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Types and composition of diseases and pests of restructured forest and pasture plants in the dry part of the Aral Sea

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Types and composition of diseases and pests of restructured forest and pasture plants in the dry part of the Aral Sea

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Abstract. Studies on the dried bottom of the Aral Sea have shown that dominant disease from 3 species of them in Haloxylon plant is Podosphaera leucotricha and the dominant species from 34 species of pests is Big Dwarf Haloxylon Locust (D. albidula) and Small Haloxylon Locust (D. annulata roseipen). Chemical and biological control measures were taken against this disease and pests. When using anti-inflammatory drugs Redomil gold, Dnox, Fundazol and Sporagin, their effectiveness is as follows: Redomil gold - 68% sp (2.0–2.5 kg / ha), Fundazol - 50% ke (2.0 l / ha), Dnox - 40% ke (2.0 l / ha) and Sporagin (4.0, l / ha) were tested using fungicides in the norms. Of the drugs used in the experimental variant, Redomil gold, 68% s.p. (2.0-2.5 kg / ha) was the highest biological efficacy against powdery mildew in the variant in which the fungicides were applied, was 91.3%.

1. Introduction

Today, bioecological tragedies are taking place in many places due to the negative impact of anthropogenic factors on nature [1-5]. One of them is the drying up of the Aral Sea. As a result of the withdrawal of seawater, it was replaced by a typical desert, consisting of a huge complex of salty sand landscapes. The desert came to be known as the Aralkum, a new natural area in Central Asia. The Aralkum is the youngest desert in the world. It is located in the northern part of Kazakhstan and in the southern part of the Republic of Karakalpakstan. Its area is 5 million hectares, of which about 2.5-3 million hectares belong to the Republic of Karakalpakstan.

One of the most pressing issues is the prevention of sand and salt landslides caused by strong winds on the dried bottom of the Aral Sea, as well as the creation of systems to protect naturally propagated desert plants (including Haloxylon, sugarcane, cherkez) from pests. As a result, maintaining healthy trees and shrubs in the regions will increase their seed yield by 50-60%, produce quality seeds for the establishment of protected forests in the desert areas, and create the conditions for natural tree reproduction. The level of forest coverage in the region will increase significantly, which will prevent strong salt and sand storms from rising from the seabed [6-8].

Areas free of seawater pose an important challenge for scientists, such as a comprehensive study of its flora and vegetation [9, 10]. The structure and directions of development of new natural complexes, as well as the activity and succession of plants, changes in landscapes have necessitated a careful study of the arid part of the Aral Sea. In this regard, there is a need to study the migration and growth of plants in the open space under natural conditions and under the influence of human factors.

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The establishment of new forests and pastures in the Aral Sea region, on the dried bottom of the Aral Sea, will help preserve and develop biodiversity. Biodiversity conservation focuses on the prospects for the protection and use of flora, current issues in the protection, conservation and restoration of soil fertility, and the negative impact of biotic and abiotic factors on plant growth and development [11-14].

2. Research Methods

Researches in 2020-2021 have been carried out for determination of spread, damage and development of diseases and pests in the newly formed forest and pasture plants (Haloxylon, sugarcane, cherkez, etc.) in the Muynak district of the Republic of Karakalpakstan, mainly on the dried bottom of the Aral Sea. Laboratory studies were conducted in the Forest Protection Laboratory of the Forestry Research Institute.

The research was conducted in laboratory conditions as well as in small and large field experiments. This was done on the newly formed and perennial forest and pasture plants (Haloxylon, sugarcane, cherkez, etc.) on the dried bottom of the Aral Sea today.

Based on the prevalence, damage, bioecological characteristics of the main dominant species of newly formed forest and pasture plants (Haloxylon, sugarcane, cherkez, etc.) on the dried bottom of the Aral Sea, the research was devoted for forecasting system in the development of a set of methods and tools. The main goal is to keep the ECHQ (economic criterion of harmlessness quantity) of diseases and pests at a low level, to develop agrotechnologies that are less harmful and environmentally safe for the environment, humans and warm-blooded animals.

To do this, the method of M.I. Dementyeva is used to analyze the phytosanitary condition of established plantations.

The development of the disease is determined by the following formula:

$$R = \frac{\sum(a*b)*100\%}{N*K} \quad (1)$$

R – disease progression in %,

Σ (a • b) – is the sum of the product of the affected organs in terms of points,

a – the number of infected plants,

N – the total number of observed plant members,

K – the highest score on the scale.

