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ASSESSMENT OF THE INFLUENCE OF *THUJA OCCIDENTALIS* L. AND *PLATYCLADUS ORIENTALIS* L. SPECIES ON THE ECOLOGICAL COMPOSITION OF SOILS IN ALMATY CONDITIONS

Most of the pollutants from the atmosphere of the urbanised area get into the soil. Due to the increase in population and motor transport in Almaty city there is a high level of atmospheric air pollution, increased content of heavy metals in the soil. Accumulation of heavy metals by green trees from the soil positively affects soil conditions, in this regard, it is relevant to assess the current state of soil cover of regions where *Thuja occidentalis* L. and *Platycladus orientalis* L. trees grow. In the article, to determine the influence of western and eastern thuja trees on soil composition, soil were obtained with coordinates at point 2 and control point, where trees of thuja species grew side by side. Total and mobile content of heavy metals in soil (Cu, Zn, Mn, Fe) were determined by atomic absorption spectrometry. Morphological characterisation of the soil cover was made, granulometric composition and soil types were determined by the Tyurin method. Point 1 *Thuja occidentalis* L. humus content in soil cuttings on which the tree was growing showed maximum content of 3.82% in 0-10 cm, while *Platycladus orientalis* L. when growing the humus content is low 1.86%, the soil in point 2 opposite *Platycladus orientalis* L. humus content of 2.96% when growing *Thuja occidentalis* L. (2.14%) has a higher humus content compared to the augmented soil.

Thuja occidentalis L. and *Platycladus orientalis* L. in the control, where the species grew together, the humus content is 3.1%. the pH value ranged from 8.26 to 8.81, with soil cuttings generally showing a strong alkaline environment. Among the heavy metals, Zn, Cu and Fe were found to be significantly above the MAC in the soil, meaning that the soils of the study area were contaminated with heavy metals. At profile 1, the soil on which western thuja grew has less amount of Zn, Cu, Mn, Fe compared to the soil on which eastern thuja grew, Mn- and others are above MAC. At profile 3, only the Fe size of *Platycladus orientalis* L. is higher in the overgrown soil. *Thuja occidentalis* L. and *Platycladus orientalis* L. where the species grew together, the amount of Mn decreased by 452.2μg/kg. The study showed that the accumulation of heavy metals in the soil decreased when growing the western thuja species compared to the eastern thuja species.

Key words: *Thuja*, soil cover, granulometric composition, humus, heavy metals, MPC.

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Алматы қаласы жағдайында туя *Thuja Occidentalis* L. және *Platycladus Orientalis* L. түрлерінің топырақтың экологиялық құрамына әсерін бағалау

Урбанизацияланған аумақтың атмосферасынан ластаушы заттардың көп бөлігі топыраққа түседі. Алматы қаласында халық санының көбеюіне, автокөліктердің артуына байланысты атмосфералық ауаның ластану деңгейі жоғары, топырақ құрамында ауыр металл мөлшері артқан. Жасыл ағаштардың топырақтан ауыр металдарды аккумуляциялауы топырақ жағдайына оң әсерін тигізеді, осы орайда Алматы қаласындағы *Thuja occidentalis* L. және *Platycladus orientalis* L. ағаштары өсетін аймақтардың топырақ жамылғыларының қазіргі жағдайын бағалау өзекті.

Мақалада Батыс және Шығыс туя ағаштарының топырақ құрамына тигізетін әсерін айқындау үшін топырақ кескіндері координаттары 2-кесінді және туя түрлерінің ағаштары қатар өскен бақылау нүктесінен алынды. Ауыр металдардың топырақтағы жалпы және жылжымалы мөлшерлері (Cu, Zn, Mn, Fe) атомды-абсорбциялық спектрометрия әдісімен анықталды. Топырақ жамылғысының морфологиялық сипаттамасы жасалып, гранулометриялық құрамы және топырақ типтері Тюрин әдісімен анықталды. 1-кесіндіде *Thuja occidentalis* L. ағашы өскен топырақ кесінділеріндегі гумус мөлшері 0-10см кескінінде ең жоғарғы мөлшерді 3,82%-ды көрсетті, ал *Platycladus orientalis* L. өскен жағдайда гумус мөлшері төмен 1,86%, 2-нүкте топырағында керісінше *Platycladus orientalis* L. өскен жағдайда гумус мөлшері 2,96% *Thuja occidentalis* L. (2,14%) өскен топырақпен салыстырғанда жоғары көрсеткішке ие. *Thuja occidentalis* L. және *Platycladus orientalis* L. түрлері бірге өскен бақылау вариантында гумус мөлшері 3,1%. pH- мәні 8,26-8,81 аралығында ауытқыды, топырақ кесінділері жалпы алғанда күшті сілтілі ортаны көрсетті. Ауыр металдар арасында Zn, Cu және Fe топырақтағы ШРК мөлшерінен айтарлықтай жоғары екендігі яғни, зерттелген аймақ топырақтары ауыр металдармен ластанғандығы анықталды. 1-кесіндіде Батыс туясы өскен топырақта Шығыс туя ағашы өскен топырақпен салыстырғанда Zn, Cu, Mn, Fe мөлшері азырақ, Mn-басқасы ШРК-дан жоғары. 3-кесіндіде тек Fe мөлшері *Platycladus orientalis* L. өскен топырақта көбірек. Екі Батыс және Шығыс туясы қатар өскен жағдайда Mn мөлшері 452,2 азайған. Зерттеу нәтижесі Батыс туя өскен топырақта, Шығыс туя өскен топырақ құрамымен салыстырғанда ауыр металдардың жинақталуы төмендегенін көрсетті.

