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"SYNANTHROPIZATION OF FLORA AND VEGETATION"

BOOK OF ABSTRACTS

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Dear Colleagues,
Participants of the XII International Conference!

It has been four years since the last Conference in Poznan. During this time, interesting and original scientific material for discussion has been accumulated. Botanists and ecologists from Hungary, Slovakia, Poland and Ukraine participate in these forums traditionally, and Belarus at first. We are glad to meet you, as well as our regular participants of the Conference of this cycle and our new colleagues. The XII International Conference "Synanthropization of Flora and Vegetation", held in Ukraine for the third time, is evidence of the continuous and ever-growing interest to this scientific topic. The problems of anthropization of the flora and vegetation have become important issues in global conservational concerns, in forming the immediate environment of humans. It is therefore time to unite and strengthen our efforts.

Members of the Organizing Committee are happy to welcome all participants and guests of the Conference in the beautiful and hospitable land of Transcarpathia, Silver Land. We are grateful to all participants for your interest to the Conference and, of course, to all institutions and individuals who supported our forum. Our special thanks to"RENER" Group of Energy Companies for support of publication of this Book of Abstracts. We wish you a very productive work, interesting and fascinating discussions, meetings with old friends, new scientific and personal contacts, unforgettable impressions of field trips and the charming nature of Transcarpathia.

Organizing Committee

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XII International Conference "Synanthropization of Flora and Vegetation"
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THE MAIN STAGES AND RESEARCH TRENDS OF INVESTIGATION OF ALIEN SPECIES IN THE FLORA OF UKRAINE

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The investigation of the flora of Ukraine, in particular it's alien fraction has a long (more than 200 years) history in which we distinguish three main stages. Analyzing them, we focus our attention on the most informative sources.

The First Stage (the second half of the 19th century). The first records about alien plant species appeared in floristic editions from the territory of Ukraine after 1850. For example, we find them in works of P. Rogowich (1855; 1869), V. Czerniajew (1859), V. Montresor (1881, 1898), I. Schmalhausen (1886, 1895–1897), J. Paczoskiy (1897, 1899, 1900) etc. In the first records about some species we discovered its native range, and sometimes, facts of intensive distribution of them, for example, *Amaranthus albus* L. (Paczoskiy, 1897). This trend is actively developing and diversifying now.

The Second Stage (the first half of the 20th century). It's related with the works of V. Taliiev, such as "Flora of Crimea and the human's role in its development" (1900, in russian) and "Human as a botanical and geographical factor" (1902, in rus.), which consists of a discussion about the reasons of the distribution of alien plant species. At any later dates M. Kotov was a follower of this trend, and he actively developed this research (1921, 1923, 1927, 1965, 1979). In some other investigations, new cases of introduction of alien plants, caused by human activity, were recorded.

The Third Stage (the second half of the 20th and the first half of 21st century). For the first time the results of the investigation of the alien fraction of the flora of some large botanical and geographical zones of Ukraine, among them Forest Steppe and Steppe (Protopopova, 1965; 1966, 1973), Crimea (Kozhevnikova, 1970; Rubtsov, Kozhevnikova, 1971) have been summarized. At later the synanthropic and alien fractions of Ukrainian flora have been identified and studied comprehensively. A brief compendium of the species from these groups has been prepared according to results of these investigations. It consists of 646 alien plant species and 479 apophytes. The regional and fractional features, development trends, the regularities of the modernization of the flora, zonal-regional division of its autochthonous (apophytic fraction) and allochthonic (alien fraction) elements have been revealed. That adventization causes the interruption of structural and functional relationships in ecosystems has been proved also. The historical course of phytoinvasions and their connection with anthropogenic transformations of nature have also been reconstructed and some theoretical questions of the adaptation of species of non-indigenous plants are presented by V. Protopopova (1991, in rus.).

One of the interesting trends of the investigation of the alien fraction of the flora of Ukraine is the research of anthropogenic transformation of ecosystems, first of all, its phytodiversity. For the

first time, the reasoning of such a research trend as an analysis of composition and structure of flora for a directed transformation of plant cover is proposed. Also, the method of flora-isolates (an elementary territorial unit of anthropogenic flora) is introduced. The first typologies of transformed flora and macroecotops of partsial flora for the role in florogenesis have been developed. The functional role of various types of anthropogenic flora in reproduction and preservation of plant cover is substantiated. A significant role of phytoinvasions in the processes of transformation of modern flora has been proved. These problems are most covered by an example of the structure, genesis, transformation and development of measures for the conservation of the flora of the South-Eastern Ukraine (Kondratyuk et al., 1980; Burda, 1991, in rus.).

At the last time (at the end of 20th and at the beginning of the 21st century) research of the alien fractions of regional flora is considerably intensified (Kotov, 1979; Burda, 1982, 1988; Oitsius, 2011; Shynder, 2012; Bagrikova, 2013; Dvirna, 2015; Kucher, 2017). In particular, the urban flora and its dynamics with the characteristics of the alien component are studied (Burda, 1997; Moysiyenko, 1999; Melnyk, 2001; Mosyakin, Yavorska, 2002; Protopopova, Shevera, 2002, 2003; Kucherevsky, Shole, 2003, 2009; Kagalo et al., 2004; Gubar, 2006; Arkushina, 2007; Iepikhin, 2008; Zavialova, 2010, 2012; Zvyagintseva, 2015a, b, Gutsman, 2013; Khlystun, 2006; Melnyk, 2009; Baranovsky et al., 2012; Karmyzova, 2016, etc.). The period is characterized by the transition to an analysis of comparisons of the floristic composition of the aboriginal and alien fractions of protected areas of Ukraine (Burda, 1985; Dubyna, Protopopova, 1985; Kondratyuk et al., 1987, etc.), agricultural communities (Burda, 2001-2003, 2005). However, the energy load of weed populations in agrotypes of grain crops is established (Burda, Mohylnyk, 2003), phytodiversity of the human-made ecotops (Kondratyuk et al., 1980; Glukhov et al., 2012), in particular, railways (Burda, Tokhtar, 1992; Tokhtar, 1993, 2005; Petryk, 1993). The information about active distribution of aboriginal species from specific settlements to the human-made habitats has been published. For example, some cases of spontaneous distribution of species of the genus *Gypsophila* L. from seaside saline sands to coal mines and industrial sites of metallurgical factories, known in the cities of Donbas (Kharkhota, Dmytrenko, 1977) etc. The research of the alien species populations were initiated (Mariyushkina, 1986; Burda et al., 1998; Panchenko, 2005), which are continuing (Burda, 2012; Golivets, 2014, etc.)

Ukrainian scientists also develop some theoretical and methodological problems (Burda, 1991; Burda, Ignatyuk, 2011; Burda et al., 2015; Protopopova, 1991).

The middle of the 1990s was marked by a significant increase in the possibilities of direct informational and scientific exchange and general technological progress. From this, significant qualitative and quantitative changes began. The total scope of publications is growing significantly. The spectrum of research of the group of invasive alien species is expanding and an adaptation of existing modern terminology and classifications of approaches is taking place. At this time generalization of accumulated factual data and their rethinking, etc. were carried out. Currently, the main attention is paid to the study of the peculiarities of the process of alien flora of some regions and the specification of the negative effects of its impact on aboriginal species, communities, biotopes and ecosystems (Protopopova et al., 2009; Protopopova, Fedoronchuk, Shevera, 2012; Fitsailo, Pashkevych, 2013; Burda et al., 2015). The features of the expansion of some alien plant species are analyzed (Protopopova et al., 2002; 2003; Burda, Ignatyuk, 2012; Burda, 2012; 2014). The composition of alien species in the flora of Ukraine is established (830 taxa) (Protopopova, Mosyakin, Shevera, 2002, 2003). The tolerance of the flora of protected areas to the invasion of alien species is studied (Burda, 2006). The investigation of them in this flora is continuing (Burda et al., 2014; Petrovich et al., 2014; Zavialova, 2012, 2017, 2018; Pashkevych, Burda, 2017). EcoNET (Protopopova, Shevera, 2008) research was start. The current conditional background pollution of the forest-steppe flora is determined, which is 16% (Burda et al., 2015). The role of alien species in the formation of agrophytocenoses (Burda, Prydatko, 2005; Burda, 2013, 2018; Burda, 2017) and their segetal potential (Burda, 2003) have been determined. The participation of species of alien plants in the formation of plant cover of human-made settlements has been revealed (Tochtar, 2002, 2003).

The main trend of research becomes the assessment of the impact of foreign, in particular, invasive and potentially invasive species, including transformers (Protopopova et al., 2009; 2010; 2012; 2014; 2015; Prots, Drescher, 2010; Vykhor, Prots, 2012; 2014; Prots, 2013; Simpson, Prots, 2013; Vykhor, 2015; Kucher, 2015; Dvirna, 2017, etc.), by determing the amount or volume of economic loss that they cause (Protopopova et al., 2002; Grygorak et al., 2004). Issues of evolution in vascular plants invasions (Burda, 2015), dual implications of plant introduction into Ukraine as "a grand experiment on plant cover improvement" (Burda, 2013), etc. are discussed. In this case, the species composition of ergasiophytes (458), which constitute a significant proportion of the alien fraction of the flora of Ukraine have been established and investigated (Protopopova, Shevera, 2014; Burda, 2017). In order to organize the activities of botanical gardens and arboretums within their territories, in part of the control of invasions of alien species for the preservation of ecosystems free from the negative impact of the inhabitants, the Council of Botanical Gardens and Arboretums of Ukraine has adopted the Code of Conduct of Botanic Gardens and Arboretums of Ukraine on Invasive Alien Species (Burda et al., 2014). Along with other aspects of research of this stage, the issues of the nomenclature (Mosyakin, 1996; Mosyakin, Robertson, 2003; Burda et al., 2004; Mosyakin S., 2008, 2012, 2018; Mosyakin, Clemants, 2008; Mosyakin A., 2008; Goncharenko, 2011) and terminology (Mosyakin, 1998; Protopopova, Shevera, 2005; Burda et al., 2015) are considered. Recently, the search for botanists focused on the assessment of the adaptive capacity of individual invasive species in the context of global climate change (Protopopova, Shevera, 2007; Mosyakin A., Kazarinova, 2014; Didukh et al., 2016; Mosyakin A., 2016; Shevera et al., 2016).

Taking into account the current world trends of research of alien species, in particular, connected with the prevention of their entry and distribution, our scientists have compiled black lists, which included the most dangerous alien species for the Protected Areas (Zavialova, 2016, 2017) and for the whole of Ukraine (Protopopova, Shevera, 2018). Alien species have been classified according to priority; priority species are controlled, or their distribution is restrained, in some cases (for example, quarantine organisms) – destroyed.

Along with the scientific provision of research, a working version of the National Strategy for the Control of Non-Native Plants in Ukraine has been developed (Protopopova, Mosyakin, Shevera, 2002, 2003). At the same time, additions to the current legislative acts and laws of Ukraine "On Plant Quarantine", "On Plant World", "On the Red Book of Ukraine", "On the Nature Reserve Fund" in parts related to non-native plant species (Protopopova, Mosyakin, Shevera, 2003), but not all of these proposals are implemented. However, the first official regional list of invasive species in Transcarpathia (Shevera et al., 2017) was recently adopted in Ukraine. An important role of Ukrainian botanists are dedicated to promoting Ukraine's global and European policies on invasive alien species and the prospects for its consolidation at the legislative level (Mosyakin, 2006; Burda, 2013, 2014; Ivashchenko, Burda, 2014).

Summarizing the analysis of the publications included in the "Bibliography ... " (Burda et al., 2013–2016; 2018), we have identified the following main trends in the research of the species of the alien faction of the flora of Ukraine, as floristics (regional and local) – 719 works; chorology (new records of some species as supplementation of information about their secondary range) – 139; biology (mainly weeds) – 117; ecology – 79; control over distribution (control measures) – 75; taxonomy – 28; phytosociology – 3; research of alien plants populations – 17; general problems – 14; informational messages (chronicles, reviews, short messages) – 9; molecular genetic studies – 2; economic evaluation – 2, paleobotany – 1, education – 1. To the second part (Related) we included works (in general 356 publications), in which the types of alien plants were not the main object of research (but contain some important information about them), devoted to the study of the spontaneous flora or vegetation of certain territories and objects, taxonomy or species resources, introduction or afforestation, etc.

Problems of alien plants, as well as biological migration in general, remain at the center of attention of the Ukrainian public, are discussed at the congresses of the Ukrainian Botanical Society, numerous scientific conferences. With the aim of highlighting the problems associated with

invasive alien species at the regional and local levels, Ukrainian botanists initiated and held in the year 2006 and 2012 target all-Ukrainian scientific conferences “Synanthropization of the Plant Cover of Ukraine” (Burda et al., 2013). In “Bibliography ...” most works are devoted to various aspects of the study of species of genera *Ambrosia* sp. div. (mainly *A. artemisiifolia* L.) – 32, *Impatiens* sp. div. – 18, *Heracleum* sp. div. – 17, *Solidago* sp. div.– 16, *Oenothera* sp. div. – 14, *Phalacroloma* sp. div. – 13, *Amaranthus* sp. div. – 11, *Asclepias syriaca* – 10, etc.

Such as, the presented spectra only testify to the complexity and versatility of research, which already covered the most important directions of studying the problem of plant invasions in Ukraine. In future, along with the development of the main perspective aspects of the study (floristics, biology, chorology), which give the basic material for making a scientific base, researchers should pay more attention to the study of ecology, taxonomy, participation in biotopes, population characteristics of alien species, reconstruction of migration routes, the results of which can highlight the peculiarities of the formation and role of adaptive possibilities of alien species.

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THE PECULARITY OF ZONAL AND REGIONAL DISTRIBUTION OF THE GROUP OF SPECIES WITH HIGH INVASIVE ABILITY IN UKRAINE

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The group of alien plant species with high invasive potential of the Ukrainian flora was selected and investigated (64). As a result of this research was found that in this group are predominate: kenophytes by the immigration time; Mediterranean species by the origin, ergasiophytes by the introduction way, the species which belongs to the family *Asteraceae* by the taxonomic structure, therophytes by the life forms, xeromesophytes by the hygromorphes spectra and the meadow plants by the phytocenotic association.

The distribution of the investigated alien species group was estimated at zone-regional level. As a study result we found:

1) the most alien species are represented in almost all regions;

2) the species composition in the regions is characterized by low specificity, except the Crimea;

3) the number of alien species decreases in the latitudinal direction: in the Forest zone of Ukraine – 60 sp., Forest-Steppe – 56, Steppe – 50, in the Crimea – 43;

4) the agriophytes demonstrated a similar tendency of distribution;

5) naturalization degree of most species decreases in a southeast direction.

By methods of mathematical statistics (cluster analysis, correspondence analysis, different metrics of similarity coefficients) and software Statistica vers. 8.0, Microsoft Excel the comparative analysis of the species composition of the investigated group on the main characteristics was carried out and the specificity of saturation with their species of various origin was established.

Dendrogram by method of complete linkage and distance *sum* demonstrated two clusters which formed by species of this group: first cluster included species which common for regions of forest and forest-steppe zones, second cluster unites species common for steppe and the Crimea. Diagram by correspondence analysis confirmed this distribution and specificity of the species composition of this group in Crimea fully. It was established that vast majority species of this group originated from the American continent and Mediterranean region. However, by saturation / presence in all botanical and geographical regions of Ukraine the species of American origin (predominantly North American) are prevalent predominantly.

These results demonstrated the high tolerance of alien plant species with high invasive ability to the natural and climatic conditions of different zones of Ukraine.

FEATURES OF THE FLOODPLAIN TERRACES VEGETATION COVER OF THE PIDZAMKOVYI PARK IN UZHHOROD

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The studies of urban flora of Uzhhorod started in the middle of the XIX century. According to preliminary estimates (Protopopova, Shevera, 2002), the urban flora of vascular plants of the town consists of about 800 species, of which 460 are attributed to the synanthropic fraction. An important step in the continuation of these studies is the detailed study of the particular territories (micro regions) and biotopes of the town and their monitoring.

142 species that belong to 46 families and 110 genera were identified in the flora of the investigated area. The structure of the alien fraction by the degree of naturalization is as follows. The most numerous by species are epoecophytes – 25 species, comprising 19% of the total species number and 51.96% of the number of alien species. The ergasiophytes of the town are on second place – 18 species, i.e., 12,68% and 34,62%, respectively. The smallest group is agriophytes – 9 species (4,93% and 13,47%, respectively).

The apophytic fraction is represented by 88 species, comprising 61,98% of the total species; the alien fraction includes 52 species, 48% of the total. The nucleus of the apophytic fraction consists of plant species that are actively distributed in anthropogenic ecotope, but, at the same time, retain a solid position in the local flora. The ratio of evapophytes, hemiapophytes and unstable apophytes is 1:2,58:1,06, respectively. The ratio of these groups in the synanthropic flora of Ukraine is 1,11:1,27:1, respectively.

There is no significant difference in the taxonomic composition of apophytic and alien fractions of synanthropic flora.

By the nature of geographical distribution, the Eurasian species (19,7%), cosmopolites and hemi-cosmopolites (19,01%), European (14,08%) and Holarctic (13,38%) species predominate. Among life forms the herbaceous plants are dominant (82% of the total number of species). The basis of the flora consists of herbaceous polycarpics (53%). The group of annuals is on the second place (19%).

Long-term observation of the territory indicates the fluctuative nature of many species (*Datura stramonium* L., *Knautia arvensis* (L.) Coult, *Acinos arvensis* (Lam.) Dandy, *Consolida regalis* S. F. Gray), as well as the persistent trend for xerophytization of all types of groups on the territory and the gradual reduction of the number and gradual lost of the perennial hygro- and mesohygrophytic species (*Bidens tripartita* L., *Lycopus europaeus* L., *Mentha longifolia* (L.) Huds., *Impatiens grandulifera* Royle, *Polygonum persicaria* L.).

