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## FLORISTIC COMPOSITION OF SOME PLANT COMMUNITIES INCLUDING JUNIPERUS SERAVSCHANICA KOM. IN AKSU-ZHABAGLY STATE NATURAL RESERVE

The floristic composition of plant communities, including *Juniperus seravschanica* Kom. from the Aksu-Zhabagly state natural reserve, was studied. Three populations of *J. seravschanica* represented by 8 cenopopulations have been studied. The list of studied plant communities with the participation of *J. seravschanica* includes 254 species of 175 genera from 51 families. The majority of them are herbaceous plants (87%), trees, and shrubs – 32 species (13%). The leading position among these species have representatives of 11 main families, constituting 56% of the total list: Apiaceae Lindl., Asteraceae Dumort., Brassicaceae Burnett, Scrophulariaceae Juss., Caryophyllaceae Juss., Fabaceae Lindl., Lamiaceae Lindl., Liliaceae Juss., Poaceae Barnhart, Ranunculaceae Juss. and Rosaceae Juss. It were also revealed that there are other rare species listed in the Red Book of Kazakhstan – *Ungernia sewerzowii* (Regel) B. Fedtsch., *Mediasia macrophylla* (Regel ex Schmalh.) Pimenov., *Arum korolkowii* Regel, *Eminium lehmannii* (Bunge) O.Kuntze, *Centaurea turkestanica* Franch., *Celtis caucasica* Willd., *Allochrysa gypsophiloides* (Regel) Schischk., *Euonymus koopmannii* Lauche, *Rhaphidophyton regelii* (Bunge) Ijgin, *Colchicum luteum* Baker, *Medicago tianschanica* Vassilcz., *Juno coerulea* (B. Fedtsch.) Pojak., *Tulipa greigii* Regel, *Tulipa kaufmanniana* Regel, *Malus sieversii* (Ledeb.) M. Roem., and *Valeriana chionophila* Popov & Kult. Since *J. seravschanica* plays an important ecological role and has an important forest-forming, water-protective, soil-protective, and anti-mudflow value, the study of the current state of cenopopulations with its participation may be a valuable source of information for the conservation and rational use of genetic resources in the Western Tien Shan. The results obtained in the current study will be used further in the study of the genetic diversity research of wild flora, including species of the genus *Juniperus*.

**Key words:** *Juniperus seravschanica*, species, plant community, cenopopulation, population, Aksu-Zhabagly state natural reserve, floristic composition.

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### Ақсу-Жабағылы мемлекеттік табиғи қорығындағы *Juniperus seravschanica* ком. қатысуымен кейбір өсімдіктер бірлестіктерінің флоралық құрамы

Ақсу-Жабағылы мемлекеттік табиғи қорығында Қызыл кітапқа енген *Juniperus seravschanica* Kom. түрінің қатысуымен өсімдіктер бірлестігінің флоралық құрамы зерттелді. Зеравшан аршасының 8 ценопопуляциядан тұратын 3 популяциясы зерттелді. *J. seravschanica* қатысуымен зерттелген өсімдік қауымдастығындағы түрлердің жиынтық тізіміне 51 тұқымдасқа жататын 175 туыстың 254 түрі кіреді. Олардың көпшілігін шөптесін өсімдіктерден (87 %), сондай-ақ ағаштар мен бұталардың – 32 түрінен (13 %) тұрады. Жалпы тізімнің 56% 11 негізгі тұқымдас өкілдері құрайды: Apiaceae Lindl., Asteraceae Dumort., Brassicaceae Burnett, Scrophulariaceae Juss., Caryophyllaceae Juss., Fabaceae Lindl., Lamiaceae Lindl., Liliaceae Juss., Poaceae Barnhart, Ranunculaceae Juss. және Rosaceae Juss. Бұл бірлестіктердің құрамында Қазақстанның Қызыл кітабына енген басқа да сирек түрлердің бар екені анықталды – *Ungernia sewerzowii* (Regel) B. Fedtsch., *Mediasia macrophylla* (Regel ex Schmalh.) Pimenov., *Arum korolkowii* Regel, *Eminium lehmannii* (Bunge) O.Kuntze, *Centaurea turkestanica* Franch., *Celtis caucasica* Willd., *Allochrysa gypsophiloides* (Regel)

Schischk., *Euonymus koopmannii* Lauche, *Rhaphidophyton regelii* (Bunge) Ijin, *Colchicum luteum* Baker, *Medicago tianschanica* Vassilcz., *Juno coerulea* (B. Fedtsch.) Pojak., *Tulipa greigii* Regel, *Tulipa kaufmanniana* Regel, *Malus sieversii* (Ledeb.) M. Roem., and *Valeriana chionophila* Popov & Kult. *J. seravschanica* маңызды орман түзетін, суды, топырақты қорғау және селге қарсы маңызы бар экологиялық рөл атқаратындықтан, оның қатысуымен ценопопуляциялардың қазіргі жағдайын зерттеу нәтижелері Батыс Тянь-Шаньдағы генетикалық ресурстарды сақтау және ұтымды пайдалану үшін құнды ақпарат көзі бола алады. Алынған нәтижелер жабайы өсімдік түрлерінің, оның ішінде *Juniperus* туысы түрлерінің генетикалық алуантүрлілігін зерттеуде қолданылады.

**Түйін сөздер:** *Juniperus seravschanica*, түрлер, өсімдіктер бірлестігі, ценопопуляция, популяция, Ақсу-Жабағылы мемлекеттік табиғи қорығы, флоралық құрамы.

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### Флористический состав некоторых растительных сообществ с участием *Juniperus Seravschanica* Kom. в Ақсу-Жабағлинском Государственном Природном Заповеднике

Изучен флористический состав растительных сообществ с участием краснокнижного вида *Juniperus seravschanica* Kom. в Ақсу-Жабағлинском государственном природном заповеднике. Было изучено 3 популяции можжевельника зеравшанского, представленных 8 ценопопуляциями. Сводный список флоры растительных сообществ с участием *Juniperus seravschanica* включает 254 видов из 175 рода 51 семейств. Большинство из них представлено травянистыми растениями (87 %), древесно-кустарниковых – 32 вида (13 %). Ведущее положение занимают представители 11 основных семейств, составляющих 56 % от общего списка: *Apiaceae* Lindl., *Asteraceae* Dumort., *Brassicaceae* Burnett, *Scrophulariaceae* Juss., *Caryophyllaceae* Juss., *Fabaceae* Lindl., *Lamiaceae* Lindl., *Liliaceae* Juss., *Poaceae* Barnhart, *Ranunculaceae* Juss. и *Rosaceae* Juss. Выявлено, что в составе данных сообществ встречаются другие редкие виды, занесенные в Красную книгу Казахстана – *Ungernia sewerzowii* (Regel) B. Fedtsch., *Mediasia macrophylla* (Regel ex Schmalh.) Pimenov., *Arum korolkowii* Regel, *Eminium lehmannii* (Bunge) O.Kuntze, *Centaurea turkestanica* Franch., *Celtis caucasica* Willd., *Allochrysa gypsophiloides* (Regel) Schischk., *Euonymus koopmannii* Lauche, *Rhaphidophyton regelii* (Bunge) Ijin, *Colchicum luteum* Baker, *Medicago tianschanica* Vassilcz., *Juno coerulea* (B. Fedtsch.) Pojak., *Tulipa greigii* Regel, *Tulipa kaufmanniana* Regel, *Malus sieversii* (Ledeb.) M. Roem., and *Valeriana chionophila* Popov & Kult. Поскольку *J. seravschanica* играет важную экологическую роль, имеет важное лесообразующее, водоохранное, почвозащитное и противоселевое значение, результаты изучения современного состояния растительных сообществ с его участием могут быть ценным источником информации для сохранения и рационального использования генетических ресурсов в Западном Тянь-Шане. Полученные результаты могут быть использованы в изучении генетического разнообразия дикорастущих видов растений, включая виды рода *Juniperus*.

