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Current status of the rare component of the urban flora of Kharkiv K.O.Zvyahintseva

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The article presents data on the current status of the rare component of the urban flora of Kharkiv and objects of the nature reserve fund (NRF). Within limits of the city, there are 15 objects and areas of the NRF, including 2 areas of national significance, 2 areas of local significance, and 11 botanical monuments of nature. It is established that rare vascular plants cover 14.4% of the entire floristic composition of the natural fraction of the urban flora and 6.1% of the flora of the city as a whole. 67 rare species of plants under protection have been identified: 17 of them are listed in the Red Book of Ukraine, 9 of them are listed in the Convention for International Trade with Endangered Species (CITES), 4 of them are listed in the Berne Convention; 65 of them are included in the regional list of the Kharkiv region. A phytocenotic analysis was conducted, and it has been established that the phytocenotic structure of the rare component of Kharkiv urban flora is represented by almost all the phytocenotic groups growing in the suburban zone of the city. The ecotopological differentiation of rare plant species within the territory of natural floristic complexes has been analyzed. Maps of distribution for all rare species of plants have been plotted. A substantiation of the object of the Novozhanove nature reserve fund has been provided.

Key words: *objects of nature reserve fund, urbanflora, rare species of plants, phytocenotic structure, ecotopes, maps of distribution, Kharkiv, Ukraine.*

Сучасний стан раритетної компоненти урбанофлори Харкова К.О.Звягінцева

У статті наведено дані щодо сучасного стану раритетної компоненти урбанофлори Харкова та об'єктів природно-заповідного фонду (ПЗФ). На території міста знаходяться 15 об'єктів і територій ПЗФ, зокрема 2 – загальнодержавного значення, 2 – місцевого і 11 ботанічних пам'яток природи. Встановлено, що рідкісні судинні рослини охоплюють 14,4% всього флористичного складу природної фракції урбанофлори та 6,1% від флори міста загалом. Виявлено 67 рідкісних видів рослин, що знаходяться під охороною: з них 17 занесені до Червоної книги України, 9 – до Конвенції CITES, 4 – Бернської Конвенції; 65 включені до регіонального списку Харківської області. Проведено фітоценотичний аналіз і з'ясовано, що фітоценотична структура раритетної компоненти урбанофлори Харкова представлена майже всіма фітоценотичними групами, що поширені в субурбанзоні міста. Проаналізовано екотопологічну диференціацію рідкісних видів рослин на території природно-флористичних комплексів. Для усіх рідкісних видів урбанофлори складені карти поширення. Подано обґрунтування об'єкту природно-заповідного фонду «Новожанове».

Ключові слова: *об'єкти природно-заповідного фонду, флора міста, рідкісні види рослин, фітоценотична структура, екотопи, карти поширення, Харків, Україна.*

Современное состояние раритетной компоненты урбанофлоры Харькова К.А.Звягинцева

В статье приведены данные о современном состоянии раритетной компоненты урбанофлоры Харькова и объектов природно-заповедного фонда (ПЗФ). На территории города находятся 15 объектов и территорий ПЗФ, в том числе 2 – общегосударственного значения, 2 – местного и 11 ботанических памятников природы. Установлено, что редкие сосудистые растения охватывают 14,4% всего флористического состава природной фракции урбанофлоры и 6,1% от флоры города в целом. Выявлено 67 редких видов растений, находящихся под охраной, 17 из них занесены в Красную книгу Украины, 9 – в Конвенцию CITES, 4 – в Бернскую Конвенцию; 65 включены в региональный список Харьковской области. Проведен фитоценотический анализ и установлено, что фитоценотическая структура раритетной компоненты урбанофлоры Харькова представлена почти всеми фитоценотическими группами, произрастающими в субурбанзоне города. Проанализирована экотопологическая дифференциация редких видов растений на территории природно-флористических

комплексов. Для всех редких видов растений урбанофлоры составлены карты распространения. Подано обоснование объекта природно-заповедного фонда «Новожаново».

Ключевые слова: *объекты природно-заповедного фонда, флора города, редкие виды растений, фитоценоотическая структура, экотопы, карты распространения, Харьков, Украина.*

Introduction

Under the conditions of enhanced human impact on the natural vegetation cover, the vital environmental challenge is to preserve species diversity and, in the first place, to ensure the protection of rare species (Gorelova, Alyokhin, 1999; Gorelova, Tveretynova, 1992), because populations of endemic, relict, boundary areal species of plants react in the most sensitive way to changing environmental conditions.

The protection of plants and plant communities in urban areas is particularly acute, but effective mechanisms are practically not developed and practical measures are ineffective.

