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ASSESSMENT OF THE CURRENT STATE OF CENOPOPULATIONS OF *VERONICA SPICATA* L. AND *VERONICA SPURIA* L. IN THE FLORA OF THE KASKELEN GORGE, ILE ALATAU

This article examines the current state of the cenopopulations of *Veronica spicata* and *Veronica spuria* within the flora of the Kaskelen Gorge, Ile Alatau. A taxonomic, ecological, and geographical analysis of the populations' flora is presented. The age structures of the cenopopulations of both species reveal stable structures, predominantly composed of virginile and generative plants. The proportion of undergrowth in the studied cenopopulations is relatively low, ranging from 2% to 9%. Most cenopopulations of *V. spicata* and *V. spuria* lack juvenile plants and have a small proportion of immature individuals. This phenomenon is attributed to insufficient seed renewal in recent years, a rapid transition of immature individuals to the virginal stage, and the absence of senile plants in the dominant part of the cenopopulations. The viability of individuals in these cenopopulations is primarily influenced by habitat type. The age structure analysis indicates that the cenopopulations of *V. spicata* and *V. spuria* are in satisfactory condition as part of the mountain-meadow and forb phytocenoses of the Kaskelen Gorge, Ile Alatau.

Key words: *Veronica spicata, Veronica spuria,* populations, cenopopulations, Kaskelen Gorge, Ile Alatau.

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Іле Алатауының Қаскелең шатқалының флорасындағы *Veronica spicata* L. және *Veronica spuria* L. түрлерінің ценопопуляцияларының қазіргі жағдайын бағалау

Мақала Іле Алатауының Қаскелең шатқалының флорасындағы *V. spicata* L. және *V. spuria* L. түрлерінің қазіргі жағдайын зерттеуге арналған. Бұл мақалада *Veronica spicata* және *V. spuria* түрлері популяцияларының флорасына таксономиялық, экологиялық және географиялық талдау жасалған. Қаскелең флорасындағы *V. spicata* және *V. spuria* ценопопуляцияларының жастық құрылымдарының талдауы. Іле Алатауының шатқалдары олардың құрылымы біршама тұрақты және тың және генеративті өсімдіктер тобының басым екенін көрсетті. Зерттелетін ценопопуляциялардағы төменгі өсінділердің үлесі салыстырмалы түрде төмен және 2-ден 9%-ға дейін. *V. spicata* және *V. spuria* ценопопуляцияларының көпшілігі жас өсімдіктердің болмауымен және жетілмеген даралардың аз ғана пайызымен сипатталады, бұл соңғы бірнеше жылда жеткілікті тұқым жаңартуының болмауымен және жетілмеген өсімдіктердің тез ауысуымен байланысты. даралардың тың күйге ауысуы және ценопопуляциялардың басым бөлігінде кәрілік өсімдіктердің болмауы. Ценопопуляциялардағы *V. spicata* және *V. spuria* дараларының өміршеңдігіне негізінен тіршілік ету ортасының түрі әсер етеді. *V. spicata* және *V. spuria* ценопопуляцияларының

ген жастық құрылымы олардың Іле Алатауының Қаскелең шатқалының таулы-шалғындық және форб фитоценоздарының құрамындағы қанағаттанарлық жағдайын көрсетеді.

Түйін сөздер: *Veronica spicata, Veronica spuria,* популяциялар, ценопопуляциялар, Қаскелең шатқалы, Іле Алатауы.

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Оценка современного состояния популяций видов *Veronica spicata L.* и *Veronica spuria L.* во флоре Каскеленского ущелья Заилийского Алатау

Статья посвящена изучению современного состояния популяций видов *Veronica spicata* и *Veronica spuria* во флоре Каскеленского ущелья Заилийского Алатау. В статье представлен таксономический, экологический и географический анализ флоры популяций этих видов. Анализ возрастной структуры ценопопуляций *V. spicata u V. spuria* показал, что их структура относительно стабильна, с преобладанием виргинильных и генеративных растений. Доля подроста в исследуемых ценопопуляциях невысока и составляет от 2 до 9 %. Для большинства ценопопуляций характерно отсутствие ювенильных растений и низкий процент имматурных особей, что связано с недостаточным семенным возобновлением в последние годы, быстрым переходом имматурных особей в виргинильное состояние и отсутствием сенильных растений в доминирующей части популяций. На жизнеспособность особей *V. spicata u V. spuria* в ценопопуляциях в основном влияет тип местообитания. Возрастная структура ценопопуляций указывает на их удовлетворительное состояние в составе горно-луговых и разнотравных фитоценозов Каскеленского ущелья Заилийского Алатау.

Ключевые слова: *Veronica spicata, Veronica spuria,* популяции, ценопопуляции, Каскеленское ущелье, Заилийский Алатау.

Introduction

The Kaskelen Gorge is located in the western part of the Ile Alatau, a section of the Northern Tien Shan mountain system. This system forms a latitudinally oriented, northern folded region within the extensive Tien Shan mountain chains. The entrance to the Kaskelen Gorge is situated on the Upper Kaskelen Highway, 28 km from Almaty. A limestone quarry is located within the gorge. The forest spruce belt in this area lies between altitudes of 1900–2700 meters. The gorge itself is gently sloping and extends upwards for an additional 25 km beyond the end of the asphalt road.

The most notable side gorges are Kozhai, Emegen, Kasymbek (Sai), and South Kazachka. At an altitude of 2900 m, the Kaskelen Gorge branches into two large gorges: Right and Left Kaskelen. The relief of the high mountains in most parts of these gorges transitions to gentler slopes, forming alpine meadows and moraine lakes. The majority of peaks in the Kaskelen Gorge, ranging from 3800–3900 m in height, are not glaciated. They exhibit significant rock erosion, with abundant fragmented rocks and steep northern slopes. At the headwaters of the Kaskelen Gorge, there are approximately six peaks with glaciers that exceed 4000 m in height.

The Ile Alatau Range, part of the Northern Tien Shan system, is located in southeastern Kazakhstan within the boundaries of Almaty and Almaty region. It is one of the most picturesque and geographically diverse mountain formations in Central Asia. The Ile Alatau lies between the Ile and Chu rivers, forming a natural border between Kazakhstan and Kyrgyzstan. To the south, it is bounded by the Ile Valley, and to the north, by a large foothill plain. The Ile Alatau is divided into several ridges, including the main ridge, which is the highest and longest, and where Zhambyl Peak is located. The northern ridge is notable for its height and diverse landscapes, including deep gorges like Malaya Almatinka Gorge.

The predominant altitudes of the range are 4000–4600 m, with Talgar Peak (4973–4979 m) as the highest point. The Gorodetsky Glacier is situated on the northern slope. Mountain peaks are frequently covered by glaciers, which serve as key

sources of water for the region. The primary rivers flowing from the Ile Alatau are the Ile, Chu, and their tributaries. The highest part of the Ile Alatau, surrounding Talgar Peak and the headwaters of the Talgar and Chilik Rivers, is known as the Talgar Massif.

