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Some Elemental Analysis in *Epilobium hirsutum* L. Plant Which Has Natural Distribution Around Seydisuyu Stream

Murat Ardıç[a,*] and İsmühan Potoğlu Erkara[a]

[a] Eskişehir Osmangazi University, Department of Biology, 26480, Eskişehir-Turkey

***Corresponding author: mardic@ogu.edu.tr**
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ABSTRACT

In this study, accumulation of some elements in *Epilobium hirsutum* L. which was collected from 6 different locations on Seydisuyu stream (Seyitgazi/Eskişehir) were investigated. All plants need to intake macro and micro elements to maintain their lives. Generally, low dosage of these elements is essential for plants. Unfortunately, higher dosage of these elements has toxic effects on plants. For this reason, reactions and levels of these elements should be known in soil and specially water. In study area, Potassium (K), Calcium (Ca), Magnesium (Mg), Iron (Fe), Mangan (Mn), Boron (B), Zinc (Zn), Copper (Cu), Sodium (Na), Silicium (Si), Nicel (Ni) and Cadmium (Cd) elements were analysed in roots, stems and leaves of *Epilobium hirsutum* L. except from these elemental analysis, pH, Humidity, Heat, Conductivity and UV levels of specimen locations were investigated.
Seyitgazi plain is an erosion plain and it has organic substance rich soils. Seydisuyu stream is elongated from beginning to end of the Seyitgazi plain. The most important feature of the region that distinguishes it from other working areas is that the largest mining enterprise in which the element Boron, the richness of our country, is extracted, is located in the region. One of the main important factors on the Boron accumulation is seasonal flow of Seydisuyu stream in parallel with the water elemental content.
According to the studied analysis, Cd, Mn, Ca and B levels were clearly higher than determined limit values. Fn and Zn levels were identified between limit values and level of Cu was identified under of these values. In the other elements, elemental analysis results founded between limit values.

Keywords: *Epilobium hirsutum* L., Plant Elemental Analysis, Boron

INTRODUCTION

Our country is very rich in biological terms. The most important reasons for this are variable height differences, being located in three different phytogeographical regions and the presence of many different water environments. Turkey's flora is hosting around 12,000 plant species. Of these, 3700 are endemic. It is obvious that our geographical position has a great share in this wealth (Güner A. 2012). The vascular plant flora of the Seyitgazi Plain (Eskişehir, Turkey) was investigated during 2017-2018. During the botanic excursion in the investigation area, 1200 seed plant example was teken-out from 120 different locations years between 2011-2013. Identification of the examples was performed by relevant literature. Results of the identification, 341 genus includes 83 familia has 598 species and subspecies were identified. 98 taxa belong to İran-Turan, 64 taxa belong to Europe-Sibiria, 60 taxa belong to Mediterranean phytogeogrophical area. Area of the 376 species and subspecies weren't known, or they can be seen in multi-zone. 84 taxa which were identified in the investigation area is endemic species and percentage of the endemic species in the area is %14. 70 of the endemic taxa are LC (Least Concern), 7 of the them are NT (Near Threatened), 5 of them are CD (Conservation-dependent), and 2 of them are VU (Vulnerable) according to red list (IUCN, 2001). All the taxa have been collected as herbarium material (Koyuncu, O., Yaylacı, Ö. K., 2014).

Epilobium belongs to the Onagraceae family and is a genus with 21 different species in our country (Güner, A. 2012). *Epilobium hirsutum* L., which is one of these species, is a perennial plant and it is distributed in almost all parts of our country. In addition, the leaves are 2-12 cm long, 0.5-3.5 cm wide and can reach 2 meters in length (Stace, C.A. 2010).

Some elements in our soils are found in very small amounts (mg / kg-1 or less) but are important elements for plant growth. These elements are called micro elements. Copper (Cu), zinc (Zn), manganese (Mn), iron (Fe) and boron (B) are important plant nutrients and are called heavy metals except boron. High concentrations of these elements cause toxic effects. Elements such as cadmium (Cd) and nickel (Ni) are toxic to plants and are called pollutants (Webber, J., 1981).

