

The study of some phenotype and physiological characteristic of water hyacinth *Eichhornia crassipes* (Mart.) Solms-Laubach on different regions of Thi-qar governorate .

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Abstract

The plant of water hyacinth *Eichhornia crassipes* is an abundant floating aquatic weed that has great potential for reproduction in Iraq especially at Thi-Qar governorate at last years, So the study was conducted on plant at three different regions to know the differences on some phenotypic characters are (plant high , root long , number of leaves , leaf area and the fresh and the dry weights of leaves) . The results were revealed a clear difference at plant high , root long , number of leaves , leaf area , fresh and dry weights of plant shoots , also concentrations of chlorophyll , carotenoids , carbohydrates and proteins were estimated . It was found that a clear difference on the concentrations of the components that were studied .

The ability of plant for extraction and accumulation of some heavy metals (Pb , Cd , Cu , Zn and Mn) and its concentrations on plant tissues , water and soils were studied . The results were showing that , concentrations of heavy metals ranged between (0.32 – 25.24) mg / gm on the plant tissues , whereas ranged between (0.09 – 2.40) mg / l on water and ranged between (0.53 – 26.66) mg / gm on plant soil . From the results , it was noticed that , the high concentration of lead and the low concentration of cadmium .

Key words : vegetative growth , heavy metals , water , sediments , water hyacinth

I. **Introduction**

The water hyacinth (*Eichhornia crassipes* (Mart) Solms-Laubach) belongs to the family (Pontederiacae), a herbaceous plant of the same species. It is floating in water bodies, growing, multiplying rapidly, consuming large quantities of water, absorbing large quantities of dissolved oxygen in water which causes a change in the properties of water and makes it smell foul and thus a polluted environment and a real threat to aquatic organisms in the countries in which it is located, and the plant is the most dangerous aquatic plant, which exists in the form of stable colonies in shallow water and deep, fixed or moving, Fresh and Fresh (Villamagna, 2009). The native Atlantic is tropical or subtropical in South America, and there are currently plants in the warm world of the world (Agunbiade *et al.*, 2009), it is currently spread in more than 50 countries between latitudes 39 North and 39 South (Centeret *et al.*, 2005). The plant grows in the form of a dense vegetative surface on the surface of the water, formed by a large mass in a short period of time as a result of its rapid multiplication. Of this capacity and has the potential to re-grow by various means in the event of abnormal conditions such as control, rapid response and adaptation to environmental changes and severely affects the ecosystem, which is not a problem in its native habitat due to the existence of ecological balance (Tellez, 2008).

The plant of the Nile Flower is a plant that has spread in the last decades to various continents of the world from the original home in South America to different parts of the world, including Iraq, and the plant has the ability to grow rapidly and its biomass is very large and bears a number of heavy metals (Suchsmitaet *al.*, 2016), and the lack of sufficient knowledge of the nature of plant growth under environmental conditions in Iraq, the purpose of the study was to understand how the plant grows under different environmental conditions on the one hand and to study some of the vegetative and plant properties of the plant and knowledge of its ability to accumulate heavy metal elements on the other.

II. **Materials and Methods:**

This study included the collection of plant samples from three sites, the first from the Euphrates river and its branches (the city of Nasiriyah St1), the second from the Graf river (St2), the third from the water of Al Eslah district (St3) and collected samples of water and soil for the study sites. The samples were collected by three replicates and each of the three sites, The following:

1. Indicators of vegetative and root growth:

The height of the plant (cm) was measured by the metric tape, as well as the average number of leaves calculated by taking the mean of the three replicates for each of the studied sites.

2. Soft and dry weight of leaves:

The weight of the leaves was estimated by a sensitive balance and the weights were recorded. The samples were then placed in the incubator for drying at 75 ° C for 48 hours and then weighed after cooling to determine the dry weight of the leaves.

3 - the leave area of the plant:

The leave area of three leaves randomly taken from each plant species was calculated according to their location using the equation (Mckee, 1964):

$$\text{the leave area cm}^2 = 1.25 \times 3.143 \times \text{Paper length (cm)} \times \text{Width (cm)}$$

4 - Determination of protein concentrations and dissolved carbohydrates:

(Herbert *et al.*, 1971), about 200 mg of fresh samples and was crushed with 10 cm³ of distilled water in a ceramic vase and then centrifuged for 15 minutes. (50) for 30 minutes. The centrifuge was then reused and leachate free of solids and chlorophyll was taken. The absorbance of the protein was measured using a (Spectro SC Labomed)In spectral device of American origin at wavelength of 600 nanometers Carbohydrate uptake was measured at wavelength (490) nm.

