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The Ecological State and the Problems of Recultivation of Man-Made Disturbed Irrigated Soils

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ABSTRACT

This article considers man-made pollution of the environment around the thermal power plant of the city of Angren, Almalyk district, Tashkent region. GIS technologies were usedin order to study this object. This area was explored in certain sites. The sources of pollution of the studied objects are identified. The physical, chemical and biological properties of the soil were studied in laboratory and field conditions. An Angren TPP and a new Angren TPP have important place, since they are sources of pollution of irrigated soils and residential settlements. The activities of various industrial enterprises led to man-made soil degradation. Hazardous heavy metals are divided into 3 groups. In theseareas, pollution leads to man-made degradation of the soil and affects the environment, flora, and water sources. The negative changes of the above mentioned features have been revealed. The soil cover becomes poor and scarce due to pollution of ash and slag from the thermal power plants release. Flora and fauna become rare and endangered. The man-made pollution causes great damage to irrigated gray soils. Angren TPPs are the main source of anthropogenic disturbances in the research area, wind is the main factor in the spread of pollution from both sources, and pollution is not related to groundwater. The main sources of man-made pollution of soils in the Tashkent region are Angren TPPs, the main cause of pollution is the anthropogenic factor. Man-made pollution is distributed around the territory of the Angren thermal power plant by 1.6-8 km. In the studied sitesaffected by man-made pollution and ecological conditions, the pollution leads to a decrease in the totality of microorganisms, deterioration of physical properties, changes in chemical properties, disruption of air and water regime, decrease in soil fertility.It is recommended to take this consistency of the events into consideration while developing reclamation technology on technically degraded lands. It is possible to restore soil fertility and improve the ecological situation of an object only with the help of land reclamation equipment and a recultivationmethod.. The article also presents some aspects of the study made on the introduced plant Lyciumchinense Mill for research in sanitary protection zones. The data on the anatomical structure of LyciumChinense Mill leaves are considered for diagnostics and further greening of the environment.

KEYWORDS

Pollution, Man-made, Soil, Physical, Chemical, Biological, Soil Sections, Improvement, Recultivation, Anomocytic Type of Stomata, Stomata, Epidermis.

Introduction

The world today has a growing trend of natural and anthropogenic effects on the soil leading to changes in soil properties, environmental conditions and productivity, and in sometimes to inappropriate use. Artificial soil degradation is defined as a change of its ecological state, which reduces soil fertility and effectiveness. Therefore, the prevention of man-made degradation of irrigated soils, the development of recultivation technologies, clearing and efficient use of land are of great importance in all countries of the world.A number of scientific studies are being held worldwide in order to identify man-made soil disturbances, soil and climatic recultivation processes during the chemical industry, the heat and power sector, oil and gas, coal and mineral deposits processes. In this regard, it is necessary to identify the main factors of contamination of man-made disturbed soils, to identify the level of soil contamination by protection and pollution zones, to identify the mechanism for changing productivity, affecting the physical, chemical and biological properties of soils, and also to develop inexpensive and secondary harmless technologies.Nowadays the main sources and factors affecting the man-made degradation of irrigated soils in the republic, types of chemical pollution, physical and chemical properties of soils and soil fertility, selection of appropriate types of remediation, development of measures for soil recultivation should be defined. In order to restore productivity and efficient use of soils large-scale measures are being taken. It is important to determine the properties of man-made disturbed soils in the areas of pollution and genetic stratification of the soil, as well as to

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develop the appropriate reclamation technology. Therefore, it is more accurate to use GIS maps for man-made disturbed lands.Currently, soil pollution is one of the global problems. Therefore, the problems of adaptation of plants to various environmental pollutants occurring under anthropogenic influence are of increasing scientific and practical interest. The release of toxic compounds into the environment leads to chemical contamination. Pollutants are environmentally hazardous factors. They disrupt the ecosystem, the flow of substances and energy, reduce productivity and change the structure of the population and species diversity.

People in the course of their activities produce a huge amount of chemicals that have a negative impact on the environment. There is waste at all stages of the production of final products, and any final product after being used also becomes waste. A special place among them is occupied by heavy metals (HM). Environmental pollution with heavy metals has a negative impact on the properties of soils.

Some plant species, as indicators and hyperaccumulators of heavy metals, are of great importance for the phytoremediation of contaminated soils. The use of plants to restore polluted nearby areas is much more economical than chemical and technical methods and causes less damage to the natural environment. The accumulation of various chemical compounds in the soil leads to contamination of groundwater and surface water bodies with metals, their accumulation in plant tissues and organs.

Taking into account the current unfavorable state of the territory, it is necessary to develop a set of measures to maintain soil fertility, which can improve polluted soils with the greatest effect. The most promising method for cleaning up pollution in industrialized countries is considered phytoremediation – cleaning the soil with the help of plants. Certain plant species growing in polluted areas can accumulate a certain amount of heavy metals in their tissues without visible signs of oppression (Baker et al., 1989, Chaney et al., 1983).

Almost the only technology suitable for cleaning contaminated soils from heavy metals is phytoremediation, a high — tech strategy based on the ability of some plants to accumulate HM in high concentrations in aboveground organs (Reeves et al., 2000). Among HM-resistant plants, a special place is occupied by hyperaccumulative plants that can not only grow on highly enriched soils, but also accumulate them in the aboveground mass in concentrations ten or more times higher than the average for plants that do not belong to this group (Reeves et al., 2000, Krämer et al., 2010).

For this purpose, preliminary experiments with introduced plants were carried out on the territory of the Angren thermal power plant in the sanitary protection zone (1000 m). Among them, a special place is occupied by Lyciumchinense Mill of Genus Lycium L. from the Solanaceae family.

