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Relationship of *Galium incanum* Sibth. & Sm. subsp. *incanum* and *Galium verum* L. Taxa Which Have Natural Distribution in Seyitgazi-Kırka Area With B Element

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ABSTRACT

In this study, distance of *Galium incanum* Sibth. & Sm. subsp. *incanum* and *Galium verum* L. subsp. *verum* which are naturally distributed in Seyitgazi Kırka area to Eti mine works was identified. Also soil elemental analysis were performed and B concentration of roots, stems, leaves and flowers were identified in these plant. These studied plant specimens were evaluated for identify effects of the genetic factors on B toxicity. In the light of obtained data, genetic features are directly connected with B toxicity in natural plants. In this regards, to maintain the success in soil reclamation activities and so protection of the ecological balance, B resistant accumulator plants should be selected in high B included areas. Performed analysis showed that, precipitation and seasonal changes are effects the B intake in both of studied taxa. Especially B concentration of *Galium verum* L. subsp. *verum* is clearly higher than *Galium incanum* Sibth. & Sm. subsp. *incanum*. For example, B concentration in root and stem more than twice, about two time more in flower and more than three times in leaf in *Galium verum* L. subsp. *verum*. According to this results, genetical and morphological differences have important role at the habitat selection and B contents of plants.

Keywords: *Galium incanum* Sibth. & Sm. subsp. *incanum, Galium verum* L. subsp. *verum,* B

INTRODUCTION

There have been over 400,000 plant species worldwide. The most important reasons why there are so many plant species are climate and geographical differences. It is estimated that our country is home to more than 12000 plant species in 3 different phytogeographical regions. These phytogeographic regions; Iran-Turanian, Euro-Siberian and Mediterranean. The fact that we host so many phytogeographical regions ensures that the number of endemic species is high. The endemism rate in our country is around %30. The vascular plant flora of the Seyitgazi Plain (Eskişehir, Turkey) was investigated during 2010-2013. During the botanic excursion in the investigation area, 1200 seed plant example was taken-out from 120 different locations years 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 belongs to İran-Turan, 64 taxa belongs to Europe-Sibiria, 60 taxa belongs 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 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 of the taxa has been collected as herbarium material. (Koyuncu & Yaylacı 2014).

Galium incanum Sibth. & Sm. subsp. *incanum* and *Galium verum* L. subsp. *verum* plants, used in this study are species belonging to Rubiaceae family. It is reported that there are close to 500 genera and 6000 species belonging to Rubiaceae family. It is thought that there are about 10 genera and 170 species in our country. There are trees, shrubs and herbaceous species. The most important genera; Rubia, Coffee, Cinchona,

Asperula and Galium (Simson 2010). In a study conducted in 2013, *Galium incanum* SM subsp centrale Ehrend species were analysed with XRF and many elements such as Na, Mg, Al, Si, Cl, K but B element was not analysed. In addition, *Galium* species are cultivated to provide nitrogen richness, essential oils and antimicrobial effect and cadmium accumulation as an accumulator plant it is known that studies on (Van et al. 2005, Kayalar et al. 2013, Lu et al. 2017).

Our country contains around 70% of the world boron reserve. Seyitgazi Kırka region, where this study was conducted, is a region which is 45 km far from Eskişehir and has a steppe climate. Eskişehir-Kırka region is one of the most abundant regions in these reserves (Uygan & Çetin 2004). Boron mining in the region has been operating since the 1960s. It is stated that there is about 500 million tons of visible borax reserves in this region (Arda 1969).

Boron is one of the 16 important plant nutrients for its plants. In addition, boron is the only nonmetal element among plant nutrients. At the same time, deficiency and toxicity limits are much closed element to each other makes boron critical elements for plants. Boron is present in the soil as boric acid or borate. Plants show differences according to boron uptake from soil. The reason for this difference is that they need different amounts of boron to grow. Boron deficiency is indicated as mg boron per kilogram of dry weight. Critical value for Gramineae is 5-10 mg B. For dicotyledonous plants 20-70 mg B (Ho 2000).

