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Taxonomic and typological structure of the flora of Eastern Podilia (Ukraine)

Oleksandr Mudrak[1]*,

Yuliia Ovchynnykova[2],

Halyna Mudrak[3],

Halyna Tarasenko[1]

[1] Communal Higher Educational Institution "Vinnytsia Academy of Continuing Education", Hrushevskogo St. 13, Vinnytsia 21100, Ukraine

[2] Vasyl' Stus Donetsk National University, 600-richcha St. 21, Vinnytsia 21021, Ukraine

[3] Vinnytsia National Agrarian University, 3 Sonyachna St., Vinnytsia 21008, Ukraine

On the basis of herbarium data, literary and cartographic sources, own field research with subsequent critical-system processing of the collected material, an inscription of the flora of Eastern Podilia was compiled, which includes 1210 species belonging to 526 genera and to 123 families. The taxonomic structure of the flora of the investigated area includes five divisions, where the Magnoliophyta division with 1183 species is dominant (97.2%). The authors have also established the biomorphological structure of phytogenic manures of the region, 88.6% of which belong to herbaceous plants. The majority of species belong to polycarpic 736 (60.8%), monocarpic (17.4%), and young (10.4%) species. It should be noted that when assessing phytobiota by the Raunkiaer eco-biomorphic index, it was found that hemicryptophytes (47.9%) and tetophytes (22.2%) prevailed in the studied flora. Cryptophytes, which are divided into geophytes, gelophytes, and hydrophytes, constituted 17.6%, and phanerophytes and hamefites 12.3%. As a result of studies on the ecological and coenotic structure of the flora of the region, there are 16 categories of ecological structure. The dominant group is the meadow-steppe – 191 species (15.8%), rayon – 185 species (15.3%), and non-forest species – 183 species (15.1%) of vegetation.

Keywords: species, phytodiversity, ecological and coenotic analysis, factors

INTRODUCTION

Plant diversity plays an important role in the health of ecosystems and well-being of society in general and individuals in particular (Gerstner et al., 2014). Plants are a key element in the research and conservation of biodiversity on the Earth (Bermudez, Cantos, 2012; Bhojwani, Dantu, 2013). The study into and investigation of biodiversity include the definition of the composition of its species (Mariničová, Eliáš, 2016; Genung et al., 2017) that is impossible without a clear view of natural (Zuo et al., 2012; Mutke et al., 2014; Salas-Morales et al., 2015; Kuzemko et al., 2016) and anthropogenic (Kadeba et al., 2015; Řepka et al., 2015; Maltseva et al., 2017) factors in the formation of the variety of the territory. For Eastern Podilia (Ukraine), phytodiversity of species is a subject to be studied and researched.

Phytodiversity is a component of biodiversity, proportional to the number of typological elements (taxa, syntaxa, etc.) of a particular biosystem and to the degree of their variability (Honcharenko, 2003). It is known that the environmental

* Corresponding author. Email: ov_mudrak@gmail.com

value of a natural area is directly proportional to the variety of phytobiota with a significant number of rare objects and inversely proportional to significant anthropogenic influence (Andrienko, 1981; Chandra, Kewat, 2017). Floristic diversity is determined by the number of taxa within a certain area (Honcharenko, 2003). The level of species phytodiversity is taken as the basis for the study of other manifestations of diversity (Mudrak et al., 2015).

It is also important and necessary to assess the state of phytodiversity according to the typological structure. Indeed, the significant ecological and geographical heterogeneity of places of growth in the process of evolution plays a significant role in the development of modern biological diversity of living organisms, including autotrophic, which are the primary and most active link of all ecosystem processes and ensure the functioning, stability, and ecological balance of the biosphere due to the circulation of substances, energy and information. Currently it is relevant to study the peculiarities of vascular plants and the patterns of their distribution in the environment, depending on the geographical and environmental conditions of their existence. The taxonomic-typological assessment of the biota is among the main methods and approaches in the research. The biomorphological, ecological, and ecological-cenotic structures of the biota were examined.

Investigation of flora, its ecological and cenotic analysis, protection and balanced use are one of the high-priority tasks in the research, conservation and reproduction of biodiversity, monitoring of the rates of adventisation of local flora and invasive processes (Litvinskaia, 2012; Kumar, 2014; Khan et al., 2016). (Baranovski et al., 2016; Lykholat et al., 2017), which provides a variety of landscapes and functions as structural elements in the formation of a regional ecological network.

