



Analysis of rare type of plants from botanical garden collection at SRU “Belsu” (Belgorod, Russia)

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Abstract

They presented the data on the collection fund of plants listed in the Red Book of Russia and Belgorod region. They performed taxonomic and typological analysis of 103 species of collection plants. They determined the largest number of species in the collection. Most of the plants came into the collection from the natural communities of the Belgorod region. Life forms were determined according to Raunkier's and Serebryakov's classification, the types of underground shoots were revealed. The studied plants were analyzed by ecological groups and area types.

Keywords: collection of rare species, анализ analysis, life forms, ecological groups

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INTRODUCTION

The priority activities of the botanical garden at the Belgorod State National Research University (NRU “BeISU”) are the study and preservation of rare and endangered plants in the region (Tokhtar et al. 2016). A special collection of rare and endangered species has been created for this purpose (Martynova et al. 2013). Botanical Garden is the link in the integrated conservation of plants within steppe and forest-steppe conditions. The main methodological approaches for plant protection are developed here both in the form of living plant (ex situ) collections and in natural populations (in situ) with the recommendations for their protection. The foundation of collection fund was started in 2002. It was developed at the expense of expeditionary visits to natural habitats in Belgorod, Voronezh, Sakhalin (Russia) and Kharkiv regions (Ukraine). During the collection creation, the plants were planted on a systematic basis in experimental plots, as well as on linear seed plots, where the introducers were in the same conditions regardless of ecological affinity, on the usual agrotechnical background of an open complex without special natural growing conditions.

The aim of the study was the comprehensive analysis of rare plants from the collection fund of the botanical garden at the National Research University “BeISU”.

MATERIALS AND METHODS

The object of the study is the collection of rare species, localized on the territory of the Botanical Garden at the National Research University “BeISU”. In order to identify the biomorphological structure of the

collection, they used the traditional system of life forms by Raunkier (1905) and Serebryakov (1962). The types of habitats are established according to the summary by Meusel (1965) with the specification by the USSR flora (1939, 1949) and by the Flora of the European part of the USSR (1984-1989). The behavior of species in culture was studied according to Baranova's method (2010).

During the analysis of the collection fund plants, they studied the following characteristics of each species: taxonomic affiliation, the life forms according to Raunkier and Serebryakov, the types of underground shoots, which is important for survival observation in culture, the ecological group on moisture level and on environment, habitat types and the plant status in Red Books.

RESULTS AND DISCUSSION

The basic list of the Botanical Garden collection includes 103 plant species belonging to 34 families and 75 genera.

The data analysis by families (**Table 1**) suggests that the largest number of species is represented by Liliaceae family (16 species). The second and the third places are occupied by Asteraceae, Ranunculaceae (11 species) and Lamiaceae families (9 species). Besides, the range of leading families includes Iridaceae and Poaceae (5 species), Fabaceae, Linaceae, Rosaceae (4 species each). The greatest number of families is represented by only one species (18 families in total).

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Table 1. The number of rare species families

Item №	Family	Number of species	% from all species
1.	Liliaceae Juss.	16	15.5
2.	Fabaceae Lindl. (Leguminosae Juss., Papilionaceae Giseke)	4	11.8
3.	Asteraceae Dumort. (Compositae Giseke)	11	10.6
4.	Ranunculaceae Juss.	11	10.6
5.	Lamiaceae Lindl. (Labiatae Juss.)	9	8.7
6.	Poaceae Barnhart (Gramineae Juss.)	5	4.8
7.	Iridaceae Juss.	5	4.8
8.	Linaceae DC. ex SF. Gray	4	3.8
9.	Rosaceae Juss.	4	3.8
10.	Hyacinthaceae Dumort.	3	2.9
11.	Scrophulariaceae Juss.	3	2.9
12.	Brassicaceae Burnett. (Cruciferae Juss.)	2	1.9
13.	Crassulaceae DC.	2	1.9
14.	Cyperaceae Juss.	2	1.9
15.	Ephedraceae Dumort.	2	1.9
16.	Primulaceae Vent.	2	1.9
17.	Amaryllidaceae St.-Hil.	1	0.9
18.	Apiaceae Lindl. (Umbelliferae Juss)	1	0.9
19.	Apocynaceae Juss.	1	0.9
20.	Asphodelaceae Juss.	1	0.9
21.	Araliaceae Juss.	1	0.9
22.	Caryophyllaceae Juss.	1	0.9
23.	Cistaceae Juss.	1	0.9
24.	Dipsacaceae Juss.	1	0.9
25.	Euphorbiaceae Juss.	1	0.9
26.	Fumariaceae DC.	1	0.9
27.	Gentianaceae Juss.	1	0.9
28.	Geraniaceae Juss.	1	0.9
29.	Menispermaceae Juss.	1	0.9
30.	Paeoniaceae Rudolphi	1	0.9
31.	Papaveraceae Juss.	1	0.9
32.	Polemoniaceae Juss.	1	0.9
33.	Rubiaceae Juss.	1	0.9
34.	Rutaceae Juss.	1	0.9