Lyciumchinense Mill. perennial is a deciduous shrub with soft, sometimes half-climbing stems. Stems up to 3-4 m high with small and thin spines. The plant has a well-branched root system, from which there are offspring that quickly begin to occupy the surrounding area. The flowers are bell-shaped, purple-pink, light purple, single or 2-5 in the axils of the leaves, have a pleasant smell (Pavlov, 1998). The box-thorn grows on the dry slopes of foothills, mountains, in rocky crevices, along roads, in other words, the plant is unpretentious. (Encyclopedic dictionary of medicinal plants and animal products St. Petersburg SpetsLit: Izdatelstvo SPKFA, 2002).

This study was held in accordance with the priority areas of science and technology development of the Republic of Uzbekistan "Agriculture, biotechnology, ecology and environmental protection."The purpose of the study. Identification of man-made disturbance and the ecological state of irrigated gray soils, and their chemical, physical and biological changes. The study of the anatomical structure of the Lyciumchinense Mill leaf in sanitary protection zones.The objectives of the study: to identify sources and factors of man-made destruction of soils of the study area; to determine the state of chemical pollution of irrigated gray soils and change in pollution sites; to determine the ecological state of the research site, to study changes in soil cover, flora;

The object of the study is the gray soils in the Tashkent region around the AngrenTPP (thermal power plant), the sanitary protection zones.

Materials and Methods

The modern methods of soil science, heavy metals and other compounds in the soil were used in field and laboratory experiments according to the methodological instruction MP 003: 2015. Recultivation measures (GOST 17.5.3.04-83) interstate standardization, separation by zones (Juvelikyan et al., 2009). Microbiological experiments (Zvyagintsev et al., 2005), mathematical and statistical processing (Dospekhov et al., 1985), and the program “StatgraphicsCenturionXVII” was used.

Results and Discussion

Irrigated lands of Uzbekistan make up 9.6% of the total land fund. The main crops are cultivated on these irrigated lands, but the specific features and productivity of these lands are severely disturbed. In particular, 60% of irrigated lands are saline, partly eroded, and inefficient for agricultural use due to desertification, waterlogging, nutrients deficiency, chemical pollution and man-made degradation.

In this paper, we consider the anthropogenic load due to the degradation of irrigated soils and man-made disturbance, where recultivation and its effective use are necessary, which will lead to a change in soil properties. It is important to study the man-made disturbance of irrigated soils, identify their main sources and factors, and also create the appropriate technology for recultivation.

Thermal power plants operate in many countries; in Pakistan, a thermal power plant operates using coal and emits coal, slag, and ash waste that negatively affect the growth and development of plants (Abdel et al., 2007). In thermal power plants due to the combustion of coal, a large amount of emissions was noted, including heavy metals, dust, slags, hydrocarbons, carbon oxides, which negatively affect the biosphere, lead to climate change, the appearance of an ozone hole (Arnab et al.,2013,Safty et al., 2013). It is proved that in India, emissions of sulfur dioxide and nitrogen oxides from thermal power plants pollute inactively affect the environment, including plants, soil, and human health (Cropper et al., 2012). On the territory of Turkey, the sources of man-made disruption are plastics, paints, metals, energy, textile industry, wood, car dusting, food, cosmetics, packaging and other industries (Yaylalı et al.,2011). Around the metallurgical plant caused great harm and damage to soils and plants, man-made air pollution affected the surface and the organic layer of the soil (Dushkova et al.,2011). Around the ferrous metallurgy industry, subsoil and subsoil pollution with heavy metals were noted, while studying the samples, an MPC exceeded (maximum of permissible concentration), which led to the unsatisfactory state of the environment (Daukaev et al.,2008).

Man-made pollution of the mining industry, which becomes the cause of soil degradation (Krasnikov et al.,2019,Datta, 2008,Schad, 2013) has been little studied. With the acceleration of urbanization over several years, the number of industrial enterprises isincreasingand the soils of the city are polluted with the following elements: Pb, Zn, Ni, Mn, Ba, As, Hg, Mo, Cr, Sr, V, Ni, Cr, Co, Cu, F, Al, Li, Be, Ti, Ag, Cd, Se, Sn, Tl, Bi, Na, K, S, Cl, oil products and other chemicals, in connection with this, the density of the soil increases, the number of actinomycetes, nitrification, denitrification bacteria decrease mushroomsthat help retain moisture (Belozertseva et al.,2015).

Currently, the problem of waste puzzles not only Uzbekistan, but also other countries of the world. 2 billion tons of industrial waste, construction and municipal waste are stored in tailing dumps; they occupy more than 12 thousand hectares and negatively affect the environment (Tursunov,2018).

As a result of metallurgical and chemical production activities in the districts of Chirchik, Angren, Almalyk, Akhangaran, Tashkent region, soils are polluted with heavy metals. The results show that elements such as copper, zinc, lead, cadmium and fluorine from natural rocks exist in the soil, but most of them enter the soil from artificial sources and are absorbed by the soil, organic substances, and fine-grained colloidal particles. The total and mobile composition of copper in clay and alkaline deposits forming urban soils in the Akhangaran oasis is 23 mg / kg and 1.0 mg / kg, zinc 100 mg / kg and 3.07 mg / kg, lead 20.0 mg / kg and 1, respectively,10 mg / kg, cadmium - 2.25 mg / kg and 1.0 mg / kg (Tursunov et al.,2003,Tursunov et al.,2006).

The area under the study was located near the Angren TPP emits the most hydrogen sulfide, nitrogen and carbon oxides. Currently, more than 10 million ashes of chemicals are accumulated around TPP Angren and NovyAngren. Every year 500 000 tons of ash are emitted from New Angren TPP, 120 000 tons are emitted from operating old

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Angren NPP(Muratova et al 2016). Thermal power plants operate from coal for electricity production. The iron and steel industry waste is a large sector that has a significant negative impact on potential soil fertility and a decrease in agricultural productivity. In addition, the accumulation of toxic chemicals used in the soil can also adversely affect geochemical processes (Vodyanitsky et al., 1995,Sangadzhieva et al.,2005). It is important to study its microbiological parameters in order to understand the state of the environment of man-made disturbed soils. The analysis of biological processes makes it possible to develop a scientific basis for the effective management of forecasting, conservation, improvement, and protection of soil fertility (Shishikin et al.,2012,La et al., 2018,Plyatsuk et al.,2018,Ruzmetov et al., 2012). When studying man-made disturbed soils, it is recommended to conduct an in-depth study of local plants, biodiversity and ecosystems of the area (Zenkov et al., 2017, Lo et al., 2018).

