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SPECIES COMPOSITION OF HYDROPHILIC FLORA OF THE
FRESHWATER ECOSYSTEM

ВИДОВИЙ СКЛАД ГІДРОФІЛЬНОЇ ФЛОРИ ПРІСНОВОДНОЇ ЕКОСИСТЕМИ

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Abstract. For the first time geobotanical researches of aquatic and coastal-aquatic vegetation on separate sections of the Styr river were carried out. According to the results of research, 125 species of higher vascular plants from 75 genera and 38 families have been described in the selected taxa. In the species composition of the most common 7 families are: Poaceae (11 genera), Potamogetonaceae (10 genera), Asteraceae (9 genera), Cyperaceae (8 genera), Polygonaceae (8 genera), Ranunculaceae (6 genera), Salicaceae (6 genera). These species of these families are 46,4%. The following genera are dominant: Potamogeton (9 genera), Salix (6 genera), Juncus, Rumex i Carex (5 species each), 8 genera – adventitious plants, the rest represent the aboriginal flora of Rivnenska oblast. Geobotanical studies have identified 14 plant communities. Coastal-aquatic vegetation is mainly formed from Glycerietum maximae, Lemnetum minoris, Lemno minoris-Spirodeletum polyrrhiza, Potametum perfoliati, P. pectinati ma Sparganietum erecti. The species composition of the lower reaches of the river is especially rich (71,2% of species). The state of populations of 6 rare species is characterized by coenopopulation studies. For the first time in Rivnenska oblast, a highly vulnerable species of Batrachium rionii was found, which is included in the Red List of aquatic macrophytes of Ukraine. Comparative analysis of different sections of the river makes it possible to assess the hydrophilic flora, to develop optimal ways to protect rare and typical plants and their groups.

Key words: section of the river, floristic wealth, coastal-aquatic vegetation.

Introduction. Increasing of anthropogenic pressure on aquatic ecosystems causes a noticeable transformation of the phytocomponent, which depends on the quality of their aquatic environment. An important part of freshwater biocenosis is aquatic and coastal-aquatic vegetation. According to the EU Water Framework Directive, the study of autotrophic aquatic organisms is envisaged to assess the ecological status of hydroecosystems (EU Directive, 2006).

Traditionally, considerable attention of scientists was focused on the floristic research of hydroecosystem (Zub, 2000; Chorna, 2001; Sadchikov & Kudrjashov, 2004; Tolochyk & Volodymyrets, 2018), peculiarities of distribution of macrophytes (Dubyna et. al., 1993; Chambers, 2008). Much of the work concerned research on the nature of overgrowing of reservoirs and streams, the composition and structure of vegetation, its dynamics and production processes (Papchenkov, 2003; Egertson et. al., 2004; Pyrina & Lyashenko, 2005; Costanza et. al., 2007; Chao et. al., 2014; Pasichnaja et. al., 2015; Prokopchuk & Hrubinko, 2016). In recent years, comprehensive studies of the hydroflora, the study of anthropogenic changes in aquatic ecosystems, the protection of reservoirs, coastal areas, their rare species and



cenoses have been intensified. Currently, the relevance of research is due to the need to study the level of exploitation, protection and reproduction of aquatic ecosystems (Brannen & Bielak, 2004; Gilvear et. al., 2013; Trebilco et. al., 2013; Deng et. al., 2015; Kopylov et. al., 2018). The natural vegetation acts as an objective source of information about the processes that take place in rivers (Dubyna, 1996, 2006; Papchenkov, 2001; Pyrina & Lyashenko, 2005; Clayton & Edwards, 2006). Particularly relevant today is the problem of studying the flora of freshwater ecosystems, which plays a major role in the ecological balance and self-purification of water bodies. Works of both foreign and domestic botanists, hydrobiologists and ecologists are devoted to the study of hydrophilic flora (Chorna, 2001; Gryb et. al., 2003; Fedorchyk, 2005; Baranovsky et. al., 2006; Cronin et. al., 2006; Chambers et. al., 2008; Mäemets et. al., 2010; Belyakov et. al., 2017).