Plant nutrients are divided into micro and macro nutrients. Macro nutrients are the nutrients that plants need more. Micro nutrients are less needed than macro nutrients. Therefore, micro nutrients are called trace elements. Plants do not necessarily require some elements. There are basically two criteria for a plant nutrient to be essential. Being directly part of a molecule that is an element of metabolism or in the absence of the element, the plant can go into stress and show certain symptoms, stopping its growth and development. Many reactions occur in plants in the absence of essential nutrients. Symptoms such as yellowing of leaves and drying of leaves are seen. These can be defined as stress responses (Epstein, E. & Bloom A. 2005).

Boron is one of the most important basic plant nutrients for plant growth. Toxicity and deficiency doses are the element closest to each other (Dere, H. H., 2010). Our country has 65% of the world boron reserve and one of the most important of these reserves is in Eskişehir Kırka (Uygan, D., ve Çetin, Ö., 2004).

Potassium (K) is one of the most necessary elements for plant protection against diseases and development of these functions. It is known that there are negative effects such as weakening of body and branches, thinning of cell walls and accumulation of sugar in leaves in potassium deficiency (Bergmann. W., 1992).

Calcium (Ca) increases plant resistance. An appropriate amount of calcium narrows the gaps between plant cells and reduces the concentration of free amino acids, making it difficult for pathogens to enter the organism (Bergmann. W., 1992). It was determined that calcium deficiency caused damage to the root parts of the plant and the formation of new shoots was negatively affected (Locascio, S.J., Bartz, J.A., Weingartner, D.P. 1992).

Magnesium (Mg), as is known, promotes the defence system of cells and indirectly the plant due to their effects on nucleic acid metabolism. According to the studies, it has been observed that magnesium at the appropriate concentrations significantly reduces the necrosis due to pathogens. In addition, magnesium is a very important part of the photosynthesis event. Since chlorophyll molecule is the building block, there is no photosynthesis in its deficiency. For this reason, yellowing is seen on the leaves called chlorosis. At the same time, the deficiency of magnesium, which is involved in many metabolic events, is interrupted (Bergmann. W., 1992).

Silicon (Si) is one of the few elements that have effects on both physiological and mechanical properties of plants. It is known that the properties increase resistance to fungi and reduce stress effects in plants. They are also involved as cationic Co-factors of enzymes involved in enzymatic activities against pathogens (Fauteux, F., Rémus-Borel, W., Menzies, J.G. and Bélanger R.R., 2006).

Sodium (Na) is indirectly associated with potassium. Because the balance of sodium potassium in plants, especially when exposed to salt stress is very critical. Sodium from salt (NaCl) prevents potassium intake

from the roots. Therefore, increasing sodium concentration in the cell increases and causes toxic effect (Hasegawa PM, Bressan RA, Zhu JK, Bohnert HJ 2000).

MATERIALS AND METHODS

Plants collected from different locations near the Seydisuyu stream; primarily divided into roots, stems and leaves. Dry samples, which are divided into small pieces in porcelain mortar with the help of scissors, are separated into small pieces with pestle. It is then individually weighed on a precision scale to measure 0.25 g. The weighed samples are taken into tubes and 9 ml of 65% HNO_3 and 3 ml of $HClO_4$ are added. Then the tubes are placed in the oven carefully and boring closed. It is left in the oven for 1 hour. After the waiting period is removed, it is removed from the oven and allowed to cool. The cooled samples are centrifuged. Finally, they are filtered through filter paper and their volumes are completed to 100 ml and element contents are determined by Atomic Absorption Spectrophotometer. The results were documented and evaluated with SPSS 17 program. PH, conductivity and soil temperature were determined by IQ 150 pH meter, UV amount by LightScout UV Meter and soil moisture content by Case FieldScout TDR 100.

RESULTS AND DISCUSSION

Table 1. Some Seydisuyu Stream Locations, pH, mV, Soil Temp. UV and Humidity Analysis

LOCALITIES	pH	mV	Soil Temp. °C	UV mw	Humidity ds/m
1. (Seydisuyu Source)	**3,54**	**234**	**13,4**	**82**	**72,3**
2. (Çatören and Kunduzlar Dam)	**5,21**	**161,5**	**14,6**	**96,6**	**111,7**
3. (Sancar Village)	**5,46**	**122,1**	**14,4**	**113,4**	**142,1**
4. (Yazıdere Village)	**3,62**	**278**	**14,9**	**129,4**	**131,7**
5. (Hamidiye)	**4,04**	**271**	**15,1**	**117,3**	**106,2**
6. (Mahmudiye-Çifteler)	**3,98**	**299**	**14,7**	**108,9**	**119,8**