MATERIALS AND METHODS

In order to get a complete view of the state of Eastern Podilia phytodiversity, an analysis of the vegetation of the investigated region was initially carried out, a systematic list was drawn up, and quantitative composition of the plants was determined. After geobotanical research, the general floristic list was drawn up in a classified or alphabetical order. The first method of description of taxa was preferred. For this purpose, the system of A. L. Takhtadzhan (1987) that was adopted in the majority of modern Ukrainian floristic reports was used. According to this system, divisions, classes, families of higher plants, and families and species are put in an alphabetical order using Latin names. After that, a systematic analysis of the flora was carried out, its variety was assessed, and the flora was compared with neighbouring and remote vegetative groups. As the main indicators of the systematic structure, the ratios between different groups of higher plants were examined. These ratios were expressed in numbers that represent the amount of species of each systematic group within the defined flora. The floristic spectrum was drawn up on the basis of various features, the most important of which are the spectra reflecting the composition and sequence of location: families by the number of species; families by the number of genera; genera by the number of species. The comparison and the final analysis of the state of a particular area of Eastern Podilia were conducted on this basis.

The taxonomic-typological structure of the flora of vascular plants of Eastern Podilia is drawn up on the basis of archival and herbarium data, cartographic and literary sources, field studies, followed by the critical-system processing of the collected material. The materials of the National Herbarium of Ukraine (M. G. Kholodny Institute of Botany of the National Academy of Sciences of Ukraine), Herbarium Funds of Mykola Grishko National Botanic Garden of the National Academy of Sciences of Ukraine, the National Museum of Natural History of Ukraine, the National Museum of Natural History of the National Academy of Sciences of Ukraine, local museums of Eastern Podilia, Karmelyukove Podilia National Nature Park, Tsentralne Podilia National

Nature Park, Dnister, Murafa, Serednie Pobuzhia, Nemyrivske Pobuzhia Regional Natural Parks (Volovik, Mudrak, 2007; Mudrak, 2008; Yavorskaia, 2005; Mudrak, 2009; Mudrak et al., 2015; Mudrak et al., 2006; Mudrak, Mudrak, 2013; Patyka et al., 2003; Andrienko et al., 1985; Didukh, 2009; Mosiakin, Phedorchuk, 1999).

RESULTS AND DISCUSSION

The systematic spectra of the flora show diversity at the level of systematic ranks of species complex. That is, if all divisions, families that make up the flora are arranged in the decreasing order of the species diversity, a general generic floristic spectrum will be obtained. The greatest attention was focused on the first part of the spectrum (about 10–15 taxa), which consisted of the richest families or genera (Malyshev, 1972).

The spectra reflect the main peculiarities of the systematic composition and therefore, they are used to characterize the flora. Moreover, in contrast to absolute indices of flora, relative ones of a systematic structure are stabilized values, which makes it possible to compare the latter in diverse flora (Tolmachev, 1970).

During the period of field expeditions, we carried out 103 field descriptions (100 × 100) (Fig. 1). As a result of studies in Eastern Podilia, where various types of anthropogenically-disturbed areas and natural phytocenoses were studied, 1210 types of vascular plants were identified, which belong to 526 genera and 123 families.

During the research of the systematic structure of the flora in the investigated area it was found that species belong to five groups (Table 1).

The groups of *Lycopodiophyta, Equisetophyta, Polypodiophyta* and *Pinophyta* play a minor role in the formation of the species diversity of the flora of the investigated region and make up 2.2% of the species, which are distributed in Eastern Podilia.

