IRSTI 62.09.37 https://doi.org/10.26577/eb.2023.v96.i3.02

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# DISTRIBUTION FEATURES AND BIOLOGICAL CHARACTERISTICS OF ENDEMIC PLANT OF WESTERN TIEN-SHAN *ERANTHIS LONGISTIPITATA*

The article provides updated data on the distribution of the endemic species of the Western Tien Shan Eranthis longistipitata Regel on the territory of the Aksu-Jabagly Nature Reserve. The features of the structures of the discovered coenopopulations are described. As a result of route field studies of the Kazakh part of the Western Tien Shan, 3 coenopopulations of Eranthis longistipitata were discovered. The first population is the Taldy-Bulak Gorge (left bank of the stream); the second population is the Zhetimsai Gorge (left bank of the stream); the third population is the Valley of the Irsu River. The discovered populations are marked on the map of the Aksu-Jabagly Nature Reserve. Monitoring sites were created for all coenopopulations, the species density was calculated using the method of A.A.Uranov, the species composition was determined. The average density of Eranthis longistipitata species varied from 14 to 22 pcs/2m$^2$. The morphometric characteristics of the detected species growing in 3 different sites have been studied. The population of Eranthis longistipitata growing in the valley of the Irsu River was marked by the maximum indicators (stem height, number of leaves and sepals). The plant community of 3 monitoring sites and the predominant soil type were determined. Explanatory graphs and tables have been created and an assessment of the current state of the structural features of the distribution and coenopopulations of Eranthis longistipitata in the Kazakh part of the Western Tien Shan has been given.

**Key words**: Eranthis longistipitata Regel, Western Tien Shan, Aksu Jabagly Nature Reserve, endemic, population density, morphometric characteristics.

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## Батыс Тянь-Шань эндемикалық *Eranthis longistipitata* өсімдігінің таралу ерекшеліктері мен биологиялық сипаттамалары

Мақалада Ақсу-Жабағылы мемлекеттік табиғи қорығының аумағында өсетін Батыс Тянь-Шаньның эндемикалық Eranthis longistipitata Regel өсімдігінің таралуы туралы нақтыланған мәліметтер келтірілген. Анықталған ценопопуляция құрылымдарының ерекшеліктері сипатталған. Батыс Тянь-Шаньның қазақстандық бөлігін маршруттық далалық зерттеу нәтижесінде Eranthis longistipitata өсімдігінің 3 ценопопуляциясы табылды. Бірінші популяция – Талдыбұлақ шатқалы (ағынның сол жағалауы); екінші популяция – Жетімсай шатқалы (ағынның сол жағалауы); үшінші популяция – Ирсу өзенінің аңғары. Табылған популяциялар Ақсу-Жабағылы табиғи қорығының картасында белгіленген. Барлық ценопопуляциялар үшін мониторингтік алаңдар құрылды, түрдің тығыздығы А.А. Уранов әдісімен есептелді, тірі жер жамылғысының түрлік құрамы анықталды. Eranthis longistipitata өсімдігінің орташа тығыздығы 14-тен 22 дана/2м$^2$-ге дейін анықталды. 3 түрлі аймақта өсетін табылған Eranthis longistipitata өсімдігінің морфометриялық сипаттамалары зерттелді. Табылған популяциялардың арасында максималды көрсеткіштер (сабағының биіктігі, жапырақтары мен сепалдарының саны) Ирсу өзенінің аңғарында туған. 3 бақылау алаңының өсімдіктер қауымдастығы және топырақтың басым түрі анықталды. Түсіндірме графиктер

 

мен кестелер жасалды және Батыс Тянь-Шаньның Қазақстандық бөлігінде (Ақсу-Жабағылы мемлекеттік табиғи қорығының аумағында) Eranthis longistipitata өсімдігінің таралуы мен ценопопуляцияларының құрылымдық ерекшеліктерінің қазіргі жай-күйіне баға берілді.

**Түйін сөздер**: Eranthis longistipitata Regel, Батыс Тянь-Шань, Ақсу-Жабағылы мемлекеттік табиғи қорығы, эндемик, популяцияның тығыздығы, морфометриялық сипаттамалары.

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**Особенности распространения и биологические характеристики эндемичного растения Западного Тянь-Шаня *Eranthis Longistipitata***

В статье предоставлены уточненные данные о распространении эндемичного вида Западного Тянь-Шаня Eranthis longistipitata Regel на территории Аксу-Джабаглинского заповедника. Описаны особенности структур обнаруженных ценопопуляций. В результате маршрутных полевых исследований Казахстанской части Западного Тянь-Шаня были обнаружены 3 ценопопуляции Eranthis longistipitata. Первая популяция – Ущелье Талды-булак (левый берег ручья); вторая популяция – Ущелье Жетімсай (левый берег ручья); третья популяция – долина реки Ирсу. Обнаруженные популяции отмечены на карте Аксу-Джабаглинского природного заповедника. Для всех ценопопуляций были созданы мониторинговые площадки, плотность вида рассчитывалась по методу А.А.Уранова, определялся видовой состав живого напочвенного покрова. Средняя плотность вида Eranthis longistipitata варьировала от 14 до 22 шт/2м$^2$. Исследованы морфометрические характеристики обнаруженного вида, произрастающих в 3 разных участках. Максимальными показателями (высотой стебля, количеством листьев и чашелистиков) отмечена популяция Eranthis longistipitata, произрастающая в долине реки Ирсу. Определено растительное сообщество 3 мониторинговых площадок и преобладающий тип почв. Созданы пояснительные графики и таблицы и дана оценка современного состояния структурных особенностей распространения и ценопопуляций Eranthis longistipitata на Казахстанской части Западного Тянь-Шаня.