5- Determination of the concentrations of plant pigments:

The concentration of chlorophyll was determined by the modified Arnon-Makinky method (2004). The weight of 100 mg of fresh plant leaves was crushed with 10 cm³ of acetone at 80% by ceramic mortar. The filtered was read at the wavelength (663 and 645) nm using the process of the centrifugation process at a rate of 3000 cycles / min for 5 minutes. Optical spectrometer The chlorophyll concentrations were calculated according to the formula described by (Arnon, 1949).

$$\text{Mg. g}^{-1}\text{chlorophyll a / mg tissue} = [12.7 (D663)] - [2.69 (D645)] \times v (100xw)$$

$$\text{Mg. g}^{-1}\text{chlorophyll b / mg tissue} = [22.9 (D645)] - [4.68D633] \times v (100xw)$$

$$\text{Mg. g}^{-1}\text{chlorophyll / mg tissue} = [20.2 (D645)] + [18.2 (D633)] \times v (100xw)$$

V = the final size of the filter (cm³).

D = Optical density of chlorophyll extract.

W = fresh weight (g).

Carotenoids were estimated at wavelength (480) nanometers by the method described by Davies (1965) and calculated on the basis of the following equation:

Optical intensity at wavelength (480) x Total solution size x1000

$$\text{Total carotene (mg / gm)} = \text{-----} 10x \text{-----} 100 \times 250$$

Heavy metals:

The total heavy metals (both soluble and suspended) were estimated in the water samples by taking 50 cm³ of the water sample and 5 cm³ of nitric acid was added to it and then heated at 70 ° C to pre - (3) of HCl (0.5 N) for the purpose of dissolving the salt, and then complete the volume with ions free distilled water to 25 cm³ and save in plastic bottles until measured with the British 986 British Atomic Absorption Spectrometer (APHA) , 2003). Extraction of heavy metals from soils was followed by Yietal (2007). The extraction of heavy metals from the Nile vegetation was adopted (Orson et al., 1992) in the extraction process.

Statistical analysis:

The statistical comparison between the averages was performed by the analysis of variance (ANOVA), using the (T test). The statistical program Spss 11 was used, and the least significant difference was used at the moral level (P <.05), (Narrator and Behind God, 2000).

III. Results and discussion:-

The results in Table (1) show the apparent differences in plant height rates in the different studied sites, and this difference may be due to the plant growth method in these sites. When increasing its density in the area unit, the plant tends to increase in height, While the plant density of the unit of area is few, the plant tends to horizontal growth more than vertical growth, as well as note the difference in the rate of the number of papers and may be due to the composition or increase the number of leaves when available food and heat appropriate but the number varies according to the nature of plant growth, a For months when the formation of new leaves is lacking, the plant tends to form new leaves. By noting the table above, the number of leaves is not as important, but the leave area is important because the nature of the growth of this plant can produce a large number of leaves, especially in the cold atmosphere, but the leave area is limited. (Didham, *et al.*, 2005; Wilson *et al.*, 2005)

Table (1) :shows the phenotypic characteristics of the Nile flower plant in different locations

Location	Average Leave dry weight (g)	Average Leave fresh weight (g)	Average Leave area (cm ²)	Average number of Leave	Average Root lengths (cm)	Average Plant height (cm)

St1	10.00	86.00	2.82	9.00	12.27	74.00
St2	12.00	90.00	4.71	8.00	14.92	82.08
St3	12.00	88.00	5.89	15.00	16.9	90.53
LSD	0.00	2.00	1.18	0.66	1.17	8.08

Table (2) shows the apparent differences in the ratio of chlorophyll, carotene, carbohydrates and protein. This means that the increase in the area occupied by plants is due to the production capacity of photosynthesis. This means that the rate of photosynthesis is very high compared to other plants or jungles. Which indirectly encouraged the spread and difficulty of combating it. Evidence of this was observed to have a high positive relationship between the leave area and the number of leaves and dry weight with the area occupied by the plant (Al-Waka'a, 2012).

