

NEWS

OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN

SERIES OF BIOLOGICAL AND MEDICAL

ISSN 2224-5308

Volume 2, Number 326 (2018), 61 – 68

UDC 582.31 (574. 54)

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ENDEMISM OF FLORA OF THE BOLSHIE BARSUKI SANDS

Abstract. The article presents the results of expeditions to the Bolshie Barsuki sands. The floral composition and life forms have been reviewed, specific locations of 11 endemic species according to herbarium materials are indicated.

Keywords: Bolshie Barsuki, flora, endemic species.

Introduction. The Bolshie Barsuki sands are one of the largest sand massifs of Northern Priaralye (an area North of the Aral Sea). They stretch as a strip about 24 km wide narrowing down in the central part up to several kilometers and expanding in the south up to 80 km, and the massif is spreading throughout 200–250 km from the Aral Sea to Shalkar city. The Bolshie Barsuki sands belong to psammophyte type of Northern and Central deserts and are related to the West-North Turansub-province of the North Turan province [1].

Study of flora of the Bolshie Barsuki sand massifs in the 18–19th centuries began with the first expeditions of the Russian natural scientists P. S. Palass, A. A. Bunge, A. Lehman, I. Borshchev [2]. At the beginning of the 20th century, an unprecedented in scale Project of botanical research in Russia was initiated. It was connected with Stolypin agrarian reforms and resettlement of poor peasants from the Central regions of Russia to Siberia and Central Asia. For this reason, the Resettlement Administration was created. To explore the soil and plant conditions in Siberia and Central Asia from 1908 to 1914, it had financed 86 expeditions covering practically all Asian part of Russia including the territory of Turgai region. Expeditions included many botanists working in the Bolshie Barsuki: V. P. Drobov, V. I. Lipsky, I. M. Krashenninnikov, V. F. Kapelkin, V.I. Smimov [3], V. A. Dubyansky, B. A. Fedchenko [4]. At present, S. A. Aipeisova has been researching the flora of Aktobe region [5].

Wormwood vegetation of predominantly *Dracunculus* subgenus is common for the Northern part of the Bolshie Barsuki on sandhills: *Artemisia arenaria* DC., *A. quinqueloba* Trautv., *A. tomentella* Trautv. On slightly and strongly saline soils dominate worm wood communities such as *A. lerchiana* Weber, *A. pauciflora* Weber, *A. semiarida* (Krasch. & Lavrenko) Filatova, while at the Paleozoic clay outcrops – *A. camelorum* Krasch. Psammophilous bushes and undershrubs are common for the central and southern parts of sands (various species of *Calligonum*, *Ephedra*, *Ammodendron*, *Krascheninnikovia ceratoides* (L.) Gueldenst., *Salsola arbuscula* Pall.), and also wormwood: *Artemisia santolina* Schrenk, *A. songarica* Schrenk, *A. terrae-albae* Krasch. Near sandhill territories we meet saltwort (*Anabasis salsa* (C.A.Mey.) Benth. ex Volkens, *Salsola arbusculiformis* Drob., *S. orientalis* S.G.Gmel., *Nanophyton erinaceum* (Pall.) Bunge) and wormwood (*Artemisia turanica* Krasch., *A. terrae-albae* Krasch.) communities [1, 6].

Despite the long history of research, flora of the Bolshie Barsukisand massifs and habitats of endemic plants have been insufficiently studied which stood to reason to undertake the given research.

Materials and research methods. Expeditions were conducted in May–June, 2017 along the Bolshie Barsuki sandmassif. Radial routes crossed sand massifs in the North-East and South-West (figure 2). The main types of vegetation were determined: saltwort-wormwood, psammophilous-cereal, psammophilous-wormwood, psammophilous-shrubby deserts, solonetzic soils, saline soils, solonetzic meadows.