**Ключевые слова:** *Juniperus seravschanica*, виды, растительное сообщество, ценопопуляция, популяция, Ақсу-Жабағлинский государственный природный заповедник, флористический состав.

## Introduction

*Juniperus* L. is the most numerous genus in the family Cupressaceae Bartl. It represents evergreen coniferous trees or shrubs found on almost all continents in a variety of environmental conditions [1]. There are about 75 species of junipers in the world, belonging to 3 sections: *Caryocedrus*, *Juniperus*, *Sabina* [2]. All types of juniper are widely used in folk medicine, they play an important ecological role in nature, protecting soils from erosion and reducing mudflow hazard. Many species of junipers

are dominant representatives of plant communities in mountain systems [3]. In Kazakhstan there are 7 species of junipers, which are one of the important components of mountain forest phytocenoses [4, 5].

The object of this study were plant communities with the Zeravshan juniper (*Juniperus seravschanica* Kom.), included in the Red Book of Kazakhstan (category III) [6]. *J. seravschanica* is a wind-pollinated, drought-resistant, slow-growing tree (Fig. 1), reaching a height of up to 10 m, leaves are oblong, sharp with an oblong gland on the back, cones are large, spherical or ovoid, 10-13 mm in diameter [7].



**Picture 1** – The object of research is the Red Data Book species *Juniperus seravschanica* Kom.

*J. seravschanica* is widely distributed in southern Kazakhstan, southeastern Uzbekistan, western Kyrgyzstan, and the mountainous regions of Tajikistan and northern Afghanistan [3]. In Kazakhstan, *J. seravschanica* is found on the mountain ranges of the Western Tien Shan (Karzhantau, Ugamsky, Talassky Alatau), Syrdarya Karatau (Boraldaytau), the western part of the Kirghiz Range, forming sparse forests everywhere, and in small areas, more dense communities [6, 8].

The study area is in the Turkestan region's Aksu-Zhabagly state nature reserve. According to the floristic zoning of Kazakhstan, this area belongs to the 29th floristic region – “Western Tien Shan” [7]. This area is a unique environment, rich in floristic diversity of higher vascular plants, and makes up about 50% of the flora of the Western Tien Shan and almost 25% of the flora of all Central Asia [9]. Representatives of about 20 genera endemic to the Central Asian Mountain system grow here, which indicates a high degree of endemism. Also, on the reserve territory of the wild relatives of cultivated plants, medicinal plants, and species listed in the Red Books of Kazakhstan, Uzbekistan, and Kyrgyzstan are occurred [10]. Despite the wide distribution of *J. seravschanica*, a decrease in the number of natural populations is observed. Sparse woodlands dominated by *J. seravschanica* are most widespread in these regions, although the availability of zeravshan juniper growing in the lower belt has determined the greatest anthropogenic impact on them [11]. The main factor in reducing the number of species is the use of wood for construction, overgrazing, fires, and haymaking, which prevent natural renewal [12].

The altitudinal range of *J. seravschanica* ranges from 500 to 3500 m above sea level. The main massifs of juniper forests occupy the slopes of southern exposures in the altitude range of 1200 (1600) – 2000 (2400) m and form the lower boundary of the type. On Talas Alatau ridge the juniper forests occupy a height interval of 1200-2000 m, on the Ugam ridges – 1200-2200 (2500) m. At the upper boundary above (more than 2200-2400 m) more cryophilic species are common – *J. semiglobosa* Regel and *J. turkestanica* Kom. [13, 14]. *J. seravschanica* grows on fine-earth, more often rubbly-stony mountain gray-brown (xeromorphic), less often on mountain brown and light brown leached soils underlain by dense rocks. *J. seravschanica* can grow on a wide variety of substrates, from steep (up to 70°) rocky outcrops to powerful brown soils with significant (up to 16%) humus content. The average annual temperature in the *J. seravschanica* area is +6-10°C, the duration of the frost-free period is 150-190 days, the annual precipitation reaches up to 600-700 mm (with a winter-spring maximum), the average relative humidity in summer period is 25-35 % [11, 15]. The natural regeneration of *J. seravschanica* is usually weak. Over the entire area of the range, light forest formations from *J. seravschanica* find optimal conditions for development in the middle mountains, which indicates a high thermophilicity of the species [11].

The floristic composition of plant communities of junipers with the *J. seravschanica* in the Western Tien Shan has not been studied enough. The last detailed studies of juniper forest communities' floristic composition and diversity were carried out in 1962-1980. According to the results of these works, the floristic composition ranges from 80 species [16], 137 species [17], 40–50 species [18], and 159 species [11]. This indicates the need for regular monitoring and strengthening of the protection of communities.

The main purpose of this work is to study the floristic composition of the plant communities of juniper forests with the participation of *J. seravschanica* in the Aksu-Zhabagly State Nature Reserve (SNR).

## Materials and methods

Expedition trips to the Aksu-Zhabagly State Nature Reserve (SNR) were carried out in 2021, data processing was carried out in 2021-2022. Three populations of *J. seravschanica* were studied on the territory of the Aksu-Zhabagly SNR. Population 1,

explored in the Baldabrek River valley, Darbaza tract, consisted of 4 cenopopulations (CP). Population 2 growing in the Aksu canyon was represented by 2 cenopopulations [5]. Population 3 explored in the Bala-baldabrek River valley, Chuuldak tract and consisted of 2 cenopopulations. The studies were carried out with the route-reconnaissance method using a GPS navigator (GPS ETREX 20, Garmin). These points were fixed and thoroughly investigated, and test sites were laid in size from 10×10 to 50×50 m.

Geobotanical descriptions of sites were carried out according to generally accepted methods [19, 20], species abundance according to the Drude scale [21], and plant identification – using regional and republican summaries, determinants, and reference books [7, 22, 23]. Herbarium samples were collected

and processed to accurately identify the types of communities [5]. The nomenclature of taxa is based on the summary of Cherepanov [24] and Abdulina [4].

## Results and discussion

As a result of research on the territory of the Aksu-Dzhabagly SNR, 3 populations of *J. seravschanica* were identified, and a geobotanical description of plant communities with its participation was carried out. Each population included several cenopopulations: population 1 – 4 cenopopulations, population 2 – 2 cenopopulations, and population 3 – 2 cenopopulations (Table 1). The Red Book species [6] of the studied community are highlighted in bold (Table 2).