Түйін сөздер: топырақ жамылғысы, гранулометриялық құрамы, гумус, ауыр металдар, ШРК.

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Оценка влияния видов *Thuja Occidentalis* L. и *Platycladus Orientalis* L. на экологический состав почв в условиях города Алматы

Большая часть загрязняющих веществ из атмосферы урбанизированной территории попадает в почву. В связи с увеличением численности населения и автотранспорта в городе Алматы наблюдается высокий уровень загрязнения атмосферного воздуха, повышенное содержание тяжелых металлов в почве. Аккумуляция тяжелых металлов зелеными деревьями из почвы положительно влияет на почвенные условия, в связи с чем актуальна оценка современного состояния почвенных покровов регионов, где растут деревья *Thuja occidentalis* L. и *Platycladus orientalis* L.

В статье для определения влияния деревьев западной и восточной туи на состав почвы были получены изображения профиля почвы с координатами в профиле 3 и контрольной точки, где деревья видов туи росли бок о бок. Общее и подвижное содержание тяжелых металлов в почве (Cu, Zn, Mn, Fe) определяли методом атомно-абсорбционной спектрометрии. Составлена морфологическая характеристика почвенного покрова, гранулометрический состав и типы почв определены методом Тюрина. В профиле 1, где росли деревья *Thuja occidentalis* L. содержание гумуса в почвенных профилях показало максимальное содержание 3,82% в профиле 0-10 см, при выращивании *Platycladus orientalis* L. содержание гумуса более низкое 1,86%, в почвенном профиле в точке 2, напротив, где росло дерево *Platycladus orientalis* L. содержание гумуса имеет более высокий показатель – 2,96%, а при выращивании *Thuja occidentalis* L. -2,14%. В контрольном варианте, где виды *Thuja occidentalis* L. и *Platycladus orientalis* L. росли вместе, содержание гумуса составляет 3,1%, значение pH колебалось от 8,26 до 8,81, при этом почвы в целом демонстрировали сильную щелочную среду. Среди тяжелых металлов было обнаружено, что Zn, Cu и Fe значительно превышают ПДК в почве, это показывает, что почвы исследуемой области были загрязнены тяжелыми металлами. В профиле 1, на которой росла западная туя, в почве количество Zn, Cu, Mn меньше, чем Fe по сравнению с почвой, на которой росла восточная туя Mn и другие элементы превышает ПДК. В профиле 3 только количество Fe больше, в почве которой росла *Platycladus orientalis*. В почве, где совместно произрастали туя западная и восточная, количество Mn снизилось на 452,2 мкг/кг. Исследование показало, что при выращивании вида туи западной в почве аккумуляция тяжелых металлов понижается, по сравнению с видом туи восточной.

Ключевые слова: почвенный покров, гранулометрический состав, гумус, тяжелые металлы, ПДК.

Introduction

The urban environment is defined by unique ecological processes and specific anthropogenic influences that lead to significant environmental transformations [1]. The city of Almaty, being the largest megacity in Kazakhstan, faces a number of environmental problems related to urbanisation, air, soil and water pollution. Plants play a key role in stabilising urban ecosystems, including improving soil quality. Assessing the impact of different plant species on the ecological composition of soils in Almaty city conditions is an important area of research aimed at developing strategies for sustainable urban greening and rehabilitation of degraded areas [2]. Urban environments also have specific light conditions that disrupt natural biological rhythms. [3]. Urban soils are subjected to considerable human-induced alterations, experiencing extensive changes due to factors such as compaction, contamination, and the proliferation of impermeable surfaces like asphalt. These factors negatively affect soil temperature, air circulation, and water exchange, which in turn influence vegetation health [4].

