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Combined Salinity and Lead on Physiological Responses of *Atriplex* Action; *A. halimus* L., *A. canescens* (Pursh) Nutt

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Abstract

These plants were submitted under the combined action of salinity-lead on the physiological responses of these two species *Atriplex halimus* L. and *Atriplex canescens* (Pursh) Nutt.. These plants have made an abiotic stress for a week sprinkled with solutions containing different concentrations of lead, 1000 ppm, 3000 ppm, 5000 ppm $pb(NO_3)_2$ in the presence of NaCl salt at two different concentrations, 300 and 600 $meq.l^{-1}$ compared with the results from control plants that are watered by nutrient solution HOAGLAND. Both species have undergone the same treatment. The study was based on: the determination of the content of minerals such as potassium, sodium and calcium on the aerial part (leaves), and the root portion.

Keywords: *Atriplex halimus* L.; *Atriplex canescens* (Pursh) Nutt.; salinity; Lead; halophyte; minerals.

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1. Introduction

Human activities, which have intensified over the last century have led to the accumulation of certain metal and metalloid trace elements [1]. They are responsible for a deterioration of soil quality, ecosystem functioning and quality of groundwater in some areas [2].

Among the different pollutants can introduce risks to health and the environment, lead is the one that is most often found in contaminated [3] environments.

Because of the high toxicity of this element, it seems hard to imagine that plants can find in places affected by pollution ecological niches acceptable.

However, some plants, through morphological and physiological adaptations have been able to handle this pollution by developing mechanisms to reject or accumulate these toxic elements. Moreover, salinity is a growing environmental problem around the world, especially the Mediterranean and North Africa; this is considered a most important abiotic factor that limits the growth and productivity of plants.

2. Materials and methods

2.1. The plant equipment

It consists of two *Atriplex* species; *Atriplex halimus* L, harvested from University of Oran in November 2012 *Atriplex canescens* (Pursh) Nutt. from the station Djelfa 2011.

Figure 1: The seeds are disinfected with bleach to 8% for 5 minutes and rinsed several times with distilled water to remove all traces of chlorine. After soaking the seeds of *Atriplex*, they are then germinated in Petri dishes and placed in an incubator at 25°C.

Figure1- *Atriplex* germinated seeds

Figure2- Experimental devices

2.2. Methods

The culture substrate: The substrate used corresponds to the mixture of 2 parts sand to 1 part loam, sand was brought back to the beach of Andalouses which subsequently undergoes several successive operations, including adequate screening for the production of fine sand particles. Then repeated with tap water and spirit of salt to remove all carbonates and chlorides, followed by consecutive rinses with distilled water to remove all traces of chlorides, and finally the sand is washing air dried and used to support the culture of the plant.

Transplanting: After germination, the seedlings are transferred carefully on a one seedling per pot and placed in a greenhouse located at the University of Oran, including temperature, humidity and wind factors are controlled. Irrigation is carried out at 60% of the holding capacity of the substrate is 80 ml per pot. Watering is done three times a week, two times with distilled water and once to the nutrient solution type Hoagland [4] diluted 1/1000 commonly used in the laboratory of plant physiology. After 4 months, plants of both species undergoing treatment with lead nitrate at 3 concentrations (1000, 3000 and 5000 ppm) combined with salt (NaCl) at two concentrations, 300 and 600 meq.l^{-1} with 5 replications for each treatment compared with the control plants watered by the nutritive solution Hoagland.

Sample collection: The organs (leaves, roots), are carefully separated the underground part was rinsed with tap water and then quickly dried with paper Joseph.

2.3. Extraction of minerals:

The methods of extraction and dosage of mineral elements are made on the leaves and roots of stressed and control plants by the analytical method described by [5] and which is to determine the elemental composition of a plant by first, by burning and then to the complete destruction of organic matter [6], the residue is then analyzed. After stoving of dry plant material is crushed with a mortar to obtain a fine powder, then stored in pill sealed by plugs plasma.100mg solids and incinerated at 450 ° C for 2 hours in a muffle furnace. After cooling, 2 ml of HNO3 / capsule is added, and then returns to the oven for 1 hour. The ash obtained was dissolved in 3 ml of HCl (6N), then filtered, and the volume is brought to 50 ml. From this solution, the assays of Na^+ and K^+ are made by flame photometry.

3. Results and discussion

3.1. Responses of the Atriplex halimus L. under salt stress associated with lead

3.1.1. Sodium content

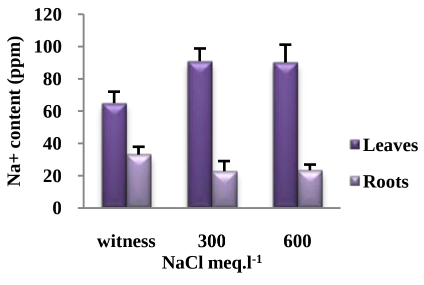

Figure 3 - Sodium content of leaves and roots of *Atriplex halimus* L. stressed to salinity in the presence of 1000 ppm of $pb(NO_3)_2$.

