UDC 502.5:581.9(477.63).
DOI https://doi.org/10.32782/2226-0099.2025.145.1.36

ECOLOGICAL STATE OF PHYTOCENOSES OF THE LANDSCAPE RESERVE "PETROPAVLIVSKY LIMAN" AND ITS SURROUNDINGS

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Nowadays, human activity significantly affects the natural vegetation cover, in particular meadows. One of the main anthropogenic impacts is land reclamation, drainage and irrigation, economic development of such territories, which includes the formation of dumps, in some cases haymaking and grazing of livestock, which is accompanied by pasqval changes. Each of these factors in a certain way affects the floristic composition, which leads to a change in the types of phytocenoses. In recent years, changes in the flora have been observed throughout Ukraine, which are accompanied by the formation of synanthropic complexes in the flora and the adventitization of species. The article examines the ecological state of phytocenoses of the landscape reserve "Petropavlevsky Liman", which is located in the Dnipropetrovsk region. The research was conducted according to parameters that include determining the total area of projective coverage, the percentage of species belonging to the synanthropic complex of flora. The ordination method was used to cluster ecological groups of plants in relation to moisture and nutrient content in the soil, as well as the illumination of the territory. The flora in the studied areas includes 93 species of higher vascular plants belonging to 33 families. Asteraceae – 17% form the basis of the taxonomic fraction. Species of alien flora make up up to 14% of the species composition. It was found that the ecological state of phytocenoses in the three studied points in the conditions of the reserve differs in the following parameters: the number of species; the degree of degression; the species composition of plants belonging to the synanthropic complex, which indicates a different level of anthropogenic impact in the studied expedition points. The highest indicator of the degree of degression is observed in the point located in the meds of the reserve itself (Id = 303) due to the most pronounced degree of synanthropization, which is accompanied by the development of ruderal-nitrophilic groups of the Chalidonio-Galieta type, which indicates high soil fertility and the predominant presence of ecological groups of plants in relation to average and moderate soil moisture. The lowest indicator was observed for the first expedition point near the mine (Id = 120) with the smallest amount of projective vegetation cover, which was accompanied by the impact on the soils of not only anthropogenic, but also zoogenic factors, as a result of which the vegetation cover is formed the worst, and representatives of the synanthropic complex among plants make up 8% of the total area of coverage. Near the village of Petrivka, an average indicator of the degree of degression was observed and since the advantage in terms of coverage area belonged to perennial cereals, a weak stage of grazing is observed here, and the presence of plants of the synanthropic group indicates a stage of degression at its initial stage. Accordingly, it seems advisable to conduct annual studies to determine the rate of degression on the territory of the landscape reserve.

Key words: *synanthropization, digression, environmental parameters, plants, species, pasqual changes.*

Білушенко А.А. Екологічний стан фітоценозів ландшафтного заказника «Петропавлівський лиман» та його околиць

Нині, людська діяльність значним чином впливає на природний рослинний покрив, зокрема на лучний. Одними із основних антропогенних впливів є меліоративні заходи, осушення та обводнення, господарське освоєння таких територій, яке включає утворення відвалів, в деяких випадках сінокосіння та випасання худоби, що супроводжується пасквальними змінами. Кожен із цих факторів, певним чином впливає на флористичний склад, що призводить до зміну типів фітоценозів. За останні роки на усій території України спостерігаються зміни у флорі, які супроводжуються утворенням синантропних

комплексів у складі флори та адвентизація видів. В статті, розглядається екологічний стан фітоценозів ландшафтного заказника «Петропавлівський лиман», який знаходиться на території Дніпропетровської області. Дослідження проведені за параметрами, які включають визначення загальної площі проективного покриття, відсоток видів, які належать до синантропного комплексу флори. Ординаційним методом проведена кластеризація екологічних груп рослин по відношенню до зволоження та вмісту поживних речовин в ґрунті, а також освітленості території. В складі флори на досліджених територіях 93 види вищих судинних рослин, які належать до 33 родин. Asteraceae – 17% складають основу таксономічної фракції. Види чужорідної флори складають до 14% від видового складу. З'ясовано, що екологічний стан фітоценозів в досліджених трьох пунктах в умовах заказника відрізняється за наступними параметрами: за кількістю видів; ступенем дегресії; видовим складом рослин, які належать до синантропного комплексу, що свідчить про різний рівень антропогенного впливу в досліджених експедиційних пунктах. Найвищий показник ступеня дегресії спостерігається в пункті, який знаходиться в межах самого заказника (I_d = 303) за рахунок найбільш вираженого ступеня синантропізації, який супроводжується розвитком рудерально-нітрофільних угрупувань типу Chalidonio-Galieta, що свідчить про високу родючість ґрунту і переважною присутністю екологічних груп рослин за відношенням до середньої і помірної зволоженості ґрунту. Найнижчий показник спостерігався для першого експедиційного пункту біля шахти (I_d = 120) з найменшою кількістю проективного покриття рослинністю, що супроводжувалося впливом на ґрунти не тільки антропогенних, а й зоогенних чинників в результаті чого рослинний покрив сформований найгірше, а представники синантропного комплексу серед рослин складають 8% від загальної площі покриття. Біля с. Петрівка, спостерігався середній показник ступеня дегресії і оскільки перевага за площею покриття належала багаторічним злакам, то тут спостерігається слабка стадія випасання, а наявність рослин синантропної групи, свідчить про стадію дегресії на початковому її етапі. Відповідно бачиться доцільним проведення щорічних досліджень з метою з'ясування швидкості дегресії на території ландшафтного заказника.