A total of 100 leaves and 10 leaf blades and young shoots from 25 of the selected Haloxylon, sugarcane, and cherkez plants were examined without interruption. The degree of damage is calculated by evaluating each leaf, leaf petiole and young twigs on the following scales:

Scale 1: To determine the infestation of Haloxylon, sugarcane, cherkez with fusarium wilt, Powdery mildew and fake Powdery mildew diseases:

Points:

0 - no damage;

0.1 - leaves have 1-5 small, barely visible spots;

1 - spots occupy up to 10% of the leaf surface;

2 - spots occupy 10-25 percent of the leaf surface;

3 - spots occupied 26-50 percent of the leaf surface;

4 - Spots occupy more than 50 percent of the leaf surface.

Scale 2: To determine the infestation of fungi by Haloxylon, Sugarcane, Cherkez and young (green) twigs:

Points:

0 - no damage;

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0.1 – there are 1-5 small, barely visible spots on the leaf;
1 - leaf bands and young (green) branches damaged up to 5 percent;
2 - leaf bands and young (green) branches are damaged up to 25 percent;
3 - more than 25 percent of the leaf bands and young (green) branches are damaged.
The biology and phenology of diseases of Haloxylon, sugarcane, and cherkez plants have been studied through observation and literature.

2.1 Separation of pathogenic fungi into pure cultures
A wet chamber was used to isolate the cultures of pathogenic fungi found in the plantation.
To do this, Petri dishes with a plate-sized filter paper on the bottom are sterilized in an autoclave at 121 degrees for two hours, and the filter paper inside is moistened with sterile water. The surface of the samples was then sterilized with 96% alcohol in front of an alcohol lamp flame and cut with sterile scissors measuring 0.3-0.5 cm. The cut samples are collected in 4-5 pieces evenly on the surface of the filter paper on a Petri dish. Petri dishes were then placed in thermostats at 24-26 degrees celsius to grow fungies. The growth of fungi on the petri dishes is observed from the third day. In front of an alcohol flame, the hyphae were transplanted from the fungal mycelium into a nutrient medium in a pre-agar solution and placed in a thermostat at 24-26 ° C. After 3-4 days, fungi begin to grow and develop in these solutions.

The biological effectiveness of fungicides used against the disease is calculated by the following formula:

$$T = \frac{R_n - R_t}{R_n} \times 100 \tag{2}$$

T – biological efficiency, %,
R_t – controlled disease progression, %,
R_n – experimental disease progression, %.

Pidoplichko expressions were used to identify fungal species.
The effect of various fungicides against pathogenic fungi was studied on the basis of the All-Union Scientific Research Institute of Chemicals for Plant Protection method.
The fungicides being tested were weighed and dissolved in acetone, then 3 cm3 of the drug was pipetted and placed in a 40-degree dilute artificial medium in a flask. The flask was shaken, then poured into Petri dishes and left for 24 hours. After a day, the test fungi were inoculated into 3 locations of the treated artificial nutrient medium on a Petri dish and placed in a thermostat at 24 ° C. After 3 days, the growth of the fungi was analyzed.
The method of Dospekhov was used to determine the economic efficiency in the development of Haloxylon, sugarcane, cherkez.
The number of pests were calculated according to the "Guidelines" published by Khodjayev and methods of Uspensky.
Chemical treatment in Haloxylon, sugarcane, cherkez areas is carried out mainly with the help of OVX-28 ventilated tractor sprayers and motorized hand sprayers. Insecticides tested against pests are carried out using special agro toxicological methods published under the editorship of Gar and Khodjayev. During the test the recommendations of Turabkhodjayeva were taken into account.
Processing is carried out in the morning and evening, taking into accounts the weather and wind speed (up to 1 m / s). Some drugs are tested first in small field experiments and then in large field experiments. In small field experiments, the area is 200-300 m2, and 320-350 liters of water per hectare are used using a hand-held (motorized) device. In practical experiments, OVX-28 ventilated tractor sprayers are used and 200-300 liters of water per hectare is consumed. Entomological

calculations are performed 3–7–10–14–21 days before and after spraying the field, and, if necessary, every 5–10 days, depending on the purpose and nature of the experiment.

The number of pests was determined by the number of stems in each bush during the growing season of Haloxylon, sugarcane, cherkez and the average number of pests infested by 10 stalks.
The biological effectiveness of the drugs in the experiment was calculated according to the well-known Abbot formula. The advantage of this formula is that it takes into account the control option. If the number of pests there (in the next few days) falls below the natural control of 30%, the experiment will be stopped from that day.

$$BC = \frac{A_B - B_A}{A_B} \times 100(\%) \quad (3)$$

which:
AB – biological efficiency;
A – the number of pests in the experimental variant (before spraying);
a – the number of pests in the experimental variant, (in the days after spraying);
B – the number of pests in the control (drug-free) option (before spraying);
в – the number of pests in the control option (next calculation days).