Despite being exposed to complex chemical, physical, and biogenic stressors from atmospheric, surface, and groundwater pollution, plants remain crucial for ecological stabilization in urban areas, primarily through photosynthesis and pollutant absorption [5, 6].

In urban environments, soils subjected to considerable human influence undergo substantial alterations. Urban ecosystems are complex anthropogenic formations in which natural components are significantly influenced by human economic activity. Soils are an important component of urbanised areas, performing key ecological functions such as absorbing pollutants, regulating hydrological processes, maintaining biodiversity and providing conditions for vegetation growth. However, active land use, construction, transport infrastructure and air pollution lead to the deterioration of urban soils, reducing their fertility and ability to self-repair [7].

One of the promising directions of preserving and improving the ecological state of soils in cities is the use of vegetation, which has a complex effect on their physical and chemical properties and biological parameters. Various plant species contribute to the improvement of soil structure, prevent soil erosion, regulate moisture levels, participate in the processes of organic matter decomposition and stimulate the development of soil microbiota. In addition, green spaces can accumulate and neutralise pollutants, including heavy metals, petroleum products and other toxicants [8].

Annual harvesting of fallen leaves, mowing of lawn grasses change the elemental composition of the soil, which can lead to the unravelling of natural biogeochemical cycles. In addition, urban soils become alkalised, reducing the availability of nutrient elements. Fertility is largely determined by the activity of soil microflora and mesofauna, but for the reasons mentioned earlier, urban soils are practically sterile almost to a metre depth [9].

The study of the influence of various plant species on the composition and properties of urban soils is an urgent task in the context of sustainable development of urban areas and improvement of their ecological condition. Currently, studies are underway to assess the ability of woody, shrub and herbaceous plants to adapt to contaminated soils, their role in soil formation processes, as well as their potential in phytoremediation and bioremediation [10].

Conifers play a significant role in enhancing the quality of the urban environment. Most conifers are evergreen, making them particularly valuable for landscaping in temperate zones, as they contribute to air purification by filtering dust and harmful gases even during winter. However, their use in urban landscaping can be challenging due to their high sensitivity to various pollutants, largely attributed to the long lifespan of their needles. Despite this, some conifer species show remarkable resistance to anthropogenic pollution. Among these, species from the genus Thuja (Thuja L.) are especially noteworthy, as they not only have high ornamental appeal but also exhibit greater tolerance to toxic gases compared to other conifers [11].

Soil texture and organic matter were the main factors in plant distribution [12]. The city of Almaty is situated on the south-eastern side of Kazakhstan, in a region characterised by physical-geographical and natural-climatic conditions that place it within the Tien Shan Mountain system, at an altitude of 670-970 metres above sea level, along the Big and Malaya Almaty rivers. The city is home to a diverse range of natural ecosystems, including glaciers on the southern border and semi-deserts on the northern border. The high-mountainous tier of the Zailiyskiy Alatau mountain range is characterised by alpine forms of relief. In the foothills, there is a steppe belt. In the northern part of the city, the uneven relief begins to level off sharply, and the steppe belt runs along the rivers Bolshaya and Malaya Almatinka, Esentai (Vesnovka), Remizovka.

The mountains in the Almaty region are formed by layers of crystalline slab-stone rocks, which were formed by the Tien Shan Mountain system and date back to the Precambrian period.

Today, Almaty is included in the list of 25 polluted cities in the world. The main problem in the ecology of Almaty is the pollution of the urban atmosphere and soil cover. A variety of harmful substances are emitted into the atmosphere of the city from industrial enterprises, heat and power systems, motor transport and other sources. As a result, harmful substances contaminate the soil, water sources, living organisms, plants, animals, and humans [13-15].

In Almaty, one of the most urgent environmental issues is the pollution of air and soil by heavy metals. The health of the local plant life serves as a critical indicator of the city's ecological well-being, as plants play a fundamental role in enhancing the urban ecosystem.

The mobility of heavy metals is contingent upon their geochemical state and the degree of technogenic impact. It is important to consider that the presence of a heavy granulometric composition in the soil environment can affect the binding of heavy metals. Furthermore, an increase in the degree of soil pH can enhance the absorption capacity of cationic metals (copper, zinc, lead). These conditions may therefore affect the accumulation of heavy metals in upper amounts in the studied soils.

The principal sources of heavy metal inputs are industrial pollution of the city, thermal power plants, metallurgical plants, transport, chemicals used in agriculture, waste incineration, ferrous and non-ferrous metallurgy industry. The impact of pollutants is felt over distances of tens of kilometres [16,17].

