The Ecological Response of Medicinal Plant Watercress (*Nasturtium officinale* R. Br. (Brassicaceae)) to Different Sources of Water in Different Times

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Abstract

This study investigated the watercress (*Nasturtium officinale*) belongs to Brassicaceae grown at Reshen area where is located in Halabja - Iraqi Kurdistan Region, to investigate the effect of different sources of water in different collection times on the Phenotypic (morphological characters) and content of the chemical compounds of plants which studied which illustrate the comparative of minerals which exist in clear and polluted water and also exist in the vegetative and the root parts of collection of watercress (*Nasturtium officinale*), which are growing in this area. The results have shown; watercress obtained from clear water in both times are healthy more than polluted water. A large amount of nutrient variability were observed in measured traits, the measured traits showed significant variations across the two sources of water and plants collection time distribution and there were the significant difference in measured traits at two different sources of water chemically (i.e., Ca, N, and Fe). polluted water in two times (first and second times), caused increasing vegetative fresh weight and root, dry vegetative and root parts, branch number, plant height significantly. The result shows that plant from polluted water in second collection time had a better response than other treatments, but it's not healthy.

Keywords: Brassicaceae, Clear and polluted water، Phenotypic, watercress, Halabja.

الاستجابة البيئية للنبات الطبي جرجير الماء (كوزه له) *Nasturtium officinale* (Brassicaceae) لمصادر مختلفة من المياه باوقات مختلفة

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الخلاصة

اجريت هذه الدراسة على نباتات النوع *Nasturtium officinale* (Brassicaceae) النامية في منطقة ريشين في حلبجة -كوردستان العراق ، وتضمنت الدراسة تأثير مصادر مختلفة من المياه في أوقات جمع مختلفة على الصفات المظهرية والمحتوى الكيميائي لنباتات النوع المدروس والتي توضح المقارنة بين عناصر المعادن التي توجد في المياه النقية والملوثة والموجودة في الاجزاء الخضرية وفي جذور النبات النامية في هذه المنطقه. أظهرت النتائج التي تم الحصول عليها من المياه النقية بانها أكثر صحية في كل الأوقات من المياه الملوثة وقد لوحظت كمية كبيرة من تقلب المغذيات في الصفات التى تمت دراستها ، وأظهرت الصفات التى تمت دراستها اختلافات كبيرة عبر مصدرين من توزيع المياه واماكن ووقت جمع وكان هناك اختلافات كبيره في الصفات يقاس على اثنين من مصادر مختلفة كيميائيا من المياه مثل (الكالسيوم، النيتروجين والحديد). وقد أظهرت النتائج ان المياه الملوثة في مرتين (المرة الأولى والمرة الثانية) ادت الى زيادة الوزن لكل من (الاجزاء الخضريه الطازجة والجذور، الاجزاء الخضرية الجافة والجذرية ، عدد افرع النبات) وارتفاع النبات إلى حد كبير. وتظهر النتائج ان هذا النبات النامي في المياه الملوثة في وقت الجمع الثاني كان ذو استجابة أفضل من العلاجات الأخرى ولكنها ليست صحية.

الكلمات المفتاحية: العائله الصليبية ، المياه النقيه والملوثة ، الشكل المظهري ، watercress ، حلبجة .

