

RARE PLANTS OF ECOLOGICAL NETWORK IN CONNECTING AREAS OF VINNYTSIA REGION

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Встановлено, що раритетне фіторізноманіття регіону складають вищі судинні рослини, серед яких: 9 видів — занесені до Червоної книги України, 4 види — до Червоного списку Міжнародного союзу охорони природи, 7 видів — до Європейського Червоного списку, 3 види — до Конвенції про охорону дикої флори і фауни та природних середовищ їх існування в Європі і 8 видів — до Конвенції про міжнародну торгівлю видами дикої флори і фауни, що перебувають під загрозою зникнення.

Ключові слова: Червона книга України, сполучні території, рідкісні види, екомережа.

Today the development of national ecological network is a priority task in the environmental sphere. The main purpose of ecological network creation is extension of country space with natural landscapes and formation of territorial integrated system that would ensure preservation of natural ecosystems and species of plant and animal life and their populations. In view of the excessive vegetation cover in the transformed Vinnytsia region that belongs to the Right-Bank Forest Steppe zone, researches of flora in connecting areas of ecological network are especially important [1]. Connecting areas (ecological corridors) combine among themselves key areas, objects of natural reserve fund (NRF), thus providing species migration and exchange of genetic material. However, in the legislation is still not clearly defined a connection between objects of the NRF with structural elements of the ecological network and also regimes of economic activity on these areas are not established [2]. The Law of Ukraine «On the Red Book of Ukraine» is one of the main legislative acts defining the basic foundations of biodiversity conservation [3]. It defines the list of species which are endangered of population abundance decrease or even extinction. At the same time at the base of the main provisions of this law are approaches that slightly differ from approaches dedicated for species determining for inclusion to the Red List,

adopted by the International Union for Conservation of Nature (hereinafter — IUCN) and realized in most European countries. For comprehensive issues resolution of landscape and biological diversity preservation in the region the «Regional Programme of environmental protection and rational use of natural resources for 2013–2018» was adopted (session decision of the Vinnytsia Regional Council № 418 from 18.12.2012).

MATERIALS AND RESEARCH METHODS

Field researches of anthropogenically-transformed phytocoenoses of agrolandscapes in connecting areas of Vinnytsia region ecological network were conducted. For the researches we selected the following administrative districts of the region: Vinnytskyi, Tyvrivskyi, Zhmerynkyi and Mohyliv-Podilskyi districts. Selection of connecting areas meets the criteria for allocation of ecological network elements [1].

Researches were carried out in anthropogenically-transformed phytocoenoses of agrolandscapes (meadows, pastures, border zone of fields, forest belts) in connecting areas of ecological network in Vinnytsia region (Buzkyi, Dnistrovskyi, Rivskyi, Nemyiskyi, Liadivskyi ecological corridors), based on generally accepted methodology [4]. Identification of phytobiota species composition was conducted by expeditionary-routing method. We used the results of our own field studies, materials of herbarium fund of the M.G. Kholod-

ny Institute of Botany of NAS of Ukraine (KW). Plant names are given according to the nomenclature list of vascular plants of Ukraine (Mosyakin, Federonchuk, 1999) [5]. Cameral treatment of results were conducted using the computer program MS Excel.

RESULTS AND DISCUSSION

It is known that ecological corridors are strips of forest, meadow, steppe, wetland and shrubs along river valleys [7]. Connecting areas (ecological corridors) in Vinnytsia region have three levels: national – 3, regional – 6 and local – 7 (Table) [5–7].

The total number of types of higher vascular plants in Vinnytsia region amounts to 600 species, that representing 2.53% of the total species of Ukraine, and 346 species of which are subject for protection [9–14]. We also noticed 264 species of higher vascular plants (44% of the total amount in the region), from which rare phytodiversity amounts 31 species that are included to the Red Book of Ukraine (2009) – 9 species [14], IUCN Red List – 4 types [9], European Red List – 7 species [11], Convention for Protection of Wild Flora and fauna and natural environment of their existence in Europe (Bern, 1979) – 3 species [13], Convention about International Trade in Endangered Species of wild flora and fauna that are threatened by extinction (CITES, Washington, 1973) – 8 species [12].

During geo-botanical researches of environmental and anthropogenic-transformed vegetation of connecting areas we found rare, endemic and relict species and plant groupings that are included to the Red Book of Ukraine, Green Book of Ukraine, IUCN Red List, European Red List [8–13].