**Table 1** – Characteristics of cenopopulations with the participation of *Juniperus seravschanica*

Populations	Ceno-populations	Location, GPS coordinates, altitude (m) above sea level, soil surface	Community name	Total projective cover, %	Number of species
Population 1	CP-1	Darbaza tract, right bank of the Baldabrek river, southern slope; 42.252497, 70.440052; altitude 1800-2100 m above sea level, gravel-stony soil	Cereals – forb juniper forest with <i>J. seravschanica</i>	60%	30
	CP-2	Darbaza tract, left bank of the Baldabrek river, southwestern slope; 42.253742, 70.442360; altitude 1950-2000 m a.s.l.; fine gravel (50-60%) with rare stones	Forb-cereal-alfalfa mixed juniper forest with <i>J. semiglobosa</i>	70-75%	51
	CP-3	Darbaza tract, right bank of the Baldabrek river, southern rocky slope, 42.252599, 70.440053; altitude 2000-2100 m above sea level; rocky soil	Forbs – cereal mixed juniper forest with <i>J. semiglobosa</i>	50 %	46
	CP-4	Darbaza tract, right bank of the Baldabrek river, southwestern slope; 42.252539, 70.439733 altitude 1700-1850 m above sea level, rocky slope with fine gravelly soil	Forb-cereal juniper forest ( <i>J. seravschanica</i> )	50-60%	60
Population 2	CP-5	The middle part of the Aksu canyon, the right bank of the Aksu river, the southern slope; 42.331250, 70.372583; altitude 1535-1610 m above sea level, gravelly soil	Eremurus- cereal -forb with <i>J. seravschanica</i>	50 %	96
	CP-6	Aksu canyon, right bank of the Aksu River, southern slope; 42.331199, 70.378189; altitude 1300-1500 m above sea level, densely finely gravelly, rarely with large stones	Woody-shrub with cereal -forb herbage with <i>J. seravschanica</i>	70%	98



Table continuation

Populations	Ceno-populations	Location, GPS coordinates, altitude (m) above sea level, soil surface	Community name	Total projective cover, %	Number of species
Population 3	CP-7	Chuuldak tract, left bank of the Bala-baldabrek river, southern slope; 42.285569, 70.402514; altitude 1600-1800 m above sea level, fine gravelly soil	Savannah-cereal -forb juniper forest ( <i>J. seravschanica</i> )	90%	38
	CP-8	Chuuldak tract, left bank of the Bala-baldabrek river, southeast slope; 42.285167, 70.431194; height 1890-1975 m above sea level, gravel-stony soil	Savannah – wheatgrass -forb mixed juniper forest ( <i>J. seravschanica</i> , <i>J. semiglobosa</i> )	100 %	41

Population 1 was studied in the Baldabrek river valley, in the Darbaza tract, at an altitude of 1700-2100 m above sea level. CP-1, CP-2, CP-3 and CP-4 were studied in this area.

CP-1 was found on the right bank of the Baldabrek River, in the southern slope, at an altitude of 1800 to 2100 m above sea level, GPS coordinates N 42.252497, E 70.440052. The vegetation cover of this area is represented by cereals-forb juniper forest with *J. seravschanica* (with the predominance of *Festuca valesiaca* Gaudin, *Hordeum bulbosum* L., *Piptatherum ferganense* (Litv.) Roshev. ex Nikitina, *Poa bulbosa* L., *Eremurus regelii* Vved., etc.). The soil surface is gravel-stony. The total projective cover of plants (TPC) is 60%. The floristic composition of CP-1 consists of 30 species belonging to 23 genera and 17 families.

CP-2 was found on the left bank of the Baldabrek River, on the southwestern slope, at an altitude of 1950 to 2000 m above sea level, GPS coordinates N 42.253742, E 70.442360. The soil is 50-60% fine gravel with rare stones. The vegetation cover of this area is represented by a forb-cereal-alfalfa mixed community, with the predominance of *Achillea setacea*, *Cousinia chrysantha*, *Taraxacum montanum*, *Lindelofia stylosa*, *Campanula glomerata*, *Calamagrostis epigejos*, *Elytrigia repens*, *Medicago lupulina*, *M. tianschanica*, etc.). The authors of the species names are presented in Table 2. The total projective cover is 70-75%. The floristic composition of CP-2 consists of 51 species representing 41 genera from 21 families.

Table 2 – Abundance of species in the studied cenopopulations with the participation of *J. seravschanica*

Species	Population 1				Population 2		Population 3	
	CP-1	CP-2	CP-3	CP-4	CP-5	CP-6	CP-7	CP-8
<b>1. Aceraceae Juss.</b>								
<i>Acer semenovii</i> Regel et Heard.		un			un			
<b>2. Alliaceae J. Agardh</b>								
<i>Allium caesium</i> Schrenk					sol	un		
<i>A. drobovii</i> Vved.			sol	un		un		
<i>A. eriocoleum</i> Vved.					sol			
<i>A. inconspicuum</i> Vved.					sol			
<i>A. sewerzowii</i> Regel					un			
<b>3. Amaryllidaceae J.St.-Hil.</b>								
<i>Ungernia sewerzowii</i> (Regel) B. Fedtsch.				un				
<b>4. Apiaceae Lindl.</b>								
<i>Aegopodium alpestre</i> Ledeb.	sol							
<i>A. tadshikorum</i> Schischk.					sp			

<i>Bunium setaceum</i> (Schrenk) H. Wolff						un		
<i>Bupleurum thianschanicum</i> Freyn					sol			
<i>Elaeosticta transitoria</i> (Korovin) Kljuykov, Pimenov & V.N.Tikhom.							sp	
<i>Ferula kirialovii</i> Pimenov				sol				
<i>F. penninervis</i> Regel & Schmalh.						sol		
<i>F. tenuisecta</i> Korovin	cop1		sp	sol	sol	sol	sp-cop1	sol
<i>Hymenolyma bupleuroides</i> (Schrenk) Korov.						un		
<b><i>Mediasia macrophylla</i> (Regel ex Schmalh.) Pimenov.</b>				sp				
<i>Oedibasis apiculata</i> (Kar. & Kir.) Koso-Pol.			sol		sol			
<i>Pilopleura tordyloides</i> (Korovin) Pimenov						un		
<i>Prangos pabularia</i> Lindl.			sol					
<i>Scandix stellata</i> Banks & Sol.					sol			
<i>Schrenkia golickeana</i> (Regel & Schmalh.) B. Fedtsch.	sp	sol		sol	sol		sp	sp
<i>Trachydium tianschanicum</i> Korov. (= <i>Aulacospermum tianschanicum</i> (Korovin) C. Norman)					un	sol		
<i>Turgenia latifolia</i> (L.) Hoffm.						un		
<b>5. Araceae Juss.</b>								
<b><i>Arum korolkowii</i> Regel</b>						un		
<b><i>Eminium lehmannii</i> (Bunge) O.Kuntze</b>						un		
<b>6. Asphodelaceae Juss.</b>								
<i>Eremurus lactiflorus</i> O. Fedtsch.			un	un	sp			
<i>E. regelii</i> Vved.	sp	cop1			sol		sol	
<b>7. Asteraceae Dumort.</b>								
<i>Achillea filipendulina</i> Lam.						un		
<i>A. millefolium</i> L.			sol		un			cop1-sp
<i>A. setacea</i> Waldst. & Kit.		sol-sp						
<i>Aster canescens</i> (Nees) Fisjun					sol			
<i>Centaurea squarrosa</i> Willd.		sp			sol	sp		
<b><i>C. turkestanica</i> Franch.</b>						cop1		
<i>Cousinia chrysantha</i> Kult.		un-sol						
<i>C. fetissowii</i> C. Winkl.			un					
<i>Erigeron podolicus</i> Besser					sol			
<i>E. pseudoseravschanicus</i> Botsch.						un		
<i>Galatella villosula</i> Novopokr.			sol					sp
<i>Helichrysum maracandicum</i> Popov				un		un		
<i>Hieracium echioides</i> Lumn.			sol					sp
<i>H. virosum</i> Pall.					sol			
<i>Inula macrophylla</i> Kar. & Kir.					sol	sol, sp		