The climate of the Ile Alatau is sharply continental, characterized by significant temperature fluctuations between winter and summer. Average winter temperatures can drop to -10°C or lower, while summer temperatures can reach +30°C. Precipitation is predominantly in the form of snow during winter, while thunderstorms are common in summer. The Ile Alatau Range consists of diverse rock types, including granites, marbles, and limestones. The range was formed during the Caledonian orogeny and was extensively reshaped during the Quaternary period. Key rock formations include granites, conglomerates, limestones, and shales.

Numerous lakes, primarily of glacial origin, are associated with the region's active mudflow processes. The most significant and well-known lakes are the Big Almaty Lake and Lake Issyk. These lakes, along with glaciers, are crucial water sources for the region.

The vegetation of the Ile Alatau is diverse, including spruce forests (*Picea schrenkiana* Fisch. & C.A. Mey) and deciduous forests comprising species like *Malus sieversii* (Ledeb.) M. Roem., *Populus tremula* L., and *Crataegus songarica* K. Koch. The middle and lower mountain zones are characterized by shrub-steppe vegetation, including species such as *Atraphaxis muschketowii* Krasn., Cotoneaster uniflorus Bunge, *C. melanocarpus* Fisch. ex Blytt., *C. oliganthus* Pojark., *Cotoneaster soongoricus* (Regel & Herder) Popov., *Rosa alberti* Regel, *R. beggeriana* Schrenk, *Lonicera hispida* Pall. ex Schult., and *Ribes meyeri* Maxim [1].

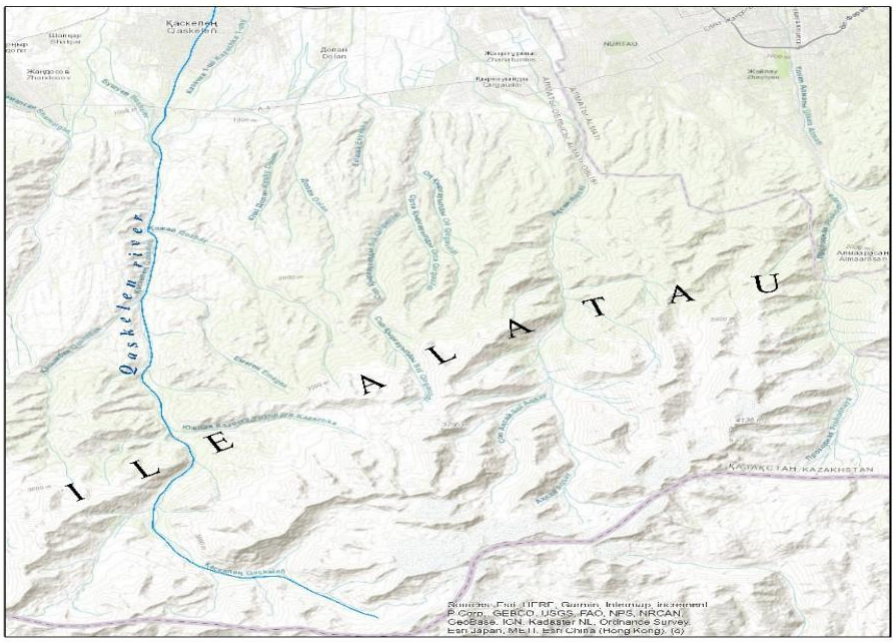

Figure 1 – Map-scheme of the Kaskelen Gorge of Ile Alatau

The study focuses on the current state of populations of *V. spicata* and *V. spuria*,, as well as the floristic composition of their cenopopulations in the Ile Alatau.

The studied species, *V. spicata* and *V. spuria*, belong to the genus *Veronica* L., subgenus *Veronicella* (Fourr.) Boriss., section *Pseudolysimachia* (W. Koch) Opiz. Within this classification, *V.spicata* is part of subsection *Spuriae* (Holub) A. Jelen., while *V. spuria* belongs to subsection *Pseudo-Lysimachium* Koch.

The genus *Veronica* L. is a member of the Plantaginaceae (formerly Scrophulariaceae). It is one of the largest and most widespread genera, encompassing up to 300 species that primarily inhabit temperate and cold regions of the Northern Hemisphere,

often at high altitudes [2]. In the flora of Kazakhstan, the genus *Veronica* L. is highly polymorphic, displaying significant diversity in systematic, biomorphological, geographical, and ecological-cenotic parameters. Within the Ile Alatau Range, the genus represents a minor component of the regional flora.

The genus *Veronica* L. is among the oldest of the steppe flora in the Eurasian steppe region, originating from preboreal elements of the Altai-Mongolian steppe during the Tertiary Pliocene period. Within the steppe flora, *Veronica* L. species are considered easily recognizable florogenetic elements, categorized by M.G. Popov as ancient Mediterranean steppe elements. This group includes *V. spicata* and *V. spuria*, [3]. Globally, the genus consists of approximately 300 species, predominantly found in Mediterranean regions. In Kazakhstan, the genus is represented by 47 species, including three endemics: *Veronica arenosa* (Serg.) Boriss., *Veronica chantavica* Pavlov, and *Veronica luetkeana* Rupr. [4].

Several species of *Veronica* L. are valuable medicinal plants. Traditionally, plants of this genus have been widely used in folk medicine. Decoctions of the aerial parts of *Veronica spicata* L. are used to treat neuroses, respiratory infections, pulmonary tuberculosis, liver diseases, metrorrhagia, diarrhea, and bladder disorders. Externally, the decoction acts as a wound-healing and styptic agent, while it is also used as an analgesic for pain and headaches. Dried herb powder is applied to treat panaritium, typically healing within 3–4 days. Fresh leaves are used to alleviate severe sweating when placed between toes. Additionally, herbal infusions are employed to wash wounds and snake bites, while the herb itself is applied directly to the bite site. Preparations of *V. spicata* exhibit anti-inflammatory properties and are utilized to treat colds, cardiovascular diseases, and skin conditions.

Studies of the methanol extract of *V. spicata* herb using adsorption chromatography have isolated four flavonoid compounds. The herb contains flavonoids, iridoids, phenolcarboxylic acids, nitrogenous compounds, vitamin C, and trace elements. These findings highlight the plant's traditional and official medicinal applications in Kazakhstan and other countries, driving increasing interest in its potential uses [5].

Decoratively, *V. spicata* is highly valued in horticulture. It is widely cultivated in gardens worldwide, thriving in both warm and cold regions. The species is celebrated for its vibrant colors, dense foliage, and long flowering period. It is frequently used in mixed borders and single plantings, complementing other flowers. Through selective breeding, numerous varieties with varying sizes and flower colors have been developed.

V. spicata is a perennial meadow-steppe species of the Palaearctic region. It is a grayish-green plant with erect or ascending stems, 10–50 (75) cm tall, and a woody rhizome. The stems, either solitary or few, are stout, ascending at the base, and pubescent with short, detached hairs mixed with glandular hairs, especially in the inflorescence. Leaves are grayish, with lower ones petiolate, oblong-ovate, or broadly elliptical (3–8 cm long, 0.9–1.3[3] cm wide), and obtuse. Middle and upper leaves are oblong-lanceolate, nearly sessile, sparsely toothed, and entire-edged towards the apex. The inflorescence is a terminal, dense, elongated raceme, usually solitary, with narrowly lanceolate bracts equal to or slightly longer than the sessile calyx.