The systematic structure of the flora is dominated by the *Magnoliophyta* division, which includes 1183 species (97.2%). The species related

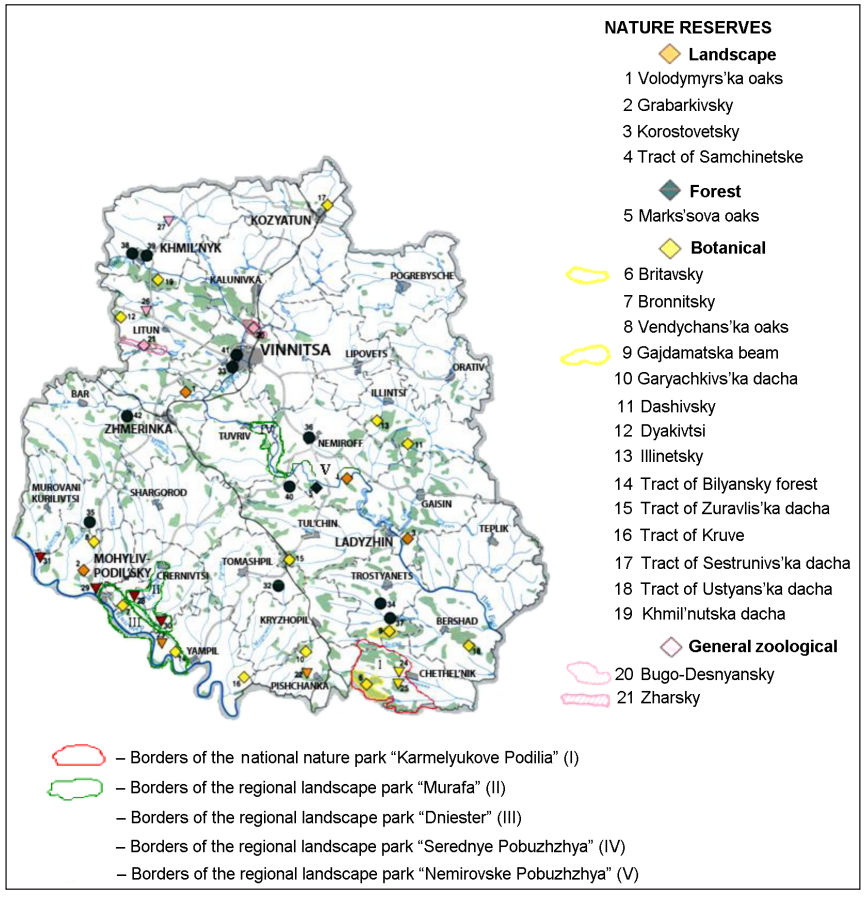

Fig. 1. Map-scheme of field studies of the flora of Eastern Podilia

Table 1. **Systematic structure of the flora of vascular plants of Eastern Podilia**

Division	Families	Genera	Species	% of the total amount		
				families	genera	species
Lycopodiophyta (Lycophyta)	1	1	1	0.8	0.2	0.1
Equisetophyta (Sphenopsida)	1	1	9	0.8	0.2	0.7
Polypodiophyta (Fern)	9	11	15	7.3	2.1	1.2
Pinophyta (Gymnosperms)	1	1	2	0.8	0.2	0.2
Magnoliophyta (Angiosperms)	111	512	1183	90.2	97.3	97.8
Total	123	526	1210			

to *Magnoliophyta* belong to two classes of *Magnoliophyda* (78.8%) and *Liliopsida* (18.9%).

The taxonomic spectrum (of families and species) of phytobiota gives an idea of the composition and ratio of leading families and their ranks depending on the number of species included in these families. The family spectrum of leading families of phytobiota consists of 26 families, 15 of them reflect the main properties of the flora (Table 2).

Five families of Asteraceae with 146 species (12.1%), Poaceae – 78 (6.4%), Rosaceae – 73 species (6.0%), Fabaceae – 69 (5.7%), and Lamiaceae – 68 (5.6%) are dominant. Fifteen families in the generic spectrum also include such families as *Brassicaceae*, *Scrophulariaceae*, *Apiaceae*, *Cyperaceae*, *Caryophyllaceae*, *Ranunculaceae*, *Chenopodiaceae*, *Boraginaceae*, *Liliaceae*, *Euphorbiaceae*, and the amount of species in these families varies from 19 to 59 species (Table 2).

