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ON BRYOPHYTE FLORA OF THE DREVLYANSKY NATURE RESERVE

Currently in Ukrainian Polissya there are four nature reserves – Cheremsky, Rivnensky, Polissksy and Drevlyansky, of which only the latter remained unexplored in bryiological aspect. At summer 2016 the bryophytes of the Drevlyansky nature reserve (the Narodychi district of the Zhytomyr Region, Ukraine) were investigated by authors of the paper. It was examined pine, oak and pine, oak and hornbeam woods, eutrophic swamps, granite outcrops on the river Uzh and various artificial substrates.

According to previous data, at bryoflora of the Drevlyansky natural reserve it was established 85 species, out of them 72 ones are reported for the first time. Liverworts in the reserve are presented mostly common species (Marchantia polymorpha L., Pellia epiphylla (L.) Corda, Riccia fluitans L., Lophocolea heterophylla (Schrad.) Dumort., Ptilidium pulcherrimum (Weber) Vain. etc.). Mosses are represented by 77 species. The genera of Orthotrichum Hedw. (7 species), Sphagnum L., Dicranum Hedw., Grimmia Hedw., Bryum Hedw. (all of 4 species) have the highest relative richness of taxa. This is related to the zonal (the presence of forests and wetlands) and regional (the presence of granite) features of the area. In the reserve the greatest species diversity was found on soil (47 species), after that follow trunk of trees (29 ones), stony substrates (21) and dead wood (13 species). Fissidens fontanus (Bach. Pyl.) Steud., a species from the Red Book of Ukraine, as well as regional rare bryophytes Riccardia incurvata Lindb., Campyliadelphus chrysophyllus (Brid.) R.S.Chopra and Syntrichia papillosa (Wils.) Jur. occur there. On the whole, the Drevlyansky nature reserve, like Polissksy reserve, plays the important role in protection of epilithic bryophytes of the Zhytomyr Polissya.

Key words: bryophytes, rare species, Drevlyansky nature reserve, Zhytomyr Polissya.
The state and prospects of study of hornworts and liverworts of Forest-Steppe of Ukraine are characterized. The literature sources, that contain information on these groups of bryophytes, chronologically analyzed, the herbarium materials of a number of Ukraine’s herbarium viewed and the original data processed.

Antocerotophyta has four species that belong to one order, one family, two genera. Marchantiophyta represented by 49 species from 27 genera, 21 families, 6 orders, 2 classes.

It was established the role of liverworts in the formation of bryophyte communities, the results of bryocoenoses’ classification by eco-floristic classification. As a result of original research it was found that in the surveyed bryocoenoses of Forest-Steppe of Ukraine there are 11 species of liverworts belonging to 10 genera, 9 families, 6 orders, two classes. Liverworts are available in all substrate types of bryophyte communities: epigeous, epiphytic, epixylous, epilithic.

The coenotic role of hornworts and liverworts in forming of bryocoenoses in Forest-Steppe of Ukraine is ambiguous. They are integral components of the 29 associations, one subassociation and 15 without rank communities, 16 unions, 12 orders, 8 classes of mossy vegetation of Forest-Steppe of Ukraine, which are the diagnostic species of syntaxa or their insignificant components.

Thus, the hornwort and liverwort flora in a forest-steppe zone of Ukraine is poor enough. They investigated not individually, but together with the mosses. Perspective directions in their study are: research within natural protected objects; studying the hepatic flora of urban ecosystems; clarification of the role of hornworts and liverworts in forming of bryocoenoses, description and compilation of relevant syntaxa syntaxonomical schemes of mossy vegetation with their participation.

Key words: hornworts, liverworts, bryophytes, hepatic flora, bryophyte communities, the Forest-Steppe of Ukraine.
QUANTITATIVE PARAMETERS OF ASH CONTENT IN MEADOW PLANTS OF THE LEFT-BANK FOREST-STEPPE OF UKRAINE

We have carried out the study of the ash content in representatives of the various economic and systematic groups of wild meadow plants of the Left-bank Forest-steppe of Ukraine. It is established that the ash content of the investigated plants ranged from 3.4 to 23.2 per cent. The amount of ash in some of the investigated gramineous representatives fluctuated almost in 7 times (the 3.0-16.9 per cent), in the bean – this scale was not so big. All studied species by the ash content was divided into three groups: small (7.0%), medium (score of 7.0-10.0%) and high (more than 10.0%). The greatest number of systematic groups had an ash content at the level of the second group.

The accumulation of ash substances on the economic groups in the meadows in the phase of flowering showed a slightly larger content for the representatives of Fabaceae (8.0±0.4%) in comparison with the Poaceae (7.5±0.7%), for the representatives of forbs it was at the level of 9.0±0.2 per cent. The decrease in ash content at the end of the growing season was founded mostly in perennials. For the annual this trend is not followed. It was established that the total ash content in the aboveground mass of Urtica dioica L. from wet biotops is lower than in ones from drier biotops. Meadow representatives that grow on ordinary and typical chernozems have high ash content, on other soil types – medium and low. The significant difference in the ash content depending on hygromorpha was not detected. Only representatives of halophyts have a higher mineral content.

Thus, the ash content of meadow plants from the researched region characterized by high variability. It depends on the systematic position, ontogeny phase of plants and the influence of external conditions, among which the major environmental factors are light, moisture and soil type. With this purpose to determine the nutritional value of plants, in particular, the ash content, it is necessary to conduct regular monitoring studies in specific areas and take them into account in forecasting the yield and productivity of meadow phytocenoses.

Key words: meadow plants, ash, variability, the Left-bank Forest-steppe of Ukraine.
UDC 661.162

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PHYTOCENOTIC EFFICIENCY OF INHIBITION BY SOWING OF CROP PLANTS AS A FACTOR OF BIOLOGICAL CONTROL OF AMBROSIA ARTEMISIFOLIA L. (ASTERACEAE)

The article deals with the results of study the effectiveness of biological control the malignant weed in modern agroecosystems – Ambrosia artemisifolia L. The study was conducted in the first two links of the grain-fallow-tilled crop rotation and based on strengthening the competitiveness of crops by selecting of optimal seeding rates that is a precondition of phytocenotic inhibition of weeds in the crop due to reduction of energy intensity of lower tier in agrophytocenosis.

