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Original Article

Geobotanical characteristics of plant communities with participation of rare species *Alnus glutinosa* (L.) Gaertn.

Características geobotânicas de comunidades vegetais com participação de espécies raras de *Alnus glutinosa* (L.) Gaertn.

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Abstract

The article gives a geobotanical description and a floristic analysis of communities with the participation of the rare and relict species Alnus glutinosa in condition of Aktobe region. The aim of the study is to provide a geobotanical assessment of the current status of a rare, relict species of the *Alnus glutinosa* population, which was included in the Red Data Book of Kazakhstan. At present, the flora of the Aktobe region is not sufficiently studied. Conservation of the biodiversity of the Aktobe region flora is one of the most topical issues. In Aktobe region, due to the lack of grazing, felling of trees, using as fuel and the emergence of uncontrolled tourism and at the same time due to the lack of natural renewal of the area, these consequences lead to a quantitative reduction in the species. In this regard, it is necessary to study the species and organize protection and conservation measures. The results of the study showed that the plant *Alnus glutinosa* is rarely found in the flora of Kazakhstan and also the distribution areas are reduced. Of the three investigated points, plants from 24 families were identified. Plant communities of *Alnus glutinosa* are being studied for the first time in the Aktobe region. For the first time in the conditions of the Aktobe region, the habitat of black alder was discovered. The floral composition of plant communities of *Alnus glutinosa* grown in various ecological environments was revealed, the ratio of life forms and phytocenotic features were studied for the first time. In addition, alder felt mite and ground bug, damaging black alder, were identified from 3 studied populations. It has been established that the main reason for the spread of this pest is a very strong moistening of the ground on which sticky Alder grows. Results sequencing showed that the DNA sample under study belongs to the fungus *Alternaria alternata*.

Key words: Aktobe region, *Alnus glutinosa*, life form, population, flora, tier, *Acalitus brevitarsus*, *Kleidocerys resedae*.

Resumo

O artigo apresenta uma descrição geobotânica e uma análise florística de comunidades com a participação da espécie rara *Alnus glutinosa,* na região de Aktobe. O objetivo do estudo é fornecer uma avaliação geobotânica do estado atual de uma espécie rara da população de *Alnus glutinosa*, que foi incluída no Livro Vermelho de Dados do Cazaquistão. Atualmente, a flora da região de Aktobe não é suficientemente estudada. A conservação da biodiversidade da flora da região de Aktobe é uma das questões mais atuais. Nessa região, em razão da falta de pastoreio, do abate de árvores para utilização como combustível, do surgimento do turismo descontrolado e, ao mesmo tempo, por causa da falta de renovação natural da área, vem ocorrendo uma redução quantitativa das espécies. Neste sentido, é necessário estudar as espécies e organizar medidas de proteção e conservação delas. Os resultados do estudo mostraram que a planta *Alnus glutinosa* é raramente encontrada na flora do Cazaquistão e também que as áreas de distribuição são reduzidas. Dos três pontos investigados, foram identificadas plantas de 24 famílias. Pela primeira vez, estão sendo estudadas as comunidades vegetais de *Alnus glutinosa* na região de Aktobe, bem como foi descoberto o habitat do amieiro-negro. Foi revelada a composição floral das comunidades vegetais de *Alnus glutinosa* cultivadas em vários ambientes ecológicos, assim como foram estudadas pela primeira vez a proporção de formas de vida e as características fitocenóticas. Além disso, o ácaro do feltro do amieiro e o percevejo-do-solo, que danificam o amieiro-preto, foram identificados em três populações estudadas. Foi estabelecido que a principal razão para a propagação desta praga é o forte umedecimento do solo onde cresce o amieiro. O sequenciamento dos resultados mostrou que a amostra de DNA em estudo pertence ao fungo *Alternaria alternata*.

Palavras-chave: região de Aktobe, *Alnus glutinosa*, forma de vida, população, flora, camada, *Acalitus brevitarsus*, *Kleidocerys resedae*.

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1. Introduction

Alnus glutinosa (L.) Gaertn. is a very rare, relict species belonging to the Betulaceae family. The first description of the species found on the territory of Kazakhstan is presented in the third volume of the 9-volume work "Flora of Kazakhstan". *Alnus glutinosa* is listed in the Red Book of Kazakhstan as a very rare species (Institute of Botany and Phytointroduction, 2014). More than 40 species of the genus *Alnus* are known, widely distributed mainly in the Northern Hemisphere in Eurasia and in the wooded areas of North America. A tree reaching a height of 20-30 meters, trunk diameter up to 90 cm. The branches are triangular or rounded, smooth or with sparse villi, young individuals secrete adhesives, resins. The buds are obovate, 9-15 cm long, the opposite leaves are simple, rounded or obovate, 4-9 (12) cm long, about 3-6 (10) cm wide. The flowers in the male are small, consist of flower companions divided into four. Male 4, pollen yellow. The flowers of women's earrings are arranged in leafless legs of 3-5, 12-15 mm long, 10 mm in diameter, pink in color. Blooms in early spring (April-May) before the appearance of leaves.