Around the iron ore purification plant, pollution occurs changing the chemical and agrochemical properties and the amount of nitrogen has significantly decreased (Vodoleev et al., 2018). Cr, Pb, Cu, Zn and other heavy metals are accumulated in the roots of plants and other exposed organs(Violante et al., 2010).

The activities of various industrial enterprises led to man-made soil degradation. Hazardous heavy metals are divided into the following 3 groups (Table 1) according to the international standard (GOST 17.4.1.02-83. Protection of Nature, 1983).

Table 1. Heavy metals risk

Safety level	Elements
High	As, Cd, Hg, Se, Pb, Zn
Medium	Co, Ni, Mo, Cu, Cr, Sb
Low	Ba, W, W, Mn, Sr
Not defined	Ge, Sn, Ce, La, Bi, Y, Rb, Cs etc.

As a result of man-made disturbance, the amount of organic substances in the soil decreased. Plants located in this area need minerals, nitrogen, phosphorus and lack of nutrients leads to the loss of microorganisms (Lukina et al.,2009,Alam et al.,2011,Yuldasheva et al.,2017).

The Tashkent region area, which is under the research, is geographically located in the north and northeast of the region, with the Chatkal ridge and its branches occupied by Kurama, Pskem and Ugam. Its highest points are the peaks of Adelung (4301 m) and Beshtar (4229 m) on the Pskem ridge. Most of the southern and southwestern parts of it consist of the foothill plain of the Syr Darya (Chirchik-Akhangaran valley) (Atlas of the Tashkent region,2016).

The studies were conducted in the Tashkent region of the Akhangaran region, where the TPP of the Angren and TPP of the new Angrenplay a significant role, since they are sources of pollution of irrigated soils and residential villages. In areas, pollution leads to man-made degradation of the soil and affects the environment, flora, and water sources. On the map you can see the research area (Figure 1).

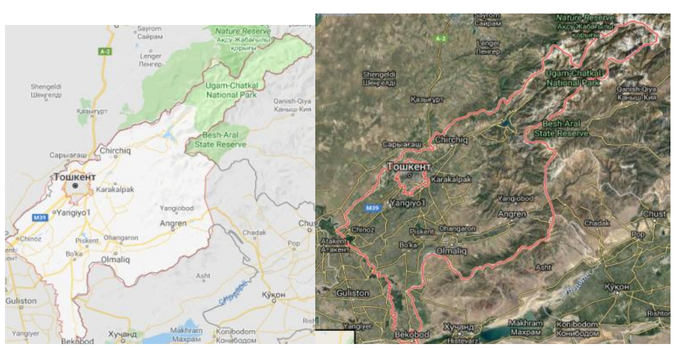

Fig. 1. The geographical location of the research area

The Akhangaran region is located in the southeastern part of the Tashkent region and borders on Tajikistan in the south,Parkent in the north and partially on Middle Chirchik, from the east to Tajikistan and partially on Namangan region in the west. Geographic coordinates of the research area (Table 2).

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Table 2. Geographic coordinates of the research area

Angren town	
Northern point	N $41^{0}\,06^{1}81^{11}$northern latitude, E $70^{0}\,08^{1}\,53^{11}$eastern longitude
Southern point	N $40^{0}\,96^{1}\,60^{11}$northern latitude, E $70^{0}\,04^{1}83^{11}$eastern longitude
Eastern point	N $41^{0}\,02^{1}23^{11}$northern latitude, E $70^{0}98^{111}$eastern longitude
Western point	N $40^{0}\,98^{1}11^{11}$northern latitude, E $69^{0}\,99^{1}08^{11}$eastern longitude

Large geomorphological regions are located in the Tashkent region (Ruzmetov et al., 2018), highlands, medium and low mountains, low and high plains and low and high river terraces. The different structure of the earth's surface, the diversity of plant species, and the genetic types of soils have led to significant climate change. The hydrogeological conditions of the region are determined by geomorphological and lithological and relief conditions. Groundwater is formed mainly by underground transit water flowing through the mountains and foothills. In addition, they are formed by filtration water from the Chirchik, Akhangaran, Korasu and other irrigation networks, partly due to precipitation. Their levels rise from terraces III-IV to the oasis. On the IV terrace the ground water is at a depth of 5-10 m in the soil. In shallow and not deep valleys, groundwater reaches the surface and forms meadow soils. The groundwater level on terrace III is 2-3-5 m. Groundwater flows during the winter-spring season under the influence of groundwater. On the slopes of terraces I and II, groundwater levels are at depths of 2-3, 1-2 and 0.5-1,0 m. Under these conditions, hemihydromorphic meadow and hydromorphic meadows and meadow soils are formed. Groundwater is mostly salty and less mineralized. The highest levels are observed in July-August. At this time, glaciers and melting snow from the mountains increase the water level, causing the rise of rivers, which leads to the rise of groundwater as a result of irrigation of crops.

The vegetation of the research area is characterized by a vegetative period of plant growth and it is 210 days. Irrigated agriculture is widely used in this area. Juniper forests are found at an altitude of 1200–1400 m, and subalpine and alpine meadows are found at more than 2000 m. From the geobotanical point of view, Tashkent region is covered with ephemeral and ephemeroid plants. In this area, peculiar plants are found –*Poanemoralis, Poaangustifolia, Artemisiaabsinthium, Convolvulusarvensis, Viciatenuifolia, Bromusdanthoniae, Plantagolanceolata*and other plants. At an altitude of 350 m of the Akhangaran valley, the above listed plants are distributed where research was carried out. At an altitude of 500 m of the Akhangaran district, hawthorn bushes, pine and spicy almonds are found. At an altitude of 1200 m, along with various herbs, there are almonds, hawthorn, barberry, juniper, maple, nuts, Tien Shan spruce, birch, poplar, willow, apple, cherry and others.