In the conditions of the Left-bank Forest-steppe of Ukraine the most effective biological oppression of A. artemisifolia and other weeds is provided at growing in an occupied fallow of vetch-oat mixture with a seeding rate of 2,5 million viable seeds per 1 ha for the vetch (grade Belotserkivska 50) and 1,25 million seeds per 1 ha for the oat (grade Scakun). It allows to eliminate the weeds out of competitive struggle due to reduction of energy intensity of illumination the lower tier of stam formation at harvest time to 0,14 cal/cm².

Maximum phytocenotic inhibition of weeds by sowings of winter wheat (grade Ukrainka Poltavska) in an occupied fallow reached at seeding rate of 4,5 million viable seeds per 1 ha (assuming all the elements of an intensive technology of growing crops) when is ensured the reduction of photosynthetically active radiation in crops to 0,19-0,24 cal/cm². Under such conditions, A. artemisifolia and other weeds do not pass light stage of development, because of that do not bloom and do not form viable seeds.

The biological control of A. artemisifolia and other weeds in an occupied fallow and sown over it winter wheat allows to reduce expenses on herbicides in crop rotation and improve the phytosanitary condition of crops.

**Key words:** Ambrosia artemisifolia, biological control of weeds, phytocenotic inhibition, seeding rates, energy intensity of crop illumination.
UDC 712.253 (477.53)

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THE CONCEPT OF TERRITORIAL STRUCTURE DEVELOPMENT OF THE REGIONAL LANDSCAPE PARK «HADIATSKYI» (UKRAINE)

The article presents the concept of territorial structure development of the regional landscape park «Hadiatskyi», founded in 2011 on the square 12803.3 hectares in the Hadiach district, Poltava region (Ukraine). It was defined two conceptual problems stipulating necessity of the measures implementation for the optimal functioning of the nature reserve object and performing certain functions: ensure protection of typical and rare focuses of phytodiversity on the adjacent to park areas and optimize zoning of its territories. The necessity to improve the territorial organization RLP «Hadiatskyi» considering the indicators of sustainability, significance of natural-territorial complexes and integrity of lowland-river system preservation was specified. There are three basic positions for the development of the territorial park structure: inclusion of pinery-terraced complexes in its composition on the left bank of the river Psel in its middle reaches within the natural vegetation distribution; gullies and gully systems on the right bank of the river Psel with the areas of steppe and meadow-steppe vegetation and sozological valuable valley areas of the river Khorol within the Hadiach district. The florosozological value of the territories that are perspective for joining in terms of representativeness and uniqueness was defined. Implementation of the proposed activities of territorial structure organization will enable to expand the area of RLP «Hadiatskyi» and improve the key natural-territorial complexes representation, provide the preservation of spatial and functional connections between their components, increase the conservancy rate in Poltava region and strengthen the bio-regional ecological network of Poltava region.

Key words: phytodiversity, indicators of representativeness and uniqueness, valley-river system, territorial structure, nature reserve object, regional landscape park «Hadiatskyi», ecological network of Poltava region.
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ECOLOGICAL AND COENOTIC CHARACTERISTIC AND THE STATE OF COENOPOPULATIONS *TULIPA QUERCETORUM* KLOKOV & ZOZ (LILIACEAE) IN THE RIVER VORSKLA CATCHMENT BASIN AREA (WITHIN THE BOUNDARY OF POLTAVA REGION)

The article presents the results of research about the cenotic eco-features, density and age structure of 12 coenopopulations of *Tulipa quercetorum* Klokov & Zoz (Liliaceae) – a rare species included in the Red Book of Ukraine, at the basin of the river Vorskla (Poltava region). In the investigated area 40 locations *Tulipa quercetorum* were found, among them 36 units are in Poltava region and two others are in Sumy and Kharkiv regions. It was confirmed that the 8 locations and 7 types of the species were revealed for the first time. According to coenotic analysis *Tulipa quercetorum* habitat is in deciduous forests. Due to the wide ecological and coenotical amplitude this type is also determined in meadow and meadow-steppe vegetation. In Syntaxonomical aspect *Tulipa quercetorum* was found in the composition of groups of 4 associations (*Tulipo quercetorum-Quercetum roboris*, *Stellario holosteae-Carpinetum betuli*, *Alopecuretum pratensis*, *Thymo marschalliani-Caricetum praecocis*), 4 unions (*Scillo sibericae-Quercion roboris*, *Carpinion betuli*, *Festucion pratensis*, *Fragario viridis-Trifolion montani*) and 3 classes (*Querco-Fagetea*, *Molinio-Arrhenatheretea*, *Festuco-Brometea*). *Tulipa quercetorum* can be characterized by two types of ontogeny – full and abbreviated. In the full version there are three periods and six age classes. It was established that most of populations were full nominated of normal type, and are characterized by bimodal, left-sided age spectrum with maximum on individuals of regenerative period. In the most investigated coeno populations there were no sprouts, but the presence of juvenile specimens indicates their age spectrum. According to specified age index all coenopopulations are young. The density of coeno populations is ranging from 29 to 116 individuals per m² and is largely dependent on the degree of anthropogenic load.

**Key words:** *Tulipa quercetorum*, *basin of the river Vorskla*, *coenopopulations*, *age structure*. 
STATE AND PROSPECTS OF OPTIMIZATION THE PLANT COVER OF HYDROPHILIC ECOTOPES OF THE POLTAVA BOTANICAL GARDEN

The floristic and coenotic features of the plant cover of hydrophilic ecotopes (stream and pond) on the territory of Poltava V.G. Korolenko National Pedagogical University’s Botanical Garden were studied. It was found that hydrophilic plant cover undergoes significant anthropogenic transformation: a poor composition of flora and communities of macrophytes, excessive overgrowing of water area, hyperproduction of filamentous algae indicate the violation of ecological balance in the pond ecosystem; in coastal flora of creek and pond the high participation of ruderal and alien elements takes place.

The recommendations to optimization the state of the plant cover of hydrophilic ecotopes were given. To optimize the pond ecosystem of Botanical Garden is expedient to recommend reconstruction of hydraulic structures to improve water circulation, control of the sources of pollution and hydrochemical monitoring of catchment area, correction areas of overgrowing the water surface (especially by free floating vegetation and filamentous algae), study the whole biota of aquatic biocenosis and its impact on the given ecosystem, phytosanitary control the spread of weeds, especially alien, streamlining and compliance with the regime of water protection zone, cultivation of helophytes communities on the principle of bioplato. Among measures of optimization the vegetation cover of coastal space should be noted mowing of herbaceous vegetation along the perimeter and placing the curtains of decorative hygrophilous plants, felling and control the spontaneous spreading of shrubs and trees.