Root systems are located superficially. Tuberous bacteria (Schinza alni) form tubers in their roots. In addition, in a moist substrate, its root system is small, highly branched. The roots of Frankia alni form a symbiotic relationship with the endophytic nitrogenous actinomycete (San José et al., 2014). It has a positive effect on the growth of plants that grow next to it, increasing the amount of nitrogen and organic substances in the soil (Nasiyevich, 2013; Mussynov et al., 2014). Nitrogen-loving plants (for example, nettles, raspberries, etc.) are constantly growing in the alder community (Nasiyev et al., 2021). It is used in folk medicine. Among some dominant classes in most European habitats, *Alnus glutinosa* is the dominant and important species for forestry (Persson et al., 2016). This is of great interest for research because it has a positive impact on the coastal ecosystem (Rzabay et al., 2018; Yerezhepkyzy et al., 2021). Its root system has a positive effect on the stabilization of water banks, as well as on environmental requirements that do not tolerate shade and grow only in moist places (Mingeot et al., 2016). In addition, this species has wooded and woody-fibrous potential, as its height and diameter grow rapidly (Kudaibergenova et al., 2023). The destruction of the *Alnus glutinosa* species can negatively affect the composition of forests and soils, habitat and lead to soil erosion (San José et al., 2015). The recent death of the *Alnus glutinosa* plant from a fungal disease (Phytophthora alni) has led to a decline in most of Europe (Mingeot et al., 2016; Kochorov et al., 2023). Sticky bloodwood is a common species in European forests and has a high potential as industrial biomass and wood (Kantarbayeva et al., 2017; Shaldybayeva et al., 2023). Sticky, bloody tree bark is used as a dye. Depending on the processing, it produces black, yellow and red colors on fabrics (wool and silk), and also paints the skin very well in the same colors. Pruning, using the *Alnus glutinosa* plant as fuel and harvesting for the manufacture of tinctures from earrings and cones leads to a decrease in its quantity (Nasiyev and Dukeyeva, 2023). Currently, one of the most important problems is taking measures to preserve the *Alnus glutinosa* community in the forests of Europe (Yerezhepkyzy et al., 2017).

The alder felt mite (Acalitus brevitarsus) and the ground bug (Kleidocerys resedae) are also considered as a pest of black alder. The main limiting factor affecting the increase in the number of bedbugs is the high level of moisture in the places where black alder grows.

Mites pose a serious problem to plants worldwide, attacking crops and spreading disease (Adilkhankyzy et al., 2022). When mites damage crops of economic importance the impacts can be felt globally. Mites are among the most diverse and successful of invertebrates, with over 45,000 described species, with many more thousands to be discovered. They are responsible for a significant portion of the losses of crops for food, fibre, industry and other purposes, and require expensive and often controversial pest control measures. (Vacante, 2015; Makarova et al., 2022).

Kleidocerys resedae is a species of hemipteran insects from the family of ground bugs. It is widespread in the Holarctic. They live on various shrubby and woody plants, for example, birch, alder and others. The imago's body length is 4.3—5.5 mm. The insect is reddish-brown, the front part is lighter than the rest of the body color. The pronotum is shiny. Individual spots on the upper side of the body, almost the entire underside is black.

The ground bug *Kleidocerys resedae* belongs to the family *Lygaeidae*, to the subfamily *Ischnorhynchinae*, to the genus *Kleidocerys*, to the order "*Hemiptera*", to the infraorder *Pentatomomorpha*. The insect is reddish-brown, the front part is lighter than the rest of the body color, almost the entire underside is black. Body length 4.3-5.5 mm.

This type of bug is a dangerous pest of birch, oak, poplar, alder. The bug, feeding on the generative organs of plants, in particular their seeds, causes them great harm.

The main purpose of the work is a geobotanical assessment of the current state of populations of the rare species *Alnus glutinosa* (L.) Gaertn. in the conditions of the Aktobe region and the identification of black alder pests.

2. Materials and Methods

The main purpose of our study is a geobotanical assessment of the current state of the population of a rare, relict species of *Alnus glutinosa*, listed in the Red Book of Kazakhstan. For this purpose, a special expedition to the Aktobe region was organized in the summer of 2017. GPS coordinates of the Aktobe region: N 50° 41'16" and E 57° 24'23". During the search, three populations of *Alnus glutinosa* were discovered and studied.

The first population is protected by the state as a natural botanical monument 2.5 km from the winter quarters of Zhanatan near the village of Petropavlovsk, Aktobe region at N 50° 46' 57" and E 56° h22' 24" approximately 350 meters above sea level. This area features undulating terrain with moderate drainage, influenced by its position along a natural water runoff path. The climate is characterized by cold winters and warm summers, with an average annual temperature of 7 °C and precipitation of 400 mm. Humidity levels are typically higher during late spring and

early autumn, coinciding with the main growth periods for Alnus glutinosa.

The second population of *Alnus glutinosa* was found in the Aktobe region, near the Zhaman Kargaly River. GPS coordinates: N 50° 20'21" and E 57° 20' 39" at a lower elevation of 280 meters. The geomorphology here includes flat riverine landscapes, which provide rich alluvial soils with excellent drainage. This site receives an average annual precipitation of 450 mm and experiences similar temperature patterns to the first site but with slightly higher humidity levels due to proximity to the river.