Ключові слова: *синантропізація, дегресія, параметри довкілля, рослини, види, пасквальні зміни.*

Problem statement. Petropavlivskyi estuary is a landscape reserve of national importance. It is located in the Dnipropetrovsk region, near the villages of Kokhanivka, Bragynivka, Samarske, Petrivka, Mykolaivka, and the urban-type settlement of Petropavlivka. The status of the territory was granted to preserve valuable natural complexes of the river floodplain. In this regard, the question arises of how and to what extent this object is subject to anthropogenic impact, how its vegetation changes depending on the action of the main environmental factors – soil moisture and nutrient content, as well as the light regime of the territory, since illumination is an important factor that affects the processes of photosynthesis and the general development of vegetation. Currently, human activity significantly affects the natural vegetation cover, in particular meadow and estuary. One of the main anthropogenic impacts is land reclamation, drainage, irrigation, economic development, which is accompanied by the formation of dumps, haymaking and grazing of livestock, which entails pasqval changes. Each of these factors has a corresponding effect on the floristic composition, which leads to a change in the types of phytocenoses. In recent years, changes in the flora have been observed throughout the territory of Ukraine, which are accompanied by the formation of synanthropic complexes of vegetation as part of the aboriginal flora, and the existing adventitization of species. And indeed, the presence of species that belong to synanthropic complex indicates the presence of destructive processes of the corresponding phytocenosis. Therefore, a study of the species composition of the local phytocenosis and the identification of species of the synanthropic vegetation complex will give us an idea of the level of destruction of the local phytocenosis at the selected points of the reserve studied by us and beyond.

Analysis of basic research and publications. According to physical and geographical zoning, the territory is included in the left-bank part of the South-Steppe Dnieper [4]. The reserve and its surroundings are subject to significant anthropogenic impact due to human activity. That is why it is advisable to analyze phytodiversity in order to get an idea of the level of transformation of the territory. The object of our research is located in the floodplain of the Samara River. Meadow and salt marsh vegetation is characteristic of the floodplain territory [6]. The Samara River has an extensive hydrographic network with 39 first-order tributaries (more than 10 km), 142 second-, third-, and other-order tributaries and the density of the river network (including tributaries) is 0.33 km [4]. The floristic composition of the surroundings, as well as the reserve itself, is not sufficiently studied. However, the territory related to the floodplain areas of the Samara River itself is quite well studied [7, 8]. The flora of the Samara region has been sufficiently studied [1, 2, 5, 9]. We previously conducted an analysis of phytodiversity and compiled a list of plants according to their corresponding bioecological certification [3].

Task statement. The purpose of the work is to investigate the ecological state of phytocenoses of the landscape reserve "Petropavlevsky Liman" according to parameters that include the total area of projective cover on the territory of the studied points, the percentage of species belonging to the synanthropic complex of flora, the requirements of plant species that are associated with the parameters of the surrounding environment – soil moisture, soil nutrition, and lighting, which will allow us to identify relevant changes in the studied cenosis.

To achieve this goal, the following main research tasks have been identified:

1. To investigate phytodiversity;

2. To identify plant species belonging to synanthropic complexes in the composition of the phytocenosis, which will allow us to obtain an indicator of the degree of destruction of the cenosis;

3. Obtain the results of DCA – ordination, and construct diagrams for the three studied points on the territory of the reserve and beyond, which will characterize the requirements of plants in relation to three environmental parameters – area illumination, soil moisture and the presence of nutrients in it, and will allow us to understand in which direction the cenosis changes.

Three points were selected for the research: 1 – the area around the mine, 2 – the territory of the reserve, 3 – the vicinity of the village of Petrivka (Fig. 1). Coordinates: latitude 48.3918971; longitude 36.362125. Date of the descriptions: 15.05–01.06.2021. Within the research points, 16 model plots were laid out, on which descriptions were carried out. The most complete systematic structure of the flora of any area, relative to the projective cover, reflects the percentage ratio of species from different families.