The corolla is blue or violet, occasionally pink or white, and measures 2–3 times the calyx length (0.5–0.7 cm wide), with a short hairy tube and four deflected lobes. Stamens are nearly as long as the corolla, and seeds are flatly convex, broadly ovate, and smooth. The species flowers from June to October, with fruiting occurring from July to October [6].

It grows in dry steppe and forest meadows, steppe hollows, shrubs, pine forests, sandy areas, stony and steppe slopes of plains and foothills, and rises to the forest belt of mountains [6].

Range of distribution in Kazakhstan: Spurs of the Common Syrt, Tobol-Ishim Plain, Irtysh Plain, Semipalatinsk Pine Forest, Kokshetau Upland, Caspian Lowland, Ulytau Mountains, Eastern Small Hills, Karkaraly Mountains, Altai Mountains, Tarbagatai Ridge, Dzhungar Alatau, Ile and Kungei Alatau, Ketmen and Terskey Alatau.

General distribution: The European part of the USSR, Caucasus, Central Asia, Western and Eastern Siberia (southern regions), Scandinavia, Western Europe, the Mediterranean, and Western China [6].

General information about cenopopulations of *V. spicata* highlights its significant polymorphism, indicating the need for further study. *V. spicata* is a perennial herbaceous plant with xeromorphic features and broad ecological plasticity. However, its distribution in the study area is limited. It is a typical mesoxerophyte with a Palaearctic habitat, adapted to varying light and moisture conditions. It grows in open areas, including dry steppe and forest meadows, steppe hollows, shrubs, and pine forests, as well as sandy, stony, and steppe slopes, extending to the forest belt at altitudes of 900–2600 m above sea level.

Modern studies indicate that *V. spicata* is not homogeneous. It exhibits significant polymorphism, forming populations that differ in minor morphological, physiological, and ecological traits. These variations underscore its classification as a highly variable species, as noted by many researchers [2–4].

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Modern studies indicate that *V. spicata* is not homogeneous. It exhibits significant polymorphism, forming populations that differ in minor morphological, physiological, and ecological traits. These variations underscore its classification as a highly variable species, as noted by many researchers [7–10].

Grows in meadow steppes, meadow-steppe and meadow slopes, birch forests, depressions of sparse pine forests, and on chernozem-like limestone and loamy, sometimes saline soils [11–15].

Distribution in Kazakhstan: Occurs in all regions of Kazakhstan except for the most arid deserts.

General distribution: Found in the European part of the former USSR, the Caucasus, Central Asia, Western Siberia, and Middle and Southern Europe [6].

The species *V. spicata* and *V. spuria*, belonging to the genus *Veronica* L., are perennial polycarpics. These species are similar in growth habits and vegetation types but differ significantly in their geographical distribution [16–21]. Despite the relatively comprehensive study of the vascular plant flora of the Ile Alatau, specific population studies of *V. spicata and V. spuria* have not yet been conducted. Consequently, the existing literature on these species is scattered, incomplete, and not always accurate.

Currently, the population structure and morphological and biological characteristics of *V. spicata* and *V. spuria* growing in natural conditions in the Ile Alatau region remain largely unstudied. In the last decade, scientific interest in *V. spicata* and *V. spuria* has increased significantly [21–26].

Materials and research methods

Representatives of the Plantaginaceae (formerly Scrophulariaceae) family, *V. spicata* and *V. spu- ria*, from natural cenopopulations were the objects of this study. The research was conducted in 2024 within natural phytocenoses in the western part of the Ile Alatau Range, specifically in the Kaskelen Gorge, Kaskelen District, Almaty Region (Table 1).

Table 1 – Cenopopulations of *V. spicata* and *V. spuria* were identified during field studies.

Species name, cenopopulation number	Geographical location	Coordinates location
Veronica spicata L. and *Veronica spuria* L. CP 1.	Almaty region, Kaskelen district, Kaskelen gorge, Ile Alatau, forest belt, north-eastern slope.	43°00′983′′N, 76°36′827′′E, 1856 m.a.s.l.
Veronica spicata L. and *Veronica spuria* L. CP 2.	Almaty region, Kaskelen district, Kaskelen gorge, Ile Alatau, forest belt, north-eastern slope, slope of western exposure.	43°00′983′′N, 76°36′485′′E, 1756 m.a.s.l.
Veronica spicata L. and *Veronica spuria* L. CP 3.	Almaty region, Kaskelen district, Kaskelen gorge, Ile Alatau, forest belt, north-eastern slope.	43°00′983′′N, 76°36′ 658′′E, 1796 m.a.s.l.

To study the current state of populations of *V. spicata* and *V. spuria* in their natural habitats, expeditionary fieldwork was planned using the route-reconnaissance method in the Kaskelen Gorge. The abundance of species in phytocenoses was determined using the Drude abundance scale. For each cenopopulation, the following parameters were assessed: number of generative and vegetative individuals, height of generative shoots, number of leaves on generative shoots, peduncle length, number of leaves per individual, inflorescence size, and number of flowers. These indices were determined with 20-fold repetition.

Methodology of sample plots. The methodology for estimating the density and abundance of the studied species corresponds to the programme and methodology for observing species cenopopulations. Population studies of *V. spicata* and *V. spuria*, including plant morphology, ecological and phytocoenotic characteristics of populations, age composition, seed productivity, and vitality of cenopopulations and individuals, were conducted following established methods.

To study the geographical distribution of *V. spicata* and *V. spuria*, the route-reconnaissance method was applied, supplemented by classical methods for studying plant morphology, phytocenoses, ecology, and biology.

Determination of species composition of plant communities. The species composition of plants in phytocenoses was determined using relevant botanical references and identifiers, such as Flora of Kazakhstan and Central Asia Plant Identifier. The structure of plant families follows the classification system of A. L. Takhtajyan, with species and genera listed alphabetically within families.

Route-reconnaissance method. This field method involves walking along predetermined routes to discover and collect plants, enabling the coverage of large areas and the study of species diversity.

Collection and processing of herbarium material. Specimens of *V. spicata* and *V. spuria* were collected, labeled with information about the location, date, and collector, and placed in herbarium folders. After fieldwork, the specimens were dried and examined under binocular loupes. Herbarium collection and processing followed the standard methodology of A. K. Skvortsov [27].

Species identification and systematics. Species identification was carried out in the laboratory using multi-volume reports and botanical reference books, such as Flora of the USSR, Flora of Kazakhstan, Central Asia Plant Identifier, and Illustrated Plant Identifier of Kazakhstan. Taxonomic classifications follow the Plants of the World Online (POWO) database and works by S. K. Cherepanov and S.A.Abdulina. The life forms were analyzed using the classifications of K. Raunkier and I. G. Serebryakov [28].

During the field studies in the Kaskelen Gorge, three cenopopulations of *V. spicata* and *V. spuria* were identified. Morphological characteristics of these species were studied on living plants and herbarium specimens.