The third population of *Alnus glutinosa* was found at the farm "Zhansaya" in the village of Sambay of the Karagash rural district of the Aktobe region at N 49° 59' 01" nd E 57° 12' 11". GPS coordinates: N 49° 56' 14" and E 57° 5' 10" at an elevation of 300 meters. The area is characterized by gentle slopes, which contribute to moderate drainage. The climate here is drier, with annual precipitation averaging 350 mm, and the temperature ranges are similar to the other two sites. Humidity is generally lower, affecting the moisture availability for Alnus glutinosa communities

The alder grove, where the first population was taken under protection, is located in a ravine. The land area is about 1.5 hectares. The percentage of plant coating is 80-85%. The groundwater lies at a depth of only 1 meter. And swampy land near ground water is the most favorable environment for the growth of *Alnus glutinosa*. On the cover of plants, 5 tiers are clearly noticeable. The first tier is formed by *Alnus glutinosa*, up to 18 m high, the second tier is formed by *Salix triandra, Salix pentandra, Betula pendula*, 5-7 m high, the third tier is Salix cinerea, Rosa pisiformis, 1.5-2 m high, the fourth tier is Cirsium serrulatum, *Inula helenium*, up to 1 m high, the fifth tier is *Urtica dioica, Chartolepis intermedia, Artemisia Scoparia, Stipa capillata*, forms a height of 25-50 cm.

Soil samples were collected from multiple points within each site to ensure representative sampling. At each site, samples were taken from a depth of 0-30 cm using a soil auger. This depth range captures the topsoil and part of the subsoil, where most root activity occurs and where soil properties are crucial for plant growth. Soil texture was determined using the hydrometer method, which involves measuring the relative proportions of sand, silt, and clay. Soil moisture was measured by weighing soil samples before and after drying them in an oven at 105 °C until a constant weight was achieved.

The object of the study is *Alnus glutinosa* (L.) Gaertn. Studies of plants were carried out by the method of route exploration using GPS navigation. In the course of the work, the geobotanical characteristics of the community and the floristic analysis were carried out using a generally accepted approach. In each population, 10 transects with a volume of 100 m2 were built, and individuals were counted from each transect. In addition, herbarium material was collected from all plants found in the plant community.

Collection and drying of herbarium material was carried out according to A. K. Skvortsov (Stepanova et al., 2020). The collection of plants was carried out in clear weather. Immediately after harvesting, the plant was transferred from the folder to herbarium sheets intended for drying. A pack of stacked plants was placed in a press and pulled together with a rope. Dried for 5 days. Then the plants were laid out on sheets for stickers. A label was attached to each sheet. The mounted plants were put into a herbarium cabinet.

When determining plants, they relied on "Flora of Kazakhstan" and "illustrated determinant of plants of Kazakhstan". The plant inventory was made along with the method presented by S. A. Abdulin and S. K. Cherepanovby establishing fixed plots along transects that were evenly distributed across each of the three study sites. Each plot measured 10x10 meters, within which all plant species were identified and catalogued. Plant identification was performed in the field using the 'Flora of Kazakhstan' and 'Illustrated Determinant of Plants of Kazakhstan' as primary reference guides. Specimens that could not be identified in the field were collected, preserved, and later analyzed in the laboratory for further taxonomic verification.

Plant life forms were determined according to the Raunkier classification. Raunkier classified 5 main types of life forms, demonstrated in Table 1.

To study the insects of the inhabitants of the black alder, we spread a strong white plastic film with a size of 4m*4m under the tree on the ground. They knocked out a branch located exactly above the canvas and lightly hit it with a stick. The insects that fell on the canvas were collected and placed in a plastic container. To obtain accurate and complete results, 6 black alder shakes were performed once in the same biotope (5 plant specimens were used). Insects collected from one plant population in one biotope were placed in one container and provided with labels. The definition of insects was carried out by the visual method of determination, the insect determinant was used.

The laboratory study was determined by visual and microscopic method, under a microscope of the MBS-

Table 1. Raunkier classification of life forms.

Type	Description
Phanerophytes	Buds and terminal shoots, designed to survive an unfavorable period, are located high above the ground.
Hamefits	Buds and terminal shoots designed to endure an unfavorable period develop on shoots lying on the surface of the earth or located close to it.
Hemicryptophytes	Bearing buds of renewal on the surface of the soil or in the most superficial layer, under the litter.
Cryptophytes	Buds or the ends of shoots, designed to endure an unfavorable period, are in the soil or at the bottom of a reservoir.
Therophytes	Survive an unfavorable season exclusively in the form of seeds

10 and EX 30 brands, the size of the object is 20x, 40x and 100x. The country of origin is Russia.

To study the fungal communities of *Alnus glutinosa* species, a plot with trees located in the points of the city of Aktobe will be selected.

Samples of trees were taken in two different growing seasons in 2023 in May (before the period of sporulation of *Alnus glutinosa*), as well as in September (during the expected early period of infection of *Alnus glutinosa*, before the aging of leaves and their fall).