Figure 1 – General view of the Bolshie Barsuki sands

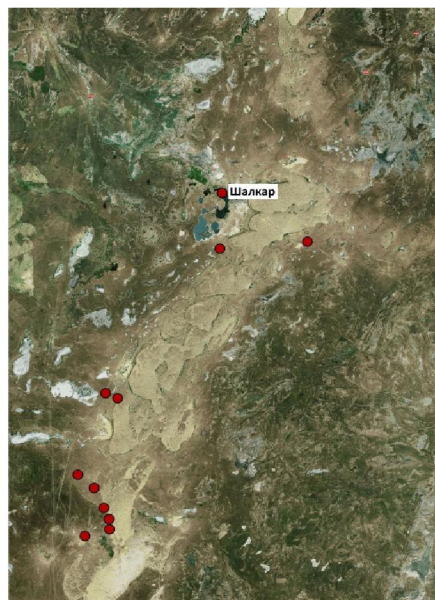


Figure 2 – Flora research locations

During the expedition over 600 herbarium sheets (KG, KUZ) were collected. According to the preliminary data, 287 plant species belonging to 39 families were found in the investigated territory. Eleven endemic species were determined. Floristic features were described and vital conditions estimated to characterize the habitat of each endemic species.

Results and discussion. *Artemisia albicerata* Krasch. 1946, Bot. mat. herb. BIN of Academy of Sciences of the USSR, 9:173; Filatova 1966, Fl. Kaz. 9: 110; Li, 1993, Opr. rast. of Sr. Asia, 10: 561.

The plant is similar to *A. arenaria* DC, widely spread in the Bolshie Barsuki, but differs from it by simple leaves cut and far too extended leaf segments. Besides, stalks in the lower part of *A. albicerata* Krasch. have white hairs while at *A. arenaria* DC has straw-colored ones.

N. S. Filatova [7] considered that *A. albicerata* Krasch. outspread on the sand massifs to the South from Lake Balkhash, upstream of the river Ili. A.D. Li [8] believed that it expanded its habitat including Betpakdala, Priaral Deserts, lower reaches of the Chu and Sarysu rivers. Our research confirms the location of *A. albicerata* Krasch. in the Priaral sands. It is the first time it has ever been found in the territory of Aktobe region [5].

The main habitats are crushed rock sands along the roads and sites trampled down by cattle.

Aktobe region, the Bolshie Barsukisands, in the vicinity of Baykadam village, plenty, 09 VI 2017, D. Alibekov, E. Gabdullin; same place, in the vicinity of Eset-Ata village, 13 VI 2017, D. Alibekov, E. Gabdullin; same place: Shalkar district, coast of Shalkar Lake, territory of Shalkar experimental station, 47° 50' 33" NL, 59° 34' EL, 173 m, 14 VI 2017, A. Kupriyanov.

A. albicerata Krasch. forms floristic complexes of psammophilous wormwoods which are common for the Northern part of Bolshie Barsuki. According to L.Y. Kurochkina [9] these floristic complexes are distinctive for a certain stage of syngensis, overgrown wind-blown sands. It includes *Artemisia arenaria* DC, *Calligonum aphyllum* (Pall.) Guerke, *Ammodendron bifolium* (Pall.) Yakovlev, *Leymus racemosus* (Lam.) Tzvel., *Festuca beckeri* (Hack.) Trautv., *Koeleria glauca* (Spreng.) DC., *Euphorbia seguieriana*

Neck., *Syrenia siliculosa* (M.Bieb.) Andr., *Hyalea pulchella* (Ledeb.) K.Koch, *Achillea micrantha* Willd., *Helichrysum maracandicum* M.Pop.

Artemisia aralensis Krasch. 1936, Spisok rast. Herb. Fl. USSR, 10: 105; Pavlov, 1938, Fl. Centr. Kaz., 3: 272; Nasimova, 1993, Opr. rast. Sr. Asia, 10: 569. (figure 4).



Figure 3 – *Artemisia aralensis* Krasch.



Figure 4 – *Artemisia quinqueloba* Trautv.

N. S. Filatova [10] refers *A. aralensis* Krasch. to the section *Sclerophyllum* Filat, Kazachstanicae Filat subsection. Twice-divided leaf blades are its characteristic feature. *A. aralensis* Krasch. is close to *A. camelorum* Krasch. but has higher and stronger stalks, insignificant stiffening of the shootbases and longer leaf segments.

The plant is endemic and can be found in the far West of the Kazakh Melkosopchnik (Kazakh Uplands), in Turgai Hollow, the Caspian Depression, valley of the Syr Darya River.

The plant grows on the salted clay courses of temporary water currents, on clay slopes of precipices, ravines, in lowlands and on the edge of sandhills. This plant is quite rare on suburbs of sand massifs.