The dominant families make up about 67.4% of the investigated flora. Almost 11.4% of the species belong to families whose generic

Table 2. **Spectrum of dominant families of phytobiota of Eastern Podilia**

Family	Rank	The number of genera in the family	The amount of species	% of the total amount		Ratio species/ genera
				genera	species	
Asteraceae	I	56	146	10.6	12.1	2.6
Poaceae	II	36	78	6.8	6.4	2.2
Rosaceae	III	23	73	4.4	6.0	3.2
Fabaceae	IV	21	69	4.0	5.7	3.3
Lamiaceae	V	28	68	5.3	5.6	2.4
Brassicaceae	VI	34	59	6.5	4.9	1.7
Scrophylariaceae	VII	16	51	3.0	4.2	3.2
Apiaceae	VIII	33	50	6.3	4.1	1.5
Cyperaceae	IX	8	47	1.5	3.9	5.9
Caryophyllaceae	X	26	45	4.9	3.7	1.7
Ranunculaceae	XI	19	41	3.6	3.4	2.2
Chenopodiaceae	XII	4	25	0.8	2.1	6.3
Boraginaceae	XIII	14	24	2.7	2.0	1.7
Liliaceae	XIV	10	20	1.9	1.7	2.0
Euphorbiaceae	XV	2	19	0.4	1.6	9.5
Total		330	815	62.7	67.4	2.5

diversity is represented by 9–16 species. Among them are *Rubiaceae*, *Polygonaceae*, *Orchidaceae*, *Violaceae*, *Campanulaceae*, *Geraniaceae*, *Salicaceae*, *Primulaceae*, *Potamogetonaceae*, *Juncaceae*, *Equisetaceae.*

The average number of species in the genera of dominant families varies from 1.5 in Euphorbiaceae to 9.5 in Apiaceae (Table 2).

Another 33 families are monospecies, in general, they constitute 2.7% of the total phytobiota. Comparing the family spectrum of our research, it turned out that the dominant families of the region are almost the same, but put in a different order. It proves that the investigated area is approaching the vegetation of the forest-steppe in terms of the family spectrum of species. It is not obligatory that higher taxa with a large number of species play a more important role in the formation of vegetation than taxa of the same rank, which include a smaller number of species. It is also true that taxa, which include a relatively small number of species, can play an equally important role in the formation of vegetation as taxa of the same rank, which include more species. It is especially typical for man-made ecotops regarding ruderal and segetal species, concentrated in separate families (*Amaranthaceae*, etc.). An example of such "ruderal-segetal families" can be the family *Chenopodiaceae* (the 12th place in the family spectrum, 25 species (2.1%)), which includes mainly synanthropic plants and plays an important role in the formation of the flora of the investigated areas. These species are mainly spread on the grassland and edges of fields. A remarkably high role of the family *Cyperiaceae* (the ninth in the spectrum of leading families, 47 species) is, on the one hand, due to the expansion of the species of this family on meadows, steppes, pastures and banks of ponds and rivers of the studied areas and, on the other hand, it can be explained by sufficient preservation of the paludophyton in the flora of agricultural areas of the region. Thirty genera are dominant in the generic spectrum of flora and make up 28.4% of the total number of species. Other 71.6% of genera are represented by 1–6 species. The results of Table 3 indicate that the leading families include the leading genera, where the number of species ranges from 7 to 36 (Table 3).

The genera *Carex* L. (36 species, 3%), *Euphorbia* L. (18 species, 1.5%), *Rosa* L. and *Veronica* L. (17 species, 1.4%) *Potentilla* L. and *Viola* L. (14 species, 1.2%), *Chenopodium* L. and *Trifolium* L. (13 species, 1.1%), *Ranunculus* L. (12 species, 1%), *Campanula* L., *Centaurea* L., *Galium* L., *Geranium* L., *Potamogeton* L. (11 species, 0.9%) and others are dominant. Dominant genera combine 344 species (28.4%).

The statement that in modern floristics the preference is given to 10–12 leading families, which reflect the main part of the floristic spectrum, is fair and proven. The presence of such leading families is typical of the Holarctic flora and, accordingly, of the specific flora of Eastern Podilia.

A small number of families plays a leading role in species diversity, but the number of families with a small number of species predominates quantitatively.

Typological structure of the flora of Eastern Podilia. The typological assessment of the biota is one of the most used methods and approaches in the investigation of the region. Biomorphological (according to indices of life forms in terms of habitat and biomorph of Raunkiaer (1934) ecological-cenotic, ecological (concerning water and light regime) structures, genesis and sozological confinement of the species are investigated. That is why it is necessary and compulsory to be aware of the typological structure of the phytodiversity of the investigated area.