In the study of higher aquatic vegetation of Ukraine there are five stages: floristic, ecological-typological, ecological-coenotic, complex research, zoological and several scientific areas, including floristic (Dubyna, 2006). Many years of research are presented in the collective monograph of Ukrainian, Czech and Slovak scientists (Dubyna et. al., 1993). Subsequent lists of macrophyte species were given in the works (Zyb, 2000; Chorna, 2001; Fedorchyk, 2003; Musienko & Ol'hovych, 2004; Dubyna, 2006). Fragmentary information on the species composition of the hydrophilic flora of Rivne region was published by Volodymyrets V.O. and Grohovska Yu. R. (Grohovs'ka & Volodymyrets, 2015). The study of the species composition and ecological characteristics of higher aquatic plants guarantees an adequate assessment of river water quality and is important for assessing the general condition of aquatic ecosystems. Therefore, the study of the species composition of the hydrophilic flora of the Styr River is relevant, as these data can be used in phytomonitoring studies.

The aim of our study was to study the species composition of the hydrophilic flora of the middle and lower reaches of the Styr River.

Material and methods. The object of the study are separate sections of the Styr River within the Rivne region. Analysis and evaluation of the hydrophilic flora of the Styr River were carried out in the following areas: floristic, geobotanical and coenopopulation. The classification of *Magnoliophyta* is given by the system APG IV (APG, 2016), a group of adventitious plants by J. Kornaš (Kornaš, 1968), the names of species are presented using the database The Plant List (The Plant List, 2013). The field and analytical research methods were used in the research process.

Results and discussion. The middle course of the studied river is formed by Cretaceous rocks, the surface is very denuded and wavy, covered with forest thickness, in some places on its high sections limestone outcrops can be observed. The lower course is a plain with large swamps, where a significant forest cover is formed on sandy soils, there is a deep occurrence of Cretaceous marls in its western part and shallow - in the east, which significantly affects the landscape and conditions of formation of the Styr hydroecosystem (Gerenchuk, 1975).

The individual parts of the basin differ in the characteristics of water-bearing rocks, feeding conditions, interconnection and discharge of groundwater of the entire thickness of sediments. There is a hydraulic connection between the groundwater of



these aquifers. Almost all aquifers in the basin are used for water supply (Nacional'nyj atlas Ukrajinjy, 2007).

According to the results of field research in the surveyed areas of the Styr River within the Rivne region, 125 species of higher vascular plants from 75 genera and 38 families were identified. In this list, 6,4% of the total identified species composition (8 species) are adventitious plants, namely: *Acorus calamus*, *Bidens frondosa*, *Echinocystis lobata*, *Elodea canadensis*, *Juncus tenuis*, *Salix fragilis*, *Xanthium albinum*, *Zizania latifolia*, the rest represent flora of Rivne region.

In the species composition of the hydrophilic flora, the most common are 7 families, namely: *Poaceae* (11 species), *Potamogetonaceae* (10 species), *Asteraceae* (9 species), *Cyperaceae* (8 species), *Polygonaceae* (8 species), *Ranunculaceae* (6 species), *Salicaceae* (6 species), is show in Figure 1.

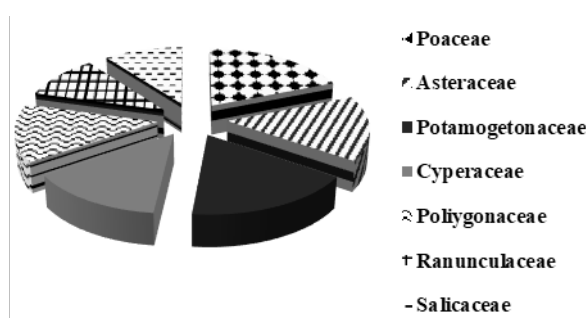


Figure 1. Dominant families of hydrophilic flora, %

These species of these families account for 46,4% of the total number of species, and the most common genera are: *Potamogeton* (9 species), *Salix* (6 species), *Juncus*, *Rumex* and *Carex* (5 species each).

For the first time we conducted geobotanical studies of aquatic and coastal-aquatic vegetation of the middle and lower reaches of the Styr River. As part of the selected taxa identified 125 species within 14 plant groups (Table 1).

