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Invasive plant species in the flora of the Karaganda region

Studying the invasive flora of regions is an important task for preserving biological diversity and monitoring the potential spread of invasive taxa. The aim of this study was to compile a list of invasive vascular plant species in the Karaganda region and to characterize them according to their distribution, time and mode of introduction, and degree of naturalization. The study identified 112 invasive species belonging to 91 genera and 36 families in the region. In terms of the time of introduction, neophytes predominate in the Karaganda Region — 97 species, or 86.6 %. Archeophytes account for a smaller share — 15 taxa (13.4 %). According to the mode of introduction, the following were identified: ergasiophytes (53 species, or 47.3 %), xenophytes (54 species, or 48.2 %), and acoluthophytes (5 species, or 4.5 %). According to the degree of naturalization, the following were identified: epicophytes (47 species or 42.0 %), ephemerophytes (26 species or 23.2 %), agrioophytes (27 species or 24.1 %), and colonophytes (12 species or 10.7 %). In terms of distribution, invasive species were classified as follows: occasional — 34 taxa (30.35 %); common — 44 taxa (39.28 %); very rare — 14 taxa (12.50 %); rare — 19 taxa (16.96 %). The data obtained reflect active migration processes involving the dispersal of seeds of invasive species and their gradual integration into local plant communities. The active naturalization and prevalence of many taxa require constant monitoring and the development of programs to curb their further spread in the Karaganda region.

Keywords: invasive species, Karaganda region, dispersal method, degree of distribution, time of dispersal, degree of naturalization.

Introduction

The Convention on Biological Diversity (1992) calls for the conservation of ex situ habitats, that is, the conservation of habitats within ecosystems and natural habitats. At the 15th meeting of the Conference of the Parties to the Convention on Biological Diversity (Montreal, Canada, December 7–19, 2022), it was agreed in agenda item 21 that invasive species are one of the main factors contributing to the loss of natural biodiversity on a global scale. Noting the increase in international shipments of living organisms and the potential for their introduction into new territories, it is proposed that invasive species be monitored at the national level, measures be taken to mitigate any harmful effects on local populations, and population sizes be controlled and regulated. Conference participants noted the need to study the pathways of invasion of flora and fauna species, assess the damage caused, and take measures to prevent their spread, further introduction, or mitigate the consequences [1].

According to the definition of https://www.gisp.org/, invasive alien species are animals, plants, fungi, and microorganisms that have entered an environment that is not their natural habitat and have established themselves there [2].

Many countries around the world have developed strategies to combat invasive species. For example, the European Strategy on Invasive Alien Species (2003) [3] states that invasive species have long been introduced into Europe, but this process has accelerated over the past century, posing threats to biodiversity. The guiding principles of the strategy for combating invasive species establish a three-stage approach: 1) preventing introduction into other countries and within countries; 2) if introduction has occurred, take early warning measures to prevent establishment; 3) in the event of establishment, take measures for the long-term management of invasive species. In the United States, there is a plan for managing invasive species that involves federal agencies, state agencies, local authorities, and the private sector. Specifically, the transport of invasive species between states is completely prohibited; measures are in place for their on-site eradication; and grants are regularly allocated for the control and eradication of invasive weed species.

In Russia, a large-scale study was conducted on the most dangerous invasions [4], of which about 62 % were introduced accidentally, 33 % intentionally, and 5 % spread on their own. Many alien species currently occupy a small range but tend to spread rapidly.

Kazakhstan has not yet adopted a strategy to combat invasive species, and there is no comprehensive list of species, particularly at the regional level, which justifies the relevance and novelty of this study. The study of invasive species must begin at the regional level.

The aim of this study is to compile a list of invasive plant species in the Karaganda Region and to characterize them by time and mode of introduction, as well as their degree of naturalization.

Experimental

The subject of the study was alien species of vascular plants in the flora of the Karaganda Region. Field collections and data analysis were conducted in 2025. A preliminary inventory of alien plants was compiled based on an analysis of field journals, herbarium materials (herbarium funds: AA, QAR, TASH, LE, MW, SVER, NS, NSK, KUZ, ALTB), and data from the GBIF and iNaturlist platforms. Field studies covered various parts of the Karaganda Region; based on these collections, the species composition of the flora was analyzed and invasive species were identified.

Taxonomic characterization was based on an analysis of the species, genus, and family composition of invasive species. The names of the accepted plant genera and species are taken from the Plants of the World Online (POWO) website [5].