The vegetation around the Angren TPP is affected by three types of man-made impact: firstly, from ash and slag emissions from thermal power plants, secondly, from chemicals contained in the smoke emitted by thermal power plants, and thirdly, as a result of human exposure to land use, resulting in a change in terrain, discharges of gravel, abandoned building materials. The area with such pollution amounts to more than 25 hectares, and as the distance from the thermal power station moves away, its man-made impact decreases (Figure 2).

Fig.2. Type of vegetation on man-made disturbed soils of theterritory under the research

When examining the territory around the Angren TPP and the new TPP, two types of impact of anthropogenic disturbance were noted. The first one, which arose as a result of direct ingress of ash and small particles of coal on the environment, leads to uneven terrain, crushed stone and other stones, which led to soil degradation. There has

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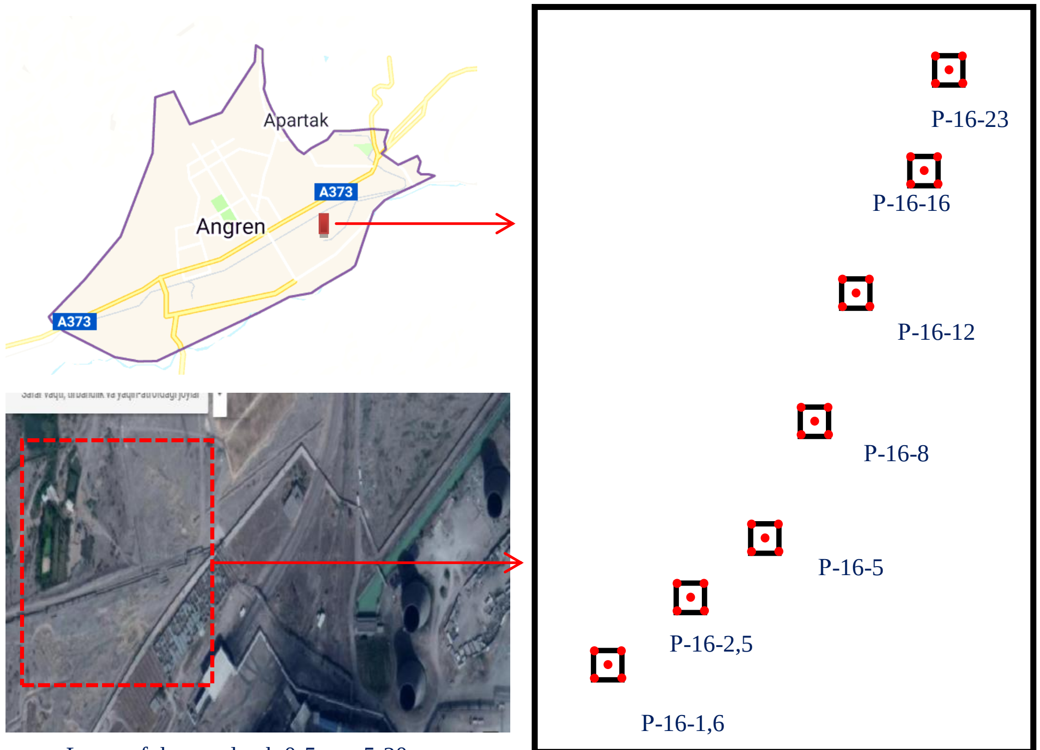
been no restoration work for a long time. The second, due to the emission of smoke into the environment along with chemicals. The wind flow also negatively affects the environment, and pollution spreads up to 10-12 km. The use of vegetation in this area is subject to pollution, which is subsequently unsafe for human health.

For analysis, gray-brown soils around the Angren TPP and the new Angren TPP, mainly contaminated with ashes around the studied object, were taken. Ashes are common in the northern, northeastern part of the territory due to the flow of wind and atmosphere. Soil samples were taken from sections of the northern direction (Figure 3).



Layer of the cut depth 0-5 cm, 5-20 cm, 20-40 cm, 40-60 cm, 60-80 cm, 80-110 cm, 110-150 cm,150-180cm смсм.

Fig.3. The points of soil cut around the Angren TPP

Here the people are engaged in the agriculture, growing various crops (wheat, corn, legume, alfalfa and others), and animal breeding as well. The pollution of the Angren TPP soil was caused by ashes and the emission of the chemicals smog (Figure 4).

Fig.4. Ecological condition and man-made disturbance aroundAngren TPP

As a result of man-made impact on soils, changes in the morphological characteristics of the soil are often observed

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it depends on the degree, type of impact and other aspects. Morphological features of soils also changed in the research area. The cross-cut and sampling of soil in the research area was carried out according to the requirements of GOST: 17.4.4.02–84 - Interstate Standard and recommendations by G.A. Juvelikyan, as well as changes with the modification of B. Jabborov.

Depending on the terrain soil samples were taken. From each 0.5-20 ha of the territory in the 10x10 meters, 1 test sample was made of the area intended for agricultural sowing around the Angren TPP. Samples were taken to control the degree of soil contamination, the characteristics of the sources of pollution and the sown species.

In accordance with the Interstate Standard, samples weighing at least 200 grams were taken from the surface of the soil layer to control the determination of the degree of pollution with heavy metals and other substances by the point characteristics. Soil samples were taken from depths of 0-5 and 5-20 cm.

