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Effect of Salt Concentrations on Amarantus Germination under in Vitro

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Abstract

In many parts of the world, *Amaranthus* plants are vegetables, their ornamental plants and their seeds are considered grains. It is also widely used as an animal feed. Paint can be made from colorful flowers. Both the leaves and the small yellow seeds with black specks can be eaten and the dried seeds can be milled to make bread. Amaranth, which is the main grain of Aztecs, is abundantly fibrous and contains high protein. It is also very rich in terms of vitamins and is rich in B2 vitamins (riboflavin), B9 vitamins (folic acid), calcium, copper, iron, magnesium, phosphorus, potassium and zinc. In this study, the effects of different salt levels (0, 50, 100, 150 and 200 mM NaCl) on the germination of *Amaranthus* plant in vitro conditions were investigated. Three *Amaranthus* species were used in the study. The seeds of *Amanthus albus, Amaranthus retroflexus* and *Amaranthus blitoides* were collected from Sanliurfa natural herbals. Seeds were germinated in petri dishes containing sterile filter papers. The seeds of *Amaranthus albus, Amaranthus blitoides* and *A.retroflexus* seeds began to germinate on the 2nd day after 50 mM and 100 mM NaCl application. In terms of germination percentages, the best results were observed in *A. albus*.

Keywords: *Amanthus* species; Germination; Seed; NaCl.

1. Introduction

Amaranthus is a family of plants of the Amaranthaceae family, of which about 60 species are known in many parts of the world and their leaves are vegetable, ornamental plants and seeds are counted as grains [1], as well as renewing the leaves and small seeds. It can be used for making bread by grinding [2]. In China, annual production of *Amaranthus* cereal is 60,000 hectares, making it the largest producer in the world [2].

Amaranthus is used as an animal feed due to its high nutritional value and is also used in many products such as noodles, biscuits, wine, soy sauce, and is attracting interest in markets in China. The cultivation of amarant species as cereal is based on Aztec civilizations about 5000 years ago. Seed of amarant has been high protein (12-17%) [1]. *Amaranthus* has been reported by various researchers in their flour mixtures to increase nutritional value [3]. Its flowering time is from June to August.

Amaranthus retroflexus is found in the family of Amaranthaceae, used for food, medical purposes and also as animal feed. Seeds of *Amaranthus blitoides* are used as food source. In Mexico and Peru, green leaves of *Amaranthus blitoides* were used as vegetables, and seeds were used as cereals [4]. It has also been reported that their seeds are fermented to produce beverages named *Amaranthus* beer. Plant size varies according to species and environmental conditions [1].

Salinity affects agricultural production in arid and semi-arid regions. Salinity one of the most important factors stress on cells [5]. Wouyou, *et al.* [3] found that sadium chlorite decreased germination of amarant cultivars. A study from Menezes, *et al.* [6] has reported that salt stress has affected the growth of *Amaranthus cruentus* L. As regards tolerance to salt, there are differences among families, species and species, as well as differences among varieties of the same species [5].

Amaranthus which is also popular in our country in recent years, is often used by those who want to lose weight. In this study, the effects of different salt concentrations on the seed germination of *Amaranthus retroflexus, A.blitoides* and *A.albus* species naturally grown in Şanlıurfa, Turkey were investigated.

2. Materials and Methods

Şanlıurfa which states in Turkey's Southeast Anatolia region lies between 37°49'12"- 40°10'00" east of the meridian 36°41 '28"-37°57'50" north latitude. The altitude of Şanliurfa is about 500 m and surrounded by places 600-800 m in elevation. The city Şanlıurfa is situated in semi-arid region of Mediterranean climate. In this region, the days are hot and arid in summer, mild and rainy in winter.

The climate of the region was evaluated according to the records of Şanlıurfa Meteorology Station (Table 1). As shown according to the records, the climate is dry for a long period from June to October. To determine botanical composition of *Amaranthus* species, *Amaranthus* species were dried at room temperature without disturbing the original structure and plant identifications were made according to Davis [7].