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ECTOMYCORRHIZAL FUNGAL COMMUNITIES ASSOCIATED WITH *BETULA PENDULA* ROTH. AND *PINUS SYLVESTRIS* L. IN HEAVY METAL CONTAMINATED SITES

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Areas transformed by the metallurgical industry constitute a harsh conditions for plant growth and soil biotadue to the presence of high levels of heavy metals in the soil.There are two pioneer tree species silver birch (*Betula pendula* L.) and Scots pine (*Pinus sylvestris* L.)that either appear spontaneously or are introduced intentionally during reclamation works of such devastated areas in Poland. Among different factors facilitating the growth of those trees in contaminated soils, there are ectomycorrhizal fungal (EMF) symbionts adapted to elevated concentrations to heavy metals.

The aim of studies was to determine the community composition of EMFassociated with *P. sylvestris* and *B. pendula* from heavily polluted areas around zinc-lead smelters in Southern Poland and non-contaminated sites. We hypothesized that heavy metal contamination had influence on community structure of EMF colonizing fine roots of birch and pine differently.

We identified a total of 65 ectomycorrhizal OTUs, of which 64 were associated with silver birch and 54 with Scots pine. Ectomycorrhizal communities differed significantly between contaminated and non-contaminated sites, both for birch stands and pine stands, however the dissimilarity between birch contaminated and non-contaminated stands was greater. Moreover we found that in contrast to non-polluted sites there was no significant differences between the birch and pine EMF communities on contaminated sites. *Russulaceae*, *Sclerodermataceae* and *Rhizopogonaceae* were the most dominant EMF families associated with birch trees at contaminated sites while in control *sites Russulaceae*. In comparison, in pine trees at contaminated sites the most dominant EMF families were *Rhizopogonaceae* and *Sclerodermaceae*, while in control sites *Russulaceae* and *Suillaceae*.

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ANTHROPOPHYTES IN PROTECTED MOUNTAIN AREA: PAST, PRESENT AND RISK TO DIVERSITY – A CASE STUDY FROM THE MURÁNSKA PLANINA NATIONAL PARK (WESTERN CARPATHIANS)

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Due to the high number and unusual variety of plant species and their communities, including several endemic taxa, Muránska planina Mts belongs to the most interesting and natural-valuable areas not only in Slovakia but also throughout the whole Carpathian Arch. Protected area of the Muránska planina National Park was almost not invaded by non-native plant taxa to the end of 20th century; there was no information about massive invasive attack of alien plants on natural plant communities. Most of the anthropophytes including alien and/or invasive species began to spread to the area of national park in the period of 2000–2015. Some of them are creating stands on the bigger surface and pose risk for species composition and diversity of natural plant communities. Currently, the most dangerous invasive plants of the area are: *Ambrosia artemisiifolia*, *Aster lanceolatus*, *Bunias orientalis*, *Fallopia japonica*, *Helianthus tuberosus*, *Rhus typhina*, *Robinia pseudoacacia*, *Solidago canadensis* and *Solidago gigantea.* The fastest expanding ruderal/anthropophyte species or species forming extensive stands in the territory of the national park are: *Ambrosia artemisiifolia*, *Aster lanceolatus*, *Bunias orientalis*, *Conium maculatum*, *Datura stramonium*, *Erechtites hieraciifolius*, *Helianthus tuberosus*, *Lupinus polyphyllus*, *Robinia pseudoacacia*, *Solidago canadensis* and *Solidago gigantea*. As the most frequent factors influencing the propagation of non-native species and occupation of the natural sites have been identified: hunting (e.g. feed-troughs, fodder crop decoys, game food plots, little feed grain fields for game), waste disposal (refuse tips, spoil heaps, made-up grounds), forest cutting and salvage logging (e.g. forest roads, tree logs deposits and other wood transfer facilities), and ornamental plants cultivation outside of the built-up urban areas.

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INVASIVE PLANT SPECIES OF THE KAMPINOS FOREST OUTSKIRTS – THE CURRENT STATE AND THREATS TO THE KAMPINOS NATIONAL PARK (CENTRAL POLAND)

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Studies aimed at the identification of the range and the ways of spread of invasive alien species (IAS) in the Kampinos Forest outskirts were carried out by 2012 to mid of 2018. Special emphasis was placed on surveying the sites of the IAS and diagnosing potential threats posed to the natural and semi-natural vegetation of the national park by the IAS present in rural areas. A floristic survey was carried out on the majority (93 localities) of settlement areas in vicinity of the Kampinos National Park (KNP), in its buffer zone, frequently near the border of Park. Fourty invasive taxa were found which may potentially pose a threat to the ecosystems of KNP. The most frequently identified species included trees and shrubs: *Acer negundo*, *Rhus typhina*, *Robinia pseudoacacia* and *Rosa rugosa*, and herbaceous plants, such as *Amaranthus retrofexus*, *Anthoxanthum aristatum*, *Echinochoa crus-galli*, *Galinsoga parviflora*, *Reynoutria japonica*, *R.* × *bohemica*, *Rudbeckia laciniata*, *Setaria pumila*, *S. viridis*, *Solidago gigantea* and *S. canadensis*. Species encroaching from the settlement areas to semi-natural and natural communities include *Bidens frondosa*, *Echinocystis lobata*, *Impatiens glandulifera*, *I. parviflora*, *Juncus tenuis*, *Lupinus polyphyllus*, *Reunoutria japonica*, *R.* × *bohemica* and *Solidago gigantea*. Most of them are species from the highest (III and IV) classes of invasiveness in Poland. Close distance to Warsaw conurbation, and the road network developed around KNP has certainly affected the number of alien species recorded in the analysed area. Urbanized lands neighbouring the Park are still probably a source from where alien plants disperse to the protected area.

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THE APPROXIMATION MODELS FOR GEOSTATISTICAL METHODS WITH THE USE OF SEASONAL VARIATION AND NDVI OF INVASIVE PLANT SPECIES

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Predictive modeling of plant species distributions based on their relationship with environmental variables is necessary for resource management and conservation decision making support. They may also be applicable to monitoring and control of invasive species. In this study, we focused on determining the relationship between selected aspects of seasonal variability (e.g. cover and the life-cycle stages, co-dominants) for *Heracleum sosnowskyi* and *Fallopia* spp. using geostatistical methods supplemented by field data set and Normalized Difference Vegetation Index (NDVI). Geostatistics is a useful tool for analyzing the structure of spatial variability between sampling points and estimated values in the nodes of interpolation grid with an associated standard deviation map. The accuracy of the two geostatistical methods used, Ordinary Kriging (OK) and Ordinary Cokriging (CK), was compared to predict the distribution for analyzing species. The calculated coefficients of determination (R^2) for *H. sosnowskyi* and *Fallopia* spp. showed the fitting for both models (OK and CK) and the field data to estimated values, respectively.In the case of models for *H. sosnowskyi* the $R^2$was equal to 0.96 while for *Fallopia* spp. was 0.87. The value measured and the value estimated for *Fallopia* spp. showed 0.70 (CK) and 0.74 (OK) while for *H. sosnowskyi* they were slightly higher, 0.96 (CK) and 0.99 (OK). These values showed well-conducted models approximation. Using geostatistical estimation allows the visualisation of species distribution and cover in local scale, and contribute to more effective management strategy for invasive plant species.

Research has been carried out under the Biostrateg Programme of the Polish National Centre for Research and Development (NCBiR), project No. DZP/BIOSTRATEG-II/390/2015: The innovative approach supporting monitoring of non-forest Natura 2000 habitats, using remote sensing methods (HabitARS).

HALOPHILOUS PLANT COVER OF POTASSIUM MINE NEAR KALUSH TOWN (WESTERN UKRAINE)

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Halophilic vegetation on the territory of Western Ukraine is represented rather fragmentarily, mostly on mining areas, the most important of which is potash mining. Among others, Dombrowski mine of Kalush-Holynska potash deposit belongs to these areas, which is located in the inner zone of the Carpathian foredeep in Kalush district, Ivano-Frankivsk region (Holubchak, 2010). The areas that are saline in this way are the place for the formation of azonal halophilous flora and vegetation. Despite of some publications (Borsukevych, Danylyk, 2010; Kuznecov, 2016 et al.), the halophilic vegetation of this territory is studied insufficiently. Therefore, the purpose of our study was to at least partially fill in this gap.

Research conducted on halophilic vegetation during expeditions in 2016-2017 on anthropogenically transformed territory that is adjacent to the western Dombrowski mine of Kalush-Holynska potash deposit.

The specificity of the hydrohalophilic vegetation is determined by species that are azonal elements of the Subcarpathian region flora and such rare species of Western Ukraine as: *Ruppia maritima* L. and *Salicornia prostrata* Pall. belong to them, also known from the territory of the alike mine near Stebnyk town (Lviv region). In the investigated locality, these species form almost monodominant groups that belong to the respective associations of *Salicornietum prostratae* Soó 1964 and *Ruppietum maritimae* Beguinot 1941. Another coastal-water halophyte represented here on a large area is *Puccinellia distans* (Jacq.) Parl., which predominates in composed association of *Astero(tripoli)-Puccinellietum distantis* Weinert (1956) 1989. Among the halophytic xerophytic succulents *Suaeda prostrata* Pall. was determined. This species also forms the association of *Spergulario marginatae-Suaedetum prostratae* Vicherek in Moravec et al. 1995.

Therefore, the halophilic vegetation of the investigated territory is characterized by some heterogeneity and ecological xerophytic and hygrophytic specificity.

THE ROLE OF TRANSFORMERS-SPECIES IN THE CHANGING OF THE HABITATS STRUCTURE

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Problem of plant invasion that is getting menacing proportions is one of the most relevant one, which causes its comprehensive study. If previously some findings, the speed of distribution and change of areawere investigated, in other words the focus was on the botanical-geographical aspects, then in last decades - syntaxonomic features, estimation of econiche, change of adaptive properties, influence on the structure of biotopes are researched. These studies are reflected in the term of transformers-species, they crossed the F-barrier and change the structure of the cenosis. Invasive species are diagnostic for many syntaxes and used for the names of three unions *Chenopodion-Robinion*, *Balloto nigrae-Robinion* and *Rubo caesii-Amorphion* and one class *Robinietea*in Ukraine. Meanwhile in Slovakia there are four classes, nine unions and twenty associations (Sibikova et.al., 2018). The leading factors that cause the expansion of invasive species are anthropogenic and climatic. The habitats of the hygrophilic type with sharp change in moisture, which, at the same time, promote the mineralization of stable humus nitrogen compounds are most vulnerable. The character of the biotope change depends on the type of transformer strategy in a greater degree (R-strategists mainly determine fluctuation changes, C-character succession, S-synevolution). S-strategy appears in hybridization and the certain differences that reach the species level (*Solidago altissima*, *S. gigantea*, *S. canadensis*, *Reynoutria japonica*, *R. sachalinensis*, *Heracleum sosnowskyi*, *H. mantegazzianum*). The processes of fluctuation, synevolution and succession occur simultaneously but with different speeds and at different scales, depending on the type of habitat. In accordance with the nature of the influence of transformer species over these or other components, we propose to separateceno-, hydro-, pedo-, litodestructors, reflecting their specificity, and not the scale of influence. Cenodestructors are presented by *Bidens frondosa*, *Helianthus tuberosus*, *Aster novi-belgii*, *Echinocystis lobata*, *Solidago canadensis*, *Opuntia humifusa*, *Impatiens parviflora* and other, hydrodestructors are presented by *Elodea canadensis*, *Azolla filiculoides*, *Lemna minuta*, *Piscia stratiotes*, pedodestructorsare presented by – *Quercus rubra*, *Robinia pseudoacacia*, *Acer negundo*, *Fraxinus pennsylvanica*, *Elaeagnus angustifolia* etc, litodestructors are presented by – *Amorpha fruticosa*, *Morus alba*. It is clear that some species act as multiple destructors at the same time. For example, most pedodestructors are cenoddestructors etc.

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INVASIVE ALIEN PLANT SPECIES IN THE FLORA OF BELARUS

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The problem of biological invasions in Belarus and neighboring countries has been devoted a great deal of attention in recent decades. The invasion of alien species into the country's natural environment has soared. In this regard, the publication of the popular science book entitled "Plants-Aggressors. An Invasive Alien Species in the Flora of Belarus" (2017, in Russian) is of current interest.

Currently, more than 50 species of alien plants are recognized as the most aggressive in Belarus (Dubovik et al., 2012, in Rus.) and annually this list is increased and corrected. Now we can state that in the last few years the plants that have become very aggressive in Belarus are *Swida alba* (L.) Opiz, *Rudbeckia laciniata* L., *Symphoricarpos rivularis* Suksdorf (non double-flowering form), *Prunus ceracifera* Ehrh. and some others, which previously did not exhibit such properties. More than 300 taxa of the flora of Belarus are potentially invasive species. They require constant monitoring.

There are eight species from the group of invasive plants that were recorded in Belarus before 1780 (according to the first publication and the appearance of herbarium materials from the territory of republic). Among them, 5 – during the years 1780 – 1850, 11 – from 1851 to 1900, 14 – from 1901 to 1950, and 14 – after 1950. This is due to the development of industry, transport, agricultural, and introduction of ornamental plants.

A significant part of invasive species in Belarus appeared as a result of their introduction. Outside the sites of primary introduction, the most aggressive invasive species such as *Solidago canadensis* L., *S. gigantea* Ait., *Echynocystis lobata* (Michx.) Torr. et Gray, *Impatiens glandulifera* Royle, *Reynoutria japonica* Houtt., *R. sachalinensis* (F. Shmidt) Nakai et al. was founded in 1960-1980 or after 1990. They are an integral component of disturbed and natural communities, in places they form practically numerous monodominant colonies occupying vast territories. Especially favorable for the distribution of these species is the presence of wasteland. They quickly seize positions and actively compete with native species of the flora in these habitats. A sharp increase in numbers of them occurred during the period of popularity of these plants in horticulture.

Alien plants are able to hybridize with native species, which leads to the absorption or disappearance of wild plants. hybrid individuals often do not form full seeds or the effect of heterosis is manifested. However, their invasive success is achieved through intensive vegetative reproduction. Often hybrid individuals have more dangerous invasive properties than parental species. Such hybrids, with pronounced aggressive properties, include perennial plants of *Aster* x *salignus* Willd., *A.* x *versicolor* Willd., *Reynoutria* x *bohemica* Chrtek et Chrtková. Probably, most of the populations of giant hogweed in Belarus are also hybrids. At first they were obtained as breeding forms in botanical gardens during their joint cultivation. Now they are often identified as *Heracleum sosnowskyi* Manden. Although even in one population of the plant, by external signs, they can be attributed both to a typical *H. sosnowskyi* and to *H. wilhelmsii* Fisch. et Ave-Lall. or to their intermediate forms.

DISTRIBUTION OF BATHURST BURR (*XANTHIUM SPINOSUM* L.) IN TRANSCARPATHIA

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Bathurst burr (*Xanthium spinosum* L.), a noxious naturalised species, was introduced to Europe in the 18th century. This South American species is secondarily distributed and often naturalized in subtropical and hot temperate regions of southern Europe. In the Central Europe it is rare, regionally less common. It prefers hot and dry habitats such as pastures, steppe grasslands, sandy places, abandoned vineyards and ruderal places. The distribution of *Xanthium spinosum* in western Ukraine was studied using herbarium specimens and literature sources. The first historical record is located near the town of Khust in 1855. Further evidence comes mainly from the thirties and the sixties of the 20th century. In the western part of Ukraine (Transcarpathia), the species was recorded mainly in pastures grazed by cattle and sheep near the large rivers (Latorica and Tisa) and in the margins of fields and gardens as a weed. Seldom was it recorded on sandy banks of Latorica and Tisa rivers. In the past, it was locally introduced into the Carpathian villages in places with reloading and processing of sheep wool, train stations, roadsides and shambles. The distribution map was processed.

ASCLEPIAS SYRIACA L. IN UKRAINE

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Asclepias syriaca L. is a North American kenophyte, ergaziophyte, colonophyte, a local invasive species or sometimes a local potentially invasive species. It has been cultivated by F. Baziner since 1855. A milkweed was cultivated as a technical plant, a rubber-bearing one. It was recorded as a wild plant for the first time in Ukraine «in the vicinity of Kyiv, in a ravine near the village of Novoselki, June 5, 1914, Yu.N. Semenkevich» (*KW*) in 1914. Today it is cultivated in various botanical gardens, research stations, on some collection plots.

At present the species is currently common throughout the country. It occurs mainly in anthropogenic (ruderal phytocenoses and agrocenoses and near primary cultivation centers, where it forms colonies and occupies considerable areas) and seminatural (forest edges and meadows) ecotones. The distribution is mainly a diffuse-banded-local one.

In Ukraine *A. syriaca* populations were found a part of *Galio-Urticetea* Passarge ex Kopecky 1969 (a ruderal type of vegetation), *Artemisietea vulgaris* Lohmeyer et al. ex von Rochow 1951 (a ruderal type), and *Festucetea vaginatae* Soo ex Vicherek 1972 (a psamophyte type), and in most cases it forms a monospecies vegetation.

According to the classification of biotopes *A. syriaca* is widespread in different types of biotopes, mainly in biotopes of type-I (the biotopes formed due to a human economic activity), which are formed as a result of a constant effect of the anthropogenic factor.