Buzkyi national meridional ecological corridor is located near the valley of the Southern Bug and its tributaries. It combines landscapes of Northern and Eastern Podillya and Dnieper sublimity. Within the region on ecological corridor is laid Galitsko-Slobozhanskyi latitudinal ecological corridor. The structure of land use is: 35.37% of area is occupied by forest, meadow and steppe, wetland vegetation, about 57.85% – arable lands and 6.8% – roads and human settlements [1].

Research results show that within ecological corridor such plant species registered in Red Book of Ukraine are increasing: *Chamaecytisus blockianus* (Pawl.) Klásk. (nanophanerophyte, mesoxerophyte, calcicole, rare endemic) found among shrubs on the slopes in valley of the Southern Bug River, the number of species was limited to 4 specimens per 1 m². The species is included to the European Red List and IUCN Red List. At the edge of the forest in the valley of the Southern Bug River near the city of Hnivan we found *Epipactis purpurata* Smith. – (polycarpic, geophytes, mesophyte, heliosciophyte, rare) – population density was 2–5 species per 1 m².

Investigated phytocoenosis of connecting areas in Vinnytsia region

Title of eco-corridor	Geographical location	Length, km	Width, km	Status in ecological network	Land area, ha
Buzkyi	Valley of the Southern Bug River	58	2–10	national	211232
Dnistrovskiyi	Valley of the Dnister River	166	2–6	national	66421
Rivskiyi	Valley of the Riv River	83	1.5–3.5	interregional	20753
Liadivskiyi	Valley of the Liadova River	88	1–3	local	35213
Nemyiskiyi	Valley of the Nemyia River	64	1–2	local	9618

Species is included to the Appendix II CITES (species that are under threat of extinction). In the meadows we observed *E. palustris* (L.) Crantz — (polycarpic, geophyte, mesophyte, heliosciophyte), populations are numerically small 1–3 specimens per 1 m². Species are also included to the IUCN Red List. Under the woodside and on floodplain hay meadows we found *Listera ovata* (L.) R.Br. — (hemipterophyte, geophyte, heliosciophyte, mesophyte) rare, the number of species does not exceed 3 specimens per 1 m². *Neotinea ustulata* (L.) R.M. Bateman — (polycarpic, geophyte, xeromesophyte, heliosciophyte), whose population density is low: from 1 to 4 specimens per 1 m², also grows here. Besides the Red Book of Ukraine it is also listed in Appendix II CITES. Among the regionally rare plant species on pastures around the village of Mohylivka we observed *Trifolium pannonicum* Jacq. — (polycarpic, hemipterophyte, geophyte, xeromesophyte) — species is distributed as separate localities, population density is high, from 11 to 25 specimens per 1 m², in slowly continuous flow waters of the Southern Bug River we found *Nuphar lutea* (L.) Smith (polycarpic, hydrophyte, heliophyte), whose population density is high [15]. In the meadows around the village of Selyshche occurs: *Poa versicolor* Besser (polycarpic, hemipterophyte, heliosciophyte, mesoxerophyte) with high population density — more than 30 specimens per 1 m², *Phlomis tuberosa* L. (polycarpic, geophyte, heliosciophyte, xeromesophyte) with an average population density up to 10 specimens per 1 m², *Salvia betonicaefolia* Etl. (polycarpic, hemipterophyte, sciophyte, xeromesophyte), whose population density is 8–12 specimens per 1 m².

In addition, we observed communities from the Green Book: associations of mixed oak forests (with bulb); association of hornbeam-oak forests, pilose-sedge.

Dniester National submeridional ecological corridor is located near the Dniester river valley. It combines elements of ecological network of Vinnytsia region with elements of ecological network of Khmelnytskyi region and the Republic of Moldova, and therefore

