

COMPOSITION OF THE SYNANTHROPIC FRACTION OF SPONTANEOUS FLORA OF THE GARDENS AND PARKS IN THE MIDDLE POBUZHCHIA REGION OF UKRAINE

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Abstract

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The aim of our work was to analyse synanthropic fraction of spontaneous flora of gardens and parks in the Middle Pobuzhzhia Region of Ukraine and to reveal the features of synanthropisation. The landscapes of gardens and parks in the Region include botanical gardens, arboretums and monuments of landscape art. A total of 15 objects were studied. The floras of parks were estimated by proportion of different groups (origin, naturalisation degree, time and ways of introduction) of synanthropic species. The synanthropic fraction of spontaneous flora was calculated using the indices of synanthropisation, apophytisation, anthropophytisation, archeophytisation, kenophytisation and modernisation. These indices were specified for each park and for the Middle Pobuzhzhia Region in general. The obtained data were compared to each other and to the analogous urban floras from different zones of Ukraine. It was revealed that the apophytisation processes were dominated by the processes of adventisation in most of the parks. The proportion of the synanthropic fraction of spontaneous flora of the Middle Pobuzhzhia Region was significantly lower compared to urban floras of some cities of Ukraine, and despite a considerable anthropogenic pressure retained some features of natural flora.

Keywords: alien species, apophytes, gardens, parks, Sofiivka, Southern Bug River, spontaneous flora, synanthropic fraction of flora, urban flora.

INTRODUCTION

The harmonious progress of urbanization, economic development and the environment is an important field of research that combines the social and natural sciences. Urbanisation affects the economy and the population’s health, education and socialisation; it impacts on and is concerned with environmental protection and remediation, in addition to the exploitation of natural resources (LI & MA, 2014).

Under the urbanisation influence, the processes of synanthropisation of flora and vegetation of urban and suburban habitats, semi-natural and devastated areas develop, resulting in impoverishment of species composition of native fraction of urban flora, changing dominant species, degradation of plant commu-

nities, violation of trophic chains, etc. (VLADIMIROV, 1999; KUCHERIAVYI, 2001).

The vegetation of cities plays an important role in improving the state of the urbanized environment; therefore, more and more attention is paid to its purposeful research. Optimisation, rational use, modelling of vegetation development in cities is impossible without inventory and analysis of urban flora (PROTOPOVA, 1998).

Most European urban parks, gardens and other landscape architectural types are based on native flora and alien ornamental species introduced from the 16th century. Only a small percentage (approximately 11%) of them became invasive and competed with the native species (ELMQVIST et al., 2013). The first floristic research of urban floras started in Western

Europe in the second half of the 20th century (KENT, 1975; KOWARIK, 1990; SUDNIK-WOJCIKOWSKA, 1987). Some Polish (SUDNIK-WOJCIKOWSKA, 1998) and German (SUKOPP, 1973; SUKOPP & WERNER, 1983) scientists have worked especially intensively in this area.

Gradually, this line of research has spread in Ukraine, where the first studies of the urban floras began with the series of publications by R. I. BURDA (BURDA, 1982, 1988, 1990, 1991, 1997) and continued in different regions: Kherson (MOYSIYENKO, 1999), Great Yalta (LEVON, 1999), Mykolajiv (MELNYK, 2001), Kyiv (MOSYAKIN & YAVORSKA, 2002), Uzhorod (PROTOPOPOVA & SHEVERA, 2002, 2003), Kryvyi Rih (KUCHEREVSKIJ & SHOL, 2009), Simferopol (YEPIKHIN, 2008), etc. Parks and gardens are an integral part of an urban flora and in most of the aforementioned works they are mentioned, though rarely separated.