HERBARIUM OF INVASIVE PLANTS IN THE TYVODAR LEGOTSKY TRANSCARPATHIAN REGIONAL MUSEUM

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Herbarium of the Municipal Institution "Tyvodar Legotsky Transcarpathian Regional Museum" of the Transcarpathian Regional Council is kept in funds on such storage groups as "Botany", "Temporary" and "Illustrative auxiliary". According to the Inventory Book of Inventory Reports, the first samples arrived at the museum in 1947. Plants have been systematized by families and placed in 31 folders. Inventory cards were not included on them, only the list of plants, the date of the description and the signature of the scientific employee are indicated on the cover of the folder. In 1966, most of this herbarium was transferred to the Department of Botany of Uzhhorod State University. The beginning of the formation of a scientific botanical collection can be considered in1953, when the inventory book "Botany" was introduced, in which the complete data on the herbarium specimen had already been entered. On June 2018 in the main fund "Botany" at the museum 1128 herbarium sheets is stored.

After inventorying the herbarium of the main fund, we discovered 13 herbarium sheets with plants, which, according to the official List, approved by the decision No.721 of 23.03.2017 session of the Transcarpathian Regional Council are invasive in the Transcarpathian region. From 31 listed species there are 8 species in the herbarium: *Acer negundo* L., *Erigeron annuus* (L.) Desf. (4 herbarium sheets), *Amaranthus retroflexus* L. (2), *Robinia pseudoacacia* L. (1), *Impatiens parviflora* DC (2), *Amorpha fruticosa* L. (1), *Echinocystis lobata* (Michx.) Torr. & A. Gray (1), *Salix fragilis* L (1). All plants except *Salix fragilis* have labels with source data. Most of the herbarium sheets (8) collected in the vicinity of the city of Uzhhorod, in particular *Amaranthus retroflexus* and *Echinocystis lobata* on the yard of Uzhgorod castle. Altogether, on the territory of the castle grow such invasive species as: *Solidago canadensis*, *Erigeron canadensis*, which have not yet entered to the herbarium of the museum's funds, 1 – in Mukachevo, Berehove and Vishkovo village in Khust district. The oldest sample in the herbarium is *Amaranthus retroflexus*, collected by the botanist amateur Istvan Laudon on August 24, 1885 in Trieste, Italy.

Invasive plant species are very poorly represented in the botanical collection of the museum. The collection needs to be supplemented and needs new gatherings that can be used with the educational purpose about dangerous species in the flora of Transcarpathia for visitors to the museum.

SYNTAXONOMY OF RUDERAL VEGETATION OF BEREHOVE (UKRAINE)

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Berehove (Transcarpathia) is a border town, which contributes to the active introduction of alien species and the formation of specific communities of ruderal vegetation. The formation of plant communities is also influenced by the climatic conditions of the Transcarpathian Lowland and the form of management of the territory. 51 relevés originally, carried out in September 2016 and 2017, is analysed using the Modified TWINSPAN. Diagnostic species of the syntaxons is determined using calculations of their fidelity based on a phi-coefficient. Syntaxonomic scheme of vegetation of the territory of Berehove includes coenoses of 12 associations and 4 derivate communities belonging to 9 unions, 9 orders and 7 classes.Community *Ambrosio artemisiifoliae-Chenopodietum albi* Marjuschkina et Solomakha 1985) and DC *Ambrosia artemisiifolia* (*Digitario sanguinalis-Eragrostietea minoris* Mucina, Lososová et Šilc in Mucina et al. 2016) are distributed mainly along railroad tracks and along roadsides on gravelly dry soils. Coenoses of the ass. *Chenopodietum stricti* (Oberd. 1957) Passarge 1964, (*Sisymbrietea* Gutte et Hilbig 1975) are noted on the sites of abandoned vegetable gardens and along roads. Derivative communities (DC) *Amaranthus deflexus* and *Galinsoga parviflora* (*Papaveretea rhoeadis* S. Brullo et al. 2001) are confined to sufficiently wet and nitrified soils of roadside sites. Communities composed of perennial weed species: *Agropyretum repentis* Felföldy 1942, *Calamagrostietum epigei* Kostylev in Solomakha et al. 1992, *Erigeretum canadensi-acris* Smetana 2002, and *Tanaceto-Artemisietum vulgaris* Br.-Bl. (1931) 1949 (*Artemisietea vulgaris* Lohmeyer et al. in Tx. ex von Rochow 1951) occur on old rewritements (in the vicinity of the city), in the area of railway station warehouses, along roads with a ground covering, along the edge of training football fields, on garbage cans and other similar ecotopes with dry depleted soils. Coenoses of the ass. *Arctietum lappae* Felföldy 1942 (*Epilobietea angustifolii* Tx. et Preising ex von Rochow 1951) are found infrequently, on moist, enriched humus territories near houses. Communities of the class *Polygono-Poetea annuae* Rivas-Martínez 1975 (*Polygonetum arenastri* Gams 1927 corr. Lanikova in Chytrý 2009, DC *Lolium perenne-Polygonum aviculare*) extended to trampling sites along the roads paved and unpaved, both within the city and its surroundings. Coenoses of the ass. *Glechomo hederaceae-Potentilletum reptantis* Levon 1997 recorded mainly in the grass cover under the canopy of plantations of *Acer campestre* L. on the territory of the park of the district hospital, as well as on the mowed lawns in the central part of the city. Communities of the class *Galio-Urticetea* Passarge ex Kopecký 1969 (*Urtico-Aegopodietum podagrariae* Oberd. 1964, *Elytrigio repentis-Aegopodietum podagrariae* Tx. 1967) occupy significant areas on the wet nitrified sections of the bank of the Verke River and the canal passing near the resort complex «Zhayvoronok». Recently there is an increasing distribution of plant communities with the participation of an invasive species *Reynoutria japonica* Houtt. – the ass. *Reynoutrietum japonicae* Görs et Müller in Görs 1975 (*Galio-Urticetea*).

BRYOPHYTES DIVERSITY IN AREAS AFTER ZINC AND LEAD ORES MINING IN SILESIA-CRACOW REGION (S POLAND)

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In the areas of former exploitation of zinc and lead ores in the Silesia-Cracow region (S Poland), briological studies were carried out as part of the project "Good practices for enhancing biodiversity and active protection of calamine grasslands in the Silesia-Cracow region BioGalmans". The project aims are: to restore, strengthen and maintain appropriate habitat conditions for the preservation of biodiversity of galman grasslands (6130 – *Violetea calaminariae*). The research was conducted in six areas near Tarnowskie Góry (one area), Bolesław (2) and Jaworzno (3). These were post-mining dumps or areas after former surface exploitation of metal ores. Characteristic for the soil substrate found on them were: shallow, skeletal soil, high concentration of heavy metals and a relatively high pH (above 7).

In total 83 species of bryophytes (4 liverworts and 79 moss) were recorded in the studied areas. Most species were found on the waste heap of the Fryderyk mine in Tarnowskie Góry (58 species), and the least on the heap in Bolesław (only 6 species). In terms of frequency, the largest group were very rare species, recorded only on one site (30), and only 4 species were found in all studied areas (*Bryum caespiticium*, *Ceratodon purpureus*, *Schistidium crassipilum* and *Tortella tortuosa*). In terms of habitat preferences, terrestrial species predominated (64 species occurred on the soil), furthermore there were 32 epilitic species (on dolomite and concrete rubble), 26 epiphytic species (on the bark of different tree species) and only 7 epixylic species (on the dead wood). There is a large group of calciphilous species, including *Campyliadelphus chrysophyllus*, *Campylium stellatum* var. protensum, *Ditrichum flexicaule*, *Encalypta streptocarpa*, *Fissidens dubius*, *Schistidium crassipilum*, *Tortella tortuosa* and *T. inclinata* (due to the high pH of the soil and the occurrence of dolomite rubble).

THE INVASIVE SPECIES OF KHARKIV REGION (UKRAINE)

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The problem of adventive species is recognized as the second and in some countries even the first threat to biodiversity. That is why one of the important tasks is the study of the distribution of invasive species and the level of their impact on natural coenosis.

The proposed list is based on reference and regulatory European documents on invasive alien species within the framework of the UN Convention on Biological Diversity and the Berne Convention. The given list of species is proposed for consideration and approval by the Kharkiv Regional Council.

The research was conducted in the period from 2017 to 2018 on the territory of the Kharkiv region. The compiled list includes 15 species of invasive plants. According to the results of the study, invasive species are divided into two groups according to the level of invasive potential. The first group includes 3 species with a mean invasive capacity. This group includes *Impatiens parviflora* DC., *Solidago canadensis* L., *Iva xanthiifolia* (Nutt.) Fresen. The second group includes plants with high invasive ability. It includes the following species – *Ambrosia artemisiifolia* L., *Bidens frondosa* L., *Conyza canadensis* (L.) Cronquist, *Parthenocissus quinquefolia* (L.) Planch., *Erigeron annuus* (L.) Desf., *Robinia pseudoacacia* L., *Acer negundo* L., *Amaranthus retroflexus* L., *Galinsoga parviflora* Cav., *Portulaca oleracea* L., *Oxybaphus nyctagineus* (Michx.) Sweet, *Grindelia squarrosa* (Pursh) Dun.

These species are dangerous to natural vegetation expectations and require monitoring and control.

FIRST RECORDS OF LICHENS FOR THE BEREHOVE (TRANSCARPATHIA, UKRAINE)

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Due to the anthropogenic transformation of urban flora the identifying of common tendencies in synantropization of flora in the cities becomes more relevant. Lichens are widely used in a monitoring. The survey of the lichen composition in Ukrainian cities was mainly related to the lichen-indicator studies of the air pollution (Kondratyuk, 2008). Accumulation of information on lichens in urban areas helps to determine the ecological range and the overall pattern of species distribution. This significantly eases the biological monitoring and prediction of the state of urban ecosystems (Dymytrova, 2006; Kondratyuk, 2008).

Our research was conducted in Berehove (Transcarpathia) in autumn period (September, 2016) and it is first survey of lichens for this town. Samples of lichens on the territory of Berehove town were collected from different substrate, especially bark of trees, soil, and rock.

32 lichen species in the Berehove town were found. Lichens collected on the bark of trees were prevailed. Mostoften wedetected species belonging tothe genus *Amandinea*, *Athallia*, *Catillaria*, *Hypogymnia*, *Parmelia*, *Physcia*, *Phaeophyscia*, *Lepraria*, *Massjukiella*, *Xanthoria*. Also we detect species (*Melanelixia glabratula* (Lamy) Sandler & Arup, *Punctelia subrudecta* (Nyl.) Krog, *Flavoparmelia caperata* (L.) Hale., *Evernia prunastri* (L.) Ach.). Previously these species were found in Transcarpathia (Mukachevo region) (Oxner, 1993) in natural ecotypes. Species *Oxneria fulva* (Hoffm.) S.Y. Kondr. &Kärnefelt is particulary to be noted. On the rocky substratum (basement of houses, reinforced concrete structures, and tile) occur species: *Calogaya decipiens* (Arnold) Arup, Frödén & Søchting, *Candellariella aurella* (Hoffm.) Zahlbr., *Protoparmeliopsis muralis* (Schreb.) M. Choisy, *Myriolecis dispersa* (Pers.) Śliwa, Zhao Xin & Lumbsch, *Verrucaria nigrescens* Pers., *V. muralis* Ach. On the soil and only on the outskirts of the town species of the genus *Cladonia* were recorded.

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VARIABILITY OF MORPHOLOGICAL CHARACTERISTICS OF *ELYTRIGIA REPENS* (L.) NEVSKI POPULATIONS IN DIFFERENT ECOLOGICAL CONDITIONS

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The processes of synantropization create a real threat for phytodiversity on the territory of Ukraine. The aim of our research is to establish mechanisms that ensure the livelihoods of *Elytrigia repens* (L.) Nevski populations, as well as their adaptation to changing conditions of natural and built environment.

The research was conducted on the basis of the classical morphological and geographic method (Serebryakov, 1962; Mirkin, 1983; Zlobin, 1984, Schmidt, 1984; Lakin; 1990; Nemy, 2001; Didukh, 2011).

According to the research results of the variability of morphological characteristics of *Elytrigia repens* local populations in different ecological conditions, it has been established that ramets' morphometric features are characterized by different levels of intrapopulation variability (V = 9.76 − 28.97%). In all researched *Elytrigia repens* cenopopulations the most volatile sign is the length of the leaf blade (V = 9.76 - 28.97%). The lowest values of the variation coefficient are typical for the number of spikelets in the spicule (V = 12.14 – 21.26%). In analyzing the coefficient of variation of morphological characteristics of model populations, it was established that significant morphological variability of the ramets is one of the mechanisms for maintaining the life of model populations in conditions of anthropogenic loading. It has been found that populations E3, E6 and E8 grow in better conditions and have a higher survival mechanism, unlike populations E1 and E5. The analysis of reproductive effort for *Elytrigia repens* model populations showed high reproductive effort for populations E5, E6 and E18 (anthropogenic types of loose soil biotypes); average for E4 and E7 (areas with significant soil trampling); low for E1, E2 and E3 (semi-natural types of biotypes with unknown anthropogenic pressure).

According to the research results of morphological characteristics of the local *Elytrigia repens* populations in different ecological conditions, it has been determined that ramets' morphometric features are characterized by different levels of intrapopulation variability (V = 9.76 − 28.97%). The highest variation values are noted for *Elytrigia repens* populations, which are confined to semi-natural phytocoenoses, being one of the mechanisms of the pulp local adaptation in unfavorable conditions.

ABOUT THE ROLE OF THE CARPATHIAN BIOSPHERE RESERVE IN CONSERVATION OF THE MOUNTAIN FLORA AND VEGETATION

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This year marks exactly 50 years since the foundation of the Carpathian Biosphere Reserve (the successor of the Carpathian State Reserve), which now covers 58 035.8 ha and represents the whole landscape and biological diversity of the Ukrainian Carpathians from the foothills to the subalpine and alpine zones. It is located within the Rakhiv, Tyachiv, Khust and Vynohradiv districts of the Transcarpathian region. Together with the transition zone, which constitutes 124.3 thousand hectares, that unite its Maramoros, Chornohora, Svydovets and Uholka-Shyrokyi Luh massifs, in Tyachevo and Rakhiv districts, the reserve is a part of the UNESCO international network of biosphere reserves. It hosts the geographical Center of Europe, the highest peak of Ukrainian Carpathians mountain Hoverla, the unique Valley of Narcissus, the subalpine and alpine zones of the Carpathians, unique highland lakes and the maintained traditional Hutsul polonina farming. Here were described 3223 species of plants and mushrooms (fungi), about 250 species of which are listed in the Red Data Book of Ukraine, international and European red lists, including the legendary species like Alpine Edelweiss (Leontopodium alpinum L.), Pink Rhodiola (Rhodiola rosea L.), Rhododendron East-Carpathian (Rhododendron kotchei Simonk.) and others. In addition, here there are 63 species of endemic plants, and 37 rare plant communities which are listed in the Green Book of Ukraine. Among the 1353 species of vascular plants, in the ecosystems of the biosphere reserve are found, 297 species of the synanthropic fraction of flora out of 184 genera and 54 families. And this is more than 21.9% of all vascular species found on its territory (Kozurak, Antosyak, Voloshchuk, 2014). Adventive species in the massifs of the biosphere reserve are distributed as follows: Kuzi-Tribushany - 145 species (29.9% of the massif's flora), Svydovets - 50 species (11.0%), Chornohora - 78 species (12.7%), Maramorosh - 70 species (13.8%), Uholka-Shyrokyi Luh - 143 species (19.5%), Valley of Narcissus - 149 species (28.6%), Chorna Hora - 150 species (37.9%), Yuliyivski Hory - 162 species (36.5%). It is also important to emphasize that the primeval beech forests of the Carpathian biosphere reserve are included in the list of UNESCO World Heritage Sites and form, together with 12 European countries, the largest part of the trans-national site "Ancient and Primeval Beech Forests of the Carpathians and other Regions of Europe".

The Carpathian Biosphere Reserve is one of the largest scientific and ecological educational centers of the Carpathian region. Here work botanical and other scientific laboratories, a network of monitoring sites, phenological points, hydro- and meteorological posts, a geographic information system, etc. For the outstanding results in nature conservation, the Carpathian Biosphere Reserve, was the only one in Ukraine, to be four times awarded by the European Council with the European Diploma.

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THE VEGETATION OF BILA SKELIA AND ITS STATE

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Roztochchia is a unique natural region, where 20 years ago the Yavoriv National Nature Park was created with an aim at protection of valuable ecocenotic complexes. One of its valuable geological-geomorphological and botanical objects is the Bila Skelia tract – a rocky strand with the outputs of limestone and limestone sandstones of the Lower-Neogene age. In the lower part of south-west slope of the tract is situated rare for Roztochchia area of steppe-heath, stocky meadow on sandy-rocky outcrops-BilaSkelia. In its upper part is exuded an association of *Sedoalbi-Allietum montani* Klika 1939 (Syn.: *Centaureo stoebes-Allietum montani* Tichý et al. 1997), where dominate *Allium montanum.* High projective covering have thermophilic species such as: *Sedum acre, Festuca psammophila, Centaurea rhenana, Acinos arvensis, Alyssum gmelinii* var. *montanum, Artemisia campestris, Dianthus carthusianorum, Euphorbia cyparissias, Helianthemum nummularium, Galium boreale, Potentilla arenaria, Teucrium chamaedrys, Thymus pullegioides*. It belongs to the union of *Alysso-Festucion pallentis* Moravec in Holub et al. 1967, *Stipo pulcherrimae-Festucetalia pallentis* Klika 1931 order, which is salient for meadow steps west Podillia, class of *Festuco-Brometea* Br.-Bl. etR.Tx. in Br.-Bl. 1949. At the foot of Bila Skelia is located association of *Festuco-Pinetum sylvestris* Kobendza 1930 em Soó 1960 (syn: *Peucedano oreoselini-Pinetum* W. Matuszkiewicz 1962) *Dicrano-Pinion* Libb. 1933 s. str (syn. *Festuco ovinae-Pinion sylvestri* Vorobyov, Balaschov et V. Sl. 1997) union, *Pinetalia* Oberd. 1949 order, *Vaccinio-Piceetea* Br.-Bl. 1939 class. It causes acidification of the soil and because of collision there is danger of extinction of xerothermic species of *Festuco-Brometea* class.