Table continuation

<i>Lactuca serriola</i> L.					un	sol		
<i>Picris nuristanica</i> Bornm.						un		
<i>Phaeacasium pulchrum</i> (L.) Rchb. f.					sol			
<i>Pseudolynosiris grimmii</i> (Regel et Schmalh.) Novopokr.							sp-sol	
<i>Scorzonera inconspicua</i> Lipsch. ex Pavlov	sp	un	un		sp			
<i>S. turkestanica</i> Franch.					un			sol
<i>Tanacetum pseudachillea</i> C. Winkl.					sol			
<i>Taraxacum montanum</i> (C.A.Mey.) DC.		sol						
<i>Taraxacum</i> sp		un						
<i>Tragopogon marginifolius</i> Pavlov	sol							
<i>T. vvedenskyi</i> Popov ex Pavlov							un	
<i>T. turkestanicus</i> S.A. Nikitin ex Pavlov		un					sol	sol
<b>8. Balsaminaceae A.Rich.</b>								
<i>Impatiens parviflora</i> DC.					sol		sol	
<b>9. Berberidaceae Juss.</b>								
<i>Berberis oblonga</i> (Regel) Schneid.				un		sol	sp	sol
<i>Gymnospermium albertii</i> (Regel) Takht.	sp		sol	un	sol			
<b>10. Boraginaceae Juss.</b>								
<i>Lappula microcarpa</i> (Ledeb.) Gürke	un	un						
<i>Lindelofia macrostyla</i> (Bunge) Popov						sol		
<i>L. stylosa</i> (Kar. & Kir.) Brand		sol	sol					
<i>Lithospermum arvense</i> L.						un	sol	
<i>Myosotis micrantha</i> Pall. ex Lehm.				sol				
<i>Onosma irritans</i> Popov ex Pavlov						un		
<b>11. Brassicaceae Burnett</b>								
<i>Alliaria officinalis</i> Andr. ex M.Bieb.					un			
<i>Alyssum campestre</i> (L.) L.				sol	cop1	sol		
<i>A. dasycarpum</i> Stephan ex Willd.						sol		
<i>Arabidopsis pumila</i> (Stephan) N. Busch					sp-sol		sp-sol	
<i>Draba huetii</i> Boiss.				sol				
<i>Megacarpaea orbiculata</i> B. Fedtsch.					un			
<i>Pseudoclausia gracillima</i> (Popov ex Botsch. & Vved.) A.N. Vassiljeva								sol
<i>P. turkestanica</i> (Lipsky)		un						
<i>Sisymbrium loeselii</i> Jusl.								un
<i>Thlaspi perfoliatum</i> L.	sp			cop1	sol		cop1	

<i>Turritis glabra</i> L.					un	un		
<b>12. Campanulaceae Juss.</b>								
<i>Asyneuma argutum</i> (Regel) Bornm.						sol	sp	
<i>Campanula glomerata</i> L.		sol						
<i>Codonopsis clematidea</i> (Schrenk) Clarke					un			
<i>Sergia sewerzowii</i> (Regel) Fed.					sp			
<b>13. Celtidaceae Link.</b>								
<i>Celtis caucasica</i> Willd.						sp		
<b>14. Caprifoliaceae Juss.</b>								
<i>Lonicera karelinii</i> Bunge ex P. Kir.		un-sol						
<i>L. nummulariifolia</i> Jaub. & Spach		un	un	un		sp	sp	sol-sp
<i>L. stenantha</i> Pojark.					un			
<i>L. tianschanica</i> Pojark.		sol	sol	sol	un	sol	sp	sp
<b>15. Caryophyllaceae Juss.</b>								
<i>Allochrysa gypsophiloides</i> (Regel) Schischk.						sol		
<i>Arenaria</i> sp.				sol				
<i>Cerastium inflatum</i> Gren.						sol	sol	
<i>Dianthus karataviensis</i> Pavlov		sol	sol					
<i>Minuartia meyeri</i> (Boiss.) Bornm.					un	un		
<i>Melandrium viscosum</i> (L.) Celak.					un			
<i>Silene brahuica</i> Boiss.		sol			un			
<i>S. guntensis</i> (B. Fedtsch.)						sol		
<i>Tunica stricta</i> (Bunge) Fisch.								sol
<b>16. Celastraceae R.Br.</b>								
<i>Euonymus koopmannii</i> Lauche						sol		
<b>17. Chenopodiaceae Burnett</b>								
<i>Rhaphidophyton regelii</i> (Bunge) Iljin					cop1			
<b>18. Colchicaceae DC.</b>								
<i>Colchicum luteum</i> Baker	sol							
<b>19. Convallariaceae Horan.</b>								
<i>Polygonatum sewerzowii</i> Regel		sol	sol	sol		cop1		
<b>20. Convolvulaceae Juss.</b>								
<i>Convolvulus arvensis</i> L.	sol					un		cop1
<i>C. lineatus</i> L.	sp							
<i>C. pseudocantabrica</i> Schrenk						sp		
<b>21. Crassulaceae J.St.-Hil.</b>								
<i>Rosularia turkestanica</i> (Regel & C. Winkl.) A. Berger					un			
<i>Sedum alberti</i> Regel				sol				
<i>S. pentapetalum</i> Boriss.						sol		
<b>22. Cupressaceae Bartl.</b>								
<i>Juniperus semiglobosa</i> Regel.		sp-sol	sol					sol



<i>J. seravschanica</i> Kom.	cop1	sp-sol	sol	cop1	sol	sol	sp-cop1	sp-cop1
<i>J. turkestanica</i> Kom.		un-sol						
<b>23. Cyperaceae Juss.</b>								
<i>Carex turkestanica</i> Regel	cop1	sol	sp	sp-sol				
<b>24. Cystopteridaceae (Payer) Shmakov</b>								
<i>Cystopteris fragilis</i> (L.) Bernh.						un		
<b>25. Dipsacaceae Juss.</b>								
<i>Cephalaria syriaca</i> (L.) Schrad.						sol		
<i>Dipsacus dipsacoides</i> (Kar. & Kir.) Botsch.			sol					
<i>Scabiosa songarica</i> Schrenk			sp-sol					
<b>26. Ephedraceae Dumort.</b>								
<i>Ephedra equisetina</i> Bunge				sol		sp		
<b>27. Euphorbiaceae Juss.</b>								
<i>Euphorbia jaxartica</i> Prokh.					sol	un		
<i>E. sewerzowii</i> Herd. ex Prokh.					sol			
<i>E. talastavica</i> Prokh.					un			
<b>28. Fabaceae Lindl.</b>								
<i>Astragalus anisomerus</i> Bunge			un					
<i>A. atrovinosus</i> Popov	sol	un			un			
<i>A. macrotropis</i> Bunge	sol			un	un			sol
<i>A. schrenkianus</i> Fisch. et C. A. Mey.								
<i>Cicer flexuosum</i> Lipsky						sol		
<i>Hedysarum plumosum</i> Boiss. et Hausskn.							sol	
<i>Lathyrus inconspicuus</i> L.					sol			
<i>Medicago lupulina</i> L.		cop1			sol	un		
<i>M. tianschanica</i> Vassilez.		sp-cop1				sol	sp	
<i>Oxytropis pilosissima</i> Vved.		sol						
<i>O. tschimganica</i> Gontsch.	sp			un			sol	
<i>Melissitus aristatus</i> (Vassilez.) Latsch.		sol-sp	sp	sol				
<i>Vicia kokanica</i> Regel & Schmalh.						sol		
<i>V. tenuifolia</i> Roth						un		
<b>29. Fumariaceae DC.</b>								
<i>Corydalis ledebouriana</i> Kar. & Kir.			sp	un				
<b>30. Geraniaceae Juss.</b>								
<i>Geranium divaricatum</i> Ehrh.					sol			
<i>G. robertianum</i> L.					sol			
<i>G. transversale</i> (Kar. & Kir.) Vved.	sol		sol		sol			
<b>31. Hypericaceae Juss.</b>								
<i>Hypericum elongatum</i> Ledeb.				un		sol	sp	sol
<i>H. perforatum</i> L.			sol	un	un	sol	sp	
<i>H. scabrum</i> L.	sp	sol-sp	sp	sol	sp	sp		sp-cop1
<b>32. Iridaceae Juss.</b>								
<i>Iris sogdiana</i> Bunge		un		sol				sol