Introduction

The watercress belongs to Brassicaceae family, which is growing at riversides are aquatic plant or semi aquatic plant , **(**Annalakshmi *et al*. 2012**)** state that *Nasturtium officinale* is found in shallow, cold, gently moving, fresh water in lakes, reservoirs, streams, rivers, and on damp soil. It is important to note that the plant, free source and level will make a difference in nutrient uptake. The macrophytic plants will directly affect the available biomass for storage and translocation as well as resistance and susceptibility to toxicity, **(**Turgut *et al*.2004**).**It is also often found in gently flowing streams, or "areas of running water adjacent to springs and river banks or on wet soil, a prominent role in this process is played by the popular cruciferous vegetables (Brassicaceae), which contain several bioactive compounds with consequent antioxidant and other health-promoting properties, one of these vegetables is watercress (*Nasturtium officinale*) used as a medicinal plant in Kurdistan, **(**Li *et al*. 2009**).**It also is an edible plant; the vegetative green parts are used a lot from human like other vegetables. The main purpose of utilizing watercress as cited that watercress leaves are used as a green salad, or can be steamed and consumed as a normally processed vegetable, **(**Rose *et al*. 2000**)**. Watercress has always been used for the treatment of pulmonary tuberculosis, as well as some sexually transmitted diseases, which began to surface in the western world again. In Vietnam, during the war with the United States, hundreds of American soldiers wounded tuberculosis during the war there, and did not often succeed so conventional treatment, which is given to know traditional doctors, but the juice of both lack the Watercress, with *Beta* juice, as well as added to them Summary garlic plant liquid, at a rate of a small cup twice a day and when you eat it works to speed healing of tuberculosis in a spectacular way, given as it contains all of the garlic and lack of delight the eye of organic sulfur, which has the upper hand in breaking the unity of the microbe that causes tuberculosis (tuberculosis bacteria) and the traditional resistance to the drug at the same time. In China, where the plant is grown and used in abundance, they will use in the treatment of gingivitis and of redness and swelling of the gums with bleeding them. In case of illness logical herpes is known (Shingles) talk that taking 500 mg of the basic amino acid (lysine Lysine science has said) at a rate of three times a day, it works to reduce the symptoms of the disease and associated pain to him, where he is surrounded Allecin each individual cell It prevents the arrival of the virus to the inside, it was found that the Watercress plant contains a high proportion of this amino acid. The juice of this plant contains removers toxins from the body, and it also fought for worms and internal parasites, the juice is useful for diabetics, as it lowers blood sugar, and reduces inflammation of the nerves associated with the case, prevents hair loss, as well as dealing with the inflammation of the airways and lungs. Watercress is also used for the treatment of localized and control of some cases of muscular rheumatism, gout pain, especially if adding a cabbage or cabbage juice or even a massage paper external topical, (http://www.musslima.org/forum/showthread.php). Watercress contains a relatively large amount of vitamins C and provitamin A, folic acid, iodine, iron, protein, and especially calcium and Sulphur compounds, which influence its characteristic odor, but also adds to its nutritional benefits. Is containing many mineral and vitamins which supply human body,this plant is growing in different environmental and water either fresh water or polluted water or in a full heavy metals water. In addition, watercress has also a history of medicinal use. This plant is vegetable which has been the focus of several studies regarding its anticancer properties, mainly due to its high anti-oxidants content, (Murphy et al., 2001). The soil pH range for *N. officinale* is between 4.3 and 8.3. It is locally abundant in nutrient rich waters and prefers abundant sunlight. In addition, the *Nasturtium officinale* growth in a different sources of water needs doses of carbon dioxide, sunlight, and nutrients for photosynthesis, while it can obtain nutrients from both the water and soil, it requires its nitrate from the water and iron from the substrate, an analysis in the British Isles shows that the plant grows in waters with plentiful potassium, calcium, magnesium, nitrate, and sulfate. However, phosphate quantities were low and it is known that phosphorous fertilizers are the only ones used in commercial production of watercress, **(**Howard & Lyon 1952**).** The mechanisms of obtaining nutrients due to growing two types of root systems of *N. officinale* allow the plant to shift its nutrient uptake depending on environmental conditions, for example, when large amounts of phosphorous are present in the water, more phosphorous will uptake in the adventitious roots, conversely when less phosphorous is available in the water column, the plant uptakes more phosphorous from the substrate through its basal roots system, **(**Cumbus & Robinson 1977**).** Also, chelating agents can translocation the metal from roots to above ground parts of plants, **(**Turgut *et al.* 2004**).** Furthermore, Aquatic plants are known in accumulating metals from their environment, (Outridge & Noller, 1991; Ali & Soltan , 1999), and affect metal fluxes rough those ecosystems, (Nadar *et al*. 2009; Srivastov *et al*. 1994).Pollutants and environmental pollution can lead to significant problems for both living organisms and societies, the increases in worldwide population, as well as the advances in technology, contribute significantly to environmental pollution, **(**Shokrzadeh *et al*. 2009**)**. This study investigated the interaction between elements concentration in the plants and growth medium (water) to determine the plant's nutritional value by comparing to recommended dietary between the source of water and different times, this study is the first that dealt with this species in such a field in Iraq.

Materials and Methods

This study was carried out in (Reshen) from Halabja province from the first of September 2015 to the first of January 2016. The geographical location of the experimental station was 35º 36´ N and 45º 46´ E with the altitude of 726m.Average annual rainfall rate (600-800 mm/year).

The sources of the Plants that used in the experiment

Samples were collected from two different sampling sites (two sources) in five different dimensions along the river Reshen September 2015 during the early hours of the day. The sampling sites were Clear and polluted water about 1 bunch of watercress (10 plants per bunch), including the roots, were collected from each site and stored in the plastic bag. Approximately 1000 mL of surrounding water (growth solution) was collected from each site, Physical and Chemical analysis of the mediums and dehydrated plants. Watercress was gathered along a variable length of each of the water ways depending on the abundance of the watercress. Sampling commenced in the second week of September 2015 and continued for a total of three weeks.