From the 104 species that grows on the Bila Skelia *Alyssum gmelinii* Jord., *Anemone sylvestris* L., *Astragalus danicus* Retz., *Festuca psammophila* (Hacq. ex Celak.) Fritsch. belong to regionally rare, but they are not included to the Red Book and are in need of protection in Lviv region. Part from species is located on the verge of its habitat and are rare for Roztochchia: *Allium montanum* F. W. Schmidt, *Anthericum ramosum* L., *Gypsophila fastigita* L., *Juniperus communis* L., *Parnassia palustris* L. From alien species on Bila Skelia are *Aethusa cynapium* and *Vicia tetrasperma* – archeophytes, *Stenactis annua* and *Impatiens parviflora* – kenophytes, which are solitary situated. From apophytes are found 9 species – hemiapophytes, which have high projective covering (25-30%).

We consider that BilaSkelia tract (quarter of 47 Majdan forestry of the Staritskyi Military timber enterprise) is necessary to referto the permanent use of Yavoriv NNP and to ensure the protection and conservation of valuable natural ecosystems in Roztochchia.

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THE *HESPERIS* SPECIES IN THE FLORA OF UKRAINE WITH SPECIAL ATTENTION TO SYNANTHROPIZATION

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The genus *Hesperis* L. includes from 25 (Al-Shehbaz, 1988) to 60 species (Dvořák, 1980). There are nine species in Ukraine (along with *H. tristis* L.). Center of the species diversity (almost 70% of endemic species) covers the Balkan peninsula, the Caucasus and the Iran-Turanian floristic region (Al-Shehbaz, 1988). Significant endemism is noted for M. Asia (Cullen, 1965) – the boundary of three floristic regions (Takhtajan, 1978). Some species of *Hesperis* belong to the adventive elements that are capable for naturalizing and forming a part of natural plant communities. *H. matronalis* L. is a very popular ornamental plant. It is known from 97 regions of the world (Mandakova et al., 2017). *H. pycnotrica* Borbás & Degen actively expand beyond the natural habitat to the east: Altai, Siberia, Kyrgyzstan, Central Asia (Dorofeev, 2013; Ebel, 2002; Lazkov et al., 2011); to the north: Lithuania (Gudžinskas, 1997), Sweden (Herloff, 1999) and south-west: Romania (Costache, 2011). This species also grows in North America (Dorofeev, 2013). In Ukraine, *H. pycnotrica* is known from both natural and anthropogenically transformed biotopes (Tzvelev, 1959). Other *Hesperis* species are also capable for falling out of cultivation. This fact is often confirmed by herbarium collections (the exception is *H. sylvestris* Crantz s. str.). The species has a very compact natural area: mostly Central and South-Eastern Europe with two distinct localities – in Ukraine and in Poland (Atlas Florae Europaeae, 1994). Kotov noted the species for Ukraine in 1953 (s.l., together with *H. suaveolens* (Andrz.) Steud.). Later the author took only the latter, despite the fact that in 1967 F. Dvořák issued several herbarium collections from the territory of Ukraine (Dvořák, 1967). In KW herbarium we also found samples of this species collected in Ukraine: "Kolo Zloczova, zebr. Wrabia Los. (?)", N 009457 [typographic lettering on the label: "Kraj. Stacya bot. rolnicza L. Herbarium Wladislaw Tyniecki"]; "Zloczowo przy goscincu, Aug. 1860, zbr. Gomolinski, ozn. H. Lobarzewski", N 010277; "Brody, zbr. Gomolinski, ozn. H. Lobarzewski", N 010275; Potorryca kolo Socala, 1854/V" [country seat of the earl W. Dzieduszycki; now village Potorytsya of Sokal district, Lviv region] N 010265; "Potorryca, 1898, Tyniecki" N 010270; "Львовская обл., Золочевский район, Лысая гора у с. Червоне, опушка леса, 12 июля 1955 г., Бухало" [Lviv region, Zolochiv district, Lysaya gora at the village Chervone, the outskirts of the forest, July 12, 1955, Bukhalo]. The names of collectors and typographic labels suggest that *H. sylvestris* plants were grown in the middle of the 19th century in the botanical garden of the High Agronomic School in Dublyany (now the Lviv National Agrarian University). The garden was organized by Prof. W. Tyniecki and (or) in the country seat of the earl W. Dzieduszycki – a naturalist and founder of the Natural History Museum in Lviv. Later the species fell out of cultivation, but did not spread, according to its ecological preferences. Therefore, it is highly probable that in Ukraine *H. sylvestris* is an ergasiophyte. In Poland, the authors attribute this species to the taxa of uncertain status due to lack of data (Urbisz, 2011). In 1967, F. Dvořák cited it for the outskirts of Krakow with reference to the work of S. Kulczynski (l. c.). Several samples are available in the KW herbarium, including: "kolo Olszanicy [*village in the outskirts of Krakow* - italics ours] Zbr. Dzieduszycki, ozn. H. Lobarzewski" N 010281 (Zielnik Museum in Dzieduszyckich, Zbiory Hijacynta Strzemie Lobarzewskiego we Lwowie"). It is quite possible that in the vicinity of Krakow *H. sylvestris* is also ergasiophyte.

COLONIZATION OF AN ISLAND ON GÓRECKIE LAKE IN THE WIELKOPOLSKI NATIONAL PARK (POLAND) BY *AILANTHUS ALTISSIMA* (MILL.) SWINGLE CLONES AND ITS PHYTOCENOTIC EFFECTS

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The natural range of *Ailanthus altissima* (Mill.) Swingle covers the eastern regions of China and northern Vietnam, where it is a component of deciduous forests. The species was introduced to Europe in 1740, and now is one of the most invasive species of trees. It occurs commonly in Southern Europe, Western and Central Europe, both in cultivation and spontaneously. In Poland, it is strongly associated with the central zones of large cities, where it spreads both generatively and vegetatively. Recently, it is also more and more frequently observed in natural environments, especially in river valleys. This creates a potentially serious threat to native biodiversity.

About 80 years ago, a few individuals *A. altissima* have been planted for decorative purposes on an island of a post-glacial lake. Currently, this lake lies in the Wielkopolski National Park. Even 30 years ago, the population of this species on an island overgrown with riparian forest consisted of a few trees with a height of several meters. Currently, a large part of this island is colonized by several hundred ramets of varied height. The most impressive ramets reach a height of 15 m and a diameter at breast height of 0.40-0.60 m. Such dynamic population development takes place only on vegetative way, as there were no fruiting individuals observed so far as yet there were no fruiting individuals, and the distance of the island from the nearest localities exceeds 10 km. *A. altissima* expansion results in significant changes in the species composition and vegetation structure of the island. Among other things, this species tightly fills the gaps formed when native trees fall down. In this way, it inhibits the natural regeneration of the forest and threatens many rare and protected species of forest undergrowth.

The lecture will present the preliminary results of studies of *A. altissima* clonal population and its impact on the structure of native vegetation of the island.

CALAMINARIAN GRASSLANDS OF THE SILESIAN-CRACOW REGION: THE STATE OF PRESERVATION AND POSSIBILITIES OF PROTECTION

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The largest resources of zinc and lead ores in Poland occur in Silesian-Cracow Region, where they have been mined and processed since the Middle-ages. Mining activity has led to the appearance of new morphological terrain forms in the environment, including: open pits, ring-like spoil heaps, mine shafts and tunnels, dump mounds – all of them having a significant influence on plant and animal communities. High concentration of heavy metals (zinc, lead and cadmium) in the substrate has led to the emergence of new habitats. Plants which inhabit these areas must show a number of features and adaptations to enable them to grow in these unfavourable or even toxic conditions – they are metallophytes. The metallophytes are protected by legislation Europewide. Under the EU Habitats Directive Annex I (Fauna-Flora-Habitat), heavy-metal vegetation is coded as Calaminarian grasslands of the order *Violetalia calaminariae* under Code 6130. On the list of Sites of Community Importance there are two Natura 2000 areas protecting calaminarian grasslands in Silesian-Cracow Region, they are called "Pleszczotka" (PLH120092) and "Armeria" (PLH120091). Other calaminarian grasslands in this region are not protected. Based on floristic studies, it was shown that there was a decline in the biodiversity of the habitat (6130) and deterioration of the habitat conditions existing there. The most important threats include: the habitats of tree and bush species (including *Pinus sylvestris*) multiply, the occurrence of expansive (*Molinia caerulea, Carex hirta*) and invasive species (*Solidago canadensis, Reynoutria japonica*) and the destruction of the habitat as a result of intensive traffic of motor vehicles. There is a real need for actively managed for calaminarian grassland preservation.

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THE SPREAD OF *REYNOUTRIA* SPECIES IN THE KAMPINOS NATIONAL PARK AND ITS VICINITY (CENTRAL POLAND)

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Asian knotweeds: *Reynoutria japonica*, *R. sachalinensis* and R. x *bohemica* have been classified as the most dangerous invasive plants in Poland and are included on the list of 16 alien plant species which, when introduced into the natural environment, pose a threat to native biodiversity or natural habitats. Despite the serious threat they pose, these perennials are still grown as ornamental plants, and are sometimes planted in hedges.

Home gardens are a source of knotweeds spread in the region of Kampinoska Forest (national park with buffer zone). The first spontaneously-formed sites of these knotweeds taxa were identified in the 1970s (*R. japonica*; Nowak 1983) and 1980s (*R. sachalinensis*; M. Ferchmin, unpubl.). Sites of *R.* ×*bohemica* were found in the early 21st century (source data of KNP, unpubl.).

Until mid of2018 there were 176known sites where different species of *Reynoutria* were found. In most of these sites was encountered by *R. japonica* (118, of which 64 are within the national park and 54 in the buffer zone). *R.* ×*bohemica* have been found on 54 sites (six in the national park and 48 in the buffer zone).*R. sachalinensis* been found on four sites(all in the buffer zone).

Although the distribution of knotweeds is largely limited to ruderal habitats, these invasive plants, especially *R. japonica*, create a threat to semi-natural and natural biocoenoses at KNP. On some of the sites, mainly those located inside the park, *R. japonica* occupies large areas and forms compact homogeneous populations. Because of vegetative reproduction and clonal growth pattern, it rapidly colonizes new habitats and out-competes native plant species by limiting their access to light and limiting seedling germination. In many areas *R. japonica* encroaches on forest communities located in the vicinity of existing or depopulated villages.

ALIEN SPECIES OF *CORNUS* L. (*CORNACEAE* BERCHT. ET J.PRESL) IN UKRAINE

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The genus *Cornus* L. includes about 45-65 species, which are naturally common in Eurasia, North, Central and Southern (North, West) America and Africa (http://www.efloras.org; Takhtajan, 2009). They prefer the northern and temperate regions, as well as the mountainous areas of the tropics and subtropics. According to the results of recent molecular-phylogenetic studies, the volume of the genus is expanded and now it includes several subfamilies. Species of *Cornus* are among the most popular for plant cultivation. They are used as a source of edible beneficial fruits (*C. mas* L., *C. officinalis* Siebold et Zucc., *C. chinensis* Wangerin, *C. sessilis* Torr.), in ornamental horticulture, forestry, to combat erosion, etc. In Europe, for example, as ornamental plants grow 27 species (Wann, 1997). Thirty species of genus are known in Ukraine (Klymenko, 2011). Three of them are natural (*C. mas*, *Swida sanquinea* Opiz, *S. australis* Pojark. ex Grossh.), others – belong to the alien. After certain time part of them are able start to spread outside places of cultivation because naturalized. *Cornus kousa* Bürger ex Miq., (its native to Japan and Korea), introduced to Kiev from Oregon (North America), practically naturalized – for many years in succession forms self-seeding (Klymenko, 2011). *Cornus sessilis*, introduced in culture 15 years ago, feels well, intensively breeds vegetatively, forming stump-shoots. The same properties (such as vegetative reproduction and self-seeding) have the other species, such as *C. alba* L. (= *Swida alba* Opiz), *C. stolonifera* Michx. (= *Swida stolonifera* (Michx.) Rydb.), *C. baileyi* J.M. Coult. et W.H. Evans (= S*wida baileyi* Rydb.), *C. officinalis*, as well as aboriginal *C. mas*. Therefore, species of the genus *Cornus*, due to their economic value, deserve the expansion of the region of cultivation in Ukraine. However, periodic monitoring of populations is required. Like other introduced species, they have a hidden ability to invade. They can compete for ecological niches with autochthonous species, change the nature or nature of ecosystems, act as agents of transformation or degradation of the environment.

THE ROLE OF EPHEMEROPHYTES AS A PART OF SYNANTHROPOPHYTON OF THE SEA OF AZOV COASTAL ZONE

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Phytodiversity of the Sea of Azov coastal zone (SACZ) is characterized by significant species diversity and dynamic changes. The factors that lead to changes in SACZ flora and cause its synanthropization are natural, anthropogenic and natural, and anthropogenic (development of agglomerations and recreation, excessive agricultural activities). The predominance of anthropogenic changes causes the processes of modernization and adventization of the flora. It was established that commensal fraction of SACZ flora comprises 848 species from 375 genera and 74 families and 3 departments (44% of spontaneous SACZ flora). The alien fraction of the flora was formed by 376 species from 59 families, representing 19.5% of the spontaneous flora. In these terms, SACZ flora exceeded similar indicators of neighbouring areas (10.7% – in the Northwest Caucasus flora, 15.2% – in plain Crimea), and was inferior only to the flora of the South-East Ukraine – 20.9%, Northern Black Sea Region – 23.6%. Archeophytes in SACZ flora formed 121 species from 33 families (6.3%), and kenophytes (neophytes) - 255 species from 49 families (13.2%). Among apophytes the largest diversity is observed in families *Asteraceae*, *Caryophyllaceae*, *Fabaceae*, *Poaceae* and others, and among alien fraction – in families *Asteraceae*, *Brassicaceae*, *Poaceae*.

The part of ephemerophytes in synanthropophyton is insignificant (4.8%). However, they give regional flora certain specific features, in particular, dissolve boundaries of the geographical distribution of the flora's taxa. According to the systematic features ephemerophytes belong to 39 genera, 18 families, 2 departments, 1 class. Most of these species are among *Asteraceae* (7), *Poaceae* (7), *Lamiaceae* (4). According to the biomorphology among ephemerophytes there are most of all monocarpic plants 29 (70.7%), of which annuals (53.6%) and biennials (7.1%), much less there are perennials – 9 (22.0%), and wood biomorphes there are only 3 (7.3%). According to the origin among ephemerophytes there are 16 species from the Mediterranea, 10 from Asia (3 from West, 4 from Central and 4 from East Asia), 8 from Europe, 4 from North America and 1 from South America.

ALIEN FRACTION OF THE FLORA OF CHERNIVTSI (CHERNIVTSI REGION, UKRAINE)

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Research of urban flora is one of actual direction of modern floristic investigation, since under the influence of urbanization it takes place synanthropization of vegetation of urban and suburban areas. One of the important aspects of the urbanfloras` study is the analysis of the alien fraction. Alien fraction of Chernivtsy` flora are represented by 280 species of vascular plants, which is 24.3% of the total number of species of the studied territory (total: 1152 species) and belongs to 192 genera, 55 families. In the analysis of species by the time of entry, it was determined that kenophytes will prevail (188 species), archeophytes – 92 species. According to the degree of naturalization is dominated by epoecophytes – 177, ephemerophytes – 84, agriophytes – 11, colonophytes – 9. According to D. Richardson et al.'s classification (Richardson et al., 2000) – 152 species overcome E-barrier, 43 – F-barrier, 77 – D-barrier, 5 – C-barrier and 3 – B-barrier. The species that overcame F-barrier are the most dangerous, because the species-transformers are belonging this group. Within the city territory we have been discovered 7 species-transformers: *Ambrosia artemisiifolia* L., *Solidago canadensis* L., *Phallacrolomma annum* (L.) Dumort., *Impatiens parviflora* DC. and *I. glandulifera* Royle, *Acer negundo* L., *Echinocystis lobata* (Michx.) Torr. & A.Gray. According to geographical origin the species from the Mediterranean (67) and North American (52) prevail. Numerous is the group from Mediterranean-Iran-Turanian region (35). As a result of our research it was found new alien species, which are new not only for the territory of Chernvitsy, but also for Chernivtsi region. Among them: *Ambrosia psilostachya* DC., *Brachyactis ciliata* (Ledeb.) Ledeb., *Oxybaphus nyctagineus* (Michx.) Sweet, etc.

SYNANTHROPIC FLORA OF THE DESNA PLATEAU (SUMY REGION, UKRAINE)

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The Desna Plateau (DP) is situated in the north east part of Ukraine at the border line of Polissya (the forest-covered territory) and forest-steppes physical and geographical zones. It is geographical position is within N 51° 21′-51° 55′ (North latitude), E 33°10′-34°15′ (East longitude) and belongs to Sumy region Hlukhiv, Krolevets, Putyvl districts. The Desna Plateau is founded from west spurs of the Middle Russian Heights.