It was observed that the magnesium (Mg) and iron (Fe) content of the *Western Thuja, Thuja occidentalis* L., The concentrations of magnesium (Mg) and iron (Fe) were notably higher in plants growing near the institution compared to those in areas influenced by heavy vehicular traffic. In contrast, calcium (Ca) levels nearly doubled in plants from the cleaner environment.The *Eastern Thuja*, *Platycladus orientalis* L. Franco, exhibited a Mg content of 1.91% in the vicinity of the institution and 1.70% in an area with elevated vehicular traffic [18].

This article aims to evaluate the soil conditions in which *Thuja occidentalis* L. and *Platycladus orientalis* L. trees are growing. To this end, the following objectives were established:

1. To determine the impact of *Thuja occidentalis* and *Platycladus orientalis* trees on soil conditions in the context of Almaty city;
2. To analyse the chemical composition of the soil cover in which *Thuja occidentalis* L. and *Platycladus orientalis* L. grow in the context of Almaty city.

The soil cover of Almaty city exhibits clear indications of high altitude belts, with the presence of foothill desert and steppe zones. In contrast to the natural landscapes that once existed, the city now displays a landscape that is largely cultural in nature. In some areas, the soil is characterised by the presence of chernozems, while in the majority of the city, the soil is composed of dark-brown and light-brown soils [19].

Materials and methods

Soil coordinates were obtained (near Al-Farabi Kazakh National University), (near Kazakh National Pedagogical University named after Abai (P3-4)) and Almaty-1 district. These zones have their own features of soil formation.

Field survey and laboratory methods

Field methods (1). In the course of field studies, natural conditions of the study sites were described, soil profiles were laid down, their morphological features were described, soil samples were selected for laboratory studies. In the course of field research 5 soil profiles were laid and studied. Field studies, sampling and preparation of samples were carried out in accordance with generally accepted methods [20-21].

Laboratory methods (2). In total, 5 soil profiles were laid in the areas where the sites were found. For chemical soil analysis, 19 samples were collected, each analyzed in four replicates. Soil samples were analyzed in the analytical laboratory of U.U. Uspanov Kazakh Scientific Research Institute of Soil Science and Agrochemistry. Soil organic matter content was determined by Tyurin method. Total nitrogen was analysed by titration (Keldal method). Total phosphorus and potassium were measured using a spectrophotometer (Specord 210 Plus, Germany). Soil pH was determined using a pH-meter (I-160MI, 2007, Russia). CO_2 content – using a calcimeter. Granulometric composition was determined by Kachinsky method. Total salt content in soil was analysed using a flame photometer (Flapho4, Germany). Total and mobile amounts of heavy metals in the soil (Cu, Zn, Mn, Fe, etc.) were determined by atomic absorption spectrometry.

Research results and analysis

Morphological description of soils

The analysis of morphological features revealed that the soil profile near KazNU (P1-2) belong to dark chestnut soil types, while those near KazNPU (P3-4) and near Almaty-1 (P5) belong to chestnut soil types.

P1. The projective cover of vegetation is 85-90%. Coordinates: N 43.224444°; E 76.922778°. Height above sea level H: 870 m. The depth of the profile is 100 cm.

Horizon	Depth, cm	Thickness, Cm	Description
A	0-10	10	Dark brown, fresh, loose, medium-grown, coarse-grained, granular-grained, slit (porous), with small veins, with dead plant remains, medium boiling.
AB	10-40	30	Brown, in some places with brown tints, compacted, fresh, sandy, fine-grained, veins moderately scattered, with traces of insect marks, with slightly small stone particles, strongly boiling.
B	40-65	25	Light brown, with dark spots in between, dense, sandy, fine-grained, with a few small stony compounds, roots and insect pathways occur, transition to the second layer is evident, strongly boiling
C	65-100	35	Light brown, yellowish tone, structureless, dry, sandy-powdery, fine-porous, root-dominated, weakly boiling

P2. The second soil profile was also built near KazNU. The projective cover of vegetation cover is 85-90%. Coordinates: N 43.216667°; E 76.916667°. Height above sea level H: 878 m. The depth of the profile is 100 cm.

Horizon	Depth, cm	Thickness, Cm	Description
A	0-23	23	Dark brown, grey, whitish tinged, fresh, compacted, sandy-grained, lumpy-powdery, alkaline, with insect tracks, roots in abundance, with vegetable remains, strongly boiling with hydrochloric acid.
B_1	23-33	10	Brown, with brown tinge, compacted, fresh, medium sandy, alkaline, lumpy, small veins, traces and traces of insects, not boiled by hydrochloric acid.
B_2	33-57	24	Light brown, fresh, loose, structureless, sandy loam, coarse stones and fine stones, with small veins, not boiling, occur.
C	57-100	43	Greyish, dry, structureless, sandstones,stones and small stones are found, there are also middle-sized stones and stubs.

