Features Of Contamination Of Trees And Shrubs With Heavy Metals In The Conditions Of Nukus

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Abstract
The article presents the results of a study of the characteristics of plant growth and development in zones with different anthropogenic load. A visual assessment of the vital state of woody plants was carried out. Various monitoring zones of Nukus differ in the levels of heavy metals. It was found that the soil cover of the studied areas contains about 30 names of heavy metals (Cd, Cr, Hg, Pb, Jn, Mn, Ni, Co, etc.). Seven of them (Cd, As, Hg, Cr, Ni, Jn, Co) have the greatest anthropogenic impact. High pollution of soils with heavy metals is of a local nature. It is shown that different plant species differ in their ability to accumulate heavy metals.

Key words: woody plants, vital state, growth, development, heavy metals, species-specificity of accumulation, soil, activation analysis.

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The sharply continental climate, aridity of the territory, increased wind activity and soil salinization contribute to the aggravation of environmental problems in the settlements of the Southern Aral Sea region. One of the most effective means of improving the urban environment, both in terms of results and timing of implementation, and in terms of cost, is landscaping. Green spaces contribute to the improvement of microclimatic, ecological and sanitary and hygienic conditions of the environment, i.e. reduce the negative impact of factors of natural and man-made origin. However, the influence of negative factors inherent in urbanized areas leads to a decrease in productivity, premature aging and damage, and sometimes the death of plants.

Air and soil pollution, increasing exhaust gases and increasing oil and fuel leakage have a negative effect on green spaces. The worst growing conditions are characterized by woody plants surrounded by asphalt and concrete barriers.

The success of landscaping cities and other settlements largely depends on the correct selection of tree and shrub species. The compliance of the biological and ecological properties of these plants with the climatic features of the city, as well as the specific conditions in which the plantings are created, contributes to an increase in the stability, durability and decorativeness of plants.

In urban ecosystems, plants are forced to adapt to unfavorable environmental conditions leading to a decrease in plant resistance: the life span of plants is reduced, their assimilation apparatus is damaged, and vegetative and seed productivity decreases.

Studies of some authors have established the accumulation of heavy metals in leaves in an urban environment. According to A.K. Frolov (1998) the greatest pollution with Pb, Cu, Zn, Ni and Cr is observed in the street plantings of trees in St. Petersburg, less in boulevard and even less in parks. In terms of the total amount of metals, linden has a greater absorption capacity, followed by elm, maple, and the least - oak [10].

A significant number of works have been devoted to the study of urban vegetation. An interesting experience in this regard has been accumulated in a number of cities in Russia, Germany, the United States, etc. In the city of Nukus, no such complex studies of vegetation have

been carried out, although this problem is no less urgent and significant for him. In this regard, we are conducting research on the bioecological features of ornamental woody plants in the conditions of Nukus. This work is devoted to the study of the trace element composition of leaves of woody plants in urban landscapes.

Objects and research methods.

Taxonomic analysis of woody plants was carried out according to the corresponding keys and reference books [2].

Phenological observations were carried out using generally accepted methods [1,4].

The selection of soil samples was taken under planting. The depth of sampling is 0-15 cm. The average sample was prepared by mixing soil samples taken from 3-4 points from a specific planting object.

The assessment of the state of woody plants was carried out in plants growing under relatively uniform illumination conditions in order to minimize phytocenotic influences; examined trees growing separately in the central areas of the Botanical Garden. Leaves without visible signs of damage were selected for analytical studies. Leaves for analysis were collected in early July. Phenological observations were carried out throughout the growing season [3,7].

The assessment of the vital state of woody plants was carried out by a visual method based on the determination of the degree of disturbance of the assimilation apparatus and crowns [8].

