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Research of fungal diseases of herbaceous plants exposed from Aksu Ferroalloy Plant

Annotation

Main problem: Technogenic "metamorphosis" of vegetation near such large industrial facilities as Pavlodar is considered to be the result of various active chemical and mechanical factors provoked by economic activities associated with the influence of emissions from industrial companies. The effect of anthropogenic impacts on vegetation in all regions of Kazakhstan varies and is largely dependent on the economic development of the territory, but in any case, the end result of this impact is the change in the vegetation, causing violations of with structure, reduced vodorazdelnaya flora and productivity of communities. This, in turn, can cause infection of herbaceous plants with pathogenic fungi, which then carry with them: a decrease in the intensity of plant growth, a deterioration in their decorative qualities, a decrease in the survival of the biological species.

Purpose: to study the types of fungi-pathogens of phytopathogenic diseases and to determine the degree of modification of the plant component, which is under intense negative technogenic influence from the Aksu Ferroalloy Plant (AFP).

Methods: For the experimental study, species of plants such as: *Artemisia dracunculus* L; *Artemesia vulgaris* L; *Atriplex fera* L; *Atriplex patula* L; *Artemisia annua* L were selected for the content of fungi-pathogens of phytopathogenic diseases.

Results and their significance: This experimental study was aimed at the presence of fungi-pathogens of herbaceous plants as a result of human impact, occurring near the industrial zone "AFP". The composition of fungi-pathogens of herbaceous plants collected in this industrial zone was considered and studied. According to the results of an experimental laboratory study, phytopathogenic fungi of herbaceous plants belonging to 1 ordo, 1 familia, and 4 species were found.

Keywords: herbaceous plants, spore, phytopathogen, fungal disease.

Introduction

The vegetation cover of the Earth serves as the main autotrophic block for each ecosystem in nature and performs many different and vital functions that humans lose as a result of its economic activities [1].

The effect of anthropogenic impacts on vegetation in all regions of Kazakhstan varies and is largely dependent on the economic development of the territory, but in any case, the end result of this impact is the change in the vegetation, causing violations of withstructure, reduced vodorazdelnaya flora and productivity of communities. This, in turn, can cause infection of herbaceous plants with pathogenic fungi, which then carry with them: a decrease in the intensity of plant growth, a deterioration in their decorative qualities, a decrease in the survival of the biological species. To date, the results of mechanical impact on anthropogenic vegetation changes have been well studied in the Republic of Kazakhstan.

The result of this influence was cattle grazing, road digression, etc. The reaction from pollution by factory emissions to individual plant species, causing subsequent transformation, is still poorly studied.

From all over the country, is in Pavlodar region perform their work in the largest thermal power and steel companies: Pavlodar aluminum plant (PAP), CHP-1,2,3, Kazakhstani electrolysis plant, Aksu Ferroalloy plant (AFP), Aksu power plant (AGRES), PF LLP "KSP Steel" – melted steel at the base of workshops pre-existing tractor plant and petrochemical (ppcp), cardboard roofing factories, etc Pavlodar is a leader in the quantity of emissions to the atmosphere. The emissions of the above companies are primarily dust of various levels of dispersion, which contains heavy metals(HM), as well as a gas component that has a significant effect on the vegetation cover throughout the surrounding area of the territory.

Aksu Ferroalloy Plant is one of the largest metallurgical enterprises for the production of chromium, silicon and manganese alloys, located in Aksu. The company has four workshops with twenty-six furnaces. The structure of the plant also includes a system for processing slag. The main products of the company are high-carbon ferrochrome, ferrosilicochrome, ferrosilicomanganese, ferrosilicon.

Technogenic "metamorphosis" of vegetation near such large industrial facilities as Pavlodar is considered to be the result of various active chemical and mechanical factors provoked by economic activities associated with the influence of emissions from industrial companies [2].

Therefore, in order to preserve the entire biodiversity of the system, restore the natural vegetation cover and improve the ecological state of the environment, it is necessary to know about the features of vegetation

successions under the influence of anthropogenic factors, the reaction of individual flora species to the effects of chemical elements and their various compounds.

Materials and methods

The experimental study was conducted in Aksu, according to the degree of technogenic impact of vegetation cover in the zone of influence of an industrial enterprise. This work consists in the study and research of fungal diseases of the territory of the AFP, which is of particular concern, thereby creating a large-scale environmental problem for the entire Earth. Small and large production complexes cause a negative impact on the plant world. Herbaceous vegetation growing nearby can be infected with pathogenic bacteria, which reduce the intensity of plant growth and impair decorative properties, reducing their survival rate.

