Artículo de investigación

Invasive fraction flora analysis in the southwest of the central Russian upland

Análisis de flora de fracción invasiva en el sudoeste de las tierras altas de Rusia central
Análise da fração de flora invasiva no sudoeste do planalto central da Rússia

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Abstract

As a result of the studying the flora invasive component of the southwest of the Central Russian Upland (Russia), the taxonomic and typological structure of alien species in the region was defined. There were found new species registered for the first time in the study area. The analysis of life forms of the invasive component of the flora of the region revealed the predominance of annuals (33.4%), polycarpic herbs (25.0%), trees (17.8%) in its structure. In their relation to moisture conditions eumesophytes (46.5%) and xeromesophytes (32.1%) dominate among the invasive species. The analysis of the geographical element indicates that among invasive species the expanded area plants of North American origin (40.4%), European origin (27.4%) and Asian origin (10.7%) prevail.

Keywords: invasive species, structure, analysis, life forms

Resumen

Como resultado del estudio del componente invasor de la flora del sudoeste de la Región Central de Rusia (Rusia), se definió la estructura taxonómica y tipológica de las especies exóticas en la región. Se encontraron nuevas especies registradas por primera vez en el área de estudio. El análisis de las formas de vida del componente invasivo de la flora de la región reveló el predominio de plantas anuales (33.4%), hierbas policarpicas (25.0%), árboles (17.8%) en su estructura. En su relación con las condiciones de humedad, eumesophytes (46.5%) y xeromesophytes (32.1%) dominan entre las especies invasoras. El análisis del elemento geográfico indica que entre las especies invasoras predominan las plantas de área expandida de origen norteamericano (40.4%), origen europeo (27.4%) y origen asiático (10.7%).

Palabras claves: especies invasoras, estructura, análisis, formas de vida.

Resumo

Como resultado do estudo do componente invasivo da flora do sudoeste do Planalto Central Russo (Rússia), foi definida a estrutura taxonômica e tipológica das espécies exóticas na região. Foram encontradas novas espécies registradas pela primeira vez na área de estudo. A análise das formas de vida do componente invasivo da flora da região revelou a predominância de plantas anuais (33,4%), ervas policárticas (25,0%), árvores (17,8%) em sua estrutura. Em relação às condições de umidade, emasófitos (46,5%) e

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xeromesófitos (32,1%) dominam entre as espécies invasoras. A análise do elemento geográfico indica que entre as espécies invasoras prevalecem as plantas de área expandida de origem norte-americana (40,4%), origem européia (27,4%) e asiática (10,7%).

Palavras-chave: espécies invasoras, estrutura, análise, formas de vida.

Introduction

The flora of the southwest of the Central Russian Upland is formed within the boundaries of the steppe and forest-steppe zones (Lisetskii et al, 2016). Recently, we have noted the intensification of alien plant introduction in this region (Tokhtar & Groshenko, 2008; Tokhtar & Groshenko, 2014; Tokhtar et al, 2011; Tokhtar & Kurskoy, 2017; Tokhtar, 2018).
During the studies of the flora of the southwest of the Central Russian Upland, which we consider within the administrative boundaries of the Belgorod region, a holistic analysis of invasive species was not carried out.
The purpose of this study was to analyze the formation features of the flora invasive component of the southwest of the Central Russian Upland.

Research Methodology

The object of the study were invasive plant species in the southwest of the Central Russian Upland. The studies were conducted in the period from 2011 to 2018. During the field trips we examined 183 habitats with native invasive species, studied the flora invasive component in 27 specially protected territories of different ranks within the administrative boundaries of 10 different districts of the Belgorod region.
Traditional methods of comparative analysis were used to identify the regularities of the invasive component formation of the southwestern flora of the Central Russian Upland and to analyze the taxonomic and typological structures. (Tokhtar, 2016; Raunkiaer, 1904; Serebryakov, 1962).

Results

The study of the flora invasive component for the first time in the region allowed to identify 22 new species: Amaranthus cruentus L., Amelanchier spicata (Lam.) C. Koch, Campanula × spryginii Saksonov et Tzvelev, Centaurea montana L., Chenopodium betaceum Andrz., Commelina communis L., Datura inoxia Mill., Dipsacus fullonum L., Euphorbia davidii Subils, Euphorbia marginata Pursh, Grindelia squarrosa (Pursh) Dunal, Jurinea charcoviensis Klokov, Lupinus polyphyllus Lindl., Melampyrum polonicum (Beauv.) Soo, Nicotiana rustica L., Oenothera oakesiana (A. Gray) Robbins. ex S. Watson,, Onobrychis tanaitica Spreng., Panicum dichotomiflorum Michx., Physalis philadelphica Lam., Ptelea trifoliata L., Thladiantha dubia Bunge. 10 of these species are presented for the first time in the Central Black Earth region.

Our systematic analysis of the invasive component of flora allowed us to establish that this flora element includes 29 families, 70 genera and 84 species. The characteristic feature of the systematic structure of the flora invasive component in comparison with the regional one is the increase in the ranks of Rosaceae families (from 4.4% to 11.8%), Asteraceae (from 13.4% to 17.7%), Fabaceae (from 5.3% to 8.3%), Brassicaceae (from 6.3% to 8.3%) (Tokhtar et al, 2017) and status lowering of Poaceae families (from 9.1% to 8.3%), Lamiaceae (from 4.7% to 1.2%) or their disappearance: Caryophyllaceae, Cyperaceae, Scrophulariaceae.