Aktobe region, the Bolshie Barsuki sands, on clay slopes, 17 VI 2017, D. Alibekov, E. Gabdullin.

A. aralensis Krasch. forms floristic complexes with *Atriplex cana* C.A.Mey., *Nanophyton erinaceum* (Pall.) Bunge, *Halimione verrucifera* (M.Bieb.) Aellen, *Halocnemum strobilaceum* (Pall.) M.Bieb., *Climacoptera* sp., *Limonium suffruticosum* (L.) Kuntze, *Frankenia pulverulenta* L., *Nitraria schoberi* L., *Artemisia pauciflora* Weber., *Leymus angustus* (Trin.) Pilg., *Glycyrrhiza korshinskyi* Grig., *Krascheninnikovia ceratoides* (L.) Gueldenst.

Artemisia camelorum Krasch. 1930, Mat. komis. eksped. issl. 26: 272; Filatova 1966, Fl. Kaz. 9: 126; Bakanova. 1993, Opr. rast. Sr. Asia, 10: 569.

The plant was described in the vicinity of Shalkar (former Czelkar) [11] and its original habitat covered exclusively desert regions of the Central Kazakhstan (Turgai, Shalkar, Kyzylorda) [12] which is supported by the numerous herbarium collections found in the West and North of the Bolshie Barsuki sand massif and stored in St. Petersburg (LE). Collections of the past decades (KG) show that *A. camelorum* Krasch. penetrates into the territory of Kazakh Melkosopchnik through tertiary multicoloured clays [13].

Outcrops of tertiary carbonate clays are found on the outskirts of sand massifs.

Aktobe region, Shalkar district, coast of Shalkar Lake, territory of Shalkar experimental station, clay outcrops 47°50'335" NL, 59°34'804" EL, 173 m, 16 VI 2017, A. Kupriyanov.

A. camelorum Krasch. forms plant communities on solonchic soils including *Agropyron fragile* (Roth) P.Candargy, *Alhagi pseudalhagi* (M.Bieb.) Fisch., *Tanacetum achilleifolium* (M.Bieb.) Sch. Bip., *Atriplex cana* C.A.Mey., *Camphorosma monspeliaca* L., *Ceratocarpus utriculosus* Bluket, *Limonium macrorrhizon* (Ledeb.) Kuntze, *Zygophyllum fabago* L., *Tragopogon dubius* Scop.

Artemisia halophila Krasch. 1930, Mat. komis. eksp. issl. 26: 272; Filatova, 1966, Fl. Kaz. 9: 117; Nasimova, 1993, Opr. rast. Sr. Asia, 10: 567.

N. S. Filatova [10] refers it to the numerous section of *Halophyllum* Filat., *Aralocaspicae* Filat subsection to which also belong the desert-Kazakh complex of wormwoods with twice- or thrice-divided leaf blades. It is characterized by juicy rollleaf segments.

The plant is endemic and grows in deserts of the Central and South Kazakhstan (Betpakdala, Priaral region, Muyunkum, Ustyurt, Mangyshlak, Kyzylkum, Karakum).

The plant is found on the salty gypsiferous clays, saline soils, temporary waterways and outskirts of springs and wells.

Aktobe region, the Bolshie Barsuki sands, in the vicinity of Zhanaturmys village, on temporary waterways, 12 VI 2017, D. Alibekov, E. M. Gabdullin; same place: Shalkar district, 50 km to the South from Shalkar village, on temporary waterways, saline soils. 47 °25'480" NL, 59 °14'220" EL, 337 m, A. Kupriyanov.

A. halophila Krasch. forms floristic complexes with *Elaeagnus angustifolia* L., *Salix caspica* Pall., *Halimodendron halodendron* (Pall.) Voss, *Tamarix hispida* Willd., *Phragmites australis* (Cav.) Trin. ex Steud., *Puccinellia distans* (Jacq.) Parl., *Achnatherum splendens* (Trin.) Nevski, *Glycyrrhiza glabra* L., *Plantago salsa* Pall., *Thalictrum flavum* L., *Ranunculus repens* L., *R. sceleratus* L., *Lepidium latifolium* L., *L. perfoliatum* L.