At each time period, materials from visually healthy branches were selected from each selected tree and two individuals of each clone were selected, depending on the available material. In each time period, the same trees will be visited for comparison. The leaves are separated from the shoot, placed in plastic bags and labeled accordingly. All collected samples were stored immediately on dry ice in the field. In the laboratory, the samples were transferred to the freezer at a temperature of 20 °C until further work. Samples from the collected leaves were washed with tap water in order to remove dust. Then a small part of the leaves was cut out with sterile scissors, then soaked for 30 seconds in 70% ethanol, after which the explant was washed with sterile distilled water. Then soaked in 2% (NaOCl) sodium hypochloride for 5 minutes, then soaked again in 70% ethanol for 30 seconds. Then soaked in sterile water for a minute and then dried in sterile filter paper under a laminar flow until completely dry.

The cultivation process was carried out on a PDA nutrient medium. Cultured petri dishes were incubated in a thermostat at a temperature of 22-25 °C in a dark place for 4-5 days. Next, transplantation was carried out into a pure PDA nutrient medium until a pure culture of various microbiomes was obtained (Figure 1).

After obtaining a pure culture, the DNA of microbiome samples was isolated. Genomic DNA was isolated using the High Pure PCR Template Preparation KIT (Roche Diagnostics, Inc., Mannheim, Germany) in accordance with the manufacturer's instructions.

KIT DNA Isolation Protocol:

1. In ependorf tubes with a volume of 1500 ml, we collect a pure culture isolated by DNA;
2. Add 300-400 mL of lizis buffer to the test tubes;
3. Next, we rub the contents with a sterile pestle;
4. 5 min. Centrifuged at 6500 rpm;
5. We take the nozzle liquid into a new ependorf tube. We throw out the sediments with a test tube;
6. Add beinding buffer 200 mL to the test tubes;
7. Next add proteinaza-k 40 mL;
8. Put the test tubes in a water bath with a temperature of 65-70 °C for 10 minutes;
9. Add 100 mL of izoproponol;
10. The contents are poured into a new test tube with spin filter tubes (filter);
11. Then we centrifuge for 1 minute at 9500 rpm;
12. Next, we throw out the test tubes with sedimentary liquid, insert the filter into a new test tube. (dna in the filter);
13. Add 500 mL inhibitor removal buffer;
14. Centrifugate for 1 minute at 9500 rpm;
15. We throw out the test tubes with sedimentary liquid, insert the filter into a new test tube;
16. Add 500 mL of wash buffer;
17. Centrifugate for 1 minute at 9500 rpm;
18. We throw out the test tubes with sedimentary liquid, insert the filter into a new test tube;
19. Repeat positions 16-17-18;
20. We centrifuge for 20 seconds at maximum speed. Approximately 13800 rpm;
21. We throw out the test tubes with sedimentary liquid, insert the filter into a new test tube with a lid;
22. Add 50-100 mL of elution buffer (the smaller the buffer, the better the dna concentration);
23. Centrifugate for 1 minute at 9500 rpm;
24. We throw out the filter, dna in a test tube. We sign the test tubes.

After DNA isolation, a quantitative and qualitative assessment of the concentration of DNA nucleic acids was carried out. To do this, a spectrophotometric method with a Biotek Tek3 microplate was used.

PCR amplification was performed using ITS1\ ITS4 primers. The nucleotide order of ITS1\ITS4 primers is shown in Table 2.

The volume of the contents of the PCR reaction mixture is 25 µl, of which: Master Mix (GRS)- 12.5 ml; primer ITS1 forward 1 µl; ITS4 reverse 1 µl; Template DNA 3 µl; MQ water 7.5 µl.

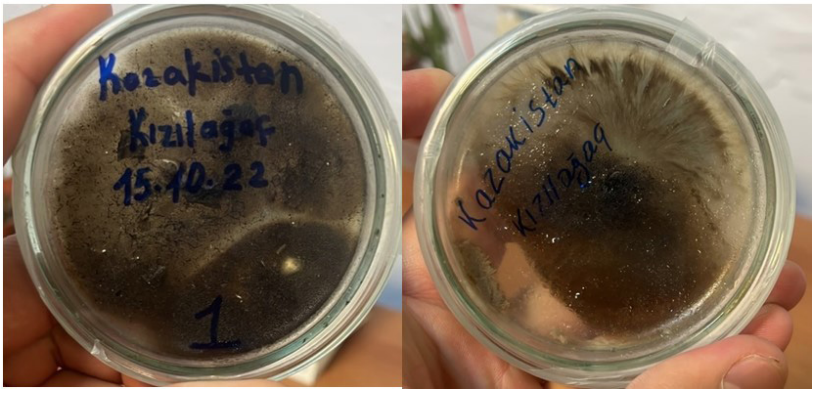

Figure 1. Study the fungal communities of *Alnus glutinosa* species.

Table 2. Sequences of ITS plots primers.

Primer Name	Sequence 5' - 3'
ITS1 (forward)	TCC GTA GGT GAA CCT GCG G
ITS4 (reverse)	TCC TCC GCT TAT TGA TAT GC

Amplification was performed in a SuperCycler thermal cycler (Kyratec) under the following conditions: 95 °C for 3 minutes, 40 cycles of 95 °C for 15 seconds, 58 °C for 15 seconds and 72 °C for 15 seconds and the final expansion stage for 3 minutes at 72 °C.