The method developed by Goncharev is used to calculate the economic and cost-effectiveness of drugs. Economic efficiency is calculated based on the method of Chenkin.
The results of the experiments on the project are analyzed by the method of Dospekhov. The results obtained in the experiment are analyzed mathematically in different ways. According to this method, the smallest difference between the experimental parameters (ECF) is calculated.

3. Results and Discussions

Podosphaera leucotricha - The fungus Podosphaera causes diseases like the leaves do not develop well and become boat-like, and trees and young seedlings are severely damaged. Plant growth may be reduced by 30-50% [15].
Examples of locust species that cause major damage to agricultural crops in Uzbekistan are Locusta migratoria L, Dociostaurus maroccanus Thunb, Dociostaurus kraussi Ingen, Calliptamus turanicus Tarb.
Of the 41 species identified in Karakalpakstan, locusta migratoria L and Calliptamus italicus L, solitary C. Barbarus Costa, Thrinchus campanulatus FdW, Tetrix tartara I.Bol, Heteractis adspersus Redt and others are the main pests.
Research on the bioecology of locust species found in reeds along rivers and lakes of Uzbekistan and in the Fergana Valley, as well as more than 80 species of locusts adapted to living in tugai and riverbanks. scientific data on the ecological distribution of such species were collected.
There is no system in place to protect sand and salt landslides caused by strong winds on the dried bottom of the Aral Sea, and to protect naturally propagated desert plants, including Haloxylon, sugarcane, and cherkez, from diseases and pests.
The prevalence of diseases and pests in forests and pastures in the dry bottom of the Aral Sea in the Republic of Karakalpakstan, their degree of damage, species, development, dominant species and bioecological features were studied in 2020-2021. As a result of our research, 3 different types of diseases and 34 different types of pests were identified.
Today, the main (dominant) type of disease in Haloxylon is Powdery mildew, which has a high level of economic damage. For this reason, much of our research has focused on the spread, harm, and bioecological features of this disease in the field and in the laboratory, and on the application of agro-technical, chemical, and biological control measures to protect Haloxylon plants.
Powdery mildew can cause great damage when strongly developed. Damaged leaves do not grow well and fall off quickly, and damaged twigs stop growing, and their tips often dry out. The formed nodules

will soon fall off. The growth intensity of the plant might decrease up to 40-50% and it might dry out. Many scientists believe that dew reduces the winter hardiness of trees. In cold weather, the first damaged buds and twigs die. However, it should be noted that the mycelium of the pathogen is killed along with them. This is one of the reasons why the number of infections decreases after a severe winter.

Early damaged leaves and buds die after budding. The severity of the disease is determined by the onset of the disease. Diseases of plant organs are not uniformly observed.

We can see that the leaves and buds are mostly damaged in the neck area. Without the use of chemical protection, we can observe that the leaves are severely damaged. In black Haloxylon, it was 71.2% in our experiments (Table 1).

Table 1. Infection of Haloxylons and sugarcane with Powdery mildew disease (Moynak 2021)

Plant varieties	Damage rate%		Average by regions, %
	1-5 years	10-15 years	
	Spring season		
Black Haloxylon	46.8	71.2	59.0
Kandim	5.1	16.2	10.7

All methods and techniques of the generally accepted science of phytopathology and mycology were used in the implementation of the experiment. The research was conducted on a Haloxylon in the Moynak area. The experimental variants consist of 4 variants with 3 repetitions, arranged in 1 tier. Haloxylon seedlings are planted in a 10x2 scheme. The results of the study are presented in Table 2.

During the study, Redomil gold, 68% wettable powder (2.0-2.5 kg / ha), Fundazol, 50% wettable powder (2.0 l / ha), Dnox, 40% emulsion concentrate (2.0 l / ha) and Sporagin (4.0, l / ha) fungicides were tested. According to the results of the experiment, in the control variant, the leaves of Haloxylon were affected by Powdery mildew disease by 26.0%, while the development of the disease was correspondingly 10%. Of the drugs used in the experimental variant, Redomil gold, 68% wettable powder (2.5 kg / ha) showed the highest biological efficacy against Powdery mildew disease in the variant using the fungicide (Table 2). The incidence was 4.5% in the leaves. The incidence of the disease was 0.85% in the leaf, respectively, and the biological efficiency in the leaf was 91.3%.