**Ключевые слова**: Eranthis longistipitata Regel, Западный Тянь-Шань, Аксу-Джабаглинский государственный природный заповедник, эндемик, плотность популяций, морфометрические характеристики.

## Introduction

The flora of Kazakhstan includes more than 13 thousand species, including more than 5750 species of higher vascular plants, about 5000 – fungi, 485 – lichens, more than 2000 – algae, about 500 – mossy. There are centers of flora endemism in Kazakhstan (Karatau Mountains, Western Tien Shan), a number of unique natural complexes and communities original in floral composition. The country has a full range of subzonal vegetation variants of steppes, deserts and mountain belts characteristic of central Eurasia [1].

The Western Tien Shan is characterized by exceptional diversity, mosaic and beauty of landscapes; outstanding evidence of large-scale geological and evolutionary processes; a unique combination of different types of ecosystems; a rich animal and plant world, a considerable proportion of which are endemic species and communities, as well as a significant number of rare and endangered species [2].

Aksu-JabaglyNature Reserve is the northern part of the Western Tien Shan at the point of convergence of the borders of three states – Kazakhstan, Kyrgyzstan and Uzbekistan. It occupies a mountainous territory stretching 53 km from west to east and 41 km from south to north. Aksu-Jabagly Nature Reserve is unique not only for the duration of the protection regime established in it and the diversity of the flora and fauna represented [3].

The flora of the Reserve is about 50% of the flora of the Western Tien Shan (without Karatau) and almost 25% of the flora of the entire Central Asia. It is characterized by a high degree of endemism – representatives of 20 out of 64 genera endemic to the Mountainous Central Asian province grow here. 72 species of plants – wild relatives of cultivated plants, about 200 species of medicinal plants and 57

species listed in the Red Books of Kazakhstan, Uzbekistan and Kyrgyzstan grow on the territory of the Reserve [4].

One of the endemic species of the Western Tien Shan is *Eranthis longistipitata* Regel (Figure 1).

All *Eranthis* species are distributed in limited areas from southern Europe to central Asia that extend to China, Eastern Russia, Central Asia, Korea and Japan (Fig. 2).

Three species with yellow sepals are *E.hyemalis* (L.) Salisb., which grow in southern Europe including parts of France, Italy, and the Balkans; *E.cilicica* Schott Kotschy, which is considered conspecific with *E.hyemalis* and is found in southwestern Asia including Turkey and Afghanistan; and *E.longistipitata* Regel is native to central Asia from central southern Russia eastward to Uzbekistan and Iran.

**Figure 1 –** *E.longistipitata* flowering period on the territory of Aksu-Jabagly Nature Reserve

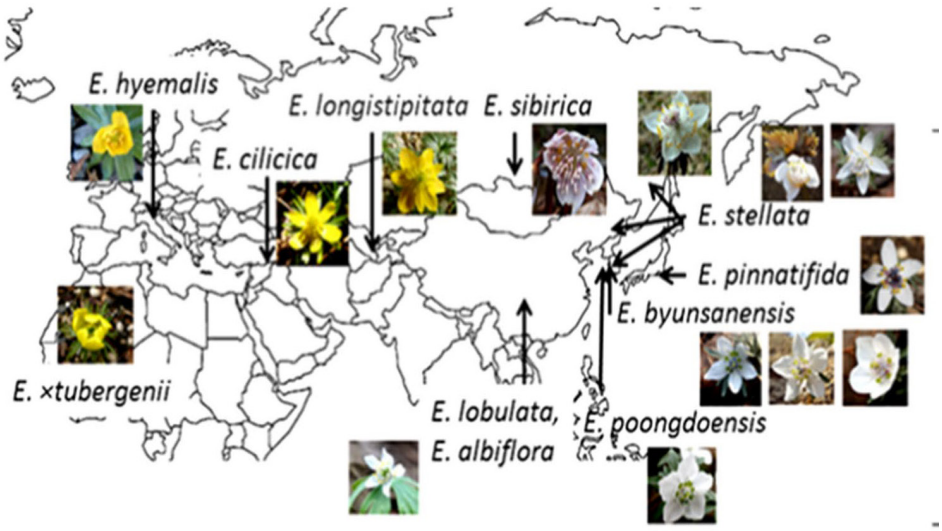


**Figure 2 –** Distribution of *Eranthis* species [5]

Species with white sepals include *E.sibirica* D.C., native to northern Asia; *E.albifora* Franchet and *E.lobulata* W.T.Wang, native to western China; *E.stellata* Maxim., native to eastern Asia including northern China, Korea, and southeast Russia [6]; *E.byunsanensis* B.Y.Sun, native to the southern part of Korea; *E.pungdoensis* B.U. Oh, native to a very small Pungdo island of the west coast of Korea; and *E.pinnatifda* Maxim., native to Japan. Most species of *Eranthis* have flowers with a single petal.

On the basis of morphology, the genus has been divided into two sections: *E.* sect. *Eranthis* and *E.* sect. *Shibateranthis* (Nakai) Tamura [7]. The type section is characterized by annual tubers, yellow sepals and emarginate or slightly bilobate upper petal margins without swellings (nectaries), whereas the members of section *Shibateranthis* have long-lived tubers, white sepals and bilobate or forked petal margins with swellings [8].

