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Research Article

BIOCHEMICAL COMPOSITION OF THE LEAVES OF THE SPECIES MAGNOLIA GRANDIFLORA L., LIRIODENDRON TULIPIFERA L. IN THE CONDITIONS OF THE CITY OF TASHKENT

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ABSTRACT

This article presents the results of determining the content of mobile forms of heavy metals Pb, Hg, Cd, Ni, Cu, Zn, Co, Cr, and macro-microelements in the leaves of two species of the Magnoliaceae family (Magnoliaceae) by the ISP-MS method. Growing in the Botanical Garden of the Academy of Sciences of Uzbekistan, introduced into Uzbekistan. Biochemical analyzes recorded the presence of 44 macro and microelements in the leaves, such as Ca, Mg, K, Fe, Na, F and the accumulation of heavy metals. Woody plants with a high metal accumulating capacity can be useful for phytoremediation of polluted urban areas.

KEYWORDS

Magnoliaceae, Magnolia grandiflora L., Liriodendron tulipifera L., ISP-MS, accumulation, bioindicator, phytoremediation, macro and microelements, heavy metals.

INTRODUCTION

In the world, much attention is paid to solving the problems of protecting the environment from pollution by anthropogenic and natural aerosols. The main reason for the deterioration of the ecological situation in urbanized areas is the ever-increasing man-made pollution of the environment. Woody plants are

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an indicator of the state of the environment. In this regard, the study of the possibility of using ornamental woody plants to reduce the technogenic stress on the ecosystem, where their leaf surface can be used as a unique bioindicator, is of great importance.

Purpose of work: assessment of biochemical parameters of leaves of species Magnolia grandiflora L., Liriodendron tulipifera L. and their degree of contamination with heavy metals.

Magnolia large-flowered - (Magnolia grandiflora L.) - a species of flowering plants, part of the Magnoliaceae family (Magnoliaceae). Native to North America. As an ornamental plant, it is grown in Georgia, the Crimea, and Central Asia. Evergreen tree up to 25-30 m high.

Magnolamine and magnolin, which are alkaloids, are isolated from magnolia leaves. In addition, the leaves are rich in glycosides, essential oils, and some minerals. It is known that this plant can accumulate selenium. Essential oils are also found in the flowers, and magnolia fruits contain fatty oils consisting of unsaturated acids. The magnolia bark contains magnoflorin, and the roots contain salicifolin and candicin. [1] Magnolia is a well-known medicinal plant. An aqueous infusion of the leaves is taken orally with impaired digestion. In Mexican folk medicine, magnolia seeds have been used as an antispasmodic in the treatment of heart disease [2].

In modern scientific medicine, a tincture of leaves and flowers of magnolia, 700 alcohol (1:1), 20-30 drops - 3 times a day, is used in the treatment of hypertension and heart failure [3]. Great prospects open up in the treatment of oncological diseases with magnolia preparations [4,5,6].

Tulip tree - (Liriodendron tulipifera L.) - a tall tree of the Magnoliaceae family (Magnoliaceae) naturally growing in eastern North America. The species was introduced into Uzbekistan at the end of the 19th century, but, as Rusanov F.N. (1975), did not gain distribution due to poor seed germination [7]. In the 50s of the twentieth century, a grove of these trees was created in the Tashkent Botanical Garden at the Academy of Sciences. This species was propagated and transferred to the landscaping of Tashkent. The species is of great interest as an exotic breed, promising for cultivation in Uzbekistan.

The tree has its large lyre-shaped, glossy, four-lobed leaves. It blooms with large single greenish-yellow flowers with an orange spot at the base, similar to tulip flowers. Fast growing, average height is 25-36m. The wood is strong, yellowish gray with a satin finish [8].

It is important to note the value of this breed as a source of natural medicinal substances. Leaves, flowers, seeds, branches, bark and roots of a tree contain a variety of biologically active compounds, among which alkaloids sesquiterpenes, steroids, benzinoids, oxoaporphins, coumarin scopoletin and others have been identified [9,10].