<i>Juno coerulea</i> (B. Fedtsch.) Poljak.						sol		
<b>33. Ixioliriaceae Nakai.</b>								
<i>Ixiolirion tataricum</i> (Pall.) Roem.			sp		sp			
<b>34. Lamiaceae Lindl.</b>								
<i>Acinos graveolens</i> (M. Bieb.)				un	sol			
<i>Betonica foliosa</i> Rupr.						sol		
<i>Lamium amplexicaule</i> L.					un	sol		
<i>Leonurus turkestanicus</i> VI Krecz. & Kuprian.						un		
<i>Origanum tyttanthum</i> Gontsch.		sol	sol	un	sol	sol		cop1
<i>Phlomoides brachystegia</i> (Bunge) Adylov, Kamelin & Makhm.					un	sol		
<i>Ph. speciosa</i> (Rupr.) Adylov, Kamelin & Makhm.		un	sol	un			sol	sol
<i>Salvia sclarea</i> L.					sol	sol		
<i>Scutellaria immaculata</i> Nevski ex Juz.					sol-sp			
<i>Ziziphora bungeana</i> Juz.		cop1	sp				sol	cop1-sp
<b>35. Liliaceae Juss.</b>								
<i>Gagea filiformis</i> (Ledeb.) Kar. & Kir.				un				
<i>G. gageoides</i> (Zucc.) Vved.				sp				
<i>G. minutiflora</i> Regel		sol	sol	sp				
<i>G. olgae</i> Regel				un				
<i>G. popovii</i> Vved.			sol	sol	sp			
<i>G. tenera</i> Pascher.				un				
<i>G. turkestanica</i> Pascher			sol					
<i>Korolkowia sewerzowii</i> (Regel) Regel					sol			
<i>Rhinopetalum stenanthum</i> Regel		sol			sp			
<i>Tulipa greigii</i> Regel					sp	sol		
<i>T. kaufmanniana</i> Regel			sp					
<i>T. turkestanica</i> (Regel) Regel		sol						
<b>36. Malvaceae Juss.</b>								
<i>Alcea nudiflora</i> (Lindl.) Boiss.			sol			sp-cop1	sol	sol
<b>37. Orobanchaceae Vent.</b>								
<i>Orobanche kotschyi</i> Reut.					un			
<b>38. Papaveraceae Juss.</b>								
<i>Papaver litwinowii</i> Fedde ex Popov								sol
<i>P. pavoninum</i> Schrenk						sol		
<b>39. Plantaginaceae Juss.</b>								
<i>Plantago lanceolata</i> L.		sol	sol					sp
<b>40. Plumbaginaceae Juss.</b>								
<i>Acantholimon alberti</i> Regel	sol	sol						
<b>41. Poaceae Barnhart</b>								
<i>Alopecurus pratensis</i> L.		sol						

Table continuation

<i>Anisantha tectorum</i> (L.) Nevski					cop1	sol		
<i>Bothriochloa ischaemum</i> (L.) Keng				sol				
<i>Bromopsis inermis</i> (Leyss.) Holub						sol		
<i>Bromus danthoniae</i> Trin.						sol		
<i>B. pseudodanthoniae</i> Drobow					sol			
<i>B. oxyodon</i> Schrenk					sol	sp	un	
<i>Bromus</i> sp.	un							
<i>Calamagrostis epigejos</i> (L.) Roth		sol						
<i>Dactylis glomerata</i> L.					un	sol		
<i>Elytrigia repens</i> (L.) Nevski		sp-sol						
<i>E. trichophora</i> (Link) Nevski			sol	sol-sp		sp		cop1
<i>Festuca valesiaca</i> Gaudin	sol			sol				sp
<i>Hordeum bulbosum</i> L.	sol					sp	cop1-2	sol
<i>Koeleria glauca</i> (Spreng.) DC.		un						
<i>Leymus aemulans</i> (Nevski) Tzvelev					sol			
<i>Melica altissima</i> L.						sp		
<i>M. inaequiglumis</i> Boiss.						un		
<i>M. transilvanica</i> Schur						sol		
<i>Milium vernale</i> M.Bieb.						sp-sol		
<i>Phleum paniculatum</i> Huds.					sp	sp		
<i>Piptatherum ferganense</i> (Litv.) Roshev. ex Nikitina	sol							
<i>Poa angustifolia</i> L.				sol				sol-sp
<i>P. bulbosa</i> L.	sol	un-sol	sp	cop1-sp		sol	cop1	sp
<i>P. nemoralis</i> L.					sp			
<i>P. relaxa</i> Ovcz.		sol						sol
<i>Stipa lessingiana</i> Trin. & Rupr.				sol				
<i>Taeniatherum crinitum</i> (Schreb.) Nevski					sol			
<b>42. Polygonaceae Juss.</b>								
<i>Atraphaxis pyrifolia</i> Bunge						sol		
<i>A. virgata</i> (Regel) Krasn.						un		
<i>Polygonum polycnemoides</i> Jaub. & Spach						un		
<i>Rheum maximowiczii</i> Losinsk.		cop1	sol-sp					
<i>Rumex tianschanicus</i> Losinsk.								un
<b>43. Ranunculaceae Juss.</b>								
<i>Anemone gortschakowii</i> Kar. & Kir.					sol			
<i>A. petiolulosa</i> Juz.				un				
<i>Clematis orientalis</i> L.							sol	
<i>Delphinium longipedunculatum</i> Regel & Schmalh.					sp-sol			
<i>D. semibarbatum</i> Bien. ex Boiss.					sp			
<i>Ranunculus regelianus</i> Ovcz.	sol	un	sp	sp				

