomrod, in Gome Province. 10 seeds of Tajan cultivar were placed in Petri dishes which covered with filter paper, regularly. Then 10 ml of the treatments added to each Petri dishes. To avoid respiration and transpiration, the door of Petri dishes covered with parafilm. The samples were transferred to germinator without any light in 20 °C and 50% humidity. 7 days later, the length of coleoptile and cleorhiza, number of radicle and length of longest radicle and plumule measured. Then the coleoptile and cleorhiza of each petri placed in separated paper and placed in the pocket and all information of Petri written of it. On each pocket, the fresh weight (FW) of coleoptile and cleorhiza added, also. Then two papers pressed to each other and all samples transferred to oven at 70 °C for 48 h, then the dry weight (DW) of them measured. The cultured seeds were maintained at 25±1 and absolutely no light. After 7 days, number of germinated seeds, radicle and plumule length, coleoptile length, fresh and dry weight of seedlings measured. Tissue Water Content calculated using the following formula: TWC= ((FW-DW)/FW) × 100. The collected data analyzed using SPSS, SAS and MSTAT-C softwares. The means were separated using Duncan Multiple Range Tests at 5% of probability level.

3. RESULTS

Analysis of variance showed that there was significant difference among salinity, hormone levels and their opposite effects on coleoptile and cleorhiza length, cleorhiza number and dry weight of cleorhiza at 1% of probability level (Table 1). The opposite effect of salinity× hormone was significant for germination rate and damaged seeds at 5% of probability level (Table 1). Salinity, hormone and their contraction effects was not significant for other properties (coleoptile and seedling dry weight and TWC) (Table 1).

3.1. Coleoptile Length

There was significant difference among salinity, hormone and their contraction effect at 1% of probability level (Table 1). The longest coleoptile was seen in salinity of 3.87 ds/m with 7.432 cm, and the shortest was in salinity of 12.87 ds/m with 4.609 cm (Table 2). Longest coleoptile was seen in GA3 100 mg/L with 6.336 cm and the shortest was in Putrescine 2.5 m/mol with 4.719 cm. The results of salinity× hormone treatments showed that the longest coleoptile was in salinity of 3.87 ds/m and GA3 100 mg/L (9.506 cm), while it was shortest in Putrescine 2.5 m/mol with 3.322 cm. these results were in agreement with Ghorbani et al. (2011).

3.2. Cleorhiza Length

The results indicated that there was significant difference among salinity, hormone and their opposite effects at 1% of probability level (Table 1). The maximum of length was in salinity of 5.95 ds/m with 5.085 cm, while the minimum was in salinity of 10.25 ds/m with 3.773 cm (Table 2). The maximum of length was in not application of hormone with 6.818 cm and the minimum was in GA3 200 mg/L with 2.760 cm (Table 3). The results of

opposite effects of salinity × hormone indicated that the maximum of length was in salinity of 5.95 ds/m and not application of hormone with 8.429 cm, while it was minimum in application of GA3 200 mg/L with 1.735 cm. these results were in agreement with Achard et al., 2006 and Hisamatsu et al., 2000.

3.3. Cleorhiza Number

It was significant difference among salinity, hormone and their opposite effects at 1% of probability level (Table 1). The most number of Cleorhiza was in salinity of 12.87 ds/m with 5.085, and the lowest was in salinity of 10.25 ds/m with 4.67 (Table 2). The most number of Cleorhiza was in application of Putrescine 2.5 m/mol with 5.106 and the lowest was in application of GA3 100mg/L and Spermidine 5m/mol with 4.657 (Table 3). The results of opposite effects of salinity × hormone showed that the most number of Cleorhiza was in salinity of 12.87 ds/m and GA3 200 mg/L with 5.553, while it was lowest in salinity of 10.25 ds/m and GA3 200 mg/L with 3.78 (Figure 3). These results were in agreement with Iqbal and Ashraf, 2010 and Desingh, 2007.

