

Adventive component of Kuzbass flora

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Abstract. The article presents data about of the adventive component of the flora of the Kemerovo region, which differs from other subjects of the Asian part of Russia with the highest population density and is a region of intensive development. It is noted that the beginning of the introduction of alien species into the territory of the region through human activity can be considered by the XVII century. A group of archaeophytes is indicated for this period. For the territory of the Kemerovo region, the boundary between archaeophytes and neophytes can serve as the XVIII century. The most significant anthropogenic influence on the vegetation cover of Kuzbass began in the 20th century. It was established that the alien component of the flora of vascular plants is 338 species of 224 genera, 80 families. The largest foreign species and genera of the family are noted: Asteraceae, Poaceae Fabaceae, Brassicaceae, Lamiaceae, Boraginaceae, Caryophyllaceae, Chenopodiaceae. For each floristic area, the number of alien species is indicated, as well as the "original" alien species, noted so far only in this area. It is proposed to supplement the list of invasive species of Kuzbass with 15 species. It has been established that among the alien species of Kuzbass xenophytes, therophytes, one-two-year-old summer-green grassy rod-rooted monocarpics predominate. Geographical analysis of the adventitious flora showed that the enrichment of the Kuzbass flora with alien species was multidirectional.

1 Introduction

The problem of adventization of flora has now acquired a global character. The process of introducing alien species and their naturalization is proceeding rapidly almost throughout the globe, which carries various, but more often negative consequences [1]. There is a need to study the extent of the impact of adventization on the natural components and economies of the regions. For Kuzbass, which differs from other subjects of the Asian part of Russia in the highest population density and is a region of intensive development, this is especially

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true. On the territory of the Kemerovo region, alien plants easily find conditions favorable for growth. Mining in the Kuznetsk coal basin is also carried out in an open way, which leads to the emergence of vast areas occupied by dumps, which are vast areas of disturbed land where advents can settle without proper competition from native species. Also, the central steppe and forest-steppe regions of Kuzbass, already by the middle of the 20th century, as A.V. Kuminova [2], were plowed up and currently the land is under agricultural land, and alien weeds are obviously introduced with the seed material of cultivated crops. The largest settlements of Kuzbass are concentrated in the Kuznetsk basin, the road network is well developed, which contributes to the spread of xenophyte species.

The beginning of the introduction of alien species into the region with the help of human activity, we can consider the mature stage of anthropogenesis, which dates back to the 17th century, when the Russian-speaking population appears on the territory of Kuzbass [3]. During the development of the Kuznetsk Territory, Russian pioneers met Teleuts, Shors, whose cultural origins were formed in the era of the early and developed Middle Ages. Before the arrival of the Russian population, the economic structure of these peoples had a different character: nomadic and semi-sedentary, with elements of primitive agriculture. But it was the active migration processes that certainly contributed to the emergence of some archaeophytes. The group of archaeophytes includes species not only deliberately introduced by humans, but also the accompanying weedy species: *Cannabis sativa* L., *Bunias orientalis* L., *Avena sativa* L., *Panicum miliaceum* L., *Echinochloa crus-galli* (L.) P. Be. *Leptidium ruderales* L., *Atriplex patula* L., *Neslia paniculata* (L.) Desv. For the territory of the Kemerovo region, the border between archaeophytes and neophytes can serve as the 18th century, when the Siberian tract was arranged and the activities of the Russian-American company in Siberia and the Far East developed [4].

Thus, the most significant anthropogenic impact on the vegetation cover of Kuzbass began in the 20th century, when, along with the developing agricultural development of the land, there was a rapid growth of coal mining enterprises, which led to the complete destruction of the vegetation cover in large areas and, apparently, served as a sharp increase in the share of alien species in the flora of the Kemerovo region. At the beginning of the XXI century. decorative gardening begins to actively develop, which contributes to the enrichment of flora by ergasiophytes.

2 Materials and Methods

The materials were the funds of the Herbarium of the Kuzbass Botanical Garden, formed during expeditionary studies of the territory of Kuzbass over the past 20 years, as well as literary data. The determination of herbarium material was carried out with the involvement of the funds of the Herbarium of the Kuzbass Botanical Garden (KUZ) and modern Determiners. Plant names reconciled according to database - International Plant Names Index (IPNI).