Purpose. The purpose of this work is to study the population features of V. spicata and V. spuria in natural populations within the Kaskelen Gorge of the Ile Alatau [29].

Results and their discussion

To clarify the natural locations of *V. spicata* and *V. spuria* cenopopulations in the Ile Alatau, Kaskelen Gorge, to plan the routes for expedition trips, to establish flowering dates, and to identify occupied ecological niches, a study was conducted using herbarium material from the main herbarium collection of the Institute of Botany and Phytointroduction, as well as literary floristic data.

The results of the study on *V. spicata* and *V. spuria* indicate that these species, found in vari- ous habitats of the Kaskelen Gorge in the Ile Alatau, exhibit structural differences related to zonality, climatic conditions, and their abundance in plant communities. The study also revealed the ecological confinement of these plants to specific hydrological regimes. For both *V. spicata and V. spuria*, the optimal habitat is the broad middle belt of the forest-steppe zone. However, within the study area, the density of individuals is low. This is attributed to low seed productivity, dif- ficulty in seed germination, high seedling mortal- ity, and the elimination of individual specimens due to natural factors. These factors make both species rare and in need of conservation measures in their natural habitats.

a) b) c) d)

Figure 2 – Populations of *V. spicata* and *V.spuria* in the Kaskelen Gorge of the western part of Ile Alatau (a,b – *Veronica spuria* L., c,d – *Veronica spicata* L.).

Table 2 – Characteristics of the locations of the *V. spicata* and *V. spuria* cenopopulations in the Kaskelen gorge

Name of the Cenopopulation and its locality	Ecological phytocenotic confinement	Area of CP, m^2	Number of pregenerative individuals per 10 m^2	Vitality indicators CP
Kaskelen population of *V. spicata and V. spuria* L.				
1. Cenopopulation of woody-shrub-forb-grass phytocenosis. Almaty region, Kaskelen district, Kaskelen gorge, Intermountain valley of Ile Alatau, northwestern slope. 43°00′983′′N, 76°36′ 827′′E, 1856 m above sea level. Cenopopulation (1) was produced in open habitats (northern slopes), forming a sparse cover.	Kaskelen Gorge, northern slopes. In small, few groups, in moist meadow habitats.	50	5	17 generative individuals. Young, slowly progressing, capable of self-sustaining by seed and vegetative means, stably maintaining its territory.
2. Cenopopulation of geranium-seseli-forb phytocenosis. Almaty region, Kaskelen district, Kaskelen gorge, Ile Alatau, north-eastern slope. 43°00′209′′N, 76°37′ 150″E, 1987m above sea level. Cenopopulation (2) grows in open habitats (northern slopes), forming a sparse cover.	The slope of the northern exposure is geranium-seseli-forb. The species is located in small groups along the slope of the northern exposure.	150	11	98 generative individuals. Normal type, actively progressing, reproducing both by seed and vegetative means

Continuation of the table

Name of the Cenopopulation and its locality	Ecological phytocenotic confinement	Area of CP, m^2	Number of pregenerative individuals per 10 m^2	Vitality indicators CP
3. Cenopopulation of oregano-cereal-forb phytocenosis. Almaty region, Kaskelen district, Kaskelen gorge, Ile Alatau, northwestern slope. 43°01′505′′N, 76°36′ 758′′E, 1802 m above sea level.	Oregano-cereal-forb community on the western-northern slope.	100	7	47 generative individuals. Weakly progressing, with a right-sided spectrum, aging, but with satisfactory renewal.

The age structure of cenopopulations of *V. spicata and V. spuria* was studied across four test plots. The density of cenopopulations varied from 17 to 105 specimens per square meter. Individuals of vegetative origin comprised 50 to 73% of the populations. Analysis of the age spectra showed that the age structure is relatively stable, with the age index ranging from 0.210 to 0.299. Generative plants accounted for 17 to 39% of the populations, while the virginile group represented the maximum proportion (37-58%) in all cenopopulations. The share of undergrowth (juvenile and immature stages) ranged from 15 to 23%, with individuals of vegetative origin prevailing, likely due to the deep degree of rejuvenation of vegetative rudiments. All studied cenopopulations can be classified as normal (homeostatic), indicating high vitality and stability of these species in the studied phytocenoses.

The Kaskelen population (Pop 1) of *V. spicata and V. spuria* is located in the western part of the Ile Alatau, within the forest belt of the Kaskelen Gorge, at an altitude of 1875 m above sea level. The projective cover of this population is 30-35%, and it occupies sporadic loci in meadow mesophytic and mesoxerophytic plant communities. These sites are characterized by full or diffused illumination, weak wind exposure throughout the year, and annual precipitation levels of 800-1000 mm, primarily occurring in spring and autumn. Typical habitats include mountain forest forb-meadow plant communities at altitudes of 1800-2800 m, on dark-colored soils of the forest-meadow-steppe zone.

In the study area of the Kaskelen population, three spatially isolated cenopopulations were identified within different types of phytocenoses. These cenopopulations share similar environmental conditions and floristic composition. The vegetation cover is diverse, comprising 76 species. The most represented families are Poaceae (14%), Asteraceae (7%), Rosaceae (5%), Ranunculaceae (4%), and Fabaceae (3%). Herbaceous species dominate the phytocenosis, accounting for 97% of the life forms, with woody and shrub species comprising 3%. Ecologically, mesophytic species dominate (63%), with mesoxerophytes constituting 23%. The synanthropization coefficient is 29%, indicating a moderate degree of anthropogenic pressure.

Cenopopulation (1) of woody-shrub-forb-grass phytocenosis includes species such as *Picea schrenkiana* Fisch. et Mey., *Crataegus songarica* K. Koch., *Salix alatavica* Kar. ex Stschegl., *Rosa alberti* Regel., *Cichorium intybus* L., *Ligularia narynensis* (C. Winkl.) O. Fedtsch. & B. Fedtsch., *Elytrigia repens* Nevski, and *Alopecurus pratensis* L. It is located in the Almaty Region, Kaskelen District, Kaskelen Gorge, within the intermountain valley of the Ile Alatau on a northwestern slope, at an altitude of 1856 m above sea level. The cenopopulation grows in open habitats (northern-facing slopes), forming a sparse cover.

The cenopopulation of *V. spicata and V. spuria* occurs as isolated individuals within the intermountain forest zone in the middle spruce belt. The site is characterized by complex relief, forming an open space within the intermountain valley. Tree species include *Picea schrenkiana* Fisch. et Mey. and *Salix alatavica* Kar. ex Stschegl. Among shrubs, the most common species are *Ribes meyeri* Maxim., *Spiraea lasiocarpa* Kar. & Kir., and Cotoneaster uniflorus Bunge, with a density of about 0.1–0.2. Less common is *Betula tianschanica* Rupr., forming the first tier.