3.4. Cleorhiza Dry Weight

It was significant difference among hormone treatments at 1% of probability level and no significant among salinity and opposite effects of salinity × hormone treatments (Table 1). The highest of Cleorhiza dry weight was in control with 0.057 g, and the lowest was in application of GA3 100mg/L and Spermidine 5m/mol with 0.035 g. These results were in agreement with Kumar and Singh, 1996; Nayyaret al., 1995; Shakirova et. al., 2003. The results indicated that there was no significant difference among salinity and hormone treatments for germination percent and damaged seeds, but their opposite effects was significant at 5% of probability level (Table 1). The highest germination percent was observed in salinity of 3.87 ds/m and Putrescine, salinity of 5.95 ds/m and Spermidine, salinity of 12.87 ds/m and GA3 100mg/L and Spermidine 5m/mol (100%). The lowest germination percent was in salinity of 10.25 ds/m and GA3 100mg/L and Spermidine 5m/mol (77.5%) (Figure 4). These results were in agreement with Gomma 1999; Iqpal et al., 2006. The highest damaged seeds was in salinity of 10.25 ds/m and GA3 100mg/L and Spermidine 5m/mol with 2.25. The lowest was in salinity of 5.95 ds/m and GA3 100mg/L and Spermidine 5m/mol-7.36(Figure 5). These results were in agreement with Gobinathan et. al.,2009; Ghorbani et. al., 2011.

4.DISCUSSION

Regarding the present data, mutant plant, which failed to produce poly amine, could not grow and improve normally. High concentration of poly amines affects physiological process by controlling physiological action of light, hormone and stresses. Also, the suppressors of poly amine bio synthesis have many effects. They related to rapid growth of tissue and metabolisms, and their accumulation induced by plant hormone, occasionally. Suppressing senescing, cell division inducing in some cultures of plant tissue are of their physiological rolls (Galstoneet al., 1983). Maybe ability of translation of poly amines, made them not concluded as hormone, but they presence in all cells and its necessary for natural growth and improvement (Galstone & Kaur, 1987). The results indicated that in semi-resistance cultivar of Pishtaz, following increasing salinity from 3.87 to 12.87 ds/m, the germination properties decreased, severely. But the length and number of Cleorhiza increased. In General, following increasing to 12.87 ds/m in Pishtaz cultivar, using exogenous treatment of GA3 and poly amines, could not suppress the negative effects of salinity in germination process. More studies in the field of GA3 and poly amines mechanisms on morphological and physiological properties of seeds were recommended.

Table 1.
Analysis of variance for studied traits of wheat variety under salt stress

S.O.V.	DF	Length of Coleoptil	Length of Coleorhiza	Number of Coleorhiza	Dried weight of Coleorhiza	Dried weight of Coleoptil	Dried weight of seedlings	Interstitial water content of seedlings	Percentage of germination	Percentage of Damage seeds
Salinity	3	47.058**	25.324**	1.026**	0.000ns	0.013ns	0.015ns	31.827ns	163.095ns	1.631ns
Hormone	6	5.917**	29.197**	0.357*	0.001**	0.005ns	0.007ns	107.119ns	80.060ns	0.801ns
Salinity × Hormone	18	4.607**	6.466**	0.512**	0.000ns	0.009ns	0.011ns	168.504ns	224.901*	2.249*
Error	84	0.333	0.737	0.147	0.000	0.010	0.09	134.504	135.119	1.351
%CV	-	10	5	8	9	7	6	5	4	8

ns: Non significant, ** and * significant at 0.01 and 0.05 probability levels, respectively.

Table 2.
Means comparison for studied traits

S.O.V.	Length of Coleoptil (cm^2)	Length of Coleorhiza (cm^2)	Number of Coleorhiza
Salinity3.87(ds.m)	**7.432a**	**2.835d**	**5.006a**
Salinity5.95(ds.m)	**5.844b**	**5.085a**	**4.775b**
Salinity10.25(ds.m)	**4.787c**	**3.773c**	**4.677b**
Salinity12.87(ds.m)	**4.609c**	**4.359b**	**5.085a**

Table 3.
Means comparison for studied traits.

S.O.V.	0	Hormone GA100 (mg/l)	Hormone GA150 (mg/l)	Hormone GA200 (mg/l)	Putrescine (2.5 mmol/l)	Spermidin (5 mmol/l)	Hormone GA100 (mg/l) + Spermidin (5 mmol/l)
Length of Coleoptil (cm^2)	5.842bc	6.336a	6.281a	5.950ab	4.719e	5.077de	5.470cd
Length of Coleorhiza(cm^2)	6.818a	3.612c	3.524c	2.760d	3.622c	4.556b	3.199cd
Number of Coleorhiza	4.952ab	4.905ab	4.959ab	4.733b	5.106a	4.889ab	4.657b
Dried weight of Coleorhiza(g)	0.057a	0.046b	0.039bc	0.041bc	0.045bc	0.036bc	0.035c