PCR products were visualized on 1% agarose gel stained with Sage green (Biotium, Hayward, California, USA) on horizontal electropharesis.

After PCR amplification, sequencing was carried out in the commercial biotechnology company "Eurogen" LLC (Turkey).

3. Results and Discussion

Within the first population, 21 species of higher plants belonging to 10 families and 16 genera were identified. In the Alder grove of trees and shrubs, the main forest-forming species are *Betula pendula, Salix triandra, Salix pentandra*. On the slope, the meadow turns into vegetation. The meadow vegetation is dominated by *Urtica dioica*. In addition, *Stipa capillata, Inula helenium, Artemisia scoparia, Cirsium serrulatum* form a herbaceous vegetation cover. The banks of the stream are covered with *Marchantia polymorpha.*

Systematically, representatives of four divisions of higher plants are found in the first population. From the section *Bryophyta – Marschantia polymorpha*, from the section *Polypodiophyta – Thelypteris palustris, Dryopteris filix-mas*, from the section *Equisetophyta – Equisetum arvense, Equisetum pratense, Equisetum hyemale*. The remaining plants are representatives of the *Magnoliophyta* department. Their *Monocotyledoneae* class is *Stipa capillata*, the rest of the plants belong to the *Magnoliopsida* class. The *Asteraceae, Salicaceae*, and *Equisetaceae* families predominate in the number of species. Of the other families, there are 1-2 species.

In the first population, hemicryptophytes are in the first place with a clear predominance in the form of life, i.e. perennial herbaceous plants-only 11 species (52.4%). In second place are nano– and microphanerophytes, i.e. shrubby and semi-shrubby-5 species (23.8%). In third place are macrophanerophytes, that is, trees - 3 species (14.3%). In fourth place are therophytes, or annual (less often biennial) plants-2 species (9.5%).

The second population of *Alnus glutinosa* is located in the Aktobe region, along the Zhaman Kargaly River. This population has a flat terrain, grows on the banks of rivers. The river is filled with groundwater. The land area is about 1 ha. The soils of the steppe zone are dark gray-brown in color. The vegetation cover consists of a community of Poplar – alder – willow plants (*Populus nigra – Alnus glutinosa – Salix triandra, Salix acutifolia*). The percentage of plant coverage is 60-65%. 4 tiers are clearly visible on the vegetation cover. The first tier forms *Populus nigra*, height 21 meters, the second tier forms *Alnus glutinosa, Acer tataricum, Acer negundo, Salix acutifolia, Crataegus sanguinea*, height 6-8 meters, the third tier forms *Thalictrum minus, Rosa canina*, height 1-1.5 m, the fifth tier forms *Asparagus officinalis, Salvia stepposa, Artemisia vulgaris, linaria Genistifolia, Linaria ruthenica*, height 15-40 cm.

Within the second population, 31 species of higher plants belonging to 18 families and 23 genera were identified. *Populus nigra*, *Salix triandra*, *Salix acutifolia*, *Fraxinus pennsylvanica* grow well in this population. There are also plants *Rhamnus cathartica*, *Acer tataricum*, *Lonicera tatarica*. There are shrubs and semi-shrubs *Rosa canina*, *Artemisia proceriformis*, *Crataegus sanguinea*, *Dipsacus gmelinii*, *Calystegia sepium*, *Trifolium pratense*, *Crepis tectorum* are especially common among herbaceous plants. *Thelypteris palustris* is observed near the water shores. The slopes of the river valley are covered with *Marchantia polymorpha*.

Systematically, representatives of four departments of higher plants also occur in the second population. From the section *Bryophyta – Marschantia polymorpha, from the section Polypodiophyta – Thelypteris palustris*, from the section Equisetophyta – Equisetum hyemale. The remaining plants belong to the *Magnoliophyta* department. Including from the class *Monocotyledoneae – Asparagus officinalis*, and the rest of the plants are plants of the class *Magnoliopsidae*. The *Asteraceae, Fabaceae*, and *Salicaceae* families predominate in the number of species. And from the rest of the families there are 1-2 species.

In the second population, hemicryptophytes are in the first place with a clear predominance in the form of life, i.e. perennial herbaceous plants -only 15 species (48.4%). In second place are macrophanerophytes, that is, trees-7 species (22.6%). In third place are nano– and microphanerophytes, i.e. shrubby and semi-shrubby-6 species (19.3%). In fourth place are therophytes, or annual (less often biennial) plants-3 species (9.7%).

The third population of *Alnus glutinosa* grows on humus soils near the farm "Zhansaya" in the village of Sambai of the Karagash rural district of the Aktobe region. Earlier, young individuals of *Alnus glutinosa* grew among the fiery grove. The land area is about 2.5-3 hectares. The vegetation cover consists of an alder – birch–willow plant community (*Alnus glutinosa-Betula pendula-Salix acutifolia, Salix pentandra*). The percentage of plant coverage is 75-80%. The first tier forms *Alnus glutinosa*, height 16 m, the second tier *Salix acutifolia, Salix pentandra*, height 8-10 meters, the third tier *Salix triandra, Betula pendula*, height 4-6 meters, the fourth tier *Calamagrostis epigeios, Inula helenium, Crepis pannonica*, height 1-1.5 meters, the fifth tier *Elytrigia repens, Rubus caesius, Chenopodium rubrum, Chenopodium glaucum, Bunium setaceum*, height 15-40 cm.