The first tree tier is formed by *Picea schrenkiana* Fisch. et Mey. and *Salix alatavica* Kar. ex Stschegl. The second shrub tier includes *Juniperus sabina* L. and *Rosa alberti* Regel. Other shrubs include *Cotoneaster uniflorus* Bunge and Lonicera stenantha Pojark. The ground tier features a well-developed herbaceous cover, accounting for 90–95% of the vegetation. The herbaceous vegetation exhibits clear tiering due to the high density of individuals and species.

The dominant species in the herbaceous layer include *Alopecurus pratensis* L., *Cichorium intybus*

L., *Ligularia narynensis* (C. Winkl.) O. Fedtsch. & B. Fedtsch., Rumex acetosa L., Dactylis glomerata L., *Achillea asiatica* Serg., and *Achillea millefolium* L. A wide range of secondary species is present, such as *Elytrigia repens*, *Rumex tianschanicus* Losinsk., *Taraxacum officinale* F.H. Wigg., *Melandrium apetalum* (L.) Fenzl, and others.

The woody-shrub-forb-grass cenopopulation of *V. spicata and V. spuria* is characterized as young, weakly progressing, but capable of self-sustenance through seed and vegetative means. Its ability to maintain territory is unstable. The ecological conditions of the habitat, including illumination, moisture levels, and altitude, are optimal for these species.

No traces of pests, diseases, or sunburn were observed during the examination. The regeneration of *V. spicata and V. spuria* is satisfactory, with many healthy young vegetative individuals. Adequate moisture is essential for their growth, reflecting their life strategy.

Among the limiting factors, it is important to note regular grazing of cattle in the areas of settlement of *V. spicata and V. spuria* During the initial description, it was established that the state of the species in the population is not threatened. In addition, in similar ecological areas, the species may well settle and occupy new territories.

Cenopopulation (2) of geranium-seseli-forb (*Geranium collinum* Steph., *Geranium transversale* (Kar. & Kir.) Vved., *Seseli schrenkianum* (C.A. Mey. ex Schischk.) *Pimenov* & Sdobnina, *Origanum vulgare* L., Thalictrum collinum Wallr.) phytocenosis. Almaty Region, Kaskelen District, Kaskelen Gorge, Ile Alatau, northeastern slope. 43°00′209′′N, 76°37′150′′E, 1987 m above sea level. This population of *V. spicata and V. spuria* is located in the upper belt of the northeastern slope of the northern exposure of the western part of the Ile Alatau. The description was carried out in the early flowering phase. The cenopopulation of *V. spicata* and *V. spuria* is located on the northeast- ern slope, northern exposure. The soils are meadow light chestnut. The phytocenosis is polydominant in composition. The grass stand is quite dense, without noticeable bald spots. The total coverage of the phytocenosis is about 95-100%. *V. spicata and V. spuria* play practically no significant role in the formation of the phytocenosis. The studied species account for 1.1% of the community. The basis of the grass stand is made up of several species, including *Elytrigia repens* (L.) Nevski (soc).

The first tier is represented by shrubs of *Lonicera microphylla* Willd. ex Schult. (sol) and *Juniperus sabina* L. (sp). The second tier consists of the following species: *Geranium collinum* Steph. (sol), *Geranium transversale* (Kar. & Kir.) Vved. (sp), *Achillea asiatica* Serg. (sol), *Achillea millefolium* L. (sp), *Seseli schrenkianum* (C.A. Mey. ex Schischk.) Pimenov & Sdobnina (cop3), *Carum carvi* L. (sol), and *Origanum vulgare* L. (cop3). *Dactylis glomerata* L. (sol) and *Vicia sepium* L. (sol) are also present.

There is a great diversity of secondary accompanying species: *Poa pratensis* L. (cop1), *Dracocephalum origanoides* Stephan. (sol), *Artemisia absinthium* L. (sol), *Plantago major* L. (sol), *Plantago lanceolata* L. (sol), *Prunella vulgaris* L. (sp), *Artemisia annua* L. (sp), Geranium albiflorum L. (cop1), *Elytrigia repens* (L.) Nevski (soc), *Agropyron pectiniforme* Roemer & Schultes (cop), *Dactylis glomerata* L. (cop3), *Erigeron acris* L. (sp), *Galium aparine* L. (sol), *Senecio nemorensis* L. (sp), *Myosotis suaveolens* Waldst. & Kit. ex Willd. (sp), *Thalictrum petaloideum* L. (sp), *Daucus carota* L. (sp), *Berteroa incana* (L.) DC. (sp), *Astragalus chlorodontus* Bunge (sol), *Trifolium repens* L. (cop3), *Trifolium pratense* L. (cop2), *Veronica spuria* L. (sp), *Veronica spicata* L. (sp), *Verbascum thapsus* L. (sol), *Pedicularis alberti* Regel. (sol), *Vicia tenuifolia* Roth. (sol), *Vicia subvillosa* (Ledeb.) Boiss. (sol), *Origanum vulgare* L. (cop1), and *Dracocephalum integrifolium* Bunge (sol).

Cenopopulation (3) of oregano-cereal-forb (*Origanum vulgare* L., *Elytrigia repens* Nevski, *Dactylis glomerata* L.) phytocenosis. Almaty Region, Kaskelen District, Kaskelen Gorge, Ile Alatau, northwestern slope. 43°01′505′′N, 76°36′758′′E, 1802 m above sea level. The studied species stably occupy a place in this community. *V. spicata and V. spuria* account for 1.3% of the area occupied by the phytocenosis.

Adult specimens are medium-sized, up to 40 cm in height. Flowers are in terminal solitary, rarely also lateral, racemes narrowed to the top and pointed, 5-20 cm long and 0.5-1.3 cm wide. Flowers are on very short pedicels, rarely almost sessile, with bracts almost equal to the calyx. The axis of the inflorescence, bracts, and calyx are pubescent with glandular, less often with simple hairs. The species prefers to settle in small groups, in sufficiently moist places in the middle grass stand.

The existing habitat conditions are completely optimal for *V. spicata and V. spuria* According to the altitudinal structure, it is indistinctly three-tiered. The first tier, 75-170 cm high, is very sparse. The shrub tier is located along the outskirts of the community and consists of *Rosa alberti* Regel. (sp), *Rosa beggeriana* Schrenk. (sp), *Lonicera microphylla* Willd. (sp), and *Rubus idaeus* L. (cop1).

The herbage is fairly well formed, with a total cover of 90-95%. The second tier, 40–90 cm high, is fairly dense. Dominant species include *Origanum vulgare* L. (sol) and *Elytrigia repens* Nevski. Associated species include *Elymus tianschanigenus* Czerep. (sp), *Elymus caninus* (L.) L. (sp), and others.

Studies of *V. spicata and V. spuria* cenopopulations growing in the Kaskelen Gorge, located in the western part of the Ile Alatau, and the analysis of herbarium material have shown that these species exhibit a good ecological amplitude and are relatively well distributed in this area. However, the cenotic habitat of these species is somewhat narrower, as the dominant part of *V. spicata* and *V. spuria* cenopopulations is found mainly in herbaceous-grassy groupings. These habitats provide more favourable conditions, including both open and shaded areas with adequate moisture.