<i>Shibateranthis longistipitata</i> (Regel) Nakai				sol				
<i>Thalictrum isopyroides</i> CA Mey.			sol	sol	sol	un		
<i>T. simplex</i> L.						sol		
<b>44. Rhamnaceae Juss.</b>								
<i>Rhamnus cathartica</i> L.						un		
<i>R. coriacea</i> (Regel) Kom.					un			
<b>45. Rosaceae Juss.</b>								
<i>Amygdalus petunnikowii</i> Litv.					sp	un	sp	
<i>Cerasus erythrocarpa</i> Nevski					sol	sol		
<i>C. tianschanica</i> Pojark.	sp		sol	sol	sol		sol	un
<i>Cotoneaster melanocarpus</i> Fisch. ex Blytt						sol		sol
<i>Crataegus turkestanica</i> Pojark.						sp		
<b><i>Malus sieversii</i> (Ledeb.) M. Roem.</b>					un			
<i>Orthurus kokanicus</i> (Regel & Schmalh.) Juz.								sol
<i>Padus mahaleb</i> (L.) Vassilcz.						sol		
<i>Potentilla fedtschenkoana</i> Siegr. ex Th. Wolf		sol						
<i>P. orientalis</i> Juz.		sol-sp				sp		
<i>P. transcaspia</i> Th. Wolf						un		sol
<i>Poterium polygamum</i> Waldst. et Kit.						un		sp
<i>Rosa fedtschenkoana</i> Regel							sol	sol
<i>R. kokanica</i> (Regel) Juz.	cop2		sol	sol			sp	sol-sp
<i>R. nanothamnus</i> Bouleng.					sol	sp		
<i>Rubus caesius</i> L.					sol			
<i>Spiraea hypericifolia</i> L.				un				
<i>S. pilosa</i> Franch.				un	un			
<b>46. Rubiaceae Juss.</b>								
<i>Asperula karataviensis</i> Pavlov					un			
<i>A. setosa</i> Jaub. & Spach					sp			
<i>Callipeltis cucullaris</i> (L.) DC.					sol	sp		
<i>Galium aparine</i> L.		sol		sol	sol	un	sp	
<i>G. tenuissimum</i> M. Bieb.						sol		
<i>G. verum</i> L.	sol	sp-sol	sol	sol	sol	cop	sp	sp
<b>47. Rutaceae Juss.</b>								
<i>Dictamnus angustifolius</i> G. Don ex Sweet					un			
<i>Haplophyllum latifolium</i> Kar. & Kir.					sol			
<i>H. perforatum</i> Kar. & Kir.							un	
<b>48. Salicaceae Mirb.</b>								
<i>Populus talassica</i> Kom.						un		
<b>49. Scrophulariaceae Juss.</b>								
<i>Bungea vesiculifera</i> (Herder) Pavlov & Lipsch.					sp			

Table continuation

<i>Leptorhabdos parviflora</i> (Benth.) Benth.				sol-sp		sol		
<i>Linaria bungei</i> Kuprian.	sp-sol							
<i>L. popovii</i> Kuprian.					un			
<i>Pedicularis olgae</i> Regel							un	
<i>Veronica arguteserrata</i> Regel & Schmalh.					sol			
<i>V. campylopoda</i> Boiss.						sol		
<i>Verbascum songaricum</i> Schrenk							sol	
<i>V. turkestanicum</i> Franch.					un			
<b>50. Valerianaceae Batsch</b>								
<b><i>Valeriana chionophila</i> Popov &amp; Kult.</b>				sol				
<i>V. ficariifolia</i> Boiss.				sol				
<i>Valerianella turkestanica</i> Regel et Schmalh.					sol			
<i>V. plagiostephana</i> Fisch. & C.A. Mey.				sol	sol			
<b>51. Violaceae Batsch</b>								
<i>Viola modestula</i> Klokov	un							
<i>V. occulta</i> Lehm.				un			sol	
<i>Note:</i> Assessment of the abundance of the species: cop2 (copiosae 2) – abundant, there are many individuals of this species; cop1 (copiosae 1) – quite abundant, plants are found occasionally, scattered; sp (sparsae) – scattered, plants are found occasionally, scattered, in small numbers; sol (solitariae) – singly, very few plants (only a few specimens in the plot); un (unicum) – a single specimen, the species is represented by a single specimen in the plot.								

CP-3 was found on the right bank of the Baldabrek River, in the Darbaza tract, on the rocky southern slope, at an altitude of 2000 to 2100 m above sea level, GPS coordinates N 42.252599, E 70.440053. The vegetation cover of this area is represented by a forbs-cereal community, with the predominance of *Allium drobovii*, *Ferula tenuisecta*, *Hieracium echioides*, *Gymnospermium albertii*, *Scabiosa songarica*, *Phlomis speciosa*, *Elytrigia trichophora*, etc. The soil surface is rocky. The total projective cover is 50%. In CP-3, there are 46 species from 41 genera of 24 families.

CP-4 is described in the Darbaza tract, on the right bank of the Baldabrek River, on the southwestern slope, at an altitude of 1700 to 1850 m above sea level, GPS coordinates N 42.252539, E 70.439733. The vegetation cover of this site is represented by a forb-cereal with the dominance of *J. seravschanica*. The herbage is dominated by *Lonicera tianschanica*, *Arabidopsis pumila*, *Thlaspi perfoliatum*, *Schrenkia golickeana*, *Carex turkestanica*, *Gagea filiformis*, *Leptorhabdos parviflora*, *Bothriochloa ischaemum*, *Elytrigia trichophora*, *Poa bulbosa*, *Stipa lessingiana*, etc.). The soil surface is fine gravel (50-60%) with rare

stones. The total projective cover is 50-60%. The floristic composition of CP-4 is represented by 60 species from 49 genera belonging to 26 families.

When studying cenopopulations of population 1 with the participation of *J. seravschanica* was found that the flora of the studied communities includes 106 species from 90 genera of 26 families (Table 2), represented by various life forms: trees – 4, shrubs – 18, annual and perennial herbaceous plant species – 24 and 60, respectively. Most of these species are representatives of the following families: Poaceae – 16 species (16.9%), Asteraceae – 12 species (13.2%), Liliaceae – 10 species (12.2%), Rosaceae and Fabaceae 8 species each (11, 3%), Apiaceae – 7 species. The listed leading families make up 66.5% of the studied population. It should be noted that the studied population is represented by 7 Red Data Book species: *Ungernia sewerzowii*, *Mediasia macrophylla*, *Colchicum luteum*, *Juniperus seravschanica*, *Medicago tianschanica*, *Tulipa kaufmanniana*, *Valeriana chionophila*.

As a result of the study of Population 1, three tiers were identified. The first layer is woody (up to 8-10 m), and consists of *J. seravschanica*, sometimes with an admixture of *J. semiglobosa* and



deciduous trees: *Acer semenovii*, etc. The second layer is predominantly shrubby (1.5-2 m, less often up to 4 m): *Rosa kokanica*, *Spiraea hypericifolia*, *S. pilosa*, *Juniperus turkestanica*, *Cerasus tianschanica*, *Cerasus erythrocarpa*, *Berberis oblonga*, etc. The third layer is herbaceous, represented by species: *Elytrigia trichophora*, *Bromopsis inermis*, *Potentilla fedtschenkoana*, *Scabiosa songarica*, *Iris sogdiana*, *Schrenkia golickeana* and others (Table 1).

According to Pavlov's classification [25], in the plant communities of Population 1, several groups of useful plants were identified: fodder – 14, medicinal – 20, essential oil – 5, etc.

The second population (Population 2) of *J. seravschanica* was found on the southern slope of the Aksu canyon, on the right bank of the Aksu River, at an altitude of 1300 to 1610 m above sea level. This population consisted of 2 cenopopulations (CP-5, CP-6).

The location of CP-5 is the middle part on the southern slope of the Aksu canyon, the right bank of the Aksu river. GPS coordinates N 42.331250, E 70.372583, altitude from 1535 to 1610 m a.s.l. The vegetation cover is represented by an eremurus-cereal-forb community (*Eremurus lactiflorus*, *E. regelii*, *Allium eriocoleum*, *A. inconspicuum*, *Scandix stellata*, *Schrenkia golickeana*, *Trachydium tianschanicum*, *Centaurea squarrosa*, *Alyssum campestre*, *Anisantha tectorum*, *Taeniatherum crinitum*). The soil is gravel, TPC – 50%. The floristic composition of CP-5 consists of 96 species, 45 genera, 25 families.