The study was carried out on three sites that were more prone to emissions, using classical and modern ecological and geobotanical methods. Anthropogenic dynamics was carried out by the method of assessing the state of vegetation cover [3, 4].

In the process of collecting and studying phytopathogenic fungi, together with general Mycological methods, the following authors ' works, determinants were used; To study the fruit body, filaments, spores, diseased plant tissues of phytopathogenic fungi, a microscope MBR-3 and macroscopic binoculars MBS-1 were used. We studied disease-related tissue changes using the method of differential staining by I.I. Vanin. To determine the usual Schutte, we put a long-blown brush in ethyl alcohol for a few minutes, then rinse with water, 1 % Blue aniline and lactic acid solution, heated the cuttings until they evaporated and cleaned them with filter paper. After this treatment, the GIFs of the mushroom are colored blue and clearly visible separately from the tissue. We used the method of I.I. Zhuravlev to see and identify fruit bodies, shoots, pockets, spores of phytopathogenic fungi.

In the study of semi-bonded fungi, we used artificial nutrient media, wet chambers and thermostats. Using the wet chamber method, we isolated the fungus from the affected part of the plant and examined it. Since this method does not require sterile conditions, we have widely used it in the study of diseases of leaf-branch seeds, conifers.

At each site, samples of soils and dominant plant species (Artemisia dracunculus, Artemisia annua L., Artemesia vulgaris L., Atriplex fera L.) were collected for the study of fungal diseases according to the methodological recommendations. Signs of plant contamination were also assessed visually, with a geobotanical description [5].

Results

According to the results of an experimental laboratory study, phytopathogenic fungi of herbaceous plants belonging to 1 ordo, 1 familia, and 4 species were found.

Ordo *Uredinales*
Familia *Puccinia*

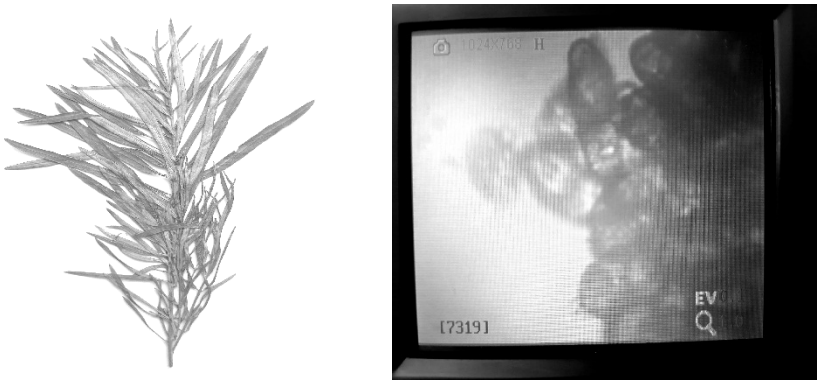
Puccinia agropyrina Erikss (DC) Lev.

Occurs on plant leaves in large numbers as black spots.

Host-plant – found on the leave of *Artemisia dracunculus*.

On both surfaces of the Leaf, you can see dark dark spots. You can find white spots that resemble white flour. Kleistoteci are scattered or grouped, with a volume of 70-102 microns. Number of shoots 2-6. number of pockets 1-5, size 38-45 X 30-40 microns. The number of Spores is 3-8, the size is 16-25 X 12-14.5 microns.

Location – Pavlodar region, Aksu city, industrial zone of Aksu ferroalloys plant, 15.09.2020, A.T. Tuleubayeva (figure 1).



A) B)

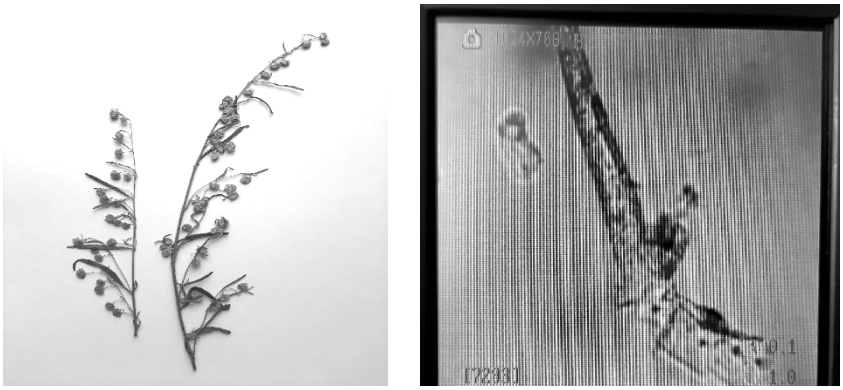
Figure 1 – teliospores of *Puccinia agropyrina Erikss (DC)* Lev.
A – general view of plant *Artemisia annua* L. disease prone
B – teliospores of *Puccinia agropyrina Erikss (DC)* Lev.