Table 1. Plant groups of individual sections of the Styr River

Name of plant groups	Minimum and maximum values		
	Number of species, pcs.	Projective coverage, %	Area (sq.m)
<i>Butomo- Alismatetum plantaginis-aquaticae</i>	8-9	45-50	20-55
<i>Butomo- Sagittarietum sagittifoliae</i>	7-10	45-80	20-60
<i>Ceratophylletum demersi</i>	7-9	40-75	70-120
<i>Elodeetum canadensis</i>	9-12	30-60	35-90
<i>Glycerietum maximae</i>	8-10	50-100	70-180
<i>Glycerietum fluitantis</i>	8-10	55-95	30-45
<i>Hydrocharitetum morsus-ranae</i>	9-12	60-80	70-170
<i>Hydrocharito-Stratiotetum aloides</i>	11	45-55	70-130
<i>Lemnetum minoris</i>	11-15	70-85	120-220
<i>Lemnetum trisulcae</i>	11-14	50-70	140-180
<i>Potameto natantis- Nymphaetum candidae</i>	7-9	70	140
<i>Potametum pectinati</i>	7-10	40-80	30-120
<i>Ricciocarpetum natantis</i>	11	60	25
<i>Spirodeletum polyrrhizae</i>	10-13	60-85	150-200



It is known that the ecological capacity of the aquatic environment of the Styr River is provided by well-developed meadow-swamp floodplains in its old rivers, as well as phytomass of higher aquatic vegetation. Typical natural plant groups of river floodplains are floodplain meadows, located mainly in their riverbeds and central parts, as well as swampy floodplain meadows located in their terraced and intergovernmental depressions (Korotun & Korotun, 1996). These groups have a characteristic species composition of higher aquatic and coastal-aquatic vegetation.

It is established that on a site of the river near the village of Verben of Demydiv district, submerged aquatic plants are mainly represented by *Potamogeton crispus*, *P. compressus*, *P. perfoliatus*, *Stuckenia pectinata* (group *Potametum perfoliati*, *P. pectinati*) with a projective cover of 35-50%, closer to the shore there is *Batrachium circinatum* (group *Batrachietum circinati*) – projective coverage up to 50%. Among free-floating unrooted plants, significant areas are occupied by *Lemna minor*, *Spirodela polyrrhiza*, *Staurogeton trisulcus* (group *Lemnetum minoris*, *Lemno minoris-Spirodeletum polyrrhizae*) with a projective cover of up to 70%, smaller areas are represented by the *Lemno-Hydrocharitetum morsus-ranae* group.

Coastal and aquatic vegetation is represented by a significant species composition. The largest area is occupied by *Glyceria maxima* (group *Glycerietum maximae*) with a projective coverage of 85-95%. Local thickets form *Carex rostrata* and *C. vesicaria*, *Phalaroides arundinacea*, *Typha angustifolia*, *Sparganium erectum*, *Mentha aquatica*, the projective cover of which was up to 60-75%. Occasionally there are groups of *Sagittaria sagittifolia*, *Sium latifolium*, *Berula erecta*, *Rorippa amphibia*, *Rumex hydrolapathum*, which do not occupy large areas. Coastal-swamp species are most pronounced *Galium palustre* and *Persicaria hydropiper* with a projective coverage of 35 to 60%.

In the section of the river near the village of Torhovytsia, Mlyniv district, the following species of submerged aquatic plants predominate: *Potamogeton perfoliatus*, *P. lucens*, *P. crispus*, *Stuckenia pectinata* (group *Potametum perfoliati*, *P. lucentis*, *P. crispi*, *P. pectinati*), projective cover is 15-30%, rare sparse thickets of *Ceratophyllum demersum* and *Myriophyllum verticillatum*. Groups of free-floating unrooted plants are most often formed by *Lemna minor* and *Spirodela polyrrhiza* (groups of *Lemnetum minoris*, *Lemno minoris-Spirodeletum polyrrhizae*), *Hydrocharis morsus-ranae* is less common, projective coverage is 50-60%. Among floating rooted plants, *Nuphar lutea* and *Persicaria amphibia* thickets with a projective cover of 2-5% sometimes occur. Coastal-aquatic vegetation is widespread in all sections of the studied river, except for the steep banks. The main role in its formation is played by such species as *Glyceria maxima* (group *Glycerietum maximae*), projective cover is up to 80%, *Phalaroides arundinacea* with projective cover 45-60% and *Carex rostrata*, *C. acutiformis*, whose projective cover is defined in the range from 35 to 50%. Locally occur *Sagittaria sagittifolia*, *Bidens cernua*, *Rumex hydrolapathum*, *Sparganium erectum*, *Berula erecta*, the projective cover of which is 30-65%, in some areas well-defined thickets of *Sparganium emersum* with a projective cover of up to 50-75% and adventitious species *Zizania latifolia*, 35-40%. In coastal-swamp species, thickets of *Agrostis stolonifera*, *Potentilla anserina*, *Rorippa palustris*, *Galium palustre*, and occasionally – *Agrostis gigantea* and



Veronica anagalloides are marked. The left bank of the river is dominated by woody thickets with *Salix cinerea* and *S. triandra*.