Research methodology. Studies of macro-microelements in leaves were carried out at the Institute of Bioorganic Chemistry of the Academy of Sciences of the Republic of Uzbekistan. One of the main pharmaceutical raw materials of the tree are its leaves. Chemical analysis was performed on two leaf samples. Determination of the content of macro and microelements in the leaves was determined by the method of "inductively coupled plasma mass spectrometry". To do this, a sample of 0.05-0.5 g of the studied leaf of species was weighed on an analytical balance and transferred to Teflon autoclaves. Then the purified concentrated mineral acids were poured into autoclaves. Nitric acid and hydrogen peroxide were used as mineral acids. When mineral acids were added

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to the autoclaves, they were used with the MWS-3+ or microwave digestion equipment provided by the Berghof program.

Results and discussion. Leaf extract of Magnolia grandiflora L., Liriodendron tulipifera L. has a complex chemical composition, which contains more than 44 biologically active components.

Table 1.

The amount of macro- and microelements in the leaves of Magnolia grandiflora L., Liriodendron tulipifera L. growing in the Botanical Garden of the Academy of Sciences of the Republic of Uzbekistan. (2022)

№	Macro- and microelements	Atomic weight	Magnolia grandiflora L.	Liriodendron tulipifera L.
1	Li	7	6,889	1,070
2	Be	9	0,122	0,124
3	B	11	121,103	79,295
4	Na	23	1015,223	1454,385
5	Mg	24	3459,714	4723,391
6	Al	27	368,925	230,788
7	Si	28	726,169	651,396
8	P	31	1613,650	2537,829
9	S	32	1023,593	1168,446
10	K	39	2532,523	6418,204
11	Ca	42	33340,073	33855,757
12	Ti	48	80,623	491,508
13	V	51	1,029	0,905
14	Cr	52	43,735	52,352
15	Mn	55	51,305	42,848
16	Fe	57	1260,317	1135,925
17	Co	59	0,829	0,856
18	Ni	60	17,035	28,441
19	Cu	63	10,152	13,200
20	Zn	66	21,693	32,718
21	Ga	69	1,108	1,234
22	Ge	74	0,009	0,009
23	As	75	0,718	0,621
24	Se	82	0,641	0,558
25	Rb	85	1,091	1,105
26	Sr	88	150,815	145,248
27	Zr	90	0,676	0,796
28	Nb	93	0,052	0,047
29	Mo	98	0,714	3,383
30	Ag	107	0,247	0,075
31	Cd	111	0,149	0,186

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32	In	115	0,001	0,001
33	Sn	118	1,333	1,041
34	Sb	121	0,276	0,287
35	Cs	133	0,026	0,020
36	Ba	138	18,333	20,333
37	Ta	181	0,002	0,002
38	W	184	0,096	0,154
39	Re	187	0,004	0,002
40	Hg	202	0,035	0,025
41	Ti	205	0,012	0,012
42	Pb	208	10,736	9,413
43	Bi	209	0,031	0,039
44	U	238	0,096	0,101

Biochemical analyzes recorded a total of 44 macro and microelements found in the leaves of the trees Magnolia grandiflora L., Liriodendron tulipifera L. The plant contains important macro and microelements such as Ca, Mg, K, Na. P, Al, Fe. Large concentrations contain **Calcium Ca** Liriodendron tulipifera L. - 33855.757 mg / kg, and in the leaves of Magnolia grandiflora L. - 33340.073 mg / kg, related to vital elements. The need for it arises already in the germination phase, and calcium deficiency symptoms: leaf growth is delayed, light yellow spots (chloriticity) appear on them, after which the leaves die.

In particular, the largest amount of **Potassium K** is contained in the leaves of the tree Liriodendron tulipifera L. 6418.204 mg/kg; Magnolia grandiflora L. 2532.523 mg/kg.

Iron Fe plays a very important role in biological processes. The leaves of Magnolia grandiflora L. contain 1260.317 mg/kg, and the leaves of Liriodendron tulipifera L. 1135.925 mg/kg.

Magnesium Mg is associated with an effect on the activity of many enzymes. It plays an important role in the process of photosynthesis, activates an enzyme that catalyzes the participation of CO_2 in photosynthesis. Magnesium concentration: Liriodendron tulipifera L- 4723.391 mg/kg, Magnolia grandiflora L.- 3459.714 mg/kg. With a deficiency of magnesium in plants, growth and the production process deteriorate, the chlorophyll content and resistance to diseases decrease.

Sodium concentration Na Liriodendron tulipifera L.- 1454.385 mg/kg, Magnolia grandiflora L.-1015.223 mg/kg.

Phosphorus P was recorded in the leaves of Liriodendron tulipifera L. - 2537.829 mg/kg, and in the leaves of Magnolia grandiflora L. - 1613.650 mg/kg.