Descriptions of plant communities were carried out on standard plots that correspond to the minimum area – from 5–9 m^2 (for herbaceous stands, 1 m^2). Their size varied depending on the boundaries of phytocenoses. Office processing of research results was carried out using the Past program and standard Microsoft Excel programs. To construct a dendrogram of flora similarity for three points of material collection, the Kulchynsky distance was used.

Ecomorphological analysis was carried out according to the main indicators of bioecological passporting of species [3]. Adventitious species and plant species of the synanthropic group were distinguished as a separate fraction. Latin names that occur in the text are given on the basis of modern nomenclature. Classification of syntaxons consisting of species associations (in places where they were expressed, since plant

associations are weakly formed due to anthropogenic influence) was carried out according to generally accepted methods.

Fig. 1. Points of investigation

Legend for Figures 5, 6, 7

Ecomorphs: Heliomorphs: He (Heliophiton) – heliophyte (photophilous); Sc (Sciophiton) – sciophyte (shade-tolerant); HeSc and ScHe – species partially demanding of light. Trophomorphs: OgTr (Oligotroph) – oligotroph (plant of nutrient-poor soils); MsTr (Mesotroph) – mesotroph (medium-rich soils); MTr (Megatroph) – megatroph (plant of nutrient-rich soils). Hygromorphs: Hg (Hygrophiton) – hygrophyte (moistened habitats); Ms (Mesophiton) – mesophyte (medium-moist habitats); X (Xerophiton) – xerophyte (dry habitats).

Presentation of the main research material. The flora in the research points is characterized by insignificant species richness. The taxonomic composition of the flora consisted of 94 species belonging to 33 families. The main families with the greatest species richness include Asteraceae – 17% of the floristic composition, Poaceae – 14%, Rosaceae – 10%. Among the elementary biomorphs, herbaceous plants dominate (95%). In general, herbaceous polycarpics (perennials) dominate the spectrum. The total part of annuals and biennials (monocarpics) makes up a smaller share in the fraction of the studied herbaceous stand, among which winter annuals make up a small share (up to 15%) [3].

Alien species are less than 14%, but in terms of species composition they form a stable fraction in the studied plant groups (Fig. 2). As is known, synanthropic species are considered to be plant species that have adapted to life in places where there is significant human influence, while benefiting from environmental changes, and feel good and develop in such conditions. To determine the level of synanthropy of phytocenoses, the indicator of the degree of destruction of the cenosis (Id) is used, which depends on the number of plant species of the synanthropic group and the area of their coverage of the studied phytocenosis (Fig. 3).

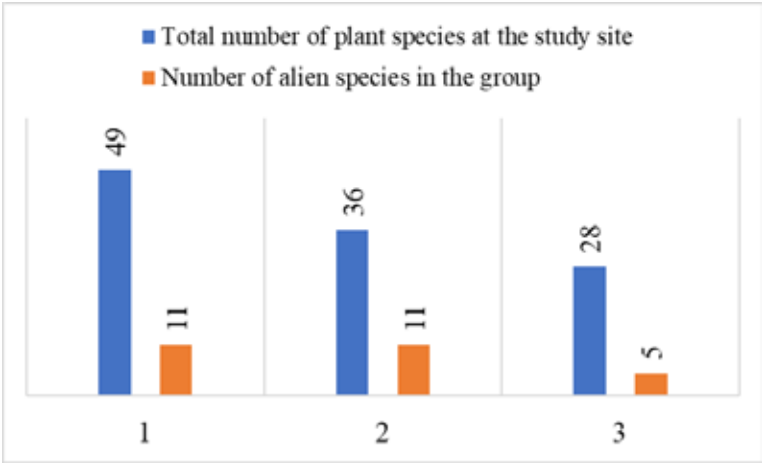

Fig. 2. Main parameters of the fractions alien species of the flora composition in the studied areas of the Petropavlovsk Liman reserve

1 – the territory around the mine; 2 – the territory of the reserve; 3 – the vicinity of the village of Petrivka.