The hydrophilic flora in the section of the river near the village of Nove is largely similar to the area within the village of Torhovvtsia. However, of the submerged aquatic plants, *Potamogeton lucens* and *Stuckenia pectinata*, play the largest role, the projective cover of which in some areas reaches more than 50%. Among floating rooted plants, *Nuphar lutea* and *Persicaria amphibia* with a projective cover of up to 10% are more common, while *Hydrocharis morsus-ranae* are practically undefined. A characteristic feature of the described section of the river is the presence in the coastal strip of woody thickets of *Salix cinerea*, *S. fragilis* and *S. triandra*, as well as *Alnus glutinosa*, among which the grass layer is dominated by *Urtica dioica* and *Galium aparine*, often *Calystegia sepium*. Coastal aquatic plants in such areas are represented by *Scutellaria galericulata* and *Phragmites australis*.

On the section of the river near the village of Zabolottia (Polonne) the swamp hydrophilic flora was the poorest, especially aquatic. In the groups of submerged aquatic plants, the most common coenoses are *Ceratophyllum demersum*, the projective cover of which was up to 10%, *Elodea canadensis*, projective cover up to 3%, *Potamogeton* spots are rare. Free-floating unrooted plants in the coastal zone are identified *Lemna minor*, *Staurogeton trisulcus*, *Spirodela polyrrhiza*, total projective cover from 30 to 40% (group *Lemnetum minoris*, *Lemno minoris-Spirodeletum polyrrhizae*). Among the floating rooted plants, sparse *Nuphar lutea* thickets with a projective cover of up to 3-5% are rare. In the formation of coastal aquatic vegetation the greatest coenotic role is played by *Glyceria maxima* (group *Glycerietum maximae*), the projective cover of which is up to 85%, *Phalaroides arundinacea* with a projective cover of 40-65%, *Carex elata* – up to 60%, in some areas *Phragmites australis* (group *Phragmitetum communis*) and *Rorippa amphibia*.

The hydrophilic vegetation on the section of the river near the discharge of industrial wastewater of the Rivne nuclear power plant is similar. However, submerged aquatic plants are identified in small numbers: rare sparse thickets of *Potamogeton perfoliatus* and *Stuckenia pectinata* (projective cover 3-5%), *Ceratophyllum demersum* with projective cover up to 5% is more common. Among the free-floating unrooted plants, *Lemna minor*, *Staurogeton trisulcus*, *Spirodela polyrrhiza* are scattered, the total projective cover of which is from 15 to 20% (group *Lemnetum minoris*, *Lemno minoris-Spirodeletum polyrrhizae*). From floating rooted plants, *Nuphar lutea* grows singly or in small groups. The greatest coenotic role in the formation of coastal-aquatic vegetation is played by *Carex elata*, projective cover 35-40%, *Glyceria maxima* (group *Glycerietum maximae*) with projective cover up to 35%, *Sparganium emersum*, projective cover 35-60%. Scattered, small spots, there are thickets of *Phalaroides arundinacea*, *Phalaroides arundinacea*, *Phragmites australis*, *Rorippa amphibia*, *Eqisetum palustre*, *Bidens frondosa*, *Mentha aquatica*, *Glyceria fluitans*, *Sagittaria sagittifolia*. Shrub thickets *Salix purpurea*, *S. viminalis*, *Frangula alnus* are widespread in the coastal zone, between which (projective coverage up to 50-85%) *Urtica galeopsifolia*, *Rorippa sylvesrtris*, *Echinocystis lobata*, rear is *Calystegia sepium*, *Ranunculus repens*, *Myosoton aquaticum*, *Stachys palustris*.