When cutting and digging samples the direction of the wind was taken for the basis. Taking into account the protective zone, no samples were taken from a distance of 0.75 km from Angren TPP. The flora and fauna of this territory have not been studied. In accordance with the adopted modification, around Angren TPP, at a distance of 1.6 km, 2.5 km, 5 km, 8 km, 12 km, 16 km, 23 km, 14 key sections were selected and marked, where soil sections were made and samples taken.

The section showed the morphological features of soils:
Section (cut) -16-2.5 was taken off 2.5 km northeast of the Angren TPP. Irrigated gray soils are widespread in the territory earlier wheat and later on corn were sown here. Crops are surrounded by mulberry trees and mulberries. You can clearly see the source of the pollutant on the environment. On the surface of the soil, the fields are covered with a thin layer of ash.

0-5 cm. The soil is dark gray, slightly moist, medium loam, finely structured, density is relatively high and plant roots are found. Rarely found invertebrate animals. The amount of ash emissions occurs in the form of dust. There is not a lot of pebbles there.

5-20 cm. The soil is dark gray, more moisture, highly dense, finely structured, the physical composition – the medium density, the medium loamy. The plants roots are rare. Rarely found invertebrate animals. There is no remains of ash. Transition to the next layer with its own shade.

20-60 cm. The soil is light gray, very moist, finely structured, highly dense, with heavy sandy loam. There are no plant roots. A nest of invertebrate animals meets. No ash was found. Transition to the next layer with density.

60-100 cm. The soil is light gray, very moist, finely structured, highly compacted, with heavy sandy loam. No plant roots. Nest of invertebrates. No ash was found. The next layer passes through the density.

100-140 cm. The soil is dark gray, with a high moisture composition, finely structured, low density, heavy loam texture, no plant roots. Nest of invertebrates. No ash was found. Moisture moves to the next layer. No contaminants were found in the lower soil layers. During the cut, it was marked that morphological features of soils were mainly observed around the Angren thermal power plant. Firstly, around sources of pollution, layers A, B, C, and D are destroyed and mixed with gravel, and secondly, ash elements that emit from gray smoke accumulate on the topsoil. Apparently, the contamination process affected the morphological features of the soil. Morphological features of other key sites are similar.

As a result of man-made disturbances of the soil, its biological and microbiological properties are first destroyed, and then their physical properties are changed.Studies have shown that the emissions of the Angren Thermal Power Plant violated the soil genetic cover. In accordance with this, there were emissions of ash caused by burning coal, a decrease in particle size by 0.05-0.01 mm in the soil. And also in the context of 16-0.9 at a depth of 0.5 and 5-20 cm layers, the amount of 1-0.25 mm particles decreases (Table 3).

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Table 3. Man-made disturbed irrigated gray soils and their physicalstructure (entirely dry soil)

Cut depth, cm	The size of particles (mm)							Alphitite<0,01мм	Soil composition
	1-0,25	0,25-0,1	0,1-0,05	0,05-,01	0,01-0,005	0,005-0,001	<0,001		
Cut-16-1,6									
0-5	0,44	3,43	8,73	37,8	10,7	17,2	21,7	49,6	Heavy sandy loam
5-20	0,37	6,29	6,99	37,9	14,5	14,2	19,7	48,4	Heavy sandy loam
20-60	0,15	4,25	5,23	42,2	14,1	12,1	21,97	48,17	Heavy sandy loam
60-100	0,11	3,78	6,89	41,8	15,6	12,5	19,2	47,42	Heavy sandy loam
Cut-16-2,5									
0-5	3,71	1,29	5,6	37,19	12,41	21,3	18,5	52,21	Heavy sandy loam
5-20	2,82	1,52	6,16	38,7	14,2	18,1	18,5	50,8	Heavy sandy loam
20-60	0,96	1,78	7,16	39,84	13,1	18,4	18,6	50,26	Heavy sandy loam
60-100	1,13	1,93	6,45	41,8	12,13	17,41	19,1	48,69	Heavy sandy loam
Cut-16-5									
0-5	4,35	6,89	10,99	36,1	12,64	14,99	13,96	41,59	Heavy sandy loam
5-20	1,44	3,12	13,45	40,9	10,01	12,5	18,4	41,03	Heavy sandy loam
20-60	3,72	5,12	10,6	40,19	13,1	11,61	15,6	40,37	Heavy sandy loam
60-100	6,77	6,37	8,5	43,4	10,33	11,39	13,19	34,91	Heavy sandy loam
Cut-16-23									
0-5	4,44	3,43	8,73	28,8	10,7	17,2	26,7	54,6	Heavy sandy loam
5-20	2,25	2,65	7,12	36,4	11,22	14,2	26,1	51,52	Heavy sandy loam
20-60	0,21	3,72	8,22	35,97	13,53	12,1	26,25	51,8	Heavy sandy loam
60-100	0,15	5,82	6,98	38,3	10,3	12,1	26,25	48,7	Heavy sandy loam

The specific weight is considered less variable among other physical properties of the soil due to a number of interdependencies and correlations. The most important of them is the composition of parent rocks. The soil porosity in the soil of this region varies greatly, mainly depending on the stratification, and is inextricably linked with the number of plant roots, soil size and specific gravity. It was noted that a relatively high porosity exists in soils with a much larger structure, which depends on the mechanical composition of the soil, the number of water-resistant aggregates, the intensity of the soil under the action of natural and external mechanical forces, and the rate of internal erosion in the mineral part. Man-made pollution and deterioration of irrigated gray soils affects bulk density and total

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porosity (Table 4).