As a result of expedition studies, three large localities of *V. spicata* and *V. spuria* cenopopulations were recorded in different ecological and phytocoenotic conditions. These species were predominantly found in moist habitats among meadow-grass and shrub-grass vegetation. Typical habitats for *V. spicata* and *V. spuria* in the Kaskelen Gorge of the Ile Alatau are open light forests and sufficiently humidified herbaceous meadows of the middle forest belt.

Below is the geobotanical characterisation of plant communities containing *V. spicata* and *V. spuria* species found in the Kaskelen Gorge, Kaskelen District, Almaty Region. The Kaskelen Gorge is located along the Upper Kaskelen Highway, 28 km from Almaty city (Table 3).

Table 3 – Geobotanical characterisation of plant communities with *V. spicata* and *V. spuria* species in the Kaskelen river gorge:

Floristic diversity					
Species name.	Family.	Abundance according to Druce	Distribution according to B.A.Bykov	Height, m/cm	Phenophase
Tree layer (Projective cover: 10–20%).					
Picea schrenkiana Fisch. & C.A. Mey.	*Pinaceae*	sol (1-3%)	In groups, unevenly.	30-40	Vegetative, flowering, fruiting.
Crataegus songarica K. Koch	*Rosaceae*	sol (1-3%)	Individually, unevenly.	6-8	Vegetative, flowering, fruiting.
Salix alatavica Kar. ex Stschegl.	*Salicaceae*	sol (5-10%)	In groups, unevenly.	6-8	Vegetative, flowering, fruiting.
Salix hastata L.	*Salicaceae*	sol (3-5%)	In groups, unevenly.	8-10	Vegetative, flowering, fruiting.
Shrubs (Projective cover: 10–20%)					
Cotoneaster uniflorus Bunge	*Rosaceae*	sol (1-3%)	Individually, unevenly.	1,5-2	Vegetative, flowering, fruiting.
Cotoneaster melanocarpus Fisch. ex Blytt	*Rosaceae*	sol (1-3%)	Individually, unevenly.	1,5-2	Vegetative, flowering, fruiting.
Rosa alberti Regel	*Rosaceae*	sol (1-3%)	In groups, unevenly	1,5	Vegetative, fruiting.
Rosa beggeriana Schrenk	*Rosaceae*	sol (1-3%)	In groups, unevenly	1,5	Vegetative, fruiting.
Spiraea lasiocarpa Kar. & Kir.	*Rosaceae*	sol (1-3%)	In groups, unevenly	1,5	Vegetative, fruiting.
Lonicera hispida Pall. ex Schult.	*Caprifoliaceae*	sol (1-2%)	Individually, unevenly.	1,5-2	Vegetative, fruiting.

Continuation of the table

Floristic diversity					
Species name.	Family.	Abundance according to Druce	Distribution according to B.A.Bykov	Height, m/cm	Phenophase
Lonicera stenantha Pojark.	*Caprifoliaceae*	sol (1-2%)	Individually, unevenly.	1,5-2	Vegetative, fruiting.
Lonicera microphylla Willd. ex Schult.	*Caprifoliaceae*	sol (1-2%)	Individually, unevenly.	1,5-2	Vegetative, flowering
Rubus idaeus L.	*Rosaceae*	sol (1-3%)	In groups, unevenly	1,5-2	Vegetative, flowering
Ribes meyeri Maxim.	*Grossulariaceae*	sol (1-3%)	In groups, unevenly	1,5-2	Vegetative, flowering
Atragene sibirica L.	*Ranunculaceae*	sol (1-3%)	In groups, unevenly	1,5-2	Vegetative, flowering
Herbaceous-shrub layer (Projective cover: 15–20%)					
Euonymus semenovii Regel & Herder	*Celastraceae*	sp- sol (5-15%)	diffusely.	0,5-1,5	Vegetative
Polygonum aviculare L.	*Polygonaceae*	sol (1-5%)	Individually	50	Vegetative
Sisymbrium loeselii L.	*Brassicaceae*	sol (1-5%)	unevenly	35	Vegetative, flowering
Pyrola rotundifolia L.	*Ericaceae*	sol (2-5%)	Individually, unevenly.	10	Vegetative, flowering
Goodyera repens (L.) R. Br.	*Orchidaceae*	sol (1-5%)	Individually	7	Vegetative
Rheum wittrockii Lundstr.	*Polygonaceae*	sol (1-5%)	Individually	50	Vegetative
Poa nemoralis L.	*Poaceae*	sp (10-15%)	unevenly.	30-40	Vegetative, flowering
Fragaria vesca L.	*Rosaceae*	sol (1-5%)	unevenly.	35	Vegetative, flowering, fruiting.
Mentha asiatica Boriss.	*Fabaceae*	sol (1-5%)	In groups	70	Vegetative, flowering, fruiting.
Alchemilla vulgaris L.	*Rosaceae*	sol (1-5%)	unevenly.	35	Vegetative, flowering, fruiting.
Poa pratensis L.	*Poaceae*	sol (1-5%)	In groups	70	Vegetative, flowering, fruiting.
Dracocephalum origanoides Stephan.	*Lamiaceae*	sol (1-5%)	In groups	35	Vegetative, flowering, fruiting.
Artemisia absinthium L.	*Asteraceae*	sol (1-5%)	unevenly.	70	Vegetative, flowering,
Plantago major L.	*Plantaginaceae*	sol (1-5%)	In groups	35	Vegetative, flowering,
Plantago lanceolata L.	*Plantaginaceae*	sol (1-5%)	In groups	55	Vegetative, flowering,
Prunella vulgaris L.	*Lamiaceae*	sol (1-5%)	unevenly.	70	Vegetative, flowering,
Artemisia annua L.	*Asteraceae*	sol (1-5%)	In groups	35	Vegetative, flowering,
Geranium albiflorum L.	*Geraniaceae*	sol (1-5%)	In groups, unevenly	70	Vegetative, flowering,