Plants of the *Eranthis* genus are endemic perennial tuberous ephemeroids [9], psychromesophytes (plants growing mainly on cold and moist soils [10], semigeliophytes (this ecological group includes those plants that are adapted to life in places with good sunlight, but resistant to shading [11]. During the growing season, plant stems grow up to 25 cm at flowering and up to 40 cm at fruiting. There is a single basal leaf, which increases in size during fruiting. Stem leaves, depending on the species, may be present or absent and also change their size during the growing season. Some species have trichomes on the peduncle and peduncle. The flowers are white or yellow, depending on the section, most often single, bisexual, stamens in the amount of about 40 pieces. The fruit is a leaflet that contains up to 8 seeds of a rounded shape [12-16].

Plants of the *Eranthis* genus have practical applications. Studies of *E.cilicica* components have led to the isolation of ten chromone derivatives, two of which were previously known. Antioxidant activity was determined in a number of substances [17]. In another study, phytochemical analysis of *E.cilicica* tubers showed the presence of eleven new cycloartan glycosides and one new oleanane glycoside, together with one known oleanane glycoside. Aglycone and its C–23 epimer and ioleanane glycosides have shown cytotoxic activity against HL–60 leukemic cells [18].

The lectin found in *E.hyemalis* tubers (L) is a protein that inactivates Type II ribosomes (Type II RIP). It has shown anti-cancer properties and has great potential as a therapeutic agent [19]. In an earlier study, a modified protocol for the extraction and purification of EHL using affinity chromatography was presented and the cytotoxic effect of lectin against amphid neurons of Caenorhabditis elegans was proved [20].

Since the Western Tien Shan is divided by three Central Asian states: Kazakhstan, Uzbekistan and Kyrgyzstan (figure 3), previously, the endemic species of the Western Tien Shan *E. longistipitata* was also found on the Uzbek and Kyrgyz sides of the Western Tien Shan (table 1).


**Figure 3** – Location of Western Tien-Shan [21]

**Table 1** – Location of points of the natural growth of *E.longistipitata* in the Western Tien Shan [22]

| № | Locality, coordinates | Habitat |
|---|---|---|
| 1 | Kyrgyzstan, Chuya region, Issyk-atinskii district, Niczniaya Serafimovka village; 42°45′02″N, 74°51′37″ E | foot of the mount |
| 2 | Kyrgyzstan, Chuya region, Issyk-atinskii district, Karandolot tract; 42°44′22″N, 74°55′50″ E | foot of the mount |
| 3 | Uzbekistan, Andijan region, Khojaabad district, east-southeastern part of Fergana valley, Kyrtashtau mountains, near Imamat village; 40°32′27″ N, 72°36′28″ E | mossy stony slope |
| 4 | Uzbekistan, Samarkand region, Urgut district, western Pamir-Alai, Gissar-Alai, western part of the Zeravshan ridge, right bank of Amankutansai river, near Amankutan kishlak; 39°18′16″ N, 66°55′45″ E | juniper forest on the slope |
| 5 | Uzbekistan, Tashkent region, Bostanlyk district, western Tian Shan, spurs of northwestern part of Chatkal ridge, Galvasay river valley—left tributary Chirchik river, left bank; 41°32′20″ N, 69°53′03″ E | walnut grove on the slope |
| 6 | Uzbekistan, Tashkent region, Bostanlyk district, Western Tian Shan, north-western part of Chatkal ridge, foot of Big Chimgan mountain, area between Galvasay and Mramornaya rivers, on road from Uchterek tract to Chimgan tract; 41°31′05″ N, 69°59′15″ E | bushy slope |

The research objective is to identify *E. longistipitata* populations on the territory of the Kazakh part of the Western Tien Shan and study their abundance, density and morphological features.

## Materials and мethods

The subject of the study is a perennial herbaceous endemic species of the Western Tien-Shan belonging to the family *Ranunculaceae* Juss. (figure 1).

The work was carried out according to generally accepted methods for studying coenopopulations [23-25].

The method of research was a route-reconnaissance survey of the territory. To study the general composition of the flora, as well as to monitor the growth points of *E. longistipitata*, field trips were carried out in spring, summer and autumn. The survey was carried out using existing maps of the Aksu-Jabagly State Nature Reserve, as well as a GPS navigator (GPS Map 65, Garmin). All locations were recorded and were identified plants that make up the phytocenosis of the monitoring site. For this purpose geobotanical monitoring plots were established, investigation of which was carried out according to the generally accepted method [26]. To study the floristic composition of the communities, about 80 herbarium specimens were collected and processed. The species were identified using the main reports [27-29].

Taking into account that *E. longistipitata*is endemic plant of the Western Tien-Shan, we have studied its morphological characteristics. For this, measurements of generative and vegetative individuals (50–80) were carried out, and data on the morphological variability of flowers were collected. To verify the distribution range of *E. longistipitata*. in Kazakhstan, all available floristic summaries and other literary sources, as well as the herbarium of the Institute of Botany of the Academy of Sciences of the Republic of Uzbekistan (TASH), the herbarium of the Altai Botanical Garden (ABG)and materials from the Plantarium website [30] were consulted. Statistical data processing was carried out using the Descriptive Statistics MS Excel 2007 program.