Biomorphological structure of higher vascular plants of the region. Life forms inherited during the evolution are formed historically to ensure the adaptation of living organisms to the environmental conditions. The biomorphological structure of the flora includes the life form in terms of habitat and the eco-biomorph of Raunkiaer (1934).

To determine the characteristic features of the flora it is necessary to identify the types of life forms of the species that form it. The biomorphological analysis is based on the linear system

Table 3. **Spectrum of the leading genera of the flora of explored phytocenoses of Eastern Podilia**

Family	Genus	Rank	Number of species	% of the total number
Cyperaceae	*Carex* L.	1	36	3.0
Euphorbiaceae	*Euphorbia* L.	2	18	1.5
Rosaceae	*Rosa* L.	3–4	17	1.4
Scrophylariaceae	*Veronica* L.	3–4	17	1.4
Rosaceae	*Potentilla* L.	5–6	14	1.2
Violaceae	*Viola* L.	5–6	14	1.2
Chenopodiaceae	*Chenopodium* L.	7–8	13	1.1
Fabaceae	*Trifolium* L.	7–8	13	1.1
Ranunculaceae	*Ranunculus* L.	9	12	1.0
Campanulaceae	*Campanula* L.	10–14	11	0.9
Asteraceae	*Centaurea* L.	10–14	11	0.9
Rubiaceae	*Galium* L.	10–14	11	0.9
Geraniaceae	*Geranium* L.	10–14	11	0.9
Potamogetonaceae	*Potamogeton* L.	10–14	11	0.9
Juncaceae	*Juncus* L.	15–16	10	0.8
Fabaceae	*Vicia* L.	15–16	10	0.8
Asteraceae	*Cirsium* L.	17–23	9	0.7
Caryophyllaceae	*Dianthus* L.	17–23	9	0.7
Equisetaceae	*Equisetum* L.	17–23	9	0.7
Fabaceae	*Astragalus* L.	17–23	9	0.7
Fabaceae	*Lathyrus* L.	17–23	9	0.7
Poaceae	*Festuca* L.	17–23	9	0.7
Lamiaceae	*Salvia* L.	17–23	9	0.7
Asteraceae	*Artemisia* L.	24–26	8	0.7
Poaceae	*Poa* L.	24–26	8	0.7
Polygonaceae	*Rumex* L.	24–26	8	0.7
Alliaceae	*Allium* L.	27–30	7	0.6
Liliaceae	*Gagea* L.	27–30	7	0.6
Asteraceae	*Hieracium* L.	27–30	7	0.6
Asteraceae	*Inula* L.	27–30	7	0.6

of life forms, which makes it possible to compare eco-biomorphs in terms of any parameters.

About 88.6% belongs to herbaceous plants in the biomorphological spectrum of the phytodiversity of the studied areas of the region. Most species belong to Polycarpics – 736 (60.8%). Monocarpics and few-year plants make up 17.4% and 10.4%, respectively (Table 4).

The bush phytobiota of the investigated areas of the region is represented by 62 species, but the genera *Euonymus* L., *Chamaecytisus* L., *Crataegus* L., *Rosa* L., *Salix* L. are the most common.

Table 4. **Biomorphological spectrum of vascular plants of Eastern Podilia**

Life forms	Number of species	% of the total number
Tree	48	4.0
Bush	62	5.1
Shrub	28	2.3
Few-year plants	126	10.4
Policarpics	736	60.8
Monocarpics	210	17.4

About 4% of the species belong to trees. They form the basis of forests, forest edges, and garden and park areas. The most common are *Acer negundo* L., *Acer campestre* L., *Betula pendula* Roth., *Acer tataricum* L., *Gleditsia triacanthos* L., *Carpinus betulus* L., *Robinia pseudoacacia* L., *Fagus sylvatica* L., *Quercus robur* L., *Quercus rubra* L., *Aesculus hippocastanum* L., *Fraxinus excelsior* L., *Armeniaca vulgaris* Lam., *Cerasus avium* L. Moench, *Malus domestica* Borkh., *Sorbus aucuparia* L., *Populus alba* L., *Salix fragilis* L., *Staphylea pinnata* L., *Tilia cordata* Mill., *Ulmus glabra* Huds, etc.