3 Results

Currently, thanks to the inventory of flora [5] (Flora of the Kemerovo Region, 2023), it has been established that the alien component of the flora of vascular plants is 338 species (19.5% of the total composition of flora species) belonging to 224 genera (36.8% of the total composition of genera) and 80 families (61% of the total composition of families). This increase in the proportion of genera and families demonstrates the diversity of alien taxa that appear in the Kuzbass flora. New to flora areas of the family are: Aceraceae, Amaranthaceae, Cucurbitaceae, Cuscutaceae, Elaeagnaceae, Fagaceae, Hygrophyllaceae,

Juglandaceae, Oleaceae, Ulmaceae, Vitaceae, Hydrangeaceae, Oleaceae, Hyacinthaceae, Amaryllidaceae and others, some of them currently belong to cultivars. With adventitious species in the flora of the Kemerovo region, 84 new genera appear: *Abutilon*, *Acalypha*, *Acer*, *Acinos*, *Amaranthus*, *Amethystea*, *Anthemis*, *Buglossoides*, *Bunias*, *Cannabis*, *Chaenorhinum*, *Collomia*, *C. C. uscuta*, *Echinochloa*, *Echinocystis*, *Echinops*, *Elsholtzia*, *Galinsoga*, *Genista*, *Hyoscyamus*, *Lapsana*, *Leersia*, *Lupinus*, *Malus*, *Neslia*, *Oenothera*, *Panicum*, *Pastinaca*, *Portulaca*, *Saponaria*, *Scleranthus*, *Setaria*, *Sphallerocarpus*, *Truellum*, *Ulmus*, *Vaccaria*, *Xanthium*, *Xanthoxalis* et al.

Since the foreign component of the flora is very heterogeneous, in this fraction we distinguish the foreign (adventitious) group itself and, separately, the group of cultivated species. Cultivated species represent the most poorly studied and variable part of modern flora. A large number of new species and varieties grown on the territory of Kuzbass, especially in private farmsteads or in summer cottages, is difficult to take into account, moreover, the range of grown varieties and forms is constantly updated. Nevertheless, it is necessary to take into account cultivated species that tend to linger for a long time at the cultivation sites and in the future, in our opinion, are capable of moving into the Advent category. In total, 98 species are assigned to the "cultural" fraction of flora (about 6% of the total composition of flora and 29% of the foreign fraction). There are currently 240 adventitious (alien) species in the Kuzbass flora (more than 13% of the total composition). They belong to 158 genera and 48 families. As you can see, about a third of alien species are represented by cultivated species (29% of genera and 40% of families). These indicators demonstrate the need for a more detailed study of the invasive potential of still relatively "harmless" (not going beyond cultivation) species.

Given the instability of the group of cultivated species, only alien species noted outside the cultivation sites and spreading over one or more types of anthropogenic habitats are further analyzed.

The largest in terms of the number of alien species (as well as in the composition of native species) is the Asteraceae family, it has 30 species; in second place is Poaceae (26 species), followed by Fabaceae (23 species), Brassicaceae (21), Lamiaceae (16), Boraginaceae (11), 10 alien species each include Caryophyllaceae and Chenopodiaceae. If aster and bluegrass retain their leading positions not only in the aboriginal fraction, but also among alien species, then the rank of other families in the advent group changes, and some families generally fall out of the category of the largest, without a single alien species, these are Cyperaceae and Orchidaceae. Ranunculaceae and Salicaceae have one alien species.

The largest in terms of the number of alien species (as well as in the composition of native species) is the Asteraceae family, it has 30 species; in second place is Poaceae (26 species), followed by Asteraceae (19 genera), Poaceae (15), Brassicaceae and Fabaceae (14 genera each), Lamiaceae (10), Caryophyllaceae (8).

The spatial distribution of alien plants in the Kemerovo region is heterogeneous. According to the floristic zoning in the Kemerovo region, 6 floristic regions have been identified: Kuznetsko-Alatausky (KA), Gorno-Shorsky (GS), Salair ridge (SK), Kuznetsk basin (KK), Kolyvan-Tomsky (KT), Kiya-Chulymsky (KC) [6]. For each floristic region, the number of alien and also "original" species has been established, which are noted only in the territory of a particular floristic region (Table 1).

For the "cultural" flora fraction, there is no comprehensive data in terms of the distribution of cultivated species in floristic areas. The main observations relate to settlements located in the Kuznetsk basin, especially the largest cities of Kuzbass - Kemerovo and Novokuznetsk. For this territory there are instructions for 41 species. In other areas, 4 species were noted (6 - in Gorno-Shorsky).

Table 1. Species diversity of floristic areas of the Kemerovo region.