Artemisia quinqueloba Trautv. 1866, in Bull. Soc. Nat. Mosc. 1: 348; Filatova, 1966, Fl. Kaz. 9: 110; Adylov, 1993, Opr. rast. Sr. Asia, 10: 560.

This plant is neoendemic and its formation is associated with a climate aridization in the Holocene. It differs from a more widespread *A. arenaria* DC by a subshrub life-form with stiffening of shoots up to the middle of the stalk. Leaves of *A. quinqueloba* Trautv., unlike *A. arenaria* DC, are densely pressed hairy. It is an endemic plant of the Central and South Kazakhstan (Pribalkhash deserts, Priaral region, Embinskoe plateau, lower courses of the Chu and Sarysu Rivers).

On the barchan, wind-blown sands, it forms a core of the psammophilous-wormwood deserts of the Priaral region [1].

The Bolshie Barsuki sands, in the vicinity of Baykadam village, plenty, 09 VI 2017, D. Alibekov, E.M.Gabdullin; same place: Shalkarsky district, in the vicinity of Baykadam village, the Bolshie Barsuki sands, sand rings, 47 °08'809" NL, 59 °14'930" EL, 190 m, 10 VI 2017, A. Kupriyanov.

A. quinqueloba Trautv. forms peculiar arenophilous communities including the following: *Calligonum aphyllum* (Pall.) Guerke, *Ammodendron bifolium* (Pall.) Yakovlev, *Leymus racemosus* (Lam.) Tzvel., *Syrenia montana* (Pall.) Klovov, *Isatis sabulosa* Stev. ex Ledeb., *Alyssum desertorum* Stapf, *Gypsophila paniculata* L., *Silene wolgensis* (Hornem.) Besser ex Spreng., *Chondrilla ambigua* Fisch. ex Kar. & Kir., *Helichrysum arenarium* (L.) Moench.

Artemisia saissanica (Krasch.) Poljak. et Filat. 1963, in Tr. In-ta Bot. AN KazSSR 15: 234; Filatova, 1966, Fl. Kaz. 9: 127; Bakanova. 1993, Opr. rast. Sr. Asia, 10: 576.

In 1936, I. M. Krasheninnikov [14] described *Artemisia mongolorum* Krasch. This wormwood was described in Mongolia, later it was he again who distinguished subspecies *ssp saissanica* in Flora of Western Siberia [15] (Krasheninnikov in P. N. Krylov, 1949). N. S. Filatova raised the wormwood rank up to species *A. saissanica* (Krasch.) Poljak. et Filat. leaving it as an endemic of Zaysan hollow [16]. Nowadays, *A. saissanica* (Krasch.) Poljak. et Filat. is found in the Kazakh Melkosopochnik [14]

N. S. Filatova [10] placed *A. saissanica* (Krasch.) Poljak. et Filat. in the section *Halophyllum* Filat., in a combined subsection *Mongolicae* Filat. This subsection hosts species with twice-, thrice-pinnately divided leaf blades, which are densely hairy at the beginning and less hairy at the end of vegetation. *A. saissanica* (Krasch.) Poljak. et Filat. is rather close to *A. scopaeformis* Ledeb., but usually differs from it by twice-pinnately divided leaves and more compact panicle, more succulent segments of the lower stem leaves. *A. saissanica* (Krasch.) Poljak. et Filat. replaces the steppe *A. nitrosa* Weber in a belt of Northern deserts.

Geographic range of *A. saissanica* (Krasch.) Poljak. et Filat. stretches a narrow strip from the Zaysan hollow through the coast of Balkhash Lake, the steppe rivers (Sarysu, Kon, Kulanotpes), up to Shalkar saline soils. The plant has been reported for Aktobe region for the first time on wet solonchaks and saline soils, salty riverbanks and lake coasts.

Aktobe region, Shalkar district, the coast of Shalkar Lake, the territory of Shalkar experimental station, sandy disrupted soils, 47 °50'335" NL, 59 °34'804" EL, 173 m, 14 VI 2017, A. Kupriyanov; same

place: 50 km to the South from Shalkar village, temporary waterway, saline soils, 47 °25'480" NL, 59 °14'220" EL, 337 m, 10. VI 2017, A. Kupriyanov.