Puccinia absinthii (DC) Lev.

Host-plant - found on the stem of *Artemisia annua* L. [6].

The conidium is shaped like a pin. Cleistotecium is scattered, located on the inner surface of the Leaf, spherical, with a volume of 200.6-234 microns. The head of the shoots is developed and pointed to the tip, needle-like, with a volume of 280-332 microns. The pocket is large,the size is 71-76.2 x 30-35. 3 microns.The number of Spores is 3, the volume is 26.9-33.1 x 17.6-31.7 microns.

Location – Pavlodar region, Aksu city, industrial zone of Aksu ferroalloys plant, 15.09.2020, A.T. Tuleubayeva (figure 2).



A) B)

Figure 2 – General view of plant *Artemisia annua* L. disease prone
A – General view of plant *Artemisia annua* L. disease prone
B – teliospores of *Puccinia agropyrina Erikss (DC)* Lev.

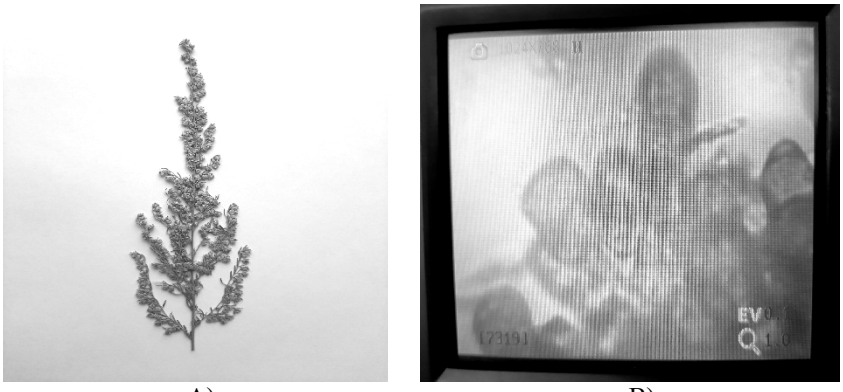
Puccinia chrysanthemi (DC) Lev.

Occurs on plant leaves in large numbers as black spots.

Host-plant – found on the leaves of *Artemesia vulgaris* L.

On the surface of the leaf, black dotted spots are sometimes present ,sometimes absent, floating, kleistoteci are scattered, ball-shaped, with a volume of 189-227 microns. The tip of the shoots is pointed, like a needle. The pockets are large, like an egg that has been stretched out. Number of spores 8-15, volume18,5-23,5 x 9-11 μm.

Location – Pavlodar region, Aksu city, industrial zone of Aksu ferroalloys plant, 15.09.2020, A.T. Tuleubayeva (figure 3).



A) B)

Figure 3 – teliospores of *Puccinia chrysanthemi (DC) Lev.*
A – General view of plant *Artemesia vulgaris* L. disease prone
B – teliospores of *Puccinia chrysanthemi (DC) Lev.*

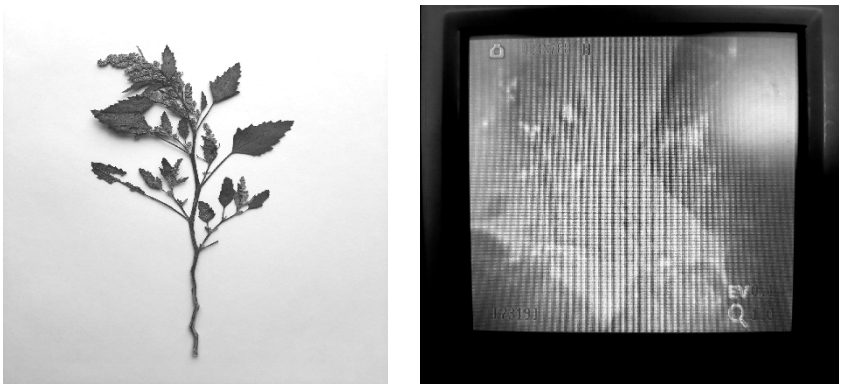
Puccinia* graminis *(DC) Lev.