Therefore, the actual problem to be addressed in urban areas is the application of a qualitatively new approach associated with the identification and development of effective measures to protect valuable biotypes with rare species of plants and plant communities.

These are urban ecosystems, through which a direct material and power contact between the city and adjacent natural ecosystems is effected (Golubets, 1994), and it shows itself not only in polluting surrounding areas with species of local and adventitious plants, but also in maintaining the continuity of existing populations of natural flora species, if they are properly protected within the city.

To ensure the proper existence of species populations and reduce their insularization, it is important to protect their fragments, including those within limits of the city. Their preservation within boundaries of the city reduces the gap between populations within territories with a transformed or destroyed cover. Thus, the city territory should be construed as a certain, moreover, very specific element of the ecological network (Protopopova, Shevera, 2004).

Many publications, including publications by national scientists (Drulyova et al., 2014; Klimov et al., 2005; Scholl, 2004; Tokaryuk, Chornei, 2003; Zhalnyn, Gorelova, 1999; Zvyagintseva, 2012 etc.) are dedicated to various aspects of studying rare species in the urban flora.

The number and composition of rare species of a certain area under study allow determining its conservation status. Rare vascular plants that are under protection within the territory of Kharkiv cover 14.4% of the floristic composition of the natural faction of the urban flora and 6.1% of the city flora as a whole. Within the territory under study, 67 species that require protection are found: 17 of them are listed in the Red Book of Ukraine (RBU, 2009), 9 of them are listed in the Convention for International Trade with Endangered Species (CITES) (Convention on International...), 4 of them are listed in the Berne Convention (Convention on the Conservation..., 1979); 65 species are included in the regional list of the Kharkiv region (Gorelova, Alyokhin, 1999; Klimov et al., 2008; Official lists..., 2012).

At present, there are 67 rare species of the urban flora of Kharkiv, most of them (35) are populations of insignificant numerical strength that are critically endangered; 27 species are known from several localities that are distributed sporadically, the magnitude of their populations is decreasing. Other plant species form more or less stable numerous populations. Most of these species are observed at objects of the NRF of various statuses.

Materials and methods

The object of the special study is the rare component of the urban flora of Kharkiv. Field studies were conducted from 2009 to 2014 within the administrative boundaries of the city. Route-reconnaissance, detailed route and semi-stationary methods that covered all zones and ecotopes were used. When studying the flora, generally accepted methods of floristic analysis were used. The zoological characteristic of species is represented in accordance with the Red Book of Ukraine and Official lists of regional rare plants of administrative territories of Ukraine (2012). The ecocenic characteristic of species of the rare faction of the urban flora under study was based on the environmental scale of Ya.P.Didukh (2003) and methodological approaches of O.L.Byelhard (1954); depending on the degree of urbanization, the classification principle by R.Wittig (1985) was used.

To map rare plants of the urban flora, a cartographic basis of Kharkiv (Zvyagintseva, Sinna, 2012) was developed using the ArcGIS 9.3 software (Fig. 1). Basic GIS data layers that form the base map were created. These layers include components of general geographic information of the map: limit, rivers, reservoirs, railways of the city. This stage also included the formation of the layer of functional

zoning of the territory (with the detachment of zones: green belt and park belt, developed areas: single- and multi-storey buildings, industrial areas, ruderal ecotopes, wasteland) that is one of the determinant factors for studying the urban flora.