P3. The third profile of the soil was near KazNPU. The projective cover of vegetation is 90-95%. Coordinates: N: 43.257222°; E: 76.93°. Height above sea level H: 780 m. The depth of the profile is 80 cm.

Horizon	Depth, cm	Thickness, Cm	Description
A	0-10	10	Grey, fresh, dense, lumpy-grained, light sandy, with fine veins, with salt crystals, small stones and rocks occur, there are traces of insects, crevices, very hard boiling
B	10-35	25	Grey, in some places with brown tints, compacted, fresh, sandy, fine-grained, veins moderately scattered, with traces of insect marks, with slightly small stone particles, strongly boiling from hydrochloric acid.
BC	35-80	45	Light grey, with whitish tinge, very dense, fresh, crumpled, light sandy, fine-grained, root-dominated, with salt crystals, with many stones, very strongly boiling.

P4. The fourth soil profile was also near KazNPU. The projective cover of vegetation is 85-90%. Coordinates: N:43.258889°; E: 76.930278°. Height above sea level H: 780 m. The depth of the profile is 100 cm.

Horizon	Depth, cm	Thickness, Cm	Description
A	0-10	10	Dark grey, fresh, loose, medium-grown, coarse-grained, granular-grained, slit (porous), with small veins, with dead plant remains, boiling from hydrochloric acid medium.
AB	10-30	20	Grey, dry, lumpy, coarse-grained, medium-grained, with paths and insect burrows, with plant roots, small stones, with salt crystals, compacted, slightly boiling from hydrochloric acid.
B	30-63	33	Grey, with distinct brown spots, dry, compacted, light sandy, powdery, slit-like, with few salt crystals, plant roots occur, there are large stones, not boiling
C	63-100	37	Light brown, dry, granular, compacted, slightly sandy, with small salt crystals, with fine veins, with few stones, not boiling from hydrochloric acid.

P5. The fifth soil profile was built near the Almaty-1. The projective cover of vegetation cover is 85-90%. Coordinates: N: 43.326111°; E:76.940833°. Height above sea level H: 700 m. The depth of the profile is 100 cm.

Horizon	Depth, cm	Thickness, Cm	Description
A	0-26	10	Light-coloured, dry, very dense, lumpy-dusty, lightly mucilaginous, slit-like, without visible salts, with thin veins, with thin insect traces, transition to the next layer obvious, strongly boiling in acid
B	26-50	20	Light coloured, dry, slightly compacted, lumpy – powdery, light grained, with thin gaps, spines occur, there are stony compounds, alternate at once in structure, boils strongly in hydrochloric acid.
BC	50-77	33	Light grey, light tinged, dry, very dense, prismatic-dusty, sandy, with small pebbles, roots occur, transition gradual, boils very strongly in hydrochloric acid.
C	77-100	37	Snow-white, dry, powdery-dusty, weakly compacted, lightweight, with many roots, with traces of insects.

Granulometric composition. Soil mechanical composition is of great importance in soil formation, use of soil for agricultural and other purposes. Mechanical composition of soil and its properties such as porosity, water-holding capacity, water permeability, water capacity, ability to accumulate substances, air and heat regimes are closely connected [22].

The granulometric composition of the first soil profile was dominated by fine sand fraction (0.25-0.05 mm) which was 28.12% followed by fine dust fraction (23.1%). The second soil profile was dominated by coarse sand (1.0-0.25 mm) and fine sand (0.25-0.05 mm) fractions (28.4 and 26.66 %). The third soil profile was dominated by fine sand (0.25 – 0.05 mm) and fine dust (0.005 – 0.001 mm) (26.1 and 25.01 %).