On the basis of the established ecological conditions of studied ecotopes the specific recommendations for their greening are given. In view of the decorative and sozological aspects of hydrophilic flora of the Left-bank Forest-steppe and biological features of some aquatic introducers the list of plants, that are promising for cultivation ex situ, proposed.

Key words: Poltava, Botanical Garden, stream, pond, hydrophilic vegetation, aquatic and coastal flora, greening.
**Introduction.** The Poltava Botanical Garden is a green adornment of Poltava city and contemporary educational and scientific base of the Faculty of Natural Sciences of Poltava V.G. Korolenko National Pedagogical University. It is located in the picturesque countryside of eastern part of the city. The object has the status of the park-monument of landscape architecture of local importance and in its current limits covers an area of 5.25 hectares.

In the structure of modern Botanical Garden are arboretum, greenhouse, floral department of decorative plants with collection areas, exposition the Museum of Ukrainian Flowering under the open sky, green class, alpine slide, department of agricultural and medicinal plants and fruit garden. Overall the collection of botanical garden has over 1500 species, varieties and forms of plants, including about 500 taxa at open and about 600 ones – at closed ground [2, 6].

Analysis of structure of the Poltava Botanical Garden and variety of flora grown it gives reason to state that the main types of vegetation of different geographical zones of Ukraine and of the world occupy the leading place in its exposition. At the same time azonal elements (meadow, swamp and aquatic vegetation) in the collection are minimal, but have considerable potential for expanding [3], as the landscape conditions here are favorable for them because of presence the hydrophilic ecotopes – a stream and a small water body (fig. 1). This, in turn, is caused by the fact that the Botanical Garden is located on the slopes of ravine formed the right tributary of the Tarapunka River (basin of the River Vorskla).

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**Fig 1. Map-scheme of the Botanical Garden of Poltava V.G. Korolenko National Pedagogical University:**
1, 2 – buildings;
3 – greenhouse;
4 – alcove;
5 – wellspring;
6 – exposition of Ukrainian Flowering;
7 – rockery;
8 – stream;
9 – water body.
In the scientific literature on Poltava Botanical Garden [1-3, 6, 8] are only a few references to the stream and pond, but concrete data about these objects and their vegetation is almost absent.

In 2012 we studied the floristic, coenotic and ecological features of a pond of the Poltava Pedagogical University’s Botany Garden, gave the recommendations to optimize the condition of this ecosystem and proposed a list of hydrophilous plant species, which are perspective for growing \textit{ex situ} [10], but it was remained out of sight the state of the watercourse and flood plain, the issue of their ordering.

At the same time the hydrophilic ecotopes of Poltava Botanical Garden characterize by diversity of flora and fauna and may be convenient objects to make excursions of natural sciences for pupils students [5], field environmental practices of students [9], and have significant landscape and aesthetic potential, able greatly to increase the recreational attractiveness of Poltava Botanical Garden and its scientific and educational value. The importance of preservation and development of these ecotopes related to their location among densely populated areas of the city, from the position of optimization of the entire urban area of Poltava and strengthening its «green carcass». Therefore \textbf{the aim of this work} is to study the vegetation cover of hydrophilic ecotopes complex of Botanical Garden with outlining the prospects for its greening.

\textbf{Materials and methods.} Current research conducted in the field season of 2015 and early in the season of 2016 using traditional hydrobotanical methods [7]. Counting of line parameters and areas of undergrowing of water body by hydrophilic vegetation implemented using software resources Digimizer to space aerial images received through the service Google Earth, by comparison with field data. Investigation of environmental indices of stream and water body conducted through standard procedures [14, 17]. Suggestions of optimization of plant cover of hydrophilic ecotopes based on specific recommendations [11, 19].

\textbf{Results and their discussions.}

\textbf{The stream} of Botanical Garden has a leak in the central part of the city, approximately of 600 m upstream, and falls to the river Tarapunka near the Monastyrska hill about 700 meters below. The lower part of the flow to the mouth goes into the underground collector. According to the hydrological description of this watercourse [18], the total length of stream – 1,6 km, the average slope – 5,61 m/km, the width of the bed – 0,5-1,0 m, the depth is about 0,5 m. Drain of water occurs throughout the year. In the bed and floodplain there are seven hydraulic structures, the most of which are ponds. At present boundaries of botanical garden there are about 275 meters of the stream. From the materials of «Development of scientific recommendations for the reconstruction of the garden of Poltava Pedagogical Institute» (1988) we know, that the difference altitudes at this site of the stream makes from 125 m to 117 m, and the maximum height on the slopes of its valley – 136 m (for northern slope) and 140 meters (to the south). According to our measurements, the width of the stream is 0,3-0,5 m, depth – 0,2 m, the flow velocity is about 0,25 m for a second, the water is clear (the index of Snellen’s transparency is 30 cm). The bed is practically not overgrown, but there are local plots with thickets of macrophyte algae \textit{Cladophora} sp., which projective coverage (PC) does not exceed 30%.
At the territory of Botanical Garden the valley of the stream is relatively narrow (30 m), the floodplain is inexpressive, 15-20 m wide, the slopes of valley are high enough (an average of 3-4 m) and sometimes steep. Most of the floodplain is overgrown with trees and shrubs based on Acer negundo L. and Robinia pseudoacacia L. Decorative value of this area enhanced by the individual copies of shrubs and trees of Salicaceae, particularly the hung form of Salix alba L. The shrubs of Viburnum opulus L. are planted and some trees of Malus domestica Borkh grow near the wellspring.

Herbaceous cover of the floodplain in whole formed spontaneously, although in some places it exposed mowing. The tall plants dominate – Rumex pratensis Mert. & W.D.J. Koch (R. crispus × R. obtusifolius), Anthriscus sylvestris (L.) Hoffm., Chenopodium urbicum L., Urtica dioica L., Arctium lappa L. та A. tomentosum Mill., Sonchus arvensis L., Dipsacus strigosus Willd. ex Roem. and so on, in which climbing stems of Humulus lupulus L., Calystegia sepium (L.) R.Br., Rubus caesius L., and in some places invasive Echinocystis lobata (Michx.) Torr. & Gray extend. Moreover, the slopes of the valley in some places decorated with climbing shoots of Parthenocissus quinquefolia (L.) Planch.

