

The Composition and Characteristics of the Dendroflora in the Transformed Conditions of the Middle Reaches of the River Khoper

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Abstract. Green plantings of the cities perform a number of important functions which provide ecological needs of cities population for a healthy surrounding medium, and his needs for communication with wildlife. The comparative analysis of species of wood plants of the towns of the Voronezh region (Borisoglebsk and Novokhopersk) was carried out. 110 types (to Borisoglebsk) and 91 species (to Novokhopersk) species of trees and bushes are registered. The systematic structure which showed a dominance of angiospermous plants that in general is characteristic of the urbanized territories. The range of geographical elements is presented by three types (European-West Asian – 35% and 40%, European – 30% and 26%, North -American – 14% and 21%). The prevailing life forms of the cities are trees, they make 56% and 60% respectively. Researchers showed, in the cities of east part of the Voronezh region many types of various origin can grow that helps to solve problems in gardening, afforestation and an agrarian and forest melioration, in creation of dendrology nurseries for the purpose of maintaining a genetic variety and the subsequent introduction of wood plants and bushes in culture.

1. Introduction

The problem of the conservation of biological diversity in anthropogenically transformed territories is especially significant, especially in connection with the processes of an urbanization, agglomeration which are followed by negative technogenic and chemical and mechanical impacts on landscapes and ecosystems [1-13].

Prikhopyorye's average falls into regions with a high level of anthropogenic transformation of a environment which reasons the urbanization, the developed agrarian complex and also the amplifying industrial and technogenic and transport load. In this territory the largest level of anthropotechnogenic transformation characterizes city settlements [8].

It is known that in settlements, especially in suburbs and especially in the cities of a plant test a potent press [3, 7, 11] from an economic complex (direct anthropogenic influence) and in the course of biotic interactions of various views-vselentsev with native organisms (the mediated anthropogenic influence on city ecosystems), in particular, at naturalization of various Advents and competitive replacement of local types by them. Including therefore the specific structure and structure of city plantings undergoes essential changes.

The research of features of trees and bushes in the conditions of the modern city settlements represents a relevant and significant scientific and practical task. It is known that in town planning, at arrangement of various functional zones green plantings of the corresponding target categories have to be created. City plantings, first of all, wood and shrubby, perform a number of the useful functions, including carry out a regulation of a microclimate, create a biological barrier on the way of an emission



and migration in a surrounding medium of pollutants and considerably provide ecological equilibrium between natural (organisms, the soil, water objects) and anthropogenic components urbosisty [3, 7].

The composition and structure of wood and shrubby vegetation within settlements in the east of the Voronezh region are studied not enough therefore this direction of researches is represented rather relevant.

The purpose of this work was carrying out the comparative analysis of wood plants of the Average Prikhopyorya (on an example urbosistem the Voronezh region) by results of the executed field researches.

Now the studying dendroflora of the urbanized areas of the Voronezh region continues. According to characteristic accounts the abstract of wood plants in the towns of Borisoglebsk and Novokhopersk located in east part of the Voronezh region is made.

2. Materials and methods

The basis of work is made by the materials of field researches of wood and shrubby vegetation of the towns of Borisoglebsk and Novokhopersk collected from 2009 to 2017 by method of route account [2]. All wood plants and bushes from structure of green plantings of different target categories (the common, restricted and express use) growing in city conditions and on suburban sites were considered. Work is documented by a herbarium from the introduced and wild-growing species of wood plants. The registered species of plants were differentiated also in life forms [6].

3. Results of study

The towns of Borisoglebsk and Novokhopersk chosen as areas of field researches are located in north-east and east parts of the Voronezh region, are the regional centers, motor transportation clusters. Local climatic conditions (moderate and continental climate, mainly slabovskholmlenny type of a relief, distribution of steppe, meadow and steppe, inundated meadow and forest vegetation) are characteristic of all Average Prikhopyorya.

Common information about above the called areas is provided in table 1.

Table 1. Total characteristic of Borisoglebsk, Novokhopersk

City	Borisoglebsk	Novokhopersk
Area	49 sq.km	14 sq.km
Population	63,000 residents	14000 residents
Location	it is located on the left-hand bank river of the Raven, near its confluence with the Khopyor River	it is located on the right bank river Khopyor (Don inflow at the height of 50-70 m over river level)
Education time	the city is founded in 1698	it is mentioned in the chronicle since the 17th century
Building	the majority of both cities is built up with private one-storey houses with gardens and kitchen gardens	
Features	in the south borders on the Tellermanovsky forest area, other part of the city is surrounded with agrotsenoza	the East and the north-east of the city borders on the Khopyor reserve, other part of neighborhood of the city adjoins to agrotsenoza

Systematic structure. During the researches it is established that 110 types, from them 28 families and 59 sorts (tab. 2) enter into structure of trees and bushes of Borisoglebsk.