The shrubs in the flora of Eastern Podilia make up about 2.3%, the main representatives are *Artemisia abrotanum* L., *Hedera helix* L., *Thymus marschallianus* Willd., *Rubus caesius* L., *Daphne mezereum* L., *Caragana frutex* L., K. Koch. *Vaccinium myrtillus* L. and others.

After the evaluation of phytobiota in terms of eco-biomorph of Raunkiaer (1934), we found that hemicryptophytes and terophytes dominated the investigated area and made up 47.9 and 22.2%, respectively. Cryptophytes, which are divided into geophytes, gelophytes and hydrophytes constitute 17.6% in the investigated flora. Phanerophytes and hamephytes make up 12.3% (Table 5).

Thus, polycarpics (60.8%) dominate in the ecotones regarding their biomorphological structure, 520 species (43%) of them belong to hemicryptophytes and geophytes (12%). The biomorphological structure makes it possible to estimate the value of species and their place in the agro-landscape and define the diversity of a particular area where they grow.

Ecological cenotic analysis of the state of higher vascular plants in the region. The ecological structure reflects the distribution of species of flora in different ecological groups depending on the environment and the norms of reaction to the environmental conditions. An ecological analysis allows us to determine the dependence of the structure of the flora on the factors of the environment. Water and soil, i.e., the level of provision of plants with moisture and nutrients, are considered to play the most important role in determining the patterns of formation of flora.

Table 5. **Ecobiomorph of the phytobiota of Eastern Podilia according to K. Raunkiaer (1934)**

Ecobiomorph	Amount	% of the total amount
Phanerophyte	45	3.7
Hamephyte	104	8.6
Hemicryptophyte	579	47.9
Geophyte	151	12.5
Gelophyte	26	2.1
Hydrophyte	36	3.0
Terophyte	269	22.2

We analyzed the vegetation state of Eastern Podilia regarding water (Table 6) and light (Table 7) regimes.

Considering the ecological structure of phytobiota of the studied region, it should be noted that 35.7% and 25.9% of the species belong to xeromesophytes and mesoxerophytes, respectively, 432 and 313 species. The predominance of these groups characterizes the studied area, which is typical for the area of the Right Bank forest steppe. As the studied areas belong to different types of ecosystems, the xerophyte and mesoxerophyte group of plants is spread in the steppe areas whereas mesophyte and mesoxerophyte are found in the forest, meadow and coastal regions. The predominance of a particular ecological group of plants may vary between mesophyte and xerophyte phytobiota within the Right Bank forest steppe, where the forest, steppe and agrocenosis are located next to each other, following one after another.

The most spread mesophytes are *Adonis vernalis* L., *Agrimonia eupatoria* L., *Anemone sylvestris* L., *Anthriscus sylvestris* (L.) Hoffm., *Chelidonium majus* L., *Geum urbanum* L., *Rosa canina* L., *Rubus idaeus* L., *Urtica dioica* L., *Viola odorata* L., they are common not only in the forest, but also in phytocenoses and other ecotopes.

Representatives of xerophytes are mainly spread in the steppe. Typical representatives of xerophytes are *Agropiron pectinatum* (Bieb) Beauv., *Astragalus austriacus* Jacq., *Astragalus dasyanthus* Pall., *Centaurea pseudocoriacea* Dobrocz., *Digitaria ischaemum* (Schreb.) Muehl., *Euphorbia pseudoglareosa* Klokov, *Leopoldia tenuiflora* (Tausch) Heldr., *Marrubium peregrinum* L., *Muscari neglectum* Guss., *Nonea pulla* DC., *Nonea rossica* Steven, *Stipa capillata* L., *Stipa lessingiana* Trin. & Rupr., *Teucrium polium* L., *Tribulus terrestris* L., *Trinia multicaulis* Schischk., *Veronica sublobata* M. A. Fisch., *Viola ambigua* Waldst. & Kit, etc.

Hygrophytes and hydrophytes are spreading wider in the landscapes of the region. Their parts in the structure of the flora are 3.5% and 11%, recpectevly. The most common representatives of these groups are species of the genera *Equisetum* L., *Carex* L., *Eleocharis* L., *Lemna* L., *Glyceria* L., *Juncus* L., *Iris* L., *Potamogeton* L., *Sparganium* L., *Gnaphalium* L., *Mentha* L., *Scutellaria* L., *Lytrum* L., etc.