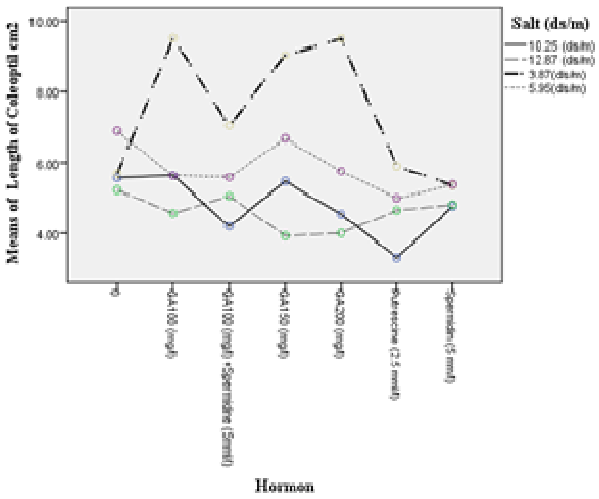

Figure 1. Means comparison of interaction for Length of Coleoptil.

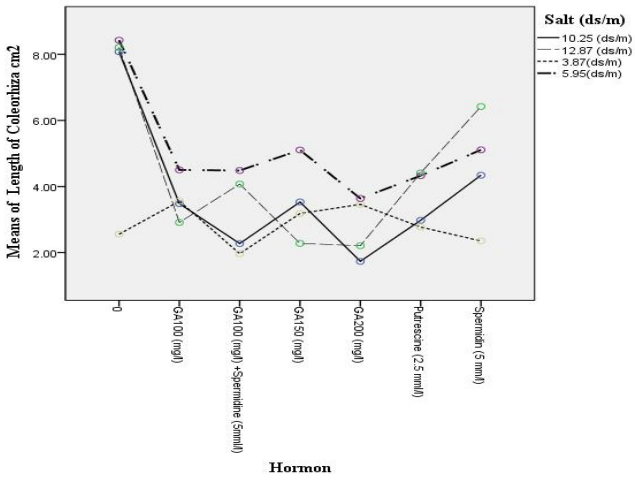

Figure 2. Means comparison of interaction for Length of Coleorhiza

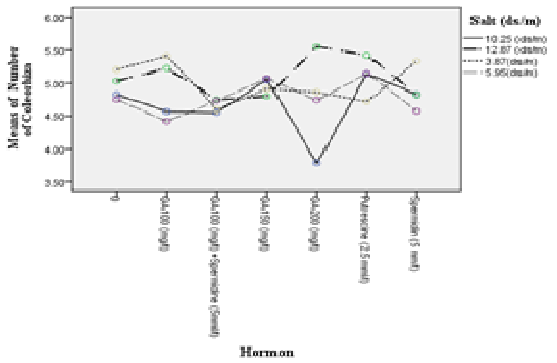

Figure 3. Means comparison of interaction for Number of Coleorhiza

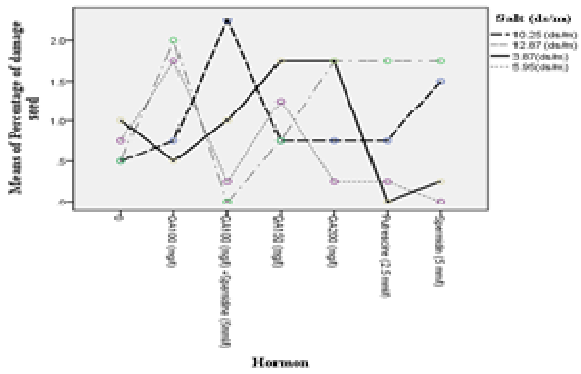

Figure 4. Means comparison of interaction for Percentage of germination

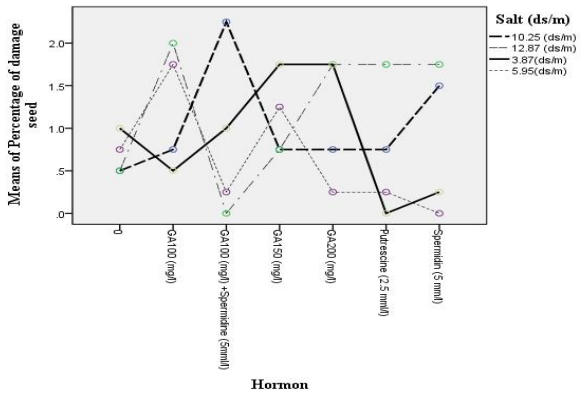

Figure 5. Means comparison of interaction for Percentage of damage seed

REFERENCES

Achard P, Cheng H, Grauwe LD, Decat J, Schoutteten H, Moritz T, Dominique VDS, Peng J, Harberd NP, 2006. Integration of plant responses to environmentally activated phytohormonal signals. Science 311: 91-94

Aziz, A., J. Martin-Tanguy and F. Larher, 1997. Plasticity of polyamine metabolism associated with high osmotic stress in rape leaf discs and with ethylene treatment. Plant Growth Regul., 21: 153-163.

Basalah MO, Mohammad S . 1999. Effect of salinity and plant growth regulators on seed germination of *Medicagosativa* L. Pakistan J Biol Sci 2: 651-653

Desingh, R, G. Kanagaraj, 2007. Influence of salinity stress on photosynthesis and antioxidative systems two cotton varieties. Gen. Appl. Plant Physiol., 33: 221-234.

Francois L. E., Grieve C. M. Maas E. V. Donovan T. J. and Lesch S. M. ,2000. Time of salt stress affects growth yield components of irrigated wheat. *Agronomy Journal,* 86, 100–107.

Galston, a. w. 1983. Plyamines as dulaors of plant development. Biscience 33:382-388.

Galston, a. w. and r. kaur-sawhney. 1987. Plyamines as endogenous growth regulators. In: davies, p. j., ed. Plant hormones and heir role in plant growh and development. Martinus nijhoff publishers, drdrecht,t he netherlands. Pp.280-295.

Gomma, A.S.A., 1999. Wheat improvement in Egypt: History and future prospects. Egypt. J. Plant Breeding.3: 1-14.