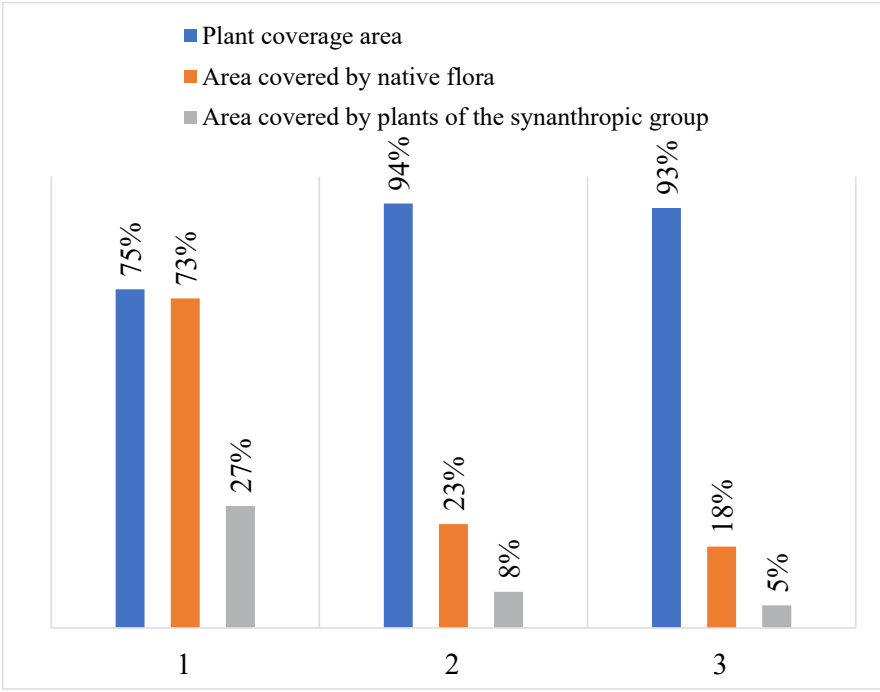

Fig. 3. Main parameters of fractions among species of synanthropic plant group in the studied areas of the Petropavlovsk Liman reserve

1 – the territory around the mine; 2 – the territory of the reserve; 3 – the vicinity of the village of Petrivka.

Plant associations are poorly formed, since all the areas we studied are subject to anthropogenic influence to varying degrees.

Based on the diversity of cenoflora, a similarity dendrogram (Kulchynsky distance) was constructed to compare the studied areas. According to the results of the analysis, we clearly see that the third group, which represents the studied territory of the vicinity of the village of Petrivka (Fig. 4), is sharply separated. This is due to the sharp transition to humid meadows with typical vegetation.

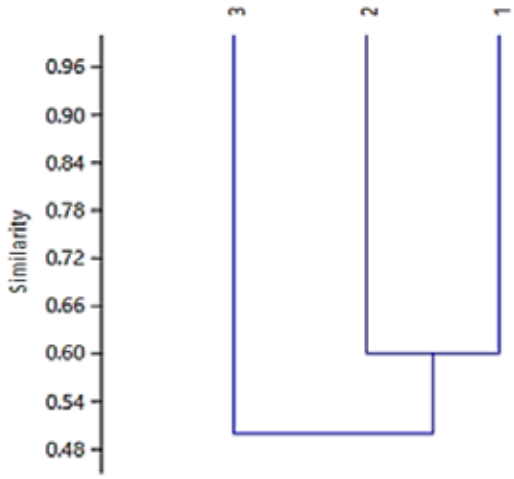

Fig. 4. Dendrogram of similarity of flora (coenoflora) of the studied territories of the reserve "Petropavlevsky Liman"

1 – the territory around the mine; 2 – the territory of the reserve; 3 – the vicinity of the village of Petrivka.

Tree and shrub vegetation at the studied points is very poorly developed and makes up less than 5%. Directly tree vegetation at two points is young and unformed (study area near the mine and the vicinity of the village of Petrivka). Most species belong to representatives of cultural and adventitious-invasive species in the fraction of the studied flora (table 1).

In the first research point on the studied areas near the mine, the dendroflora was formed due to the old orchard of fruit species (apple, apricot, cherry), which is acquiring signs of digression. The least diversity is characterized by the studied area near the village of Petrivka (wild pear and narrow-leaved olive).

The cenomorphic structure of the flora is represented mainly by meadow species. A significant share in the floristic composition is played by ruderals and species that facultatively belong to this group (44%). Species belonging to the typical ruderal fraction make up 18%. And in the rest, in relation to the three environmental parameters – light, soil moisture and the presence of nutrients in it, the following groups were distinguished – species that are partially demanding of light. Their share in the plant fraction is – 62%, the rest of the plant species belong to heliophytes (open space plants). In the hygrospectrum, species with average moisture conditions make up – 16%. Hygromesophytes and xerophytes prevail (55%). And xerophytes, the share of which grows in conditions of moderate moisture is 7%. Some species show wide tolerance to moisture conditions (2.1%). Among

trophomorphs, mesotrophic species (mesotrophs, oligotrophs) significantly prevail – 80%. A more detailed description of each of the researched points is provided below.