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Table-1. The bioclima type and rainfall regime of research area (Şanlıurfa)

Elevation (m)	P(mm)	M (°C)	m (°C)	Q	PE	S	Bioclima type
547	457.8	46.8	-6.8	42.94	7.2	0.18	Semi-arid, cold winter

P: The average annual rainfall (mm), M: The average maximum temperature of the warmest month (°C), m: The average minimum temperature of the coldest month (°C), PE: Summer rainfall (mm), S: Drought index S: PE/M, Q: Rainfall-temperature precedent Q: 2000xP/(M+m+546.6) (M-m)

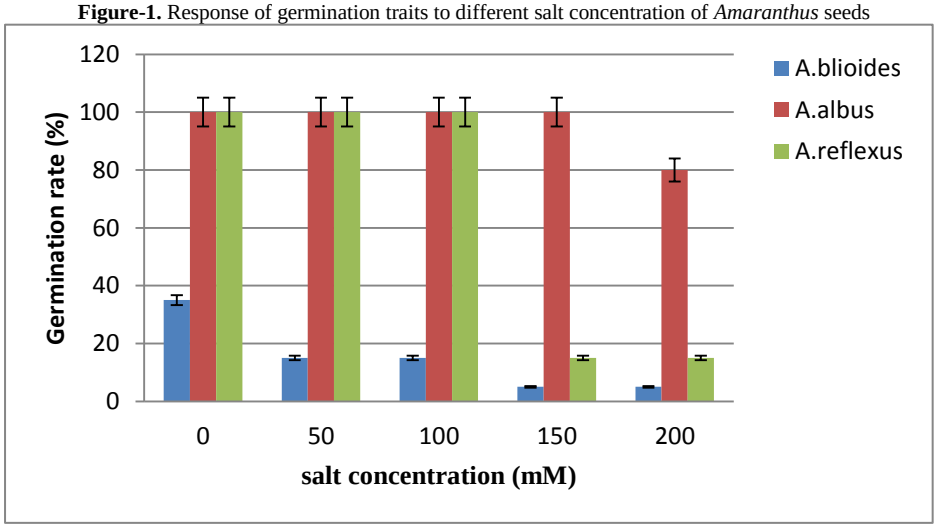
Amaranthus species were collected from Şanlıurfa's natural meadow. *Amaranthus retroflexus, Amaranthus blitoides, Amaranthus albus* seeds were used. The seeds collected from *Amaranthus* species. Seeds were kept in 95% ethyl alcohol for 5 min, 10% sodium hypochlorite for 10 min, and surface sterilized by washing 10 times in sterile distilled water. Sterile filter papers were placed in petri dishes and impregnated separately with filter paper at different doses 0 (control), 50, 100, 150, 200 mM NaCl (10 ml). The seeds were placed in petri dishes and allowed to germinate at 25 °C. The percent germination was recorded after 4 days [8, 9]. The lenghts of roots and shoots of germinated seeds were measured.

All experiments were repeated four times and data presented are averages from all experiments. Data were tested to analysis of variance.

3. Results and Discussion

In this study, the effects of different salt concentrations on the germination rates of three wild *Amaranthus* species were investigated naturally grown and collected from Şanlıurfa's meadows. It is essential to determine the salt tolerance of plants during certain growth periods, especially during the germination period, in order for the soil and water affected by salt to be used effectively. The changes in germination rate of *A.blioides, A.albus* and *A.refrexus* are presented in Figure 1. In terms of germination rate, differences between applications and *Amaranthus* species were determined (Figure 1).

Figure-1. Response of germination traits to different salt concentration of *Amaranthus* seeds

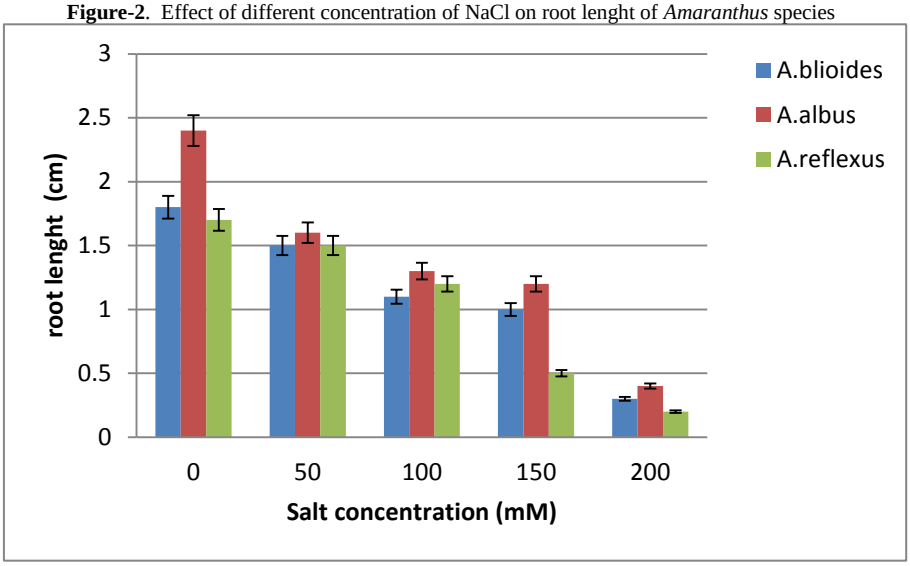


The highest germination rate was investigated in *A.albus* among *Amaranthus* species (Figure 1). This was followed by *A.refroflexus*. Increased salt concentrations have reduced the germination rate of seeds. According to Menezes, *et al.* [6], the application with 25 mM NaCl significant reduced in germination of *Amaranthus cruentus* L.

