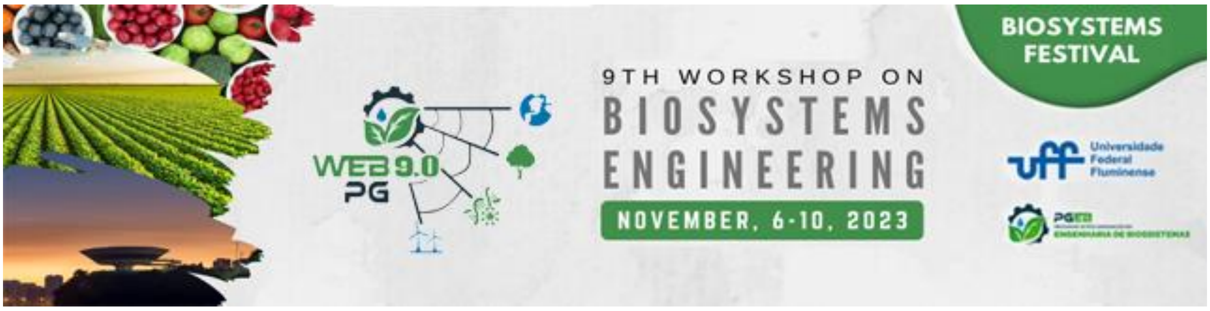

CULTIVATION OF WATER LETTUCE WITH DIFFERENT DOSES OF SALINITY

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Abstract

With the increase in pollution of water bodies, there is a need to look for decontamination alternatives. Thus, there is a need for more studies aimed at removing these pollutants, with phytoremediation emerging as an alternative, using accumulator plants such as water lettuce (Pistia stratiotes), which is a macrophyte found in fresh surface waters with a high amount of organic matter. This study sought to assess how some growth parameters and the chlorophyll concentration of water lettuce might be affected when grown in different doses of salt. To this end, an experiment was carried out in which the plants were grown for 14 days in pots containing different doses of NaCl: T1: Control (0 g/L); T2: water + 2 g/L of a nutrient solution composed of Nitrogen, Phosphorus and Potassium (15-30-15); T3: 1% of the dose of sea salt diluted in water (0.35 g/L); T4: 5% (1.75 g/L) and T5: 10% (3.5 g/L), each with 5 replicates. Leaf number, plant neck diameter and chlorophyll concentration were analyzed. The number of leaves increased in all treatments, while the diameter decreased in the presence of the nutrient solution, and in the doses of 1.75 and 3.5 g/L. The chlorophyll concentration was higher in the nutrient solution and at the 3.5 g/L dose. This indicates that small doses of salt do not affect plant growth.

Keywords: Pistia stratiotes, chlorophyll concentration, saline stress.

INTRODUCTION

Environmental pollution of water bodies in Brazil is mainly due to the lack of sanitation in large parts of cities. Approximately 50% of the sewage produced in the country is untreated (VASCO, 2022), being dumped irregularly into rivers, lagoons or directly into the sea, causing the proliferation of diseases such as dysentery and contaminating water bodies (DIB *et al*., 2022).

Sewage reaching the oceans in an uncontrolled and irregular manner occurs in many places, such as in the state of Rio de Janeiro, in Guanabara Bay, which has been suffering for years from the dumping of contaminants from different parts of the municipality (VANELK *et al*., 2021).

Thus, phytoremediation has emerged as a low-cost, environmentally friendly alternative for decontaminating the environment using plants to extract pollutants from contaminated material (NIZAM *et al*., 2020). Decontamination of the environment with plants can be used for soil and water, and the plants used for this process are characterized by high biomass production (POLIŃSKA *et al*., 2021).

Water lettuce (*Pistia stratiotes*), as it is known, is a common macrophyte in environments with fresh and still waters, with a high potential for proliferation in eutrophic environments. It has accelerated growth under the influence of light in open environments (FARNESE *et al*., 2014), and has great potential for phytoremediation (SANTOS *et al*., 2021).

Belonging to the Araceae family, it has no apparent stem and can reproduce both sexually and asexually (MARTINS *et al*., 2002). Its asexual reproduction occurs through lateral shoots (stolons), which appear regularly, rapidly increasing its biomass and consequently its area of occupation (CÍCERO *et al*., 2007).