has an international significance. Within this ecological corridor Dniester-Murafske national natural nucleus is located and also Naddnistriansko-Bernashivskiy, Mohyliv-Podilskiy, Liadivskiy, partly Vendychansko-Serebriiskiy and Yampilskiy regional centers of biodiversity [5]. The vegetation is represented by meadows, steppe, rock-steppe and forest plantings. Within the ecological corridor we found such rare plants that are listed in the Red Book of Ukraine as *Staphylea pinnata* L. (phanerophyte, xeromesophyte, heliosciophyte) — we observed four specimens near the forest around the village Yaryshiv locally. At the edge of the forest sporadically occurs only one wild species of the genus *Lilium* - *Lilium martagon* L. (polycarpic, geophyte, heliosciophyte, mesoxerophyte) whose populations are not numerous, 5–9 specimens were found by separate localities. Given specimens suffer from significant anthropogenic influence through picking up flowers for bunch of flowers and digging up bulbs. In the meadows we found a rare relict species that is included to the Appendix I of the Bern Convention — *Dracocephalum austriacum* L. (monocarp, therophyte, heliosciophyte, mesoxerophyte) — numerically small populations of 8 specimens per 1 m². In the meadow-steppe slopes singly occurs endemic *Carlina cirsioides* Klokov. (one-year plant, therophyte, heliosciophyte, xeromesophyte) — a species included to the Red Book of Ukraine and European Red List. Among regionally rare species along field roads in small localities *Crataegus oxyacantha* L. (phanerophyte, sciophyte, xeromesophyte) occurs. It is revealed a group of associations of hazel oak forests from the Green Book of Ukraine.

Rivskiy regional ecological corridor is formed along the valley of the Riv river. The function of ecological corridor is performed between natural core of landscape of the Riv and the Southern Bug valleys, combining Bar and Zhmerynka regional centers of biodiversity among themselves and the Southern Bug submeridional national ecological corridor. Plant cover is represented by forest, meadow and wetland vegetation type. Some

part of lands of ecological corridor from the villages Tokarivka and Mohylivka which are located under human settlements, roads, arable lands amounts to 63.35%, meadow and meadow-wetland vegetation occupied about 13.23% of the area, forests — 18.3% and 5.12% of lands are under the water. As part of flora there are some species registered in the Red Book of Ukraine. On the edge of the forest around the village Brailiv *Neottia nidus-avis* (L.) Rich. (polycarpic, sciophyte, mesophyte, geophyte) with numerically small population of 5–7 specimens per 1 m² occurs, the species is included to the Appendix II of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), *Epipactis helleborine* (L.) Crantz (hemicryptophyte, mesophyte, sciophyte) whose population number is 3–5 specimens per 1 m², the species is included to the Appendix II of CITES. From regionally rare species on the edge of fields around the Mohylivka village we found: *Viola rupestris* F.W. Schmidt (polycarpic, hemicryptophyte, heliosciophyte, xeromesophyte) — population number of specimens is 5 per 1 m², in wet meadows in the Riv river valley occurs *Valeriana exaltata* L. (polycarpic, geophyte, heliosciophyte, hygrophyte) — with high density population, more than 17 specimens. Among relict species registered in the Green Book of Ukraine in low flow water of the Riv river we found such populations *Potamogeton natans* L. (polycarpic, hygrophyte, heliosciophyte) and *Nuphar lutea* (L.) Smith. (polycarpic, hygrophyte, helophyte) that needs special attention and protection.

Liadivskyi regional ecological corridor is formed along the Liadova river valley. This ecological corridor connects Murovanokurylovetskyi and Liadivskyi regional centers of biodiversity among themselves and with the national Dniester submeridional ecological corridor [5–6]. Plant cover is represented by forest, steppe and shrub vegetation. Among the rare species registered in the Red Book of Ukraine endemic *Chamaecytisus podolicus* (Błocki) Klask. (polycarpic, heliophyte, xerophyte, nanophanerophyte) occurs, numerically small populations were found in the

