

Zh.I. Kuanbay¹, S.A. Abiyev¹, V.N. Tikhomirov²

¹*L.N. Gumilyov Eurasian National University, Nur-Sultan, Kazakhstan;*

²*Belarusian State University, Minsk, Belarus*

(E-mail: zhenia_80@bk.ru)

The study of some structural parameters of the flora of chink Dongyztau (Aktobe region)

The results of the study of structural indices of the flora of vascular plants chink Dongyztau are presented in the article. According to the classification of life forms of I.G. Serebryakov, the dominant share is occupied by perennial polycarpic herbs — 124 species, or 39.5 %, on the second position there are monocarpic herbs — 123 species, or 39.1 %. Semi-wood species make up 43 species, or 13.7 %, wood forms — 21 species, or 6.7 %. A high proportion of ephemera was noted which are 28 species, or 8.9 %. According to the classification of C. Raunkiaer in the flora chink Dongyztau is dominated by therophytes — 119 species, or 37.9 %. On the second place there is a group of hemi-cryptophytes — 104 species, or 33.1 %; in third place — chameophytes (46 species, or 14.6 %); in the fourth position — cryptophytes (31 species, or 9.9 %); on the fifth — phanerophytes (14 species, or 4.5 %). The ratio of life forms of plants according to both classifications confirms the climatic conditions of the region — sharp-continental and arid climate, timed to the desert zone of Kazakhstan. There are 10 useful groups of plants: fodder — 110 species; technical — 30 species; medicinal — 48 species; melliferous — 13 species; ornamental — 33 species; food — 33 species; vitamin — 11 species; poisonous — 32 species; insecticidal — 8 species; soil-, forest- and phytomeliorative — 11 species.

Keywords: chink Dongyztau, Aktobe region, flora, vascular plants, ecological group, life form, economic and useful species, practical application.

Introduction

The preservation of floristic diversity in Kazakhstan is an important task of our time, as defined by the Convention on the Conservation of Biological Diversity (1994) and the Nagoya Protocol on Access to Genetic Resources (2010) [1, 2].

In order to implement the provisions of the Convention, it is necessary to carry out an inventory of vegetation cover, especially for little studied regions, to determine the structural elements of flora, to assess the possibility of practical use of practical-valuable species of plants [3].

The bio morphological structure or spectrum of life forms of flora reflects the nature of the plant's adaptations to a set of environmental conditions in a certain physical and geographical area. Therefore, its analysis serves as a reliable tool for understanding the environmental parameters of a variety of habitats in a particular territory.

Chink Dongyztau (Aktobe region, the Western Kazakhstan) is a unique low-level region located at the junction of Aktobe, Atyrau and Mangystau regions, and is the northern mouth of Ustyurt [4]. Earlier floristic studies on the territory of West Kazakhstan [5–11] did not cover Dongyztau, so the natural flora of this region remained not studied.

The purpose of this study is to analyze the ratio of life forms, ecological groups and economic-valuable species of plants chink Dongyztau.

Methodology

The subjects of the research were vascular plants Chink Dongyztau. Identification of species composition was carried out on the basis of own field gathering of 2017–2019, previously collected herbal materials of the Institute of Botany and Phytointroduction, Mangyshlak experimental botanical garden, Botanical institute named after V.L. Komarov. Based on the results of the analysis, a list of vascular plants of the investigated territory was compiled.

Allocation of vital forms of plants was carried out on the basis of a technique, developed by I.G. Serebryakov (trees, bushes, low shrubs, semi-bushes, semi-low shrubs, long-term herbs, biennial plants, annual plants, ephemeral plants) [12, 13] and C. Raunkiaer (phanerophytes, chamephytes, hemicryptophytes, cryptophytes, therophytes) [14, 15].

Practical-valuable groups of species are identified according to the data of scientific publication [16–26].

Results and discussion

Chink Dongyaztau is located in the natural desert zone, is the northern part of Ustyurt. The territory is located in the south-western part of Aktobe region between 46°08'–46°68' st. and 56°13'–57°60' Ed. [4].