One of the main sources of energy for all living organisms is the energy of the sun. Only one group of organisms, i.e., green plants and photosynthesizing organisms, can make a direct use of solar energy. All other organisms, in essence, absorb solar energy, that is converted by green plants into the energy of chemical bonds. The light is very important for vegetation: both for the development of living forms and plant communities, and for the local distribution of plants. The changes in light intensity and its duration have a significant effect on plants. In the case of insufficient lighting, plants don't grow well, they weaken and die.

Investigating the structure of the flora of the region regarding the light regime, we have found that the main part of the species belongs to the skiophytes, i.d. shade-loving species and helioskiophytes – species of plants that grow

Table 6. **Ecological structure of vascular plants of Eastern Podilia regarding water regime**

Ecological group	Amount	% of the total amount
Hygrophyte	133	11.0
Hydrophyte	42	3.5
Xeromesophyte	432	35.7
Xerophyte	69	5.7
Mesophyte	221	18.3
Mesoxerophyte	313	25.9

Table 7. **Ecological structure of vascular plants of Eastern Podilia regarding light regime**

Ecological group	Amount of species	% of the total amount
Heliophytes	386	31.9
Helioskiophytes	390	32.2
Skioheliophytes	44	3.6
Skiophytes	390	32.2

better in shaded places, but can also grow in areas with sufficient light (Table 7). The number of species of investigated flora belonging to this group constitutes 390 species, or 32.2% of the total amount. Heliophytes, sun-loving species, make up about 32% in the studied flora. These are mainly species of meadow and steppe ecosystems.

The ecological structure of the flora of Eastern Podilia regarding the water regime belongs to the vegetation of the Right Bank forest steppe where the groups of xeromesophyte and mesoxerophyte phytobiota prevail, and regarding the light regime it is represented by skiophytes, helioskiophytes and heliophytes. The investigated area is characterized as a transitional zone from the mesophytic group of vegetation to xerophytes.

The ecological-cenotic structure of vegetation reflects the quantitative correlation of phytobiotic species belonging to certain phytocenotypes. We distinguished the following categories within phytocenoses: psammophytes, halophytes, meadow, meadow-steppe, meadow-bog, forest edge, forest coreal, forest nemorose, forest-marsh, marsh, water, coastal-water, ruderal, segetal, species with a wide ecological amplitude, petrophytes, limestone, cretaceous, etc., cultivated (Table 8).

As a result of studies of the ecological cenotic structure of the flora of the region, the dominant vegetation is meadow-steppe with 191 species (15.8%), meadow with 185 species (15.3%) and forest nemorose with 183 species (15.1%). The predominance of forest nemorose and meadow-steppe vegetation has appeared to be typical for this area.

The diversity and fragmentation of the studied area are presented by petrophytes, limestone, halophytes and psammophytes. The most common psammophytes are *Linaria genistifolia* (L.) Mill., *Myosotis micrantha* Pall. ex Lehm., *Vulpia myuros* (L.) C. C. Gmel., petrophytes are *Alyssum calycinum* L., *Asparagus verticillatus* L., *Nonea pulla* DC., *Silene longiflora* L., halophytes are *Althaea officinalis* L., *Juncus gerardii* Loisel., *Ononis intermedia* C. A. Mey. ex Rouy, *Trifolium fragiferum* L.

The most widespread species in the studied phytocenoses are the representatives of forest

Table 8. **Ecological and cenotic structure of phytobiota of Eastern Podilia**

Ecological and cenotic structure	Amount	% of the total amount
Psammophytes	26	2.1
Halophytes	12	1.0
Meadow	185	15.3
Meadow-steppe	191	15.8
Meadow-bog	126	10.4
Forest edge	74	6.1
Forest coreal	41	3.4
Forest nemorose	183	15.1
Forest marsh	35	2.9
Marsh	37	3.1
Water	45	3.7
Coastal-water	27	2.2
Ruderal, segetal	164	13.6
Species with a wide ecological amplitude	23	1.9
Petrophytes, limestone, cretaceous, etc.	22	1.8
Cultivated	19	1.6
Total	1210	100

and meadow-steppe vegetation, e.g. *Adonis vernalis* L., *Althaea officinalis* L., *Allium ursinum* L., *Anemone sylvestris* L., *Anemone ranunculoides* L., *Carex ericetorum* Pollich, *Carex leporine* L., *Carex praecox* Schreb., *Convallaria majalis* L., *Corydalis cava* (L.) Schweigg. et Koerte, *Lotus arvensis* Pers.