Table 2. Life forms of rare species

Life forms	Number of species	% from all species
Tree-shrub forms (11.5%)		
Half-shrubs	5	4.8
Subshrub	4	3.9
Bush	2	1.9
Shrub	1	0.9
Herbaceous polycarpic (85.7 %)		
Rodroot	24	23.3
Short root plants	20	19.4
Bulbous plants	15	14.6
Dense-core plants	7	6.8
Tuber forming plants	5	4.8
Bulbotuberiferous	3	2.9
Brushroot	3	2.9
Trailing	3	2.9
Long root plants	3	2.9
Root offspring	2	1.9
Loose turf	2	1.9
Without underground shoots	2	1.9
Herbaceous monocarpic plants (2.8 %)		
Biennial	2	1.9
Annual	1	0.9
K. Raunkier's system of biological types		
Hemicryptophyte	61	59.2
Geophyte	24	23.3
Chamephyte	13	12.6
Hemitherophyte	2	1.9
Phanerophyte	2	1.9
Therophyte	1	0.9

The analysis of plants by life forms (Table 2) indicates that herbaceous polycarpic plants (85.7%) dominate in the collection of rare plants, a significant part of which is related to stem rod-root (23.3%) and short-rooted plants (19.4%). Herbaceous monocarpic constitute 2.8% of the total number of plants. Half-

Table 3. Rare plant structure by environment

Ecological group	Number of species	% from all species
Aeropedophyte	58	56.3
Calciphyte	13	12.6
Petrophyte	13	12.6
Calcipetrophyte	8	7.8
Psammophyte	6	5.8
Aeropedophyte, calciphyte	2	1.9
Aeropedophyte, petrophyte	2	1.9
Petrophyte, halophyte	1	0.9

Table 4. The structure of rare species in relation to moistening conditions

Ecological group	Number of species	% from total number of species
Mesoxerophyte	41	39.8
Xeromesophyte	25	24.2
Euxerophyte	19	18.4
Mesophyte	15	14.5
Xerophyte	2	1.9
Hydromesophyte	1	0.9

Table 5. Ecological-cenotic groups of rare species

Flora-cenotic type	Number of species	% from total number of species
Steppe	43	41.7
Land-steppe	18	17.5
Skirt	9	8.7
Skirt-meadow	7	6.8
Mountain	4	3.8
Meadow	4	3.8
Extraordinary forest	4	3.8
Mountain-steppe	2	1.9
Meadow forest	2	1.9
Forest skirt	2	1.9
Skirt meadow steppe	2	1.9
Steppe, chalky	2	1.9
Boreal skirt	1	0.9
Boreal	1	0.9
Mountain-skirt-forest	1	0.9
Chalky	1	0.9

shrubs (4.8%) and subshrubs (3.9%) predominate among tree-shrub forms. According to K. Raunkier (Table 3) the spectrum of biological types is dominated by hemicryptophytes (59.2%). Geophytes (23.3%) and chamephytes (12.6%) occupy the second and the third places respectively. The remaining groups are represented by a small number of species (0.9 - 1.9%).

The analysis of ecological groups in relation to the living environment (Table 3) showed that aeropedophytes dominate in the collection (56.3%), calciphyte calciphytes and petrophytes occupy the second place (12.6%).

Mesoxerophytes (39.8%) and xeromesophytes (24.2%) dominate by substrate moistening (Table 4). A significant part is represented by Euxerophytes (18.4%) and mesophytes (14.5%).

The range of ecological-cenotic groups (Table 5) is dominated by steppe species (41.7%), most of which came into the collection from the natural communities of the Belgorod region. A large group is represented by forest-steppe species (17.5%). The remaining flora-cenotic types are represented by a small number of species.

The analysis of rare species habitat types (Table 6) showed that all types of collection fund belong to 28 types of areas, which indicates the great natural diversity

Table 6. Main groups of rare plant areas in collection fund

Item No	Area type	Number of species	% from the total number of species
1	East European	16	15.5
2	Euro-Asian	16	15.5
3	European	10	9.7
4	European-Siberian	9	8.7
5	Euro-West Asian	8	7.7
6	Euro-Caucasian	8	7.7
7	Euro-West Siberian	5	4.8
8	Asian	3	2.9
9	East European-West Siberian	3	2.9
10	Eastern European-Caucasian	3	2.9
11	East Siberian	2	1.9
12	Euro-Mediterranean	2	1.9
13	Caucasian	2	1.9
14	South European	2	1.9

of plants from the collection fund. The leading role among them belongs to 3 types of habitat: Eastern European, European-Asian (15.5%) and European (9.7%).

CONCLUSION

Thus, the analysis of rare plant species collection from the Botanical Garden of the National Research

University "BelSU" showed that nowadays it consists of 103 plant species from 75 genera and 34 families. The largest number of species is represented by the family Liliaceae (16 species), Asteraceae, Ranunculaceae (11 species) and Lamiaceae (9 species). The spectrum of life forms is dominated by grassy short-root (19.4%) and rod-root (23.3%) polycarpic trees. Aeropedophytes (56.3%), calcephytes and petrophytes (12.6%) prevail in the spectrum of ecological groups. In relation to the conditions of substrate moistening, the leading place is occupied by mesoxerophytes (39.8%) and xeromezophytes (24.2%). Steppe species with a high ecological amplitude dominate in ecological-cenotic range (41.7%). Wide-marginal species make the largest part in the spectrum of geographic elements.

Thus, according to the analysis of rare plant species from the collection of the Botanical Garden at the National Research University "BelSU", the structural composition of natural flora plants was determined, which successfully grows and multiplies under culture conditions in the Belgorod region of Russia.

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