Currently, the research on urban flora has been carried out in more than 60 cities and towns of Ukraine (BILYAVSKYI, 2012). The information on the spontaneous flora of botanical gardens and arboretums as well as their synanthropisation is still fragmentary. The largest number of works in this area devoted to the spontaneous flora of O.V. Fomin Botanical Garden of the Taras Shevchenko National University of Kyiv (BERESKINA et al., 2007; HUBAR & YAKUSHENKO 2009, HUBAR, 2010; SOLOMAKHA & HUBAR, 2008). There is some information about the spontaneous flora of “Askaniya-Nova” (HAVRYLENKO et al., 2008; SHAPOVAL, 2010) and “Oleksandria” (DOJKO, 2014) dendrological parks, the Botanical Gardens of Odesa (SHVETS & POPOVA, 2000) and Kherson (MOYSIYENKO et al., 2008) Universities.

Research on spontaneous flora of the National Dendrological Park “Sofiivka” of the National Academy of Sciences of Ukraine continues intermittently for more than 150 years (ANDRZHEYEVSKIJ, 1862, PACHOSKIJ, 1887; HORYACHEVA, 1960; SYDORUK, 1974; KOSENKO, 2000; KUZEMKO, 2008; KUZEMKO et al., 2011; KUZEMKO & KOVTONIUK, 2015, 2016). At the same time, a complex study of spontaneous flora of garden and park landscapes and the degree of its anthropogenic transformation in Ukraine has not yet been carried out.

The features of flora of gardens and parks in the Middle Pobuzhzhia Region were determined by their location in the basin of the Southern Bug River, with

a rich species pool and a variety of habitats. The landscape of gardens and parks is an anthropogenic, which combines spatially natural components (rocks and their surface forms, water, soils, vegetation, etc.) with small architectural forms and structures, road-line infrastructure and forms an interconnected unity in which the features of social perception of the world are reflected through the prism of social, economic and political development (DENISIK & KRAVTSOVA, 2012).

Spontaneous flora of gardens or parks is formed spontaneously, without direct human intervention and has undergone significant changes especially due to recreational pressure. Therefore, under strong anthropogenic pressure the monitoring of processes of synanthropisation of flora is vital for evaluation of its scale and consequences. The aim of our work was to analyse the synanthropic fraction of spontaneous flora in the Middle Pobuzhzhia Region and to reveal peculiarities of their synanthropisation. The results obtained can be useful in organizing proper management of parks and gardens to preserve their structure and aesthetic view, and to prevent plant invasions.

MATERIALS AND METHODS

Data collection

A floristic survey of spontaneous flora of gardens and parks in the Middle Pobuzhzhia Region was performed in 2015–2017, including botanical gardens, arboretums and monuments of landscape gardening in the Vinnytsya and Cherkasy Regions, a total 15 objects (Fig. 1, Table 1).

The survey was conducted by the route-mapping method; all species of spontaneous flora along the route were recorded. In addition, phytosociological relevés were performed according to the Brown-Blanquet method and all species recorded in the relevés were included in the floristic list of species. The areas of study were selected to avoid, as far as possible, cultivated areas, flower beds, newly created lawns, arboretums. The representatives of segetal and ruderal vegetation were recorded. Based on these data, an annotated checklist of spontaneous flora was compiled. The nomenclature of higher vascular plants was based on the Nomenclatural Checklist of Vascular Plants of Ukraine (MOSYAKIN & FEDORONCHUK, 1999). The species of synanthropic



Fig. 1. Location of gardens and parks in Middle Pobuzhzhia

fraction were selected and characterised according to the criteria of KORNÁS (1968) and references of PROTOPOPOVA (1991). The synanthropic fraction of the spontaneous flora was estimated according to the indices of synanthropisation (IS), apophytisation (IAP), anthropophytisation (IAN), archeophytisation (IArch), kenophytisation (IKen) and modernisation (IM) (JAKOWIAK, 1993).