## Results and discussion

The studies were carried out on the territory of the Aksu-Jabagly State Nature Reserve (established by the resolutions of the Council of People ‘s Commissars of the Kazakh ASSRdated July 14, 1926), in 2022–2023.

*E.longistipitata* is a perennial plant with an almost spherical tuber bearing 1-2 basal palmately 3-5-separated leaves and a leafless stem, 3-25 cm long, at the top of which there is a wrapper-cover divided into linear segments (figure 1).

To establish the actual places of growth in Kazakhstan, a review of herbarium funds in Kazakhstan (ABG) and Uzbekistan was carried out (TASH) (table 2).

Based on the database collected before the study, a population map of *E.longistipitata* was created (Table 3, Figure 4).

**Table 2 –** Synopsis of archival herbarium finds of *E. longistipitata* in Kazakhstan

| Location | Date | Collector |
|---|---|---|
| Kazakhstan, Novo-Nikolavka village, Aksu-Dzhabagly nature reserve, northern slope, thickets of wild roses | 24.04.1969 | Collected by: Rusov, Shmarina<br>Determined by: Rusov |
| Kazakhstan, Karatau mountains, under a snow patch, at the top of the Meshistye Mountains, near Tyulkubas station | 22.05.1939 | Collected by: N.V. Pavlov<br>Determined by: N.V. Pavlov |
| Kazakhstan, Karatau mountains, on a rocky slope | 2.05.1928 | Collected by: N.N. Graz-Guseva<br>Determined by: N.V. Pavlov |
| Kazakhstan, Turkestan region, Karatau mountains, Bazhibil pass, under a snow patch on a slope | 29.04.1930 | Collected by: S.Yu. Lipschitz<br>Determined by: S.Yu. Lipschitz |
| Kazakhstan, Turkestan region, foothills of the ridge Karatau, rocky slopes near the village of Babay Kurgan | 2.04.1930 | Collected by: S.Yu. Lipschitz<br>Determined by: S.Yu. Lipschitz |
| Kazakhstan, Karatau ridge, Mount Arkarly Tau. Forb steppe, on a slope near the village of Vasilievka | 2.05.1935 | Collected by: L. Chilikina, A. Mamirova<br>Determined by: L. Chilikina |
| Kazakhstan, Shymkent, along the ridges to the west of the city | 12.03.1932 | Collected by: P. Zhugina<br>Determined by: N.V. Pavlov |
| Kazakhstan, Turkestan region, Karatau mountains, lawns on the slopes of the mountains in the Ush-Uzen tract | 4.04.1930 | Collected by: S.Yu. Lipschitz<br>Determined by: S.Yu. Lipschitz |
| Kazakhstan, Shymkent region, between the villages of Vysokoe and Rappovka | 8.05.1973 | Collected by: L. Pimenov<br>Determined by: L. Pimenov |
| Kazakhstan, South Kazakhstan region, gravelly slopes on the tops of the Kuyuk mountains | 1.05.1939 | Collected by: N.V. Pavlov<br>Determined by: N.V. Pavlov |

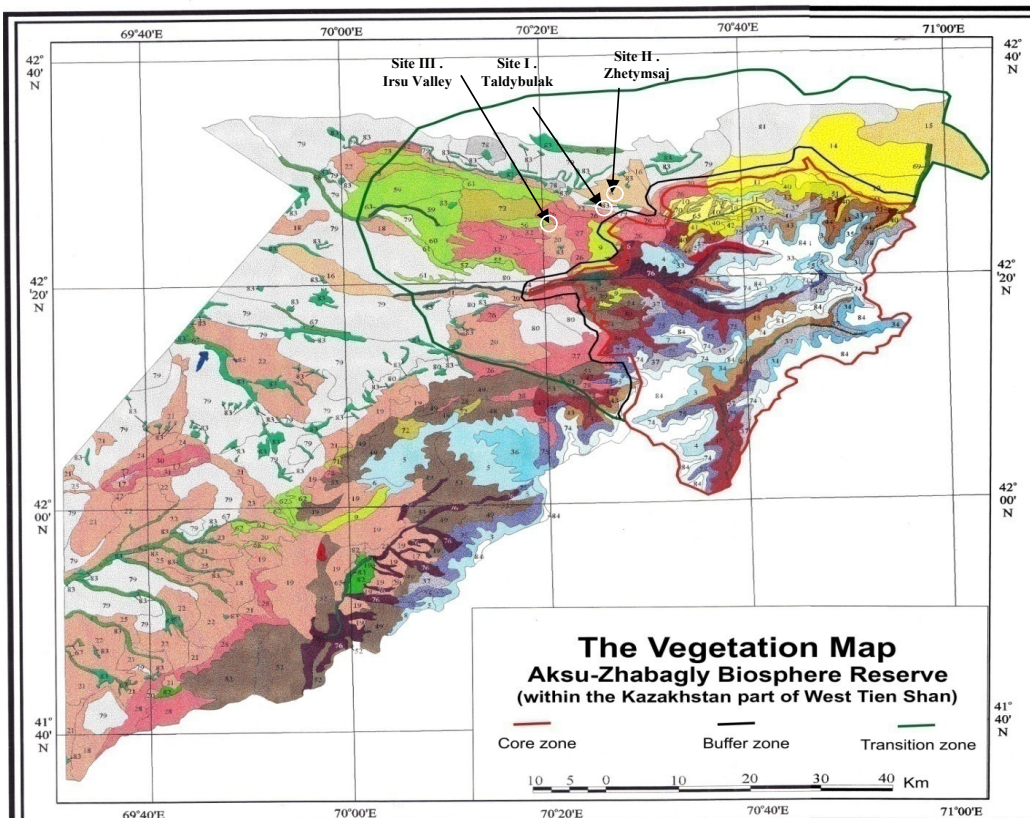


**Figure 4** – Map of the distribution areas of *E.longistipitata* populations on the territory of Aksu-Jabagly Nature Reserve [31] (Site I – Taldy-bulak Gorge, Site II – Zhetimsai Gorge, Site III – Irsu Valley)