CP-6 is found on the southern slope of the Aksu canyon, on the right bank of the Aksu river. GPS coordinates N 42.331199, E 70.378189, altitude from 1300 to 1500 m a.s.l. The vegetation cover is represented by a woody-shrub-cereal-forb community, dominated by *Celtis caucasica*, *Crataegus pontica*, *Lonicera nummulariifolia*, *Cerasus tianschanica*, *Melica altissima*, *M. inaequiglumis*, *M. transsilvanica*, *Milium vernale*, *Phleum paniculatum*, *Allium caesium*, *A. drobovii*, *Centaurea turkestanica*, *Inula macrophylla*, *Polygonatum sewerzowii*, etc. The soil surface is dense-fine gravelly, rarely with large stones. Projective coverage – 70%. The floristic composition of CP-6 consists of 98 species from 48 genera representing 26 families.

In general, in the studied communities with the participation of the second population of *J. seravschanica*, there are 110 species from 48 genera of 26 families (Table 2). Among them: are trees – 6, shrubs – 22, herbaceous annuals, and perennials

– 38 and 44, respectively. Leading families found in Population 2: Asteraceae – 21 species (10.8%), Poaceae – 20 (10.3%), Rosaceae – 16 (8%), Apiaceae – 14 (7.3%), Fabaceae and Lamiaceae 10 species each (5.2%), Brassicaceae – 9 (5%), which make up 51.8% of the total flora. The twelve Red Data Book species were identified: *Arum korolkowii*, *Eminium lehmannii*, *Centaurea turkestanica*, *Celtis caucasica*, *Allochrysa gypsophiloides*, *Euonymus koopmannii*, *Rhaphidophyton regelii*, *Juniperus seravschanica*, *Medicago tianschanica*, *Juno coerulea*, *Tulipa greigii*, *Malus sieversii* (Table 1).

Plant communities here are also represented in three tiers: the first tier is woody, consists of *J. seravschanica*, *Malus sieversii*, *Celtis caucasica*, *Acer semenovii*, *Crataegus pontica*, *Populus talassica*; the second layer is shrubby, including *Atraphaxis virgata*, *Ephedra equisetina*, *Lonicera nummulariifolia*, *Cerasus tianschanica*, *Cerasus erythrocarpa*, *Spiraea pilosa*, *Berberis oblonga*, etc.; the third tier is herbaceous: *Melica altissima*, *M. inaequiglumis*, *M. transsilvanica*, *Milium vernale*, *Phleum paniculatum*, *Allium caesium*, *A. drobovii*, *Centaurea turkestanica*, *Inula macrophylla*, etc. Several groups of useful plants were identified in the flora of the surveyed areas: fodder – 18, medicinal – 7, essential oil – 4 species.

Population 3 studied in the Bala-baldabrek river valley, Chuuldak tract, at an altitude of 1600 to 1975 m above sea level. CP-7 and CP-8 were studied in this area.

CP-7 was found on the southern slope of the Chuuldak tract, on the left bank of the Bala-baldabrek river, at an altitude of 1600 to 1800 m above sea level. GPS coordinates N 42.285569, E 70.402514. The vegetation cover of this area is represented by a savannah-cereal-forb community, dominated by *Ferula tenuisecta*, *Pseudolynosiris grimmii*, *Thlaspi perfoliatum*, *Hypericum elongatum*, *Hordeum bulbosum*, *Poa bulbosa*). The soil is fine and gravelly, and the total projective cover is 90%. The floristic composition of this community consists of 38 species belonging to 25 genera of 18 families.

CP-8 was found on the southeastern slope of the Chuuldak tract, on the left bank of the Bala-baldabrek river; GPS coordinates 42.285167, 70.431194, altitude from 1890 to 1975 m a.s.l. The vegetation cover is represented by a savannah-wheatgrass-forb community, dominated by *Elytrigia trichophora*, *Festuca valesiaca*, *Hordeum bulbosum*, *Ziziphora bungeana*, *Origanum tyttanthum*, *Hypericum scabrum*, etc.). The soil is gravel-stony, and the projective cover is 100%. The floristic composition

of CP-8 consists of 41 species, 29 genera, 16 families (Table 1).

For the floristic composition of the described areas of the species (Population 3), 64 plant species belonging to 34 genera of 18 families were identified (Table 2). The leading families include Rosaceae – 11 species (14%); Poaceae – 9 species (11.4%); Asteraceae – 8 species (10.1%); Lamiaceae, and Apiaceae – 5 species each (6.3%), which make up 48.1% of the total species composition. Among the life forms, 2 species of trees, 6 species of shrubs, and annual and perennial herbs – 18 and 38 species, respectively, were identified. Of the Red Data Book species, only *J. seravschanica* and *Medicago tianschanica* have been identified.

Studied plant communities with the participation of the third population are represented by three tiers: the first tier is woody (*J. seravschanica*, *J. semiglobosa*), the second tier is shrubby (*Lonicera nummulariifolia*, *L. tianschanica*, *Cerasus tianschanica*, *Berberis oblonga*, *Clematis orientalis*, *Rosa fedtschenkoana*, etc.), the third the layer is herbaceous (*Hypericum elongatum*, *Hordeum bulbosum*, *Poa bulbosa*, *Elytrigia trichophora*, *Festuca valesiaca*, etc.). Among them, it was revealed: fodder – 15 species, medicinal – 6, and essential oil – 4, respectively.

Thus, summary information has been summarized, including the species list of the studied communities with the participation of *J. seravschanica* and the abundance of species surveyed according to the Drude scale (Table 2). It is established that the flora of all studied communities with the participation of *J. seravschanica* includes 254 species from 175 genera of 51 families, including 7 trees (*Acer semenovii*, *Celtis caucasica*, *Crataegus pontica*, *Juniperus seravschanica*, *Juniperus semiglobosa*, *Malus sieversii*, *Populus talassica*), shrubs – 25 (*Lonicera nummulariifolia*, *Rosa kokanica*, *Cerasus tianschanica*, *C. erythrocarpa*, *Spiraea hypericifolia*, *Berberis oblonga*, etc.), annual and perennial herbaceous plant species – 56 and 166 (*Elytrigia trichophora*, *Bromopsis inermis*, *Poa bulbosa*, *Dactylis glomerata*, *Festuca valesiaca*, *Carex turkestanica*, *Ferula tenuisecta*, *Eremurus regelii*, *Hypericum scabrum*, *Hypericum elongatum*, *Arum korolkowii*, *Origanum tyttanthum*, *Helichrysum maracandicum*, *Acantholimon alberti*, *Ziziphora bungeana*, *Achillea millefolium*, *Phleum phleoides*, *Poa bulbosa*, *Hordeum bulbosum*, *Medicago tianschanica*, *Potentilla fedtschenkoana*, *Iris sogdiana*, *Schrenkia golickeana*, *Galium verum*, etc.), respectively. Most of these species (56%)

belong to the following 11 families: Apiaceae, Asteraceae, Brassicaceae, Scrophulariaceae, Caryophyllaceae, Fabaceae, Lamiaceae, Liliaceae, Poaceae, Ranunculaceae, and Rosaceae. According to our data, in all the studied plant communities, the constant companions of *J. seravschanica* are: *Lonicera nummulariifolia*, *L. tianschanica*, *Galium verum*, *Ferula tenuisecta*, *Hypericum scabrum*, *Cerasus tianschanica*, *Eremurus regelii*, *Carex turkestanica*, *Poa bulbosa*, *Hordeum bulbosum*.

