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Short communication

Comparison of mineral content between spontaneous and cultivated flowering stems of *Sideritis scardica*

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Introduction

Sideritis scardica Griseb. is an endemic species in the Balkan Peninsula. It is used in traditional medicine as a loosening agent in bronchitis and bronchial asthma; against the common cold and lung emphysema; in the treatment of inflammation, gastrointestinal disorders, and coughs; and as an active constituent of dietary supplements for the prevention of anemia (Todorova and Trendafilova, 2014). For this reason, it is a subject of intensive exploitation. The important role of *Sideritis scardica* as a traditional remedies tea and its conservation status has required its cultivation as market production. *S. sca*rdica is cultivated very difficultly; as it grows in high mountains up to 1200 m (Kostadinova et al., 2008).

Various extracts of *S. scardica* are rich with phenolic acids, phenylpropanoids, flavonoids (Petreska et al., 2011), diterpenes, hydrocarbons, and complex mineral composition (Karapandzova et al., 2013), as well volatile monoterpenes and sesquiterpenes (Qazimi et al., 2014).

S. scardica is very popular and widely advertised herb in Europe. In addition, the toxicity and the side effects from the usage of *S. scardica* as well as clinical trials need attention. For the practice, it is important to improve cultivation conditions in order to increase the accumulation of biologically active compounds and to obtain herbs with permanent and good quality (Todorova and Trendafilova, 2014). Several wild and aromatic herbs are used for medicinal and traditional phytotherapeutic purposes since they are considered as important source of essential minerals. Spontaneous herbs are also a potential link to the transfer of contaminants and heavy metals from the environment to humans through the food chain (Volpe et al., 2015).

The aim of this work was to determine the mineral content in spontaneous and cultivated flowering stems of mountain tea (*Sideritis scardica* Griseb.).

Materials and methods

Plant material

The flowering stems of *S. scardica* were collected in four different localities in North Macedonia. The spontaneous samples were collected from Ljuboten (Shara Mountain), Gurgurnica (Suva Gora), and Lazaropole (Bistra). One cultivated sample was collected from Dren (near Prilep). The plant material was air-dried, packed in paper bags, and kept in a dark and cold place until analysis.

Digestion and Chemical Analysis

Samples were digested in a microwave system by

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the wet digestion method. 0.5 g of tea sample were put in the Teflon tube, where 7 ml of HNO_3 and 2.5 ml of H_2O_2 were added. The mixture was left to react for 10 min. Then Teflon tubes were introduced in the microwave system ((Mars, CEM, USA) with the following program: 10 min up to 180ºC, hold time of 20 min at 180ºC. After digestion, the obtained solutions were filtered, poured into 25 mL plastic flasks, and the rest of the vessel was filled with redistilled water and sent for elements chemical analysis.

By the application of inductively coupled plasma – atomic emission spectrometry (ICP-AES, Varian, model 715ES) and inductively coupled plasma – mass spectrometry (ICP-MS, Plasma Quant ICP-MS, Analytic Jena, Germany) the following 25 elements were determined: Al, As, B, Ba, Bi, Ca, Cd, Co, Cs, Cr, Cu, Fe, Ga, K, Li, Mg, Mn, Na, Ni, P, Pb, Rb, Sr, V, and Zn. The QC/QA of the applied technique was performed by the standard addition method, and it was found that the recovery for the investigated elements ranges between 98.5–101.2 %. Quality control was also ensured by standard moss reference materials M2 and M3, which are prepared for the European Moss Survey (Steinnes et al., 1997).

Results

Results from this study showed the presence of 25 elements in spontaneous (Ss) and cultivated (Sc) flowering stems of *S. scardica* using ICP-AES and ICP-MS methods. The concentrations of Al, B, Ba, Ca, Cr, Cu, Fe, K, Mg, Mn, Na, P, Sr, V, and Zn in all analyzed samples were determined by ICP-AES, while the concentrations of As, Bi, Cd, Co, Cs, Ga, Li, Ni, Pb, and Rb were determined by ICP-MS method.

In all analyzed Ss and Sc samples, the minerals present in the highest amounts were macronutrients: K (13889-14761 and 16419 mg/kg) and Ca (9127-9891 and 12628 mg/kg), followed by Mg (2025-2104 and 4259 mg/kg) and P (1808-2137 and 2907 mg/kg), respectively. These minerals were dominant in the Sc sample of *S. scardica*.

The essential micronutrients Fe, Na, Mn, Zn, B, and Cu in Ss and Sc samples were detected in the range between 157-271 and 124 mg/kg, 51.5-68.9 and 73 mg/kg, 30.57-41.2 and 32.5 mg/kg, 17.6-26 and 23.5 mg/kg, 25.1-55.8 and 57 mg/kg, and 8.32-10.8 and 8.49 mg/kg of DW, respectively. Fe content was higher in Ss samples compared to Sc sample. Toxic heavy metals (As, Cd, Cr, Ni, Co and Pb) were detected in Ss and Sc samples with concentration 0.09-0.12 and 0.06 mg/kg, 0.032-0.038 and 0.057 mg/kg, 0.65-1.84 and 0.24 mg/kg, 0.64-1,04 and 1.06 mg/kg, 0.17-0.19 and 0.10 mg/kg and, 0.70-1.43 and 0.45 mg/kg, respectively. They were within the maximal permissible limit of FAO/WHO for herbal medicines. The content of As, Cr, Co, and Pb was higher in Ss samples, while the content of Cd and Ni was in Sc sample.

Conclusion

There was almost no difference in the chemical profiles of the mineral content between Ss and Sc samples. The differences in mineral content between Ss and Sc samples are directly correlated with differences in macronutrients and some toxic heavy metals content. The Sc sample exhibited similar mineral content profile compared to Ss samples of *S. scardica*, and therefore can be recommended as promising plant material from this endemic aromatic plant species rich in minerals.

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