**Table 3 –** Geographical location of the studied *E.longistipitata* populations

| № | Location | Geographical coordinates |
|---|---|---|
| Coenopopulation 1 | Taldy-bulak Gorge, left bank of the stream | 42º 25'12N 70°28'28E |
| Coenopopulation 2 | Zhetimsai Gorge, left bank of the stream | 42º 24'41N 70°32'41E |
| Coenopopulation 3 | Irsu Valley | 42º 21'33 N 70°22'28E |

The study of coenopopulations began with the study of the geographical location of the studied *E.longistipitata* species and the establishment of a plant community. Phytocenotic and ecological features of the habitat were determined by the main parameters.

As shown in Figure 4 and Table 2 populations of *E.longistipitata* in the Aksu-Jabagly Nature Reserve are represented in 3 growth sites:

1. Site I – Taldy-bulak Gorge. Community: Deciduous-shrubby. Trees and shrubs– *Crataegus turkestanica* Pojark, *Lonicera tianschanica* Pojark., *Spiraea hypericifolia* L., *Rosa kokanica* Regel, *Rosa fedtschenkoana* Regel, *Ephedra equisetina* Bunge. Population contains 14 individuals of *E.longistipitata.*

Herbaceous plants – *Ziziphora bungeana* Juz, *Hypericum perforatum* L., *Eremurus regelii* Vved, *Achillea millefolium* L., *Crocus alatavicus* Regel & Semen., *Gagea lutea* (L.) Ker Gawl, *Arum korolkowii* Regel, *Hypericum perforatum* L.

2. Site II – Zhetimsai Gorge. Comminuty: Deciduous-shrubby. Trees and shrubs – *Crataegus turkestanica* Pojark, *Lonicera tianschanica* Pojark., *Lonicera nummulariifolia* Jaub. & Spach, *Spiraea hypericifolia* L., *Rosa kokanica* Regel ex Juz., *Rosa fedtschenkoana* Regel, *Salix babylonica* L., *Malus sieversii* (Ledeb.) M.Roem.Population contains 15 individuals of *E.longistipitata.*

Herbaceous plants –*Ziziphora bungeana* Juz., *Hypericum perforatum* L., *Eremurus regelii* Vved, *Achillea millefolium* L., *Crocus alatavicus* Regel & Semen., *Gagea lutea* (L.) Ker Gawl., *Hypericum perforatum* L., *Leontice albertii* Regel, *Corydalis ledebouriana* Kar. & Kir., *Verbascum songaricum* Schrenk., *Hordeum bulbosum* L., *Tulipa kaufmanniana* Regel.

3. Site III – Irsu Valley. Comminuty: Savannoid. Trees and shrubs –*Spiraea hypericifolia* L., *Rosa kokanica* Regel ex Juz.Population contains 22 individuals of *E.longistipitata.*

Herbaceous plants –*Ziziphora bungeana* Juz., *Hypericum perforatum* L., *Eremurus regelii* Vved, *Achillea millefolium* L., *Crocus alatavicus* Regel & Semen., *Gagea lutea* (L.) Ker Gawl., *Leontice albertii* Regel, *Corydalis ledebouriana* Kar. & Kir., *Verbascum songaricum* Schrenk., *Hordeum bulbosum* L, *Tulipa kaufmanniana* Regel, *Tulipa greigii* Regel, *Rhinopetalum karelinii* Fisch. ex D. Don, *Sedum alberti* Regel.

In all coenopopulations the number of *E. longistipitata*plants was 150 individuals. The average density of the coenopopulations ranged from 14 – 22 individuals/2m$^2$ in the 3 populations (Figure 5).

Next step of our researches was investigation of differences in morphometric characteristics of generative individuals of the *E.longistipitata* populations (table 4).

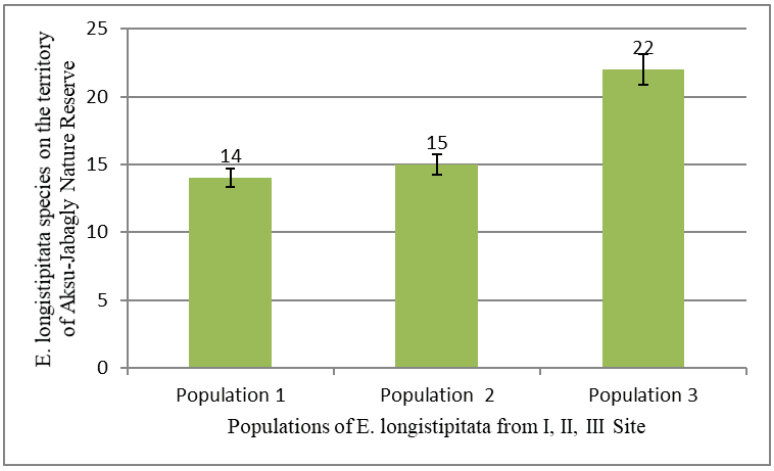


**Figure 5** – Average density of the *E.longistipitata* species on the territory of the Aksu-Jabagly Nature Reserve

**Table 4** – Morphometric characteristics of *E.longistipitata* generative individuals in 3 coenopopulations.

| Indicators | Coenopopulation from the Site I(Taldy-bulak Gorge) | Coenopopulationfrom the Site II (Zhetimsai Gorge) | Coenopopulation from the Site III (Irsu Valley) |
|---|---|---|---|
| | M±m | M±m | M±m |
| Stem height, см | 4.7 | 4.7 | 5.9 |
| Number of leaves | 2.5 | 2.6 | 3.4 |
| Number of sepals | 15 | 18 | 22 |