On the section of the river near the village of Babka the vegetation turned out to be more diverse. Submerged aquatic plants are primarily represented by different species of *Potamogeton perfoliatus*, *P. lucens*, *Stuckenia pectinata* (well-defined groups of *Potametum perfoliati*, *P. lucentis*, *P. pectinati*), the projective cover of which is 35-70% and *Elodea canadensis* and *Ceratophyllum demersum* projective coverage is up to 10%. Free-floating unrooted plants are represented by groups *Lemnetum minoris*, *Lemno minoris-Spirodeletum polyrrhizae*, the total projective cover of 15-25%, which is common in the coastal strip of the river, occasionally there are sparse thickets of *Hydrocharis morsus-ranae*. Of the floating rooted plants, *Nuphar lutea* thickets, projective cover up to 30%, are rare. Coastal-aquatic vegetation is formed almost throughout the study area. The largest areas are occupied by *Glyceria maxima* (group *Glycerietum maximae*), *Phalaroides arundinacea*, *Phragmites australis*, *Sparganium erectum* (group *Sparganietum erecti*), *Mentha aquatica*, *Bidens frondosa* and *B. tripartita*, locally distributed are thickets *Butomus umbellatus*, *Carex acutiformis*, *C. elata*, *C. rostrata*, *Typha latifolia*. The phytocenotic role of other coastal-aquatic species is insignificant, although most have a high frequency of occurrence. In some areas the local thickets of *Salix purpurea* are well expressed, the projective cover is from 65 to 90%.

The vegetation on the section of the river near the village of Sopachiv turned out to be poorer, first of all because of its steep banks. Submerged plants are represented by *Potamogeton perfoliatus*, *P. lucens*, *P. crispus* (group *Potametum perfoliati*, *P. lucentis*, *P. crispus*), the projective cover of which varies from 15-20% to 50-65%. *Elodea canadensis* and *Ceratophyllum demersum* are scattered, projective coverage 10-20%. Free-floating unrooted plants are represented mainly by *Lemna minor* and *Spirodela polyrrhiza*, occasionally by – *Staurogeton trisulcus*. Among floating rooted aquatic plants, *Nuphar lutea* and *Persicaria amphibia* with a projective cover of 2-5% are the most common. Coastal-aquatic vegetation is mainly formed by *Glyceria maxima* (group *Glycerietum maximae*), projective cover 55-85%, *Sparganium erectum* (group *Sparganietum erecti*), projective cover is up to 75%, *Rorippa amphibia* and *Bidens frondosa*, 5% projective. A characteristic feature of this section of the river is the presence of narrow sandy shoals, on which thickets of *Gnaphalium uliginosum*, *Potentilla anserina*, *Ranunculus repens* have been identified.

On the river near the town settlement of Zarichne among the submerged aquatic plants, the most common cenoses involving *Ceratophyllum demersum* (group *Ceratophylletum demersi*), the projective cover of which was 10-25%, of different species of rhododendrons, where *Potamogeton crispus*, *P. natans*, *P. perfoliata*, and *Stuckenia pectinata* had the largest projective cover (well-defined groups are *Potametum perfoliati*, *P. pectinati*). *Elodea canadensis* with a projective coverage of up to 5% is rare. Free-floating unrooted plants on the river section in the coastal zone are common *Lemna minor*, *Staurogeton trisulcus*, *Spirodela polyrrhiza*, total projective cover 30-50% (groups *Lemnetum minoris*, *Lemno minoris-Spirodeletum polyrrhizae* are much less common thickets such as *Hydrocharitetum morsus-ranae*) and *Stratiotes aloides* (group *Hydrocharito-Stratiotetum aloides*) with a projective coverage of up to 75%, rarely identified *Persicaria amphibia*. Of the floating rooted plants, *Nuphar lutea* thickets (*Potameto-Nupharetum* group) are most common, with



a projective cover of 50 to 85%. More diverse was the coastal-aquatic vegetation, in the formation of which the largest role is played by *Glyceria maxima* (group *Glycerietum maximae*), *G. fluitans* (group *Glycerietum fluitansis*), *Carex acutiformis*, *C. rostrata* (group *Carici acutae- Glycerietum maximae*), *Sparganium erectum* (group *Sparganietum erecti*), *Rumex hydrolapathum*, *Sium latifolium* whose projective coverage varies between 35-85%. The role of other coastal and aquatic species was insignificant, and the groups with their participation are local in nature. Among the coastal-swamp species, the largest areas are occupied by *Bidens tripartita*, *Mentha aquatica*, *Galium palustre*.