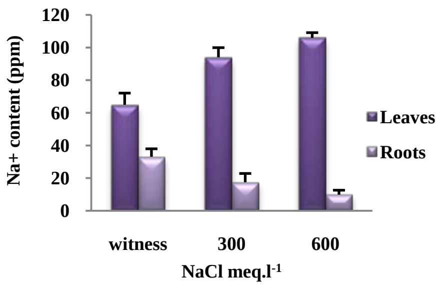

Figure 4 - Sodium content of leaves and roots of *Atriplex halimus* L. stressed to salinity in the presence of 3000 ppm of pb$(NO_3)_2$.

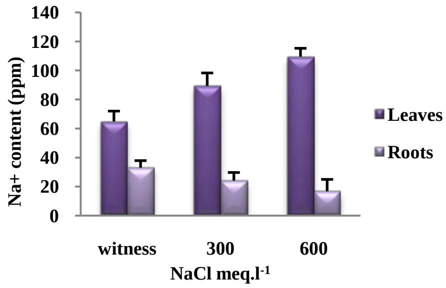

Figure 5 - Sodium content of leaves and roots of *Atriplex halimus* L. stressed to salinity in the presence of 5000 ppm of pb$(NO_3)_2$.

The Na^+ content of leaves shows an increase for stressed plants (90,92 and 90,08 ppm) for the treatment of 1000 ppm pb relative to control plants (64,88 ppm) to a level of 109,54 ppm for the last treatment applied. The analyzed roots fed with two salt concentrations in the presence or some plants 1000, 3000 and 5000 ppm of lead nitrate in a regression present content of this element relative to the control plants (22,76 to 33,08 ppm to up 16,8 ppm).

3.1.2. Potassium content

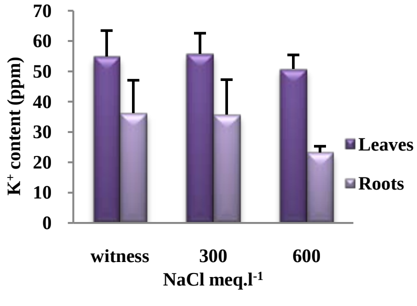

Figure 6 - Potassium content of the leaves and roots of *Atriplex halimus* L. stressed to salinity in the presence of 1000 ppm of pb$(NO_3)_2$.

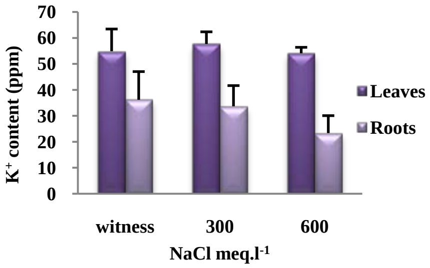

Figure 7 - potassium content of the leaves and roots of *Atriplex*. *halimus* L. stressed to salinity in the presence of 3000 ppm of pb$(NO_3)_2$.

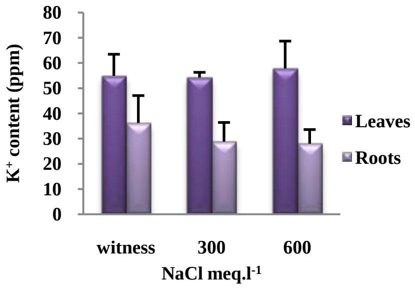

Figure 8 - potassium content of the leaves and roots of *Atriplex*. *halimus* L. stressed to salinity in the presence of 5000 ppm of pb$(NO_3)_2$.

3.2. Responses of the Atriplex canescens (pursh) nutt. under salt stress associated with lead

3.2.1. Sodium content

3.2.2.

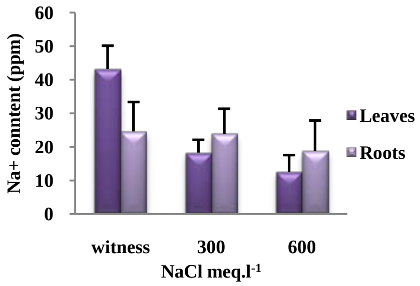

Figure 9**:** Sodium content of leaves and roots of Atriplex canescens (Pursh) Nutt. stressed to salinity in the presence of 1000 ppm of pb$(NO_3)_2$.

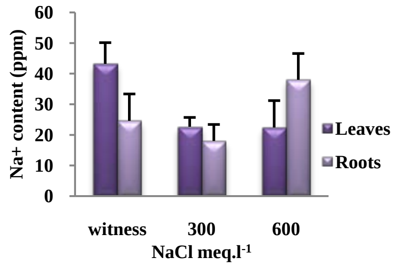

Figure 10: Sodium content of leaves and roots of *Atriplex canescens* (Pursh) Nutt. stressed to salinity in the presence of 3000 ppm of pb$(NO_3)_2$.