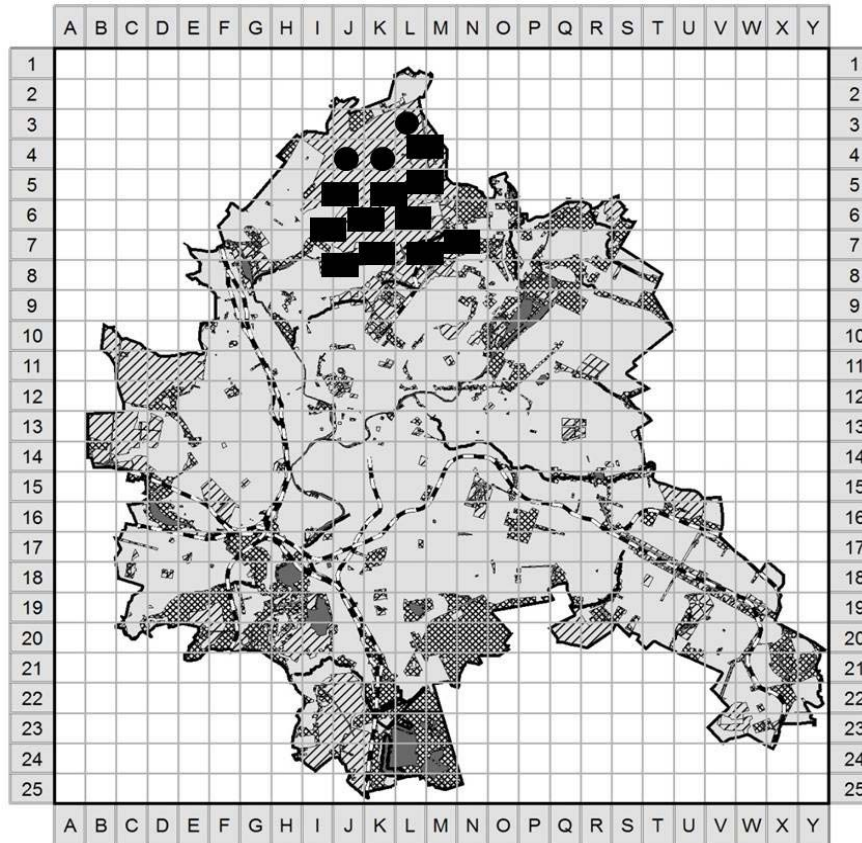


Fig. 1. Maps of distribution of rare plants in the city of Kharkiv: ● *Allium ursinum* L., ■ *Tulipa quercetorum* Klokov ex Zoz

Distribution of rare plants of Kharkiv growing on the territory of natural floral complexes of the city (Zvyagintseva, 2015) that are characterized by certain natural conditions, history of formation and nature of use were analyzed as the result of the study.

Results and discussion

The territory of Kharkiv is 31000 ha, including over 20 thousand hectares of the developed land. The total area of woodlands and green areas of the city is about 15 thousand hectares that include 26 parks, 7 gardens, 193 public gardens, 35 parkways, 4 quays, 4 meadow and hydro parks, 3 groves, and 1 forest park. In the city, there are 15 objects and areas of the NRF (Fig. 2), including 2 objects of national significance, 2 objects of local significance and 11 botanical monuments of nature (Klimov et al., 2005). Among the NRF objects of national significance, there are the Kharkiv Zoo and Botanical Garden of V.N.Karazin Kharkiv National University (6); objects of local significance – the Hryhorivskiy Bir forest reserve (4), the Saltivskiy hydrological reserve (5). As far as botanical monuments of nature concerned, they are presented mostly by remains of the indigenous upland oak forest that is generally spread in the central part of the city – T.H.Shevchenko Garden, Pomirky (1), the Scientists' Club House, the Babushkin Oak, Pushkinska street, Chornohlazivski oaks.

The greatest number of species listed in the RBU is concentrated in the Sokolniki–Pomirky forest reserve (2) (163.1 ha) that is a part of the forest park management and is characterized by the typical forest of southern forest-steppe: dry and fresh maple-lime groves. In particular, *Allium ursinum*, *Gladiolus imbricatus* L., *Tulipa quercetorum*, *Dracosephalum ruyschiana* L., *Anemone sylvestris* L., *Actaea*

spicata L., *Ficaria calthifolia* Reichenb., *Dentaria bulbifera* L., *D. quinquefolia* M. Bieb., *Primula veris* L., *Vincetoxicum scandens* Sommier ex Levier, *Melampyrum argyrocomum* Fisch. ex Koso-Pol. etc. were found here.