According to our data the flora of the Desna Plateau includes 920 species of vascular plants belonging to 464 genera, 112 families. The synanthropic flora of studied region includes 337 species of vascular plants belonging to 220 genera, 51 families. The floristic indexes of taxonomic diversity of synantropic flora are: genus / family = 4,3; species / family = 6,6; species / genus = 1,5. The index of synanthropization of studied flora is 36,6%. Taxonomic spectrum of 10 leading places from the synanthropic flora includes *Asteraceae* (41genera, 69 species), *Brassicaceae* (22 genera, 31 species), *Poaceae* 16; 24, *Fabaceae* – 12; 24, *Lamiaceae* – 13; 20, *Apiaceae* – 14; 18, *Chenopodiaceae* – 4; 16, *Boraginaceae* – 12; 13, *Caryophyllaceae* – 10; 12, *Rosaceae* – 9; 11. Enhancing the role of the *Chenopodiaceae* family arid areas and arctic desert *Brassicaceae* family shows a high level of anthropogenic transformation of DP. The leading ten families include 143 (65%) genera of synanthropic DP flora. The biggest among the species number is the genus *Chenopodium* (7), genera *Atriplex* and *Vicia,* which have 6 species each; *Artemisia* and *Amaranthus* which have 5 species each; *Helianthus, Bidens, Trifolium, Plantago, Ranunculus, Bromus, Rumex* have 4 species each, 18 genera have 3 species, 35 genera have 2, the rest 156 genera are monotypic. According to our data, the alien component includes 179 species which constitutes 19,4% of the total number of vascular plant species of the studied flora, and 52,8% of synanthropic flora, the native component of which consists of 158 species (46,8%). It is known that the proportion of both fractions is an important indicator of the flora characteristics. DP flora has the ratio of alien and apophytes fractions of synanthropic flora is 1: 1,13 in favor of alien species**.** According to the time of immigration the non-native flora of the Desna Plateau is divided into archeophytes – 80 (44,7%), kenophytes – 64 (35,75%) and eukenophytes – 35 (19,55%). Thus, the status of anthropogenic transformation of the studied flora is characterized according to Yackowiak indexes: index of anthropophysation – 19,45 %; index of archeophytisation – 8,7%; index of kenophytisation –10,76 %; index of modernization – 55,3 %.

ALIEN PLANTS` COLLECTIONS FROM TERRITORY OF BESSARABIA IN HISTORICAL HERBARIUM OF OHWPC (MSUD)

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Problem of investigation of non-aboriginal species is one from the most important in modern science. It is impossible to give prognosis about appearing, naturalization and disappearing of plant species in modern flora without historical analysis their being on the definite territory. So, investigation of herbarium collections is one from first steps for receiving primary information and building base for monitoring investigations of invasive species of plants. Herbarium of Odessa High Women Pedagogical Courses (OHWPC) is component of historical collection of Herbarium of Odesa I.I. Mechnikov National University (MSUD), which was included in 2004 to list of objects to be national property of Ukraine. Collectors of historical herbarium were graduated students of OHWPC and students and lectors of university. Besides them, in herbarium there are collections of J.K. Paczoski and Natural Museum of RAN, which were received by exchange. The aim of our investigations was to reveal and analyze invasive plants, which were collected on Bessarabia territory in 1915-1925. There are 13 species Magnoliophyta from 12 genus and 7 families. Their names adduced as they were written on the labels. Amaranthaceae: *Amaranthus retroflexus* L.(one herbarium leaf); Cruciferae: *Capsella bursa-pastoris* Moench. (2 h.l.), *Lepidium draba* L.(4 h.l.), *Raphanus raphanistrum* L. (2 h.l.), *Sinapis arvensis* L. (2 h.l.), *Sisymbrium loeselii* L. (2 h.l.), *S. sophia* L. (3 h.l.); Leguminosae: *Vicia villosa* Roth. (2 h.l.); Umbelliferae: *Conium maculatum* L. (7 h.l.); Labiatae: *Ballota nigra* L. (11 h.l.); Solanaceae: *Lycium barbarum* L. (1 h.l.); Compositae: *Carduus acanthoides* L. (1 h.l.), *Chrysanthemum inodorum* L (10 h.l.). The most of plants were collected by V.F. Pasternatskaya in settlements of Akkerman, Beltsy, Kishinew, Sergeevka, Orgeev, Chotyn districts. The place of collection were indicated such a way: forest, garden, park, near way, between crops, near river. Now those species are invasive for Bessarabia and South of Ukraine. By chronotype they are mainly archaeophytes, by degree of naturalization – epecophytes. Correlation between mono- and polycarpics is 2,25:1. Between heliomorphs there are mainly heliophytes, between hygromorphs – mesophytes (xeromesophytes), by way of distribution of fruits and seeds: auto- and zoochores.

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BIOCHEMICAL PROFILING OF SHOOT BARK FOR IDENTIFYING SPECIES AND HYBRIDS IN THE GENUS *JUGLANS*

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The present research aimed to qualitatively study phenolic composition in bark and periderm of plants of the genus *Juglans* in order to use planar-chromatographic fingerprint for species and hybrids identification.The examined individuals of *Juglans* introduced into the culture, some of them spontaneously gone wild in the forests and parks of Kiev. Samples of the bark of annual shoots were selected on April 17-24, 2018 in spontaneous self-replicating populations, which we described earlier (Burda, Koniakin, 2018). Bark samples belonged to 6 species (*J. regia* – 14, *J. subcordiformis* – 8, *J. ailantifolia* – 4, *J. mandshurica* – 7, *J. cinerea* – 3 and *J. nigra* – 4) and 5 putative hybrid combinations – 13, which were previously identified by morphological features.

Biochemical profiling was performed by HPTLC. Stationary phase–plate HPTLC Silicagel 60 (Merck), mobile phase–chloroform, acetic acid, methanol, water (60:32:12:8v/v/v/v). Migration distance was 65 mm from the lower plate edge (migration time 40 min), followed by drying for 3 min. Detection of phenols was performed after derivatization with 1% NP reagent (diphenylboryloxyethylamine) and fluorescence enhancement of zones with 5% polyethylene glycol (PEG) 400. The evaluation was carried out at 366 nm UV.

Chromatography analysis of methanol extracts revealed 30 phenolic components. The most complex and variable biochemical profiles were found in *J. subcordiformis* (up to 20), *J. mandshurica* (18), *J. cinerea* (16). Only 11 phenolic substances were found in the bark of shoots of *J. nigra*. Plants of that species were characterized by relatively stable biochemical profiles. Up to six flavonoids were detected in *J. nigra* and *J. regia*. They are marker characters of those species, allowing identification of *J. nigra* and *J. regia* and their hybrids. Interestingly, the biochemical profile of *J. regia* var. *macrocarpa* revealed two compounds with bright blue fluorescence (Rf~0.60 and 0.69), typical of *J. regia.* Densitometry revealed that their content in the large-fruited form is 7.7 and 3.2 times higher respectively.

Biochemical profiling of the bark of wintering shoots proved to be a reliable method for differentiating the diversity of spontaneous populations of species of the genus *Juglans.* In an applied plan, for example, the detected biochemical feature of the *J. regia* is very important for the early identification of large-fruited forms among seedlings.

ORCHIDACEAE JUSS. SPECIES POPULATIONS IN UZHHOROD

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All *Orchidaceae* family representatives are rare, endangered plants and are listed in the Red Data Book of Ukraine (2009). One of the most urgent things to do for rare plants conservation is inventory of their localities. Lack of appropriate environmental conditions for orchids is special at urban zones. Populations of *Orchidaceae* family species are known from 23 localities within Uzhhorod boundaries. Previously were found *Anacamptis morio* (L.) R.M. Bateman, Pridgeon & M.W. Chase, *Cephalanthera longifolia* (L.) Fritsch., *Dactylorhiza majalis* (Reichenb) P.F. Hunt et Summerhayes, *Epipactis helleborine* (L.) Crantz., *Listera ovata* (L.) R. Br., *Neottia nidus-avis* (L.) Rich., *Platanthera bifolia* (L.) Rich., *Platanthera chlorantha* (Cust.) Reichenb. (Loya, 2006). These populations are restricted to the nature vegetation fragments. Exept *Anacamptis morio* populations, orchids in Uzhhorod tend to have small populations (up to 100 specimens). During 10 years monitoring only 5 populations were observed repeatedly. One population of tuberous orchid *A. morio* was observed every year (up to 5000 specimens) and other *A. morio* population with 272 specimens was observed only once. Two populations of tuberous orchid *Platanthera bifolia* (with 120 and 16 specimens correspondingly) and saprophyte rhizomatous orchid *Neottia nidus-avis* were observed every year. While populations of other rhizomatous and tuberous orchids were observed only once during 2005–2017 period. So, populations of *Orchidaceae* species are less tolerant in the Uzhhorod urban environment.

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INVASIVE SPECIES INFLUENCE ON TERRESTRIAL VEGETATION OF THE NATIONAL NATURE PARK "PODILSKI TOVTRY"

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Invasive species of the National Park "Podilski Tovtry" were investigated during 1996–2017. Analysis of species diversity of the National Park resulted in discovery of 26 aggressive invasive species namely *Acer negundo* L., *Ailanthus altissima* (Mill.) Swingle, *Amaranthus albus* L., *Amaranthus retroflexus* L., *Ambrosia artemisiifolia* L., *Amorpha fruticosa* L., *Bidens frondosa* L., *Cardaria draba* (L.) Desv., *Echinocystis lobata* Torr. et A. Gray, *Eleagnus angustifolia* L., *Elodea canadensis* Michx., *Erigeron canadensis* L., *Galinsoga parviflora* Cav., *Impatiens glandulifera* Royle, *Heracleum mantegazzianum* Sommier et Levier, *Impatiens parviflora* DC., *Iva xanthiifolia* Nutt, *Parthenocissus quinquefolia* (L.) Planch, *Phalacroloma annuum* (L.) Dumort., *Pinus sylvestris* L., *Reynoutria japonica* Houtt, *Robinia pseudoacaia* L., *Salix fragilis* L. *Solidago canadensis* L., *Ulmus pumila* L., *Xanthium albinum* (Widd.) H. Scholz.

Invasive species are represented by 15 classes of forest, meadow-steppe, steppe, boggy, and water plants. Intervention of invasive species has caused transformation of vegetation of the National Park "Podilski Tovtry". Most sufficient changes have been observed on the areas of limestone rocky meadow-steppe slopes. In particular, *Ailanthus altissima*, *Acer negundo*, *Eleagnus angustifolia*, *Robinia pseudoacaia*, *Pinus sylvestris*, *Parthenocissus quinquefolia* are causing displacement of typical vegetation including rare communities and species. *Erigeron canadensis*, *Phalacroloma annuum* are more active in occupation of the habitats of species, which disappeared from these areas in result of firing, tightening as well as water and wind erosion. Climate change factors (lack of precipitation, increase of summer temperature over 30°C) caused harmful impact on indigenous species. We have observed death of plants, buds, and flowers of many typical and rare species due to lack of huminidy, especially on calcephalotrophytic areas. At the same time, invasive species went through accelerated onthomorphogenesis, produced high-grade seeds, and next year demonstrated high germination (68-90%). High seeds productivity of these species guarantees sufficient viability in soils and germination. These invasive species are highly competitive and replace aboriginal species in plant communities of classes *Festuco-Brometea* Br.-Bl. et Tx. ex Soó 1947, *Sedo-Scleranthetea* Br.-Bl. 1955, *Trifolio-Geranietea* T. Müller 1962, *Molinio-Arrhenatheretea* Tx. 1937.

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VISITOR – APPLICATION FOR MONITORING OF INVASIVE SPECIES

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Invasive species currently represent a growing problem because they often cause considerable economic and biodiversity losses therefore their monitoring is of high importance for society. For acquiring new knowledge on distribution, abundance and ecology of the selected alien species in Slovakia we utilised involvement of broad public. We developed system for collection of alien distribution data, utilising modern technologies (smartphone app), database for storage of the collected data and website for visualisation of the results. Visitor is a smartphone app for mapping of invasive species – including 17 plants and 13 animals. With the in-built smartphone camera and GPS co-ordinates the registered users record the occurrence of the monitored species and after filling out a simple form they send the finding to the database. Each finding is afterwards verified by an expert and verified finding is displayed on the map, which is available to everyone on the website (www.visitor.sav.sk). The website is also a source of information on the monitored species, their descriptions and photos. The participation of volunteers on the monitoring and research on alien organisms brings not only the new data. People also get opportunity to participate on the publicly beneficial research and get more information on this topic.

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HOW THE EASTERN MIGRATION ROUTE INFLUENCES THE SLOVAK FLORA?

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Rail transport is an important way of spreading of plant species and introduction of the alien plants into new areas and countries. We studied selected railway localities in south eastern Slovakia to determine the influence of the Eastern Migration Route on the Slovak flora. Railway stations and trans-shipment yards in the Čierna nad Tisou, Dobrá, Veľké Kapušany and Maťovce were studied from 1964 to 2013; first in 1964–1998 and recently in 2012–2013. We recorded all vascular plant taxa to evaluate the structure and diversity of vegetation – the presence of native, alien and threatened taxa, the representation of families and some species characteristics, and to compare the changes after 40 years, during which there was a decrease in imports of goods and the use of trans-shipment yards.

A total of 657 plant taxa were recorded in all localities (566 taxa in the historic and 431 taxa in the recent data set). Native species prevailed over alien and archaeophytes over neophytes in both time periods and naturalised taxa dominated among alien plants. The most frequent families were *Poaceae, Asteraceae* and *Brassicaceae*. Hemicryptophytes and therophytes were the most abundant life forms. Majority of the recorded species were competitors, reproducing by seed and pollinated by insects. Zoochory and hemerochory were the most frequent dispersal types. We identified 49 threatened taxa (38 in the historic and 27 in the recent data set) and 1 species protected by law.

Despite the decline in the species occurrence in the recent data set, we recorded some species not present in the past (e.g. *Geranium purpureum* and *Senecio vernalis*). Overall, we recorded 12 new alien taxa for the territory of Slovakia, which we evaluate as casual neophytes.

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ALIEN FRACTION OF THE FLORA OF THE NATIONAL NATURE PARK “KARMELIUKOVE PODILLYA”

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National Nature Park ”Karmelyukove Podillya“ is the only National park in Vinnitsa region. It was established in 2009 for the conservation of the forest and steppes which is typical for the south-eastern part of Podillya.

The structure of the alien fraction of the flora`s NNP includes all spontaneously growing plant species that are non-aboriginal for the Park flora and that are brought by a person on its territory either accidentally or deliberately. Such species are potentially capable of self-reproduction and distribution under certain conditions of the region.

An annotated list of alien species is based on the data collected during floristic surveys by the route-expeditionary method which were conducted on the Park territory during May – September 2014–2017. The investigations cover different degrees of transformation of ecotopes and various aims of economic usage of the territory as well as dumps and waste grounds.

The criteria of J. Kornaś that given by V. Protopopova (1991) are used for selection and characterization of the alien fraction flora plants. Some indices such as synanthropisation (IS), apophytysation (IAp), anthropophytysation (IAn), arheophytization (IArch), kenophytization (IKen) and modernization (IM) were used for the state determination of the flora transformation (Jackowiak, 1993).

The species composition of the alien fraction flora of the region is represented by 126 species (52.7%) of vascular plants. Among them prevail archeophytes (72 species, 57.1% of the alien fraction), while the kenophytes are represented in the park by 54 species (42.9%).

From the ”List of alien plant species of Ukraine with the high invasion ability“, given by V.V. Protopopova and co-authors (2002), 19 species were found in the region. Among them category I includes 9 species: *Acer negundo* L. is a widespread species that represents a potential threat; *Ailanthus altissima* (Mill.) Swingle is a widespread species of a moderate threat; *Ambrosia artemisiifolia* L. is an aggressive species that poses a strong threat; *Amorpha fruticosa* L. represents a potential threat; *Bidens frondosa* L. represents a weak threat; *Grindelia squarrosa* (Pursh.) Dunal. is an aggressive species that poses a strong threat; *Helianthus tuberosus* L. represents a weak threat; *Iva xanthiifolia* Nut. is a widespread species that represents a moderate threat; *Solidago canadensis* L. is a widespread species that poses a moderate threat.

In order to prevent genetic contamination of the gene pool of indigenous plant species and invasions of introduced species into natural ecosystems on the territory of the NNP ”Karmelyukove Podillya“ according to Article 32 of the Law “On Plant World”, recommendations have been developed to reduce contamination by invasive plant species and transferred to the Park user (State enterprise "Chethelnitsky forestry").

CREATION OF THE BASIS OF DATA OF AGE-TREES AS A MECHANISM OF SUPPORT OF BIOGRAPHY OF CITY FORESTS

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The landscape art park-monument ”Feofaniya“ is located on the border of two landscape zones - the Forest-steppe and Polissya in the south-eastern suburb of Kyiv. Its territory contains natural ecosystems and artificial phytocenoses. This territory is complemented by a cascade of ponds geomatic springs. This is a unique protected area of the green zone of the capital of Ukraine, which combines natural forest and a park - a kind of garden landscape of the XXI century. The vegetation cover consists of phytocenoses of native oak forest with high density of old trees and derivatives of horn-beech forest. The native oak forest with old trees is the main natural and scientific value of the territory.

Existing biodiversity of this forest area requires additional measures for the protection, complex study, documentation of the state through the rapidly increasing recreational load. Therefore, the first inventory of trees *Q. robur* with the use of mapping software (GIS) in the territory ”Feofaniya“ was conducted. There were determined locations of 4610 old trees *Q. robur*. Information about the location of these trees, trunk diameter each and the age category were plotted on the park map. An electronic database and mapped schemes of old trees geospatial location have been created. This allowed us to analyze the spatial location of the old trees *Q. robur* in the territory of park forest sections. Discovered places of maximum concentration of the oldest trees. This is important for the development of measures to protect them in conditions of significant recreational load on the territory.