The obtained data were compared to the literature data on synanthropisation of urban flora of different natural zones: forest zone in Chernihiv (ZAVYALOVA, 2012) and Uzhorod (PROTOPOPOVA & SHEVERA, 2002); forest-steppe zone in Kharkiv (ZVYAGINTSEVA, 2015) and Kropyvnytskyi (former Kirovograd) (ARKUSHINA & POPOVA, 2010), steppe zone in Kryvyi Rih (KUCHER-EVSKUJ & SHOL, 2009), Donetsk-Makiivka (DEREVYANSKA, 2014), Kherson (MOYSIYENKO, 1999), Mykolajiv (MELNYK, 2001), and Mariupol (BURDA, 1991).

Study area

The term "Middle Pobuzhzhia" was used in relation to the central (middle) part of the Southern Bug

River basin, from the city of Vinnitsya to the town of Oleksandrivka, Mykolajiv Region (Fig. 1).

Middle Pobuzhzhia is a historical and geographical region. The source of the river is in the Podil'ian Upland, and it flows into the Bugs estuary of the Black Sea. The area of its basin is 63700 km. In general, the climate in the Southern Bug River basin is moderately continental with mild winters and rather warm humid summers. Mean annual temperature is 7.1–8.1°C. Annual rainfall is 550–669 mm, gradually decreasing from north to south. From a geological point of view, Middle Pobuzhzhia is located within of the Ukrainian Crystalline Shield, which is one of the largest elevated sites of the crystalline foundation of the Eastern European Platform and ancient crystalline rocks (granites, gneisses) come to the surface in many places. Most of the studied parks and gardens are created precisely in such places due to their picturesque beauty. The light gray, dark gray and black podzolic soils are prevailing in the region (VORONA et al., 2009).

According to the geobotanical zonation of

Table 1. Gardens and parks in Middle Pobuzhzhia

No.	Name	Status	Location	Period of establishment	Year of granting status	Area, hectares	Date of examination
1	Central City Park in Vinnytsia (Central Park of Culture and Recreation named after M. Gorky)	Monuments of landscape gardening of national importance	Vinnytsia town, Hlibna Street, 1 49°14'09" N 28°27'15" E	The first half of the 19th century	1987	30.0	July 2016
2	"Podillia" Botanical Garden	Monuments of landscape gardening of national importance	Vinnytsia town, Pirogov Street, 153 49°13'04" N 28°25'13" E	20th century (1963)	1987	72.0	July 2016
3	M.I. Pirogov National Museum-Estate Park	Monuments of landscape gardening of local importance	Vinnytsia town, Pirogov Street, 153 49°12'57" N 28°24'30" E	20th century (1944)	1995	18.9	July 2016
4	Acad. O.I. Yushchenko Park	Monuments of landscape gardening of local importance	Vinnytsia town, Pirogov Street, 109 49°12'53" N 28°26'26" E	1902	1972	15.0	July 2016
5	Nemyrivsky Park	Monuments of landscape gardening of national importance	Nemyriv town, Nemyriv district, Shevchenko Street, 16 48°58'01" N 28°50'42" E	18th century (1787)	1960	76.87	June 2015 April 2016
6	Sokiletsky Park	Monuments of landscape gardening of local importance	Sokilets village, Nemyriv district Mikhailovskaya Street, 49 48°51'44" N 28°43'05" E	17th–18th centuries	1972	30.4	June 2015
7	Pechersky Park	Monuments of landscape gardening of national importance	Pechera village, Tulchin district, 48°51'41" N 28°42'38" E	At the end of the 17th century	1984	19.0	June 2015
8	Kryzhopilsky Park	Monuments of landscape gardening of local importance	Kryzhopil urban village, Kryzhopil district, Michurina Street, 1 48°22'48" N 28°52'36" E	At the end of the 19th century	2009	29.0	July 2016
9	Verkhivsky Park	Monuments of landscape gardening of national importance	Verkhivka village, Trostyanets district, Technikumovska Street, 1 48°26'31" N 29°08'53" E	At the end of the 19th century (1891)	1960	25.0	September 2017
10	Obodivsky Park	Monuments of landscape gardening of national importance	Obodivka village, Trostyanets district, 48°24'14" N 29°15'31" E	At the end of the 19th century	1960	17.0	September 2017
11	Leskivsky Park	Monuments of landscape gardening of local importance	Leskove village, Monastyrische district, 48°59'37" N 29°52'47" E	18th century (1772)	1996	89.0	August 2017
12	Shelpakhivsky Park	Monuments of landscape gardening of local importance	Shelpakhivka village, Khrystynivka district, 48°42'7" N 29°55'1" E	18th century	2000	20.0	April 2016
13	Synytsky Park	Monuments of landscape gardening of local importance	Synytsia village, Khrystynivka district, 48°41'51" N 30°03'41" E	18th century	1972	42.0	April 2016
14	National Dendrological Park "Sofiivka" of NAS of Ukraine	Monuments of landscape gardening of national importance	Uman town, Uman district, Kyivska Street, 12a 48°45'47" N 30°13'21" E	1796	1983	179.2	2015–2017
15	Talnivsky Park	Monuments of landscape gardening of national importance	Talne town, Talne district, Zamkova Street, 93 48°51'53" N 30°41'59" E	At the end of the 19th century	1960	406.0	April 2016 June 2016