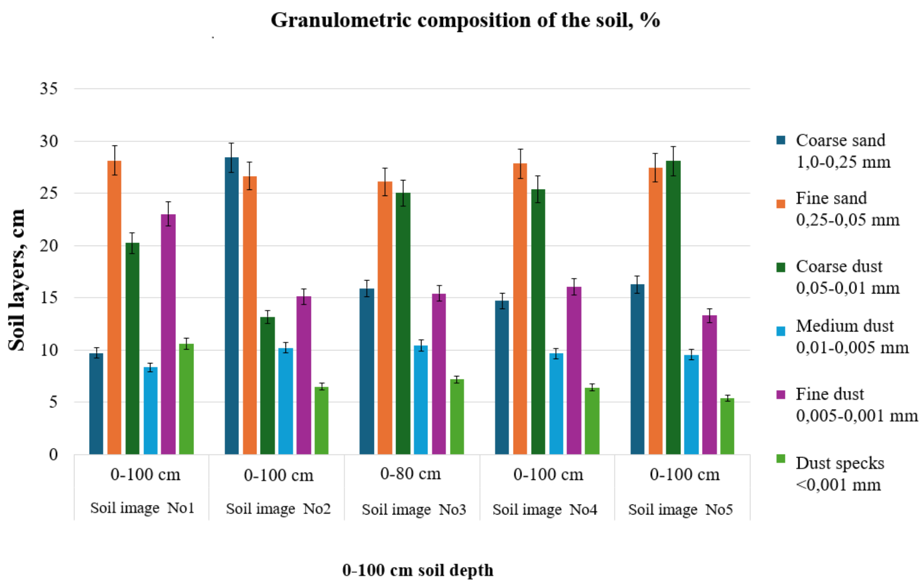

Figure 6 – Granulometric composition of soil on which *Thuja occidentalis* L. and *Platycladus orientalis* L. trees grew in Almaty city

In the fourth soil profile, fine sand (0.25 – 0.05 mm) and fine dust (0.005 – 0.001 mm) were predominant (27.82 and 25.38 %). The granulometric composition is heavy sandy-clayey. The fifth soil profile was also dominated by fine sand (0.25 – 0.05 mm) and fine dust (0.005 – 0.001 mm) (27.43 and 28.1 %).

Four of the soil profile studied for particle size distribution were heavy sandy-clayey and one was medium sandy-clayey. Heavy sandy clayey soils are muddy, freeze on drying, and require agrochemical management with machinery.

Chemical composition pH soil acidity. In the first soil profile, the humus content is 3.82 – 0.86% in 0 – 50 cm soil layer. Accordingly, the surface soil layer was higher. The soil medium reaction ranged from 8.33 – 8.75 at 0 – 100 cm soil layer, i.e. showed a strong alkaline environment (Fig.7). In the second soil profile (KazNU), the humus content ranged from 0.07 to 2.02% in 0-50 cm layer of soil. The reaction of soil medium was in the range of 8.26 – 8.51 at 0 – 100 cm of soil layer, i.e. strongly alkaline (Fig.7).