Plants parameters

1.Some physical and chemical characteristics of the water and digested vegetative plants:Used PH, Color, Ec, TDS meter to determine (PH),(Color),(Ec),(TDS), (Howard & Lyon,1952), determination of some elements (K^+, Na^+, Ca, Mg), (Bullock & kirk,1935). (CaCO3, Cl, SO4, Fe, No3).Total alkalinity, choicer standard methods prescribed by (Inam *et al*.2011; Osorio & Linas , 1998). Vegetative mineral determination: From each dried leaf sample 0.5 gm was digested using perchloric acid and sulphuric acid mixture (1:1), **(**Piper, 1950**).** for the following mineral analysis: Total nitrogen by semi micro-Kiel Dahl method as out lined by **(**Pregel, 1945**)**. Potassium and Sodium were estimated photometrically using the methods recommended by **(**Brown & Lilleland, 1964**)**. Calcium, magnesium, and iron were determined using atomic absorption spectrophotometer "Perkin Elmer 3300" after **(**Chapman & Pratt, 1961**)**. The non-metal elements such as chloride (Cl), nitrate (NO3) and sulphate (SO4) in the Vegetative samples were determined using test kits purchased from Merck Chemicals (Darmstadt, Germany) The Inductively Coupled Plasma Atomic Emission Spectrometer (ICP-AES) instrument model used was Arcos from M/S.

2. Fresh Vegetative and root Weight per plant (g): on plant was chosen from each sample, removed from the soil surface, washed out and cut to separate the green part from the root part and finally weighing them by using scales.

3. Dry vegetative and root weight per plant (g): After taken weight of the fresh roots and vegetative, they were put in the oven (105 C°)for 24h, lastly weighting them by using sensible scales as it has been mentioned by (Al-Sahaf, 1989).

4. Branches numbers (number/plants): The branches of the main stem have been counted for each plant at the beginning of collecting plants.

5. Plant Height (cm): The length has been measured from the surface of the stem to the top of the plant by using the ruler at the beginning of collecting plants.

6. Statistical analysis: All data of the present investigation were subjected to analysis of variance and significant difference among means was determined according to **(**Snedecor & Cochran, 1972**)**.Whereas, capital and small letters were used for differentiating the values of specific and comparison effects of investigated factors, respectively. The means comparison was done by Duncan's Multiple Ranges Test under 5% which was claimed by (XLSTST 2000), **(**Duncan, 1955**)**.

Result and Discussion

Taxonomic Notes

Nasturtium officinale is an emergent perennial herb, Plate (1 A,B), 8 to 70 cm high, the roots type are fibrous with short stalks. It is usually found in clumps in cold, gently flowing, shallow fresh water. It will be emergent through the winter in waters that do not freeze. Older leaves are compound with many wavy-edged, oval or lanceolate - shaped leaflets growing from a central stalk. The leaves are between 3 and 14 cm long, with the end leaflet typically being the largest, flowers are 3-5 mm long and have 4 white petals. Its fruits are 8 to 28 mm long and 2 mm wide and found on stalks that are 5 to 15 mm long. They are thin, slightly curved cylinders and contain 4 rows of small, round seeds.

A B

Plate (1 A, B): *Nasturtium officinale* (watercress) (floating stems) grows in Reshen area from Halabja province.

Physical and chemical characteristics of plants

The data in Table (1& 2) show that watercress (*Nasturtium officinale*) obtained from clear water in both times are healthy more than polluted water and the samples have given from polluted water had more elements in comparison to clear water except Fe^{2}& Fe^{3}(0.08 mmol. L^{-1}) that in the second time in clear water was more than second time in the polluted water with waste.

Table (1): Some physical and chemical characteristics of the water that *(Nasturtium officinale)* grown in different source of water on different plants collection times

N	chemical analysis	Result of clear water		Result of polluted water	
		15/10/2015	15/11/2015	15/10/2015	15/11/2015
1.	PH	7.34	7.12	6.98	5.95
2.	Color	Nil	Nil	Nil	Nil
3.	EcdS / m	620	788	312	418
4.	TSD	396.8	421.1	199.6	401.8
5.	K mg L^{-1}	2.75	3.88	3.6	4.15
6.	Na $mmol_c.L^{-1}$	41.57	52.31	6.35	7.33
7.	Ca $mmol_c.L^{-1}$	98.2	91.3	66	71
8.	Mg $mmol_c.L^{-1}$	31.6	32.6	18.21	20.18
9.	$CaCO_3mmol_c.L^{-1}$	290	410	200	270
10.	Cl $mmol_c.L^{-1}$	45	55	42	63
11.	$SO^4mmol_c.L^{-1}$	72	61	12	13
12.	Fe ^{2}& Fe $^{+3}mmol_c.L^{-1}$	0.0.01	0.0.3	0.0.5	0.0.8
13.	$NO_3mmol_c.L^{-1}$	3.25	4.26	8.7	9.6
The water was analyzed at Soil & Water Dept. Laboratories/ The Directorate of Water & Irrigation in Sulaimaniya					