Table 4. Man-made disturbed irrigated gray soils and their generalphysical properties

Soil cut	The depth, cm	The specific weight, g/cm ^{3}	Weight,g/ cm ^{3}	Total porosity,%
Cut-16-0,9	0-5	2, 70	1,23	45,5
	5-20	2, 70	1,22	45,3
	20-55	2,71	1,14	41,91
Cut-16-2,5	0-5	2,74	1,22	44,53
	5-20	2,71	1,2 0	44,2
	20-55	2,72	1,14	41,91
Cut-16-55	0-5	2,73	1,32	48,3
	5-20	2,76	1,31	47,4
	20-55	2,71	1,3 0	47,97
Cut-16-18	0-5	2,71	1,26	46,49
	5-20	2,67	1,24	46,44
	20-55	2,66	1,23	46,24
Cut-16-23	0-5	2,7 0	1,48	54,81
	5-20	2,7 0	1,4 0	51,8
	20-55	2,71	1,38	50,92

The surface area of the soil is rich in organic substances and is more susceptible to agrotechnical influences. Irrigated gray soils around the Angren TPP, on the contrary, the specific weight being increased on the layers of 0-5 cm, 5-20 cm leads to a decrease in the total porosity. The section Cut-16-0.9, which is located off 0.9 km from the source of pollution. Here the genetic layer is disturbed, you can see the remains and ash of coal, which leads to degradation of the soil layers. On a 0-5 layer cm, the specific gravity in was 1.23 g / cm^{3}, the total porosity was 45.56%, the layer of 5-20 cm specific gravity was 1.22 g / cm^{3}, and the total porosity was 45.35%, while the background of the section is 16-23 on layers of 5-5 cm and 5-20 cm. In soil layers, the mass and total porosity were 1.48 and 1.40 g / cm^{3}, respectively, with a total porosity of 54.81% and 51,85%. Thus, the effect of emissions into the soil during the operation of thermal power plants in Angren negatively affected the mass and total soil porosity. In the research area, pollution led to the destruction of flora and a reduction in the number of species, a decrease in the annual accumulation of biomass and organic matter in the soil, as well as the formation of a microbiological zone around the root of each plant, as evidenced by the loss of soil biological activity. It follows that the diversity of plants in the study area affects the biological, physical, microbiological state of the soil (Figure 5).

Fig.5. The view of the flora of the man-made disturbed soils around Angren thermal power plant

For many years, flora and fauna were most affected by flows, the accumulation of chemicals in the form of smoke from thermal power plants. TPP significantly affected the vegetation cover in species reduction: *Roemeriarefracta, Capsellaburcpastoris, Althaea officinalis, Malvaneglecta, Alhagipseudalhagi, Glycyrrhiza glabra, Lathyrus pratensis, Centaureasguarrosa, Michorthratuspentensius, B. trichomanthomasmajorhontis* and other plants. It has been found that in areas close to the source of pollution significant losses are occurred. Plants that have declined or disappeared due to man-made disturbance of the soil can be restored after recultivation, which will take several

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years.
We studied the morpho-anatomical structure of the leaves of Lyciumchinense Mill for diagnostics and greening the sanitary protection zone (figure 6).

Fig. 6. General view of Lyciumchinense Mill planting in the sanitaryprotection zone

While studying the external features of the leaves, attention was paid to the shape and pubescence of the leaves, the length and width of the leaf blade and petiole, the color of the studied plant raw materials were determined. In the course of the study of whole raw materials, it was revealed that the leaves of L. chinese are short-stemmed, the shape of the petiole is cylindrical. The leaf blade is elliptical (lanceolate) with a solid edge. The shape of the leaf tip is pointed, the base of the leaf is wedge-shaped. Venation – peritoneovenous. The arrangement of the leaves is regular, sometimes they are close together in bundles. Leaves without pubescence, the upper surface is dark green, the lower surface is lighter green (Figure 7).

Fig. 7. Structure of Lyciumchinense Mill leaf

Simultaneously with the morphological description of the vegetative organs, for anatomical study it was recorded in 70^0 ethanol. For the preparation of sections of vegetative organs have been used a manual method. Cross sections of the leaf, petiole are prepared manually with a safety razor. Cross-sections of the leaf are made through the middle, and the petiole-through the base. Sections were stained with methylene blue and safranin followed by gluing in glycerin (Barykina et al., 2004). Descriptions of the main tissues and cells are given by S. R. Metcalfe, L. Chalk (Metcalfe et al., 1957), K. Esau (Esau, 1969), E. A. Sokolova (Sokolova et al, 2010), epidermis – by S. F. Zakharevich (Zakharevich, 1954). Microphotographs are made by a computer microphotometer with a digital camera

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brand A123 of Sapop company under a microscope Motic B1-220A-3.Some images were processed on the computer in the program "Photoshop CS5".

The leaves of Lyciumchinense Mill are formed on the shoot individually in alternating order or in bundles from 2 to 4. Their shape is ovate, rhombic, lanceolate or linear-lanceolate.On the paradermal section, the outlines of epidermal cells on the adaxial side are slightly branched, the projection is polygonal, and on the abaxial side they are more sinuous, the projection is polygonal. The cells of the adaxial (upper) epidermis are larger than those of the abaxial (lower) one. In the cell membranes of the epidermis, nucleoli are clearly visible on both sides of the leaf (Figure 8).