About 13.6% of the investigated flora belongs to the ruderal and segetal group. Thus, *Anagallis arvensis* L., *Cannabis ruderalis* Janisch., *Capsella bursa-pastoris* (L.) Medik., *Carduus acanthoides* L., *Cirsium setosum* (Willd.) Besser, *Consolida regalis* S. F. Gray, *Elytrigia repens* (L.) Nevski, *Galium aparine* L., *Senecio vernalis* Waldst. & Kit., *Setaria glauca* (L.) Beauv., *Sinapis arvensis* L., *Sonchus arvensis* L., *Thlaspi arvense* L., *Veronica persica* Poir., *Viola arvensis* Murray etc. have been found in all types of investigated anthropogenic landscapes.

The cultivated flora is represented by 19 species (1.6%) in the agrolandscapes of Eastern Podilia. These are mainly crops grown in this area – *Amorpha fruticosa* L., *Caragana arborescens* Lam., *Populus italica* (Du Roi) Moench, *Spiraeaalba* Du Roi, etc. – types of cultivated trees and bushes that can be often seen in the gardens and parks of the region. In the investigated areas, they were found in anthropogenically-modified tracts.

Thus, ecological and cenotic analysis of flora sufficiently reflects the peculiarities of the vegetation of the investigated region. The predominance of the species of meadow-steppe, forest nemorose, meadow and meadow-bog ecological and cenotic groups proves the relative conservation of ecosystems. A significant number of the species of meadow, meadow-bog, water, and coastal-water groups make up almost half of the total amount, which proves the hydrophylic nature of the flora in general. Therefore, the flora is typical for Holarctic areas with moderate climate regarding its ecological cenotic structure.

CONCLUSIONS

The general characteristic of the floristic diversity of Eastern Podilia is particularly important for its evaluation in areas with a high level of anthropogenic fragmentation of vegetation, as it represents the flora of the cenoses from different parts of the area. The peculiarities of floristic, biomorphological and ecological-cenotic structures are used for floristic zoning of the area, distinguishing the main directions of anthropogenic transformation of phytobiota and the development of effective ways to preserve phytodiversity in the structure of the regional ecological network.

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Oleksandr Mudrak, Yuliia Ovchynnykova, Halyna Mudrak, Halyna Tarasenko

RYTŲ PODOLĖS (UKRAINA) TAKSONOMINĖ IR TIPOLOGINĖ FLOROS STRUKTŪRA

Santrauka

Remiantis herbariumo duomenimis, literatūriniais ir kartografiniais šaltiniais, buvo atliktas Rytų Podolės nuosavo lauko floros tyrimas ir įvertinta surinkta medžiaga. Florą sudarė 1 210 rūšių, priklausančių 526 gentims ir 123 šeimoms. Tiriamosios zonos floros struktūroje išskirtuose 5 skyriuose vyrauja magnolijūnai (Magnoliophyta) – 1183 rūšys (97,2 %). Didesnę regiono fitogenetinių trąšų biomorfologinės struktūros dalį (88,6 %) sudaro žoliniai augalai: polikarpiniai (60,8 %), monokarpiniai (17,4 %) ir jaunos rūšys (10,4 %). Vertinant fitobiotą pagal Raunkier ekobiomorfo rodyklės indeksą, nustatyta, kad tiriamojoje floroje vyravo hemikriptofitai (47,9 %) ir terofitai (22,2 %). Kriptofitai (dar skirstomi į geofitus, gelofitus ir hidrofitus) sudarė 17,6 %, fanerofitai ir chamefitai – 12,3 %. Tyrimo duomenimis, regiono floros ekologinėje ir keonotinėje struktūroje vyrauja pievos ir stepių (191, arba 15,8 %), miško (185, arba 15,3 %) ir ne miško (183, arba 15,1 %) rūšių augmenija.

Raktažodžiai: rūšys, fitodiversiškumas, ekologinė ir keonotinė analizė, veiksniai