The plant forms floristic complexes on the damp saline soils including *Tamarix hispida* Willd., *Phragmites australis* (Cav.) Trin. ex Steud., *Bassia sedoides* (Pall.) Asch., *Chenopodium album* L., *Salicornia europaea* L., *Camphorosma lessingii* Litv., *Artemisia lerchiana*, *A. austriaca* Jacq. *A. schrenkiana* Ledeb., *Aeluropus lagopoides* subsp. *repens* (Desf.) Tzvel. (*A. repens* (Desf.) Parl.), *Juncus jaxarticus* V. Krecz. & Gontsch., *Lepidium latifolium* L.

Artemisia tomentella Trautv. 1866, in Bull. Soc. Nat. Mosc. 39, 1: 351; Filatova, 1966, Fl. Kaz., 9: 108; Adylov, 1993, Opr. rast. Sr. Asia, 10: 562.

N. V. Pavlov [12] indicated a small endemic habitat of *A. tomentella* Trautv in the sands of Aktobe region. However, later even wider area of this wormwood in the territory of Kazakhstan was detected [16]. Two contrast habitats are favourable for its growth: on the crushed rock and stony slopes of low mountains and on light sandy soils. In the Bolshie Barsuki sands it grows in places with disrupted soil and vegetation cover as a result of cattle pasture. Outside sand massifs it is found in the Mugodzhaz mountains.

Aktobe region, the Bolshie Barsuki sands, in the vicinity of Baykadam village, on sandy soils, plenty, 09 VI 2017, D. Alibekov, E. Gabdullin; same place: in the vicinity of Sarysay village, the Mugodzhaz mountains, stony slopes. 48 °27'213" NL, 58 °30'812" EL, 337 m, 15 VI 2017, A. Kupriyanov.

In the Bolshie Barsuki sands *A. tomentella* Trautv. forms communities with *Calligonum aphyllum* (Pall.) Guerke, *Agropyron desertorum* (Fisch. ex Link) Schult., *Koeleria glauca* (Spreng.) DC., *Astragalus brachypus* Schrenk, *Ammodendron bifolium* (Pall.) Yakovlev, *Artemisia arenaria* DC., *Senecio subdentatus* Ledeb.

Echinops albicaulis Kar. et Kir. 1842, Bull. Soc. Nat. Mosc. 15: 387; Goloskokov, 1966, Fl. Kaz. 9: 181; Li, 1993, Opr. rast. Sr. Asia, 10: 235.

It is an endemic plant of the Central and West Kazakhstan growing in the Northern deserts on sands, sabulous soils, often in spots where lands are subject to the intensive pasture, sometimes found along the shoulders of steppe roads.

Aktobe region, the Bolshie Barsuki sands, in the vicinity of Eset-Ata village, 15 VI 2017, D. Alibekov, E. Gabdullin.

It forms peculiar psammophilous communities including the following: *Leymus racemosus* (Lam.) Tzvel., *Allium caspium* (Pall.) M.Bieb., *Scorzonera ensifolia* M.Bieb., *Artemisia arenaria*, *A. quinqueloba*, *A. lerchiana*, *Chondrilla ambigua* Fisch. ex Kar. & Kir., *Gypsophila paniculata* L., *Carex physodes* M.Bieb., *Allium turkestanicum* Regel, *Eremopyrum orientale* (L.) Jaub. & Spach, *Euphorbia seguieriana* Neck., *Ferula sibirica* Willd. (= *Soranthus meyeri* Ledeb.).

Jurinea xerophytica Iljin, 1962, Fl. USSR. 27: 716, 549; Fisyun, 1966, Fl. Kaz. 9: 287; Chern. and Tsukerv., 1993, Opr. rast. Sr. Asia, 10: 381.



Figure 5 – *Echinops albicaulis* Kar. et Kir.



Figure 6 – *Jurinea xerophytica* Iljin

It differs from the West Siberian species *Jurinea schischkiniana* Iljin by slightly curved and very twiggy stalks. Usually it grows on the inter-dune lowlands, rises on the sand rings, less frequently found near sandhills on the loamy salted soils. It is an endemic of Kazakhstan.