Ukraine, Middle Pobuzhzhia is situated within the Eurasian steppe region of the forest-steppe sub-oblast of the Eastern European forest-steppe province of oak forests, steppe meadows and meadow steppes of the Ukrainian forest-steppe subprovince (DIDUKH & SHEL'YAG-SOSONCO, 2003).

RESULTS

Spontaneous flora of the Middle Pobuzhzhia Region includes 698 species of vascular plants from 377 genera and 103 families. The analysis of synanthropic fraction of spontaneous flora of Middle Pobuzhzhia is presented in Table 2.

The synanthropic component of Middle Pobuzhzhia consists of 289 species (41.4%). The largest proportion of synanthropic species was revealed in M.I. Pirogov National Museum-Estate Park (70.8%), the smallest – in Pechersky Park (37.3, all other parks had the proportions of about 50%, which indicated a significant anthropogenic pressure on park habitats (Fig. 2).

The apophytes prevailed in all studied synanthropic fraction and had ranged from 50 to 80% (Table 2). This indicated that the processes of apophytisation prevailed over the processes of adventisation. By the proportion of the apophyte fraction, the spontaneous flora of Verkhivsky Park (79.1%) occupied

the first place; the second was the flora of Talnivsky Park (78.7%), which was only 0.1% inferior to Sokiletsky Park flora (77.7%), the last place belonged to the flora of Central City Park in Vinnytsia (54.9%). Within the apophyte fraction, evapophytes prevailed in almost all studied parks, only in Shelpakhivsky Park and Dendrological Park “Sofiivka” – hemiapophytes took a leading position with 26.1 and 22.9%, respectively.

In the alien fraction, archaeophytes prevailed in the most parks (9 out of 15); the highest proportion was detected in Central City Park of Vinnytsia (27.5%), the lowest in Talnivsky Park (6.7%) (Table 2). However, in the synanthropic fraction of spontaneous flora of six parks, we revealed predominance of kenophytes with the largest content in Kryzhopilsky Park (17.2%) and the smallest in Synytsky Park (10.4%).

Comparative characteristics of synanthropic flora fractions showed that epecophytes prevailed in the flora of Central City Park in Vinnytsia – 37.3% (Table 2). The largest proportion of agriophytes was revealed in Leskivsky Park (7.3%), ergasiophytes (3.3%) and hemiepecophytes – in Dendrological Park “Sofiivka” (7.5%), while ephemeroxytes – in Talnivsky Park (4.4%).