According to the data obtained in Table 4, the main morphometric characteristics of individuals from coenopopulation III are superior to the rest. These individuals have the highest stem length, the maximum number of leaves and the number of sepals. Also, as shown in Figure 5, the maximum number of *E.longistipitata* individuals was also noted in the coenopopulation growing in the Irsu valley.

This fact may be due to the fact that the Irsu Valley is higher than the other two points (1454 m above sea level). Accordingly, the amount of precipitation and the humidity level are higher than in Taldybulak (1198 m above sea level) and Zhetimsai Gorge (1452 m above sea level). It should also be noted that the level of humidity and precipitation is higher there, since populations of *E. longistipitata* grow in the valley of the Irsu River, and in the other two points – Taldy-bulak gorge and Zhetimsai populations of *E. longistipitata* grow along small streams. The soil type in the Irsu River Valley is also different. Stony soil type and savanna vegetation type prevail here, while deciduous shrub vegetation type and gray-brown soils prevail in Taldybulak and Zhetimsai gorges.

## Conclusion

As a result of the conducted research, the areas of growth of *E.longistipitata* populations in the Kazakh part of the Western Tien Shan (the territory of the Aksu-Jabagly Reserve) have been established. 3 points are marked: Taldy-bulak Gorge, Zhetimsai Gorge and Irsu Valley. Established growth sites have different levels of altitude above sea level. The highest point of the place where *E.longistipitata* grows is the valley of the Irsu River. At the same time, the average population density of *E.longistipitata* at these three points has been established. The highest density is noted on site No. III (the valley of the Irsu River). The next stage of the research was to determine the morphometric characteristics of the detected populations. The following parameters were selected as indicators: the height of the stem, the number of leaves and the number of sepals. The maximum values are marked by the coenopopulations of *E.longistipitata* growing in the valley of the Irsu River. The data obtained indicate the presence of factors influencing the favorable growth of coenopopulations in the natural habitats of *E.longistipitata*: humidity, the presence of rocky soil and a savanoid plants community.

## Conflict of interest

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

## Funding

The work was carried out within the framework of the grant funding program for young scientists under the project “Zhas Galym” for 2022-2024, carried out by the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan, on theme AP15473152 “Conservation of biodiversity and research of biologically active compounds of *Eranthis longistipitata*”.

## References

1 Materials of the Fifth National Report of the Republic of Kazakhstan on biological diversity. – Astana, 2014.

2 Akzhigitova N.I. Diversity of plant communities of the main formations of the subalpine belt of the Western Tien Shan // Biodiversity of the Western Tien Shan: protection and rational use. – Tashkent, 2002. – P. 32–35.

3 Kovshar’ A.F. Aksu-Jabagly Nature Reserve is 90 years old // Nature Conservation Research. Reserved science. 2016. №1 (1). C.111-118

4 Karmysheva N.K. 1973. Flora and vegetation of AksuDzhabagly nature reserve. Alma-Ata. 176 p.

5 Park, S.Y., Jeon, M.J., Ma, S.H. *et al.* Phylogeny and genetic variation in the genus *Eranthis* using nrITS and cpIS single nucleotide polymorphisms. *Hortic. Environ. Biotechnol.* **60**, 239–252 (2019). https://doi.org/10.1007/s13580-018-0113-0

6 Li L, Tamura M (2001) Etranthis Salisbury, Trans. Linn. Soc. London 8:303. 1807, nom. cons. Flora China 6:148–149

7 Tamura M (1987) *Eranthis* and *Shibateranthis*. Acta Phytotaxonomica et Geobotanica 38: 96–97.

8 Tamura M (1995) *Eranthis*. In: Hiepko P (Ed.), Die Natürlichen Pflanzenfamilien, vol. 17(4). Duncker und Humblot, Berlin, 253–255.

9 Sokolova T. G. Diagnoses and keys of age-related conditions of forest plants. Ephemeroids. / T.G.Sokolova. – M.: Lenin Moscow State Pedagogical Institute, 1987. – 80 p.

10 Bykov B.A. Geobotanical Dictionary./ B.A.Bykov. –2nd ed., reworked. and add.– Alma–Ata.: Science, 1973. – 216 p.

11 Garkusha L.Ya. Intra-landscape structure and ecological features of hornbeam forests of the Mountainous Crimea // Scientific notes of the V. I. Vernadsky Crimean Federal University. Geography. Geology. – 2008. –Vol.21. – № 60. – P. 102–118.

12 Krasnopevtseva V.M. Biology of *Eranthis sibirica* DC. on Hamar–Daban / V.M.Krasnopevtseva, A.S. Krasnopevtseva // Proceedings of the Samara Scientific Center of the Russian Academy of Sciences. – 2013. – Vol.15. – № 3/2. – P. 845–848.