The occurrence of species was assessed using the following gradations: common—species are found everywhere in suitable habitats; occasional—plants occur sporadically but not in all regions of the study area; rare—plants found only sporadically in individual regions of the study area; very rare—no more than 5 locations are known throughout the entire study area [6].

Based on the mode of introduction, the following groups are distinguished: ergasiophytes, alucophytes, and xenophytes [7]; based on the time of introduction: neophytes and archaeophytes [8]; and based on the degree of naturalization: epecophytes, ephemerophytes, agriophytes, and colonophytes [9].

Results and Discussion

Analysis of the invasive flora of the Karaganda Region has allowed for the preliminary identification of 112 species of adventive (introduced) plants belonging to 36 families and 91 genera (Table 1). The greatest species diversity is exhibited by the families Asteraceae (24 species, 21.4 %), Brassicaceae (10 species, 8.9 %), Poaceae (9 species, 8.0 %), and Rosaceae (5 species, 4.5 %), which is characteristic of the flora of temperate regions with actively cultivated agricultural lands. They account for more than 40 % of all introduced species in the region.

Table 1

List of invasive plant species in the Karaganda Region

No.	Species	Family	Period of introduction	Mode of introduction	Degree of naturalization	Occurrence
1	*Amaranthus albus* L.	Amaranthaceae	neophyte	xenophyte	epiphyte	occasionally
2	*Amaranthus blitoides* S. Wats.	Amaranthaceae	neophyte	xenophyte	epiphyte	rare
3	*Amaranthus retroflexus* L.	Amaranthaceae	neophyte	xenophyte	epiphyte	common
4	*Atriplex hortensis* L.	Amaranthaceae	neophyte	ergasiophyte	ephemerophyte	occasionally
5	*Bassia scoparia* (L.) Beck	Amaranthaceae	neophyte	xenophyte	epiphyte	common
6	*Anethum graveolens* L.	Apiaceae	neophyte	ergasiophyte	ephemerophyte	common
7	*Carum carvi* L.	Apiaceae	neophyte	xenophyte	agriophyte	occasionally
8	*Conium maculatum* L.	Apiaceae	archaeophyte	xenophyte	epiphyte	very rare
9	*Pastinaca sativa* L.	Apiaceae	archaeophyte	ergasiophyte	agriophyte	occasionally
10	*Turgenia latifolia* (L.) Hoffm.	Apiaceae	neophyte	acolyutophyte	ephemerophyte	rare
11	*Artemisia sieversiana* Ehrh. ex	Asteraceae	neophyte	xenophyte	epiphyte	common
12	*Artemisia tournefortiana*	Asteraceae	neophyte	acolyutophyte	ephemerophyte	occasional