Table 2. Systematic structure dendroflora of Borisoglebsk

Department	Class	Family	Sort	Species
<i>Pinophyta</i>	1	3	6	12
<i>Magnoliophyta</i>	1	25	53	100
Total	2	28	59	112

Dendroflora of Novokhopersk is presented by 91 species, to the falling into 23 families and, respectively, to 49 childbirth that it is reflected in table 3.

Table 3. Systematic structure dendroflora of Novokhopersk

Department	Class	Family	Sort	Species
<i>Pinophyta</i>	1	2	5	8
<i>Magnoliophyta</i>	1	21	44	83
Total	2	23	49	91

The systematic analysis of wood plants of areas of researches revealed that its basis is made by representatives of angiospermous plants (*Magnoliophyta*) – 89% in Borisoglebsk, and in Novokhopersk their quantity reaches 91%. Thus, the quantitative ratio of the considered group angiospermous approximately equal in both settlements. At the same time the share of representatives of gymnospermous (*Pinophyta*) is rather small: in Borisoglebsk it makes 11%, in Novokhopersk – 9%.

The ratio of departments and classes shows empery of representatives of angiospermous plants. Such ratio in general is characteristic of these urbanized territories. Increase in number of department of *Pinophyta* pays an attention that it is bound to a larger variety cultivated in the territory of the cities gymnospermous, mainly from among introduced species.

Further on table 4 the range of the leading families of the considered plants is presented.

Table 4. Range of the leading families dendroflora of Borisoglebsk, Novokhopersk

p/o	Family	The place in a range	Number of sorts			
			Borisoglebsk		Novokhopersk	
			Absolute quantity	Share as a percents, %	Absolute quantity	Share as a percents, %
1	<i>Rosaceae</i>	1	25	33	18	34
2	<i>Salicaceae</i>	2	10	13	7	13
3	<i>Caprifoliaceae</i>	3	9	12	5	9
4	<i>Pinaceae</i>	4	8	11	5	9
5	<i>Grossulariaceae</i>	5-7	5	6	4	8
6	<i>Oleaceae</i>	5-7	5	6	4	8
7	<i>Aceraceae</i>	5-7	5	6	4	8
8	<i>Ulmaceae</i>	8	4	5	3	5.5
9	<i>Betulaceae</i>	9-10	3	4	3	5.5
10	<i>Cupressaceae</i>	9-10	3	4	1	2
	Total:		77	100	54	100

As appears from table 4, the leading position in structure of wood plants and bushes of Borisoglebsk and Novokhopersk occupies the *Rosaceae* family numbering 25 sorts and 18 sorts respectively that makes 33% and 34% of total number of the registered representatives of the studied group of plants for each of these areas. The second place is taken by the *Salicaceae* family (13%). These two families take the leading positions that in general is characteristic of regions of Eastern Europe with a temperate climate. Such ratio is explained by historically developed introduction due to enrichment of wood and shrubby vegetation decorative and fruit and berry cultures. *Rosaceae* – one of large families of the flowering plants presented in areas of researches. Besides, his representatives are widespread almost in all areas of the globe where can grow floral, but after all their main part is concentrated in a moderate zone of the northern hemisphere. They meet in the most various vegetable communities and though do not play the dominating role, are, nevertheless, one of the major for us families of plants. The made family taking the leading place reckons the greatest number of fruit and berry, medicinal and vitamin-containing cultures that is rather fully used in the national economy, but often in private enterprises by means of gardening, truck farming, cultivation of numerous front gardens, hotbeds and flower beds. Representatives of the *Salicaceae* family originally were native types which then were widely cultivated that, by the way, is observed and presently in view of the fact that plants of the specified family have high decorative qualities and are allocated with vitality in culture. They frost-are also wind-resistant, photophilous.

Also it should be noted that the role in structure of a city dendroflora in the conditions of the Average Prikhopyorya of the *Pinaceae* family differing in a small amount of sort, but a large number of species is rather big. Species of this systematic group are highly decorative and in too time have high qualities of wood. Therefore they are often used as in gardening, forestry, and in other branches of the national economy: construction, housing and communal services, by production of stationery (various products from wood), the pharmaceutical industry.

Biomorphological structure. On the developed I.G. Serebryakov [6] classification, a range the ecomorph of wood and shrubby plants of the towns of Borisoglebsk and Novokhopersk is created by three types. The prevailing life forms are trees which make 56% and 60% respectively of total number of the registered species.

These are such widespread representatives as *Populus bolleana* Lauche, *Salix caprea* L., *Quercus robur* L., *Pinus sylvestris* L., *Malus domestica* Borkh., *Cerasus vulgaris* Mill. and others. Bushes are presented by such types as *Rubus idaeus* L., *Prunus domestica* L., *Ribes nigrum* L., *Ribes aureum* Pursh, *Rosa canina* L. Most poorly in structure an ecomorph of wood and shrubby plants lianas – only 4% are presented: *Vitis vinifera* L., *Parthenocissus inserta* (Kern.) Fritsch, *Schisandra chinensis* (Turcz.) Baill.