13 Erst A. S. An integrative taxonomic approach reveals a new species of *Eranthis* (*Ranunculaceae*) in North Asia / A.S. Erst [et al.] // PhytoKeys. – 2020. – № 140. – P. 75–100.

14 Jung Wo–Ch. Comparative seed morphology of Korean Eranthis (Ranunculaceae) / Wo–Ch. Jung, D.–Yo. Shin, K. Heo // Korean Journal of Plant Taxonomy. – 2010. – Vol. 40. – № 2. – P. 105–107.

15 Oh B.–Un. Comparative seed morphology of Korean Eranthis (Ranunculaceae) / B.–Un Oh, S.–J. JI // Korean Journal of Plant Taxonomy. – 2009. – Vol. 39. – № 2. – P. 86–88.

16 Sun B. Yu. A New species of Eranthis (Ranunculaceae) from Korea: E. byunsanensis / B. Yu. Sun, Ch. H. Kim, T. Ji. Kim // Korean Journal of Plant Taxonomy. – 1993. – Vol. 23. – № 1. – P. 21–26.

17 Kuroda M. Chromones from the tubers of Eranthis cilicica and their antioxidant activity / M. Kuroda [et al.] // Phytochemistry. – 2009. – № 70. – P. 288–293.

18 Watanabe K. Cycloartane and Oleanane Glycosides from the Tubers of Eranthis cilicica / K. Watanabe [et al.] // Molecules. – 2018. – Vol. 24. – № 1. – 69 p.

19 Djafari Ja. Synthesis of Gold Functionalised Nanoparticles with the Eranthis hyemalis Lectin and Preliminary Toxicological Studies on Caenorhabditis elegans / Ja. Djafari [et al.] // Materials. – 2018. – Vol. 11. – № 8. – 1363 P.

20 McConnell. Winter Aconite (Eranthis hyemalis) Lectin as a cytotoxic effector in the lifecycle of Caenorhabditis elegans / McConnell [et al.] // PeerJ – Life and Environment Journal. – 2015. – Vol. 20. – № 3. – 1206 p.

21 https://www.naturalworldheritagesites.org/sites/western-tien-shan/

22 Kostikova, V.A.; Chernonosov, A.A.; Kuznetsov, A.A.; Petrova, N.V.; Krivenko, D.A.; Chernysheva, O.A.; Wang, W.; Erst, A.S. Identification of Flavonoids in the Leaves of Eranthis longistipitata (Ranunculaceae) by Liquid Chromatography with High-Resolution Mass Spectrometry (LC-HRMS). Plants 2021, 10, 2146. https://doi.org/10.3390/ plants10102146

23 Rabotnov T. A. Methods for determining the age and duration of life in herbaceous plants. Field geobotany. – Vol. 2. M.- L. – 1960. – P. 240-262.

24 Zlobin Y.A. Principles and methods of studying cenotic plant populations. – Kazan: Publishing of KSU. – 1989. – P. 147-196.

25 Uranov A.A. Age spectrum of cenopopulations as a function of time and energy wave processes // Scientific report of the higher school. Biol.science. – 1975. – Vol. 2. – P. 7-34.

26 Field geobotany. – M.-L.: Publishing House of the USSR Academy of Sciences. 1964-1971.

27 Flora of the USSR. Vv. 1-30. M. – L.– 1934-1964.

28 Flora of Kazakhstan. Vv. 1-9. Alma-Ata, – 1956-1966.

29 The determinant of Central Asia. Critical Synopsis of flora. Vv. 1-10. – Tashkent. – 1968-1993.

30 https://www.plantarium.ru/

31 https://www.kazmab.kz/index.php/biosfernye-rezervaty1/natsionalnaya-set/aksu-zhabagly/opisanie

**References**

1 Akzhigitova N.I. Raznoobrazie rastitel'nyh soobshhestv osnovnyh formacij subal'pijskogo pojasa Zapadnogo Tjan'-Shanja [Diversity of plant communities of the main formations of the subalpine belt of the Western Tien Shan] // Bioraznoobrazie Zapadnogo Tjan'-Shanja: ohrana i racional'noe ispol'zovanie. – Tashkent, 2002. – P. 32–35.

2 Bykov B.A. Geobotanicheskij slovar' [Geobotanical Dictionary]. / B.A.Bykov. – 2-e izdanie, pererabotannoe i dopolnennoe – Alma–Ata. : Nauka, 1973. – 216 p.

3 Djafari Ja. Synthesis of Gold Functionalised Nanoparticles with the Eranthis hyemalis Lectin and Preliminary Toxicological Studies on Caenorhabditis elegans / Ja. Djafari [et al.] // Materials. – 2018. – Vol. 11. – № 8. – 1363 P.

4 Erst A. S. An integrative taxonomic approach reveals a new species of Eranthis (Ranunculaceae) in North Asia / A.S. Erst [et al.] // PhytoKeys. – 2020. – № 140. – P. 75–100.

5 Field geobotany. – M.-L.: Publishing House of the USSR Academy of Sciences. 1964-1971.

6 Flora of Kazakhstan. Vv. 1-9. Alma-Ata, – 1956-1966.

7 Flora of the USSR. Vv. 1-30. M. – L.– 1934-1964.

8 Garkusha L.Ya. Vnutrilandshaftnaja struktura i jekologicheskie osobennosti grabovyh lesov Gornogo Kryma [Intra-landscape structure and ecological features of hornbeam forests of the Mountainous Crimea] // Uchenye zapiski Krymskogo federal'nogo universiteta imeni V.I.Vernadskogo. Geografija. Geologija. – 2008. – Vol.21. – № 60. – P. 102–118.