The difference between *Amaranthus* species was found statistically significant ($p<0.05$). The most resistant type to salt was *Amaranthus albus*, the most sensitive species was determined as *A.blitoides*. It has also been investigated in various studies that the germination rate and speed of seeds of wild species were low [10].

In our study; According to the seeds of two *Amaranthus* species; it is thought that the seeds of *Amaranthus blitoides* with low germination rate are dormant. For this reason, it is necessary to carry out new researches in order to overcome the obstacle of dormancy and to obtain germination at a higher level. At the end of the study, *A.albus* was not affected at 150 mM NaCl. Many authors use growth variables to select amaranth tolerant to salt stress [3, 5, 10].The highest value for root length was determined as 2.4 cm in *A.albus*, 1.8 cm in *A.bliotides* and 1.7 cm in *A.refroflexus* in control (Fig. 2).

Figure-2. Effect of different concentration of NaCl on root lenght of *Amaranthus* species



In all three species; while the highest values in shoot length and wet weight were determined in the control, the lowest values were obtained in 200 mM NaCl application. Similar results were reported for *Amaranthus creuentus* L. and other *Amaranthus* cultivars [3, 6].With the application of salt stress, the germination rate and stem shoot length of *Amaranthus* species decreased. Similar results have shown that with increasing salt stress, different plant seeds prolong the germination period, reducing seedling, root and shoot length [11, 12].

As a result, it can be said that the highest germination rate among the species investigated, which is different in the growth of germination and shoot in the increasing salt stress among the wild *Amaranthus* species, is less affected than the salt stress in the early development period of the root length of *A.albus*.

References

[1] Stallknecht, G. F. and Schulz-Schaeffer, J. R., 1993. *Amaranth rediscovered*. New York: New Crops. pp. 211-218.

[2] Yue, S. X., Sun, H. L., and Tang, F. D., 1993. *The research and development of grain amaranthus in China*. Beijing, China: Agricultural Science and Technology Publishg House.

[3] Wouyou, A., Gandonou, C. B., Montcho, D., Kpinkoun, J., Kinsou, E., Komlan, F. A., and Gnancadja, S. L., 2016. "Salinity resistance of six amaranth (amaranthus sp.) cultivars cultivated in benin at germination stage." *International Journal of Plant & Soil Science*, vol. 11, pp. 1-10.

[4] Early, D. K., 1990. *Amarant production in Mexico and Peru, Advances in new crops*. Porland: Timpers. pp. 140-142.

[5] Moosavi, A., Tavakkol, A. R., Sharif-Zadeh, F., and Aynehband, A., 2009. "Seed priming to increase salt and drought stress tolerance during germination in cultivated species of Amaranth." *Seed Science and Technology*, vol. 37, pp. 781-785.

[6] Menezes, R. V., André, D. d. A. N., Marcos, d. O. R., and Alide, M. W. C., 2017. "Growth and contents of organic and inorganic solutes in amaranth under salt stress." *Pesq. Agropec. Trop., Goiânia*, vol. 47, pp. 22-30.

[7] Davis, P. H., 1988. *Flora of Turkey and the East Aegean Islands* vol. 10. Edinburg, Scotland: Edinburg University Press. p. 538.

[8] International Seed Testing Association, I., 1996. "International rules for seed testing." *Seed Sci. And Technol.*, vol. 24,

[9] Matthews, S., 1980. *Controlled deterioration: A new vigour test for crop seeds. Hebblethwaite PD, ed. Seed production*. London: Butterworths. pp. 513-526.

[10] Luo, W. R. and Sun, Y. D., 2012. *Effects of NaCl stress on the germination characteristics of Amaranth seeds*. Advances in Future Computer and Control Systems: Springer Berlin Heidelberg. pp. 23-27.

[11] Ashraf, M. and Foolad, M., 2005. "Incuding salt tolerance in maize (Zea mays L.) through seed priming with chloride salts: growth and ion transport at early growth stages." *Acta Physiol. Plant*, vol. 23, pp. 407-414.

[12] El-Dardiry, E. L., 2007. "Effect of soil and water salinity on barley grains germination under some amendments." *World J. of Agric. Sci. Egypt.*, vol. 3, pp. 329-338.