Foliage samples were taken from one tree in 10, the number of mixed samples from 2-3 trees of the same species. Before drying, the leaves were washed with distilled water to remove elements deposited on the leaf surface and not participating in the plant metabolism. The content of chemical elements in plant and soil samples was determined by the method of neutron activation analysis at the Institute of Nuclear Physics of the Academy of Sciences of the Republic of Uzbekistan. The analysis results were recalculated to dry matter.

Results and its discussion

It is known that in urban ecosystems, plants are forced to adapt to unfavorable ecological conditions for them, leading to a decrease in plant resistance. A comparative study of the characteristics of growth and development of plants showed that some introduced woody plants changed their habit and grow as undersized trees and shrubs. Such plants include Fraxinus excelsior L., Fraxinus pensylvanica March., Salix alba L., Populus alba L., Ulmus pumila L., Maclura aurantiaca Nutt., Salix babylonica L., Catalpa bignonioides Walt., Juniperus communis L. Numerous studies it was found that adaptation of plants to drought and soil salinity manifests itself in habit, suppression of growth, decrease in plant height, decrease in development rates, etc. As a result, the introduced woody plants acquire a stunted form and their lifespan is reduced [6,7]. The results of the conducted biometric studies are shown in table. one.

Table 1

Condition of woody plants at monitoring sites

Types	Height, m.	Barrel diameter, cm.	Amount, PCS.	Landings	condition
Botanical Garden					
Fraxinus excelsior L.	4,27-5,30	6,84-8,57	Many	Г	+++
Fraxinus pensylvanica March.	6,41-9,71	12,9-26,4	Many	Г	+++
Salix alba L.	8,43-10,47	12,2-16,4	Many	Г	+++
Populus alba L.	8,32-9,48	10,1-30,8	Many	Г	+++
Ulmus pumila L.	6,42-12,36	21,3-28,9	Many	Г	++
Maclura aurantiaca Nutt.	4,57-5,2	10,3-9,71	Many	Г	+++
Salix babylonica L	8,23-11,6	5,57-5,89	Many	Г	+++
A. Dosnazarov Street					

Fraxinus excelsior L.	6,31-9,28	9,87-43,6	91	O	++
Fraxinus pensylvanica March.	3,66-10,03	8,91-42,3	78	O	++
Salix alba L.	7,27-8,39	8,59-30,5	17	Г	++
Populus alba L.	9,96-13,29	31,5-66,8	79	Г	+++
Ulmus pumila L.	10,24-12,43	42,2-54,1	165	O	+++
M. Zhumanazarov Street					
Fraxinus excelsior L.	4,63-5,19	8,91-13,3	102	O	++
Fraxinus pensylvanica March.	5,34-8,15	15,2-22,9	61	O	++
Salix alba L.	10,25-11,18	21,0-23,7	25	Г	++
Populus alba L.	3,16-5,21	3,82-12,2	89	O	+++
Caialpa bignonioides Walt.	2,25-3,42	4,14-5,57	57	Г	+++
Salix babylonica L.	8,5-9,43	3,98-4,29	14	Г	++
Turtkul Avenue					
*Fraxinus excelsio*r L.	5,25-9,17	8,91-42,0	35	O	++
Fraxinus pensylvanica March.	5,22-8,73	9,55-42,3	52	O	++
Salix alba L.	10,47-13,31	27,7-38,8	85	Г	++
Populus alba L.	8,32-9,28	7,32-42,3	4	Г	+++
Juniperus communis L.	2,21-3,34	7,32-10,8	14	Г	++
Caialpa bignonioides Walt.	2,80-2,87	5,41-6,36	8	Г	++
Ulmus pumila L.	3,39-4,52	4,77-8,28	26	O	++

As can be seen from the data in table. 1, in the Botanical Garden, introduced woody plants Fraxinus excelsior L., Fraxinus pensylvanica March., Salix babylonica L., Populus alba L., Ulmus pumila L., Maclura aurantiaca Nutt., Salix babylonica L. grow as low-growing trees and shrubs. number, group plantings and are in good condition.