Studies have shown that 314 species of vascular plants belonging to 170 genera and 40 families grow in the area under study (Table 1).

Table 1

Taxonomic characteristics of the vascular plants of chink Dongyaztau

No.	Name of taxon	Amount of families, pieces	Amount of genera, pieces	Amount of species, pieces
1	<i>Gnetopsida</i>	1	1	2
2	<i>Monocots</i>	6	23	40
3	<i>Eudicots</i>	34	45	272
	Total	41	69	314

Analysis of life forms according I.G. Serebryakov is presented in Table 2.

Table 2

Life forms of vascular plants of flora of chink Dongyaztau (by I.G. Serebryakov)

No.	Types of life forms	Absolute number of species, pieces	% from general composition of species
1	Woody species	21	
	Trees	1	0.3
	Upright bushes	14	4.5
	Lianas bushes	1	0.3
	Low shrubs	5	1.6
2	Semi-wood types	43	
	Semi-shrubs	26	8.3
	Semi-low shrubs	17	5.4
3	Semi-carpic herbs	124	
	Core root	39	12.4
	Long root	40	12.7
	Short root	3	0.9
	Turfious	17	5.4
	Root offspring	2	0.6
	Tuber forming	7	2.2
	Bulbous	6	1.9
4	Monocarpic herbs	123	
	Perennial, biennial	4	1.3
	Annual long-vegetative	89	28.3
	Ephemers	28	8.9

The results showed that the dominant component in life forms is perennial polycarpic herbs — 124 species (39.5 %), the second position is occupied by monocarpics, including perennial, biennial and annual — 123 species (39.1 %). Woody forms occupy 21 species (*Elaeagnus angustifolia* L., *Spiraea hypericifolia* L., *Nitraria sibirica* Pall., *Nitraria schoberi* L. and others), accounting for 6.7 % of the total flora composition of vascular plants. The bulk is occupied by shrubs; trees, as a life form of natural vegetation, are not present in the region, only 1 species — *Elaeagnus angustifolia* L.

A significant proportion of ephemeral species is 28 (8.9 %) (*Anisanta tectorium* (L.) Nevski, *Ceratocephala falcata* (L.) Pers., *Ceratocephala testiculata* (Crantz) Bess., *Consolida rugulosa* f. *paradoxa* (Bunge) Iranshahr., *Alyssum desertorum* Staph., *Alyssum linifolium* Stephan ex Willd., *Alyssum stenostachyum* Botsch. & Vved., *Chorispora tenella* (Pall.) DC., *Descurainia sophia* (L.) Webb ex Prantl, *Erysimum leucanthemum* (Stephan ex Willd.), and long-root plants — 40 species, or 12.7 % (*Medicago falcata* L., *Melilotus officinalis* (L.) Potus. and others).

This ratio is due to the fact that the chink Dongyaztau is located in the desert zone of Kazakhstan, characterized by acute moisture deficiency. Arid conditions allow for the successful existence of herbaceous

plants with a short spring cycle of vegetation, as well as long-spring species adapted extracting moisture from deep soil horizons. The growth of wood molds is limited by narrow ecotopes along streams, temporary watercourses, in inter-axial downsides, in places with close occurrence of groundwater.

Semi-wood forms occupy 43 species (13.7 %) — *Anabasis eriopoda* (Schrenk) Benth. ex Volkens., *Anabasis truncata* (Schrenk) Bunge, *Atriplex cana* Ledeb., *Arthrophytum lehmannianum* Bunge and others. This is because semi-shrubs and semi-low shrubs are typical of arid habitats, and have quite a variety of adaptations to harsh living conditions, including salted soils and sands. The studied area is characterized by the pronounced heterogeneity of the vegetation cover associated with different types of soils, edaphic versions of the desert and the neighborhood with the steppe zone [5].

Analysis of life forms by C. Raunkiaer allowed determining the prevalence of therophytes — 119 species, which is 37.9 % of the total species composition (Table 3).

