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ELEMENT COMPOSITION OF BARBERRY (*BERBERUS* L.) AND DEAF NETTLE (*LAMIUM ALBUM* L.) LEAVES

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Macro- and microelement compositions of barberry (*Berberus* L.) and deaf nettle (*Lamium Album* L.) leaves, collected from the territory of Goris City (RA) by atomic absorbtion spectrophotometry method were studied. It was shown that the heavy metal (Hg, Pb, Cd and As) content values in the mentioned plant leaves do not exceed their maximum allowable concentrations (MAC).

Keywords: macro- and microelements, element composition, atomic-absorbtion spectrophotometry method, leaves of barberry, leaves of deaf nettle.

Introduction. In the work [1], on the example of initiated oxidation of cumene, we investigated antioxidant effect of benzene extracts from leaves of barberry (*Berberus* L.) and deaf nettle (*Lamium Album* L.). It is established that at dissolution of one *mg* of extract from barberry leaves in 5 *mL* of reactionary mix (cumene + benzene chloride + initiator) turns out a solution with concentration of antioxidants equal to $0.52{\cdot}10^{-4}$ *mol/L*, and in the case of extracting from leaves of deaf nettle – $0.49{\cdot}10^{-4}$ *mol/L*. On the example of extracts from the leaves of barberry and deaf nettle it is shown [2] that their antioxidant properties are caused by flavonoids, generally by rutin. It is known that plants, except biologically active organic compounds, contain also inorganic elements For example, as it is reported in work [3], there are found over 80 chemical elements both in plants, and in (a) human body, which are classified into macro- and microelements. Such division is based on principle of quantitative maintenance (or content) of an element in organism tissues. Regularities of distribution of chemical elements in plants in many respects depend on the place and conditions of their growth – the geographical district, chemical composition of the soil, ecological and climatic conditions etc. [4].

In this work we studied the macro- and microelement (or trace and major element) composition of leaves of barberry ordinary (*Berberus* L.) and deaf nettle (*Lamium Album* L.). The choice of these plants is based on the fact that, as it is mentioned above, extracts of their leaves contain over 15% antioxidants and can be

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used for stabilization of easily oxidized organic compounds. Besides, these plants are widely used in traditional medicine for treating various diseases. Particularly, the leaves of deaf nettle are applied as styptic cure for uterine, pulmonary, intestinal, hemorrhoidal bleedings, for cystitis, eczema and other skin diseases. The tincture (or infusion) of leaves of barberry is used for liver diseases, bleedings and as anti--inflammational cure.

The chemical composition of plants depends on two main factors – genetic and environmental. The genetic factor underlies in the formation of chemical composition of plants. The ecological factor prevents the implementation of the genotypic program of absorbtion of chemical elements by plants, especially when habitat is enriched with compounds of these elements [5, 6]. From the practical point of view, the data on chemical composition of food and medicinal plants are necessary both for balanced food of a person, and for preventing and treating of the diseases connected with diselementoses. The macro- and microelements of plants have a definite therapeutic effect in treatment of a person as they are in the most available form and set peculiar to wildlife [7].

Therefore, in our opinion the definition of the contents of macro- and microelements in plants has a vital importance.

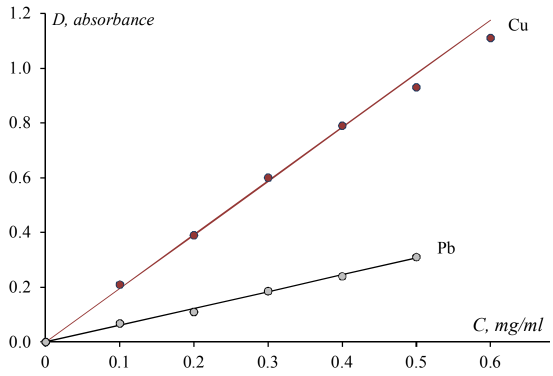
Materials and Methods. The materials for researches (the leaves of barberry and deaf nettle) were collected in the natural places of growth (Goris City, Republic of Armenia, 1470 *m* a. s. l.) in the phase of their flowering. Definition of qualitative composition and quantitative contents of macro- and micronutrients was carried out by the method of atomic absorbtion spectrophotometry on the AAS-3 spectrophotometer, by the technique "Raw materials and food products. Atomic absorbtion method of toxic elements definition" (GOST 30178-96).