In general, in the surveyed areas, in addition to *J. seravschanica*, there are 16 Red Book species: *Ungernia sewerzowii*, *Mediasia macrophylla*, *Arum korolkowii*, *Eminium lehmannii*, *Centaurea turkestanica*, *Celtis caucasica*, *Allochrysa gypsophiloides*, *Euonymus koopmannii*, *Rhaphidophyton regelii*, *Colchicum luteum*, *Medicago tianschanica*, *Juno coerulea*, *Tulipa greigii*, *T. kaufmanniana*, *Malus sieversii*, and *Valeriana chionophila* [6]. In this regard, it is important to regularly monitor and strengthen the conservation of the surveyed communities in this region.

## Conclusion

*J. seravschanica* is an important element of juniper forests on the Western Tien Shan mountain ranges. As a result of this study, an analysis of 3 main populations of *J. seravschanica* was carried out. The floristic composition of plant communities with the participation of the Red Book species *J. seravschanica* is mainly represented by herbal plant species, most of which are perennials, fewer shrubs. A species list of the studied communities with information on the abundance of species was compiled, 16 rare plant species listed in the Red Book of Kazakhstan were identified. Since *J. seravschanica* plays an important ecological role, and has an important forest-forming, water-protective, soil-protective, and anti-mudflow value, the results of studying the current state of plant communities with his participation can be a valuable source of information for the conservation and rational use of genetic resources in the Western Tien Shan. The results obtained will be used in the study of the genetic diversity of wild plant species, including species of the *Juniperus* genus.

## Conflict of interest

All authors have read and were familiar with the content of the article and have no conflict of interest.

## Funding

This research has been funded by the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan (Grant No. AP09259027).

## Acknowledgment

The authors express their gratitude to the staff of the Aksu-Zhabagly State Nature Reserve and the Committee for Forestry and Wildlife of the Ministry of Ecology and Natural Resources of the Republic of Kazakhstan for the opportunity to conduct research.

## References

1. Farjon A.A. Handbook of the World's Conifers. Koninklijke Brill NV: Leiden, Netherlands; 2017.
2. Adams R.P. The junipers of the world: The genus *Juniperus*. 4th ed. Trafford Publ., Victoria, BC; 2014.
3. Rahmonov O., Szczypiek T., Niedźwiedz T., Myga-Piątek U., Rahmonov M., Snytko V.A. The human impact on the transformation of juniper forest landscape in the western part of the Pamir-Alay range (Tajikistan). *Environmental Earth Sciences*. 2017;76(8):324. doi:10.1007/s12665-017-6643-4
4. Abdulina S.A. Checklist of vascular plants of Kazakhstan. Almaty: 1999.
5. Yermagambetova M.M., Abugaliev S.I., Turuspekov Y.K., Almerkova S.S. Conspectus of the genus *Juniperus* L. growing in Kazakhstan. *Proceedings on applied botany, genetics and breeding*. 2022;183(3):161-170. (In Russian) <https://doi.org/10.30901/2227-8834-2022-3-161-170>
6. The Red Data Book of Kazakhstan. Volume 2. Part 1. Plants. Re-edition, completed and revised. Astana, 2014.
7. Flora of Kazakhstan: in 9 vols. Alma-Ata: Academy of Science of KazSSR, 1956-1966. (In Russian)
8. Ivashchenko A.A. The flora Sairam-Ugam state national natural park (Kazakhstan) (Spisok flory Sayram-Ugamskogo gosudarstvennogo natsional'nogo prirodnoogo parka (Kazakhstan)). *Botanical research of Siberia and Kazakhstan*. 2020; 26: 52-63. (In Russian)
9. Rachkovskaya E.I. Rastitel'nyy pokrov Aksu-Zhabaglynskogo zapovednika // Vegetation cover of the Aksu-Zhabagly Reserve // *Proceedings of the Aksu-Zhabagly Reserve*. Issue. 11. Almaty, 2016, pp. 149–170. (In Russian)
10. Kovshar A.F. Aksu-Zhabaglynskomu zapovedniku 90 let // 90 years of Aksu-Zhabagly Reserve. *Nature Conservation Research. Reserved science*. 2016. no. 11. pp. 111-118. (In Russian)
11. Pavlov N. Rastitel'nyy pokrov Zapadnogo Tyan'-Shanya // Vegetation cover of the Western Tien Shan. – M.: University, 1980. – 246 p. (In Russian)
12. Sultangaziev, O., Konrad, H., Schueler, S., & Geburek, T. North-south population subdivision of *Juniperus seravschanica* in Kyrgyzstan revealed through novel plastid DNA markers. *Journal of Systematics and Evolution*, 2012, 50(5), pp. 411-421.
13. Sidorenko G. T. Rastitel'nost' i kormovyye resursy Kuraminskogo khrebtu // Vegetation and forage resources of the Kuraminsky Range / G. T. Sidorenko. – Stalinabad: Publishing House of the Academy of Sciences of the TajSSR, 1953. – 101 p. (In Russian)
14. Kamelin, R.V. Kukhistan district of mountainous Central Asia. Botanical and geographical analysis. (Komarov readings, XXXI) L., Nauka, 1979. – 117 p. (In Russian)
15. Kamelin, R.V. Florogenetic analysis of the natural flora of mountainous Central Asia. L., 1973. – 356 p. (In Russian)
16. Korovin, E.P. Rastitel'nost' Sredney Azii i Yuzhnogo Kazakhstana // Vegetation of Central Asia and South Kazakhstan. Tashkent: Publishing House of the Academy of Sciences of the Uzbek SSR, 1962. – Book. 2. – 547 p. (In Russian)
17. Karmysheva N.Kh. Flora i rastitel'nost' zapovednika Aksu-Dzhabagly // Flora and vegetation of the Aksu-Dzhabagly reserve. Alma-Ata, 1973. 176 p. (In Russian)
18. Arifkhanova, M. M. Rastitel'nost' Ferganskoy doliny // Vegetation of the Fergana Valley. Tashkent: Fan, 1967. – 295 p. (In Russian)
19. Rabotnov T.A. Zhiznennyj cikl mnogoletnih travjanistykh rastenij v lugovykh cenozakh // The life cycle of perennial herbaceous plants in meadow cenoses *Proceedings of the Academy of Sciences of the USSR, Academy of Sciences, Series 3 Geobotany*. 1950: 7-124. (In Russian)
20. Bykov B.A. Vvodnyy ocherk flory i rastitel'nosti Kazakhstana // Introductory essay on the flora and vegetation of Kazakhstan // *Vegetation cover of Kazakhstan*. Alma-Ata: Nauka, 1966. 164 p. (In Russian)
21. Lavrenko E.M., Korchagin A.A. Poleyaya geobotanika // Field geobotany. Volume. 5. Moscow-Leningrad: Nauka, 1976. (In Russian)
22. Flora of the USSR: in 30 vols. Moscow-Leningrad, 1934-1964. (In Russian)
23. Opredeleteli rasteniy Sredney Azii (Kriticheskiy konspekt flory) // Keys to plants of Central Asia (Critical abstract of flora): T1-10. Tashkent: FAN, 1968-1993. (In Russian)
24. Czerepanov S.K. Vascular Plants of Russia and Adjacent States (the Former USSR). St. Petersburg: Peace and Family; 1995. (In Russian)
25. Pavlov N.V. Rastitel'noe syr'e Kazakhstana (Rasteniye ih veshchestva ispol'zovanie) // Vegetable raw materials of Kazakhstan (Plant: their substances use). Leningrad: Publishing House of the USSR Academy of Sciences, 1947. (In Russian)