Within the third population, 24 species of higher plants belonging to 14 families and 21 relatives were identified. This population vegetation is growing again on the site of the burned forest. The floral composition is not particularly rich. *Betula pendula, Salix acutifolia,* and *Salix pentandra* grow well in the black alder population. It also forms a coating of plants *Inula helenium, Polygonum acetosum, Rubus caesius, Verbascum marschallianum. Calamagrostis*

epigeios, Elytrigia repens grow at the entrance to the forest. *Marchantia polymorpha* is found in some water areas of the forest.

Systematically, even in the third population there are representatives of four divisions of higher plants. From the *Bryophyta* section there are plants of *Marschantia polymorpha*, from the *Polypodiophyta* section – *Thelypteris palustris*, from the *Equisetophyta* section – *Equisetum hyemale*. And the rest of the plants are Plants of the *Magnoliophyta* section. Its *Monocotyledoneae* class includes *Calamagrostis epigeios, Elytrigia repens*, and the remaining plants belong to the *Magnoliopsidae* class. The family *Asteraceae, Brassicaceae, Chenopodiaceae* prevails in the number of species, and from the other families there are 1-2 species.

In the third population, hemicryptophytes are in the first place with a clear predominance in the form of life, that is, perennial herbaceous plants – only 12 species (50%). In second place are therophytes, or annual (less often biennial) plants-5 species (20.8%). In third place are macrophanerophytes, that is, trees - 4 species (16.7%). In fourth place are nano- and microphanerophytes, i.e. shrubby and semi-shrubby-3 species (12.5%).

According to the form of life, all three populations have a high rate of hemicryptophytes. According to the number of therophytes, the third population prevails. And the number of microphanerophytes and nano-, microphanerophytes is higher in the second population (Figure 2).

According to the floral composition of plant communities with the participation of *Alnus glutinosa*, 1 species from the *Marchantiaceae* family is found in three populations. Of the *Polypodiaceae* family, there are 2 species in the first population, and 1 species in the remaining populations. There are 3 species from the *Equisetaceae* family in the first population, and 1 species in the remaining populations. Of the *Poaceae* family, 1 species is found in the first population, 2 species in the third. In the second population from the *Liliaceae* family, only 1 species is found. There are 3 species from the *Salicaceae* family in each population. Of the *Betulaceae* family, there are 2 species in the first and third populations, and 1 species in the first population. In the first and third populations of the *Urticaceae* family, 1 species occurs. 1 species from the *Polygonaceae* family, 2 species from the *Chenopodiaceae* family, 1 species from the *Apiaceae* family, 1 species from the *Plantaginaceae* family are found only in the third population. 1 species from the *Ranunculaceae* family, 3 species from the *Fabaceae* family, 2 species from the *Aceraceae* family, 1 species from the *Oleaceae* family, 1 species from the *Convolvulaceae* family, 1 species from the *Lamiaceae* family, 1 species from the *Caprifoliaceae* family, 1 species from the *Dipsacaceae* family are found only in the second population. Of the *Rosaceae* family, there are 2 species in the first and second populations, and 1 species in the third. Of the *Rhamnaceae* family, 1 species occurs in the first and second populations. Of the *Asteraceae* family, 5 species are found in the first population, 7 species in the second, and 6 species in the third. The *Asteraceae* family dominates in three populations (Table 3).

In the studied 3 populations, we found that the leaves of black alder were damaged by the alder felt mite (*Acalitus brevitarsus*). This led to damage to the leaves of some shrubs of the plant, deformation of the leaves (Figure 3).

Our preliminary findings suggest that while biotic damage is common, the majority of observed damage falls within the minor to moderate category, with severe damage affecting a smaller proportion of the population. This reduction in photosynthesis can lead to reduced growth rates and diminished reproductive output, which was evidenced by a lower count of viable seeds in damaged plants (Shi et al., 2022). However, in areas where severe damage was noted, there was a noticeable reduction in plant vigor and seed production. This indicates that while such biotic interactions are part of the natural ecological dynamics, they can escalate to problematic levels under certain conditions, such as prolonged wet seasons which favor the proliferation of mites and bugs.

And also, a pest bug Kleidocerys resedae was noted on the territory of 3 populations (Figure 4).

The bug pierces the leaf blade of the alder and sucks the juices from them. As a result, small holes formed in the puncture sites, the leaves became sluggish and shrunken, the edges of some leaves bent to the underside. The type of damage is bending of the edge of the leaves, lethargy, shrinkage, small spots and small holes on the leaves (Figure 4).