Continuation of Table 1

No.	Species	Family	Period of introduction	Mode of introduction	Degree of naturalization	Occurrence
13	*Carduus acanthoides* L.	Asteraceae	neophyte	xenophyte	ephemerophyte	common
14	*Centaurea cyanus* L.	Asteraceae	neophyte	xenophyte	epicophyte	occasional
15	*Centaurea diffusa* Lam.	Asteraceae	neophyte	xenophyte	epicophyte	occasional
16	*Centaurea pseudomaculosa*	Asteraceae	neophyte	xenophyte	epicophyte	rare
17	*Cichorium intybus* L.	Asteraceae	neophyte	ergasiophyte	agriophyte	common
18	*Cota tinctoria* (L.) G. Gay	Asteraceae	neophyte	acolyutophyte	epicophyte	occasional
19	*Cyclachaena xanthiifolia*	Asteraceae	neophyte	xenophyte	epiphyte	rare
20	*Echinops sphaerocephalus* L.	Asteraceae	neophyte	xenophyte	epicophyte	rare
21	*Erigeron canadensis* L.	Asteraceae	neophyte	xenophyte	epiphyte	common
22	*Grindelia squarrosa* (Pursh)	Asteraceae	neophyte	xenophyte	epicophyte	rare
23	*Helianthus annuus* L.	Asteraceae	neophyte	ergasiophyte	ephemerophyte	occasionally
24	*Helianthus tuberosus* L.	Asteraceae	neophyte	ergasiophyte	epiphyte	occasionally
25	*Matricaria chamomilla* L.	Asteraceae	neophyte	xenophyte	ephemerophyte	common
26	*Matricaria discoidea* DC.	Asteraceae	neophyte	xenophyte	agriophyte	rare
27	*Rhaponticum repens* (L.)	Asteraceae	neophyte	xenophyte	epiphyte	common
28	*Senecio viscosus* L.	Asteraceae	neophyte	xenophyte	agriophyte	rare
29	*Sonchus oleraceus* L.	Asteraceae	archaeophyte	xenophyte	agriophyte	usually
30	*Tragopogon dubius* Scop.	Asteraceae	neophyte	xenophyte	epicophyte	common
31	*Tripleurospermum inodorum*	Asteraceae	archaeophyte	xenophyte	epiphyte	common
32	*Xanthium orientale* L.	Asteraceae	neophyte	xenophyte	epiphyte	rare
33	*Xanthium strumarium* L.	Asteraceae	neophyte	xenophyte	agriophyte	common
34	*Armoracia rusticana*	Brassicaceae	neophyte	ergasiophyte	colonophyte	common
35	*Brassica juncea* (L.) Czern.	Brassicaceae	neophyte	xenophyte	ephemerophyte	common
36	*Brassica rapa* L.	Brassicaceae	archaeophyte	xenophyte	epiphyte	occasionally
37	*Bunias orientalis* L.	Brassicaceae	neophyte	xenophyte	epiphyte	occasionally
38	*Camelina sativa* (L.) Crantz	Brassicaceae	neophyte	ergasiophyte	ephemerophyte	common
39	*Capsella bursa-pastoris* (L.)	Brassicaceae	archaeophyte	xenophyte	agriophyte	usually
40	*Hesperis matronalis* L.	Brassicaceae	neophyte	ergasiophyte	ephemerophyte	rare
41	*Isatis tinctoria* L.	Brassicaceae	archaeophyte	xenophyte	agriophyte	common
42	*Lepidium densiflorum* Schrad.	Brassicaceae	neophyte	xenophyte	epiphyte	occasional
43	*Rhamphospermum arvense*	Brassicaceae	archaeophyte	xenophyte	epiphyte	occasional
44	*Cannabis sativa* L.	Cannabaceae	archaeophyte	ergasiophyte	epephyte	occasionally
45	*Impatiens glandulifera* Royle	Balsaminaceae	neophyte	ergasiophyte	agriophyte	very rare
46	*Berberis vulgaris* L.	Berberidaceae	neophyte	ergasiophyte	colonophyte	very common
47	*Cerinthe minor* L.	Boraginaceae	neophyte	xenophyte	ephemerophyte	very rare
48	*Echium vulgare* L.	Boraginaceae	neophyte	ergasiophyte	epicophyte	common
49	*Symphytum officinale* L.	Boraginaceae	neophyte	ergasiophyte	epicophyte	rare
50	*Cerastium holosteoides* Fries.	Caryophyllaceae	neophyte	xenophyte	agriophyte	occasionally
51	*Gypsophila vaccaria* (L.) Sm.	Caryophyllaceae	neophyte	xenophyte	epiphyte	common
52	*Saponaria officinalis* L.	Caryophyllaceae	neophyte	ergasiophyte	epiphyte	occasionally
53	*Silene csereii* Baumg.	Caryophyllaceae	neophyte	xenophyte	epicophyte	occasional
54	*Stellaria media* (L.) Vill.	Caryophyllaceae	neophyte	xenophyte	epiphyte	common
55	*Euonymus europaeus* L.	Celastraceae	neophyte	ergasiophyte	agriophyte	rare
56	*Cornus alba* L.	Cornaceae	neophyte	ergasiophyte	colonophyte	very rare
57	*Echinocystis lobata* (Michx.)	Cucurbitaceae	neophyte	ergasiophyte	ephemerophyte	rare
58	*Cuscuta approximata* Bab.	Convolvulaceae	neophyte	xenophyte	epiphyte	occasional