Table 1

Tree and shrub vegetation of the studied areas of the landscape reserve "Petropavlevsky Liman"

Species name	Research points		
	1	2	3
Cherry (*Cerasus fructicosa*) ∩	+		
Apricot (*Armeniaca vulgaris*) ∩	+		
Apple (*Malus*) ∩	+		
Wild pear (*Pyrus communis*) ∩			+
Pennsylvania ash (*Fraxinus pennsylvanica*) *	+	+	
Common oak (*Quercus robur*)		+	
В'яз низький (*Ulmus pumila)* *	+		
American maple (*Acer negundo*) *	+	+	
Tatar maple (*A. tataricum*) *	+	+	
Sharp-leaved maple (*A. platanoides*)		+	
Olive holly (*Elaeagnus angustifolia*) *	+		+
Pyramidal poplar (*Populus pyramidalis)* *	+		
Warty birch (*Betula pendula*)	+		
White acacia (*Robinia pseudoacacia*) *		+	
Common rosehip (*Rosa canina*)	+		

*Notes: 1 – Test sites near the mine; 2 – directly the protected area; 3 – vicinity of the village of Petrivka; * – adventive species; ∩ – cultivated species.*

In the area around the mine, mesophytic plants predominate. Plant associations at the trial sites of this observation point are poorly formed. The site is characterized by weediness. The winter annual *Anisantha tectorum* dominates in the herbaceous cover – 30%. Nine plant species are alien, of which *Ambrosia artemisiifolia* and *Heracleum sosnowskyi* are considered quarantine. Representatives of the genus Rumex are present. The characteristic weediness is partly explained by anthropogenic impact – household litter, which entails biological pollution – taking into account the presence of plant species belonging to the synanthropic complex (*Anisantha tectorum, Ballota nigra, Chenopodium album, Ambrosia artemisiifolia, Vicia cracca, Lactuca serriola, Galium aparine, Potentiola argentea*), the area of projective cover of which in some places reaches 60%, and the indicator of the degree of destruction of the cenosis in the presence of these species (Id = 120).

In places, *Tanacetum vulgare* + *Elymus repens* form an association with the dominance of *Tanacetum vulgare* (30%). On the ordination diagram of the distribution groups descriptions in the multidimensional space of three environmental parameters (illumination, soil moisture and its enrichment with nutrients), one can trace the conjugation influence of individual factors on this distribution. At the same time, the vectors of ecological groups of plants by illumination and humidity almost coincide with the second axis of ordination (Fig. 5). As we can see, the numbers on the diagram indicate the study areas in space, and the vectors form plants of the corresponding ecological

groups in relation to these areas with the corresponding ecological factors for them. Therefore, all the studied areas are associated with species that are demanding or partially demanding for light, and species that are demanding for soils of poor and medium enrichment in nutrients.