Woody plants growing on the streets of A. Dosnazarov, M. Zhumanazarov and Turtkul Avenue equally have group and single plantings, many of them are in good condition, and some (Fraxinus excelsior L., Fraxinus pensylvanica March., Salix alba L. , Ulmus pumila L., Salix babylonica L., Catalpa bignonioides Walt.) Are in satisfactory condition.

The study of the action of heavy metal ions on plants attracts attention due to the increase in their pollution of the environment, as well as their significant accumulation by plants. Toxicity to living organisms is determined both by the properties of the elements themselves, and by their migration ability, as well as the degree of accumulation in living tissues [5, 9].

The studied elements according to GOST 17.4.1. 02-83 belong to class 1 (Cd, Hg, Jn, As, Pb) and class 2 toxicity.

As a result of the analyzes carried out, it was shown that in the conditions of the city of Nukus, soils accumulate Cd, Jn, Ni, Mn, Co, Cr, Fe, and the maximum differences in the content of these elements are noted in soils along the highways.

The gross content of heavy metals was as follows (mg / kg of soil) nickel - 210, arsenic - 7.8, chromium - 81, cobalt - 12, zinc - 120.

It is known that not only the concentration of heavy metals in soils is essential, but also their availability. As a result, heavy metal ions are able to accumulate to varying degrees in roots, stems and leaves. It was revealed that the content of most heavy metals in various plant organs depends on their species and biological characteristics: on the

stage of development, the intensity of growth processes, etc. It has been shown that different plant organs contain different amounts of the same element [9].

The content of elements in samples of plants and soils of the city of Nukus is shown in Table 2.

Table 2

Element content in plant and soil samples, μg / g

Type of plant	Growing place	Element content, μg / g						
		Cd	As	Hg	Cr	Ni	Jn	Co
U. pumila	Botsad	<0,10	0,98/5,0	<0,010	8,4/63	27170	25/52	1,2/8,3
	Dosnazarov st.	<0,10	0,61/5,3	<0,010	3,8/66	<1,0140	18/89	0,65/11
	Turtkul Ave.	<0,10	0,45/7,5	0,0240	3,3/60	<1,0150	18/100	0,49/10
	Zhumamuratov street	<0,10	0,32/5,5	<0,10	2,1/72	<1,072	12,5/73	0,32/8,5
C.bignonioides	Botsad	<0,10	0,86/5,0	0,010	7,1/63	1,0170	34/52	0,93/8,3
	Zhumamuratov street	0,10	0,77/7,7	0,010	2,4/57	5,960	235/105	0,39/9,4
	Turtkul Ave.	0,10	0,83/6,9	0,010	4,8/62	24110	33/98	0,66/10,5
S.bobylonica	Botsad	1,00	0,27/4,8	<0,010	1,1/82	<1,055	480/53	0,37/8,8
	Dosnazarov st.	0,510	0,21/5,6	<0,010	0,9/56,5	<1,096	255/70	0,98/7,9
	Zhumamuratov street	0,40	0,71/4,2	<0,0140	1,5/55	<1,0115	160/60	1,5/7,9
S.alba	Dosnazarov st.	0,460	0,53/4,9	<0,010	1,2/62	<1,0220	58/93	0,31/12
	Turtkul Ave.	<0,10	0,16/5,9	<0,0230	0,84/57	22140	160/80	0,79/9,1
	Zhumamuratov street	<0,10	0,31/4,9	<0,0170	1,3/51	<1,0120	99,5/93	0,66/8,5
P.alba	Dosnozarov st.	1,50	0,51/7,8	<0,010	1,5/61	14160	630/84	3,3/11
	Turtkul Ave.	<0,10	0,49/7,6	<0,010	3,1/59,5	<1,0150	250/120	0,99/10
P.nigra	Botsad	<0,10	0,39/5,4	<0,010	2,8/81	<1,02,3	46/55	2,0/8,0
	Zhumamuratov street	<0,10	0,44/7,4	<0,010	0,78/55	<1,0<10	220/80	1,7/9,5
	Dosnozarov st.	2,60	0,75/0	<0,010	0,81/0	<1,00	505/120	1,8/10
F.pennsylvanica	Botsad	<0,10	0,36/5,1	0,0250	2,4/69	<1,088	12,5/52	0,34/8,1
	Dosnozarov st.	<0,10	0,91/5,0	0,0520	1,8/55	<1,0150	17/130	0,40/9,9
	Zhumamuratov street	<0,10	1,2/5,2	0,0530	1,5/53	<1,0110	24/81	0,21/8,1
	Turtkul Ave.	<0,10	0,91/4,9	0,0370	4,9/54	2394	37/67,5	0,76/8,2
F.excelsior	Botsad	<0,10	0,72/6,8	0,0390	5,1/54	<1,0210	15/54	0,69/9,0
	Dosnozarov st.	<0,10	0,39/5,1	0,00980	1,5/53	<1,098	21/120	0,19/10
	Zhumamuratov street	<0,10	0,74/5,7	0,0510	1,6/70	7,5120	6,8/71	0,23/9,25
	Turtkul Ave.	<0,10	0,80/2,5	<0,010	2,0/72	10115	9,0/85	0,3/7,8