It is a tropical plant that is intolerant of the cold, but its seeds are capable of surviving freezing temperatures and prefer water with an acidic pH and organic matter (SILVA, 1981), but little is known about growing the species in saline environments. This study therefore sought to assess how some growth parameters and chlorophyll concentration in water lettuce might be affected when grown in different salt doses.

MATERIALS AND METHODS

The study was carried out in a greenhouse with 70% shading, located on the Gragoatá campus of the Fluminense Federal University in Niterói, RJ. Its coordinates are 22º 54' 00"S latitude and 43º 08' 00"W longitude, with an altitude of 8m. The tropical climate is dominant in the area, with a dry and rainy winter, an annual rainfall of 1200mm and an average annual temperature of 23ºC.

The water lettuces (*Pistia stratiotes*) used came from a seedling bank on the Aubergue Suisse farm, located in Nova Friburgo in the state of Rio de Janeiro. The plants selected were those that were not in the process of reproduction and had between 7 and 10 leaves.

The experiment was carried out in a completely randomized design, containing one plant species and 5 different doses of salt, as described in Table 1, using the dose of sea salt (35 g/L) as a reference for the different dosages. The five treatments consisted of: T1: (Control) grown only in water, i.e. 0 g/L of salt; T2: water + 2 g/L of nutrient solution composed of Nitrogen, Phosphorus and Potassium (15-30-15); T3: 1% of the dose of sea salt diluted in water (0.35 g/L); T4: 5% (1.75 g/L) and T5: 10% (3.5 g/L), with 5 repetitions in each treatment.

Table 1: Doses of salt by treatment

Treatament	0%	T2 (Nutritive Solution)	T3 (1%)	T4 (5%)	T5 (10%)
Quantity of salt	0	2 g/L	0.35 g/L	1.75 g/L	3.5 g/L

To start the experiment, the treatment pots were prepared by adding the doses of NaCl to the water in which the plants were grown for 14 days, with an initial analysis being carried out every 7 days. The following analyses were carried out: number of fully expanded leaves (units); neck diameter, using a caliper (mm); chlorophyll concentration, using a Minolta SPAD-502 portable chlorophyll meter and measurements were taken on three different leaves per plant, considering only the lower two thirds of the leaf ($\mu g\ cm^{-2}$).

The data obtained was processed using the SISVAR® program, where a factorial analysis of variance (ANOVA) was carried out, followed by a Tukey test at 5% probability.

RESULTS AND DISCUSSION

To better analyze the data, the sequence of days of analysis was evaluated together for each treatment individually, in order to see if there were any changes in the plants so as to understand how the presence of salt influenced their growth. It can be seen that in all five treatments the plants increased their number of leaves (Figure 1) as the days went by, but in all the treatments at the end, they did not differ from the control. On the fourteenth day, the only treatment to lose leaves was the one with the highest dose of salt containing 3.5 g/L, but without differing from the others.