The accumulation of **Manganese Mn** in the leaves is more characteristic of woody plants. The maximum content of Mn was found in the leaves of large-flowered magnolia - 51.305 mg/kg, and in the leaves of the tulip tree - 42.848 mg/kg.

One of the main objectives of the study was to study the contamination of plant materials with heavy metals on the example of the leaves of Magnolia grandiflora L., Liriodendron tulipifera L.

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The accumulation of heavy metals lead Pb, mercury Hg, cadmium Cd, nickel Ni, copper Cu, zinc Zn, cobalt Co, chromium Cr was studied.

As a result of the research, the following was revealed:

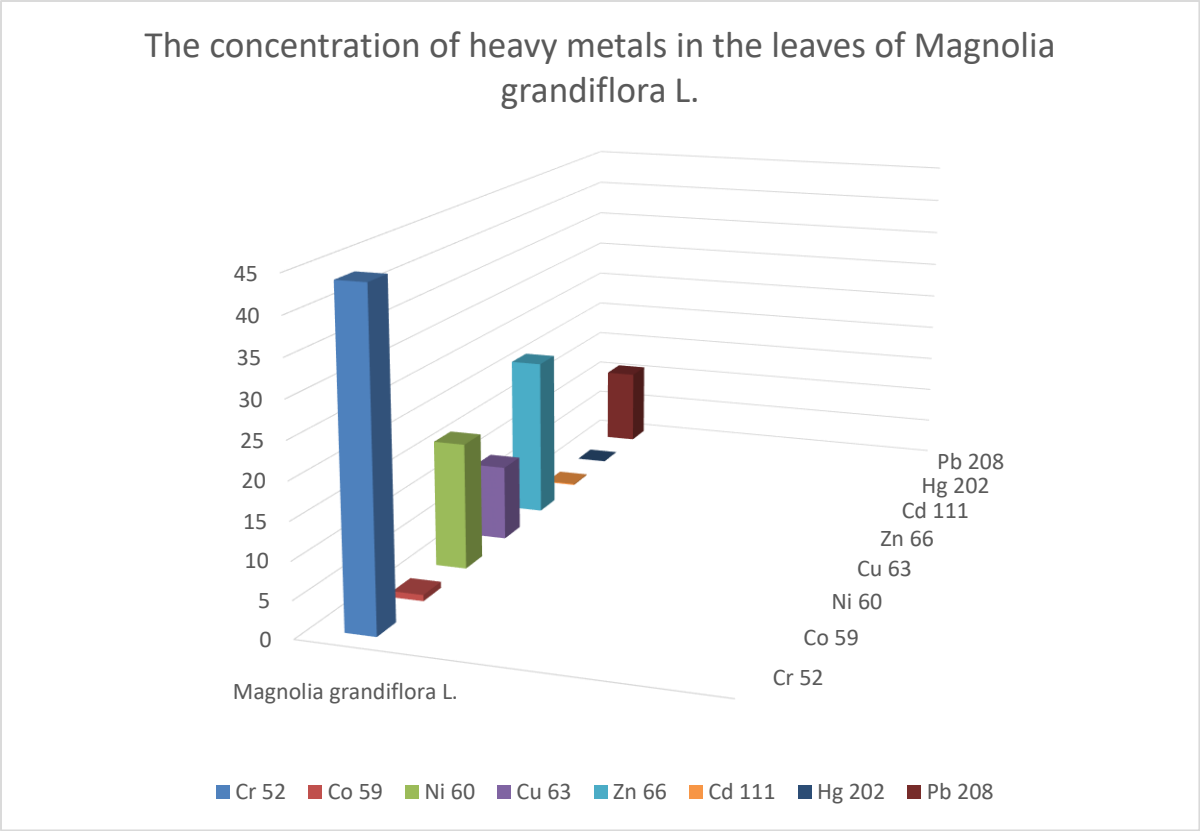

Fig.1. The concentration of heavy metals in the leaves of Magnolia grandiflora L.