Fraction	Floristic areas					
	KA	GS	SK	KK	KT	KC
Total number of species						
Alien	65	87	73	213	80	71
All Flora	964	970	952	1179	794	910
"Original" species						
Alien	1	5	3	86	3	3
Total in the flora of the floristic district	102	37	13	153	7	38

For the Kuznetsk depression area, the largest number of "original" alien species was noted – 86 (40.4% of the total number of alien species in this area), in other areas this indicator is much lower (from 1 to 5 species). In this area alone, the number of "original" alien species exceeds the number of "original" native species and accounts for 7.3% of the total flora of the area. Of course, the decisive role here is played by the high degree of development and settlement of the basin part of Kuzbass.

4 Discussion

Therefore, foreign species find suitable conditions in this territory, there is a constant influx of diaspores due to the developed network of roads and railways. Only in this area are marked: *Amaranthus blitum* L., *A. cruentus* L., *A. powellii* S. Wats., *Amethystea caerulea* L., *Apera spica-venti* (L.) Beauv., *Bidens frondosa* L., *Impatiens parviflora* DC., *Lepidium affine* Ledeb., *L. apetalum* Willd. et al.

The floristic region of Kuznetsk Alatau is also distinguished by the fact that in its flora not only the least alien species, but also from the "original" only one species was noted: *Phalacrolooma septentrionalis* (Fern. et Wieg.) Tzvel., currently having only one location. Alien species noted only in Kiya-Chulym district also have the only locations: *Corispermum declinatum* Steph. ex Iljin, *Sagina nodosa* (L.) Fenzl, *Sisyrinchium septentrionale* Bicknell. On the territory of Mountain Shoria, they are also very rare, sometimes in a single place: *Arctium minus*, *Juglans mandshurica* Maxim., *Mentha × gracilis* Sole, *Potamogeton sarmaticus* Maemets, *Veronica officinalis* L. The collections of "original" alien species noted for the territory of the Salair Ridge have not been repeated for a long time, they were indicated by P.N. Krylov in Flora of Western Siberia [7], the modern distribution of such species in the region requires further research: *Betonica officinalis* L., *Melandrium dioicum* (L.) Coss. et Germ., *Datura stramonium* L. Alien species noted only for the Kolyvan-Tomsk floristic region also have one location: *Anthyllis arenaria* (Rupr.) Juz., *Cardaria draba* (L.) Desv., *Plantago arenaria* Waldst. et Kit.

Of the 58 species included in the Black Book of Flora of Siberia [8], 47 invasive species are listed for the Kemerovo Region in accordance with the scale of the level of aggressiveness. Observations of recent years and the results of the analysis of the current

state of the flora of vascular plants show that the process of expanding the ranges of some alien species within Kuzbass is in an active phase. We believe that in addition to the species already indicated for the region, the following species should be added to the invasive species of Kuzbass: *Bidens frondosa*, *Campanula rapunculoides* L., *Carduus acanthoides* L., *Xanthoxalis stricta* (L.) Small, *Aster novi-belgii*, *Chaenorhinum minus* (L.) Lange, *Chrysopsis campestris* Desv., *Convallaria majalis* L., *Echinops sphaerocephalus* L., *Galeopsis ladanum* L., *Galeopsis speciosa* Mill., *Impatiens parviflora*, *Leersia oryzoides* (L.) Sw., *Medicago* × *varia* T. Martyn., *Sisymbrium volgense* M. Bieb. ex E. Fourn.

By the method of introduction, the vast majority of alien species are accidentally introduced - xenophytes (about 70%), species deliberately introduced - ergasiophytes (about 30%) are in second place, to the smallest group of xenoergasiophytes, species with an unclear scenario of origin include: *Echinocystis lobata* (Michx.) Torr. & A. Gray, *Lolium perenne* L., *Amaranthus cruentus*, and several others.

5 Conclusions

Obviously, the data on the composition of the flora of a particular floristic region will be supplemented in the future with new finds, the distribution of some species will be refined. Nevertheless, these data most accurately reflect the current state of the floristic diversity of both the Kemerovo region as a whole and each floristic region, and also allow us to analyze the degree of synanthropization of the Kuzbass flora as a whole and its individual regions.

As a result, it should be noted that the problem of alien plant species is becoming increasingly important not only for economically developed territories, but also for the relatively preserved mountainous regions of Kuznetsk Alatau and Gornaya Shoria. The heterogeneity in the chorological, ecological and biological plan of the species of the adventitious fraction allows them to find suitable conditions in various types of ecotopes in the territory of Kuzbass. Given the increased invasion process, the possibility of changing the behavior scenario of adventitious species, the urgent need for constant monitoring of alien species, the degree of their naturalization, especially in natural cenoses, is obvious.

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