Table 2. Biological efficiency of fungicides used against Haloxylon Powdery mildew disease (Moynak, 2021)

Drugs	Consumptio n rate, l.kg / ha	Disease spread, %	Disease progression, %	Biological efficiency %
Control - (chemically untreated)	-	26	10.0	-
Sporagin	4.0	11.5	4.0	60.5
Dnox, 40% emulsion concentrate	2.0	12.5	3.5	65.2
Fundazol, 50% emulsion concentrate	2.0	6.0	1.4	85.5
Ridomil gold, 68% wettable powder	2.0	10.5	2.3	77.0
Ridomil gold, 68% wettable powder	2.5	4.5	0.85	91.3
ECF_{05}				3.2

When sporagin (4.0 l / ha) was used, the incidence was 11.5% per leaf and the disease rate was 4.0% per leaf. Biological efficiency reached 60.5%.

In summary, Redomil gold achieved the highest biological efficiency of 91.3% in our variant using a 68% wettable powder (2.5 kg / ha) fungicide.

Table 3. Types of pests found in forest and pasture plants formed on the dried bottom of the Aral Sea and their distribution (Muynaq, 2020-2021)

№	Types of pests	Existence
	Category: Orthoptera	
	Large family: Acridoidea	
1	Large Haloxylon locust (Dericorus albidula Serv.)	+++
2	Small fat Haloxylon locust (Dericorus annulata roseipennis Redt.)	++
	Category: Coleoptera-Jestkokrylye-Hardwings	
	Family: Scarabaeidae	
3	Beetle (Lethrus rosmarus Ball.)	+
4	Turkestan horn beetle (Oryctes punctipennis punctipennis Motsch.)	+
	Family: Elateridae	
5	Agriotes meticulosus Cand.	++
6	*Agriotes caspicus Heyd*	+
7	*Aeoloides grisescens* Germ.	+
8	*Drasterius bimaculatus* Rossi.	+
9	*Melanotus acuminatus* Rtt.	+
10	*Cardiophorus longulus* Er.	+
	Family: Buprestidae	
11	Haloxylon golden beetle (Lampetis argentata Mnnh.)	+
12	Wild black gold beetle (Capnodis excisa Men.)	+
	Family: Tenebrionidae	
13	Tentyria black beetle (Tentyria gigas Fald.)	+
14	Trigonostselis black beetle (Trigonoscelis nodosa Fisch.)	+
15	Okner black beetle (Ocnera pilicollis Fald.)	+
16	Large black beetle (Pisterotarsa gigantea F.-W.)	+
17	Blaps heophila F.-W.	+
18	Blaps parvicollis subcordata Seidl.	+
	Family: Meloidae	
19	Mylabris frolov Germ.	
20	Mylabris quadripunctata L.	
	Family: Chrysomelidae	
21	Wormwood (Theone costipennis Kirsch.)	+
	Family: Curculionidae	
22	Megamecus variegatus Gebl.	+
23	Chromosomus fischeri Fahrs.	+
24	Hairy barid (Baris memnonia Boh.)	+
	Category: Lepidoptera - Cheshuekrylye	
	Family: Zygaenidae - Pestryanki - butterflies	
26	Turkestan parti coloured butterfly (*Zygaena truchmena* Ev.)	+
	Family: Noctuidae	
27	Cucullia boryphora F.-W.	+
28	Aleucanitis flexuosa Men.	+
	Family: Arctiidae - Bear worms	
29	Brown butterfly (Phragmatobia fuliginosa L.)	+
30	The caterpillar (Arctia caja L.)	+
	Family: Pieridae - Butterflies	
31	Desert Yellow Butterfly (Colias erate Esp.)	+
32	Faust morning butterfly (*Zegris fausti* Chr.)	+
33	Icarus blue butterfly (Lycaena icarus Rtt.)	+
	Family: Nymphalidae	
34	Asparagus butterfly (Pyrameis cardui L.)	+

Experimental studies on development of agrotechnical measures to control forest (Haloxylon, sugarcane, cherkessia) and pasture pests on the dried bottom of the Aral Sea based on the study of their distribution, degree of damage, species composition, development, dominant species and their bioecological characteristics were conducted.
Insect samples were collected during our monitoring observations to study the harmful entomofauna of Haloxylon and other sand-holding plants in the Muynak region on the dried bottom of the Aral Sea. In our study, 1 class, 3 genera, 14 families, 34 species of pests were identified (Table 3).
The 34 species of pests identified during the monitoring of harmful entomofauna of Haloxylon and other sand-bearing plants in the forests established on the dried bottom of the Aral Sea belong to 1 class, 3 genera and 14 families. When the dominant species were analyzed, it was found that the locusts that cause the most damage to the Haloxylon plant were the Great Fatty Haloxylon Locust (D. albidula) and the Small Fatty Saxovol Locust (D. annulata roseipennis).