On the base of the obtained results, the indices of synanthropisation, apophytisation, anthropo-

Table 2. Comparative characteristics of synanthropic flora fractions (%) in gardens and parks in Middle Pobuzhzhia

Parks	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Synanthropic flora (species number)	51	90	85	57	108	76	57	58	43	51	41	23	67	240	45
Apophytes fraction	54.9	68.9	61.2	61.4	63.0	77.6	68.4	67.2	79.1	64.7	65.8	69.6	71.6	57.1	77.8
Random apophytes	13.7	11.1	15.3	12.3	12.0	15.8	10.5	12.1	20.9	9.8	14.6	21.7	13.4	16.7	13.3
Hemiapophytes	13.7	25.6	17.6	17.5	20.4	30.3	22.8	24.1	25.6	19.6	17.1	26.1	25.4	22.9	31.1
Evapophytes	27.5	32.2	28.2	31.6	30.6	31.6	35.1	31.0	32.6	35.3	34.1	21.7	32.8	17.5	33.3
Alien fraction	45.1	31.1	38.8	38.6	37.0	22.4	31.6	32.8	20.9	35.3	34.2	30.4	28.4	42.1	22.2
Archaeophytes	27.5	13.3	24.7	22.8	19.4	9.2	17.5	15.5	9.3	17.7	17.1	17.4	17.9	21.3	6.7
Kenophytes	17.6	17.8	14.1	15.8	17.6	13.2	14.0	15.8	11.6	17.6	17.1	13.0	10.4	20.8	15.6
Agriophytes	3.9	4.4	3.5	3.5	5.6	5.3	5.3	6.9	4.7	5.9	7.3	4.3	6.0	2.9	4.4
Hemiagriophytes	2.0	2.2	0	1.8	1.9	0	0	0	0	2.0	0	0	1.5	3.3	0
Epecophytes	37.3	16.7	31.8	29.8	26.9	13.2	22.8	20.7	11.6	23.5	24.4	17.4	17.9	27.1	8.9
Ergasiophytes	2.0	5.6	1.2	3.5	0.9	2.6	1.8	3.4	4.7	3.9	2.4	4.3	3.0	7.5	4.4
Ephemeroxytes	0	2.2	2.4	0	0.9	1.3	1.8	1.7	0	0	0	4.3	0	1.3	4.4

1 – Central City Park in Vinnytsia, 2 – “Podillia” Botanical Garden, 3 – M.I. Pirogov National Museum-Estate Park, 4 – Acad. O.I. Yushchenko Park, 5 – Nemyrivsky Park, 6 – Sokiletsky Park, 7 – Pechersky Park, 8 – Kryzhopilsky Park, 9 – Verkhivsky Park, 10 – Obodivsky Park, 11 – Leskivsky Park, 12 – Shelpakhivsky Park, 13 – Synytsky Park, 14 – National Dendrological Park “Sofiivka” of NAS of Ukraine, 15 – Talnivsky Park.

phytisation, archeophytisation, kenophytisation and modernisation of the studied floras were calculated (Table 3).

According to the value of the synanthropisation index (reflecting participation of synanthropic species in flora), the flora of M.I. Pirogov National Museum-Estate Park ranked first (70.8%). A similar situation for this park was observed in the processes of apophytisation, archeophytisation, kenophytisation, which indicates a large synanthropisation of the flora and a significant anthropogenic pressure on the plant cover of this park due to its high tourist attraction and location in the regional centre, the most populated city within the study area. The smallest value of the index of synanthropisation was determined in Pechersky Park (37.3%), which is probably due to its difficult accessibility for recreation purposes because of the features of relief, in particular, the presence of rapid rocky slopes.