Plant development in boron deficiency in plants has been proven by studies (Loomis & Durst 1992). At the same time, the presence of excess boron in soil or irrigation water causes toxicity and as a result, effects such as chlorosis in the plant, shedding in new shoots and growth rate come to a halt have been observed (Uygan & Çetin 2004). Plants receive boron uptake by absorption. It is carried by xylem up to the peaks. Therefore, the uptake and transport of the boron element is closely related to water (Kacar & Katkat 2006). Boron is the most abundant element in plants, reproductive organs and leaves, while the least fruit, seeds and roots have been reported in studies (Zhao & Oosterhuis 2002).

MATERIALS AND METHODS

Galium incanum Sibth. & Sm. Subsp. incanum and *Galium verum* L. subsp. verum, B. plants were collected from Seyitgazi-Kırka Boron Mining Area and their environs between 2017-2018 years (Fig. 1, 2).

Fig. 1. *Galium incanum* subsp. *incanum*

Fig. 2. *Galium verum* subsp. *verum*

Boron analysis has been performed on stem, leaf and root of studied taxa by curcumin technique. 0,5 g of dried and crushed plant materials was put into ceramic cinerarium and they were burned until white ash was obtained. When was the ceramic cinerarium getting cold, 5 ml 1.0 N HCl added into it. Cinerarium was kept on water bath for a while and then contents of ceramic burning capsules were quantitatively transferred into

volumetric flask (50 ml) by distilled water. Contents of volumetric flask were fulfilled to 50 ml by distilled water and they were shook. We waited for a while till silicium pile up at the bottom of the volumetric flask. After this, 1 ml of clear plant solutions was transferred into ceramic capsules. 4 ml curcumin-oxalic acid solution added on to each clear plant solution and they were waited on the 55 ± 3 °C water bath till solution evaporated. When ceramic capsules got cold to room temperature, 10 ml ethyl alcohol was added in to capsules and they were mixed by glass stick for dissolving the residue. Then each of these solutions were transferred into volumetric flasks (25 ml) and they were completed their degree by ethyl alcohol. Each solutions absorbance value were measured at 540 nm by Jasco V-530 UV/VIS branded spectrophotometer. Boron content calculations from absorbance values were performed according to (Kacar & İnal 2008). The soil analyzes were performed with ICP-OES. The results were analyzed in SPSS 17.0 package program.

RESULTS AND DISCUSSION

Table 1. Boron concentration of *G. incanum* and *G. verum* B (mg kg-1 dry weight)

Plant Parts	***Galium incanum* subsp. incanum**	***Galium verum* subsp. *verum***
Root	107,2	201,3
Stem	164,8	372,3
Leaf	178,3	542,8
Flowers	238,4	494,8
Soil (Summer)	17,49	52,49
Soil (Spring)	62,72	88,9

As in the world, B deficiency is observed in most parts of our country, especially B value around Kırka is quite above the limits of toxicity. As it is known, toxicity and deficiency of boron are the closest elements and can be observed in different amounts depending on season, land structure, selected plant type, rainfall in that year and environmental variables.

Boron (B) can be transported by a result of mining process or run off from mine bed in Kırka. It also can be exist in groundwater and it is hazardous for plants because of sensitivity of plants against this element and hard to rewash by plants. It has found an environmental problem that the product quality can be affected negatively because of too much boron accumulation in root, stem and leaf part of plants in summer time.

Especially B contration of *Galium verum* L. subsp. *verum* is clearly higher than *Galium incanum* Sibth. & Sm. subsp. *incanum*. For example, B concantration in root and stem more than twice, about two time more in flower and more than three times in leaf in *Galium verum* L. subsp. *verum*. According to this results, genetical and morphological differences have important role at the habitat selection and B contents of plants.

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