Occurs on plant leaves in large numbers as black spots.

Host-plant – found on the leaves of *Atriplex fera* L. Bunge.

The fruit body of the mushroom is not particularly noticeable. Kleistotzi was lying on his side. The head of the shoots is rounded and straight towards the end. There are many pockets with a volume of 22-28 microns. The number of Spores is 2, the size is 27-29 X 14-18 microns.

Location – Pavlodar region, Aksu city, industrial zone of Aksu ferroalloys plant, 15.09.2020, A.T. Tuleubayeva (figure 4)



A) B)

Figure 4 – teliospores of *Puccinia* graminis *(DC) Lev.*
A – general view of plant *Atriplex fera* L. Bunge disease prone.
B – teliospores of *Puccinia* graminis *(DC) Lev.*

Discussion

Due to the intense impact of a complex of anthropogenic, physical and mechanical factors, the modern vegetation cover in the zone of influence of an industrial facility within a radius of 50 km has been completely transformed, and no indigenous vegetation communities have been preserved [6, 7].

The natural restoration of vegetation directly depends on the necessary diversity of phytocenoses located near, or at a distance that plant diasporas can overcome. In particular, the specific biology of the distribution of species plays a particularly important role. Also important is the nature of the landscape, which can promote or hinder the dispersal of plant species. In addition, the habitat conditions should not be completely disturbed, while remaining suitable for the development of phytocenoses with all their inherent combinations of species, and competitive relations with cultural or derived vegetation should allow the settlement of the corresponding species of natural cenoses.

These facts show the need to develop approaches and methods for ecological restoration of transformed vegetation [8].

A significant place among the diverse living organisms that inhabit the Earth's surface is occupied by fungi. Mushrooms are one of the oldest objects of human attention. They are not only decomposers of complex organic substances, but also synthesizers of biologically active substances, vitamins, food proteins, as well as pathogens of various infectious diseases of humans, animals and plants.

In the field of World mycology and Phytopathology, it is known that A.A. Yachevsky, a talented student of M.S. Voronin, worked a lot. About 500 scientific papers published, most of them are devoted to phytopathogenic fungi of Woody and shrubby plants.

The first data on fungi of Kazakhstan can be seen in the works of A.E. Regel and D.M. Sorokin. In addition to collecting general Botanical herbariums, they also collected plants that were affected by diseases. Materials related to the microflora of Central Asia are presented in the works of N.G. Zaprometov and P.N. Golovin. N.G. Zaprometov collected and identified 767 species of fungi, of which 246 species were found in Kazakhstan. Having studied the collected materials, Zaprometov proved that the physical and geographical location has a great influence on the formation of the Central Asian microflora.

There are only a few works on pathogenic fungi of Woody and shrubby plants of Pavlodar region. They were presented by T.M. Ponamareva's book «Mushroom diseases of the main villages in Pavlodar» and the article of A.B. Kadenova, B.H. Shaimardanova, A.M. Akimova "Vision, number and Phytopathological presence of villages and bushmen of the Southern Zone of the city of Pavlodar" and teaching aids "Practical guidance on diagnosis and protection of forest crops of Pavlodar region. In this paper, an inventory of Woody and shrubby plants is presented, and information on damage to some species by phytopathogenic bacteria and fungal pathogens is provided. However, the listed biological and ecological features of the development of pathogenic organisms, the level of plant damage is not considered.

In addition, some works on phytopathogenic fungi of Woody and shrubby plants grafted in the region are not found in the literature. And no research on the phytosanitary conditions of green spaces of large industrial cities belonging to this region, including Ekibastuz and Aksu, has been conducted.

Conclusion

In this study, pathogens of herbaceous plants were identified as a result of man-made exposure occurring near the industrial zone of the Aksu Ferroalloy Plant. The composition of fungi-pathogens of herbaceous plants collected in this zone was considered and studied. According to the results of an experimental laboratory study, phytopathogenic fungi of herbaceous plants belonging to 1 series, 1 relative, and 4 species were found.