The lower grassy sublayer is formed by Geum urbanum L., Lapsana communis L., Plantago major L., Taraxacum officinale Wigg. aggr., Chenopodium album L., Chelidonium majus L., Ambrosia artemisifolia L., Xanthoxalis stricta (L.) Small. Among grasses the most notable are Elytrigia repens (L.) Nevski, Dactylis glomerata L., Festuca gigantea (L.) Vill., Digitaria sanguinalis (L.) Scop.

Along the banks of the stream hydrophilic forbs are represented by Ranunculus repens L. and R. sceleratus L., Sium sisaroides DC., Persicaria hydropiper (L.) Delarbre and P. maculosa S.F. Gray, Epilobium palustre L., Lysimachia nummularia L., Myosoton aquaticum (L.) Moench, Bidens frondosa L., Impatiens glandulifera Royle, in some places hydrophilic grasses are also marked – Catabrosa aquatica (L.) P. Beauv. and Glycera notata Chevall.

The lower part of the floodplain (on the eastern edge of the park) is a swampy plot of about 1500 m² with the dominance in grassy layer of Scirpus sylvaticus L., high participation of Carex sp. and Impatiens glandulifera as well as climbing herbs – Humulus lupulus, Calystegia sepium, Echinocystis lobata. The plot is interesting as an example of wetlands and requires minimal regulation in order to provide ability of access for its study.

The water body, near the stream, occupies an important place in the structure of the Botanical Garden and the system of its hydrophilic ecotopes. It is located in the western part of the Botanical Garden, on super flood-plain terrace of the stream, from which it feeds through water-filled communication and is delimited by an earthen dam. It is an earth reservoir of almost right rectangular shape elongated from east to west at 37 m. According to the water economic passport of this pond (2007), its water surface area is 700 m², average depth – 1.9 m, maximum depth – 2.7 m. The perimeter of the pond is about 100 m. The water body has a weak-flowing regime due to return of water lower to stream through the discharge pipe. Water clarity in the growing season amounts 60 cm. The overgrowing degree by higher aquatic vegetation at the beginning of the growing season (April) is about 15% (mainly due to thickets of helophytes), in the period of maximum development of aquatic vegetation it reaches 100% (through free floating cenoses). The bottom sediments are loams in combination with silt.
The higher aquatic vegetation of pond characterized by unvaried floristic and coenotic composition. Aquatic flora includes only 7 species of higher macrophytes belonging to various ecological groups. Thus, all water area of pond covered with free-floating vegetation on the basis of *Spirodea polyrrhiza* (L.) Schleid and *Lemma minor* L. with almost equal participation of every species and total PC to 100%. Hydrophytes free floating in the water presented by sparse thickets of *Ceratophyllum demersum* L. (PC within 10%), rooted submerged hydrophytes presented by solitary specimens of *Potamogeton crispus* L. The helophyte’s belt is scrappy, consists of sparse (PC to 60%, the density of thickets of dominant is 65 specimens for m²) 0,5-1(3) m in wide communities of *Typha latifolia* L., among them there are some specimens of *Rumex hydrolapathum* Huds. and *Lythrum salicaria* L. Thickets of air-water vegetation distributed along almost half of perimeter of the pond, which creates conditions for forming of decorative compositions with aquatic plants without needing a significant correction of existing helophyte’s communities (fig 2.).

*Fig 2. The scheme of overgrowing the reservoir of Botanical Garden:*

1 – the communities of *Typha latifolia*, 2 – the communities of *Lemma minor* + *Spirodea polyrrhiza*; a dotted line shows the zone of spread of submerged vegetation on the basis of filamentous algae.

At the bottom of the reservoir it was marked a strong layer of filamentous algae, which actively vegetate in the second half of spring and early summer before the development of free floating vegetation and after vegetation emerge on a water surface. Active eating of aquatic vegetation by fish is insufficient factor for removal of excess phytomass, as evidenced by heavy siltation of bottom soils. This points to the necessity of regular clearing of a pond. The last time these measures were conducted in 2006.

The air-water vegetation produces the main share of macrophyte phytomass (92,4%), the free-floating vegetation provides 6,3% and the submerged vegetation (mainly filamentous algae) – only 1,3%.

The air-dry phytomass of macrophytes is about 0,68 kg/m² of water area, but the biggest burden falls to the coastal areas, where 1 m² of submerged and air-water thickets produce more than 4 kg of phytomass, which significantly exceed value (till 1,5 kg/m²), established as optimal for forming of good water quality [4].
Compared to 2012 in the structure of aquatic vegetation it were found some insignificant changes. Thus free floating communities still formed entirely from *Spirodea polyrhiza*, which now codominates with *Lemma minor*. This may indicate a slight decrease of eutrophication processes in the reservoir, as the optimal trophical level of water environment for *L. minor* is slightly lower than for *S. polyrhiza* [12]. But in any case, the spatial distribution of duckweed thickets in the reservoir is excessive, creating a shading the soil, hampering overgrowth of other plant species and limiting settlement of invertebrates. This accumulates the considerable biomass that needs the mechanical removal. In addition, it is marked a slight increase in the area of *Typha latifolia* communities that signals the gradual process of pond waterlogging [13].

Among the hydrophilic forbs that grow along the water’s edge and the banks of the stream with variable levels of moisture, it should be note *Ranunculus repens*, *Myosoton aquaticum*, *Lycopus europaeus* L., *Rumex × pratensis*, *Persicaria maculosa*, *Solanum dulcamara* L., *Calystegia sepium*, *Sonchus palustris* L., *Eupatorium cannabinum* L., *Tussilago farfara* L., *Impatiens glandulifera*.

The plant cover of adjacent to the reservoir area represented by meadows on the basis of *Elytrigia repens*, *Poa pratensis* L., *Trifolium repens* L., *Dactylis glomerata* L., *Glechoma hederacea* L. The close growth of trees causes the presence of skirt elements (*Aegopodium podagraria* L., *Geum urbanum*, *Lamium maculatum* (L.) L., *Dipsacus strigosus*). The participation of ruderal species of local flora (*Polygonum aviculare* L., *Plantago major*, *Taraxacum officinale*, *Sisymbrium officinale* (L.) Scop., *Arctium tomentosum*, *Heracleum sibiricum* L., *Urtica dioica*, *Chelidonium majus*, *Cirsium setosum* (Willd.) Besser), and some invasive species as well (*Ambrosia artemisifolia*, *Phalacrolopa annuum* (L.) Dumort.) is especially noticeable. Herbaceous cover around the pond is fragmentary mowed.