Q. robur age trees location electronic map on the territory of ”Feofaniya“ is the first national sample of stand inventory and its location cartographic combination. This development can be the basis for the program of environmental monitoring of ancient trees *Q. robur* ”Feofaniya“ and for more detailed work to create a unified registry of old trees protected areas of the capital and Ukraine.

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ALIEN PLANTS IN THE FLORA OF THE NATIONAL NATURE PARK "OLESHKIVSKI PISKY"

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National Nature Park "Oleschkivski pisky" was created in 2010. The park covers more then 8020,36 ha and is situated along the Lower Dnipro. In total, there are seven somewhat separate sandy areas (arenas) with significant sand dunes, but the park is located mainly in two of these arenas: the Kozachelagerska and Chalbaska. The landscape is dominated by sandy steppe and dunes, but spread out are depressions with meadows, halophytic vegetation, wetlands, and groves of birch, aspen, oak, and rare alder (Ukrainian name "*gaiky*").

Approximately 500 species of vascular plants grow in the Park. Among them 58 species are alien (12,2 %), which belong to 49 genera, 19 families, and 1 divisions (Magnoliophyta). The most numerous families are *Asteraceae, Poaceae, Fabaceae, Brassicaceae, Chenopodiaceae, Lamiaceae* and genera are *Xanthium, Setaria, Atriplex* та *Veronica.*

The structural analysis of the investigated flora showed that, according to the time of immigration, kenophytes prevail (55,2%), archaeophytes are far fewer (44,8%); according to the degree of naturalization, epoecophytes (28 species) and agriophytes (27 species) prevail, then ergaziophytes (3 species).

The greatest disturbance is the spread in the National Nature Park "Oleschkivski pisky" of such alien species as *Corynephorus canescens* (L.) P.Beauv., *Erigeron canadensis* L., *Cenchrus longispinus* (Hackol) Fernald, *Elaeagnus angustifolia* L., *Pinus sylvestris* L., *Robinia pseudoacacia* L., *Bidens frondosa* L. and *Xanthium albinum* (Widd.) H.Scholz.

INVASIVE POTENTIAL OF TREES AND SHRUBS IN CONDITIONS OF CLIMATE GLOBAL CHANGING (ON EXAMPLE OF ODESSA DENDROFLORA)

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Global changing of climate, which have place now, in towns lead to formation specific complexes of species, which are short time in restrict space. Especially, it is typical for steppe zone' settlements, where dendroflora presented mainly by non-aboriginal species of plants. As it is known, urban flora of steppe zone has some peculiarities in comparison with such flora of another zones and it differ from nature steppe flora. For such peculiarities, it can be attributed mesofitisation of flora, shading, changing of wind speed, humidity and structure of soil. Flora is derivative from those complexes and common tendencies became constant. So town surrounding promotes prevalence definite ways of diaspora' spreading, which are presented by anemochoria, autochoria, zoo- and in particular mirmekochoria. Other characteristics of plants can vary. For example, similar ecotops during last 100 years occupied *Morus alba* L. (East Asia) and *Broussonetia papyrifera* (L.) Vent. (North America), *Betula pendula* Roth. (Europe) and *Paulownia tomentosa* (Thunb.) Steud. (China), *Prunus moldavica* Kotov (Europe) and *Celtis australis* L. (Mediterranea) etc. Second species are from the end of XX century. Very active was spreading of *Ailanthus altissima* (Mill.) Swingle (East Asia), *Gleditsia triacanthos* L., *Robinia pseudoacacia* L., *Acer negundo* L. (North America), *Styphnolobium japonicum* (L.) Scott. (East Asia) etc. If we take account origin that or either species, its state in those climate conditions and ability to renew, in city planting of greenery we can indicate 25 species of plants from 18 families, which can actively spreading. Between them, we indicate *Koelreuteria paniculata* Laxm. (East Asia), *Rhodotypos kerrioides* Sieb. & Zucc. (Japan, China), *Cotoneaster acutifolius* Turcz. (China, Mongolia), *C. divaricatus* Rehd.& Wills (China), *Padus serotina* (Ehrh.) Agardh., *P. virginiana* (L.) Mill., *Cercis canadensis* L. (North America), *C. siliquastrum* L. (Mediterranea), *Ampelopsis aconitifolia* Bunge (China), *Parthenocissus quinquefolia* (L.) Planch. (North America) etc. As it indicated analysis, the centers of appearing the most active plants are East Asia, North America and particularly Europe and Mediterranean. They are in big quantity in city' dendroflora, well renew and we can wait their further spreading.

INFLUENCE OF INVASIVE SPECIES OF *PISTIA STRATIOTES* L. ON THEABORIGINAL FLORA OF UKRAINIAN RESERVOIRS

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Types of aquatic plants with high invasive potential are characterized by broad ecological amplitude, stress-tolerance, quick propagation and high level of naturalization and constitute a significant threat to biodiversity of aquatic phytocenosis. In order to prevent the reduction of biodiversity and degradation of Ukrainian reservoirs it is necessary to investigate and control the processes of the spread of invasive species and their impact on aboriginal species. This issue needs thorough examination and evaluation of the impact of invasive species on the survival and productivity of other aboriginal species by dominance of undesirable species in aquatic phytocenoses. So, the purpose of the work was to find out the impact of the invasive species *Pistia stratiotes* L., which are new for the territory of Ukraine, on the vitality of hydatophytes (*Elodea canadensis* Michx., *Vallisneria spiralis* L., *Ceratophyllum demersum* L.) – typical representatives of Ukrainian ponds to determine the degree of resistance to invasion. Plants were exhibited in 3-literaquariums, filled with water at optimal lighting conditions of 5000 lux, a water temperature was 19-20°C and a pH – 8.3. The surface of the water in the aquariums was free (control) or covered by 25 and 50% by *P. stratiotes*. Experimental plants were tested for content of pigments (by spectrophotometer ShimadzuUV-1800), water with the exposed plants was tested for content of oxygen (by Oximeters Hanna), pH (by pH-Meter PH-107), salinity (by TDS Meter TDS-2). The negative influence of invasive species *P. stratiotes* on the aboriginal species *V. spiralis* and *C. demersum* was shown. For 50% coverage of water surface areait was observed the reduction by 2 times of the total content of photosynthetic pigments for *C. demersum* and for *V. spiralis*–by 3 times, that can leadto the disappearance of these aboriginal species in the natural reservoirs of Ukraine in the case of distribution of *P. stratiotes*. It was noted the growth of water salinity (from 256 to 282 mg/l) and pH (from 8.3 to 8.7) and decrease of oxygen content (up to 31%). Such changes can lead to the replacement of some plant species by others which are more resistant to high levels of mineralization and pH. Even for 50% coverage of water surface area, *P. stratiotes* poses a real threat to the existence of submerged species, which are typical representatives of natural reservoirs of Ukraine.

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COMPARATIVE ANALYSIS OF POLLEN FERTILITY OF SPECIES OF AUTOCHTHONIC AND ALLOCHTHONIC FRACTIONS OF SPONTANEOUS FLORA OF UKRAINE

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As a result of synanthropization, a gradual de-aborigenization of the local flora and the loss of its specific features occurs, an increase in diversity of the eurybiont adventives species and a decrease in that of stenobiont native ones is observed. Study of the peculiarities of plant reproduction testifies about their competitiveness and prospects of development in biocenoses. Fertility of pollen grains is one of the indicators of reproduction efficiency, which allows to predict the resistance and adaptation of plants to various anthropogenic factors.

For comparative analysis of the pollen fertility of the representatives of the autochthonous and allochthonous fractions of the spontaneous flora of Ukraine within the genera *Medicago* L., *Veronica* L., *Geranium* L., model species characterized by different ecological amplitudes and adaptive strategies were selected: *Medicago falcata* L. (gemiapophyte), *M. sativa* L. (kenophyte), *Veronica beccabunga* L. (indigenophyte), *V. agrestis*L. (archaeophyte), *Geranium pratense* L. (occasional apophyte), *G. sibiricum* L. (kenophyte). Fertility of pollen grains was determined by iodine test, based on the calculation of starch content in fertile and sterile pollen grains.

It has been established that in adventive plants fertility of pollen is generally higher than in aboriginal plants. Thus, the average percentage of fertile pollen grains in *M. sativa* is 74,6 % and in *M. falcata* is 51,6 %; in *V. agrestis*– 92,1%, and in *V. beccabunga* – 72,8 %; *G. sibiricum*– 91,6 %, *G. pratense*– 77,3 %. It is noted that the percentage of deformed pollen grains in all investigated species of the allochthonous fraction is lower than that ofthe autochthonous fraction: *Medicago* – 5,2 % and 8, 0%; *Veronica* – 4,7 % and 8,9%; *Geranium* – 3,3 % and 5,9% respectively.

Thus, the data on the fertility of pollen of plants of different fractions of spontaneous flora testify about high indices of adventive species that are more competitive to local species due to the wide ecological amplitude, stress tolerance, reproduction rate, and high degree of naturalization. The obtained data is in agreement with the existing results of diverse researches of the adventive species of the flora both within and outside of Ukraine, and once again attracts attention to the problem of the threat to indigenous species of plants.

THE MAIN STATISTICAL REGULARITIES OF THE ALIEN FLORA OF NATURE RESERVE "DREVLYANSKIY" (ZHYTOMYR REGION, UKRAINE)

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Wide distribution of alien plant species around the world is one of the important globalization consequences. Particularly harmful effect they can have on native flora of nature protected areas. Nature reserve "Drevlyanskiy" (30872,84 ha) is situated in Narodichi district of Zhytomyr Region. The main peculiarities of this nature reserve are: high levels of radioactive contamination (after Chornobyl), absence of activity in agriculture and forestry during last 30 years, prevalence of forests in vegetation, large areas of abandoned fields.

Spontaneous flora of vascular plants of this nature reserve consists of 847 species including 196 alien ones. Coefficient of adventization of its flora is 23,14% which is less than the average for the Zhytomyr Region – 24,90%. Kenophytes predominate in the composition of alien flora – 123 species (62,76%), archeophytes number – 73 species (37,24%).

Systematic structure of nature reserve alien flora is specific. The first 10 families of it are: *Asteraceae* (39 species, 19,9%), *Poaceae* (19 species, 9,7%), *Brassicaceae* (15 species, 7,7%), *Chenopodiaceae* (14 species, 7,1%), *Rosaceae* (10 species, 5,1%), *Fabaceae* (9 species, 4,6%), *Lamiaceae* (8 species, 4,1%), *Solanaceae* (6 species, 3,1%), *Malvaceae* (6 species, 3,1%), *Caryophyllaceae* (5 species, 2,6%); in total – 131 species (66,8%) and 83 genera (61,0%). The first 5 families – *Asteraceae*, *Poaceae*, *Brassicaceae*, *Chenopodiacea*, *Rosaceae* – testify about strong influence of Mediterranean and Iranian-Turanian floristic centers on alien flora of nature reserve.

Alien species of the object according the life forms are divided into annuals – 55,1% of the total number, perennials – 19,4%, trees – 7,1%, biennials – 6,1%, shrubs – 5,6%, annuals-biennials – 4,6%, another – 2,0%; according the naturalization level – into epekophytes – 50,5% of the total number, agrio-epekophytes – 24,0%, colonophytes – 11,7%, agriophytes – 8,7%, ephemerophytes – 5,1%; according the immigration way – into xenophytes – 63,2%, ergaziophytes – 34,2% and insufficiently studied – 2,6%.

There are about 20 dangerous invasive species in the flora of nature reserve: *Solidago canadensis* L., *Amelanchier spicata* (Lam.) K. Koch, *Erechtites hieracifolia* (L.) Raf. ex DC., *Echinocystis lobata* (Michx.) Torr. & A.Gray, *Elodea canadensis* Michx. etc.

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ANALYSIS OF THE FLORISTIC LIST OF INFORMATION SYSTEM OF ALIEN PLANT SPECIES IN UKRAINE

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The concept of the Integrated Information Network «THREAT ALIEN SPECIS OF UKRAINE – TAISU» has been created by the scientists of the Institute for evolutionary ecology of the NAS of Ukraine. Established Integrated Information system for environmental threats of alien species of plants and fungi of Ukraine, including an information about the taxonomy, biological characteristics of species, their primary habitat, time of entry, adaptive capacity, response strategy, behavioral on-goings, such as naturalization, confined tohabitat (for EUNIS), size populations, level of threats and other information important to assess threats and determine plant invasions potentially vulnerable objects environment.

The Information Networkon for today includes 755 alien plant species belonging to 379 genera and 87 families. The most numerous are species from the families Asteraceae (14.9%, 112 spp.), Brassicaceae (10.3%, 78 spp.) and Poaceae (9.0%, 68 spp.). The leading genus is *Chenopodium* L. (the number of species is 21, most of them are represented by kenophytes– 52.4% (11 spp.). The spectrum of the leading genera includes also – *Amaranthus* L. (17 spp.), *Artemisia* L. and *Euphorbia* L. (each 14 spp.). The archaeophyte list includes 558 species, the kenophyte list comprises 165 species. The analysis of the list alien species by origin showed the predominance of plants species from the Mediterranean origin (297 spp., 39.3%), the Asian origin (145 spp., 19.2%) and North America (136 spp., 18.0%).

The most species-rich family – Asteraceae (include 51 genus) and Poaceae (include 32 genus) show high proportions of kenophytes: 81.3% and 75% in accordance. Among Raunkiaer's life form, hemicryptophytes dominate in the family of Asteraceae with the proportion 55.4%; the family of Poaceae are represented by the terophytes – 87%. The many species of numerous from this families 49% and 60.3% are represented by the epecophytes. Only for the I-type biotopes was explored by 59 species from the family Asteraceae and 36 from the Poaceae; but many alien species was occurring biotopes of type D, E, H, G (*Ambrosia artemisiifolia* L., *Erigeron canadensis* L. *Bromus commutatus* Schrad., *Setaria viridis* (L.) P. Beauv, ect.).

TO THE HISTORY OF THE CLUB OF CZECHOSLOVAK TOURISTS IN TRANSCARPATHIA

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When Transcarpathia became incorporated in Czechoslovakia (1919–1939), an intense development of summer and winter tourism started. While previously tourists had been seen here merely for hunting and mineral water treatment, later a number of nature enthusiasts increased. Mainly, this was due to the Club of Czechoslovak Tourists which had its branches in all district centres of Transcarpathia. there were eight such branches which encompassed over 1100 tourists. The central office was located in Uzhhorod.

In the 1920s the touristic industry was underdeveloped and the club cooperated with forestry agencies which possessed a developed infrastructure (narrow-gauge railways, forest roads), forester houses. The latter could be used by tourists for rest and overnight stay while foresters acted as guides.

The club also developed its own infrastructure. Already in the mid-1920s it had overnight stay places for tourists in Uzhhorod, Mukachevo, Volovets, Khust, Rakhiv, Uzhok, Solotvyno. In the mid-1930s the club had 17 own tourist houses and refuges, a restaurant in Nevytske, a hotel in Rakhiv and a boating station in Khust.

The club developed and marked tourist trails. The branches in Uzhhorod and Velyky Berezny developed such trails in the Uzh valley. The trails in Volovets were elaborated by the branch teams of Mukachevo and Volovets. Summer and winter recreation as well as places of interest of Transcarpathia were advertised in dedicated publications.

The events of 1938–1945 (the Munich Agreement, the Vienna Arbitration, the disintegration of Czechoslovakia, occupation of the region by Hungary, the World War II) almost totally ruined the first achievements of tourism in the area.

A CONTRIBUTION TO TAXONOMY OF *CONSOLIDA* GRAY GENUS BASED ON SEED SURFACE PATTERNS

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One of the important diagnostic features in the plant taxonomy is sculpture, ultrastructure and the shape of seeds. These features are important at various levels of the hierarchy such as species, genus or family. Currently modern imaging methods that enable a very detailed analysis of the ultrastructure of seeds are very important in carpological research. The biometric and seed sculpture analysis is proving to be a useful tool for taxonomy, ecological studies and identification of diaspores of synanthropic species.

The main aim of this work was to analyze the morphological variability of seeds from *Consolida* Gray genus. A review of available literature showed scarcity of data on seeds size and taxonomy tool complete lack of *Consolida* genus. Material to work were (seeds from 40 species) collected during field trips spanning 2014-2017 and obtained also from Herbaria collections (AAH, KW, KWHA, KWHU, S, SO, TAM). Four biometric traits were analyzed: length, width, perimeter and area of the seed. The pictures of the seeds surface structure and sculpture were made using a scanning electron microscope (SEM- Phenom Pro X). Our work showed the differences of ultrastructure between the seeds from *Consolida* genus with could be a first step to use the seeds as a taxonomy tool.

WHAT CAN AFFECT THE SEEDS SIZE? – CASE OF THE *CAPSELLA BURSA-PASTORIS* (L.) MEDIK.

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The main goal of this work was to investigate the phenotypic plasticity of *C. bursa-pastoris* seeds in throughout the range of the species. The study aimed at: i) analyzing the variability of the examined morphological traits of seeds compared to climatic habitats parameters ii) analyzing differences of ultrastructure of seeds, iii) checking if the seeds morphometric traits could be significant in species taxonomy, iiii) analyzing the mechanism of species adaptation to changing habitat condition.

