ORIGINAL ARTICLE

The analysis of the flora invasive component in the southwest of the Central Russian Upland (Russia)

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Abstract

Aim: Analytical characteristics of the flora invasive component in the southwest of the Central Russian Upland are presented in this work. **Methods:** The intensification of allogenic plants relocation into the region is confirmed by the findings of 13 new adventitious species: *Amaranthus cruentus, Campanula × spryginii, Centaurea montana, Commelina communis, Grindelia squarrosa, Jurinea charcoviensis, Lupinus polyphyllus, Nicotiana rustica, Onobrychis tanaitica, Panicum dichotomiflorum, Physalis philadelphica, Ptelea trifoliata,* and *Thladiantha dubia.* **Results:** It was defined, that *Asteraceae* (21.2%) and *Poaceae* (9.3%) took the leading position in the hierarchy of the flora invasive component. Eumosophytes (48.8%), xeromesophytes (31.6%), and mesocerphophytes (13.1%) prevailed with regard to moisture conditions.According to the life forms of Raunkier, invasive species of the region were represented mainly by terophytes (35.6%), and phanerophytes (31.6%). **Conclusion:** The greatest number of invasive species was found within the boundaries of transport highways, valleys of small rivers, floodplain meadows, and the fewest number - in the areas of cereal-meadow steppes and in the forest phytocenoses.

Key words: Analysis, degree of naturalization, invasive component of flora, life forms, structure, the southwest of the Central Russian Upland, way of relocation

INTRODUCTION

The relevance of the study of non-aboriginal plants is determined by the fact, that they are either economically valuable or harmful invasive species, crowding out local aboriginal species.[1-3] The relocation of anthropochronic species to various regions and their further naturalization contribute to the restructuring of the natural course of florogenesis.[4,5]

According to the experts, the damage from invasions of adventive plant species, on a global scale, is billions of dollars annually. Steppe species of plants become aggressive weed invaders in the territories of the USA prairies, and, conversely, American species, brought to Europe, crowd out rare, endangered, and relic species.[5,6] Relocation and distribution of allogenic plants carries a direct threat to the existence of native species, and the yield losses from weeds, many of which are adventive, are in the range from 9% to 19%.

The purpose of our investigation is to study and to analyze the flora invasive component in the southwest of the Central Russian Upland (Russia).

MATERIALS AND METHODS

The object of the study was allogenic plant species, invading into natural phytocenoses in the southwest of the Central Russian Upland, which are considered within the administrative boundaries of the Belgorod Region (Russia). The study was conducted by the traditional route method in the period from 2011 to 2016. The analysis of the flora

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invasive component, revealed in the process of investigation, was carried out according to the standard methods: The system of life forms of Raunkier[7] and Serebryakov[8] was used for the detecting of biomorphological structure; the range type was established according to the table of Meusel *et al*.;[9] the analysis of the immigration method and the degree of adventive species naturalization was carried out according to the classification of Kornas.[10]

RESULTS

As a result of the research, and the subsequent cameral processing of herbarium materials, the species composition of the invasive component of the regional flora was determined. It includes 76 species, belonging to 65 genera and 29 families. For the first time, 13 new adventitious species have been identified in the territory of the Belgorod region (Russia): *Amaranthus cruentus* L., *Campanula* × *spryginii* Saksonov et Tzvelev, *Centaurea montana* L., *Commelina communis* L., *Grindelia squarrosa* (Pursh) Dunal, *Jurinea charcoviensis* Klokov, *Lupinus polyphyllus* Lindl., *Nicotiana rustica* L., *Onobrychis tanaitica* Spreng., *Panicum dichotomiflorum* Michx., *Physalis philadelphica* Lam. (= *Physalis ixocarpa* Brot. ex Hornem.), *Ptelea trifoliata* L., *Thladiantha dubia* Bunge.

Systematic analysis of the invasive fraction of the flora has shown that it includes 29 families, 65 genera and 76 species. There are 25 families, 55 genera, 66 species - representatives of *Magnoliopsida*; *Liliopsida* includes 4 families, 10 genera and 10 species. *Asteraceae* (21.2%) takes the leading place in the hierarchy of invasive species. Cereals (9.3%) are the most prevalent among monocotyledonous plants. The 1st 10 families in the spectrum by the number of species include 58 species or 76.3% of the total flora invasive component: *Asteraceae*, *Rosaceae*, *Poaceae*, *Onagraceae*, *Brassicaceae*, *Fabaceae*, *Amaranthaceae*, *Chenopodiaceae, Balsaminaceae, Elaeagnaceae*.

In the structure of the studied flora fraction, with regard to moisture conditions, eumosophytes (48.8%), xeromesophytes (31.6%) and mezoxerophytes (13.1%) prevail among the invasive species in the southwest of the Central Russian Upland. Hygrophytes include 3.9% of species, and hydrophytes - 2.6%.