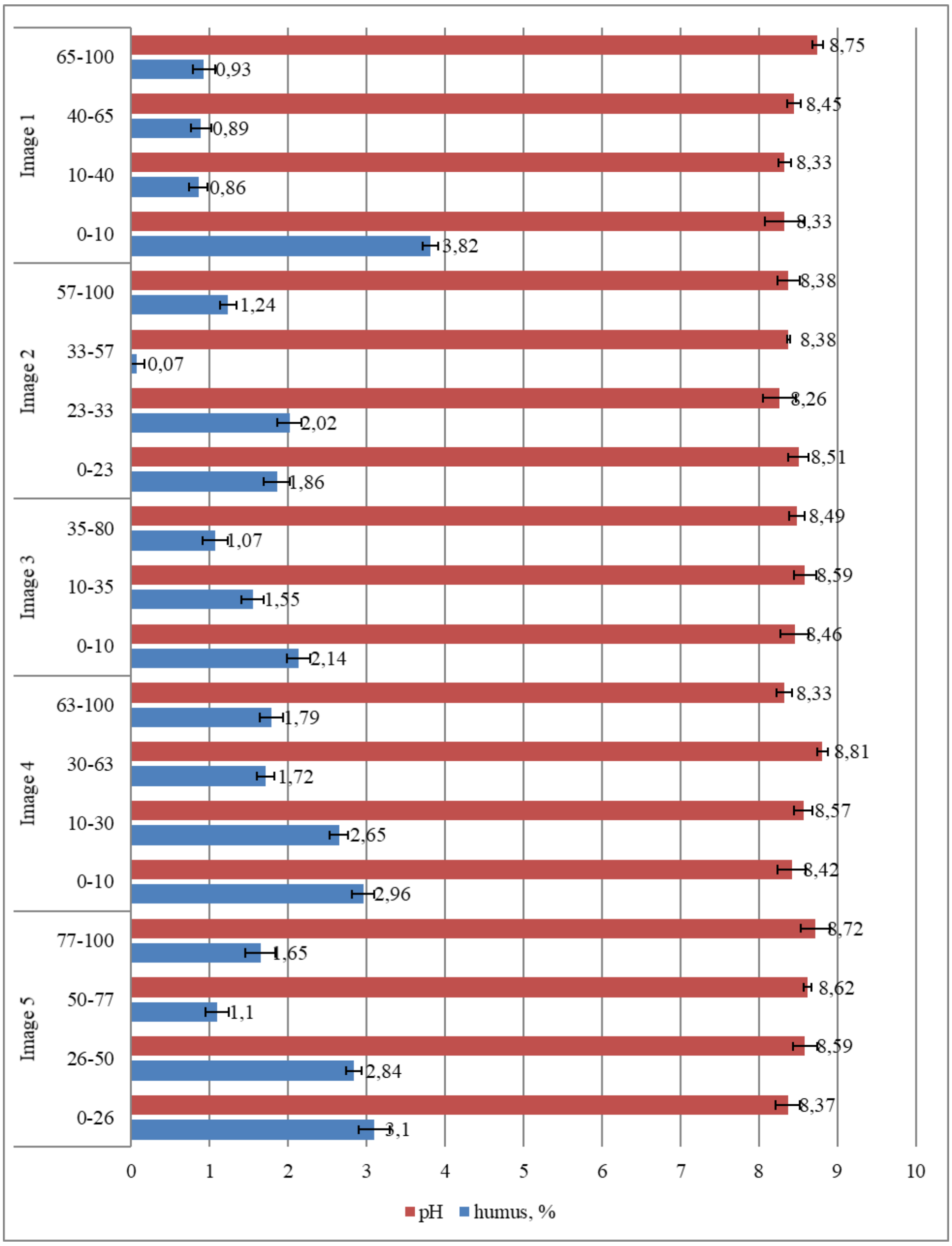

Figure 7 – The indicators of humus and pH of soil in which *Thuja occidentalis* L. and *Platycladus orientalis* L. trees grew in Almaty city

In the third soil profile, the humus content ranged from 1.55 to 2.14% in the 0-50 cm layer. The reaction of soil medium in 0-100 cm soil layer between 8.46 and 8.59 showed strong alkalinity (Fig.7). The humus content in the fourth soil profile (KazNPU) was 1.72 – 2.96% in 0 – 50 cm layer. The reaction of soil medium showed strong alkalinity in 0-100 cm of soil layer ranging from 8.33 – 8.81 (Fig.7).

In the fifth soil profile, the humus content was in the range of 2.84 – 3.10% in 0-50 cm of soil layer. The reaction of soil medium showed strong alkalinity in 0 – 100 cm of soil layer in the range of 8.37 – 8.72 (Fig.7).

It was found that all studied soil profile were covered with humus to a lesser extent in terms of humus content. And the reaction of soil medium was strongly alkaline in all profile soils.

All heavy metals in a certain minimum amount are among the trace elements necessary for the vital activity of living organisms and plant growth and development. However, their accumulation in soil above threshold amounts causes significant damage to living organisms and plants [23-25].

The presence of heavy metals in soil is higher compared to other components of the biosphere, thus heavy metal contamination of soil lasts longer. Metals are gradually destroyed in the process of leaching with accumulation in the soil, during use by plants, in the processes of erosion and deflation (Cabata-Pendias, Pendias, 1989) [26].

Table 1 – Content of heavy metals in soils of *Thuja occidentalis* L. and *Platycladus orientalis* L. in Almaty, mg/kg

№	Soil depth, cm	Mobile forms of micronutrients, mg/kg			
		Zn	Cu	Mn	Fe
Profile 1	0-10	91,6±0,55	26,8±0,08	538,4±0,26	400,0±0,15
	10-40	56,8±0,75	18,4±0,09	470,0±0,25	2780,0±1,45
	40-65	67,2±0,92	19,2±0,12	508,4±0,25	7200,0±2,05
	65-100	54,4±0,65	12,4±0,1	389,6±0,35	10192,0±1,1
	Average amount	67,5±0,7	19,2±0,1	476,6±0,3	5143,0±1,2
Profile 2	0-23	72,8±0,35	35,2±0,05	550,0±0,40	13688,0±0,7
	23-33	66,0±0,1	38,0±0,08	573,6±0,46	16824,0±0,7
	33-57	44,8±0,03	27,6±0,05	372,4±0,15	19240,0±1,15
	57-100	119,6±0,2	33,6±0,09	563,6±1,35	20384,0±0,66
	Average amount	75,8±0,2	33,6±0,1	514,9±0,6	17534,0±0,8
Profile 3	0-10	98,4±0,15	27,2±0,08	480,8±1,25	17224,0±0,55
	10-35	82,8±0,25	28,8±0,14	524,4±0,32	19152,0±1,85
	35-80	82,0±0,25	36,0±0,05	564,4±0,18	18672,0±1,12
	Average amount	87,7±0,2	30,6±0,1	532,2±0,6	18349,0±1,1
Profile 4	0-10	134,4±0,15	89,2±0,45	500,0±0,15	15376,0±0,64
	10-30	112,8±0,35	128,8±0,15	504,0±0,35	15800,0±0,76
	30-63	72,0±0,25	36,0±0,25	550,4±0,25	17744,0±1,53
	63-100	74,8±0,15	37,2±0,55	586,0±1,6	18256,0±2,52
	Average amount	98,5±0,2	72,8±0,4	535,1±0,6	16794,0±1,4
Profile 5	0-26	108,0±0,2	39,2±0,7	434,4±0,35	13024,0±0,57
	26-50	81,6±0,28	37,6±0,35	449,2±0,85	13784,0±1,16
	50-77	66,0±0,35	35,2±0,4	463,6±0,25	14880,0±1,53
	77-100	64,0±0,17	32,8±0,45	461,6±0,4	17040,0±1,7
	Average amount	79,9±0,2	36,2±0,5	452,2±0,5	14682,0±1,2
Amount of TLV in soil [25]		23	3	1500	4200