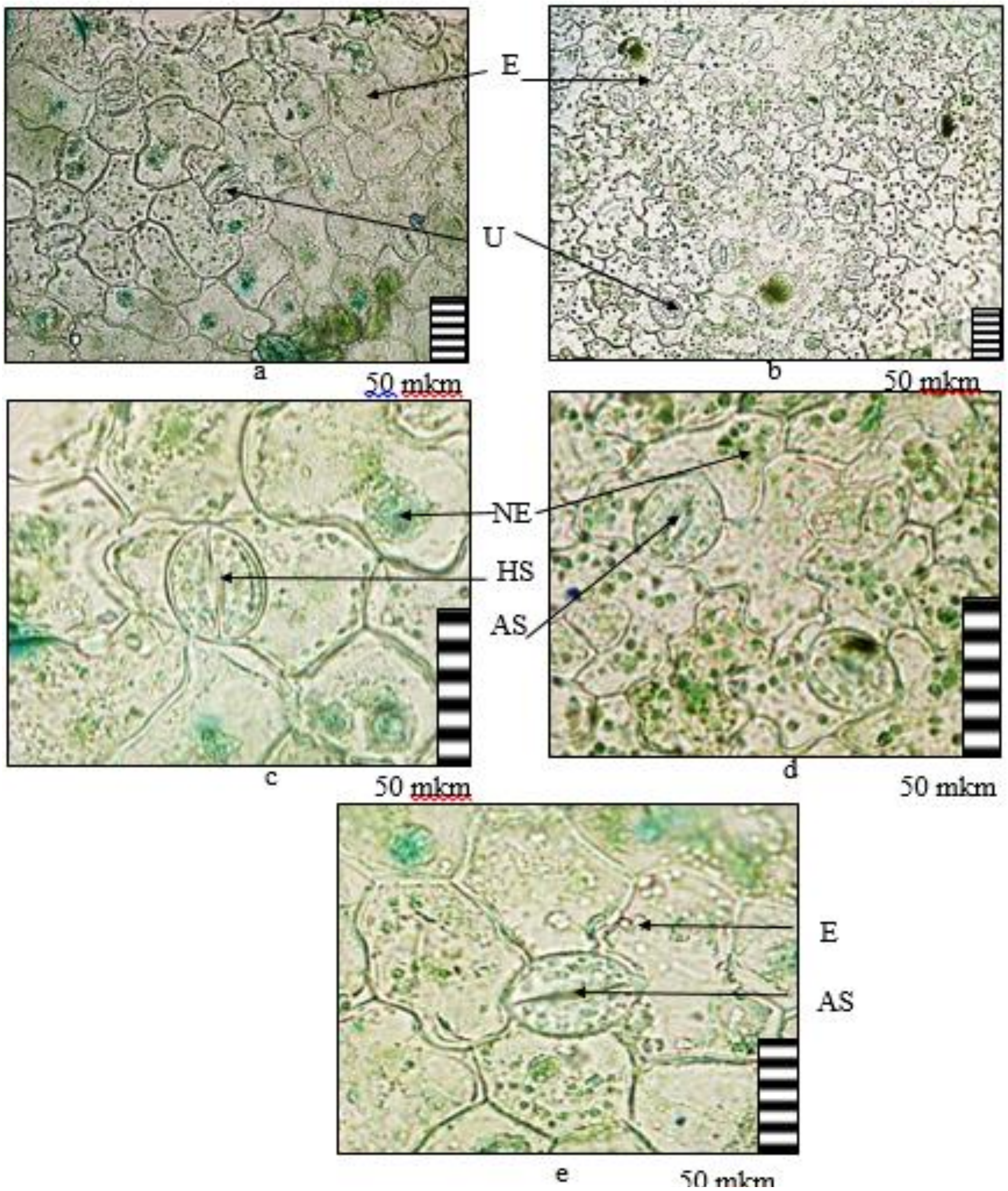

Fig. 8. Anatomical structure of the leaf epidermis of Lyciumchinense: a, c, e-upper (adaxial) epidermis; b, d-lower (abaxial) epidermis. Symbols: AS-anomocytic type of stomata, HS-hemiparacytic type of stomata, U-stomata, E-epidermis, NE - nucleolus of the epidermis.

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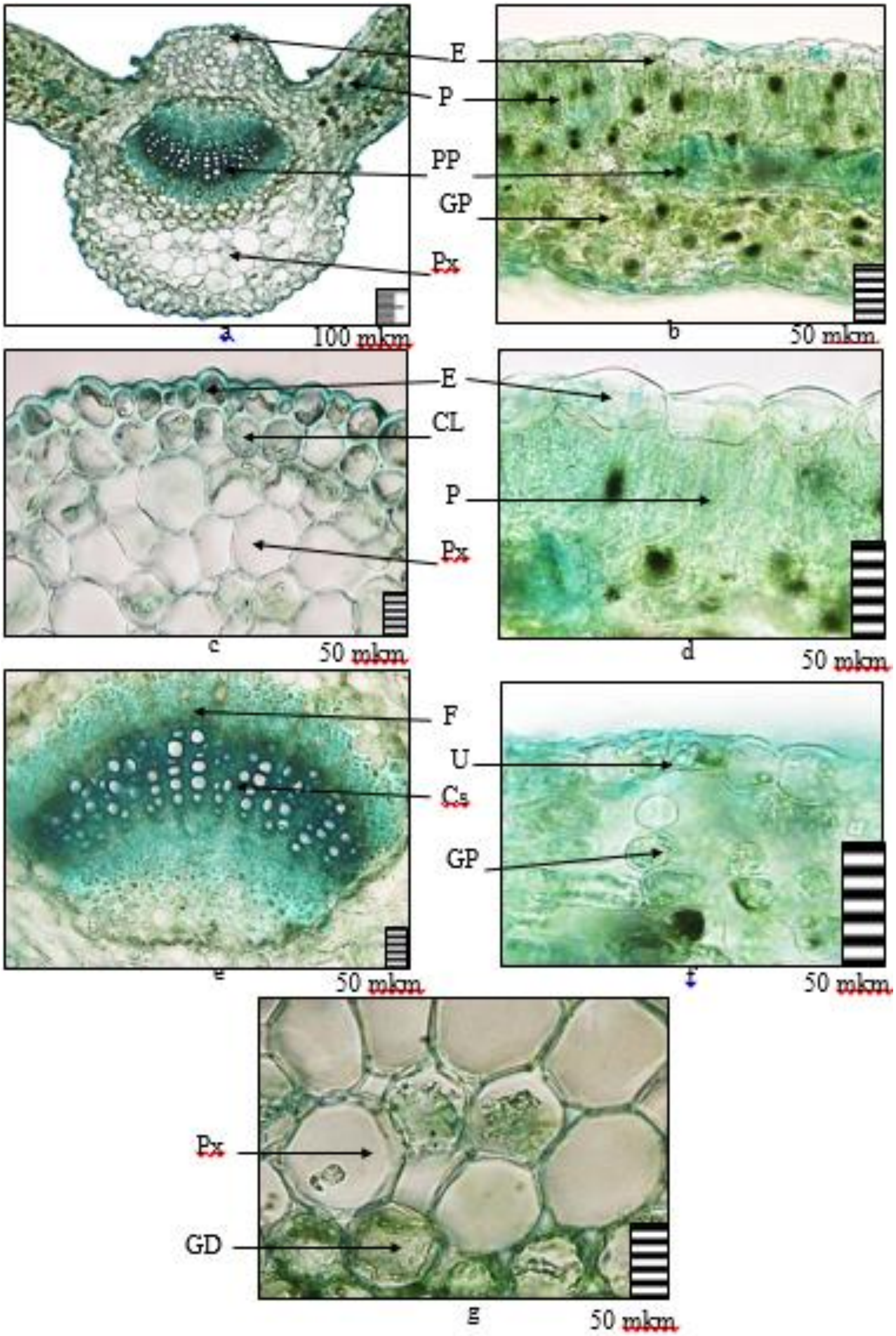