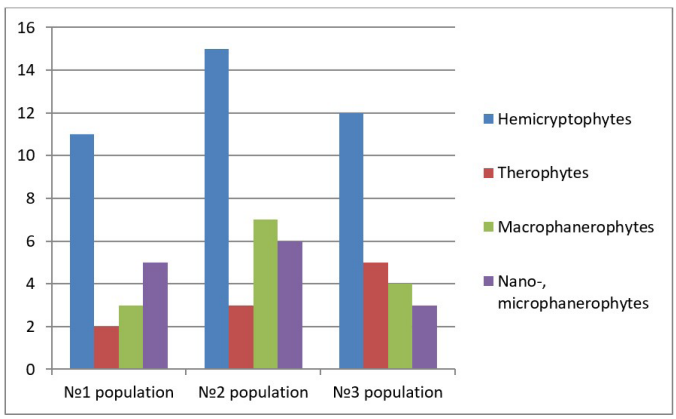

Figure 2. The ratio of plant life forms of three populations according to K. Raunkye.

Table 3. Floral composition of plant communities with participation of *Alnus glutinosa*.

№	List of plants	Population of *Alnus glutinosa*		
		№ 1 population (Winter quarters of Zhanatan)	№ 2 population (Zhaman Kargaly river)	№ 3 population (farm "Zhansaya", village of Sambay)
	Order *Bryophyta*			
	Genus *Hepaticopsida*			
I	**Family: *Marchantiaceae* (Bisch.) Lindley**			
	Marschantia polymorpha L.	+	+	+
	Order *Polypodiophyta*			
	Genus *Polypodiopsida*			
II	**Family: *Polypodiaceae* Bercht. & J. Presl**			
	Thelypteris palustris Schott	+	+	+
	Dryopteris filix-mas (L.) Schott	+		
	Order *Equisetophyta*			
	Genus *Equisetopsida*			
III	**Family: *Equisetaceae* Rich. ex DC.**			
	Equisetum arvense L.	+		
	Equisetum pratense Ehrh.	+		
	Equisetum hyemale L.	+	+	+
	Order *Magnoliophyta*			
	Genus *Monocotyledoneae*			
IV	**Family: *Poaceae* Barnhart**			
	Stipa capillata L.	+		
	Calamagrostis epigeios (L.) Roth			+
	Elytrigia repens (L.) Nevski			+
V	**Family: *Liliaceae* Juss.**			
	Asparagus officinalis L.		+	
	Genus *Magnoliopsidae*			
VI	**Family: *Salicaceae* Mirb.**			
	Populus nigra L.		+	
	Salix acutifolia Willd.		+	+
	Salix triandra L.	+	+	+
	Salix pentandra L.	+		+
	Salix cinerea L.	+		
VII	**Family: *Betulaceae* S. F. Gray**			
	Betula pendula Roth	+		+
	Alnus glutinosa (L.) Gaertn.	+	+	+
VIII	**Family: *Urticaceae* Juss.**			
	Urtica dioica L.	+		+
IX	**Family: *Polygonaceae* Juss.**			
	Polygonum acetosum Bieb.			+
X	**Family: *Chenopodiaceae* Vent.**			
	Chenopodium glaucum L.			+
	Chenopodium rubrum L.			+
XI	**Family: *Ranunculaceae* Juss.**			
	Thalictrum minus L.		+	
XII	**Family: *Rosaceae* Juss.**			
	Crataegus sanguinea Pall.		+	
	Rubus caesius L.			+
	Rosa laxa Rez.	+		
	Rosa pisiformis (Christ.) Sosn.	+		
	Rosa canina L.		+	
XIII	**Family: *Fabaceae* Lindl.**			
	Trifolium pratense L.		+	
	Caragana frutex (L.) C. Koch		+	
	Vicia biennis L.		+	

Table 3. Continued...

№	List of plants	Population of *Alnus glutinosa*		
		№ 1 population (Winter quarters of Zhanatan)	№ 2 population (Zhaman Kargaly river)	№ 3 population (farm "Zhansaya", village of Sambay)
XIV	**Family: *Aceraceae* Juss.**			
	Acer negundo L.		+	
	Acer tataricum L.		+	
XV	**Family: *Rhamnaceae* Juss.**			
	Frangula alnus Mill.	+		
	Rhamnus cathartica L.		+	
XVI	**Family: *Apiaceae* Lindl.**			
	Bunium setaceum (Schrenk) H. Wolff			+
XVII	**Family: *Oleaceae* Hoffmgg. et Link**			
	Fraxinus pennsylvanica Marsh.		+	
XVIII	**Family: *Convolvulaceae* Juss.**			
	Calystegia sepium (L.) R. Br.		+	
XIX	**Family: *Lamiaceae* Lindl.**			
	Salvia stepposa Shost.		+	
XX	**Family: *Scrophulariaceae* Juss.**			
	Verbascum marschallianum Ivanina et Trvel.			+
	Linaria genistifolia (L.) Mill.		+	
	Linaria ruthenica Blonski		+	
XXI	**Family: *Plantaginaceae* Juss.**			
	Plantago major L.			+
XXII	**Family: *Caprifoliaceae* Juss.**			
	Lonicera tatarica L.		+	
XXIII	**Family: *Dipsacaceae* Juss.**			
	Dipsacus gmelinii Bieb.		+	
XXIV	**Family: *Asteraceae* Dumort.**			
	Conyza Canadensis (L.) Cronq.			+
	Inula helenium L.	+		+
	Ptarmica cartilaginea (Ledeb. ex Reichenb.) Ledeb.			+
	Achillea millefolium L.			+
	Artemisia abrotanum L.			+
	Artemisia proceriformis Krasch.		+	
	Artemisia vulgaris L.		+	
	Artemisia austriaca Jacq.		+	
	Artemisia scoparia Waldst. et Kit.	+		
	Artemisia dracunculus L.		+	
	Artemisia arenaria DC.		+	
	Petasites spurius (Retz.) Reichenb.	+		
	Cirsium serrulatum (Bieb.) Fisch.	+		
	Chartolepis intermedia Boiss.	+		
	Cichorium intybus L.		+	
	Crepis pannonica (Jacq.) C. Koch.			+
	Crepis tectorum L.		+	