An arborescent layer on the shore of the pond represented by a group of trees *Picea abies* (L.) Karst., as well as individual specimens of *Salix alba*, *Juglans regia* L.; it is marked spontaneous regrowth of *Ulmus minor* Mill. and adventitious *Acer negundo*. The shading of water surface area is about a third of the pond square.

**Conclusions and recommendations.**

So, as our servy showed, in the flora of stream floodplain the high participation of ruderal (*Chenopodium urbicum* and *Ch. album* L., *Urtica dioica*, *Arctium lappa* and *A. tomentosum*, *Anthriscus sylvestris*, *Chelidonium majus* etc.) and adventitious (*Ambrosia artemisifolia*, *Xanthoxalis stricta*, *Echinocystis lobata*, *Bidens frondosa*, *Impatiens glandulifera* etc.) elements takes place, that indicates the anthropogenic transformation of natural vegetation.


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1 one asterisk (*) denotes species that are rare in Poltava region [15].
2 two asterisks (***) denote species listed in the Red Book of Ukraine [20].
Sobol., *Juncus effusus* L., representatives of genera *Hosta* Tratt., *Hemerocallis* L. As planting material it is also important to maximize the use of floristic diversity available on the territory of Botanical Garden.

In the Botanical Garden’s pond ecosystem it can be stated the features of violation of ecological balance: poor composition of flora and communities of macrophytes, excessive overgrowing of water area, hyperproduction of filamentous algae, high share of weeds at a coastal zone. The reasons for this may be a contamination of water of the stream flowing through populated mostly with private buildings area, secondary water pollution of pond during dying off of vegetation in conditions of weak flowing, receipt of organic substances in surface runoff from agrocenoses, destroying the integrity of plant cover at adjacent to reservoir areas because of trampling, littering and so on.

To optimize the pond ecosystem of Botanical Garden is expedient to recommend reconstruction of hydraulic structures to improve water circulation, control of the sources of pollution and hydrochemical monitoring of catchment area, correction areas of overgrowing the water surface (especially by free-floating vegetation and filamentous algae), study the whole biota of aquatic biocenosis (phyto- and zooplankton, periphyton, benthic invertebrates, ichthyofauna, etc.) and its impact on the given ecosystem, phytosanitary control the spread of weeds, especially alien, streamlining and compliance with the regime of water protection zone, cultivation of helophytes communities on the principle of bioplato [16].

Among measures of optimization the vegetation cover of coastal space should be noted mowing of herbaceous vegetation along the perimeter and placing the curtains of decorative hygrophilous plants, felling and control the spontaneous spreading of shrubs and trees.

A complete use of water bodies on the territories of botanical gardens involves growing there the different species of water and riparian-water plants, including rare and valuable for landscaping. Pond with cultivated there vegetation from an environmental point of view is an artificial community or agrocenosis that to maintain the decorative effect needs regular care by human and can serve as testing ground for experimental researches. When planning thickets should keep in mind that for the normal functioning of ecosystem of the reservoir and its aesthetic appearance plants should cover about a third of the water area [4]. Plants intended for decoration of the coastal zone must comply with the reservoir size and compositionally well combined. Excessive amounts of coastal plants, especially large, visually reduces the area of the reservoir. Among plenty of variants should be preferred those that retain a decorativeness of spring to late autumn and is not too demanding [19]. Species that are prone to strong growth, it is advisable to place at the bottom in pots [11]. Thus, the selection of the species composition of cultivated hydrophilic flora should be carried out based on the biological and ecological, decorative, ameliorative characteristics of individual species and their sozological specifics in a region and environmental conditions of reservoir.

For the water body of Poltava V.G. Korolenko National Pedagogical University’s Botanical Garden on the analysis of examined above features of ecotope and decorative and sozological aspects of hydrophilic flora of Left-bank forest-steppe is advisable to recommend the growing of following species:

- **at a zone of submerged plants** (including the presence of shallow areas and sufficient water clarity and luminosity as well as in order to counter the development of filamentous

- *at a zone of plants with floating leaves* (given the weak flow hydrological regime and insignificant fluctuations of the water level): *Nymphaea alba* L., *Nuphar lutea* (L.) Smith, *Potamogeton natans* L., *Persicaria amphibia* (L.) Delarbre, **Salvinia natans** (L.) All., *Hydrocharis morsus-ranae* L. and other;


Some tropical introduced species, such as *Eichhornia crassipes* (Mart.) Solms., *Pistia stratiotes* L., are also promising for growing in conditions of the Botanical Garden. Because of their high productivity and excessive invasiveness they should cultivated in isolation: in summer – in tubs with water near the pond or stream, and in winter – in a greenhouse (in particular piliya today is cultivated in greenhouses of Botanical Garden).

The implementation of the aforementioned measures of greening of hydrophilic ecotopes will not only replenish the collection of decorative plants of open ground and enrich the gene pool of rare hydrophilic flora, but definitely enhance the landscape and aesthetic, scientific and educational value of Poltava Botanical Garden as a whole.

**List of references:**

USING OF NONSPECIFIC FACTORS AS ACTIVATORS OF TECHNOLOGY OF CULTIVATION THE CUMULUS-OOCYTE COMPLEXES

Every step of biotechnology process for embryo obtaining in vitro is less effective than those is in vivo. As it is known, development of embryo caused by formation of oocyte cumulus complex – the oocyte surrounded by several layers of specialized granular (cumulus) cells, which are maturing in the ovarian follicle. Literature data analysis convincingly indicate that biotechnology for embryo obtaining may be significantly improved if some culture conditions for cumulus oocyte complexes and embryos, which are everywhere over stabilized, were forced to be oscillating with known biorhythms.

Concerning medium for cumulus-oocyte complexes cultivation in vitro, we applied the pH oscillation in the range from 7.2 to 8.1 units with circadian period and it was worked out and used the temperature oscillation in the range from 37 to 39°C with a 40-minute period. With the developed technologies it was conducted the continuous cultivation in vitro, which included cultivation of cumulus oocyte complexes. In total there were grown 22 cultures, in which 1249 oocyte-cumulus complexes were received.