Table (2): Some physical and chemical characteristics of digested vegetative plants of the media that watercress *(Nasturtium officinale)* grown in a different source of water on different plants collection times

Fresh weight (g/plants):

N	Plants chemical analysis	Result plants in clear water		Result plants in polluted water	
		15/10/2015	15/11/2015	15/10/2015	15/11/2015
1.	PH	7.24	7.58	6.78	6.12
2.	Color	Nil	Nil	Nil	Nil
3.	EcdS / m	457	612	722	841
4.	Kmg L^{-1}	59	62	56	64
5.	Na $mmol_c.L^{-1}$	22	27	25	31
6.	Ca $mmol_c.L^{-1}$	169	187	188	251
7.	Mg $mmol_c.L^{-1}$	0.9	1.1	1.1	2.3
8.	$CaCO_3mmol_c.L^{-1}$	4.36	5.21	5.6	7.6
9.	Cl $mmol_c.L^{-1}$	318	415	213	275
10.	$SO^4mmol_c.L^{-1}$	64	74	75	86
11.	Fe ^{2}& Fe $^3mmol_c.L^{-1}$	0.09	0.08	0.07	0.05
12.	N mg L^{-1}	5.4	6.7	8.6	9.6
The plant was analyzed at Soil & Water Dept. Laboratories/ College of Agriculture/ salahaden University					

Fresh weight (g/plants)

The data in Table (3) show that plants from polluted water in first time were 11.484 (g/plants) and in comparison to other treatments had more weight significantly. While other treatment had no significant difference to each other. Also according to Figure (1) the interaction between treatment and replication discover that the highest value was T3R5 (13.677 g/paints), in comparison to others, while lesser value was T4R1 (8.829 g/paints).

Table (3): Effect of different sources of water and different plants collection times on the vegetative growth of watercress (*Nasturtium officinale*) plants (g/ plants).

N	Categories	Mean
1.	T3	11.484 ^{A}
2.	T1	10.265 ^{B}
3.	T2	10.103 ^{B}
4.	T4	9.379 ^{B}
Means with the same letter for each treatment and Replications are not significantly different at 5% level based on Duncan's Multiple Rang Test		

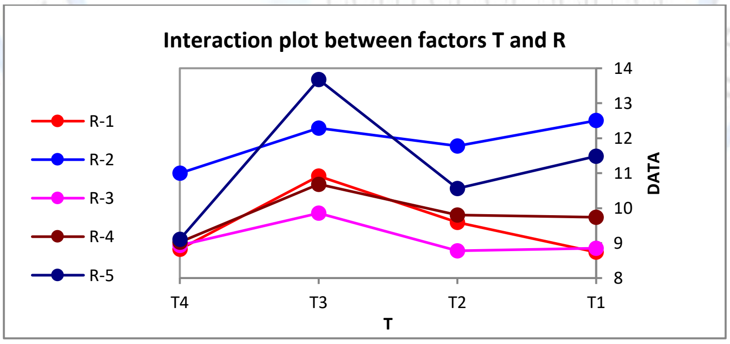

Figure (1): Change in total watercress *(Nasturtium officinale)* plant fresh weight (g/plant) over the 90 days' growth in a different source of water on different plants collection times. (Average of 10 plants per data point).

Dry weight (g/plants)

The data in Table (4) showed that the plants, while in clear source of water in second time (5.987g/plants) were different significantly to first time of clear water and second time of polluted water (4.371 and4.919 g/plants respectively) but was not different to second time of the polluted water. Moreover, Figure (2) shows the interaction between treatment and replication discover that the highest value was (T2R2) (7.555 g/paints)in comparison to other value, while lesser value was T1R1 (2.472 g/paints).

Table (4): Effect of different sources of water and different plants collection times on the dry vegetative watercress *(Nasturtium officinale)* plants (g/ plants).

N	Categories	Mean
1.	T2	5.987 A
2.	T3	5.181 AB
3.	T4	4.919 B
4.	T1	4.371 B
Means with same letter for each treatment and Replications are not significantly different at 5% level based on Duncan's Multiple Rang Test.		