meadow-steppe slopes around Liadova village, the species is also included to the European Red List and IUCN Red List, on the edge of forests we observed *Aconitum besserianum* Andr. ex Trautv. (polycarpic, hemicryptophyte, heliosciophyte, xeromesophyte) with numerically small populations of 1–4 specimens per 1 m², the species is protected by the Convention on wild flora and fauna protection (Bern Convention), *Adonis vernalis* (L.) Spach. (polycarpic, hemicryptophyte, mesoxerophyte, cryptophyte) whose population number is 8–12 specimens per 1 m², the species is registered in the Appendix II of CITES. In the surroundings of the Liadova village on the edge of forest we found *Cephalanthera damasonium* (Mill.) Druse (polycarpic, hemicryptophyte, mesophyte, geophyte), whose population is represented by a small group of 8 specimens per 1 m², *Anacamptis coriophora* (L.) R.M. Bateman (polycarpic, hemicryptophyte, geophyte, mesophyte), that occurs in the meadows in small populations of 2–4 specimens per 1 m². It is registered in the Red Book of Ukraine and Appendix II CITES. It is also fixed the distribution of regionally rare species: *Sorbus torminalis* (L.) Crantz. (phanerophyte, heliosciophyte, mesophyte) and *Euonymus europaeus* L. (phanerophyte, sciophyte, mezophyte) found in the forest belts by separate specimens. In the surroundings of the Sloboda-Yaryshivska village on the line of forest we found *Anemone sylvestris* L. Druse (polycarpic, hemicryptophyte, scioheliophyte, xeromesophyte) with numerically small populations of 4–7 specimens per 1 m². *Stellaria holostea* L. (polycarpic, hemicryptophyte, heliosciophyte, mesoxerophyte) was marked on the edge of the forest around Yaryshiv village, populations are numerous, *Eryngium campestre* L. (polycarpic, hemicryptophyte, geophyte, xeromesophyte) was observed singly on pastures and along field roads with small localities, *Rosa rubrifolia* Vill. (phanerophyte, scioheliophyte, xeromesophyte) was noted by single bushes in the forest belts around Yaryshivka village [15]. In the meadows we marked *Trifolium rubens* L. (polycarpic, hemicryptophyte, xeromesophyte) and *Silene vulgaris* (L.) Moench

(polycarpic, hemicryptophyte, heliosciophyte, xeromesophyte) whose number of individuals in the population ranges from 4 to 8 specimens per 1 m².

Nemyiskyi local ecological corridor is formed by the valley of the Nemyia river. It is located on the edge of Mohyliv-Podylskiy biodiversity regional center. Vegetation is presented by meadow, meadow-steppe, forest and shrub vegetation. In the meadows around Nemyia village endemic species *Chamaecytisus blockianus* (Pawł.) Klásk. (nanophanerophyte, mesoxerophyte, calcicole, rare endemic) grows, whose population amount is 4–6 specimens per 1 m². It is registered in the European Red List. Here we also observed *Salvia cremenecensis* Bess. (polycarpic, hemicryptophyte, mesoxerophyte, facultative calciophil), a Podolskian rare endemic which number did not exceed 5 specimens per 1 m². On the outskirts of Mohyliv-Podylskiy in beechy and hornbeam forests, relict species *Scopolia carniolica* Jacq. (polycarpic, sciophyte, geophyte, mesophyte) grows whose population number does not exceed 5 specimens per 1 m². It is necessary to note that this is the only representative of the family *Staphyleaceae* in the natural flora of Ukraine, recorded to the Red Book of Ukraine. On the edge of forest we observed numerically small populations *Aconitum besserianum* Andr. ex Trautv, on the meadow-steppe slopes *Chamaecytisus albus* (Hacq.) Rothm. (nanophanerophyte, mesoxerophyte, chamephyte, scioheliophyte) occurs, that is numerically small population of 5–7 specimens per 1 m², and *Chamaecytisus podolicus* (Bloski) Klásková (phanerophyte, chamephyte, heliosciophyte, xeromesophyte),

its number was 10 specimens per 1 m². The species is included to the European Red List and IUCN Red List.

CONCLUSIONS

National ecological corridors (Buzskiy, Dniester), interregional (Rivskiy), local (Lia-dovskiy, Nemyiskyi) levels were investigated. It was established that in the vegetation cover significant amount of rare and endemic species are distributed. Rare phytodiversity of investigated ecological corridors of the region represent 31 species of higher vascular plants that are included to the Red Book of Ukraine (2009) – 9 species, Red List of International Union for Nature Conservation – 4 species, European Red List – 7 species, Convention for Protection of Wild Flora and fauna and natural environment of their existence in Europe (Bern, 1979) – 3 species, Convention about International Trade in Endangered Species of wild flora and fauna that are threatened by extinction (CITES, Washington, 1973) – 8 species. Investigated connecting territories occupy an important place in the structure of ecological network of the region, as they are characterized by landscape diversity, floral and coenotic wealth. From aforementioned it can be concluded that significant amount of higher vascular plants that grow in these areas need protection. Therefore, just development of ecological network would promote an increase of population abundance of plant species and availability of rare, endemic species would indicate on special value of investigated ecological corridors in the structure of region ecological network.

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