Table 3

Life forms of vascular plants of the chink Dongystau according to C. Raunkiaer

No.	Life forms	Amount of species	
		Total	%
1	I. Phanerophytes — Ph	14	4.5
	1. Meso-phanerophytes (MP)	2	0.6
	2. Micro-phanerophytes (M)	7	2.2
	3. Nano-phaerophytes (N)	5	1.6
2	II. Chameophytes (Ch)	46	14.6
3	III. Hemicryptophytes (Hk)	104	33.1
4	IV. Cryptophytes (Kr)	31	9.9
5	V. Therophytes (Th)	119	37.9

A rather large percentage of therophytes can be explained by the involvement of weed and ephemeral annual plants in the study flora. The prevalence of this life form testifies to the aridity of the territory [5]. The families *Amaranthaceae* and *Brassicaceae* take the leading positions in terms of the number of therophytes (Table 4).

Table 4

Spectra of life forms (according with C. Raunkiaer) of vascular plants in the chink Dongyztau by leading families

No.	Family	Life forms, amount of species				
		Ph	Ch	Hk	Kr	Th
1	<i>Amaranthaceae</i>	4	24	—	—	39
2	<i>Asteraceae</i>	—	7	24	1	7
3	<i>Brassicaceae</i>	—	1	9	—	19
4	<i>Poaceae</i>	—	—	18	3	5
5	<i>Fabaceae</i>	2	1	16	1	5
6	<i>Boraginaceae</i>	—	—	6	2	8

Slightly inferior to hemi-cryptophytes, they are 104 species, or 33.1 % (see Fig.).

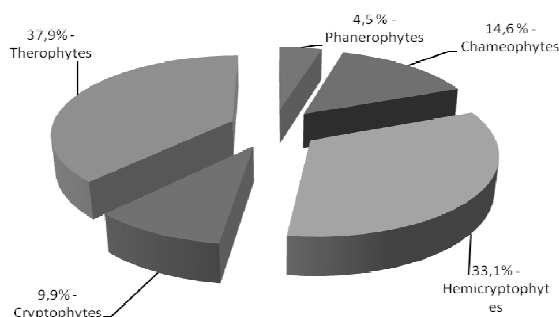


Figure. Ratio of life forms of vascular plants of chinca Dongyztau flora (according to C. Raunkiaer)

Among hemi-cryptophytes take the first place species from the family *Asteraceae* (*Achillea santolinoides* subsp. *wilhelmsii* (K. Koch) Greuter., *Artemisia nitrosa* Weber ex Stechm., *Artemisia tomentella* Trautv., *Centaurea scabiosa* subsp. *adpressa* (Ledeb.) Gugler, *Centaurea squarrosa* Willd., *Cichorium intybus* L., *Cousinia astracanic* (Spreng.) Tamamsch. And others); the next there are members of the family *Poaceae* (*Agropyron desertorum* (Fisch. ex Link) Schult., *Agropyron fragile* (Roth) P. Candargy., *Alopecurus arundinaceus* Poir., *Colpodium humile* (M.Bieb.) Griseb., *Cynodon dactylon* (L.) Pers., *Elytrigia repens* (L.) Nevski. And others) and *Fabaceae* (*Astragalus lasiophyllus* Ledeb., *Astragalus lehmannianus* Bunge., *Glycyrrhiza aspera* Pall., *Glycyrrhiza glabra* L., *Medicago falcata* L., *Trigonella arcuata* C.A. Mey., *Melilotus albus* Medik., *Melilotus officinalis* (L.) Pall., *Onobrychis arenaria* (Kit.) DC., *Pseudosphora alopecurioides* (L.) Sweet.) and others).

In third place are chameophytes. In this life form group take maximum positions species of family *Amaranthaceae* (*Anabasis aphylla* L., *Anabasis cretaceae* Pall.ex Benge., *Anabasis eriopoda* (Schrenk) Benth. ex Volkens., *Anabasis truncata* (Schrenk) Bunge., *Anabasis turkestanica* Korovin ex Ijlin., *Anabasis salsa* (C.A. Mey.) Benth. ex Volkens., *Arthrophytum lehmannianum* Bunge, *Camphorosma lessingii* Litw., *Halocnemum strobilaceum* (Pall.) M. Bieb., *Kalidium caspicum* (L.) Ung.-Sternb., *Kalidium foliatum* (Pall.) Moq., *Suaeda microphylla* Pall., *Suaeda physophora* Pall.).