For the first time in the world practice we have shown, that applying of biorhythmically oscillating parameters for oocyte-cumulus complexes cultivation in vitro does not decrease diameter gain when compared with use of constant conditions. Though we have shown that oscillating culture conditions are not worse than constant ones, the literature data and our theoretical ground convincingly give evidence about great perspectives namely oscillatory culture conditions as nonspecific factors of stimulating growth and development of oocyte-cumulus complexes in vitro. This is only the first step on the way of perspective introduction the biorhythmically oscillating parameters for cultivation of biological microobjects in biotechnology.

**Key words:** biotechnology, oscillation, pH, temperature, cumulus-oocyte complexes (COCs), in vitro, paradigm of constancy.
THE INFLUENCE OF MULTIOPROBIOTICS «SYMBITER® ACIDOPHILIC» CONCENTRATED ON CHANGES IN RATS’ LYMPHOID ORGANS UNDER PROLONGED DECLINE IN GASTRIC SECRETION OF HYDROCHLORIC ACID

It was investigated the reaction of thymus and spleen in rats with 28 days decrease of gastric acid secretion on injection of multiprobiotic «Symbiter® acidophilic» concentrated (SYM).

In rats, whom were injected only multyprobiotic SYM, relative thymus weight was not significantly changed in contrast to the relative cellness of this body, which grew significantly compared with the control. Hypoacid condition of gastric juice caused by the 28-day administration of rats by omeprazole (OM), led to a decrease of relative thymus mass while increasing relative content of lymphoid cells in this organ compared with the control group of animals. Putting away with OM multiprobiotic SYM caused growth of relative thymus weight compared with the group of rats who were administered OM, but the values of the control group animals and rats injected only SYM not reached. Relative cellness thymus in this group was in 2 times higher than in the control group, on 30% higher compared with rats with long hypoacid state and on 43% compared with rats, introduced by which only the SYM.

Putting animals multiprobiotic SYM did not significantly alter the relative weight of the spleen and significantly increased relative cellness compared with the control. 28 daily inhibition of gastric secretion of hydrochloric acid by OM in rats led to moderate splenomegaly: increased mass index and relative content of spleen lymphoid cells in this body as compared to control animals. Concomitant administration of OM multiprobiotic SYM did not significantly alter the relative weight of the spleen, compared with a group of long hypoacidity and a group of rats that received only SYM, and leave increased this figure compared with the control. Relative spleen cellness in the same group of rats, which injected with OM and SYM, was on 40% more ten in groups of animals that received only OM, on 112% than in the control group and not significantly different from the group of rats which was injected only SYM.

Thus, it was shown that long-term hypoacidity of gastric juice evoked cytomorphological changes in thymus and spleen. Injection of multiprobiotic «Symbiter® acidophilic» exert immunomodulatory action via activation of proliferative processes in observable lymphoid organs.

Key words: thymus, spleen, multiprobiotic, hypoacidity.
The research was conducted under the scientific themes of biological faculty of Taras Shevchenko National University «The study of mechanisms of functioning of the digestive tract and the development of methods of its correction» (№ of the state registration 0106U005755) and «Determination of biochemical, genetic, immunological and cytological markers of pathological conditions with a view develop tools aimed correction and prevention» (№ of the state registration 0106U005750).

Introduction. Reduced secretion of hydrochloric acid in the stomach enhances digestive tract colonization by various microorganisms as acidic environment is one of the most important factors of non-specific defense against bacterial infection [17, 29]. It is known that the microflora of the gastrointestinal tract performs immunomodulatory function at different levels of immune protection, supports immune homeostasis, actively interacting with the immune cells of the digestive tract, determine their differentiation affects the balance in the system of Th1 / Th2 and the synthesis of immune cells of many cytokines [11, 27]. There are appropriate of a prevention and a treatment of dysbiosis probiotics under conditions of the long hypoacidity of gastric juices.

Continuous reduction of gastric acidity caused by the introduction of proton pump inhibitors – omeprazole leads to morphological and functional changes in the gastrointestinal tract, inflammation and significant increase in gastrin in the blood (hypergastrinemia) [8, 34]. It is found that hiperhastrynemy is a risk factor for cancer of the stomach and colon [28, 30].

The negative effects of hypoacid of the gastric juice certainly affect in the immune system, which by many complex immune responses supports the physiological state of the body. Today special attention of researchers associated with ascertaining the regulatory role of various cytokines, which control certain immune responses, including those that significantly affect the functioning of the digestive tract. It is known that inflammatory cytokines IL-1β and TNF-α are powerful factors inhibiting gastric secretion [9], and IFN-γ stimulates the production of G-cells of the stomach gastrin [33].

Modern experimental works devoted to studying the mechanisms of action of probiotics and their role in correcting violations that occur under prolonged oppression of gastric secretion of hydrochloric acid. Mechanisms of influence hypoacid state of the immune system and possible immunomodulatory properties multiprobiotics under these conditions today are not agreed and cause interest in researchers.

The aim of the study was to explore cytomorphological reaction of thymus and rats’ spleen introduced multiprobiotic «Symbiter® acidophilic concentrated» under conditions of prolonged oppression of gastric hydrochloric acid secretion that was induced by administration of omeprazole.

Materials and methods. Research was conducted on nonlinear white male rats weighing 160-180 grams who were divided into four groups of 10 animals each. Manipulation with animals and their maintenance in vivarium carried out in accordance with international recommendations and national law to conduct biomedical research [4].

Control (I group) served as rats, which were injected intraperitoneally 0,2 ml (w/v) and 0,5 ml oral water for injection during the 28 days. The second group of rats was administered orally multiprobiotic «Symbiter® acidophilie» concentrated (SYM) (produced by «O.D. Prolisok», Ukraine) at a dose of 0,14 ml/kg dissolved in 0,5 ml of water for injection.
Hypoacid condition in rats (group III) modeled daily administration for 28 days of omeprazole (OM) (production «Sigma-Aldrich», USA), that is a blocker of H⁺/K⁺-ATPase – a key enzyme synthesis of hydrochloric acid gastric parietal cells. OM injected intraperitoneal once daily at a dose of 14 mg/kg, which was dissolved in 0,2 ml of water for injection. Rats fourth group simultaneously with the introduction of OM was injected multiyprobiotic SYM, that is a living biomass concentrated symbiosis 14 unique probiotic strains of bifidobacteria, lactobacilli, propionic acid bacteria, lactococcus and physiologically useful products of their metabolism. It contains at least 10⁹ living cells in 10 ml of SYM. The day before the experiment, the animals had access only to water.