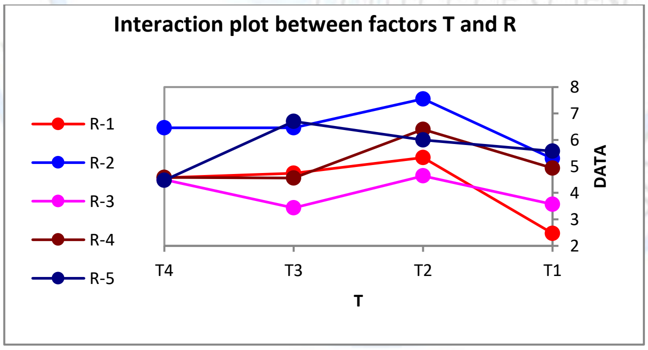

Figure (2): Change in total plant dry weight (g/plant) over the 90 days'growth in a different source of water on different plants collection times. (Average of 10 plants per data point)

Fresh root (g/plants)

The data in Table (5) showed that plants from a polluted water source in the first time (8.547g/plants) gave more fresh root significantly in comparison to other treatments. On the other hand, the second time of polluted source of water had least fresh weight (5.525g/plants).As we can see in the Figure (3), the interaction between treatment and replication discover that the highest value was (T3R5), (9.763 g/paints), while the lesser value was T4R5 (4.493 g/paints).

Table (5): Effect of different sources of water and different plants collection times. on the fresh root plants (g/ plants).

N	Categories	Mean
1.	T3	8.547 A
2.	T1	6.873 B
3.	T2	6.830 B
4.	T4	5.525 C
Means with same letter for each treatment and Replications are not significantly different at 5% level based on Duncan's Multiple Rang Test		

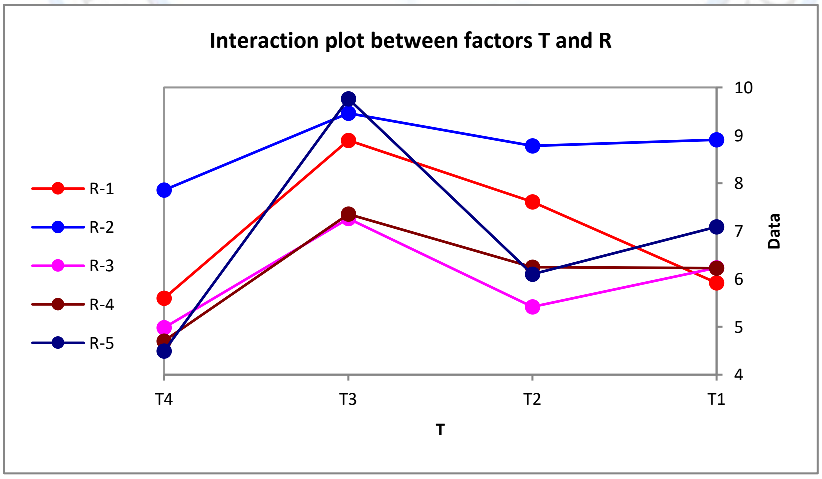

Figure (3): Change in total plant fresh root (g/plant) over the 90 days growth in a different source of water on different plants collection times. (Average of 10 plants per data point)

Dry root (g/plants)

The data in Table (6) showed that plants from polluted source of water gave more dry root weight in the first time of polluted water (5.277 g/plants) significantly. the data Presented first clear water on first time and second polluted water on second time 4.056, 2.867 (g/plants) was less significant. Also results of fered in the second time of clear water gave us lesser dry root (2.807 g/plants) in comparison to other source and time. Moreover,in Figure (4), the highest interaction value between treatment and replication was T1R2 (6.02 g/paints), While the least value was T4R5 (1.812g/paints).

Table (6): Effect of different sources of water and different plants collection times. on the dry root plants (g/ plants).

N	Categories	Mean
1.	T3	5.277 A
2.	T1	4.056 B
3.	T4	2.867 C
4.	T2	2.807 C
Means with same letter for each treatment and Replications are not significantly different at 5% level based on Duncan's Multiple Rang Test.		