Further, cryptophytes adapted to carry an unfavorable season and having a supply of nutrients in underground organs are dispersed. These include species from family *Liliaceae* (*Rhinopetalum karelinii* Fisch., *Tulipa biflora* Pall., *Tulipa schrenkii* Regel.), *Alliaceae* (*Allium caspium* (Pall.) Bieb., *Allium iliense* Regel., *Allium sabulosum* Stev.ex Bunge.), *Asparagaceae* (*Asparagus breslerianus* Schult. et Schult.fil, *Asparagus inderiensis* Blum ex Pacz., *Asparagus persicus* Baker and others).

Phanerophytes are the smallest group to appear in the following species: *Elaeagnus angustifolia* L., *Spiraea hypericifolia* L., *Nitraria schoberi* L., *Nitraria sibirica* Pall., *Anabasis gypsicola* Ijlin., *Haloxylon ammodendron* (C.A. Mey.) Bunge ex Fenzl., *Haloxylon persicum* Bunge., *Salsola arbuscula* Pall., *Atraphaxis spinosa* L., *Tamarix elongata* Ledeb., *Tamarix hispida* Willd., *Tamarix laxa* Willd., *Tamarix ramosissima* Ledeb.

At the last stage we analyzed the possibilities of practical use of plants Chink Dongyztau. We have been allocated 10 economic-valuable groups (Table 5).

Table 5

Groups of Practical useful plants on the chink Dongyztau

Practical useful group	Amount of species, pieces	% from general amount of species	Amount of genera, pieces	% from general amount of genera	Amount of families, pieces	% from general amount of families
Feed	110	35.0	69	40.5	19	47.5
Technical	30	10.0	31	18.2	15	37.5
Medical	48	15.0	46	27.0	23	57.5
Melliferous	13	4.1	13	7.6	9	22.5
Ornamental	33	11.0	30	17.6	17	42.5
Food	33	11.0	26	15.2	14	35.0
Vitamin	11	3.5	12	7.0	9	22.5
Poisonous	32	10.1	23	13.5	16	40.0
Insecticidal	8	2.5	8	4.7	7	17.5
Soil-, forest- and phytomeliorative	11	4.0	7	4.1	5	12.5

The largest number of species is suitable as feed plants is 110 species, or 35.0 % of the total species composition. These include plants such as *Aeluropus littoralis* (Gouan.) Parl., *Agropyron desertorum* (Fisch. ex Link) Schult., *Elytrigia repens* (L.) Nevski., *Elytrigia repens* (L.) Nevski., *Lathyrus incurvus* (Roth.) Willd., *Melilotus officinalis* (L.) Pall., *Onobrychis arenaria* (Kit.) DC. and others.

The second position is taken by medicinal plants is 48 species, or 15.0 %. Among this group are: *Nitraria schoberi* L., *Capparis spinosa* L., *Amaranthus retroflexus* L., *Anabasis aphylla* L., *Suaeda physophora* Pall., *Limonium gmelinii* (Willd.) O. Kuntze, *Rheum tataricum* L., *Nepeta pungens* (Bunge) Benth., *Artemisia austriaca* Jacq., *Cichorium intybus* L. and others.

On the third place there are 2 groups — ornamental and food plants, including 33 species (11.0 %). In the fourth place is poisonous plants — 32 species (10.1 %), in the fifth is technical — 30 species (10.0 %). The remaining groups are represented by a small number of species.

Conclusion

Thus, features of structural elements of flora of vascular plants of chink Dongyztau are defined, including analysis of life forms, ecological groups and practical-used species of plants.