A similar species composition of vegetation was observed in the area of the river near the village of Ivanchytsi. However, *Nymphaea candida* and *Potamogeton natans* are well expressed in the plant, with a projective coverage of up to 15% (*Potameto natansis-Nymphaeetum candidae* group), *Batrachium rionii*, projective coverage of up to 80% (*Batrachietum rionii* group) and *Hippuris vulgaris*, 65% group *Hippuritetum vulgaris*. From coastal-water and coastal-swamp groups in this area thickets of *Rumex hydrolapathum* and *R. maritimus*, *Eleocharis palustris*, *Juncus compressus*, *Sparganium emersum*, *Ranunculus flammula*, *Rorippa amphibia* are well expressed. In a large part of the coastal part of the river there are common shrubs with the participation of various species of *Salix*, among which the greatest phytocenotic role is played by *S. purpurea* and *S. triandra*, the total projective cover of which is 75-90%.

As a result of coenopopulation studies of individual sections of the Styr River, we obtained data that determine the condition of populations of rare species: *Pulicaria vulgaris*, *Hippuris vulgaris*, *Batrachium rionii*, *Nymphaea candida* (old river), *Batrachium circinatum* (Verben village), *Potamogeton gramineus* (Ivanchytsi village). For the first time in Rivne region, the species *Batrachium rionii*, was found, which is included in the Red List of Aquatic Macrophytes of Ukraine and is a highly vulnerable species (Tolochyk & Volodymyrets', 2018). Rare species of higher aquatic and coastal-aquatic plants of Rivne region were partially studied by Volodymyrets V.O., Grohovska Yu. R. and Konontsev S. V. (Grohovs'ka et. al., 2013).

In recent decades, the vegetation of the river ecosystem has tended to intensify the transformation processes caused by the high level of erosion, plowing, agricultural use of the basin.

The species composition of the hydrophilic flora in different parts of the Styr River differs, but there are some species that are characteristic only of a certain study area. Thus, the species composition of the hydrophilic flora of the river near the village of Verben of Demydiv district had 65 species. However, only here were found *Batrachium circinatum*, *Glyceria notata*, *Potamogeton compresus*, *Cicuta virosa*, as well as a representative of aquatic mosses – *Ricciocarpus natans* (family *Ricciaceae*).

On the section of the river near the village of Torhovytsia of Mlyniv district 46,4% (58 species) of the entire species species, including *Agrostis gigantea*, *Zizania latifolia*, *Myriophyllum verticillatum*, *Scrophularia umbrosa* have been identified only in this locality. Slightly poorer species composition of hydrophilic flora is in the area near the village of Nove. Only 51 species were found here.



Within the Volodymyrets district, the hydrophilic flora is represented by 87 species (69,6%), among which *Leersia oryzoides*, *Thalictrum lucidum*, *Echinocystis lobata*, *Epilobium tetragonum* were found only in this study area. It should be noted that the highest indicator of species composition is determined near the village of Babka, where there are 75 species, and the poorest is the area near the village of Zabolotta (30 species).

The largest number of species (89 or 71,2% of the total species composition) was found in the section of the river between the town settlement of Zarichne and the village of Ivanchytsi of Zarichne district. Among them are *Juncus tenuis*, *Potamogeton friesii*, *P. natans*, *P. gramineus*, *Ranunculus flammula*, *Stellaria fennica*, *Hippuris vulgaris*, *Pulicaria vulgaris* and others. Especially rich in species diversity is the area near the village of Ivanchytsi, where the river forms an old river. Only here the following species were found: *Nymphaea candida*, *Potamogeton friesii*, *Carex riparia*, *Eleocharis acicularis*, *Schoenoplectus lacustris*, *Juncus tenuis*, *Batrachium rionii*, *Ranunculus flammula*, *Hippuris vulgaris*, *Eupatorium cannabinum*, *Pulicaria vulgaris*. It was here that *Batrachium rionii* was found. A comparative analysis of different sections of the river is made, which makes it possible to assess the hydrophilic flora, to isolate and determine its uniqueness.

Conclusions.

Comprehensive research has made it possible to characterize the floristic richness of the Styr River hydroecosystem, compare individual study areas, identify natural areas, assess the degree of transformation of vegetation and propose measures to preserve and restore natural ecosystems in the river basin. The study of hydrophilic flora will create an ecological network of local and regional level, to develop optimal ways to protect rare and typical plants and their groups.