Aktobe region, in the vicinity of Shalkar village, on sandy soils, 09 VI 2017, D. Alibekov, E. Gabdullin.; same place: Shalkar district, in the vicinity of Beymbet village, the Bolshie Barsuki sands, sand rings, 47 °08'809" NL, 59 °14'930" EL, 190 m, 10 VI 2017, A. Kupriyanov.

J. xerophytica Iljin forms psammophilous communities including *Agropyron desertorum* (Fisch. ex Link) Schult., *Acanthophyllum korolkowii* Regel et Schmalh., *Artemisia lerchiana* Weber., *Kochia prostrata* (L.) Schrad., *Euphorbia seguieriana* Neck., *Filago arvensis* L., *Chondrilla ambigua* Fisch. ex Kar. & Kir.

Tanacetum saxicola (Krasch.) Tzvel. 1961, Fl. USSR, 26: 342. – Vasil. 1966, Fl. Kaz., 9: 61; Koval., 1993, Opr. rast. Sr. Asia, 10: 613 – *Pyretrum kasakstanicum* ssp. *saxicola* Krasch. 1946, Bot. Mat. Herb. BIN of Academy of Sciences of the USSR, 9: 162.

This is an endemic of Kazakhstan, described in the Mugodzhar mountains: "Aktobe region, the Mugodzhar Hills, elevated ridge near the Boktubay mountain, in the vicinity of Berchogur village, 26 VI 1927, n°587, I. Krasheninnikov" (LE). The plant is morphologically close to the other endemic, *T. scopulorum* (Krasch.) Tzvel., but differs by shorter calathid legs and largely spaced leaf segments. It grows near sand massifs on the saline clay soils, rarely on the inter-dune lowlands in similar conditions.

Aktobe region, the Bolshie Barsuki sands, in the vicinity of Baykadam village, on clay soils, 09 VI 2017, D. Alibekov, E. Gabdullin; same place: Shalkar district, in the vicinity of Baykadam village, the Bolshie Barsuki sands, the saline steppe. 47 °08'809" NL, 59 °14'930" EL, 190 m, A. Kupriyanov.

T. saxicola (Krasch.) Tzvel. forms communities with participation of *Agropyron fragile* (Roth) P.Candargy, *Stipa capillata* L., *Leymus angustus* (Trin.) Pilg., *Ferula caspica* M.Bieb., *F. canescens* (Ledeb.) Ledeb., *Artemisia camelorum* Krasch., *Agropyron fragile* (Roth) P.Candargy, *Atriplex cana* C.A.Mey., *Camphorosma monspeliaca* L., *Ceratocarpus arenarius* L., *Limonium gmelinii* (Willd.) Kuntze.

Tragopogon dubjanskyi Krasch. & S.A.Nikitin. 1930, Otch. o rab. Pochv. Bot. otr. Kazakhst. eksped. Academy of Sciences of the USSR, 4, 2: 289; Pavl., 1938, Fl. Centr. Kaz., 3: 338; Tsagol., 1966, Fl. Kaz. 9: 436; Li, 1993, Opr. rast. Sr. Asia, 10: 223.

A.G. Borisova [17] referred *T. dubjanskyi* Krasch. & S.A.Nikitin to the section *Nikitinia* Boriss., which incorporated *Tragopogons* with not incrassated flower stalks and calathid tied on short flower stalks into compound panicle inflorescence. The plant was described from Kok-Dzhida sands on the Emba River [18]. N.V. Pavlov [12] considered it as an endemic of the West Kazakhstan sands.

Aktobe region, the Bolshie Barsuki sands, on sands, in the vicinity of Eset-Ata village, 13 VI 2017, D. Alibekov, E. Gabdullin; same place: in the vicinity of Beymbet village, the Bolshie Barsuki sands,



Figure 7 – *Tanacetum saxicola* (Krasch.) Tzvel.



Figure 8 – *Tragopogon dubjanskyi* Krasch. & S.A.Nikitin.

sand ringes, 47°08'809" NL, 59°14'930" EL, 190 m, 09 VI 2017, A. Kupriyanov; same place coast of Shalkar Lake, territory of Shalkar experimental station, sandy soils, 47 °50'335" NL, 59°34'804" EL, 17 m, 10 VI 2017, A. Kupriyanov.