The ratio of life forms according to C. Raunkiaer and I.G. Serebryakov is a confirmation of the specificity of this region — sharp-continental and arid climate. Thus, the analysis of life forms by C. Raunkiaer showed the prevalence of therophytes (37.9 %) and hemi-cryptophytes (33.1 %). The share of chametophytes — 14.6 %, cryptophytes — 9.9, phanerophytes — 4.5 %. This ratio of life forms brings this territory closer to the desert flora, as the high specific gravity of therophytes is characteristic of arid zones.

According to the classification of I.G. Serebryakov in the flora of chink Dongyztau is dominated by herbaceous plants (124 species for herbaceous poly carpics and 123 species for herbaceous mono carpics). The high proportion of herbaceous plants and ephemera indicates arid habitat conditions.

10 valuable-useful groups of plants have been separated, which of them: fodder, medicinal, decorative and food plants occupy the leading positions.

References

- 1 Convention on Biological Diversity. — Rio-de-Janeiro, 1994. — 68 p.
- 2 Нагойский протокол регулирования доступа к генетическим ресурсам и совместного использования на справедливой и равной основе выгод от их применения к Конвенции о биологическом разнообразии. — ООН, 2010. — 30 с.
- 3 Бигалиев А.Б. Проблемы окружающей среды и сохранения биологического разнообразия / А.Б. Бигалиев. — Алматы: Қазақ ун-ті, 2005. — 126 с.
- 4 Физическая география Республики Казахстан: учеб. пос. / под ред. К.М. Джаналиевой. — Алматы: Қазақ ун-ті, 1998. — 265 с.
- 5 Сафронова И.Н. Пустыни Мангышлака (очерк растительности) / И.Н. Сафронова // Тр. Бот. ин-та РАН. — 1996. — Вып. 18. — 211 с.
- 6 Аралбай Н.К. Государственный кадастр растений Мангистауской области. Список высших сосудистых растений / Н.К. Аралбай, Г.М. Кудабаяева, А.А. Иманбаева. — Актау, 2006. — 250 с.
- 7 Флора Казахстана. — Т. 1–9. — Алма-Ата: Наука, 1956–1966.
- 8 Агелеуов Е.А. К итогам изучения флоры и растительности Актыюбинской области // Ботанические исследования Актыюбинской области: сб. материалов межвуз. конф. / Е.А. Агелеуов, Н.У. Джакупова. — Актыюбинск, 1992. — С. 9–14.
- 9 Айпеисова С.А. Растительность Актыюбинского флористического округа / С.А. Айпеисова // Вестн. Актыюб. гос. ун-та. — 2010. — № 1(42). — С. 42–48.
- 10 Иманбаева А.А. К изучению видового состава диких сорочичей культурных растений Атырауской области / А.А. Иманбаева, М.Ю. Ишмуратова, А.Т. Туякова // Europäische Fachhochschule. — 2015. — № 7. — С. 5–11.
- 11 Мендыбаев Е.Х. Характеристика флоры степной зоны Западно-Казахстанской области / Е.Х. Мендыбаев // Вестн. Караганд. ун-та. Сер. Биология. Медицина. География. — 2010. — № 3(59). — С. 28–33.
- 12 Серебряков И.Г. Жизненные формы высших растений и их изучение / И.Г. Серебряков // Полевая геоботаника. — Т. 3. — М.; Л.: Наука, 1964. — С. 146–205.
- 13 Серебряков И.Г. Экологическая морфология растений / И.Г. Серебряков. — М.: Высш. шк., 1962. — С. 5–27.
- 14 Raunkiaer C. Plant life forms / C. Raunkiaer. — Oxford: Clarendon press, 1937. — 65 p.
- 15 Радкевич В.А. Экология / В.А. Радкевич. — Минск: Высш. шк., 1998. — 159 с.
- 16 Абышева Л.Н. Дикорастущие полезные растения России / Л.Н. Абышева, Л.М. Беленовская, Н.С. Бобылева. — СПб.: Изд-во СПХФА, 2001. — 663 с.
- 17 Берсон Г.З. Дикорастущие съедобные растения / Г.З. Берсон. — Л.: Гидрометеоздат, 1991. — 72 с.
- 18 Миньков С.Г. Медоносные растения Казахстана / С.Г. Миньков. — Алма-Ата: Кайнар, 1974. — 204 с.
- 19 Журба О.В. Лекарственные, ядовитые и вредные растения / О.В. Журба, М.Я. Дмитриев. — М.: Колос, 2008. — 512 с.
- 20 Соколов С.Я. Фитотерапия и фитофармакология / С.Я. Соколов. — М.: Мед. информ. агентство, 2000. — 953 с.
- 21 Растительные ресурсы России. Дикорастущие цветковые растения, их компонентный состав и биологическая активность. — Т. 1–5. — М.: КМК, 2008–2012.
- 22 Кукунов М.К. Лекарства из растений / М.К. Кукунов, Л.М. Грудзинская, Н.Д. Беклемишев. — Алматы: Кітап, 2002. — 208 с.
- 23 Грудзинская Л.М. Аннотированный список лекарственных растений Казахстана: справоч. изд. / Л.М. Грудзинская, Н.Г. Гемеджиева, Н.В. Нелина, Ж.Ж. Каржаубекова. — Алматы, 2014. — 200 с.
- 24 Compendium of Medicinal and Aromatic Plants. Vol. II. Asia. — Trieste: ICS-UNIDO, 2006. — 305 p.