The index of anthropophytisation indicates the role of invasions of alien plants in the synanthropic fraction of flora. The apophytisation index reflects the participation of native species in the plant cover of transformed habitats. The ratio of these two indicators proves the processes that prevail in the studied area. The index of apophytisation (reflecting the ratio of apophytes to the total number of species) was the

highest for the flora of M.I. Pirogov National Museum-Estate Park (43.3%), and the lowest for the flora of Pechersky Park (25.5%). The highest index of anthropophytisation (reflecting the ratio of alien plants to the total number of species) was observed for the flora of M.I. Pirogov National Museum-Estate Park (27.5%), while the smallest was detected for the flora of Sokiletsky Park (8.8%). The highest value of the archeophytisation index (the ratio of archaeophytes

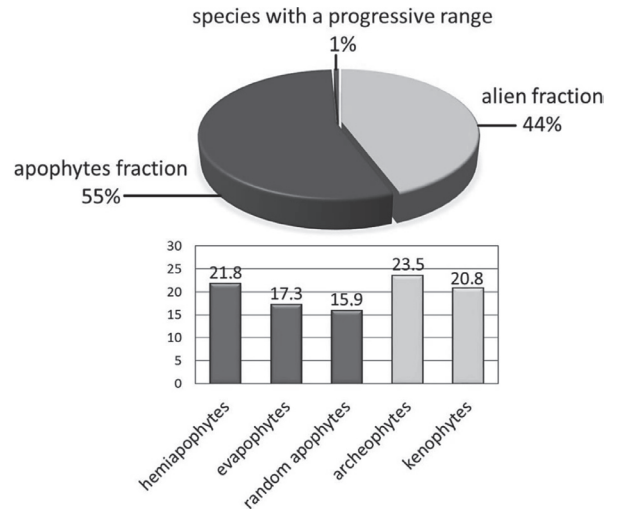


Fig. 2. The fractions of synanthropic flora of gardens and parks in Middle Pobuzhzhia

Table 3. The values of indices (%) of synanthropic flora of gardens and parks in Middle Pobuzhzhia

Parks	Indices					
	IS	IAp	IAn	IArch	IKen	IM
M.I. Pirogov National Museum-Estate Park	70.8	43.3	27.5	17.5	10	36.4
Acad. O.I. Yushchenko Park	58.2	35.7	22.4	13.3	9.2	40.9
Central City Park in Vinnytsia	56.0	30.8	25.3	15.4	9.9	39.1
“Podillia” Botanical Garden	53.3	36.7	16.6	7.1	9.5	57.1
Verkhivsky Park	52.4	29.7	11.0	4.9	6.1	55.6
Synyttsky Park	51.5	36.9	14.6	9.2	5.4	36.8
Leskivsky Park	51.3	33.8	17.5	8.6	8.6	50.0
Shelpakhivsky Park	51.1	35.6	15.6	8.9	6.7	42.9
Kryzhopilsky Park	50.9	34.2	16.7	7.9	8.8	52.6
Nemyrivsky Park	48.9	30.8	18.1	9.5	8.6	47.5
Obodivsky Park	48.6	31.4	17.1	8.6	8.6	50
Dendrological Park “Sofiivka”	45.5	25.9	19.1	9.7	9.5	49.5
Talnivsky Park	43.7	34	9.7	2.9	6.8	70
Sokiletsky Park	39.2	30.4	8.8	3.6	5.2	58.8
Pechersky Park	37.3	25.5	11.8	6.5	5.2	44.4
Spontaneous flora of gardens and parks in Middle Pobuzhzhia	41.4	22.8	18.3	9.7	8.6	46.9

IS – index of synanthropisation, IAp – index of apophytisation, IAn – index of anthropophytisation, IArch – index of archeophytisation, IKen – index of kenophytisation, IM – index of modernisation.

to the total number of species) was noted for the flora of M.I. Pirogov National Museum-Estate Park (17.5%) and the lowest for Talnivsky Park (2.9%).