Fig. 9. The anatomical structure of the leaf of Lyciumchinese Mill.
a-general view of the main vein of the leaf; b-mesophyll of the leaf; c-epidermis and collenchyma; d-palisade parenchyma; e-conducting bundle; f-spongy parenchyma and non-

submerged stomata; g-parenchymal and hydrocytic cells. Symbols: GD-hydrocytic cells, GP-spongy parenchyma, CL-collenchyma, Cs-xylem, P-palisade parenchyma, PP-conducting bundle, Px-parenchymal cells, U-stomata, F-phloem, E-epidermis.

The leaves are amphistomatic, the stomata are located on both sides of the leaf blade, located transversely to the longitudinal axis of the leaf. The shape of the stomata is round-oval. The upper (adaxial) epidermis has a significantly smaller number of stomata compared to the lower (abaxial) epidermis. All this leads to a reduction in water loss from the leaf surface. The closing cells of the stomata on both sides of the leaf are almost the same length. Stomata are not submerged, hemiparacitic and anomocytic types (Figure 8, 9).

Leaf mesophyll is on a cross-section of the dorsiventral type, which is represented by palisade cells located under the upper epidermis of the leaf mesophyll, spongy cells-above the lower epidermis of the leaf mesophyll. The epidermis is represented by a single row of cells with a thin-walled cuticle layer. The cells of the adaxial epidermis are larger than those of the abaxial epidermis. Between the adaxial and abaxial epidermis is an assimilation tissue consisting of palisade and spongy cells. Under the adaxial epidermis is the palisade parenchyma. The palisade parenchyma is chlorophyll-bearing, large and elongated, which consists of a single row of cells and is located between the adaxial epidermis and the spongy parenchyma of the leaf (Figure 9).

The spongy parenchyma is chlorophyll-bearing, consists of 3-4 rows and is located between the palisade parenchyma and the abaxial epidermis. Spongy parenchyma is rounded, large and small-celled with large cavities. Between the palisade and spongy cells are numerous lateral conducting bundles, with 3-4 small vessels.Calcium oxalate occurs in the form of crystalline sands in palisade and spongy parenchymal cells (Figure 9).

The main vein of the leaf protrudes on the abaxial side. The rest of the vein is occupied by the main parenchyma, in which are immersed several conducting bundles, thin-walled round-oval parenchyma cells, among which there are hydrocytic cells. Conducting bundles of closed bicollateral type, numerous, consisting of phloem and xylem. Xylem thin-walled, elongated shape. Their walls are thickened in the form of spirals.

Conclusion

1. Angren TPPs are the main source of man-made disturbances in the research area, wind is the main factor in the spread of pollution from both sources, and pollution is not related to groundwater.
2. The main sources of man-made pollution of soils in the Tashkent region are Angren TPPs, the main cause of pollution is the anthropogenic factor. Man-made pollution is distributed around the territory of Angren TPP for 1.6-8 km.
3. According to international classification, experimentally irrigated gray soils of the territory of Angren TPP are divided into groups: weakly anthropogenic (Low anthropogenic / ATS), medium anthropogenic (Medium anthropogenic /ATV), highly anthropogenic (Strongly anthropogenic).
4. Around the Angren thermal power station as a result of coal combustion and emissions of ash with chemicals (SiO_2, Al_2O, CaO, Fe_2O_3, N_2O, K_2O, MgO, P_2O_3, BaO, SrO, Mn_2O_7, CuO, PbO, $As_2 O_7$, Mo_2O_7, LiO), and heavy metals also contaminate the soil. This has affected the property of the soil, a decrease in the number of microorganisms and negatively affects the flora.
5. In the studied territories, caused by man-made pollution and environmental conditions, it was built in the following order: contamination of a set of microorganisms → Deterioration of physical properties → Change in chemical properties → Violation of the atmosphere and water → Decrease in soil fertility. In this context, this sequence should be taken into consideration when developing recultivation technology on technically degraded lands.
6. Restore soil fertility and improve the environmental situation of the facility is possible only with the help of land reclamation equipment and recultivation method.
7. The leaves of Lyciumchinense Mill. have the following morphological features: a short cylindrical petiole, an elliptical leaf blade with a solid edge, a pointed tip and a wedge-shaped base. The location of the unpeeled leaves is another rarely in the form of bundles.
8. Anatomical and diagnostic features of the leaves of the Lyciumchinense Mill as a morphological group of medicinal plant raw materials are the presence of crystalline sands, as well as the presence of large weakly submerged stomata on both sides of the leaf blade. Mesophyll of the leaf on a cross-section of the dorsiventral type.Conducting beams of closed bicollateral type, numerous.

9. Judging the prospects for further research of Lyciumchinense Mill it is necessary to study this plant for landscaping around polluted areas.

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