The reaction lymphoid organs was assessed by weight indexes and relative content of lymphoid cells [21], which was calculated by determining the ratio of body weight to the total weight of the animal and the number of cells to body weight, respectively.

Rats were sacrificed by dislocation method of the cervical vertebrae day after the last injection, pre-weighed on electronic scales, removed thymus and spleen, which are also weighed and placed in a Petri dish with cold medium 199 («Sigma-Aldrich», USA). The cell suspension of lymphocytes obtained from thymus and spleen by providing on density gradient Ficoll-Paque («Sigma-Aldrich», USA) method [13]. Counting lymphoid cells with parallel determination of their viability by trypan blue staining was performed according to the method [5] in the Goryaev’s chamber.

Statistical analysis of the results of studies using Student’s t test was performed to assess the reliability of using Statistica 7.0. Differences considered significant at r ≤ 0,05.

**Results and discussion.** Mass and cellness of lymphoid organs are integral indicators of generalized immune response. It should be informative studies provided only while calculating both indices since the change in mass of lymphoid organ can occur not only due to lymphoid cells, but also, for example, by epithelial cells or adipose tissue [2, 14].

Thymus is one of the key bodies in the development limphoyid organs in development of immune response, it’s main function is the maturation of T-lymphocytes [35]. In addition, the thymus regulates the level of cellular and humoral immunity by export to the periphery of effector regulatory cells and also the biologically active mediators [31].

In the control rats group relative weight and relative thymus cellness amounted to 25±2,2 × 10⁻⁴ conventional units and 60±5,5 × 10⁷ conventional units (fig. 1). In rats, whom were injected only multiyprobiotic SYM, relative thymus weight was not significantly changed and was 21±1,9 × 10⁻⁴ conventional units in contrast to the relative cellness of this body, which grew significantly to 84±7,4 × 10⁷ conventional units (40%, p ≤ 0,05) compared with the control. Established effect may be related to a natural reaction to the administration, though useful, but of alien organisms consisting multiyprobiotic, because it is known that probiotic microorganisms possess immunomodulatory properties specific abilities to incur an immune response, including the activation of T-dependent link immunity [12, 16, 23, 24].

Hypoacid condition called gastric juice daily administration of 28 rats OM led to a decrease relative thymus mass of 25±2,2 × 10⁻⁴ to 15±1,2 × 10⁻⁴ conventional units (32%, p ≤ 0,05) while increasing from 60±5,5 × 10⁷ to 92±8,3 × 10⁷ conventional units (53%, p ≤ 0,05) relative content of lymphoid cells in the body compared with the control group of animals.
Activation of proliferative processes in the rats thymus under long hypoacidity of the gastric juice, probably associated with the development of cell-mediated immune response and the need to attract to it an additional pool of T-lymphocytes. There is also evidence that there are characterized thymic hormones [6] in gastrin molecule fragments and they can stimulate immunogenesis [10].

![Graph](image)

*Fig 1. Cytomorphological rats’ thymus condition with long hypoacid as the conditions of entry multiprobiotic (M ± n, n = 10).*

* – P ≤ 0,05 compared to control;
# – P ≤ 0,05 compared with a group of animals which were administered omeprazole;
^ – P ≤ 0,05 compared to the group of animals injected Symbiter.

Therefore, strengthening the proliferation in the thymus during prolonged inhibition of gastric secretion of hydrochloric acid can occur due to trophic action of gastrin, which concentration significantly increases at the 28-day administration of OM [3, 20]. It is known that the thymus is the most sensitive to the effects of chemical and physical factors [1]. Nevertheless, thymus degradation can occur not only as a result of toxic effects of OM, but also by inhibiting migration of stromal cells from bone marrow in the anemia and the need to constantly exports to the periphery of effector and regulatory cells from the thymus to attract immune response. It is known that anemia of chronic inflammation and the development of
dysbiosis is one of the main negative effects of prolonged hypoacidity of gastric juice [7, 18, 22, 26]. The results correlate well with the literature about the development of atrophy of the thymus in animals in applying the unique OM – lansoprazole and thymoprazole [25, 32].

Putting away with OM multiprobiotic SYM caused growth relative thymus weight by 18% (p ≤ 0.05) compared with the group of rats who were administered OM, but the values of the control group animals and rats injected only SYM not reached and was 18±1.6 × 10⁻⁴ conditional units. Relative cellness thymus in this group was 120±10.1 × 10⁷ conditional units and was 2 times (p ≤ 0.05) higher than the control group, 30% (p ≤ 0.05) higher compared with rats with long hypoacid state and 43% (p ≤ 0.05) compared with rats, introduced by which only the SYM. This cytomorphological reaction of thymus to enter the SYM under the hypoacid condition may be associated with immunomodulatory properties of probiotic microorganisms that cause activation of proliferative processes in the thymus to attract new T-cells to «fight» with inflammation and dysbiosis developing against the background of a prolonged hypoacid of gastric juices caused by omeprazole.

Sensibilizate antigen lymphoid cells migrate to secondary lymphoid organs, including the spleen. Microenvironment of the spleen facilitates intercellular contacts and generate an immune response. The main events that occur in the spleen, are the induction of T-dependent B-cell immune response generation of B-lymphocyte that produce antibodies, and proliferation of CD8 + T-lymphocytes. All this time the lien is in a transient splenomegalic rate, which is proportional to the level of activation of the immune response. In addition, the spleen plays an important role as a filtering organ (on by hematogenous spread antigen) and organ destruction of erythrocytes and platelets. Immune reactions in the body, leading to significant morphological changes in spleen [19].

The relative weight and relative spleen cellness control group of rats was respectively 59±3.8 × 10⁻⁴ conditional units and 98±8.7 × 10⁶ conditional unit (fig. 2).

Putting animals multiprobiotic SYM did not significantly alter the relative weight of the spleen, which was 61±4.2 × 10⁻⁴ conditional units, and significantly increased relative cellness to 203±19.8 × 10⁶ conditional units (107%, p ≤ 0.05) compared with the control. Observed us strengthening of proliferation of lymphoid spleen cells may be associated with activation of microorganisms SYM not only cellular immunity, and humoral response to the phagocytic cells that presented antigens multiprobiotic.