Mineralization of test samples was carried out in accordance with the State Industry Standard – GOST 26929-94 "Raw materials and food products. Preparation of test samples. Mineralization for defining the maintenance (or content) of toxic elements" by dry mineralization. This method is based on complete decomposition of organic substances by burning of test samples of raw materials in the electric furnace with a controlled temperature mode. For this purpose a shot of air-dry raw material was placed in the electric furnace in a ceramic bowl. The furnace was previously adjusted on temperature 250°*C* and the temperature gradually (with a speed of 1.67 grad./*min* was increased to 450°*C*. The mineralization was continued at this temperature before receiving gray ash. After 12 *h* incineration the bowl with ash was taken out from the electric furnace and then the ash was dissolved in nitric acid.

Results and Conclusion. By standard solution of elements were constructed calibration graphs (see Figure). By the given formula was determined the quantitative maintenance of elements X (*mg*/*kg*) in air-dry leaves of deaf nettle and barberry:

$$X = \frac{CVK \cdot 10^3}{m},$$

where C is the concentration of element in the investigated solution, found from the calibration graph, mg/cm^3; V is the volume of the solution, cm^3; m is the shot of the test sample, g; K is the dilution coefficient. Results are given in the Table.



Calibration graphs of lead and copper.

The concentration of elements (mg/kg) in air-dry leaves of deaf nettle and barberry ordinary

Elements	Leaves of deaf nettle, *mg/kg*	Leaves of barberry, *mg/kg*	In world plants, *mg/kg* [8]	MAC, *mg/kg* [9]
Toxic elements				
Lead	0.3400	0.650	0.1–10	32
Cadmium	0.0280	0.031	0.013–0.28	1.0
Arsenic	0.0200	0.110	0.009–1.5	0.2
Mercury	0.0014	0.009	0.001–170	2.1
Elements-biofills				
Calcium	2820	1840	–	–
Potassium	1690	2561	–	–
Magnesium	760	540	–	–
Phosphorus	457	682	–	–
Iron	41.8	112	18–3580	–
Silicon	10.3	6.5	–	–
Manganese	7.8	9.2	1.3–500	–
Cobalt	6.2	7.2	0.01–210	–
Sodium	4.9	18.9	–	–
Zinc	4.7	3.1	1.2–73	–
Tin	2.7	1.6	0.04–7.9	–
Selenium	2.2	2.7	2–2030	–
Chromium	1.4	0.85	0.6–3.4	–
Copper	0.54	0.21	5–30	–

The values of elemental concentration given in the Table show, that the deaf nettle leaves are rich in calcium, and the barberry leaves are rich in potassium. The content of toxic metals in the studied plant leaves are in limits of background values and they are less than their maximum allowable concentrations (MAC).

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REFERENCES

1. **Vardanyan L.R., Vardanyan R.L., Atabekyan L.V., Hayrapetyan S.A.** Antioxidant Effect of the Herb Extracts of Goris Region of Armenia. 1st International Conference of GSU, 2010, p. 53 (in Russian).
2. **Atabekyan L.V.** The Quantitative Determination of the Content of Flavonoids in Deaf Nettle and Barberry Leaves. // Chem. J. of Armenia, 2012, v. 65, № 1, p. 34 (in Russian).
3. **Khanina M.G., Khanina M.A., Rodin A.P.** Element Composition of Agrimonia Pilosa Ledeb. // Chemistry of Plant Raw Material, 2010, № 2, p. 99 (in Russian).
4. **Efremov A.A., Shataina N.V., Strijeva E.N., Pervishina G.G.** Influence of Environmental Factors on the Chemical Composition of Some Wid-Growing Plants of Krasnoyarsk Region. // Chemistry of Plant Raw Material, 2002, № 3, p. 53 (in Russian).
5. **Vernadsky V.I.** Chemical Structure of the Biosphere of the Earth and its Environment. M: Nauka, 2001, 376 p. (in Russian).
6. **Ilyin V.B.** Element Chemical Composition of Plants. Novosibirsk: Nauka, 1985, 130 p. (in Russian).
7. **Alexeenko V.A.** Chemical Elements in Environment and Developments of Organisms. Biosphere Geochemistry. 2nd International Meeting. Novosibirsk, 1999, p. 106 (in Russian).
8. **Kabata-Pendias A., Pendias H.** Microelements in Soils and Plants. M.: Mir, 1989, 439 p. (in Russian).
9. **Egorova I.N.** PhD Thesis: The Content of Heavy Metals in Raw Herbs of the Kemerovo Region. Tomsk, 2010.