The indices of modernisation and kenophytisation reflect the intensity of invasions at present. The index of modernisation (indicating the proportion of kenophytes in the alien component of flora) was quite high (46.9%) for the studied flora in total with the highest value for Talnivsky Park (70%) and the lowest for M.I. Pirogov National Museum-Estate Park (36.4%). The index of kenophytisation (the ratio of kenophytes to the total number of species) also had the highest value in the flora of M.I. Pirogov National Museum-Estate Park (10%), and its smallest value was characteristic of Pechersky and Sokiletsky Parks (5.2% each). Furthermore, the indices of transformation of spontaneous flora of the garden and park landscapes in Middle Pobuzhzhia were established, which reflects the processes of synanthropisation of the region in general terms. Unfortunately, it is rather difficult to compare the obtained data, because of a limited number of publications on the synanthropic component of spontaneous flora of the garden and park landscapes in the other regions of Ukraine.

Since the spontaneous flora of botanical gardens, dendrological parks and monuments of landscape gardening, is an integral part of the urban flora (ILMINSKIKH, 1993), it would be appropriate to compare the data obtained with the data of other urban floras of some Ukrainian cities from different natural zones. The results of the comparison of anthropogenic transformation indices are given in Table 4. The largest part of the synanthropisation is characteristic of the urban flora of the Ukrainian steppe zone, the second place – the forest-steppe zone urban flora, and the third – the forest zone.

Spontaneous flora of Middle Pobuzhzhia in terms of the most indices, except index of archaeophytisation, has the lowest rates not only within the forest-steppe zone, but also compared to urban floras of the other zones of Ukraine.

DISCUSSION

The analysis of the synanthropic fraction of spontaneous flora of the Middle Pobuzhzhia Region showed that according to ABRAMOVA & MIRKIN (2000), the studied area belongs to moderately

synanthropic areas, where the participation of synanthropic species ranged from 37.3 to 70.8%, with the average of 41.4%.

The processes of apophytisation in most of the studied parks were prevailing over the processes of adventisation. Evapophytes were dominated in apophyte fraction of all the studied parks. In the alien (adventive) fraction, archaeophytes exceed a kenophytes in the majority of the parks as well as epepophytes were prevailing over other species groups. The proportions of the synanthropic flora fractions and indices of anthropogenic transformation reflected the peculiarities of functioning of the studied parks, first of all, the intensity of recreational pressure and presence or absence of an appropriate management. Thus, the parks located in the city of Vinnytsia, M.I. Pirogov National Museum-Estate Park, Acad. O.I. Yushchenko Park, the Central City Park in Vinnytsia, and Podillia Botanical Garden, experience much more anthropogenic influence (not only recreational but also practical) than parks of smaller settlements. According to the indices of anthropogenic transformation, the most synanthropised was the spontaneous flora of the park of M.I. Pirogov National Museum-Estate, the least transformed – the floras of Pechersky and Sokiletsky Parks. The situation observed in the abandoned parks such as Verkhivsky, Synytsky, Leskivsky and Shelpakhivsky, shows that the transformation of spontaneous flora is different. The degradation of vegetation was evident, which negatively affected both the overall view of the parks and the state of the habitats in general. Changes of vegetation structure occurred from a lack of care, which negatively affects the overall view of parks and their habitat conditions. In properly maintained parks such as Talnivsky, Nemyrivsky, Sokiletsky and Pechersky, anthropogenic flora transformation rates were lowest.

Interesting was the situation in Dendrological Park “Sofiivka”, where, despite a considerable anthropogenic pressure, the spontaneous flora was less transformed compared to the floras of parks in the city of Vinnytsia, although it can be argued that the intensity of anthropogenic pressure on the plant cover in these parks was approximately at the same level.