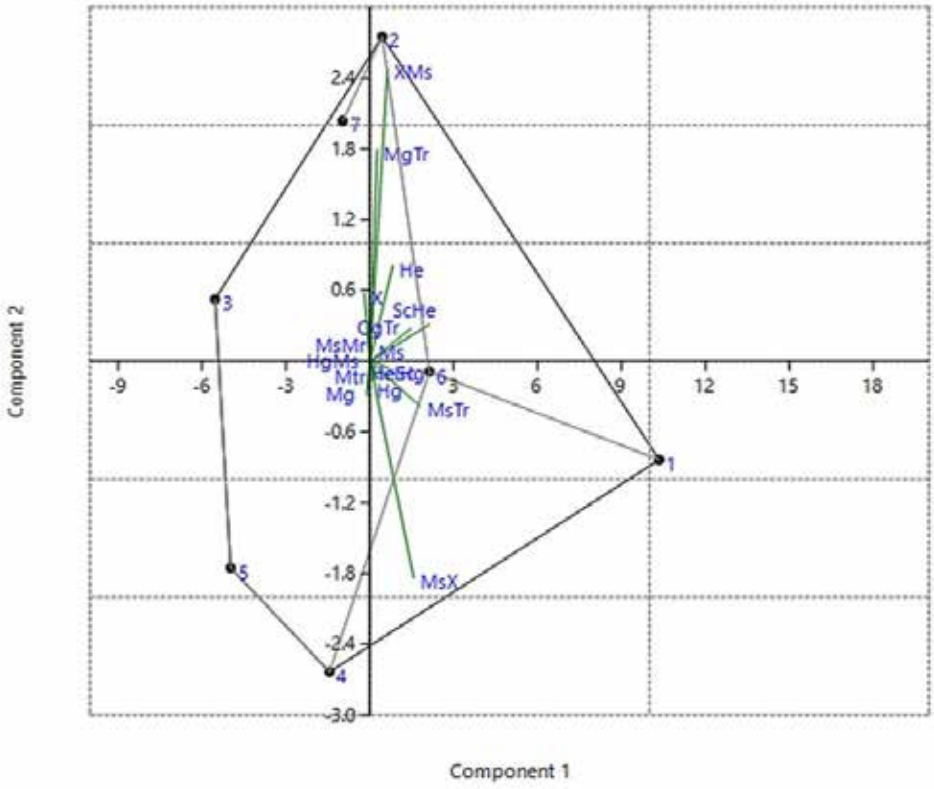

Fig. 5. DCA result – ordinations of selected clusters (territory around the mine)

The territory of the reserve is characterized by the formation of a natural formation of perennial grasses. The basis of the herbage is perennial cereals, sedges, among which *Carex acuta* is mainly noted, as well as various herbs. The environmental parameters under which meadow vegetation is formed contribute to its growth and development throughout the entire vegetation period, and therefore the area of projective cover here is the highest. Alien species in the flora fraction are not numerous in terms of the number of species, and are not common and occupy approximately 10% of the entire flora. The presence of *Chelidonium majus* in all sample plots from 5 to 15% indicates high soil fertility (related to nutrient content) with moderate moisture, as well as possible anthropogenic impact, since this species belongs to the complex of synanthropic plants. It should not be forgotten that other representatives of the synanthropic complex group (*Cirsnm arvense, Lactuca serriola, Polygonum aviculsre, Descurainia sophia, Chelidonium majus*) are also found here, and their projective coverage area is 31%. However, the indicator of the degree of destruction of the cenosis in the presence of plant species of the synanthropic complex is the highest here (I_d = 303), which can be explained by

the largest area of projective coverage by plants – on average up to 95% and even more. Having considered the diagram, it can be found that species that gravitate to nutrient-rich soils with a moderate level of moisture are associated with all the studied areas (Fig. 6).

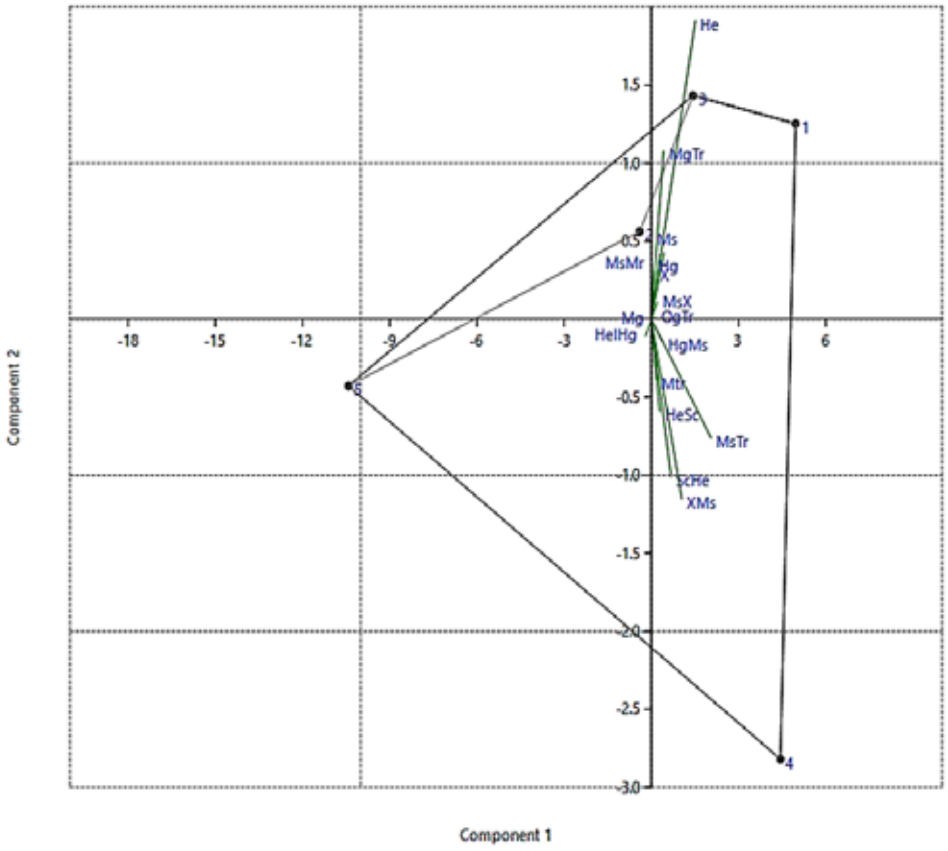

Fig. 6. DCA result – ordinations of selected clusters (territory of the reserve)

Here you can observe that the ecological group of plants in terms of nutrient-rich soils stretches in a vector upwards, and in terms of moisture levels (groups of species with moderate and medium levels) – downwards. It should be recalled that the transformation of this studied territory under the influence of anthropogenic factors created the prerequisites for the development of ruderal-nitrophilic groups *Chalidonio-Galieta*, which is associated with the bordering of the reserve territory with the field, as one of the factors of anthropogenic influence [3], which in this case can explain the highest degree of destruction of the cenosis, and therefore talk about a high degree of synanthropization.