25 Ишмуратова М.Ю. Лекарственные растения народной медицины: учеб.-метод. пос. / М.Ю. Ишмуратова. — Караганда: Болашак-Баспа, 2014. — 137 с.

26 Муравьева Д.А. Фармакогнозия / Д.А. Муравьева, И.А. Самылина, Г.П. Яковлева. — М.: Медицина, 2002. — 415 с.

Ж.И. Куанбай, С.А. Абиев, В.Н. Тихомиров

Доңызтау шыңы флорасының кейбір құрылымдық көрсеткіштерін зерттеу (Ақтөбе облысы)

Мақалада Доңызтау шыңы флорасының түтікті өсімдіктерінің құрылымдық көрсеткіштерінің зерттеу қорытындысы берілген. И.Г. Серебряковтың тіршілік формасының классификациясына сай, өсімдіктердің басым бөлігіне, көпжылдық поликарпты өсімдіктерге – 124 түр немесе 39,5 %, екінші орында монокарпты өсімдіктерге – 123 түр (39,5 %) жатады. Жартылай ағаштар – 43 түр немесе 13,7 %, ағаш – 21 түр (6,7 %). Эфемерлердің үлесіне 28 түр (8,9 %) тиесілі. К. Раункиер классификациясы бойынша Доңызтау шыңы флорасының басым бөлігін терофиттер алып жатыр. Олардың үлесінде 119 түр. Пайыздық көрсеткіші – 37,9 %. Екінші орынға гемикриптофиттер орналасқан – 104 түр немесе 33,1 %, үшіншіде хамефиттер – 46 түр (14,6 %), төртіншіде криптофиттер – 31 түр немесе 9,9 %, бесіншіде фанерофиттер (14 түр, 4,5 %). Екі классификация бойынша тіршілік формаларының түрлік қатынасын зерттеу аймағының климат жағдайы Қазақстанның шөлді аймағында орналасқан шұғыл континентті және аридті климат екендігін дәлелдейді. Өсімдіктердің шаруашылықта маңызды 10 түрі: мал-азықтық – 110, техникалық – 30, дәрілік – 48 түр, балдық – 13, сәндік – 33, тағамдық – 33, дәрумендік – 11, улы – 32, инсектицидті – 8, топырақ-, орман- және фитомелиоративті – 11 түрі тіркелген.

Кілт сөздер: Доңызтау шыңы, Ақтөбе облысы, флора, түтікті өсімдіктер, тіршілік формалары, шаруашылық-пайдалы түрлері, тәжірибеде қолдану.