Table 2. *Epilobium hirsutum* L. Root Analysis (mg kg-1 dry weight)

Elements	LOCALITIES					
	1	**2**	**3**	**4**	**5**	**6**
Cd	**0,82**	**8,92**	**17,4**	**5,01**	**2,7**	**4,6**
Cu	**2,76**	**2,93**	**3,99**	**5,86**	**14,3**	**8,09**
Fe	**296,10**	**93,2**	**17,9**	**399,2**	**220,5**	**547,3**
K	**6108,7**	**8112,3**	**38976,1**	**19820,4**	**41302,4**	**54312,5**
Mg	**3823,4**	**5723,2**	**11217,8**	**7683,5**	**9332,7**	**7714,3**
Mn	**78,6**	**79,5**	**266,3**	**242,5**	**103,5**	**194,8**
Na	**72,3**	**210,4**	**288,5**	**78,5**	**98,2**	**79,9**
Ni	**1,24**	**4,3**	**17,8**	**1,24**	**1,6**	**1,72**
Zn	**13,4**	**6,2**	**7,8**	**14,8**	**15,9**	**15,2**
B	**22,1**	**61,4**	**88,8**	**92,9**	**94,6**	**88,3**
Ca	**1606,7**	**3998,7**	**3102,3**	**4660,2**	**6823,2**	**6992,8**
Si	**36,1**	**92,2**	**98,8**	**68,4**	**102,3**	**64,2**

Table 3. *Epilobium hirsutum* L. Stem Analysis (mg kg-1 dry weight)

Elements	LOCALITIES					
	1	2	3	4	5	6
Cd	0,3	10,3	3,1	5,9	3,8	5,7
Cu	1,3	2,1	16,4	3,2	8,3	2,6
Fe	43,4	14,5	32,6	36,1	21,8	38,2
K	112642,3	52345,7	78802,4	14204,8	16912,6	21374,5
Mg	6111,1	6933,4	3283,4	8312,7	6201,2	2166,1
Mn	36,3	100,2	16,4	112,8	37,3	34,5
Na	67,7	128,5	52,8	54,3	92,2	71,1
Ni	2,1	7,4	0,8	0,6	0,2	0,5
Zn	9,2	4,3	3,9	10,2	1,1	2,4
B	36,2	112,9	180,6	140,2	102,4	76,2
Ca	4302,1	3988,4	1401,8	5266,3	2201,6	1672,5
Si	22,3	566,4	386,3	76,8	46,4	66,8

Table 4. *Epilobium hirsutum* L. leaves Analysis (mg kg-1 dry weight)

Element	LOCALITIES					
	1	2	3	4	5	6
Cd	0,6	4,3	3,8	3,1	2,1	2,9
Cu	1,3	6,2	2,5	5,9	8,6	6,2
Fe	98,2	136,8	100,2	160,8	188,4	299,4
K	61396,2	65783,6	26742,8	40126,1	34368,4	68678,6
Mg	7450,1	13987,6	8876,4	10184,2	10256,4	13302,1
Mn	103,1	552,2	272,4	298,8	282,1	416,5
Na	84,5	360,2	38,1	201,6	112,6	104,3
Ni	4,9	11,2	8,2	9,1	8,6	7,8
Zn	11,2	13,8	6,1	12,1	5,2	15,8
B	48,5	62,4	78,3	46,2	227,8	98,3
Ca	13220,1	29486,3	14627,7	11792,5	11304,4	14831,4
Si	87,3	402,6	66,2	78,4	92,8	71,6

CONCLUSION

The study area hosts different deposits depending on the plain structure and the element structures in plants and soils change accordingly. *Epilobium hirsutum* L. plant Fe, Mn, K is above the average values, while Ca, Cu differs according to soil variety and generally it is found to be above average values and Zn is at low levels. While B deficiency is observed in most of the agricultural areas in our country as in the world, B accumulation especially around Kırka locality exceeds the toxicity limits and may cause serious product and economic losses. B is known to be the closest element when toxicity and presence and season, the structure of the land, the type of plant in which it is produced in the year, annual amount, depending on different degrees can be changed in different places.

At the end of the analyzes; Cd, Mn, Ca, B elements above the determined limit values, Fe and Zn elements between the specified limit values, Cu element was found below the limit values. The results were obtained close to the required limit values of the plants in the other elements analysed.

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