In the territory near the village of Petrivka, meadow vegetation predominates with the dominance of cereals *Elymus repens* + *Poa pratensis*. Pasqval changes are observed in this area – partial disturbance of the vegetation cover is associated with grazing. However, large stages of pasqval digression are not observed, although in terms of the number of species, in some places annual and biennial weeds prevail in the model plots,

which is a direct consequence of the initial digression. Since perennial cereals predominate in abundance, they can partially stimulate the succession process. Therefore, these model sites are in a stage of weak grazing. Tree and shrub vegetation is almost undeveloped. Isolated specimens of *Pyrus communis* and *Elaeagnus angustifolia* are noted. Typical meadow species characteristic of humid floodplain areas appear in the herbaceous stand (*Juncus effuses, Stellaria media, Ranunculus acris*, etc.). Alien flora species make up approximately 5% of the entire fraction. Also, species appear that belong to the group of plants of the sisnanthropic complex *(Lamium purpureum, Capsella bursa-pastoris, Lactuca serriola, Taraxacum officinale, Stellaria media*), which make up 5% of the projective coverage area, and the indicator of the degree of destruction coenosis taking into account the plant species of the synanthropic group is equal to (Id = 197), which may indicate to us the existing level of synanthropization of the phytocenosis at the stage of its development. Analyzing the ordination diagram of the selected clusters, we see that at this observation point the situation is different, many vectors of ecological groups of plants, especially in relation to soils with medium enrichment in nutrients coincide with the second axis of ordination. And species in relation to illumination, especially heliophytes, and species in relation to soil moisture – are directed by vectors upwards (Fig. 7).

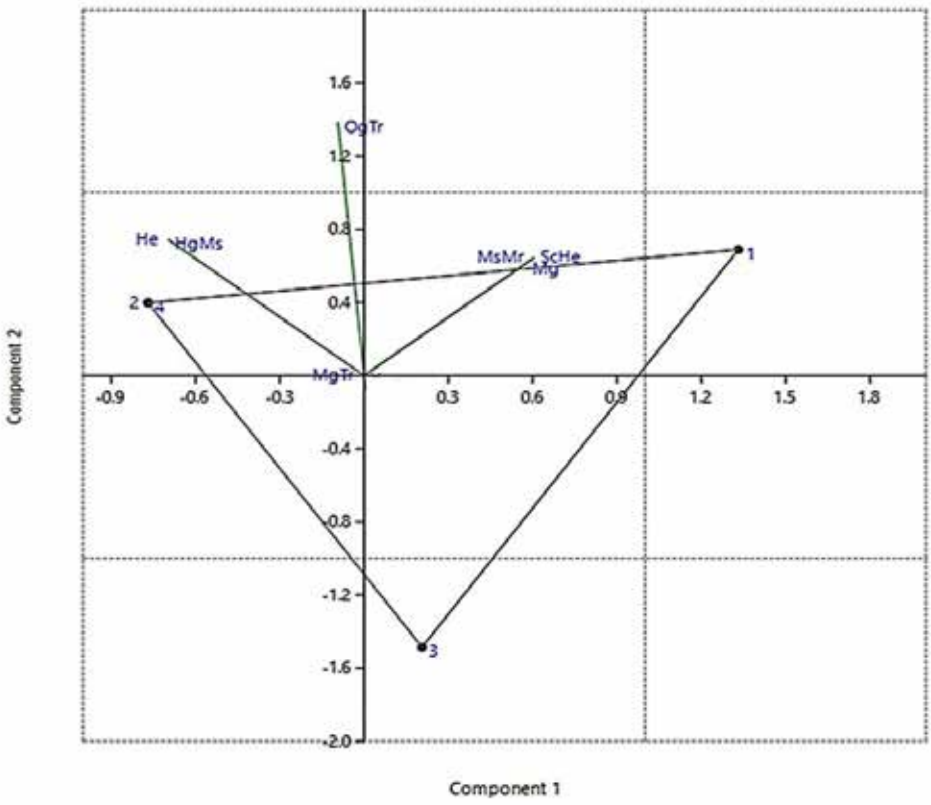

Fig. 7. DCA result – ordinations of selected clusters (surroundings of the village of Petrivka)

Analysis of the relationships between indicators of diversity of ecological groups of plants in relation to environmental parameters showed that the total number of plant species in the descriptions has a statistically significant positive correlation with the number of species of the ecological group in relation to the test plots where vegetation descriptions were conducted.