Composition of geographical elements. Plants which form this or that phytocenosis in the concrete region differ in features of their geographical origin, that is in geographical structure. Having analysed similarities and distinctions of areas of different types from among the researches considered in areas, it is possible to allocate the following geographical elements dendroflor that, actually, is reflected in table 5.

This table shows that a basis of structure of wood and shrubby plantings of Borisoglebsk, Novokhopersk species from structure of an European-West Asian geoelement (35%, 37%) make. These species are widespread mainly in moderately warm zone of Europe and the Western Asia. The continentality of climate increasing in east direction and also its intensive aridization acts as the major factor limiting their distribution. Among representatives of this group it is possible to call *Rosa canina* L., *Prunus spinosa* L., *Prunus domestica* L., *Padus avium* Mill., *Quercus robur* L., *Tilia cordata* Mill.

Among geographical elements of the European group of which 30% and 26% respectively for each of the considered urbanized areas are the share it should be noted the European species taking the third place (*Salix caprea* L., *Salix fragilis* L., *Acer platanoides* L., *Juniperus communis* L., *Sorbus aucuparia* L.).

Table 5. Geostructure dendroflora of Borisoglebsk, Novokhopersk

Groups and geocells types of geographic elements	Borisoglebsk		Novokhopersk	
	Quantity of species	Share as a percents, %	Quantity of species	Share as a percents, %
European-Asian group	38	35	37	41
Euroasian	10	9	15	17
The European-West Asian	24	22	20	22
The European-South West Asian	3	3	1	1
European-Caucasian	1	1	1	1
South East European and Asian group	3	3	2	2
European group	33	30	24	26
European	7	6	6	7
East European	4	4	2	2
South East European	6	5	4	4
Western European	13	12	10	11
Mediterranean	3	3	2	2
Asian group	12	11	10	11
Central Asian	5	5	4	4
The South West Asian	1	1	1	1
The East Asian	6	5	5	6
North -American group	16	14	11	12
Cultural group	8	7	7	8

Also the third place together with the European species was divided by natives of North America (respectively, on 14% and 12%). Emergence of these plants is caused by an introduction in the past. Plants of *Picea pungens* Engelm., *Acer negundo* L., *Ribes aureum*, *Thuja occidentalis* L. – representatives of this group. Introduced species of *Acer negundo* L. Prikhopyorya including within the Saratov region, next to it, is very widespread in city and natural conditions of the Voronezh region and across all territory.

Species Asian by origin make 11% of total of the registered representatives of wood and shrubby vegetation and take the fourth place. Treat them, in particular *Armeniaca vulgaris* Lam., *Rosa rugosa* Thunb.

The species known only in culture growing in the explored territories have also great economic value. First of all, they are used as sources of food (*Malus domestica* Borkh., *Prunus domestica* L., *Cerasus vulgaris* Mill.) and also as raw materials for production of diverse medicamentous tools.

4. Conclusion

The executed researches established rather high variety dendroflora of the considered urbanized territories that in general it is comparable to a specific variety of the residential district of the large city, such as Voronezh, and even exceeds that [7].

On the basis of the analysis of the executed accounting of objects of researches the following conclusions are received:

1. The systematic analysis of wood plants showed that its basis is made by angiospermous plants (*Magnoliophyta*) – 89% in Borisoglebsk, in Novokhopersk – 91%. The share of gymnospermous (*Pinophyta*) is rather small: in Borisoglebsk – 11%, in Novokhopersk – 9%.

2. In a range of families *Rosaceae* (33% and 34%) dominates, takes the second place this. *Salicaceae* (13%) that shows features of formation of wood and shrubby plantings of Borisoglebsk and Novokhopersk owing to mass cultivation decorative (*Salicaceae*, *Rosaceae*) and to a large extent fruit and berry cultures (*Rosaceae*).

3. Among an ecomorph of areas of researches there are 56% and 60% of total number of species it is the share of wood plants which make a basis of city green plantings and, respectively, an ecological framework of these territories.

4. Dendroflora has the dominating European-West Asian range of geographical elements (35% and 41%). The group, the second for number, is formed by the European species (30% and 26%).

5. A variety of geoelements is bound to formation of city plantings from structure of the native and introduced species of plants that in total helps to develop and to successfully solve problems of improvement of city residential districts, first of all, by means of green construction that as a result creates a possibility of achievement of effect of ecological comfort of the urban environment for locals.

So in the explored urbanized territories many species of wood plants and bushes, and various origin grow that represents an opportunity for a further introduction of representatives of these groups of organisms according to their bioecological features and further target use. It promotes optimum scheduling and the subsequent realization of actions for local and complex environmental engineering of urban and suburban areas in the conditions of the Voronezh region: gardening, afforestation, recultivation, agrarian and forest melioration.

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