The typological analysis of the structure of the flora invasive component of the southwest of the Central Russian Upland allows us to identify its characteristic features and determine the regularities of the formation and the specificity of this flora component.

The analysis of plants in their relation to moisture conditions shows that among invasive species of the region the eumesophytes, accounted for 46.5% of the total number of species, dominate, the group of xeromesophytes is in the second place (32.1%), and the third place takes the group of mesoxerophytes (14.3%). These groups of species in the structure of the invasive component, are followed by hygrophytes (5.9%) and euxerophytes (1.2%) (table 1).

Table 1. The structure of the flora invasive component of the southwest of the Central Russian Upland in relation of the species to the moisture conditions

The ecological group	The number of species	The percentage of the total number of types
Eumesophytes	39	46.5
Xeromesophytes	27	32.1
Mesoxerophytes	12	14.3
Hygrophytes	5	5.9
Euxerophytes	1	1.2

The results of the analysis of the geographical element of the invasive component of flora indicate that among the invasive species the plants of North American origin (40.4% of the total number) dominate, followed by the plants of European origin (27.4%), Asian origin (10.7%), Mediterranean-Iranian-Turanian origin (10.7%). The part of the Black sea, Caspian and East Pontic plants is 1.2%. This may be due to some similarity of the climatic characteristics of the North American continent to the conditions of vegetation formation in the southwest of the Central Russian Upland, as well as a significant number of pluriregional species with a wide ecological amplitude of this group of plants.

The study of the areas of invasive plants indicates a significant predominance of expanded area plants in their structure. Among them, the largest in number of species are European and North American species (21.4%), followed by Holarctic and Pluriregional plants (17.8%), Eurasian plants (11.9%), Pontic and ancient Mediterranean plants (9.5%), European and Mediterranean plants (6.0%), Hemipluriregional and European plants (4.8%), Siberian and Asian plants (3.6 per cent) (table 2).

Table 2. Geographical area of flora invasive component of the southwest of Central Russian Upland

№	The geographical area of species	The number of species	The percentage of the total number of types
1	European - North American	18	21.4
	European - North American	14	16.7
	European - American	3	3.6
	European - Mediterranean - North American	1	1.2
2	Holarctic	15	17.8
3	Pluriregional	15	17.8
4	Eurasian	10	11.9
	Eurasian	9	10.7
	European and East Asian	1	1.2
5	Pontic and ancient Mediterranean	8	9.5
	Pontic and ancient Mediterranean	7	8.3

	European and ancient Mediterranean	1	1.2
6	European - Mediterranean	5	6.0
	European - Mediterranean	4	4.8
	Mediterranean	1	1.2
7	Hemipluriregional	4	4.8
8	European	4	4.8
9	Siberian - Asian	3	3.6
	Siberian - Persian	2	2.4
	West Siberian - Asian	1	1.2
10	European - Mediterranean - Persian	1	1.2
11	European - West Siberian	1	1.2
12	Indian - Malay	1	1.2
In total:		84	100.0

The analysis of life forms according to I. G. Serebryakov (1962) allowed us to establish the predominance of the herbaceous plants (65.5%), annuals (33.4%), polycarpic herbs (25.0%) and trees (17.8%) among invasive species in the region. Also a significant number of species accounts for bushes. The minimum number of plants is represented in the group of monocarpic herbs, which make up 7.1% of the total number of species (table 3).

Table 3. The structure of life forms of the invasive component of the southwestern flora of the Central Russian Upland

№	Life form of species	The number of species	The percentage of the total number of types
1	Annuals	28	33,4
2	Polycarpic herbs	21	25,0
3	Trees	15	17,8
4	Bushes	14	16,7
5	Monocarpic herbs	6	7,1
In total:		84	100,0

The analysis of the invasive component of flora by the life forms of C. Raunkier (1905) shows a significant predominance of phanerophytes (34.4% of the total number of species) and therophytes (33.4%) in the structure of the flora invasive component. A significant proportion of plants accounts for hemicryptophytes (28.6%). The hydrophytes make up the least amount of invasive plants (3.6%).

Conclusions

1. A characteristic feature of the systematic structure of the flora invasive component in comparison with the regional one is the increase in the ranks of Rosaceae families: (from 4.4% to 11.8%), Asteraceae (from 13.4% to 17.7%), Fabaceae (from 5.3% to 8.3%), Brassicaceae (from 6.3% to 8.3%) and status lowering of Poaceae families (from 9.1% to 8.3%), Lamiaceae (from 4.7% to 1.2%) or their disappearance: Caryophyllaceae, Cyperaceae, Scrophulariaceae.

2. The analysis of life forms of the flora invasive component of the region revealed the predominance of annuals

(33.4%), polycarpic herbs (25.0%) and trees (17.8%) in its structure. The analysis of plants in their relation to moisture conditions shows that eumesophytes (46,5%) and xeromesophytes (32,1%) dominate among invasive species of the region.

3. The analysis of the geographical element indicates that plants of North American origin (40.4%), European origin (27.4%) and Asian origin (10.7%) dominate among the invasive species. The study of the areas of invasive plants indicates a significant number of expanded area plants with a predominance of European and North American species in their structure.

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