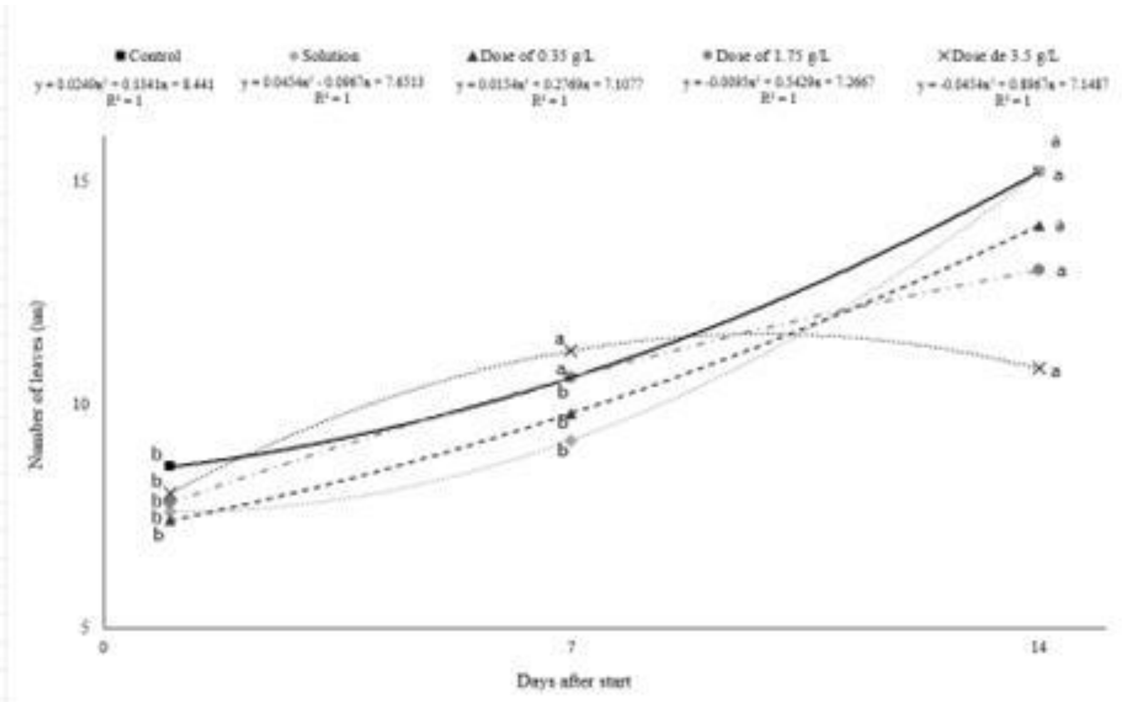

Figure 1: Number of leaves in units with a 7-day interval between analyses. Equal letters on the same day do not differ statistically by Tukey's test at 5%. Values represent the average of n=5.

For the diameter of the neck, despite the increase in the number of leaves over the course of the fourteen days, there was a reduction for the nutrient solution treatments and the doses of 1.75 and 3.5 g/L, as can be seen in Figure 2. The absence of salinity in T1 may have influenced the plant's process of remaining stable and increasing its diameter, while in the 0.35 g/L dose the plant showed no statistical differences in diameter measurement over the fourteen days.

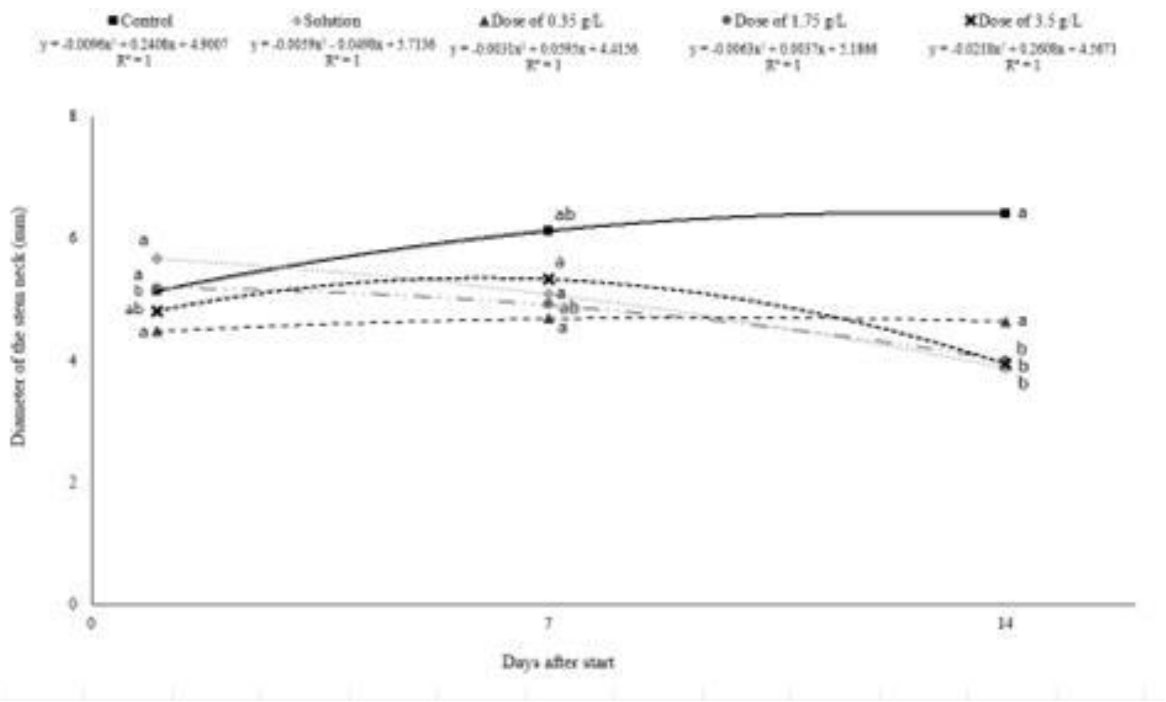

Figure 2: Stem neck diameter (mm) with a 7-day interval between analyses. Equal letters on the same day do not differ statistically by Tukey's test at 5%. Values represent the average of n=5