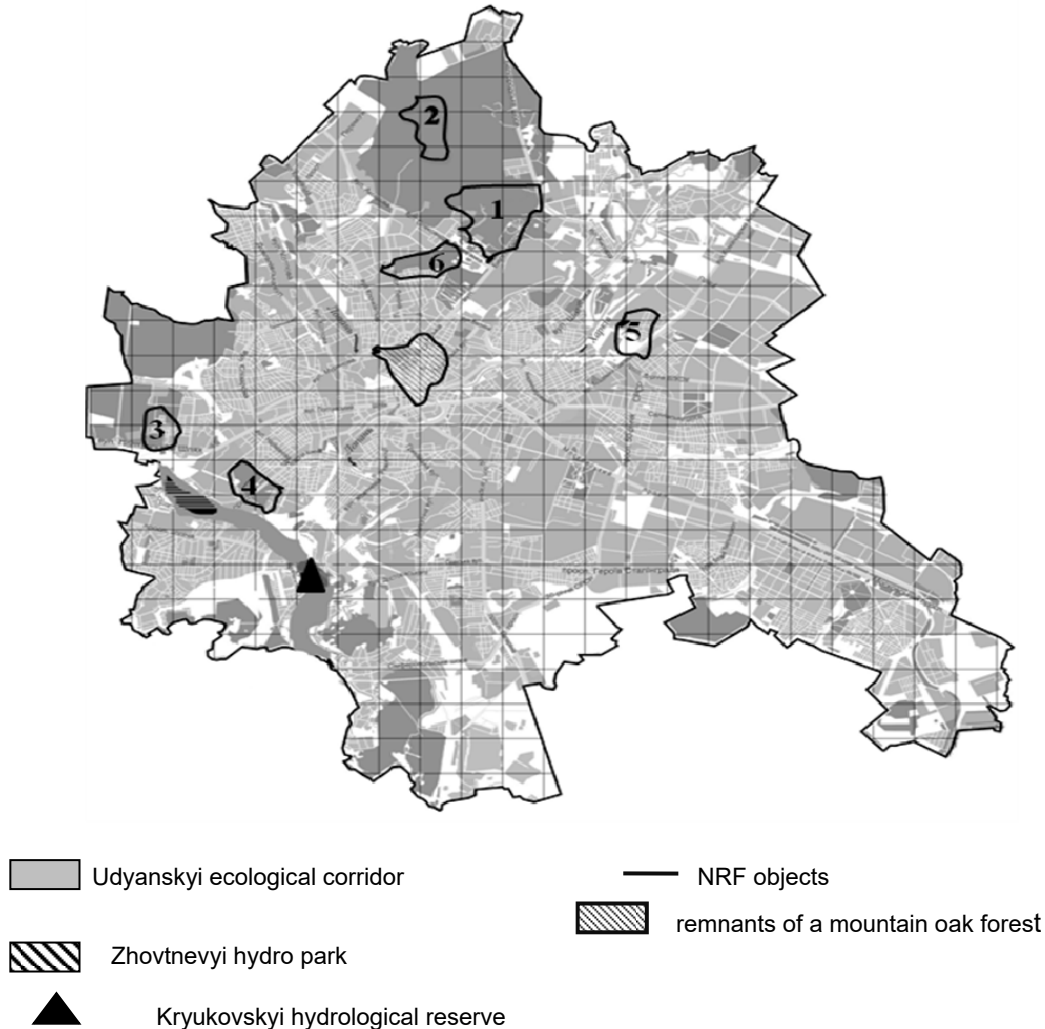


Fig. 2. The nature-protected objects of Kharkiv

The Hryhorivskiy Bir forest reserve of artificial origin (76 ha) is located in the Zhovtnevyi district of the city. Plants of the pine forest aged more than 80 years are surrounded by residential neighborhoods and located on terrace of the Udy river valley. The following plants are protected at the national and regional levels: *Pulsatilla pratensis* (L.) Mill., *P. patens* (L.) Mill., *Clematis integrifolia* L., *Veronica incana* L., *Spiraea crenata* L. etc.

In floodplains of the Udy river (the Zalyutynska botanical nature monument of local significance **(3)**, 3 hectares) and the Kharkiv river (the Saltivskiy hydrological reserve **(5)**, 11.5 hectares), fragments of meadow and wetland plant communities, where rare species that are listed in the RBU grow, remained preserved: *Botrychium lunaria* (L.) Sw., *Epipactis palustris* (L.) Grantz, *E. helleborine* (L.) Grantz, *Dactylorhiza incarnata* (L.) Soó, *D. maculate* (L.) Soó, *Anacamptis palustris* (Jacq.) R.M. Bateman, Pridgeon & M.W. Chase, *A. coriophora* (L.) R.M. Bateman, Pridgeon & M.W. Chase, *Orchis militaris* L., *O. purpurea* Huds., *Salvinia natans* (L.) All., as well as species included in the regional list of the Kharkiv oblast – *Clematis recta* L., *Bistorta officinalis* Delarbre, *Parnassia palustris* L., *Thelypteris palustris* Schott., *Hottonia palustris* L., *Pedicularis palustris* L., *Centaureum erythraea* Rafn., *C. pulchellum* (Sw.) Druce, *Potentilla palustris* (L.) Scop., *Geum rivale* L. etc.