Majid Ghorbani Javid1, Ali Sorooshzadeh, Foad Moradi, Seyed Ali Mohammad Modarres Sanavy1, Iraj Allahdadi,2011. The role of phytohormones in alleviating salt stress in crop plants. Australian Journal of crop science: AJCS:726-734

Hisamatsu, T.,2000. The role of gibberelllin in biosynthesis in the control of growth and flowering in Mathiola incana. Physiol. Plant., 109, 97-105.

Iqbal M, Ashraf M ,2010.Gibberellic acid mediated induction of salt tolerance in wheat plants: Growth, ionic partitioning, photosynthesis, yield and hormonal homeostasis. Environ Exp Bot doi:10.1016/j.envexpbot. 2010.06.002

Iqpal, M., M. Ashraf; A. Jamil U.R and Shafiq, 2006. Does seed priming induce changes in the levels of some endogenous plant hormones in hexaploid wheat plant

under salt stress. J. of Integrative Plant Biology,48(2): 181-189.

Kumar B, Singh B ,1996. Effect of plant hormones on growth and yield of wheat irrigated with saline water. Annu Agr Res 17: 209-212

Munns, R., R. A. James and A. Lauchli. 2006. Approaches to increasing the salt tolerance of wheat and other cereals. J. Exp. Bot. 57: 1025-1043.

Nayyar H, Walia DP, Kaistha BL ,1995. Performance of bread wheat (*Triticum aestivum* L.) seed primed with growth regulators and inorganic salts. Indian J Agr Sci 65: 116-122

Prakash L, Prathapasenan G ,1990. NaCl and gibberellic acid induced changes in the content of auxin, the activity of cellulose and pectin lyase during leaf growth in rice (*Oryza sativ*a). Ann Bot 365: 251-257.

Rawson, H. M., Richards, R. A. & Munns, R. ,2002. An examination of selection criteria for salt tolerance in wheat, barley and triticale. *Australian Journal of Agricultural Research*, 39(5), 759–772.

Shakirova, F.M., A.R. Sakhabutdinova, M.V. Bezrukova, R.A. Fathkutdinov and D.R. Fatkhutdinova, 2003.Changes in the hormonal status of wheat seedlings induced by salicylic acid and salinity.Plant Sci., 164:317.

Trewavas, A.1981. How Do Plant Growth Substances Work? Plant, Cell Environ. 4: 203-228.