Ж.И. Куанбай, С.А. Абиев, В.Н. Тихомиров

Изучение некоторых структурных показателей флоры чинка Доңызтау (Актюбинская область)

В статье представлены результаты исследования структурных показателей флоры сосудистых растений чинка Доңызтау. Согласно классификации жизненных форм по И.Г. Серебрякову, преобладающую долю занимают многолетние поликарпические травы — 124 видов, или 39,5 %, на второй позиции расположены монокарпические травы — 123 вида, или 39,1 %. Полудревесные виды составляют 43 вида, или 13,7 %, древесные формы — 21 вид, или 6,7 %. Отмечена высокая доля эфемеров — 28 видов, или 8,9 %. По классификации К. Раункиера, во флоре чинка Доңызтау доминируют терофиты — 119 видов, или 37,9 %. На втором месте расположена группа гемикриптофитов — 104 вида, или 33,1 %; на третьем — хамефиты (46 видов, или 14,6 %); на четвертом — криптофиты (31 вид, или 9,9 %); на пятом месте — фанерофиты (14 видов, или 4,5 %). Соотношение жизненных форм растений по обеим классификациям подтверждает климатические условия региона — резко-континентальный и аридный климат, приуроченный к пустынной зоне Казахстана. Выделены 10 хозяйственно-ценных групп растений: кормовые — 110 видов, технические — 30, лекарственные — 48, медоносные — 13, декоративные — 33, пищевые — 33, витаминные — 11, ядовитые — 32, инсектицидные — 8, почво-, лесо- и фитомелиоративные — 11 видов.

Ключевые слова: чинк Доңызтау, Актюбинская область, флора, сосудистые растения, экологическая группа, жизненная форма, хозяйственно-полезные виды, практическое применение.

References

- 1 *Convention on Biological Diversity*. (1994). Rio-de-Janeiro.
- 2 *Nahoiiskii protokol rehaulirovaniia dostupa k heneticheskim resursam i sovместnoho ispolzovaniia na spravедlivoi i ravnoi osnove vyhod ot ikh primeneniia k Konventsii o biolohicheskom raznoobrazii [Nagoya Protocol on Access to Genetic Resources and Fair and Equitable Sharing of Benefits Arising from their Use to the Convention on Biological Diversity]* (2010). UN [in Russian].
- 3 Bigaliev, A.B. (2005). *Problemy okružhaiushchei sredy i sokhraneniia biolohicheskoho raznoobrazii [Problems of environment and storage of the biological diversity]*. Almaty: Qazaq universiteti [in Russian].
- 4 *Fizicheskaia heohrafiia Respubliki Kazakhstan [Physical geography of Republic of Kazakhstan]*. (1998). Almaty: Qazaq universiteti [in Russian].