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Анотація. Вперше проведені геоботанічні дослідження водної та прибережно-водної рослинності на окремих ділянках р. Стур. Аналіз та оцінка гідрофільної флори річки здійснені за флористичним, геоботанічним та ценопопуляційним напрямками досліджень. Встановлено, що видовий склад гідрофільної флори на різних ділянках річки відрізняється, проте є окремі види, які характерні тільки для певної досліджуваної території. За результатами проведених польових досліджень у складі виділених таксонів описано 125 видів вищих судинних рослин із 75 родів та 38 родин. У видовому складі найпоширеніші 7 родин: Poaceae (11 видів), Potamogetonaceae (10 видів), Asteraceae (9 видів), Cyperaceae (8 видів), Polygonaceae (8 видів), Ranunculaceae (6 видів), Salicaceae (6 видів). Зазначені види цих родин становлять 46,4%. Серед визначених родів доміантними є: Potamogeton (9 видів), Salix (6 видів), Juncus, Rumex і Carex (по 5 видів). 6,4% (8 видів) – адвентивні рослини: Acorus calamus, Bidens frondosa, Echinocystis lobata, Elodea canadensis, Juncus tenuis, Salix fragilis, Xanthium albinum, Zizania latifolia, решта представляють аборигенну флору Рівненської області. Встановлено, що в екосистемі річки прослідковується тенденція до посилення трансформаційних процесів. У результаті проведеної геоботанічної характеристики виділено 14 рослинних угруповань. Для середньої течії річки характерні: *Batrachietum circinatis*, *Glycerietum maximae*, *Lemnetum minoris*, *Lemno minoris-Spirodeletum polyrrhizae* *Potametum perfoliati*, *P. Pectinati*. У чотирьох створах нижньої течії гідрофільна флора виявилась біднішою. Прибережно-водна рослинність, в основному, утворена *Glycerietum maximae*, *Lemnetum minoris*, *Lemno minoris-Spirodeletum polyrrhiza*, *Potametum perfoliati*, *P. pectinati* та *Sparganietum erecti*. Проте особливо багатоманітністю видового складу нижньої течії виділяється ділянка між смт. Зарічне та с. Іванчиці. Найбільшу площу займають *Batrachietum rionii*, *Carici acutae-Glycerietum maximae*, *Ceratophylletum demersi*, *Glycerietum fluitans*, *G. maximae*, *Hippuritetum vulgaris*, *Hydrocharito-Stratiotetum aloides*, *Lemnetum minoris*, *Lemno minoris-Spirodeletum polyrrhiza*, *Potameto-Nupharetum*, *Potameto natans*-*Nymphaeetum candidae*, *Potametum perfoliati*, *P. pectinati*, *Sparganietum erecti*. У результаті ценопопуляційних досліджень окремих ділянок річки отримані дані, що визначають стан популяцій 6 раритетних видів: *Pulicaria vulgaris*, *Hippuris vulgaris*, *Batrachium rionii*, *Nymphaea candida* (стариця); *Batrachium circinatum* (с. Вербень); *Potamogeton gramineus* (с. Іванчиці). Вперше на Рівненщині знайдений сильновразливий вид *Batrachium rionii*, який віднесений до Червоного списку водних макрофітів України. 71,2% видів виявлено на нижній течії річки, найпоширенішими серед них є: *Juncus tenuis*, *Potamogeton friesii*, *P. natans*, *P. gramineus*, *Ranunculus flammula*, *Stellaria fennica*, *Hippuris vulgaris*, *Pulicaria vulgaris* та інші. Найрізноманітнішою визначена ділянка, де річка утворює старицю. Лише тут були виявлені такі види: *Nymphaea candida*, *Potamogeton friesii*, *Carex riparia*, *Eleocharis acicularis*, *Schoenoplectus lacustris*, *Juncus tenuis*, *Batrachium rionii*, *Ranunculus flammula*, *Hippuris vulgaris*, *Eupatorium cannabinum*, *Pulicaria vulgaris*. Порівняльний аналіз різних ділянок річки дає можливість оцінити гідрофільну флору, розробити оптимальні шляхи охорони рідкісних і типових рослин та їх угруповань.

Ключові слова: ділянки річки, видовий склад, прибережно-водна рослинність.

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