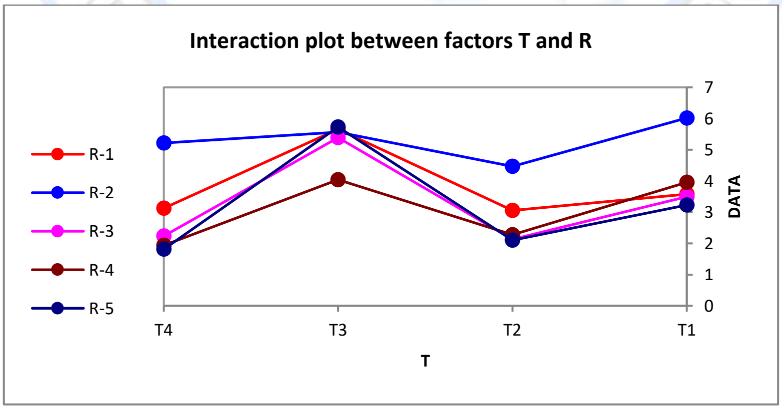

Figure (4): Change in the total plant dry root (g/plant) over the 90 days growth in a different source of water on different plants collection times. (Average of 10 plants per data point)

Branch number (number/ plants)

The data in Table (7) showed that plants from the polluted source of water in a second time (8.480 number/plants) have given the most branches in a plant. After that, the first time of clear water had more branches in the plant. However; from Figure (5) the interaction between treatment and replication discover that the highest value was T3R5 (9.8number/paints), While the least value was T2R3 (3.8number/paints) in comparison to other.

Table (7): Effect of different sources of water and different plants collection times . on the branches number plants (number/ plants).

N	Categories	Mean
1.	T3	8.480 A
2.	T1	6.440 B
3.	T2	4.680 C
4.	T4	4.480 C
Means with same letter for each treatment and Replications are not significantly different at 5% level based on Duncan's Multiple Rang Test		

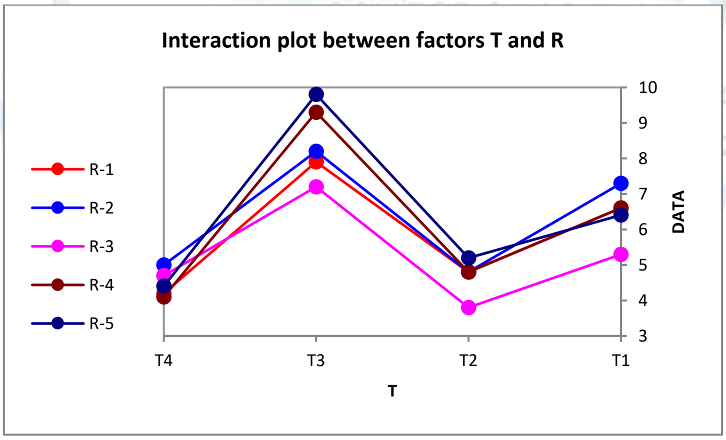

Figure (5): Change in total plant branch number (number/plant) over the 90 days'growth in a different source of water on different plants collection times. (average of 10 plants per data point).

Plant length (cm)

The data in Table (8) showed that plants from polluted source of water in the first time and also first clear source of water in the first time (16.758 and 16.678 cm, respectively) have had more length in comparison to two other sources and time treatment but they were not different to each other significantly. Also as for Figure (6) the interaction between treatment and replication discover that the highest value was T1R2 (18.82 cm), While the least value was T4R3 (11.32 cm). In this study, a widely distributed (*Nasturtium officinale*) was used to disentangle the effects of different source of water and different plants collection time, on the trait variability in each environment.

Table (8): Effect of different sources of water and different plants collection times. on the plant's length (cm).

N	Categories	Mean
1.	T3	16.758 A
2.	T1	16.678 A
3.	T2	14.074 B
4.	T4	12.442 C
Means with same letter for each treatment and Replications are not significantly different at 5% level based on Duncan's Multiple Rang Test.		

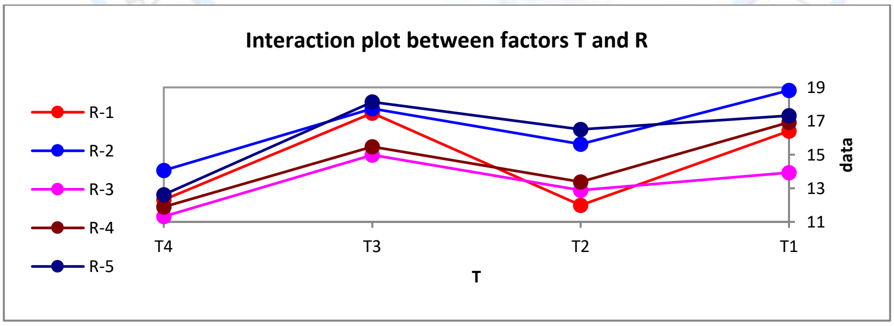

Figure (6): Change in total plants length (cm) over the 90 days'growth in different source of water on different plants collection times, (average of 10 plants per data point).

Overall, the present results lead to three important points: 1- Large amount of nutrient variability were observed in measured traits, but the branch number and shoot height might be the most important as responsible traits to environmental factors in lake and quality of water.