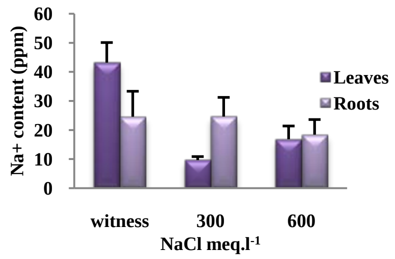

Figure 11: Sodium content of leaves and roots of *Atriplex canescens* (Pursh) Nutt. stressed salinity in the presence of 5000 ppm of pb$(NO_3)_2$.

Stress levels applied brought a considerable increase of the Na^+ sheets that appear very sensitive to the salt-nitrate combination lead which represent significant value compared to the roots which decrease of Na^+ content selected with the application of stress. Significant levels in the leaves marked for 300 and 600 meq.l^{-1} NaCl of 64.88 ppm for control plants up to 109,54 ppm for the last treatment applied. Regarding roots, decent 33, 08 to 23 ppm, 36 ppm and 17,44 ppm respectively for the control plants compared with the two salt concentrations combined nitrate bp applied up to 16,8 ppm to the last treatment.

3.2.1. Potassium content

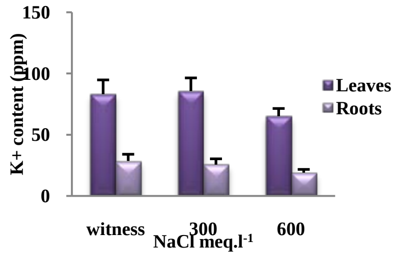

Figure 12: Potassium content of leaves and roots of *Atriplex canescens* (Pursh) Nutt. stressed salinity in the presence of 1000 ppm of pb$(NO_3)_2$.

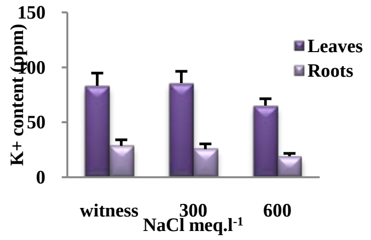

Fig 13: Potassium content (ppm) of leaves and roots of *Atriplex canescens* (Pursh) Nutt. stressed salinity in the presence of 3000 ppm of pb$(NO_3)_2$.

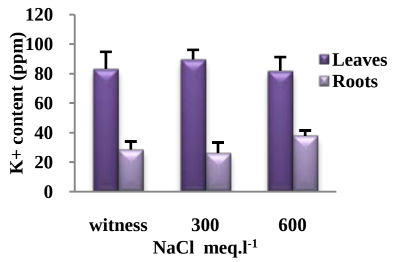

Fig 14: potassium Content (ppm) of leaves and roots of *Atriplex canescens* (Pursh) Nutt. stressed salinity in the presence of 5000 ppm of pb$(NO_3)_2$.

The contents obtained in K^+ in the leaves compared to amount of a large drop roots listing comparing stressed plants relative to control plants. It is noted that the K^+ content in the leaves increases and comparing the control plants relative to plants under salt concentrations to 300 and 600 with one meq.l^{-1} pb$(NO_3)_2$ 54,88 ppm 54,1 ppm respectively in applying stress up to 57,78 ppm. While the roots, the K^+ content decreasing with respect to the sheets, the value eenregistrant 36,2 ppm for the treatment of descending control plants up to 33,68 ppm and 28,76 ppm under stress.

4. Conclusion

The results obtained experimentally on the effect of lead and salinity have we identified the following key points:

When the plant is under stress salt-based and lead, the roots of the plant *Atriplex halimus* L. run down of the Na^+ ion by sending it to the leaves that can be charged as a result of this element, conversely to species *Atriplex canescens* (Pursh) Nutt., we note the presence of a high concentration of Na^+ to the roots than leaves. An increase in the content of K^+ in the leaves of stressed plants *Atriplex halimus* L., however, in a load store roots K^+ stress. Les which decreases with sheets of a second kind recorded content decrease in K^+ stressful, while the roots situation in cation content increases.

So are the sodium in the leaf cells of a higher K^+ with respect to the fact that the decrease Na^+/K^+ amount, while the roots, this mark relative high values.

the presence of K^+ in the cell sheets is higher than the Na^+ Plants *Atriplex canescens* (Pursh) Nutt. what means this important values of ratio Na^+/K^+ by applying the stress to the roots shows an increase values.

Our results suggest that in general saline added lead and administered to both species show that these two halophytes have resilience to changes in abiotic factors.

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