Table (2): shows that(%) of chlorophyll (a, b) total carotene, carbohydrates and protein:

Location	Chlorophyll a	Chlorophyll b	Total Carotene	Carbohydrates	Protein
St1	41.87	39.20	1.61	34.02	10.62
St2	45.36	39.24	1.98	46.11	15.43
St3	47.14	41.73	3.99	51.25	15.25
LSD	1.78	0.03	0.36	5.13	0.17

As for the heavy metals measured in the study sites, there were significant differences between the heavy metals estimated in the water of the stations, except for copper. The location (2) differed from the rest of the water at the level of P (0.05) The highest concentration of lead at site (3) and the lowest concentration of cadmium in situ (1) was due to the large amount of water from nearby residential areas, the container of wastewater and household waste, as well as proximity to the sites a The differences in the concentration of minerals studied according to the studied mineral composition to the suspended particulate matter and the tendency of most of these minerals to adsorption and binding on the surfaces of the suspended particulate matter, organic matter and mud in the water column.(Edword *et al*, 2013)

Table (3): Concentrations of heavy metals in water (mg / L)

Metals location	Cd	Cu	Mn	Pb	Zn
St1	0.09 ± 0.01 ^c	0.53 ± 0.030 ^b	0.60 ± 0.015 ^a	0.57 ± 0.01 ^c	0.43 ± 0.020 ^c
St2	0.48 ± 0.02 ^a	0.76 ± 0.025 ^a	0.20 ± 0.020 ^c	1.80 ± 0.01 ^b	0.64 ± 0.025 ^b
St3	0.31 ± 0.45 ^b	0.43 ± 0.030 ^b	0.39 ± 0.020 ^b	2.40 ± 0.10 ^a	1.06 ± 0.020 ^a
LSD	0.16	0.10	0.17	0.60	0.22

As for the heavy metals whose concentrations were estimated in the soil of the study sites, no significant differences were observed between the two sites (2 and 3) for the cadmium and magnesium minerals. The rest of the other minerals found significant differences in the studied sites (as shown in Table 2) . The highest concentration of Pb was recorded in site (1) and the lowest concentration of cadmium in situ (3). This may be due to uneven concentrations of the minerals studied in the sediment, or possibly due to dust storms and rainwater contaminated with high concentrations of these minerals to the river water and likely Also to the effect b Environmental factors in the release or retention of heavy metals, pH values, salinity and soil tissue also play an important role in reducing the toxicity of heavy metals to aquatic organisms because they form complexes with chlorine ion, making the metal not readily available for use and sedimentation, Minerals in Sediments (Al-Kinzawi, 2007)

Table (4) :Trace elements in soils (mg . g⁻¹)

Metals Location	Cd	Cu	Mn	Pb	Zn
St1	0.64 ± 0.05 ^a	9.4 ± 0.025 ^a	3.2 ± 0.020 ^a	26.66 ± 0.010 ^a	7.4 ± 0.030 ^c
St2	0.57 ± 0.025 ^b	7.3 ± 0.025 ^b	1.60 ± 0.030 ^b	17.47 ± 0.015 ^b	3.4 ± 0.020 ^b

St3	0.53 ±0.035 ^b	3.5 ±0.040 ^c	2.35 ±0.030 ^b	13.01 ±0.010 ^c	1.06 ±0.015 ^c
LSD	0.05	2.09	0.72	4.36	0.77

As for the concentrations of heavy metals estimated in the Nile flower plant, there were significant differences between the concentration of lead only in the studied sites. There were no significant differences between their concentrations at the studied sites (as shown in Table 3). This is probably due to the cumulative capacity of aquatic plants. In addition, some aquatic plants can take heavy metals associated with sediments and water through the root system, as well as by analyzing the mineral content of the plant gives a good indication of the state. The aquatic environment and what may have been exposed to it. Therefore, the study of the plant, which can be prevalent in these sites, which may be used as food for aquatic and also the reason for the presence of these minerals in the tissues of the plant, may be due to the ability of the plant to introduce some heavy metals that are essential to plant life through the process of effective transport, when exposed to heavy metals, water plants produce phytochelatin, which are rich in thiol, which in turn interferes with the removal of the toxicity and natural balance of heavy metals in plants (AL – Ebady, 2015). This is done by the phytochelatin synthase, which activates the presence of heavy metal ions stamla the glutathione-based poulitce, and the cells in response depends on the existing metal type (Al-Haidari, 2003).

Table (5) :Concentrations of heavy metals in plants (mg / g)

Metals Location	Cd	Cu	Mn	Pb	Zn
St1	4.16 ± 0.03 ^a	9.1 ± 0.08 ^a	0.23± 0.025 ^b	25.24 ± 0.010 ^a	16.5 ± 0.015 ^a
St2	2.63 ± 0.04 ^a	7.3 ± 0.03 ^b	1.02± 0.010 ^a	23.42 ± 0.030 ^b	13.51 ± 0.015 ^b
St3	0.32 ±0.04 ^b	1.24 ±0.015 ^a	1.18 ±0.020 ^a	19.67 ±0.025 ^c	12.76 ±0.025 ^b
LSD	1.53	1.83	0.20	1.83	0.87

IV. References

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