- 5 Safronova, I.N. (1996). Pustyni Manhyshlaka (ocherk rastitelnosti) [The deserts of Mangyshlak (review of vegetation)]. *Trudy Botanicheskogo instituta RAN — Bulletin of Botanical Institute of RAS*, 18, 211 [in Russian].
- 6 Aralbay, N.K., Kudabayeva, G.M., & Imanbayeva, A.A. (2006). *Hosudarstvennyi kadastr rastenii Manhistauskoj oblasti. Spisok vysshikh sosudistykh rastenii* [The state cadastre of plants of Mangystau region. The list of higher vascular plants]. Aktau [in Russian; in Kazakh].
- 7 *Flora Kazakhstana [Flora of Kazakhstan]*. (1956–1966). (Vols. 1–9). Alma-Ata: Nauka [in Russian].
- 8 Ageleuov, E.A., & Dzhakupova, N.U. (1992). K itoham izucheniia flory i rastitelnosti Aktiubinskoi oblasti [At the results of study of flora and vegetation of Aktobe region]. Proceedings from Botanical investigation of Aktobe region: *Mezhvuzovskaja konferentsiia — Inter-institute conference*. (pp. 9–14). Aktyubinsk [in Russian].
- 9 Aipeisova, S.A. (2010). Rastitelnost Aktiubinskogo floristicheskogo okruha [Vegetation of Aktobe Floristic District]. *Vestnik Aktiubinskogo gosudarstvennogo universiteta — Bulletin of Aktobe State University*, 1, 42, 42–48 [in Russian].
- 10 Imanbayeva, A.A., Ishmuratova, M.Yu., & Tuyakova, A.T. (2015). K izucheniuiu vidovogo sostava dikikh sorodichei kulturnykh rastenii Atyrauskoj oblasti [To the study of species composition of wild relatives of cultivated plants of Atyrau region]. *Europaische Fachhochschule*, 7, 5–11 [in Russian].
- 11 Mendybayev, Ye.Kh. (2010). Kharakteristika flory stepnoi zony Zapadno-Kazakhstanskoi oblasti [Characteristics of flora of steppe zone of Western-Kazakhstan Region]. *Vestnik Karahandinskogo universiteta. Seriya biologiya, meditsina, heohrafiya — Bulletin of Karaganda University. Series Biology. Medicine. Geography*, 3(59), 28–33 [in Russian].
- 12 Serebryakov, I.G. (1964). Zhiznennye formy vysshikh rastenii i ikh izuchenie [Life forms of plants and their study]. *Polevaia heobotanika — Field Geobotany*, 3, Moscow; Leningrad: Nauka [in Russian].
- 13 Serebryakov, I.G. (1962). *Ekologicheskaja morfologija rastenii [Ecological morphology of plants]*. Moscow: Vysshaja shkola [in Russian].
- 14 Raunkiaer, C. (1937). *Plant life forms*. Oxford: Clarendon press.
- 15 Radkevich, V.A. (1998). *Ekologija [Ecology]*. Minsk: Vysshaja shkola [in Russian].
- 16 Abyшева, L.N., Belenovskaja, L.M. & Bobyleva, N.S. (2001). *Dikorastushchie poleznye rasteniia Rossii [Wild useful plants of Russia]*. Saint-Petersburg: Publ. of Saint-Petersburg Chemical and Pharmaceutical Academy [in Russian].
- 17 Berson, G.Z. (1991). *Dikorastushchie sedobnye rasteniia [Wild food plants]*. Leningrad: Hidrometeoizdat [in Russian].
- 18 Minkov, S.G. (1974). *Medonosnye rasteniia Kazakhstana [Meadow plants of Kazakhstan]*. Alma-Ata: Kainar [in Russian].
- 19 Zhurba, O.V., & Dmitriev, M.Ya. (2008). *Lekarstvennye, yadovitye i vrednye rasteniia [Medicinal, poisonous and harmful plants]*. Moscow: Kolos [in Russian].
- 20 Sokolov, S.Ya. (2000). *Fitoterapiia i fitofarmakologija [Phytotherapy and phytopharmacology]*. Moscow: Medical Informative Agency [in Russian].
- 21 *Rastitelnye resursy Rossii. Dikorastushchie tsvetkovye rasteniia, ikh komponentnyi sostav i biologicheskaja aktivnost [Vegetable resources of Russia. Wild flower plants, their component composition and biological activity]*. (Vols. 1–5). (2008–2012). Moscow: KMK [in Russian].
- 22 Kukenov, M.K., Grudzinskaya, L.M. & Beklemishev, N.D. (2002). *Lekarstva iz rastenii [Medical preparations from plants]*. Almaty: Kitap [in Russian].
- 23 Grudzinskaya, L.M., Gemedzhieva, N.G., Nelina, N.V., & Karzhaubekova, Zh.Zh. (2014). *Annotirovannyi spisok lekarstvennykh rastenii Kazakhstana [Annotated list of medicinal plants in Kazakhstan]*. Almaty [in Russian].
- 24 *Compendium of Medicinal and Aromatic Plants*. (2006). (Vol. II. Asia). Trieste: ICS-UNIDO.
- 25 Ishmuratova, M.Yu. (2014). *Lekarstvennye rasteniia narodnoi meditsiny [The herbs of folk medicine]*. Karaganda: Bolashaq-Baspa [in Russian].
- 26 Muraveva, D.A., Samylina, I.A., & Yakovlev, G.P. (2002). *Farmakohnoziia [Pharmacognosy]*. Moscow: Meditsina [in Russian].