Seeds were (146 populations from 26 countries) collected during field trips spanning 2015-2017 and obtained also from Herbaria collections (AAH, KW, KWHA, KWHU, S, SO, TAM). Four biometric traits were analyzed: length, width, perimeter and area of the seed. The observations and measurements of seeds were performed with the use of a Nikon SMZ-800 dS-fi optical stereomicroscope connected with camera (Nikon). Each site was described using eight habitat parameters from the WordClim database. The pictures of the seeds surface structure and sculpture were made using a scanning electron microscope (SEM, - Phenom Pro X). According to our results can be assumed, that morphological variation of investigated traits depends on environmental conditions. Local impact and available resources have stronger impact on plant grow and the metric characteristics of the seed. Therefore, different forms of plants (winter-annual, spring-annual, ephemeras) are grow in the different environmental conditions. The winter-annual form can be overwinter in the flowering phase. According to this peculiarities of life-history traits of C. *bursa-pastoris* plants the length, width, perimeter and area of the seed ratio can ring the changes on.

CONSORTIAL RELATIONSHIPS BETWEEN ARTHROPODA AND *REYNOUTRIA* SPECIES IN THE TRANSCARPATHIA REGION

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Species of the genus *Reynoutria* Houtt. are highly invasive in Europe, including Ukraine (Protopopova, Mosyakin, Shevera, 2002). By actively settling themselves down in natural plant community they lead to the depletion of their phytodiversity.

The regulation of the number of *Reynoutria* genus species does not produce adequate results, and the information about the natural enemies of these plants and their consortial links with animals were left out of the attention by scientists. Data on phytophagous insects, trophycally linked to plants of the reynoutria genus are limited to two species: *Otiorrhynchus sulcatus* Fabricius, and *Aphalara itadori* Shinji (Beerling, 1994; Černý, 1998). It is believed that under the conditions of Europe, invasive species of reynoutria have virtually no natural enemies.

Our research on consortial relationships with representatives of Arthropoda and *R. japonica* agg., conducted in 2018 in Transcarpathia, allowed us to reveal a fairly large number of them, trophycally and topically related to these invasive species. Our investigation covered colonies of *R. japonica* agg. in Uzhhorod and Mukachevo Districts of the region. The enthomocomplex of consortive species is represented by a wide range of representatives from Insecta, Aranei and Acari classes. It is taxonomically composed from eight orders of insects: Orthoptera (Tettigoniidae), Homoptera (Cicadinea, Aphidinea), Hemiptera (Coreidae), Coleoptera (Cucujidae, Lathridiidae, Coccinellidae, Chrysomelidae), Neuroptera (Chrysopidae), Mecoptera (Panorpidae), Hymenoptera (Formicidae, Apidae), Diptera. Dominating among the phytophagous are flea beetles (Coleoptera, Alticinae), represented by four species. Along with these, there are also enthomophagous species on the reynoutria plants. Usually there is a presence of a large number of ants that may be related with aphids. Typical and abundant consorts of reynoutria are Aranei. Acari are met constantly, but in fewer quantities. The statement of the actual absence of natural enemies of *Reynoutria* species in Europe is reliably denied by our observations. The local Arthropoda comlex has adapted to feed on the tissues of these invasive species. This is confirmed by phytophagous species seen by us on these plants? and by the damage on live plants leaf plates which have nibbled and curls on them.

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PLACES OF GROWTH OF *AMORPHA FRUTICOSA* INTO LEFT BANK FOREST-STEPPE (UKRAINE)

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Amorpha fruticosa is an American species. It is a shrub, kenophyte which spread over the floodplain of the middle Dnieper during the past few decades. The species became a component of natural vegetation and influence actively on the state and dynamics of natural vegetation (transformer).Such its activity and certain negative influence on native vegetation and natural complexes of the region cause concern. In some regions of Ukraine this species only begins its expansion. It is important to study the distribution of its local populations as centers of potential danger. Such type of its distribution is typical for the northern part of the Ukrainan Left Bank Forest-steppe nowadays.

During the explorations of this region in 2017-2018 we have identified this species places of growth. All identified local populations have an artificial origin and are confined to the roadsides, the skirts of forests and the outskirts of settlements. All of them characterized by spontaneous seed reproduction.

Places of growth 1) 51°771570 N, 33° 070566 E, Puzyreva Gora between villages Desnianske and Radychiv, Korop district, Chernihiv region, habitat square –25 m^2 at the forest edge; 2) 51°075309 N, 31° 228202 E, outskirs of Kipti village, Kozelets district, Chernihiv region, habitat square – 200 m^2, brushwood on the road side; 3) 51°200390 N, 31° 176428 E, outskirs of Pryvokzalne village, Konotop district, Sumy region > 1000 m^2 , brushwood on the road side; 4) 50°241235 N. 32° 898551 E, outskirs of Kovali village, Kremenchuk district, Poltava region, 300 m^2, brushwood on the road side and on the fallow; 5) 50°024326 N, 33° 108836 E, outskirs of Pisky village, Lubny district, > 1000 m^2, brushwood on the road side and on the meadow.

Thus these populations presence and the active seeds reproduction causes a danger of wide species distribution in the region. The most vulnerable to the spread of *A. fruticosa* are flood biotopes, where the primary succession actively take place. Such location of these local populations causes a threat to the rapid spread of this species in the floodplain of small rivers such as Mnoga, Ezuch, Kukolka and the large rivers Desna and Sula. In view of this, it is advisable to apply preventive measures to restrict the distribution of this species. In particular, the most effective measure is the complete destruction of these populations as promising sources of seed germination.

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ABOUT *POETEA BULBOSAE* RIVAS GODAY ET RIVAS-MARAT. IN RIVAS-MARAT. 1978 CLASS DISTRIBUTION IN UKRAINE

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Among the early spring vegetation of Ukraine only one syntaxon was presented earlier the association *Veronico dillenii-Secalietum sylvestris* Shevchyk et Solomakha 1996 class *Koelerio-Corynephoretea canescentis* Klika in Klika et Novák 1941. In April 2018, V.L. Shevchik made up additional researches (34 descriptions) in the Kaniv city in the same vegetation cover areas, where the predominant role is played by winter ephemerals and ephemeroids. Such type of phytocoenoses occupy an area from several square meters to several ar. Descriptions are made on an area of 4 square meters. These researches allowed to assert the *Poetea bulbosae* class distribution in Ukraine which includes the Mediterranean plant groups of seasonal perennial plants and ephemeroids.

This class is characterized by the presence of common species – *Medicago lupulina, Erodium cicutarium, Plantago lanceolata, Poa bulbosa, Lolium perenne.* In Ukraine, with these species in groups also grows *Buglossoides czernjajevii, Valerianella locusta, Lamium amplexicaule, Arabidopsis thaliana, Veronica hederifolia, V. persica, V. verna, Erophila verna, Anisantha tectorum, Draba nemorosa, Ranunculus ilyricus* at all. Most of these species of Ukrainian flora are diagnostic for classes: *Koelerio-Corynephoretea canescentis* Klika in Klika et Novák 1941; Sedo-Scleranthetea Br.-Bl. 1955; Festuco-Brometea Br.-Bl. et Tx. ex Soó 1947. Such interpretation is a consequence of their frequent presence in phytocoenoses of this type, but does not correspond to the biomorpho-phenorythmotypic status of the main aedifictors of the groups of these classes. The main elements for *Koelerio-Corynephoretea canescentis* are euxerophilous cereals summer-vegetation hemicriptophytes, for *Sedo-Scleranthetea*- summer-vegetation succulent hamephytes and hemicryptophytes, for *Festuco-Brometea*, summer-vegetation megatrophic xerophytes with wide biomorphological spectrum. As for the discussed group of plants, it should be noted that they occur in groups of these classes, and can form small area phytocoenoses with predominance and the determining influence in them.

We attributed these phytocenoses to the order *Poetalia bulbosae* Rivas Goday et Rivas-Marat. in Rivas Goday et Lodero 1970 class *Poetea bulbosae*. In general it is mostly secondary or semi-natural plant groups of spring perennials, ephemerals and ephemeroids of winter type germination on light dense substrates drying in summer. The upper statums of the soil profile is characterized by the rapid mineralization of organic matter after the winter period with the wet soil. These types of phytocoenoses are the most often founded as spots, strips along paths and roads, on man-made elements of relief.

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FLORA OF SELECTED RAILWAY STATIONS OF THE TRANSCARPATHIAN LOWLAND (TRANSCARPATHIA REGION, UKRAINE)

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The results of comparative studies of the Transcarpathian Lowland (Ukraine) railway stations flora are presented. The investigation is based on the original data that were collected during field trips to the Batyovo, Berehove, Chop, Khust, Maly Khust, Vylok and Vynogradovo in 2013–2016.

The preliminary list of the railway stations spontaneous flora includes 333 taxa of vascular plants. The first three families in the flora systematic spectrum are *Asteraceae* (62 species), *Poaceae* (33 sp.) and *Fabaceae* (24 sp.). In general, the systematic spectrum is typical for synanthropic fraction of floras. In the investigated flora the next groups are prevailed: in life form spectrum – hemicryptophytes (168 sp.); in synanthropic fraction of the flora – apophytes (183 sp.), incl. euapophytes (49 sp.), hemiapophytes (59 sp.) and eventapophytes (75 sp.); in alien fraction – kenophytes (95 sp.) and species originate from North America (33 sp.) and from Mediterranean-Irano-Turanian region (33 sp.).

New alien species for Ukraine (*Geranium purpureum* Vill., *Chrysaspis patens* (Schreb.) Holub) and for the region (*Portulaca* sp. div.) are found. 17 alien plants of railway stations are noted in the official regional "List of invasive plants of Transcarpathia Region" (2017).

Four species are recorded in the IUCN Red List of Threatened Species (2017) as Least concern (LC) species and in the Red list of Transcarpathia region (2014) – *Aegilops cylindrica* Host (IUCN), *Asparagus officinalis* L. (IUCN; Transcarpathian RL), *Astragalus glycyphyllos* L. (IUCN), *Kohlrauschia prolifera* (L.) Kunth (Transcarpathian RL).

The research was supported by the project of Slovak Academy of Sciences and National Academy of Sciences of Ukraine "Current situation of invasive plant species in the border area of Ukraine and Slovakia and trends in their spreading" (2014–2016).

NOTES ON THE ALIEN FRACTION OF THE FLORA OF THE WESTERN PART OF THE KROPYVNYTSKY REGION

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The western part of the Kropyvnytsky region (Blahovishchenske, Haivoron, Holovanivsk and Vilshanka districts) is located between the rivers Southern Bug, Sinyukha and Yatran'. In this area, we recorded 227 alien plant species. Among them are 21 trees, 19 shrubs, 47 perennial herbs and 141 annual herbs.

The structure of alien fraction of the flora of this territory is typical to agricultural areas. Typical xenophytes are *Ambrosia artemisifolia* L., *Conyza canadensis* (L.) Cronq., *Erigeron annuus* (L.) Pers., *Sinapis arvensis* L. and others. In the 1990s *Echinocystis lobata* (Michx.) Torr. & A.Gray, *Grindelia squarrosa* (Pursh) Dunal, *Sclerochloa dura* (L.) P. Beauv. etc. began to spread. In the 2000s appeared: *Amaranthus powellii* S.Watson, *Aegilops cylindrica* Host, *Oxalis stricta* L., *Typha laxmannii* Lepech. Some xenophytes were locally recorded: *Bryonia alba* L. (Roznoshenske village, 2009), *Cynanchum acutum* L. (Krasnogirka village, 2014), *Neslia paniculata* (L.) Desv. (near Roznoshenske village, 2004), *Oxybaphus nyctagineus* (Michx.) Sweet (near Holovanivsk station, 2018), *Euphorbia davidii* Subils (near Blahovishchenske, 2016), *Sisymbrium orientale* L. (between Blahovishchenske and Holovanivsk, along the highway, 2018).

Many ergasiophytes in the region have spread from forest plantations: *Amorpha fruticosa* L., *Cornus australis* C.A.Mey., *Cotinus coggygria* Scop., *Gleditsia triacanthos* L., *Lonicera tatarica* L., *Prunus mahaleb* L., *P. serotina* Ehrh., *Ptelea trifoliata* L., *Ulmus pumila* L. A large number of ergasiophytes are distributed predominantly within the settlements. Thus, *Solidago canadensis* L. is marked along roads in Holovanovsk and does not show high invasive activity. The threatening for forest ecosystems are *Berberis aquifolium* Pursh and *Parthenocissus inserta* (A.Kern.) Fritsch.

The transport network in the region promotes the migration of aboriginal species. Now some of the neophytes have spread along the highways in the northern direction (*Anthriscus cerefolium* (L.) Hoffm., *Cephalaria uralensis* (Murray) Schrad. ex Roem. & Schult., *Lactuca saligna* L. and *Tragopogon dasyrhynchus* Artemcz.).

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MEDICINAL PLANTS OF SYNANTHROPIC FLORA OF UKRAINE IN STATE PHARMACOPEIA OF UKRAINE

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Flora of medicinal plants of Ukraine consist of 2219 species (Minarchenko, 2005), which is one third of the flora of vascular plants in Ukraine. Of these, 719 species of medicinal plants are species of the synanthropic flora of Ukraine (Protopopova, 1991; Minarchenko, 2005) or 32% of all species of medicinal plants in Ukraine. There are 43 species of medicinal plants of synanthropic flora are used by official medicine, they are included in the State Pharmacopoeia of Ukraine (1st, 2nd edition, supplements, 2008, 2009, 2011, 2014). Among them there are native (18) and alien species (25). Among native species of synantropic flora are euapophytes (9 species), hemiapophytes (8) and accidental apophyte (1). *Equisetum arvense* L., *Chelidonium majus* L., *Polygonum aviculare* L., *Urtica dioica* L., ets are euapophytes, which mainly prefered to the anthropogenic habitats. In both natural and anthropogenic habitats, hemiapophytes grow: *Achillea millefolium* L., *Agrimonia eupatoria* L., *Viola tricolor* L., etc. Among the alien species of medicinal plants, by the time of immigration archaeophytes (14 species) prevail, 11 species are kenophytes. Archaeophytes include such well-known medicinal plants as *Althaea officinalis* L., *Artemisia absinthium* L., *Leonurus cardiaca* L., to the kenophytes belong to *Calendula officinalis* L., *Datura stramonium* L., *Solidago canadensis* L., etc. For the degree of naturalization among the studied species is dominated by epoecophytes, species occur in anthropogenic habitats (*Ballota nigra* L., *Fumaria officinalis* L., *Malva neglecta* Wallr., *Viola arvensis* Murr., etc.). *Salix fragilis* L. and *Althaea officinalis* are agriophytes, they grow in both antropogenous and natural habitats. By the way of migration the species studied are xenophytes (10 randomly entered species) and ergasiophytes (15), species deliberately introduced for cultivation and later escaped. *Matricaria recutita* L., *Papaver rhoeas* L., *Urtica urens* L. belong to the xenophytes, the ergasiophytes are *Carthamnus tinctorius* L., *Chamaemelum nobile* (L.) All., *Foeniculum vulgare* Mill., ets.

Thus, alien species enriched the flora of medicinal plants of Ukraine with valuable species used by official and traditional medicine. The resources of many medicinal plants of synanthropic flora are significant in Ukraine, which is due to the large areas of anthropogenic habitats. Some species are cultivated for obtaining medicinal raw materials in necessary volumes. When harvesting medicinal raw materials from anthropogenic ecotopes must take into account their pollution.

THE MOST DISTRIBUTION INVASION SPECIES ON THE TERRITORY OF THE NATIONAL NATURE PARK "SYNEVYR"

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The territory of the National Natural Park "Synevyr" is located on its periphery with mountain ranges from 450 to 1719 m a.s.l. From all sides to the territory of the park adjoins the mountain relief with the forest masses of the Ukrainian Carpathians, both natural and artificial. This is, to a certain extent, a burrowing barrier that holds out the invasion of alien species into the territory of the Park, including species with highly invasion ability. The latest noted mainly in anthropogenic ecotopes in settlements of the territory of the Park, e,g. Vilshanka, Kolochava, Negrovets, Synevyr, Synevyrs' Polyana, etc. (from 480 to 900 m a.s.l.), along Tereblya River (about 60 km), and with branched small settlements of the eastern and western exposition.

The alien fraction flora of the National Nature Park "Synevyr" is presented by 104 species of vascular plants (Protopopova, Tyukh, Shevera, 1999; Tyukh, Ziman, Derbak, 2011), among them are 11 invasive species.

Amaranthus retroflexus L., rare, mainly on anthropogenic;

Ambrosia artemisiifolia L., rare, mainly on anthropogenic places; the largest locality was noted in Negrivtsy vill.;

Bidens frondosa L., common, mainly in settlements;

Galinsoga parviflora Cav., common, in settlements;

Heracleum sosnowskyi Manden., rare,only two localities in the territory of the Park: massifs "Hyrsovich" and "Sukhar"of the Kolochava forestry;

Impatiens parviflora DC., common, in beech forest of the Vilshabske forestry and anthropogenic ecotopes (along roads places);

Phalacroloma annuum (L.) Dumort., sporadically, mainly in Synevyr quail;

Reynoutria japonica Houtt., very rare, one locality near the Park Office, cultivated;

Robinia pseudoacaia L., small colony along river bank in Negrovets vill., in other places singly or very rare sporadically.

Salix fragilis L. sporadically, on the forest edge ofmeadow, along streams;

Setaria pumila (Poir.) Roem. & Schult. rare, the forest edge ofmeadow, along streams.

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INVASIVE PLANT SPECIES ALONG THE DANUBE AND THE LITTLE DANUBE RIVER

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In this presentation the distribution of invasive plant species in the Danube and Litle Danube river basins (South-West Slovakia) are recorded (from the years 2011-2017).