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Ақсу ферроқорытпа зауытының маңында кездесетін шөптесін өсімдіктердің ауру қоздырғыш саңырауқұлақтарын зерттеу

Павлодар қаласы сияқты ірі өндіріс нысандарына жақын орналасқан өсімдіктердің техногендік «метаморфозасы» өнеркәсіптік кәсіпорындар шығарындыларының әсерінен химиялық, сондай-ақ шаруашылық қызметке байланысты механикалық факторлардың әсер етуінің салдары болып табылады. Әр түрлі аймақтардағы өсімдіктерге техногендік факторлардың әсері бірдей емес және аймақтың экономикалық даму басымдықтарына байланысты, бірақ кез-келген жағдайда мұндай әсердің нәтижесі

құрылымның бұзылуымен, флористикалық әртүрліліктің төмендеуімен және қауымдастықтардың өнімділігімен бірге өсімдіктердің өзгеруі болып табылады. Бұл өз кезегінде шөптесін өсімдіктерді патогендік саңырауқұлақтармен жұқтыруға әкелуі мүмкін, олар теріс процестерді тудырады: өсімдіктердің өсу қарқындылығының төмендеуі, олардың сәндік қасиеттерінің нашарлауы, биологиялық түрлердің өмір сүруі төмендейді.

Мақаланың мақсаты – фитопатогендік аурулардың қоздырғыш саңырауқұлақтарының түрлерін зерттеу, сондай-ақ «Ақсу ферроқорытпа зауытынан» (АФҚ) қарқынды-теріс техногендік әсер ететін өсімдік компонентінің өзгеру дәрежесін анықтау. Эксперименттік зерттеу жүргізу үшін хромды, кремнийлі және марганец қорытпаларын өндіретін ірі металлургиялық кәсіпорынның бірі – «Ақсу ферроқорытпа зауытының» (АФЗ) жанында өсетін фитопатогенді аурулардың қоздырғыш саңырауқұлақтарын анықтау үшін Artemisia dracunculus L; Artemesia vulgaris L; Atriplex fera L; Atriplex patula L; Artemisia annua L тектес өсімдіктердің үлгілері жиналды.

Бұл зерттеуде «Ақсу ферроқорытпа зауыты» өнеркәсіптік аймағының маңында кездесетін шөптесін өсімдіктердің ауру қоздырғыш саңырауқұлақтарының құрамы қарастырылды. Эксперименттік зертханалық зерттеу нәтижелері бойынша 1 қатарға, 1 туысқа, 4 түрге жататын шөптесін өсімдіктердің фитопатогендік саңырауқұлақтары табылды.

Түйін сөздер: шөптесін өсімдіктер, спора, фитопатоген, саңырауқұлақ аурулары.

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Исследование грибных возбудителей травянистых растений, встречающихся вблизи Аксуского завода ферросплавов

Техногенная «метаморфоза» растительности вблизи таких крупных производственных объектов, как г. Павлодар, считается результатом разных действующих химических, а также механических факторов, спровоцированных хозяйственной деятельностью, сопряженной с влиянием выбросов, которые оказывают промышленные компании. Эффект техногенного воздействия на растительность во всех регионах Казахстана неодинаково и во многом зависит от хозяйственного освоения территории, но конечным результатом такого воздействия является изменение растительности, вызывающее нарушения видоструктуры, снижение видоразнообразия флоры и продуктивности сообществ. Это, в свою очередь, может стать причиной заражения травянистых растений болезнетворными грибками, которые влекут снижение интенсивности роста растений, ухудшение их декоративных качеств, снижение выживаемости биологического вида.

Целью статьи является изучение видов грибов-возбудителей фитопатогенных заболеваний, а также определение степени изменения растительного компонента, находящегося под интенсивно-негативным техногенным воздействием от Аксуского завода ферросплавов (АЗФ).

Для проведения экспериментального исследования были отобраны экземпляры растений, такие как Artemisia dracunculus L; Artemesia vulgaris L; Atriplex fera L; Atriplex patula L; Artemisia annua L, на содержание в них грибов-возбудителей фитопатогенных заболеваний.

Был рассмотрен и изучен состав грибов-возбудителей болезней травянистых растений, собранных в промзоне АЗФ. По результатам экспериментального лабораторного исследования были обнаружены фитопатогенные грибы травянистых растений, относящиеся к одному ряду, одному родственнику, четырем видам.

Ключевые слова: травянистые растения, споры, фитопатогены, грибковые заболевания.

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