2-The measured traits showed significant variations across the two source of water and plants collection time distribution. 3- There were significant difference in measured traits at two different source of water chemically (i.e., Ca, N, and Fe). In this study from Table (1),the water samples had acceptable levels pH in the range of 5.95- 7.34. Even though the WHO limit is 6.5-8.5, values of 5.0 are still permissible according to the Kurdistan Water Company standards. All levels of EC and TDS were below the WHO limits of 1500µs/cm and 1000mg/L respectively. It was observed that the EC of samples increased with increasing TDS results Table (1). The acceptable limit of color for drinking water is 15HU. Samples had no colors. Numerous studies have suggested that when we account the effects of plant size, the adjustments of functional traits would be adaptive responses to environment gradients such as light, nutrient and water (Weiner ,2004; Mc Connaughay & Coleman, 1999 and Maberly ,1993). From Table (1), it is realized that levels of Chloride, Sulphate and iron are below the acceptable limits. Even though the Nitrite limit in water is 4.26 mg/L in tab water, samplesT3 and T4 which gave concentrations 8.7 – 9.6 mg/L do not pose any health hazards this agree with (Illinois Department of Public Health, 1999).According to Table (1) data, they were increased significantly (41.57- 52.31$mmol_c$. L^{-1}) in clear water to (6.35-7.33$mmol_c$. L^{-1}) in polluted water.Sodium (Na) Sodium is a vital element to human life this agree with (Robert, 2006). Potassium, Chlorine and Sodium together forms a part of blood plasma.Without sodium, cells will not get the nutrients to survive. Nervous system functioning depends on it. Loss of Sodium from body can leads to dehydration and weakness, (Illinois Department of Public Health, 1999; John, 2011).Sulphur (S) Sulphur is an important element that is used in small amounts to construct all parts of human body. There is plenty of sulphur in the food products and excess of it gained by the body is excreted, (Inam *et al.* 2011). In clear water sulphur more than polluted water (72-61$mmol_c$.L^{-1}) to (12-13$mmol_c$.L^{-1}). It is essential as a component of fats, body fluids and bones. Sulfur is essential to all living things and there is a sulfur cycle in nature this method improved and agrees with (Illinois Department of Public Health, 1999; John, 2011). The monitoring of metals in these plants is of some therapeutic and prophylactic importance. From table (2) in plants K increases from different source of water (clear, polluted) and different plants collection time.Potassium (K)