Continuation of the table

Floristic diversity					
Species name.	Family.	Abundance according to Druce	Distribution according to B.A.Bykov	Height, m/cm	Phenophase
Geranium transversale (Kar. & Kir.) Vved.	*Geraniaceae*	sol (1-5%)	In groups, unevenly	35	Vegetative, flowering,
Geranium collinum Stephan ex Willd.	*Geraniaceae*	sol (1-5%)	In groups, unevenly	40	Vegetative, flowering,
Elytrigia repens (L.) Nevski	*Poaceae*	sol (1-5%)	In groups, unevenly	70	Vegetative, flowering,
Agropyron pectiniforme Roemer & Schultes	*Poaceae*	sol (1-5%)	In groups, unevenly	80	Vegetative, flowering,
Dactylis glomerata L.	*Poaceae*	sol (1-5%)	In groups, unevenly	90	Vegetative, flowering,
Erigeron acris L.	*Asteraceae*	sol (1-5%)	In groups, unevenly	55	Vegetative, flowering,
Galium aparine L.	*Rubiaceae*	sol (1-5%)	Individually, unevenly.	70	Vegetative, flowering,
Senecio nemorensis L.	*Asteraceae*	sol (1-5%)	In groups, unevenly	65	Vegetative, flowering,
Myosotis suaveolens Waldst. & Kit. ex Willd.	*Boraginaceae*	sol (1-5%)	In groups	85	Vegetative, flowering,
Thalictrum petaloideum L.	*Ranunculaceae*	sol (1-5%)	Individually, unevenly.	65	Vegetative, flowering,
Daucus carota L.	*Apiaceae*	sol (1-5%)	In groups, unevenly	95	Vegetative, flowering,
Berteroa incana (L.) DC.	*Brassicaceae*	sol (1-5%)	In groups, unevenly	85	Vegetative, flowering,
Astragalus chlorodontus Bunge	*Fabaceae*	sol (1-5%)	In groups, unevenly	85	Vegetative, flowering,
Trifolium repens L.	*Fabaceae*	sol (1-5%)	In groups, unevenly	15	Vegetative, flowering,
Trifolium pratense L.	*Fabaceae*	sol (1-5%)	In groups, unevenly	10	Vegetative, flowering,
Veronica spuria L.	*Scrophulariaceae*	sol (1-5%)	In groups, unevenly	40	Vegetative, flowering,
Veronica spicata L.	*Scrophulariaceae*	sol (1-5%)	In groups, unevenly	35	Vegetative, flowering,
Verbascum thapsus L.	*Scrophulariaceae*	sol (1-5%)	In groups, unevenly	25	Vegetative, flowering,
Pedicularis alberti Regel.	*Scrophulariaceae*	sol (1-5%)	In groups, unevenly	45	Vegetative, flowering,
Vicia tenuifolia Roth.	*Fabaceae*	sol (1-5%)	In groups, unevenly	85	Vegetative, flowering,
Vicia subvillosa (Ledeb.) Boiss.	*Fabaceae*	sol (1-5%)	In groups, unevenly	85	Vegetative, flowering,
Origanum vulgare L.	*Lamiaceae*	sol (1-5%)	In groups, unevenly	40	Vegetative, flowering,
Dracocephalum integrifolium Bunge.	*Lamiaceae*	sol (1-5%)	In groups, unevenly	40	Vegetative, flowering,
Phlomoides pratensis (Kar. & Kir.) Adylov, Kamelin & Makhm.	*Lamiaceae*	sol (1-5%)	In groups, unevenly	40	Vegetative, flowering,

Continuation of the table

Floristic diversity					
Species name.	Family.	Abundance according to Druce	Distribution according to B.A.Bykov	Height, m/cm	Phenophase
Saxifraga sibirica L.	*Saxifragaceae*	sol (1-5%)	In groups, unevenly	7	Vegetative, flowering,
Bromus squarrosus L.	*Poaceae*	sol (1-5%)	In groups, unevenly	45	Vegetative, flowering,
*Anisantha tectorum (*L.) Nevski.	*Poaceae*	sol (1-5%)	In groups, unevenly	100	Vegetative, flowering,
Veronica chamaedrys L.	*Scrophulaceae*	sol (1-5%)	In groups, unevenly	40	Vegetative, flowering,
Cortusa brotheri Pax ex Lipsky	*Primulaceae*	sol (1-5%)	In groups, unevenly	10	Vegetative, flowering,
Solenanthus circinnatus Ledeb.	*Boraginaceae*	sol (1-2%)	In groups, unevenly	40	Vegetative, flowering, fruiting
Echium vulgare L.	*Boraginaceae*	sol (1-2%)	In groups, unevenly	45	Vegetative, flowering, fruiting
Viola acutifolia (Kar. & Kir.) W. Becker	*Violaceae*	sol (1-7%)	In groups, unevenly	10	Vegetative, flowering, fruiting
Viola altaica Ker Gawl.	*Violaceae*	sol (1-7%)	In groups, unevenly	10	Vegetative, flowering, fruiting
Achillea millefolium L.	*Asteraceae*	sol (1-7%)	In groups, unevenly	70	Vegetative, flowering, fruiting
Achillea asiatica Serg.	*Asteraceae*	sol (1-4%)	In groups, unevenly	75	Vegetative, flowering, fruiting
Marrubium vulgare L.	*Lamiaceae*	sol (1-2%)	In groups, unevenly	40	Vegetative, flowering, fruiting
Rúmex confértus Willd.	*Polygonaceae*	sol (1-5%)	In groups, unevenly	90	Vegetative, flowering,
Onopordum acanthium L.	*Asteraceae*	sol (1-3%)	In groups, unevenly	25	Vegetative, flowering,
Phlomoides oreophila (Kar. & Kir.) Adylov, Kamelin & Makhm.	*Lamiaceae*	sol (1-6%)	In groups, unevenly	40	Vegetative, flowering,
Polygonum songaricum Schrenk	*Polygonaceae*	sol (1-5%)	In groups, unevenly	35	Vegetative, flowering,
Bistorta vivipara (L.) Delarbre	*Polygonaceae*	sol (1-5%)	In groups, unevenly	40	Vegetative, flowering,
Lithospermum officinale L.	*Boraginaceae*	sol (1-3%)	In groups, unevenly	50	Vegetative, flowering,
Astragalus fedtschenkoanus Lipsky	*Fabaceae*	sol (1-3%)	In groups, unevenly	20	Vegetative, flowering, fruiting
Thalictrum minus L.	*Ranunculaceae*	sol (1-5%)	In groups, unevenly	35	Vegetative, flowering, fruiting

Continuation of the table

Floristic diversity					
Species name.	Family.	Abundance according to Druce	Distribution according to B.A.Bykov	Height, m/cm	Phenophase
Ephedra equisetina Bunge	*Ephedraceae*	sol (1-5%)	In groups, unevenly	40	Vegetative, flowering, fruiting
Hesperis sibirica L.	*Brassicaceae*	sol (1-2%)	In groups, unevenly	20	Vegetative, flowering, fruiting
Achoriphragma.lancifolium (M.Pop.) Sojak.	*Brassicaceae*	sol (1-6%)	In groups, unevenly	45	Vegetative, flowering, fruiting
Asperugo procumbens L.	*Boraginaceae*	sol (1-5%)	In groups, unevenly	30	Vegetative, flowering, fruiting
Ferula akitschkensis B. Fedtsch. ex Koso-Pol.	*Apiaceae*	sol (1-3%)	In groups, unevenly	50	Vegetative, flowering, fruiting
*Rhytispermum tenuiflorum (*L. f.) Link	*Boraginaceae*	sol (1-5%)	In groups, unevenly	30	Vegetative, flowering, fruiting
Cardaria draba (L.) Desv.	*Brassicaceae*	sol (1-7%)	In groups, unevenly	20	Vegetative, flowering
Arctium lappa L.	*Asteraceae*	sol (1-2%)	In groups, unevenly	20	Vegetative, flowering
*Capsella bursa-pastoris (*L.) Medik.	*Brassicaceae*	sol (1-7%)	In groups, unevenly	15	Vegetative, flowering
Xanthium strumarium L.	*Asteraceae*	sol (1-2%)	In groups, unevenly	30	Vegetative, flowering
Taraxacum officinale F.H. Wigg.	*Asteraceae*	sol (1-12%)	In groups, unevenly	25	Vegetative, flowering
Rumex tianschanicus Losinsk.	*Polygonaceae*	sol (1-5%)	In groups, unevenly	85	Vegetative, flowering
Melandrium apetalum (L.) Fenzl	*Caryophyllaceae*	sol (1-5%)	In groups, unevenly	15	Vegetative, flowering
Descurainia sophia (L.) Webb ex Prantl	*Brassicaceae*	sol (1-7%)	In groups, unevenly	35	Vegetative, flowering
Schulzia crinita (Pall.) Spreng.	*Apiaceae*	sol (1-7%)	In groups, unevenly	10	Vegetative, flowering
Gentiana turkestanorum Gand.	*Gentianaceae*	sol (1-7%)	In groups, unevenly	45	Vegetative, flowering
Eritrichium villosum (Ledeb.) Bunge	*Boraginaceae*	sol (1-5%)	In groups, unevenly	40	Vegetative, flowering
Codonopsis clematidea (Schrenk ex Fisch. & C.A. Mey.) C.B. Clarke	*Campanulaceae*	sol (1-7%)	In groups, unevenly	30	Vegetative, flowering, fruiting
*Cirsium arvense (*L.) Scop.	*Asteraceae*	sol (1-7%)	In groups, unevenly	70	Vegetative, flowering, fruiting
Hyoscyamus niger L.	*Solanaceae*	sol (1-5%)	In groups, unevenly	30	Vegetative, flowering, fruiting