4. Conclusions

Three types of diseases (powdery mildew, fusarium wilt, root rot) and 34 types of pests were detected in forest and pasture plants formed on the dried bottom of the Aral Sea.
The predominant of the three types of Haloxylon disease is Podosphaera leucotricha.
The dominant species of the 34 species of pests were identified in the studies as the Great Fat Saxovol Locust (D. albidula) and the Small Fat Saxovol Locust (D. annulata roseipennis).
Redomil gold, 68% n.kuk (2.5 kg / ha) fungicide, achieved the highest biological effectiveness in the control of powdery mildew in the Haloxylon plant. The efficiency was 91.3%.
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References

[1] Dobrowolski JW, Tursunov O, Pirimov O, Nazarova OJ 2020 Laser Biotechnology for Nutritional Health, Sustainable Environment and Development *IOP Conf. Ser.: Earth Environ. Sci.* **614** 012108.
[2] Dobrowolski JW, Kobylarczyk J, Tursunov O, Toh SQ 2015 Integration of Local Eco-Innovation with Global Problems of Protection of the Natural Environment and Bio-Based Green Economy, *In Proceedings : AASRI International Conference on Circuits and Systems (CAS)*, Atlantis Press, **9** 25-28.
[3] Dobrowolski JW, Bedla D, Czech T, Gambus F, Gorecka K, Kiszcak W, Kuzniar T, Mazur R, Nowak A, Sliwka M, Tursunov O, Wagner A, Wieczorek J, Swiatek M 2017 Integrated Innovative Biotechnology for Optimization of Environmental Bioprocesses and a Green Economy *Optimization and Applicability of Bioprocesses* eds Purohit H, Kalia V, Vaidya A, Khardenavis A (Singapore: Springer) chapter 3 pp 27-71.
[4] Toshpulatov N, Tursunov O, Kodirov D, Kholmuratova G 2020 Environmentally friendly technology for the destruction of tobacco mosaic viruses (TMV) from selected species of plants *IOP Conf. Ser.: Earth Environ. Sci.* **614** 012133.
[5] Anarbaev A, Muxammadiev A, Umarov S, Tursunov O, Kodirov D, Khushiev S, Muhtarov F, Muzafarov S, Izzatillaev J 2020 Mobile installations for electro treatment of soils and plants with the use of photovoltaic systems as power supply *IOP Conf. Ser.: Earth Environ. Sci.* **614** 012046.

[6] Gapparov FA 2002 Biological and ecological features of the development of harmful locusts and the development of effective methods and means of combating them, Doctor of Science Dissertation, Tashkent.
[7] Gapparov FA 2014 Bioecological features of the development of harmful locusts in Uzbekistan and measures to combat them, Navruz, Tashkent.
[8] Kholmurodov EA, Zuparov MA, Sattarova RK, Khakimova NT, Nuraliev XX, Bekbergenov HSh, Avazov SE 2017 Phytopathology of agriculture, Navruz, Tashkent.
[9] Raza A, Razzaq A, Mehmood SS, Zou X, Zhang X, Lv Y, Xu J 2019 Impact of Climate Change on Crops Adaptation and Strategies to Tackle Its Outcome: A Review *Plants (Basel, Switzerland)* **8**(2) 34.
[10] Ali H, Khan E, Ilahi I 2019 Environmental Chemistry and Ecotoxicology of Hazardous Heavy Metals: Environmental Persistence, Toxicity, and Bioaccumulation *Journal of Chemistry* **2019** 6730305.
[11] Bach EM, Ramirez KS, Fraser TD, Wall DH 2020 Soil Biodiversity Integrates Solutions for a Sustainable Future *Sustainability* **12**(7) 2662.
[12] Ma J, Rong K, Cheng K 2013 Research and practice on biodiversity in situ conservation in China: pro-gress and prospect *Biodiversity Science* **20**(5) 551-558.
[13] Wang W, Feng Ch, Liu F, Li J 2020 Biodiversity conservation in China: A review of recent studies and practices *Environmental Science and Ecotechnology* **2** 100025.
[14] Squires D 2014 Biodiversity Conservation in Asia *Asia & The Pacific Policy Study* **1**(1) 144-159.
[15] Abrorov Sh, Sultanov K, Normuratov I, Modern intensive apple orchards in Uzbekistan, BAKTRIA PRESS, Tashkent.