The plant is an obligatory psammophyte, it can rather seldom be encountered on the undisrupted or slightly damaged sand ridges. The communities formed by *T. dubjanskyi* Krasch. & S.A. Nikitin have few species including *Calligonum caput-medusae* Schrenk, *Ammodendron bifolium* (Pall.) Yakovlev, *Leymus racemosus* (Lam.) Tzvel., *Syrenia montana* (Pall.) Klovov, *Isatis sabulosa* Stev. ex Ledeb., *Silene olgiana* B. Fedtsch., *Dodartia orientalis* L., *Eremurus inderiensis* (Steven) Regel, *Euphorbia seguieriana* Neck.

Endemic elements can traditionally be subdivided into paleoendemics (regressive or relic endemics) and neoendemics (progressive endemics). Paleoendemics are usually represented by certain remains (relicts) from the previous development stages of the vegetation cover [19]. The presence of a large number of neoendemics in the floral composition proves the intensive speciation processes in this territory. Taxonomic isolation in modern flora is common for paleoendemics, i.e. from the systematic viewpoint they are neatly separated from the immediate family members in this flora; they often have a discontinuous, relic area and grow on quite specific and rare habitats. In contrast, new (progressive) endemics have family relations with other species in the same territory; besides, sometimes it is also possible to reveal the progenitors of any given endemic among these related species. *Artemisia camelorum* Krasch., which bears small resemblance to wormwoods with habitats in the ancient Mediterranean [10] (*Artemisia gracilescens* Krasch. Et Iljin, *A. lerchiana* Weber., *A. pauciflora* Weber.), may be referred to paleoendemics of the Bolshie Barsuki sands. The majority of neoendemics are closely related to the morphologically similar species growing in the territory of desert Kazakhstan; these endemics, as a rule, have formed rather recently in the interface zones of related species and are often represented by hybrid populations. Neoendemics usually tend to expand their habitats during the modern period. First and foremost, it is true for the numerous endemic races of wormwoods of the subgenus *Dracunculus* (Bess.) Rybd.: *Artemisia albicerata* Krasch., *A. quinqueloba* Trautv., *A. tomentella* Trautv.. These wormwoods have a constantly extending area which is a sign of neoendemism [20]. *Artemisia aralensis* Krasch., *A. halophila* Krasch., *A. saissanica* (Krasch.) Poljak. et Filat., likely formed after the regression of Turan Sea [21], shall also be referred to this group. Overall, endemism of the Bolshie Barsuki sands flora is 3,8% from the studied flora which can be explained by the lack of isolation from the surrounding territory during the formation of sand massifs. On the other hand, more large-scale research of this territory is deemed necessary.

REFERENCES

- [1] Botanicheskaja geografija Kazahstana i srednej Azii / Pod red. E. I. Rachkovskoj, E. A. Volkovoj, V. I. Hramcovoj. SPb., **2003**, 424 p. (in Russ.).
- [2] Trudy arhiva AN SSSR. Materialy dlja istorii jekspedicii Akademii Nauk v XVIII–XIX vekah. M.; L., **1940**. Vyp. 4. 309 p. (in Russ.).
- [3] Smirnov V.I. Akmolinskij uezd. Bassejn rr. Sary-su – Jaman-Kon Predvaritel'nyj otchet o botanicheskikh issledovanijah v Sibiri i Turkestane v 1908 g. / Pod red. A. O. Flerova. **1909**. P. 90-99 (in Russ.).
- [4] Fedchenko B.A., Krashenninnikov I.M. Rasteniya Turgajskoj oblasti Trudy pochvenno-botanicheskoy jekspedicii po issledovaniju kolonizovannyh aziatskogo rasselenija. SPb., **1910**. P. 1-260 (in Russ.).
- [5] Ajpeisova S.A. Konspekt flory Aktjubinskogo floristicheskogo okruga. Aktobe, **2012**. 175 p. (in Russ.).
- [6] Gael' A.G., Kolikov M.S., Maljugin E.A., Ostanin E.S. Peschanye pustyni Severnogo Priaral'ja i puti ih osvoenija // Tr. In-ta pustyn'. Alma-Ata, **1950**. Vol. 2. 337 p. (in Russ.).
- [7] Filatova N.S. Geograficheskij analiz jendemichnyh vidov polynej Kazahstana Botanicheskie materialy Gerbarija instituta botaniki AN Kaz SSR. Alma-Ata, **1977**. N 10. P. 58-69 (in Russ.).
- [8] Li A.D. Rod *Artemisia* L. Podrod *Artemisia* Less. Opredelitel' rastenij Srednej Azii. Tashkent, **1993**. Vol. 10. P. 549-559 (in Russ.).
- [9] Kurochkina L.Ja. Psamofil'naja rastitel'nost' Kazahstana. Alma-Ata, **1978**. 271 p. (in Russ.).
- [10] Filatova N. S. Sistema polynej podroda Evrazii i Severnoj Afriki // Novosti sistematiki vysshih rastenij. **1986**. Vol. 23. P. 217-239 (in Russ.).
- [11] Krashenninnikov I.M. Otchet o rabote pochvenno-botanicheskogo otrjada Kazahstanskoj jekspedicii AN SSSR. Issledovanija 1926 goda. **1930**. Vol. 3, 2. P. 272 (in Russ.).
- [12] Pavlov N.V. Flora Central'nogo Kazahstana. Dvudol'nye. Spajnolepestnye. ... M.: AN SSSR, **1938**. Chast' 3. 429 p. (in Russ.).
- [13] Kupriyanov A.N. Polyni Central'nogo Kazahstana (*Artemisia* L., *Asteraceae*) // Botanicheskie issledovanija Sibiri i Kazahstana. Vyp. 1. Barnaul, **1995**. P. 4-29 (in Russ.).