9 https://www.kazmab.kz/index.php/biosfernye-rezervaty1/natsionalnaya-set/aksu-zhabagly/opisanie

10 https://www.naturalworldheritagesites.org/sites/western-tien-shan/

11 https://www.plantarium.ru/

12 Jung Wo–Ch. Comparative seed morphology of Korean Eranthis (Ranunculaceae) / Wo–Ch. Jung, D.–Yo. Shin, K. Heo // Korean Journal of Plant Taxonomy. – 2010. – Vol. 40. – № 2. – P. 105–107.

13 Karmysheva N.K. 1973. Flora i rastitel'nost' Aksu-Dzhabaglinskogo zapovednika [Flora and vegetation of AksuDzhabagly nature reserve]. Alma-Ata. 176 p.

14 Kostikova, V.A.; Chernonosov, A.A.; Kuznetsov, A.A.; Petrova, N.V.; Krivenko, D.A.; Chernysheva, O.A.; Wang, W.; Erst, A.S. Identification of Flavonoids in the Leaves of Eranthis longistipitata (Ranunculaceae) by Liquid Chromatography with High-Resolution Mass Spectrometry (LC-HRMS). Plants 2021, 10, 2146. https://doi.org/10.3390/ plants10102146

15 Kovshar' A.F. Aksu-zhabaglinskomu zapovedniku 90 let [Aksu-Jabagly Nature Reserve is 90 years old] // Nature Conservation Research. Zapovednaja nauka. 2016. №1 (1). P.111-118

16 Krasnopevtseva V.M. Biologija *Eranthis sibirica* DC. na Hamar–Dabane [Biology of *Eranthis sibirica* DC. on Hamar–Daban] / V.M.Krasnopevtseva, A.S. Krasnopevtseva // Izvestija Samarskogo nauchnogo centra Rossijskoj akademii nauk. – 2013. – Vol. 15. – № 3/2. – P. 845–848

17 Kuroda M. Chromones from the tubers of Eranthis cilicica and their antioxidant activity / M. Kuroda [et al.] // Phytochemistry. – 2009. – № 70. – P. 288–293.

18 Li L, Tamura M (2001) Etranthis Salisbury, Trans. Linn. Soc. London 8:303. 1807, nom. cons. Flora China 6:148–149

19 Materialy Pjatogo nacional'nogo doklada Respubliki Kazahstan o biologicheskom raznoobrazii [Materials of the Fifth National Report of the Republic of Kazakhstan on biological diversity]. – Astana, 2014.

20 McConnell. Winter Aconite (Eranthis hyemalis) Lectin as a cytotoxic effector in the lifecycle of Caenorhabditis elegans / McConnell [et al.] // PeerJ – Life and Environment Journal. – 2015. – Vol. 20. – № 3. – 1206 p.

21 Oh B.–Un. Comparative seed morphology of Korean Eranthis (Ranunculaceae) / B.–Un Oh, S.–J. JI // Korean Journal of Plant Taxonomy. – 2009. – Vol. 39. – № 2. – P. 86–88.

22 Park, S.Y., Jeon, M.J., Ma, S.H. *et al.* Phylogeny and genetic variation in the genus *Eranthis* using nrITS and cpIS single nucleotide polymorphisms. *Hortic. Environ. Biotechnol.* **60**, 239–252 (2019). https://doi.org/10.1007/s13580-018-0113-0

23 Rabotnov T. A. Methods for determining the age and duration of life in herbaceous plants. Field geobotany. – Vol. 2. M.- L. – 1960. – P. 240-262.

24 Sokolova T. G. Diagnozy i kljuchi vozrastnyh sostojanij lesnyh rastenij. Efemeroidy [Diagnoses and keys of age-related conditions of forest plants. Ephemeroids] / T. G.Sokolova. – M.: Moskovskij gosudarstvennyj pedagogicheskij institut im. V. I. Lenina, 1987. – 80 c.

25 Sun B. Yu. A New species of Eranthis (Ranunculaceae) from Korea: E. byunsanensis / B. Yu. Sun, Ch. H. Kim, T. Ji. Kim // Korean Journal of Plant Taxonomy. – 1993. – Vol. 23. – № 1. – P. 21–26.

26 Tamura M (1987) *Eranthis* and *Shibateranthis*. Acta Phytotaxonomica et Geobotanica 38: 96–97.

27 Tamura M (1995) *Eranthis*. In: Hiepko P (Ed.), Die Natürlichen Pflanzenfamilien, vol. 17(4). Duncker und Humblot, Berlin, 253–255.

28 The determinant of Central Asia. Critical Synopsis of flora. Vv. 1-10. – Tashkent. – 1968-1993.

29 Uranov A.A. Age spectrum of cenopopulations as a function of time and energy wave processes // Scientific report of the higher school. Biol.science. – 1975. – Vol. 2. – P. 7-34.

30 Watanabe K. Cycloartane and Oleanane Glycosides from the Tubers of Eranthis cilicica / K. Watanabe [et al.] // Molecules. – 2018. – Vol. 24. – № 1. – 69 p.

31 Zlobin Y.A. Principles and methods of studying cenotic plant populations. – Kazan: Publishing of KSU. – 1989. – P. 147-196.