28 daily inhibition of gastric secretion of hydrochloric acid OM in rats led to moderate splenomegaly: increased at under 73±5.5 × 10⁻⁴ conditional units (24%, p ≤ 0.05) and 148±12.7 × 10⁶ conditional units (51%, p ≤ 0.05) mass index and relative content of spleen lymphoid cells in this body as compared to control animals. This hypertrophic reaction of spleen, probably related, as with enhanced performance and phagocytic immune function, aimed at the elimination of foreign antigens during dysbiosis and to the performance of the tool «hemocateresis» the destruction of erythrocytes as a result of iron deficiency [15] and vitamin deficiency of B12 [18, 26] in rats with long hypoacidity of gastric juice.

Concomitant administration of OM multiprobiotic SYM did not significantly alter the relative weight of the spleen, which was 70±5.3 × 10⁻⁴ conditional units (p ≤ 0.05), compared with a group of long hypoacidity and a group of rats that received only SYM, and leave increased by 19% (p ≤ 0.05) this figure compared with the control. Relative spleen cellness in
the same group of rats which injected with OM SYM was 208±18,5 × 10^6 conditional units (p ≤ 0,05), which is 40% (p ≤ 0,05) more groups of animals that received only OM 112% (p ≤ 0,05) than the control group and not significantly different from the group of rats which was injected only SYM. The results may indicate a strengthening expansion of immune cells to the development of proliferative processes in the spleen as a result of immunomodulatory action SYM multiprobiotic the conditions hypoacidity of gastric juice in rats.

Fig 2. Cytomorphological state of rats spleen with long hypoacid state as the conditions of entry multiprobiotic (M ± n, n = 10).

* – P ≤ 0,05 compared to control;
# – P ≤ 0,05 compared with a group of animals which were administered omeprazole.

Conclusions. Long-term suppression of gastric secretion of hydrochloric acid leads to homeostatic alterations in the thymus and spleen of rats, that are likely related to the development of anemia, inflammation and dysbiosis in animals. Multiprobiotics SYM causes activation of proliferative processes in the studied lymphoid organs, which may be a manifestation of this immunomodulatory action involving various links of immunity to overcome the negative effects of prolonged hypoacidity of gastric juice in rats.

The obtained results give reason to consider that immunocompetent cells are involved in the immune response under conditions of hypoacidity of gastric juice. Elucidation of the mechanisms of immunomodulatory action of multiprobiotics «Symbiter® acidophilic»
concentrated facilitate its introduction into clinical practice of treating acid-associated diseases to overcome the negative effects of long-term reduction of gastric secretion of hydrochloric acid.

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INSTABILITY OF MICROSATELLITES IS A MATERIAL FOR FORMING MOLECULAR-BIOLOGICAL DIAGNOSTIC MARKERS

Relative saturation of genomes with any microsatellite sequences is the result of influence of many factors, which all in all determine composite, structural and thermodynamic features of genomic microsatellite sequences. Polymorphism of microsatellites can be identified by their morphological characteristics.

Intensive extension of microsatellite sequences due to replication errors is called microsatellite expansion. The ability of repeats to expansion depends on the length of microsatellite sequence. The relations between mutative events, leading to expansion of microsatellite sequences due to addition of a repeat, correlates with number of mutations, which lead to reduction of repeats in human microsatellites, as 10:4.

Polymorphism of microsatellites can be identified by their localization and orientation in genome. The secondary structure of DNA is currently viewed as the cause of expansion of microsatellite sequences. The secondary structure of DNA itself is the derivative of thermodynamic characteristics of its sequence.

The secondary bulge-type structures in microsatellite sequences, identified by their thermodynamic characteristics, can initiate the phenomenon of expansion of microsatellite repeats. Calculations of thermodynamic characteristics of replicable sequences allow developing number of model systems, evaluating the ability of microsatellite sequences to influence the DNA modifications, forming various secondary structures, related to phenomenon of expansion of microsatellite repeats.

Types of markers, obtained as a result of PCR, are divided into two groups on the basis of primers’ design: the first group is known as STSs (sequence-tagged sites) with primers, constructed from known sequences, and the second one is based on the random primers. The most informative or polymorphic STS-marker emerges during amplification of DNA-area, containing sequences of microsatellite repeats. This marker is based on STS, and is marked as simple-sequence length polymorphism (SSLP) or sequence-tagged microsatellite site (STMS). Each STMS-marker detects inherited codominant alleles in single locus of genome.

Key words: microsatellite sequences, microsatellite expansions, replication errors, microsatellite instability, PCR-based markers.
THE SPECIES FROM RED BOOK OF UKRAINE IN FLORA OF SURROUNDINGS OF POLTAVA CITY

The article is based on the field research the territory of surroundings of Poltava city, conducted by a detailed-route method during 2003-2015 in plant communities of the city area, as well as in forest cenoses of Rozsoshenske forestry and in meadow cenoses of suburban villages in the valleys of Vorskla and Kolomak rivers. It was carried out more than 30 expedition trips.

During the research in the flora of Poltava and its surroundings it was detected 9 species of vascular cryptogamous and angiosperm plants, included into the Red Book of Ukraine: *Salvinia natans* (L.) All., *Fritillaria meleagroides* Patrin ex Schult. et Schult. fil., *F. ruthenica* Wikstr., *Tulipa quercetorum* Klok. et Zoz, *Gladiolus tenuis* Bieb., *Epipactis helleborine* (L.) Crantz, *Orchis palustris* Jacq., *Pulsatilla nigricans* Störk, *Lathyrus venetus* (Mill.) Wohlf. It was described the state of populations and determined the concrete location of detected species. The herbarium specimens of rare plants were submitted to the Scientific Herbarium of the Chair of Botany, Ecology and Biology teaching methodology of Poltava V.G. Korolenko National Pedagogical University.

The literature sources with the floristic data for the study area, the main of which are the reports on flora by S.O. Illichevsky «Flora of outskirts of Poltava. With a complete list of wild vegetation» (1927) and by O.M. Bayrak «Synopsis of the flora of the Left bank of the Dnieper. Vascular plants» (1997), were analyzed. Despite the fact that in the last years there has been a tendency to reduce the number of specimens and quantity of habitats of many rare species of flora, in the vicinity of Poltava can still be found plant communities, involving these species. The necessity of carrying out rehabilitation measures to further conservation of detected rare species pointed.

**Key words**: Red Book species of flora, herbarium, protection, surroundings of Poltava city.