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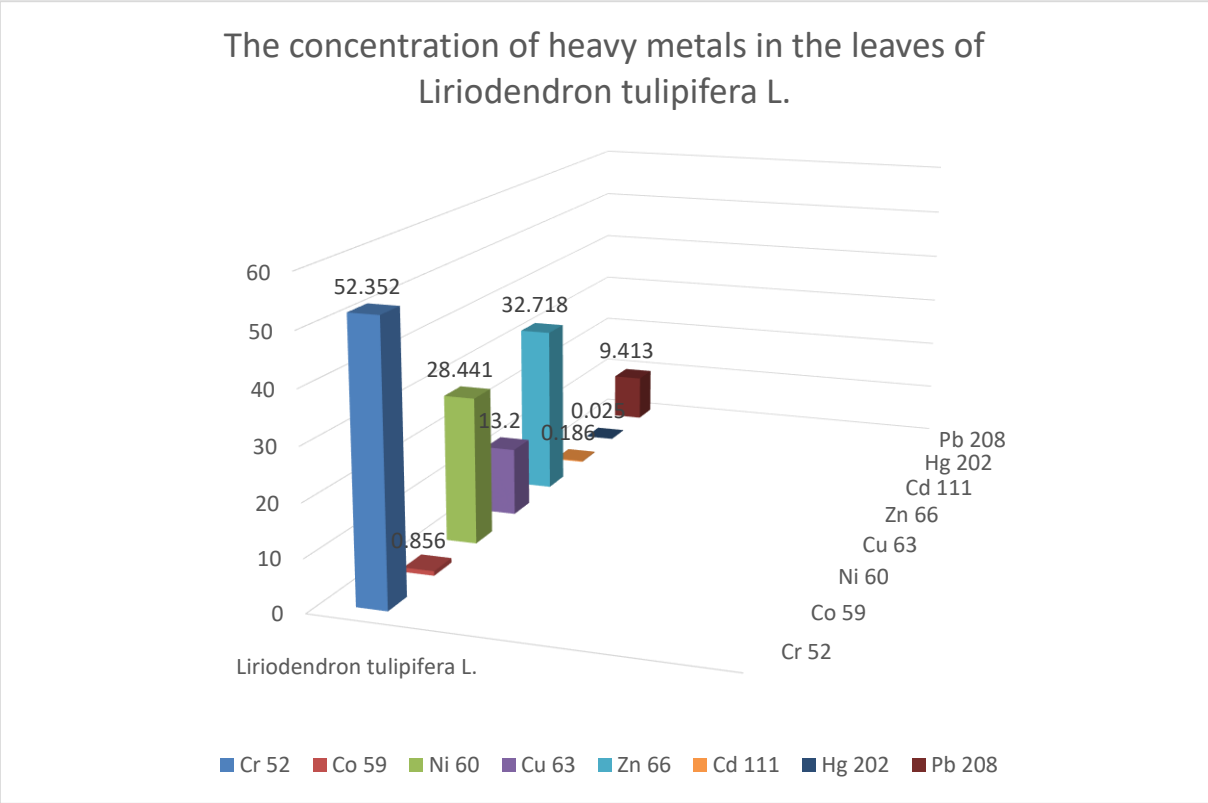

Fig.2. The concentration of heavy metals in the leaves of Liriodendron tulipifera L.

Among the range studied, Magnoliaceae were found to be resistant to heavy metals.

It was established that the amount of heavy metals (chromium mg/kg) in the leaves of ornamental trees was observed in the tulip tree, the highest 52.352 mg/kg, and in magnolia grandiflora 43.735 mg/kg.

The maximum content of zinc was observed in the leaves of the tulip tree at a concentration of 32.718 mg/kg, and in magnolia grandiflora 21.693 mg/kg.

The highest lead content was found in samples of large-flowered magnolia - 10.736 mg/kg, in the leaves of the tulip tree - 9.413 mg/kg.

Metals such as nickel and copper accumulated insignificantly in the leaves of plants in the city (2019: nickel 4-6 mg/kg, copper 1-4 mg/kg). This year (2022), the nickel metal content averaged 22.0 mg/kg, the copper content averaged 11.5 mg/g.

CONCLUSIONS

Analysis of the elemental composition of the leaves of woody plants of the Magnolia family growing in the city of Tashkent showed that the leaves contain more than 44 biologically active components.

The highest concentrations contain potassium, calcium, magnesium, phosphorus, sodium, iron, manganese, related to vital elements.

Woody plants accumulate significant amounts of heavy metals and are capable of removing them from the cycle of substances, therefore, in order to maximize the purification of the atmosphere from heavy metals, it is necessary to create diverse

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plantations with high biological stability, which can effectively improve the quality of the urban environment.

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