Continuation of Table 1

No.	Species	Family	Period of introduction	Mode of introduction	Degree of naturalization	Occurrence
59	*Cuscuta europaea* L.	Convolvulaceae	neophyte	xenophyte	epiphyte	common
60	*Thuja occidentalis* L.	Cupressaceae	neophyte	ergasiophyte	ephemerophyte	Rare
61	*Elaeagnus angustifolia* L.	Elaeagnaceae	neophyte	ergasiophyte	agriophyte	usually
62	*Elaeagnus commutata* Bernh.	Elaeagnaceae	neophyte	ergasiophyte	agriophyte	rare
63	*Hippophae rhamnoides* L.	Elaeagnaceae	neophyte	ergasiophyte	agriophyte	occasionally
64	*Caragana arborescens* Lam.	Fabaceae	neophyte	ergasiophyte	agriophyte	common
65	*Medicago sativa* L.	Fabaceae	neophyte	ergasiophyte	agriophyte	usually
66	*Trifolium pratense* L.	Fabaceae	neophyte	ergasiophyte	epiphyte	common
67	*Trifolium repens* L.	Fabaceae	neophyte	xenophyte	ephemerophyte	common
68	*Fumaria officinalis* L.	Papaveraceae	neophyte	xenophyte	ephemerophyte	common
69	*Ribes aureum* Pursh.	Grossulariaceae	neophyte	ergasiophyte	colonophyte	common
70	*Phacelia tanacetifolia* Benth.	Hydrophyllacea	neophyte	ergasiophyte	ephemerophyte	rare
71	*Clinopodium acinos* (L.)	Lamiaceae	neophyte	xenophyte	ephemerophyte	very rare
72	*Galeopsis bifida* Boenn.	Lamiaceae	neophyte	xenophyte	epiphyte	occasional
73	*Galeopsis ladanum* L.	Lamiaceae	neophyte	xenophyte	epiphyte	occasional
74	*Leonurus quinquelobatus*	Lamiaceae	neophyte	xenophyte	ephemerophyte	occasional
75	*Alcea rosea* L.	Malvaceae	neophyte	ergasiophyte	ephemerophyte	common
76	*Malva pusilla* Smith.	Malvaceae	neophyte	xenophyte	epiphyte	common
77	*Tilia cordata* Mill.	Malvaceae	neophyte	ergasiophyte	colonophyte	very rare
78	*Fraxinus pennsylvanica*	Oleaceae	neophyte	ergasiophyte	agriophyte	occasionally
79	*Syringa vulgaris* L.	Oleaceae	neophyte	ergasiophyte	colonophyte	occasionally
80	*Roemeria refracta* DC.	Papaveraceae	neophyte	acolyutophyte	ephemerophyte	rare
81	*Agropyron cristatum* (L.)	Poaceae	neophyte	ergasiophyte	agriophyte	common
82	*Avena fatua* L.	Poaceae	archaeophyte	xenophyte	epiphyte	usually
83	*Avena sativa* L.	Poaceae	archaeophyte	ergasiophyte	ephemerophyte	usually
84	*Bromus tectorum* L.	Poaceae	neophyte	xenophyte	epiphyte	common
85	*Digitaria sanguinalis* (L.)	Poaceae	neophyte	acolyutophyte	ephemerophyte	rare
86	*Echinochloa crus-galli* (L.)	Poaceae	archaeophyte	xenophyte	epiphyte	common
87	*Elymus violaceus* (Hornem.)	Poaceae	neophyte	xenophyte	epiphyte	occasional
88	*Hordeum jubatum* L.	Poaceae	neophyte	xenophyte	agriophyte	common
89	*Hordeum vulgare* L.	Poaceae	archaeophyte	ergasiophyte	ephemerophyte	usually
90	*Panicum miliaceum* L.	Poaceae	archaeophyte	ergasiophyte	agriophyte	occasionally
91	*Fagopyrum esculentum*	Polygonaceae	neophyte	ergasiophyte	ephemerophyte	rare
92	*Clematis mandshurica* Rupr.	Ranunculaceae	neophyte	ergasiophyte	ephemerophyte	very rare
93	*Amelanchier spicata* (Lam.)	Rosaceae	neophyte	ergasiophyte	colonophyte	very rare
94	*Malus baccata* (L.) Borkh.	Rosaceae	neophyte	ergasiophyte	agriophyte	common
95	*Malus domestica* Borkh.	Rosaceae	neophyte	ergasiophyte	colonophyte	usually
96	*Prunus tomentosa* Thunb.	Rosaceae	neophyte	ergasiophyte	agriophyte	common
97	*× Sorbaronia fallax*	Rosaceae	neophyte	ergasiophyte	colonophyte	occasional
98	*Populus alba* L.	Salicaceae	neophyte	ergasiophyte	agriophyte	occasionally
99	*Populus × sibirica*	Salicaceae	neophyte	ergasiophyte	colonophyte	occasional
100	*Salix acutifolia* Willd.	Salicaceae	neophyte	ergasiophyte	agriophyte	common
101	*Salix alba* L.	Salicaceae	neophyte	ergasiophyte	agriophyte	common
102	*Acer campestre* L.	Sapindaceae	neophyte	ergasiophyte	colonophyte	very rare
103	*Acer negundo* L.	Sapindaceae	neophyte	ergasiophyte	agriophyte	occasionally
104	*Acer tataricum* L.	Sapindaceae	neophyte	ergasiophyte	colonophyte	occasionally