Invasive species of the region are represented by the following life forms, according to Raunkier:[7] Terophytes constituting 35.6% of the total number of species, phanerophytes (31.6%), and hemicryptophytes (27.6%). Hydrophytes and chamefits are represented insignificantly (3.9% and 1.3%, respectively).

Most of the regional invasive species are wide-ranging: Holarctic, Pluri-Regional and East Asian species include 59.1% of the plants. Among the invasive species, the largest number of plants has North American origin (32 species, 42.2%). Then, in descending order, there are the plants of East Asian (12 species, 15.9%), Mediterranean (10 species, 13.1%), European, and Eurasian origin (by 8 species, 12.5%).

By the method of relocation of invasive species into this region, the number of xenophytes (randomly relocated species) slightly prevails over the number of ergasiophytes ("fugitives from culture") and is 52.6% and 47.4%, respectively. However, this ratio markedly differs among the plants of various life forms. Xenophytes predominate in the group of annual species (91.7% of the total number of species) and herbaceous polycarpic plants (62.5%); herbaceous monocarpic plants are completely represented by xenophytes. All the trees and shrubs, belonging to the invasive component of the flora, by the method of their relocation into the region, belong to ergasiophytes, and perennial grasses consist of them by 59.9% [Table 1].

The greatest number of invasive species was found within the boundaries of railways and roads, as they are one of the most important channels for the relocation of new species into the flora of the region. Many invasive plants were found in gardens, parks, wood lines, and other anthropogenically disturbed habitats. The least amount of allogenic invasive plants grows in natural habitats, reserves, especially protected natural areas.

DISCUSSION

Structural analysis of the flora invasive component in the southwest of the Central Russian Upland shows that the

Table 1: The degree of naturalization of invasive species, by the groups of life forms

Item No.	Life form	The degree of naturalization			
		Ephemerophyte	Colonophyte	Epekophyte	Agriophyte
1	Annual species	0	2	15	7
2	Herbaceous polycarpic plants	0	2	7	7
3	Herbaceous monocarpic plants	0	0	3	3
4	Perennial grasses	0	0	3	2
5	Trees	0	1	0	14
6	Shrubs	0	0	0	10
Total		0	5	28	43

leading place in the hierarchy of taxa, among the main families, belongs to *Asteraceae* (21.2%); and cereals are the most prevalent among monocotyledonous plants (9.3%). The 1st 10 families in the spectrum by the number of species include 58 species or 76.3% of the full range of invasive species of studied flora: *Asteraceae*, *Rosaceae*, *Poaceae*, *Onagraceae*, *Brassicaceae*, *Fabaceae*, *Amaranthaceae, Chenopodiaceae, Balsaminaceae,* and *Elaeagnaceae.*

Eumosophytes (48.8%), xeromesophytes (31.6%), and mesocerphophytes (13.1%) predominated in the structure of the invasive component of the flora, with regard to moisture conditions.

According to the classification of life forms of Raunkier,[7] the invasive species of the region are represented mainly by the terophytes (35.6%), phanerophytes (31.6%), and hemicryptophytes (27.6%).

Most of the regional invasive species are wide-ranging: Holarctic, Pluri-Regional and East Asian species include 59.1% of the plants. Among the invasive species, the largest number of plants has North American origin (32 species, 42.2%). Then, in descending order, there are the plants of East Asian (12 species, 15.9%), Mediterranean (10 species, 13.1%), European, and Eurasian origin (by 8 species, 12.5%).

By the method of relocation of invasive plants into the region, the number of xenophytes slightly predominates over the ergasiophytes (52.6% and 47.4%, respectively).

CONCLUSION

As a result of the research, species composition of the flora invasive component in the southwest of the Central Russian Upland was defined for the first time. It consists of 76 species, belonging to 65 genera and 29 families. The intensification of allogenic plants relocation into the region is confirmed by the findings of 13 adventitious species, which are new for the territory of the Belgorod region (Russia).

Structural analysis of the flora invasive component shows, that the species of the families *Asteraceae*, *Rosaceae*, *Poaceae*, eumesophytes (48.8%) and xeromesophytes (31.6%), terophytes (35.6%), and phanerophytes (31.6%) predominate in its composition. Most of the regional invasive species are wide-ranging: Holarctic, Pluri-Regional and East Asian species, including for a total 59.1% of the plants.[11]

The greatest number of invasive species was found within the boundaries of transport highways, valleys of small rivers, floodplain meadows, and the fewest number - in the areas of cereal-meadow steppes and in the forest phytocenoses.

At the present time, such transformer species as *Acer negundo* L., *Bidens frondosa* L., *Conyza canadensis* L., *Echinocystis lobata* Torr. et Gray, *Elodea canadensis* Michx., *Fraxinus pennsylvanica* Marshall, *Impatiens glandulifera* Royle, *Phalacroloma annuum* (L.) Dumort., *Robinia pseudoacacia* L., are invaded the most actively into the natural habitual areas of the region.

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