The steppe vegetation cover is presented on the steppe slopes in the territory of the village of Rohan, where species listed in the RBU – *Paeonia tenuifolia* L., *Stipa capillata* L., *S. lessingiana* Trin. ex Rupr., regionally rare species – *Ranunculus illyricus* L., *Allium flavescens* Besser, *Linaria genistifolia* (L.) Mill., *Trinia multicaulis* (Poir.) Schischk can be observed. In addition, there is *Tragopogon ucrainicus* Artemz that is included in the European Red List and listed in the Red Book of Ukraine. *Salvinia natans* (L.) All., *Pulsatilla patens*, *Thesium ebracteatum* Hayne, *Dracocephalum ruyschiana* are protected by the Berne Convention. In 2013, the Convention on International Trade in Endangered Species of Wild Fauna and Flora was adopted. The rare species of Kharkiv urban flora that fall under its effect include representatives of Orchidiaceae family that, within the limits of the city, are located at objects of the natural reserve fund (the Zalyutynska botanical monument of nature of local significance, the Saltivskiy hydrological reserve) and have the status of the species listed in the RBU. In addition, rare plant communities – *Stipeta capillatae*, *Stipeta lessingianae* – were registered in this steppe area.

The participation of various biotope types of the natural reserve fund of the city was analyzed. The study established the prevalence of forest ecotope types (26.9%). That means that most of rare species are spread in natural and semi-natural ecotopes that corresponds to ecotope differentiation of the urban flora. Other representatives of the rare faction of the city flora are divided into the following groups: pratants (14.9%), stepants (11.9%), paludants (8.9%), marginants (7.5%), hydrophytes (4.5%), halofants (1.5%). So, the rare component of the urban flora of Kharkiv is represented by almost all the phytocenotic groups that are spread in the suburban zone of the city.

The local scheme of the ecological network of the city (Klimov et al., 2008) consisting of land plots of the Udyanskyi ecological corridor is of great importance as a factor of environmental protection. The total area of the ecological network within limits of Kharkov is 500 ha. The ecological corridor runs along the valley of the Udy river, and it includes two significant areas: the Zhovtnevyi hydro park (wetland) and the Kryukovskiy hydrological reserve of local significance. The Udyanskyi ecological corridor plays an important role in preserving the natural landscapes in their natural state, and it is also a rich ornithological complex of the region.

The wetland of the Zhovtnevyi hydro park (90 hectares) is located at Poltavskiy Shlyakh street. It was formed as a result of the expansion of the channel in the Udy river floodplain on the right sloping bank as a recreational park. This NRF object is one of the most important territories of the Udyanskyi ecological corridor, where the relict species community of *Nupharetta luteae* listed in the Green Book of Ukraine was registered. In particular, it is a large ornithological complex with rare species of birds.

Another important territory within the Udyanskyi ecological corridor is the Kryukovskiy hydrological reserve of local significance (39.3 hectares) located at Kryukovska Street. This is the widest part of the Udy river valley within limits of the city with a rich phytocenotic and faunal diversity. In the reserve, floodplain alder and willow forests, wetlands and floodplain real meadows, semi-aquatic vegetation with rare plant communities with *Nupharetta luteae* remained preserved.

During the study, we found a valuable ground plot in the shape of a triangle that is located to the south of the Novoselivka station and limited by motor and rail roads and the Lopan river. This plot of land is particularly vulnerable, as it is located near Novozhanove, a major rail and sorting hub. 13 rare plant species listed in the RBU that are subject to the Convention for International Trade with Endangered Species (CITES) and formations of Prata genuine of *Festuceta pratensis* class grow there. In addition, it is the only and reliably proved habitat of *Botrychium lunaria* and *Ophioglossum vulgatum* in Kharkiv oblast. A justification for creating a new object of the natural reserve fund – the Novozhanove botanical reserve of local significance (30.48 hectares) was provided. Materials were submitted to the Department of Environment and Natural Resources of the Kharkiv oblast.

In recent years, attention is paid to the protection of loci classici, from where new for science plant species that are regulated by a number of international legal environmental regulations – the Convention on Biological Diversity, Global Strategy for Plant Conservation, Law of Ukraine On Nature Reserve Fund of Ukraine, etc. were described (Grechyshkina, 2010). Three new for science species *Pulsatilla pratensis*, *Capsella orientalis* Klokov., *Euphorbia kaleniczenkoi* Czern., loci classici of which did not survive till present, from the territory of Kharkov were described.

Conclusion

The rare species of the urban flora of Kharkiv are mainly preserved in nature reserves and natural monuments of local significance in the suburban zone. Therefore, the most important task is to preserve the rare components in the urbanized environment, and we believe that is necessary:

1. To conduct regularly an inventory and monitoring of areas that are valuable in terms of flora with rare species with identification of vegetation plots location and its presenting on the map.
2. To strengthen the legislative component on protecting rare species, in particular, to reserve objects and prepare the justification.
3. To establish and implement continuous monitoring observation over the status of rare species populations.

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