It should be noted that spontaneous flora of Middle Pobuzhzhia showed considerably lower degree of synanthropisation than the total urban floras of the

Table 4. Comparison of indices of anthropogenic transformation with corresponding indices of the other urban floras of Ukraine

Urban floras	IS	IAp	IAn	IArch	IKen	IM
Forest zone						
Chernihiv	50.0	22.8	27.1	8.85	18.3	67.4
Uzhhorod	56.6	32.2	24.3	–	–	–
Forest-steppe zone						
Kharkiv	57.5	25.9	31.6	12.5	27.3	68.3
Kropyvnytskyi (Kirovograd)	53.2	29.2	24.0	9.0	11.8	49.4
Middle Pobuzhzhia	41.4	22.8	18.3	9.7	8.6	46.9
Steppe zone						
Kryvyi Rih	58.7	29.0	29.7	9.5	20.2	68.2
Donetsk–Makiivka	51.8	23.6	28.2	9.0	19.0	68.0
Kherson	64.4	36.0	28.4	9.0	19.4	68.2
Mykolajiv	63.0	37.2	25.8	8.5	17.4	48.7
Mariupol	45.1	24.2	21.0	8.5	12.5	59.4

IS – index of synanthropisation, IAp – index of apophytisation, IAn – index of anthropophytisation, IArch – index of archeophytisation, IKen – index of kenophytisation, IM – index of modernisation.

cities and towns in Ukraine. This is due to the fact that, despite a considerable anthropogenic pressure, spontaneous flora of the Middle Pobuzhzhia Region retained some features of natural flora and was less vulnerable than urban vegetation in general.

Synanthropic flora of Middle Pobuzhzhia as well as flora of many other cities of Ukraine is still characterized by a slight dominance of the apophyte fraction, but the results of the research on urban flora in the Ukraine indicated a tendency of the increasing role of alien plant species and growing invasive potential. However, the situation may change soon. Firstly, because of the intensity of introduction processes: the properties of naturalisation of some introduced plants lead to a change in the structure of phytocoenoses, displacement of native species and the development of new monodominant communities (RICHARDSON ET AL. 2000). Thus, introduction can act as one of the sources of adventisation of natural flora and even invasions. Secondly, one of the main factors accelerating the processes of adventisation of flora is the constant recreational pressure on many gardens and parks, which makes its own adjustments, regardless of the presence or absence of management in these territories. Processes of anthropogenic influence are difficult to control as they have a dynamic character, but the indices of transformation of flora are effective indicators for the assessment of vegetation cover not only for individual parks, cities or towns, but also for the entire regions (SUDNIK-WOJCIKOWSKA, 1992). In order to enable

monitoring and prevention of possible negative consequences of this process in a timely manner, it is necessary not only to intensify the study of anthropogenic transformation of spontaneous flora in urban areas of Ukraine, but also to combine them with an appropriate management on the basis of regulated conservation measures and comprehensive care.

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UKRAINOS VIDURIO POBUŽIJOS REGIONO SINANTROPINĖS SODŲ IR PARKŲ FLOROS SUDĖTIS

Anna KOVTONIUK

Santrauka

Darbo tikslas buvo išanalizuoti Vidurio Pobužijos regiono sodų ir parkų sinantropinę florą ir nustatyti jos antropogeninės transformacijos ypatybes. Regiono kraštovaizdį formuoja sodai ir parkai, botanikos sodai, medelynai ir kraštovaizdžio meno kūriniai. Iš viso buvo ištirta 15 objektų. Parkų flora buvo įvertinta pagal sinantropinių rūšių įvairių grupių santykį. Antropogeninė floros transformacija buvo apskaičiuota naudojant sinantropizacijos, apofitizacijos, antropofitizacijos, archeofitizacijos, kenofit-

izacijos ir modernizacijos indeksus. Šie indeksai buvo nustatyti kiekvienam parkui bei visai regiono florai. Gauti duomenys buvo palyginti tarpusavyje ir su analogiška miesto flora iš skirtingų gamtinių Ukrainos zonų. Nustatyta, kad daugelyje tirtų parkų vyravo floros adventizacijos procesas. Vidurio Pobužijos regiono savaiminės floros antropogenizacija buvo mažesnė, palyginus su kai kurių Ukrainos miestų flora ir išlaikė kai kuriuos natūralios augalijos požymius.