- [14] Krasheninnikov I.M. Novye slozhnocvetnye Azii Trudy botanicheskogo instituta AN SSSR. **1936**. Ser. 1. Vyp. 1. P. 343-355 (in Russ.).
- [15] Krasheninnikov I.M. *Artemisia* L. – Polyn' v Krylov P.N. Flora Zapadnoj Sibiri. Tomsk, **1949**. Vyp. 12. P. 2760-2822 (in Russ.).
- [16] Filatova N.S. Rod *Artemisia* L. Flora Kazahstana. Alma-Ata, **1966**. Vol. 9. P. 86-140.
- [17] Borisova A.G. Rod *Tragopogon* – Kozloborodnik Flora SSSR. M.; L., **1964**. Vol. 29. P. 142-179 (in Russ.).
- [18] Krasheninnikov I., Nikitin S. Novye *Tragopogon* dlja peskov Kazahstana // Otchet o rabote pochvenno-botanicheskogo otrjada Kazahstanskoy jekspedicii AN SSSR. Issledovaniya 1926 goda. **1930**. Vol. 4, 2. P. 289 (in Russ.).
- [19] Vul'f E.V. Ponjatie o relikte v botanicheskoy geografii // Mat-ly po ist. flory i rastit. SSSR. M.; L., **1941**. Vyp. 1. P. 28-60 (in Russ.).
- [20] Jebel' A.L. Konspekt flory Severo-Zapadnoj chasti Altaj-Sajanskoj provincii. Kemerovo, **2012**. 586 p. (in Russ.).
- [21] Vasil'ev Ju.M. Poslednee oledenenie, aridnye klimaty i Kaspijskie transgresii. Razvitie prirody na territorii SSSR v pozdnem plejstocene i golocene. M.: Nauka, **1982**. P. 132-134. (in Russ.).

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ҮЛКЕН БОРСЫҚТАР ҚҰМДАРЫ ФЛОРАСЫНЫҢ ЭНДЕМИЗМІ

Аннотация. Мақалада үлкен борсықтар құмдарына ұйымдастырылған экспедицияның нәтижелері қарастырылады. Флоралық құрамы, тіршілік түрлері қарастырылған, кеппешөп материалдары бойынша 11 эндемикалық түрдің жиналған нақты орындары келтірілген.

Түйін сөздер: үлкен борсықтар, флора, эндемикалық түрлер.

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ЭНДЕМИЗМ ФЛОРЫ ПЕСКОВ БОЛЬШИЕ БАРСУКИ

Аннотация. В статье рассматриваются результаты экспедиций в пески Большие Барсуки. Рассмотрен флористический состав, жизненные формы, приведены конкретные места сборов 11 эндемичных видов по гербарным материалам.

Ключевые слова: Большие Барсуки, флора, эндемичные виды.