Danube, as an important international biocorridor enters the Slovak territory through the Devín Gate; flowing through the Danube Lowlands after 172 km leaves Slovakia near mouth of the river Ipeľ. At past it was a free flowing, wild meandering river with many big and small channels and oxbows with large inundated area. The Little Danube was one of two main arms of the Danube. In the present state the Danube bifurcates into the main channel (The Large Danube), Little Danube and Mosoni Danube, respectively. In1992 the hydrologic regime of the Danube was further altered by construction of a hydroelectric power project (the Gabčíkovo Waterworks). Changes occurred in the hydrological regime of the area, many side arms were cut of river and are drying out. In places, gradual decrease of the groundwater levels occurred. The Little Danube has mainly a semi-natural flow pattern with meandering river bed due to very low slope gradient (0,19‰). It flows through an intensively cultivated landscape, its banks are lined by fragments of floodplain forests, crowns of trees and shrubs reach the surface of the river. The main part of flow is regulated by construction of waterways, canals and dams, too. Inundated area is overgrown by vegetation, in deeper sections of the stream grows aquatic vegetation.

Recent distribution is documented by evidentiary bookings realised according to mapping status determined by State Nature Conservancy of the Slovak Republic. In assessing invasion status the actual list of alien vascular taxa and invasive plants was used (Medvecká et al., 2012).
In both river basins altogether 23 invasive plant species of Slovakia were recorded (during the years 2011 to 2017). In the Danube river basin 21 species were found, 9 of them subjected to statutory removal due Decree of statutory liquidation (No. 158/2014). Along the Litle Danube 17 taxons were identified, 5 of them subjected to statutory removal .

In contrast with the Danube river, the species *Amorpha fruticosa, Asclepias syriaca, Echinocystis lobata, Impatiens glandulifera, Helianthus tuberosus, Solidago canadensis*, were not detected in the Little Danube river basins.

Analysis of accessible herbarium documents in Bratislava institutions (BRA, SAV, SLO) notes history of spreading of those plants. The oldest herbarium documents of *Bidens frondosa* species confirmed its expansion along the waterway from Morava to Danube and subsequently to Little Danube rivers. Planting of an alien woods (*Robinia pseudacacia, Populus x canadensis, Juglans nigra*) and decrease of the area occupied by native floodplain forests were the main human-induced changes here. Plantations of introduced plants have become the focus for spreading synanthropic and invasive plants. *Impatiens glandulifera, Aster lanceolatus* and *Negundo aceroides* are the species most massively invading the moist floodplain forests (alliance *Salicion albae*) along the Danube at present. *Solidago gigantea, S. canadensis* and *Impatiens parviflora* invade drier, mesic forest type. *Ailanthus altissima, Stenactis annua agg., Ambrosia artemisiifolia, Artemisia annua, Fallopia japonica, Helianthus tuberosus* invade forests margins, ditches, forest roads and by-ways. Water habitats of channels and canals are threatened by *Elodea canadensis, E. nuttallii, Pistia stratiotes* and *Bidens frondosa.*

Recent and historical distributions (according to herbarium specimens) of the most important species are displayed on maps.

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ALIEN SPECIES IN THE VEGETATION OF THE RESERVE "BERNIVSKY ISLAND"(CHERNIVTSI REGION)

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In connection with the establishment of the Dniester reservoir in 1984, the coastal plain area of Bernovo vill. of the Kelmentsi district was flooded, and its highest left-bank part formed the island. Order of the Chernivtsi Regional State Administration dated February 8, 1996 No. 87-p. here is a reserve of local significance "Bernivsky island" with an area of 25.0 ha. At the moment, it is the part of the National Nature Park "Khotynskiy" and lies in the middle of the Dnister River.

Today its total area reaches 9-12 ha (depending on the water level), and the part where there are relatively continuous thickets of shrub and bush vegetation is approximately 9.5 ha. Eastern, western and northern parts of the island Bernovo gentle and south are sand cliff height not exceeding 2 m (this area due to water gradually destroyed) (Protected Areas of Bukovyna, 2017).

In the vegetation cover of the investigated part of the reserve, a number of alien species have been identified, in particular, *Acer negundo* L., *Althaea officinalis* L., *Amorpha fruticosa* L., *Artemisia absinthium* L., *Ballota nigra* L., *Conyza canadensis* (L.) Cronq., *Elaeagnus angustifolia* L., *Lathyrus tuberosus* L., *Morus alba* L., *Oenothera biennis* L., *Papaver rhoeas* L., *Phalacroloma annuum* (L.) Dumort., *Salix fragilis* L., *Vicia hirsuta* (L.) S.F. Gray, *Xanthium albinum* (Widder) H.Scholz. In the spectrum of the leading families, *Asteraceae* predominates, with the time of immigration– the kenophytes, the degree of naturalization – epoecophytes, by origin – from the North American species.

Invasive species of Prut-Dniester area – *Acer negundo*, *Salix fragilis* with incorporation of *Amorpha fruticosa*, *Elaeagnus angustifolia* and an aboriginal species of *Salix alba* L. form a wood-shrub tier of the island's floodplain complexes. In large areas open areas dominate *Oenothera biennis*, *Phalacroloma annuum*, competing with the types of local flora: *Aristolochia clematitis* L., *Calamagrostis epigeios* (L.) Roth, *Lysimachia vulgaris* L., etc. Phytocoenotic widest amplitude features *Phalacroloma annuum*, which is common in almost all plant complexes of the island.

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THE EFFECT OF ANTHROPOGENIC TRANSFORMATION OF FOREST STRUCTURE ON BRYOPHYTES DIVERSITY: A CASE STUDY OF THE MURCKI FOREST (SILESIAN UPLAND, POLAND)

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Forest management practices fundamentally impact the structure of a forest. Bryophytes are particularly sensitive to this type of antopogenic transformation. The aim of this study was to describe disturbances of woodland habitats caused by forest management and examine the species diversity on different types of substrates (ground, tree bark and dead wood) in the managed forest (Murckowski Forest, Silesian Upland, S Poland). In a 100 sampling plots, the structure of the forest and the species composition and abundance of bryophytes on different types of substrates (ground, tree base, tree trunk, dead wood) were analyzed.

In total, 54 bryophyte species were recorded (5 liverworts and 49 mosses). The largest number of species were observed on dead wood (42), while the least were typical epiphytes growing on tree trunks more than 30 cm above the ground (18). The main characteristics of the forests that are a consequence of anthropogenic pressure (relatively young stage of forest development, dominating a stand with only 1-2 species of trees, planting coniferous tree species on habitats of deciduous forests, introducing alien tree species, very limited amount of dead wood) have been observed on the study plots. There are three main factors that negatively determine the occurrence of bryophytes in forest habitats: the high cover of grasses and leaf litter (negatively affect the development of the ground bryophytes), lack of old, deciduous trees (limited the development of epiphytes), and small amount and size of dead wood.

GEOINFORMATIC TOOLS: A SUPPORTING SYSTEM FOR COAL MINE HEAPS RECLAMATION

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Coal mine heaps are a constant element of the landscape of the Upper Silesia, Poland. For a successful reclamation strategy of these wastelands we propose a multidisciplinary approach involving remote sensing and ecological niche modelling. Research included physico-chemical properties of substratum, floristic composition, plant biomass, arbuscular mycorrhizal fungi (AMF) communities associated to vegetation patches, mesofauna and functional microbial diversity influence on vegetation patches composition. In the laboratory conditions we tested effect of AMF inoculum, as well as, salinity stress and fertilization on survival, growth and physiology of selected plant species growing on carboniferous waste rocks. Collected data combined with satellite images obtained by remote sensing will allow to elaborate a predictional model of vegetation of coal mine heaps including abiotic factors as well as biotic ones and interactions between them, anthropogenic disturbances and variants of ecosystem modification in order to assist decision-making processes in reclamation strategies.

CRIMEAN AFFAIRS: *BIDENS FRONDOSUS* VS *B. TRIPARTITUS*

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The spontaneous flora of Crimea numbers today 2563 species and subspecies of vascular plants including 162 neophytes (6,3%). In the beginning of XXI century I was pioneered in discovering in Crimea a North American weed, *Bidens frondosa* L. (all specimens are stored in CSAU). *B. frondosa* has been known from West Europe since 1837 but in East Europe since 1950s. This species was collected in the very South of the last region in Simferopol (Crimean Foothills) only in 2006. In the Southern Coast of Crimea, *B. frondosa* was collected in 2009 (West part, Yalta) and in 2010 (East part, Kurortnoye). There has been no specimens of this species from another two geographic regions of Crimea – Crimean Plane and Kerchensky Peninsula until now. Highly likely, that *B. frondosa* has reached Crimea in the end of 1990s, because in the early 2000s there already were dozens of individuals of the new species there. During several years, *B. frondosa* was growing together with native *B. tripartita* L. here. In 2006, cover-abundance of the pair of native / adventitious species of *Bidens* were estimated in two typical plant communities in the River Salgir bottom land within sity of Simferopol. In the both communities, the first one with dominance of *Persicaria maculosa* S.F. Gray and the second of *Phragmites australis* (Cav.) Trin. ex Steud, cover-abundance of *B. tripartita / B. frondosa* was + / r or 1 / + (following the Braun-Blanquet scale) with rate of individuals 4 /1. Since then, no water regime neither composition and structure of plant communities were considerable changed in the River Salgir bottom land but *B. tripartita* was finally defeated by *B. frondosa* in 2017. There are no any plant of *B. tripartita* here now though abundance of *B. frondosa* is still rather low anyway being estimated as + or 1, i. e. as previously of *B. tripartita*. Thus, neophyte has just replaced archaeophyte during two dozen years without noticeable changing of their cover-abundance within the same plant communities.

ORDINARY KRIGING VS INVERSE DISTANCE WEIGHTING TO PREDICT THE DISTRIBUTION OF INVASIVE SPECIES

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Data on the distribution and cover of invasive plant species play a key role in protection of natural resources. Methods of spatial interpolation may be useful in generating models from in situ sampling points, especially in circumstances where remote sensing (RS) cannot be applied due to smallscale of extent wherespatial and spectral patterns are unnoticeable. Interpolation methods are widely used in environmental sciences however studies using these methods in ecology of invasive plants are scarce. We compared the accuracy of the two commonly used interpolation methods, Ordinary Kriging (OK) and Inverse Distance Weighting (IDW), to predict the distribution for two invasive species: *Heracleum sosnowskyi*and, *Fallopia* spp. Both interpolation techniques were exact interpolators but in the case of IDW the measured values closest to the prediction location have more influence on the predicted value than those farther away, while the OK is the Best Linear Unbiased Estimator (BLUE). IDW and OK generated similar distribution maps for these species, however the map from OK better reflected the distribution of species in the area, while the map with IDW is overestimated. Accurate spatial interpolations created using IDW and OK allowed us to perceive the spatial variability of species cover which RS would not be able to produce. Our study provides the basis for further research projects and management of invasive plant species where remote sensing is not suitable for use.

Research has been carried out under the Biostrateg Programme of the Polish National Centre for Research and Development (NCBiR), project No. DZP/BIOSTRATEG-II/390/2015: The innovative approach supporting monitoring of non-forest Natura 2000 habitats, using remote sensing methods (HabitARS).

ALIEN SPECIES OF THE FOREST PLANT COMMUNITIES OF THE SILESIAN FOOTHILLS

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The Silesian Foothills is the area that stands out in terms of the species richness of vascular plants. This is mainly due to the diverse of geological base and location on the foreland of the Silesian and Little Beskids. In addition, in its western part, the Silesian Foothills reaches the Moravian Gate – a pass between the Sudetes and the Carpathians, which is an important migration corridor for plants and animals from southern Europe. Despite the fact that the Silesian Foothills is a refuge for many rare and endangered species, it is an area strongly anthropogenically transformed, especially by the deforestation – forest cover reaches only 10%. It is one of major cause of alien species colonization.

The aim of the research was to find out which alien plant species are occurring in forests of the Silesian Foothills, and which plant communities are especially endangered by them.
The research conducted in 2015–2017 shows that most of plant communities of the study area are endangered by alien species, both natural and anthropogenically transformed. Plant communities most transformed by the impact of invasive species are riparian forests: *Salicetum albo-fragilis* and *Populetum albae*.

POLYGONUM POLYSTACHYUM AS AN INVASIVE SPECIES IN POLAND

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Despite *Polygonum polystachyum* was not included in a "Checklist" of Polish vascular flora, it is a dangerous alien species occurring there in less than 10 localities. New localities were found recently, and some old localities can still exist after many years after introduction. Currently, there is no information about generative reproduction of the species in Poland because of late flowering (e.g. in area of Pomerania plant is blooming in November), but is has efficient methods of vegetative reproduction. Further spreading of the species is expected and its complete withdrawal from sale is recommended. In addition, it is suggested to monitor existing sites, while also caution when removing specimens is recommended, due to the fact that the removal attempts stimulate vegetative development.

THE URBAN FLORA OF CHERNIHIV

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The urban flora of Chernihiv is represented by 1050 vascular plant species from 470 genera, 115 families and 5 divisions. Among them, 1 species is new for the territory of Ukraine (*Aizopsis aizoon* (L.) Grulich) and 44 – for the territory of Chernihiv Polissya. As the result of the structural analysis it was discovered, that the urban flora of Chernihiv is typical for flat lands (plains), formed in humid habitats of temperate climate, that causes its boreal-nemoral, suboceanic-subcontinental, mesophytic characteristics. The comparative study of the flora showed that the influence of urbanization promotes aridization of the environment, which is manifested in the quantitative increase of mesophytes and reduction of species with hygromorphic structure in the composition of the urban flora and the regional flora of the Forest zone. Predominance of the native fraction was revealed as a result of the fractional analysis of the Chernihiv urban flora, that is caused by the maintenance of natural and semi-natural areas. The evaluation of the degree of anthropogenic transformation of the Chernihiv flora using various indexes shows that the urban flora is highly synanthropyzed. The main trends of anthropogenic transformation of the urban flora are apophytization, anthropophytization, and modernization. As a result of comparative floristic investigation of urban floras of different zones it was discovered that the conservation of zonal features, as well as the degree of their transformation, depends on the intensity and duration of anthropogenic factors' influence.

ASSESSMENT OF THE ENVIRONMENTAL THREATS OF ALIEN AQUATIC PLANTS

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Today the assessment of the environmental threats of alien species for wetland ecosystems is very relevant. For example, according to the team of specialists Invasive Species Specialist Group (ISSG), which was organized under the auspices of the Species Survival Commission (SSC) of the IUCN there are 277 Ramsar sites where as a threat either from within the site or from within the catchment. This is 17% of all Ramsar sites by number, as well as by total size of sites, for 84 countries there are IAS threats to at least one of their sites. Today the list of alien species in Ukraine has 19 species of macrophytes. A number of them (*Elodea canadensis, E. nuttallii*, *Egeria densa*, *Pistia stratiotes*, *Azolla filiculoide*, *Azolla caroliniana*, *Groenlandia densa*, etc.) is characterized by a wide ecological amplitude, the ability to reclaim disturbed aquatic habitats and significantly affect synanthropization of aquatic flora. Higher aquatic plants have a number of features, which need to be considered when assessing their invasive potential. Critical analysis of "A Unified Classification of Alien Species…" and methods of estimating invasiveness of species of O.S. Abduloyeva and colleagues let us develop "The diagnostic table of the assessment of invasive potential of alien species of the higher aquatic plants of Ukraine". It represents a matrix, which is based on 10 risk criteria (a primary area, the time and the place of invasion, the degree of kinship with the flora of the region, morphological and ecological plasticity, reproductive versatility and habitat conditions, features of the ecological-phytocoenotic strategy, the ability to transform the environment), each of them is divided into three classes (low, moderate, significant). Depending on which class the species characteristic for each of the selected risk criteria corresponds, an assessment is assigned for species, that is expressed in points (from 1 to 3 according to the risk classes). As a result, the species "collects" the amount of points. The ratio raised of the amount to the maximum possible (30 points), in % gives an indicator of invasiveness (II), where: II <35% - is estimated as low 35% ≤II≥70% - moderate, II> 70% - significant.

PHRAGMITES ALTISSIMUS (BENTH.) NABILLE (POACEAE) – A NEW INVASIVE SPECIES OF KHARKIV URBAN FLORA (UKRAINE)

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As a result of research of Kharkiv urban flora (2012-2018) a new invasive species *Phragmites altissimus* was found (Zvyagintseva, 2013). This species is riverside aquatic perennial plant of North American origin. It similar to *Ph. australis* (Cav.) Trin. ex Steud., but differs in large sizes, stems are 3-9 cm in height, panicle length up to 50 cm. It grows along the banks of water bodies, rivers, on the marshes and floodplain meadows, near the groundwater outlet, in forests, on saline soils.

For Ukraine this species was indicated as subspecies of *Ph. australis* (Tsvelev, 1976). The first data about distribution of *Ph. altissimus* are known from the Kyiv, Poltava, Khmelnytsk regions (Lyubinska, 2012; Karpova, Klepets, 2013). Later, more localities has been discovered on the territory of the Right-Bank and Left-Bank Forest-Steppe(Kuz', Starovoytova, 2014).

On the Kharkiv territory *Ph. altissimus* was found in 2014 along the Udy river in the district Novaya Bavaria (CWU 0054206). It is a neophyte, a colonophyte and a xenophyte in the Kharkiv urban flora. *P. altissimus* formed dense thickets with *Ph. australis* in length up to 4. It was included in the conenoses *Phragmitetum australis* Savič 1926 (Dubyna et al., 2017). *Ph. altissimus* prefers the transformed, ruderal areas with a closeness of groundwater. It quickly moved from the stage of expansion to the form with high invasive ability, having overcome the geographical, reproductive, environmental and phytocoenotic barriers. Investigation and monitoring of the distribution of *Ph. altissimus* are continuing. In order to study distribution of *Ph. altissimus* and to reveal the centers of its introduction will becom posed the maps of distribution in the city (1 x 1 km grid).

For notes

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