The concentration of chlorophyll in plants is an important factor in assessing possible signs of stress (SANTOS *et al*., 2012). The treatment containing the nutrient solution was the one that showed the best performance, accompanied by the treatment with the highest dose of salt containing 3.5 g/L, where there were no statistical differences between them. This higher concentration of chlorophyll is extremely important because it is linked to the presence of nitrogen in it and is a response to the efficiency of the photosynthesis process (NEVES *et al*, 2005).

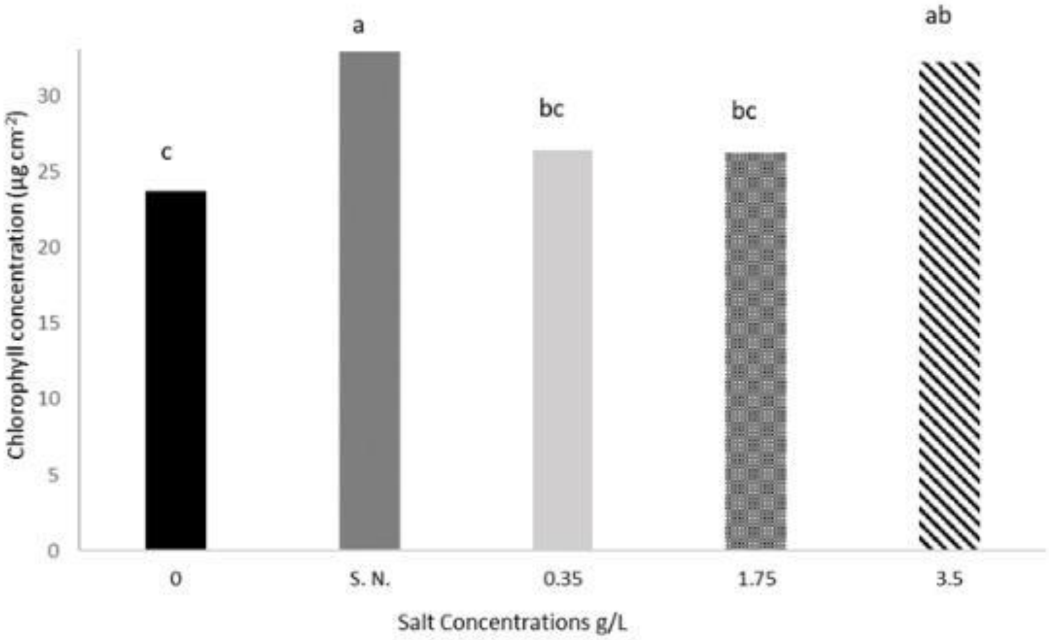

Figure 3: Chlorophyll concentration (µg cm^{-2}). Equal letters do not differ statistically by Tukey's test at 5%. Values represent the average of n=5

Oliveira *et al*. (2010) state that the effects of the presence of salt on plant growth and development come from the reduction in the osmotic potential of the solution, leading to water stress. The factors most affected by the presence of salinity is the reduction in growth due to the imbalances suffered by the plant (Sousa *et al*., 2011).

When evaluating the two growth parameters together with the chlorophyll concentration, it can be seen that the presence of salt in small quantities did not significantly interfere with plant growth.

CONSIDERATIONS

The presence of salinity in the aqueous medium affected the diameter of the neck, but there were no statistical differences in the number of leaves. The chlorophyll concentration was higher for the plants grown in the nutrient solution and for the 3.5 g/L dose, indicating that in small doses, the presence of salt did not influence the plant's growth.

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PRESENTATION: https://youtu.be/cfrRLx1M6zA