Potassium ions are the most abundant cations in the human body, (Osorio & Linas ,1998a). It is extremely important for the cells in the body, (Inam *et al.* 2011). From Table (2)the element was increased on plant from polluted water but it is not significant and non-healthy (K, N,SO4,Na,Ca,Mg, CaCO3 and Fe) decreased in clear water in two dates except (Clmmol$_c$. L^{-1}) increased in clear water (62, 6.7mg L^{-1}), (74,27,187,1.1,5.21 and 0.09mmol$_c$. L^{-1}). However; mineral is essential for smooth flow of communication signals from cell to cell and its deficiency can contribute to diseases like stroke, heart problem, diabetes and hypertension. It acts in the intercellular fluid as the primary ion. Potassium together with sodium helps to regulate the water balance within the body. It regulates the transfer of nutrients to the cell, transmits electrochemical impulses and is necessary for normal growth and enzymatic reactions, **(**Annalakshmi *et al.* 2012**).** Calcium (Ca) Calcium ions are the most resourceful and common signaling agent in the human body, **(**Berridge *et al.* 1998**).** It is important for strong bones, teeth, maintains proper blood pressure and also for blood clotting. Its deficiency can lead to very serious problems like arthritis. It plays important function in nerve transmission, hormonal functions and metabolism of vitamin D, **(**Illinois Department of Public Health. 1999 ; John, 2011**).** Magnesium (Mg) Magnesium is the fourth most abundant element in the human body and is essential for good health, (Al-Sahaf, 1989). It prevents some heart disorders and high blood pressure and is associated with improved lung functions. It helps in absorbing calcium and phosphorus. It controls insulin levels in blood. Its supply is located in the bones together with calcium and phosphorus, while it is found in cellular fluids and some soft tissue. It is involved with energy production of glucose, protein and nucleic acid synthesis, the formation of urea, muscle impulse transmission and neurotransmission. It plays an important role in enzyme activity, (Osorio & Linas,1998b).All of them agree with (KimonaKisten *et al* .2015) Elemental uptake was controlled by the plant but water quality did have an impact on uptake, Concentrations of metals in the plants were in decreasing order of Ca > Mg > Fe >Mn> Zn > Cu > Cr > Ni >Pb> Se > Cd > As > Co. The watercress plant was found to be a rich source of essential elements especially Fe and Cr and contained low concentrations of the toxic metals investigated thereby making it safe for human consumption. In this study fresh weight plants at second source of water polluted water on first collection time (11.484 g/plants) has heavier weight and larger or more significant than other source of water in polluted water, refer to water quality on elemental uptake by the plant.While the decrees value was second source of water polluted water on second collection time (9.379 g/plants), (Weiner , 2004). In dry weight first source of water clear water and second collection time (5.987 g/plant) was larger and more significant. However; lesser value was first source of water clear water on first plants collection time (4.371 g/plants), (Crisp, 1970).Numerous studies have suggested that several mechanisms have been reported to be responsible for metal uptake of plants, including adsorption, ionic exchange and precipitation, (Maine *et al.* 2004; Ivins & Bremner , 1964). It is important to note that the plant, chelator source and level will make a difference in metal uptake.The macrophytic plants will directly affect the available biomass for storage and translocation as well as resistance and susceptibility to toxicity.In the end Potassium together with sodium helps to regulate the water balance within the body. It regulates the transfer of nutrients to the cell, transmits electrochemical impulses and is necessary for normal growth and enzymatic reactions this agrees with (Annalakshmi *et al*. 2012). The roots and vegetative fresh and dry root weight from Table (3,5 & 6) show significantly increased as second source of water polluted water and first plants collection time increased (11.484, , 8.547 and 5.277 g/plants)may be resulted in excess production and accumulation of photosynthesis in aerial portion According to (Ivins & Bremner, 1964) and Plant dry mass was also reported to increase as a consequence of increased chlorophyll content this result agree with(Langton *et al*.2003), also this result was agreed with (Zheljazkov & Margina, 1996). On the other hand increase of weight agree with (Luciana *et al*.2010) which established that vegetative growth (yield and constituents) of *Mentha piperita* and *Mentha arvensis* and dry weight of *Mentha piperita* were increased as nitrogen increased and revealed by (SenthilKumar *et al*. 2009) which found that gave the highest values of plant height, number of laterals, fresh and dry weight of shoot, dry matter production, fresh herb yield and essential oil yield of Havana. The data from Table (4) showed result from first plants collection time and clear source of water was the more significant (5.987 g/plants) when comparison with other source of water and plants collection time. In other hands the results obtained during the first source of water clear water on second plants collection time with second source of water polluted water on first plants, collection time (5.987, 5.181 g/plants) did not show significant differences between treatments.This result agrees with **(**Gilda *et al*. 2011**)**. From Table (7,8) data show that branch number and plant length was increased in polluted water and first plants collection time(8.480 number/ plants -16.758 cm)quality and depth stratus accounted for the most variations of branch and plant height, which was more responsive to environmental factors (productivity) than that in second plants collection time (4.480- 12.442 cm). This species showed a more number and higher plants higher productivity which is in consistent with the studies on other macrophyte species, such as *Potamogeton obtusifolius, Nasturtium officinale, Ranunculus peltatus, Myriophyllum spicatum,*in responses to low light and water quality in a specific environment. The increased shoot height with increased water quality and water depth was considered. This may suggest that the higher plant status may be more important than the greater photosynthetic area/rates for enhancing plants under shade conditions, **(**Chambers & Kalff ,1987 **;** Jin & Guo , 2001; Going *et al*. 2008; Siefert , 2012) ; Garbey *et al*. 2006 ; Franklin, 2008 and Strand & Weisner, 2001**)**. In conclusion, understanding the source of trait variability is important in predictions of plant responses to environmental and water quality. The present study quantified the spatial structure of total variability for the important functional traits and disentangled the effects of environment and ontogeny on these traits variability across two environments. For example, individuals with higher root/shoot ratio showed a greater ability to uptake nutrients from sediments, while others with more branch number mainly worked as water interception **(**Wang *et al*. 2012; He *et al*. 2011**)**.

Conclusions

Watercress (Brassicaceae) is an aquatic plant with the potential to grow rapidly in water and to take up large amounts of nitrate and growing in different environmental and water either (fresh or polluted water) or in a full heavy metals water, and there might even be business opportunities through the sale of the plant material. Watercress plants could therefore provide a sustainable means to remove nitrogen from waterways, reducing the deleterious consequences of nutrient pollution, also this plant is vegetables, which contain several bioactive compounds with consequent antioxidant and other health-promoting and it is containing of many mineral and vitamins which supply human body. So there is a need for studies expanded this plant to knowledge the contents from (proteins, phenolic compounds, glycosides….etc) being a medicinal plant with extensive uses and task.

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