Continuation of Table 1

No.	Species	Family	Period of introduction	Mode of introduction	Degree of naturalization	Occurrence
105	*Solanum nigrum* L.	Solanaceae	archaeophyte	xenophyte	epiphyte	occasionally
106	*Portulaca oleracea* L.	Portulacaceae	neophyte	xenophyte	epiphyte	
107	*Reseda lutea* L.	Resedaceae	neophyte	xenophyte	epiphyte	very rare
108	*Myricaria bracteata* Royle	Tamaricaceae	neophyte	ergasiophyte	ephemerophyte	very rare
109	*Viola arvensis* Murr.	Violaceae	neophyte	xenophyte	epiphyte	very rare
110	*Parthenocissus quinquefolia*	Vitaceae	neophyte	ergasiophyte	epiphyte	very rare
111	*Ulmus laevis* Pall.	Ulmaceae	neophyte	ergasiophyte	epephyte	occasionally
112	*Ulmus pumila* L.	Ulmaceae	neophyte	ergasiophyte	epiphyte	usually

In terms of the time of introduction to the Karaganda region, neophytes—species introduced after 1700—dominate. There are 97 taxa (86.6 %) of these, indicating an active influx of alien plants in the most recent period, associated with the development of agriculture, urbanization, and the expansion of horticulture. The remaining species are classified as archaeophytes, that is, species that arrived before 1700. This group consists of 15 species (13.4 %). They are predominantly associated with ancient agriculture and long-term anthropogenic impact (e.g., *Sonchus oleraceus*, *Avena fatua*, *Capsella bursa-pastoris*, and others).

Based on their mode of introduction, the largest number of species fall into three main categories:

- Ergasiophytes — 53 species (47.3 %), plants originally introduced by humans into cultivation (ornamental, forage, medicinal, etc.) and subsequently naturalized in the wild flora (*Helianthus tuberosus*, *Medicago sativa*, *Acer negundo*);
- Xenophytes — 54 species (48.2 %), introduced accidentally via crop seeds, transportation, or other means (*Erigeron canadensis*, *Bromus tectorum*, *Xanthium orientale*);
- Acclimatized species — 5 species (4.5 %) that spread independently without direct human involvement, for example, *Turgenia latifolia* and *Roemeria refracta*.
- Invasive species are classified by degree of naturalization as follows:
- Epicofytes — 47 species (42.0 %), fully established and actively reproducing in natural habitats (e.g., *Erigeron canadensis*, *Rhaponticum repens*, *Lepidium densiflorum*).
- Ephemerophytes — 26 species (23.2 %), which take root temporarily but do not form stable populations (*Helianthus annuus*, *Digitaria sanguinalis*).
- Agrophytes — 27 species (24.1 %), having colonized agrocenoses and disturbed biotopes (*Capsella bursa-pastoris*, *Panicum miliaceum*).
- Colonophytes — 12 species (10.7 %), restricted to artificial or semi-natural habitats (*Berberis vulgaris*, *Tilia cordata*, *Populus × sibirica*).

In terms of prevalence, invasive species were distributed as follows: occasionally — 34 taxa (30.35 %); commonly — 44 taxa (39.28 %); very rarely — 14 taxa (12.50 %); rarely — 19 taxa (16.96 %). We can observe a trend whereby more than one-third of the identified invasive species fall into the “common” category, and about 30 % into the “occasional” category, which indicates their widespread distribution. This situation points to existing threats to the native flora.

Conclusion

Thus, the structure of the adventive flora of the Karaganda Region indicates the dominance of modern introductions (neophytes) and the significant role of xeno- and ergasiophytes, reflecting both unintentional seed dispersal and the results of human economic activity. The predominance of epecophytes indicates the active naturalization of some alien plants and their gradual incorporation into local plant communities, which requires constant monitoring to prevent potential invasive processes. These same data are confirmed by the classification of more than half of the invasive species into the “common” and “occasional” categories based on their prevalence in the study area.