The ground bug and the alder felt mite damage the leaf blade of plants, which leads to leaf deformation (Figure 5). As a consequence, this leads to damage to some black alder bushes.

1. Sample

GGGCTTCCATTTGAGGGCGGGCTGGACCTCTCGGGGTT
ACAGCCTTGCTGAATTATTCACCCTTGTCTTTTGCGTACTTCT
TGTTTCCTTGGTGGGTTCGCCCACCACTAGGACAAACATAAA
CCTTTTGTAATTGCAATCAGCGTCAGTAACAAATTAATAATT
ACAACTTTCAACAACGGATCTCTTGG

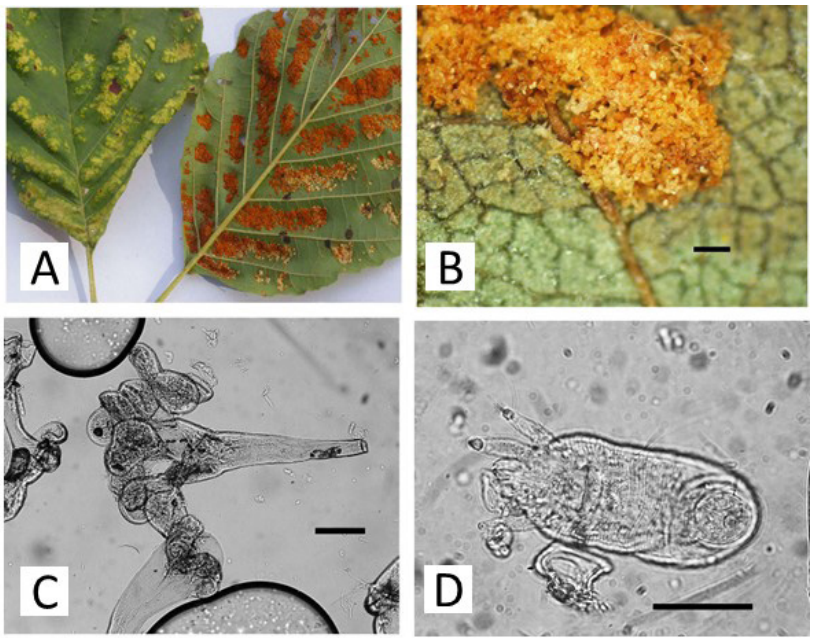

Figure 3. (A) Deformation of the leaves of *Alnus glutinosa* as a result of vesicular gall bladders and erineum; (B) Erineum - clusters of hairs covering the upper surface of the leaf; (C) Erineum hairs formed on leaves infected with a tick; (D) Microscopic tick *Acalitus brevitarsus*.

Figure 4. Ground bug (*Kleidocerys resedae*) under a microscope.

Figure 5. Affected alder leaves by mite and ground bug (*Kleidocerys resedae*).

Table 4. Sequencing results

Description	Query Cover	Perident	Accession
Alternaria alternata (16-ITS1)	100%	99.45%	MN557300.1
Alternaria alternata (1-ITS1)	100%	100%	ON226889.1

2. Sample

GGGCTGGAACCTCTCGGGGTTACAGCCTTGCTGAATTATTCACCCTTGTCTTTTGCGTACTTCTTGTTTCCTTGGTGGGTTCGCCCACCACTAGGACAAACATAAACCTTTTGTAATTGCAATCAGCGTCAGTAACAAAT

Results sequencing showed that the DNA sample under study belongs to the fungus *Alternaria alternata* (Table 4).

4. Conclusion

As a result of the study of the plant life forms of the *Alnus glutinosa* population, perennial herbaceous plants dominate in the second population, in the third population higher than in the first. Trees dominate in the second population, and in the third population they are higher than in the first. Although therophytes predominate in the third population, shrubs and semi-shrubs in this population are recessive compared to other populations, while the indicator of shrubs and semi-shrubs in the first population is in second place after the second population.

Warm air temperature, high humidity of the territory, resistance of the ground bug (*Kleidocerys resedae*) moisture resistance is the main factors that contributed to a massive increase in their number. Consequently, the occurrence and harmfulness of the pest is characterized by a high level. This type of pest is dangerous for black alder. Therefore, it is necessary to apply measures to combat them.

Results sequencing showed that the DNA sample under study belongs to the fungus *Alternaria alternata*.

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