Conclusions and suggestions. According to the results of the conducted research, the ecological state of phytocenoses of the landscape reserve "Petropavlevsky Liman" was clarified. The taxonomic composition of the flora consisted of 94 species of 33 families higher vascular plants, of which the basis taxonomic fraction was Asteraceae – 17%. Alien species occupied up to 14%. The state of phytocenoses of the three studied points was heterogeneous and, as was found, differed in the number of species, the degree of degression, and the presence of plant species of the synanthropic complex, which indicates a different level of anthropogenic impact in these three research points. The highest indicator of the degree of degression was observed for the point located directly within the reserve (I_d = 303) due to the largest area of projective vegetation cover (95%) and the most pronounced degree of synanthropization, which is accompanied by the formation and development of ruderal-nitrophilic groups of the type, which may indicate high soil fertility what related to nutrient content and the predominance of ecological groups plants in relation to average and moderate soil moisture. The lowest indicator of the degree of degression is observed for the point of the reserve territory around the mine (I_d = 120), with the smallest area of projective vegetation cover of up to 75% on average, which is simultaneously accompanied by mechanical disturbance of the upper layers of the soil not only as a result of anthropogenic activity, but also by wild animals – burrowers, as a result of which the vegetation cover is formed the worst, and plant groups of the synanthropic complex reach no less than 8% of the cover. In the studied point near the village of Petrivka the degree of degression is average compared to the previous ones (I_d = 197). It was established that since here the advantage in abundance belongs to perennial cereals, there is a weak stage of cattle grazing, which is accompanied by weakly expressed pasqval changes, and the presence of plant species of the synanthropic group indicates the presence of initial digression. The territory of the reserve requires regular research in order to clarify the rate of digression of its local phytocenoses.

REFERENCES:

1. Baranovski, B. A., Karmyzova, L. A., Roshchyna, N. O., Ivanko, I. A., &Karas, O. G. Ecological-climatic characteristics of the flora of a flood plain landscapein Southeastern Europe. *Biosystems Diversity*. 2020. Vol. 28, № 1. P. 98–112.

2. Baranovskiy B.O., Tarasov V.V., Ivanko I.A., Dubina A.O. Analysis of the rare fraction of the flora protected reserve of national importance "Samara`s Bir". *Plant world in the Red book of Ukraine*: implementation of the globalstrategy for plant conservation: *2018 year*: proceedings of the V international conference. Kherson, 2018. P. 139–142.

3. Білушенко А. А. Аналіз фіторізноманіття за станом рослинності ландшафтного заказника Петропавлівський лиман та його околиць. *Біологічні системи: теорія та інновації*. 2023. № 3-4, т. 14. С. 7–24.

4. Дем'янов В. В Гідрологічна характеристика басейну р. Самара. *Питання степового лісознавства та степової рекультивації земель*. 2012. Вип. 14. С. 67–79.

5. Gritsan, Y. I., Sytnyk, S. A., Lovynska, V. M., & Tkalich, I. I. Climatogenicreaction of Robinia pseudoacacia and Pinus sylvestris within Northern Steppe of Ukraine. *Biosystems Diversity*. 2019. Vol. 27, № 1. P. 16–20.

6. Manuk Vlad. V. & ManukVol. V. Protected coners of the Dnipropetrovsk region: sanctuaries. Dnipropetrovsk: LLC Royal Print, 2011. 120 p.
7. Рощина Н. О. Флороценотичне різноманіття озер Присамар'я у порівнянні зі штучними водоймами. *Питання степового лісознавства та степової рекультивації земель.* 2016. Вип. 45. С. 53–59.
8. Тарасов В. В. Флора Дніпропетровської та Запорізької областей: навч. посіб. Вид. 2-е, переробл. і допов. Дніпропетровськ: ДНУ та ЛІРА, 2012. 296 с.
9. Волошина Н. О. Порівняльний аналіз флори озер долини Самари в районі Присамарського біосферного стаціонару. *Вісник Харківського національного університету ім. В. Н. Каразіна. Сер. Біологія*. 2014. Вип. 20. С. 235–241.

Дата першого надходження рукопису до видання: 09.09.2025
Дата прийнятого до друку рукопису після рецензування: 23.10.2025
Дата публікації: 05.12.2025