When determining the mobile forms of trace elements it was noticed that in all variants the amount of Zn, Cu, Fe exceeded the limit concentration 3-4 times, and the amount of Mn was 2-3 times less than the threshold limit value (TLV). In the Profile 1, shows that in the soil where *Thuja occidentalis* L. was growing, the content of heavy metals was lower compared to the soil where *Platycladus orientalis* L. was growing, whereas the Profile 3 (KazNPU) presumes that in the content of Cu decreased twice where *Thuja occidentalis* L.was growing compared to the profile where *Platycladus orientalis* L. was growing. In Almaty-1 conditions, Mn was relatively decreased in the soil where two species of trees grew.

The study showed that the mobile amounts of Zn, Cu and Fe are significantly higher than the TLV in Almaty, and the amount of Mn is 3 times less than the TLV.

Table 2 – Physico-chemical indicators of soils in research areas

	Study areas from which soil profile are obtained	Mass fraction of organic matter (humus), %	pH value	Humidity, %
1	*Thuja occidentalis* L. in Al-Farabi KazNU vicinity (N: 43.224444°; E: 76.922778°)	3.82±0.33	8.33±0,98	5.93±0,45
2	*Platycladus orientalis* L. In Al-Farabi KazNU vicinity (N:43.216667°; E:76.916667°)	1.86±0,21	8.51±0,97	3.68±0,36
3	KazNPU vicinity (*Thuja occidentalis* L.)	2.96±0,27	8.42±0,94	3.29±0,38
4	KazNPU vicinity (*Platycladus orientalis* L.)	2.14±0.28	8.46±0.87	5.65±0,69
5	Almaty-1 vicinity (*Thuja occidentalis* L., *Platycladus orientalis* L.)	3.10±0,29	8.37±0,88	3.52±0,61

It was also shown in the study that in case of *Thuja occidentalis* L. growing in Point 1, the humus content is higher than 3.82%, pH value indicates alkaline environment and moisture content is higher than 5.93%. In Point 2, in case of growing *Thuja occidentalis* L., the humus has higher percentage as compared to the soil on which of *Platycladus orientalis* L. was grown. In Point 3, the humus content is 3.10 per cent in case of cultivation of Almaty-1 trees (*Thuja occidentalis* L., *Platycladus orientalis* L.).

Conclusion

According to the analysis of morphological features of soils on which *Thuja occidentalis* L., *Platycladus orientalis* L. grew in the vicinities of KazNPU and Almaty-1, dark chestnut soil type and chestnut soil type were identified in the vicinities of KazNPU and Almaty-1. Most of the soil profile studied by granulometric composition were heavy sandy-clayey.

Humus content was 1.86 – 3.82% in all soil samples studied, soil medium showed strong alkaline medium 8.33-8.51 in all soil samples.

The levels of Zn (2.9 – 4.2 times), Cu (6.4 – 24.2 times) and Fe (1.2 – 4.3 times) were above the TLV in all soil samples tested. The fourth soil profile where *Platycladus orientalis* L. grew among the soil profile had the highest values of Zn, Cu and Fe. It was observed that Mn was 3 times less than TLV in all the profile.

In conclusion, it was found that the soil in which *Thuja occidentalis* L. grew had increased humus content and less heavy metal content as compared to the soil in which *Platycladus orientalis* L. grew. Thus, *Thuja occidentalis* L. can be recommended for cultivation as a phytoremediant capable of absorbing heavy metals from soil.

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