The data obtained can serve as a basis for compiling a reference guide on alien plant species in the Karaganda Region and for developing measures to monitor them and prevent their further spread.

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Author Contributions

The manuscript was written through contributions of all authors. All authors have given approval to the final version of the manuscript. CRediT: **Kali A.** — conceptualization, drafting, and data analysis; **Sailau A.S.** — data curation and data collection.

Conflict of Interest

The authors declare no conflict of interest.

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Қарағанды облысы флорасының инвазивті түрлері

Аймақтың инвазивті флорасын зерделеу биологиялық әртүрлілікті сақтау және осы таксондардың одан әрі таралуының мониторингі үшін маңызды міндет. Зерттеудің мақсаты Қарағанды облысының тамырлы өсімдіктер флорасының инвазивті түрлерінің конспектісін жасау және олардың таралу, әкеліну үрдісі мен тәсілін осы аймақтағы табиғиландыру дәрежесі бойынша сипаттау. Зерттеу нәтижелері көрсеткендей, аймақта 91 тұқымдас пен 36 тұқымның 112 инвазивті түрі анықталған. Әкелу уақыты бойынша Қарағанды облысында неофиттердің 97 түрі немесе 86,6 % басым. Ең аз үлесті археофиттер — 15 таксон (13,4 %) алады. Енгізу тәсілі бойынша мынадай: эргасиофиттер (53 түр немесе 47,3 %), ксенофиттер (54 түр немесе 48,2 %), аколютофиттер (5 түр немесе 4,5 %). Жаратылыстану тәсілі бойынша: эпикофиттер (47 түр немесе 42,0 %), эфемерофиттер (26 түр немесе 23,2 %), агриофиттер (27 түр немесе 24,1 %), колонофиттер (12 түр немесе 10,7 %) бөлінді. Инвазивтік түрлердің таралу дәрежесі бойынша былайша бөлінеді: сирек — 34 таксон (30,35 %); жай — 44 таксон (39,28 %); өте сирек — 14 таксон (12,50 %); сирек — 19 таксон (16,96 %). Алынған деректер инвазивті түрлердің тұқымдарын енгізудің белсенді көші-қон процестерін және олардың жергілікті өсімдік қоғамдастықтарына біртіндеп енгізілуін көрсетеді. Көптеген таксондардың белсенді түрде табиғатқа

айналуы мен таралуы тұрақты мониторингті және Қарағанды облысында одан әрі таралуын тежеу бағдарламаларын әзірлеуді талап етеді.

Кілт сөздер: инвазивті түрлері, Қарағанды облысының аймағы, әкелу тәсілі, таралу дәрежесі, әкелу уақыты, жаратылу дәрежесі.

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Инвазивные виды флоры Карагандинской области

Изучение инвазивной флоры регионов является важной задачей для сохранения биологического разнообразия и мониторинга возможного дальнейшего распространения данных таксонов. Целью настоящего исследования являлось составление конспекта инвазивных видов флоры сосудистых растений Карагандинской области и их характеристика по степени распространенности, степени и способу заноса, степени натурализации в данном регионе. Результаты исследований показали, что в регионе выявлены 112 инвазивных видов из 91 рода и 36 семейств. По времени заноса в Карагандинской области преобладают неофиты — 97 видов, или 86,6 %. Меньшую долю занимают археофиты — 15 таксонов (13,4 %). По способу заноса выделены: эргасиофиты (53 вида, или 47,3 %), ксенофиты (54 вида, или 48,2 %), аколютофиты (5 видов, или 4,5 %). По способу натурализации были выделены: эпикофиты (47 видов, или 42,0 %), эфемерофиты (26 видов, или 23,2 %), агриофиты (27 видов, или 24,1 %), колонофиты (12 видов, или 10,7 %). По степени распространенности ивазивные виды распределились следующим образом: изредка — 34 таксона (30,35 %); обычно — 44 таксона (39,28 %); очень редко — 14 таксонов (12,50 %); редко — 19 таксонов (16,96 %). Полученные данные отражают активные миграционные процессы заноса семян инвазивных видов и их постепенное включение в местные растительные сообщества. Активная натурализация и распространенность многих таксонов требует постоянного мониторинга и разработки программ сдерживания дальнейшего распространения в Карагандинской области.

Ключевые слова: инвазивные виды, Карагандинская область, способ заноса, степень распространенности, время заноса, степень натурализации.

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