Note: The numerator is the content of the element in the leaves of the plant, the denominator is the content of the element in the soil.

As can be seen from the data presented, the greatest pollution of plants is observed along the high-traffic road (Turtkulsky Avenue, Dosnazarov St.).

In urban conditions, the trees under study are characterized by varying degrees of total pollution with heavy metals. According to the value of the total accumulation of heavy elements in the leaves, white poplar is noted, and the lowest is common ash.

The degree of total pollution of plants with heavy metals is influenced by such factors as the level of technogenic pollution of various districts of the city of Nukus, the condition of the plant, the content in the adjacent soils, the indicator of atmospheric pollution. In this case, the species specificity of the plant is noted.

Thus, Salix alba (Turtkulsky Ave.) and Popylus alba (Dosnazarov St.) accumulate Ni, Jn, Co. Popylus nigra (Dosnazarov St.) accumulates Cd, As and especially Jn (11 times more) than black poplar growing in the Botanical Garden (see table)

Ulmus pumila is characterized by the highest resistance to heavy metals among the studied plants.

The specific conditions of the urban environment have a significant impact on plants. Plant leaves are most exposed to environmental influences. Particles of dust and aerosols contained in the air of cities settle on the leaves. In the roadside ecosystem, the lead and zinc load on plants increases. Elements enter plants directly from the air and through the root system from the soil. The ratio of the root and aerosol intake of chemical elements into plants remains unclear.

The toxicity of heavy metals and plant resistance to them depend on many factors. There are plants that can accumulate individual metals without visible signs of oppression. There is still little information on the mechanisms of resistance of various plant species. Plant resistance is divided into three types - biological, anatomical-morphological and physiological-biochemical. Various forms of resistance play a decisive role at certain stages of ontogenesis and at certain periods of seasonal plant development.

Conclusion

As a result of the conducted surveys of green plantations of the monitoring sites in the city of Nukus, it was found that they include 9 species of ornamental woody plants. A visual assessment of the vital state of woody plants was carried out. Various monitoring zones of Nukus differ in the levels of heavy metals. It was found that the soil cover of the studied areas contains about 30 names of heavy metals (Cd, Cr, Hg, Pb, Jn, Mn, Ni, Co, etc.). Seven of them (Cd, As, Hg, Cr, Ni, Jn, Co) have the greatest anthropogenic impact. High pollution of soils with heavy metals is of a local nature. It is shown that different plant species differ in their ability to accumulate heavy metals. According to the value of the total accumulation of heavy elements in the leaves, white poplar is noted, and the lowest is common ash.

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