Continuation of the table

Floristic diversity					
Species name.	Family.	Abundance according to Druce	Distribution according to B.A.Bykov	Height, m/cm	Phenophase
Helictotrichon pubescens (Huds.) Pilg.	*Poaceae*	sol (7-10%)	In groups, unevenly	90	Vegetative, flowering, fruiting
Helictotrichon tianschanicum (Roshev.) Henrard	*Poaceae*	sol (5-10%)	In groups, unevenly	95	Vegetative, flowering, fruiting
Ligularia macrophylla (Ledeb.) DC.	*Asteraceae*	sol (1-7%)	In groups, unevenly	95	Vegetative, flowering, fruiting
*Anthriscus nemorosa (*M.Bieb.) Spreng.	*Apiaceae*	sol (1-5%)	In groups, unevenly	65	Vegetative, flowering, fruiting
Aconitum leucostomum Vorosch.	*Ranunculaceae*	sol (1-7%)	In groups, unevenly	95	Vegetative, flowering
Setaria viridis (L.) P. Beauv.	*Poaceae*	sol (1-5%)	In groups, unevenly	85	Vegetative, flowering
*Ligularia narynensis (*C. Winkl.) O. Fedtsch. & B. Fedtsch.	*Asteraceae*	sol (1-10%)	In groups, unevenly	110	Vegetative, flowering
Gentiana tianschanica Rupr.	*Gentianaceae*	sol (1-7%)	In groups, unevenly	45	Vegetative, flowering
Phleum pratense L.	*Poaceae*	sol (1-5%)	In groups, unevenly	75	Vegetative, flowering, fruiting
Solidago dahurica Kitag.	*Asteraceae*	sol (1-5%)	In groups, unevenly	90	Vegetative, flowering, fruiting
Linum perenne L.	*Linaceae*	sol (1-3%)	In groups, unevenly	100	Vegetative, flowering, fruiting
Cirsium polyacanthum Kar. & Kir.	*Asteraceae*	sol (1-5%)	In groups, unevenly	75	Vegetative, flowering, fruiting
*Phalaroides arundinacea (*L.) Rauschert	*Poaceae*	sol (1-7%)	In groups, unevenly	65	Vegetative, flowering, fruiting
Anthoxanthum odoratum L.	*Poaceae*	sol (1-5%)	In groups, unevenly	50	Vegetative, flowering
Cichorium intybus L.	*Asteraceae*	sol (1-7%)	In groups, unevenly	110	Vegetative, flowering
*Hierochloe odorata (*L.) P. Beauv.	*Poaceae*	sol (1-5%)	In groups, unevenly	60	Vegetative, flowering, fruiting
Stipa zalesskii Wilensky	*Poaceae*	sol (1-3%)	In groups, unevenly	40	Vegetative, flowering, fruiting
Brachypodium pinnatum (L.) Beauv.	*Poaceae*	sol (1-3%)	In groups, unevenly	55	Vegetative, flowering
Elymus tianschanigenus Czerep.	*Poaceae*	sol (1-5%)	In groups, unevenly	65	Vegetative, flowering

Continuation of the table

Floristic diversity					
Species name.	Family.	Abundance according to Druce	Distribution according to B.A.Bykov	Height, m/cm	Phenophase
Elymus caninus (L.) L.	*Poaceae*	sol (1-3%)	In groups, unevenly	70	Vegetative, flowering
Rumex acetosa L.	*Polygonaceae*	sol (1-7%)	In groups, unevenly	115	Vegetative, flowering, fruiting
Stellaria soongorica Roshev.	*Caryophyllaceae*	sol (1-5%)	In groups, unevenly	15	Vegetative, flowering, fruiting
Potentilla chrysantha Trevir.	*Rosaceae*	sol (1-7%)	Individually, unevenly.	25	Vegetative, flowering
Astragalus alpinus L.	*Faabaceae*	sol (1-7%)	Individually, unevenly.	15	Vegetative, flowering
Astragalus lepsensis Bunge	*Faabaceae*	sol (1-5%)	In groups, unevenly	25	Vegetative, flowering
Hedysarum semenowii Regel & Herder	*Faabaceae*	sol (1-7%)	In groups, unevenly	45	Vegetative, flowering
Euphorbia alatavica Boiss.	*Euphorbiaceae*	sol (1-5%)	In groups, unevenly	30	Vegetative, flowering
*Anthriscus sylvestris (*L.) Hoffm.	*Apiaceae*	sol (1-5%)	Individually, unevenly.	105	Vegetative, flowering
Aulacospermum rupestre Popov.	*Apiaceae*	sol (1-5%)	Individually, unevenly.	75	Vegetative, flowering
Bupleurum aureum Fisch. ex Hoffm.	*Apiaceae*	sol (1-7%)	In groups, unevenly	115	Vegetative, flowering
Carum carvi L.	*Apiaceae*	sol (1-9%)	In groups, unevenly	125	Vegetative, flowering
Carum atrosanguineum Kar. & Kir.	*Apiaceae*	sol (1-7%)	In groups, unevenly	135	Vegetative, flowering
Aegopodium alpestre Ledeb.	*Apiaceae*	sol (1-3%)	In groups, unevenly	45	Vegetative, flowering
Pedicularis macrochila Vved.	*Scrophulariaceae*	sol (1-5%)	Individually, unevenly.	55	Vegetative, flowering

The flora of the studied population of *V. spicata* and *V. spuria* in the Kaskelen Gorge of the Ile Alatau includes 132 species, representing 105 genera and 31 families. Characteristic species include *Elytrigia repens* (L.) Nevski, *Dactylis glomerata* L., *Trifolium repens* L., *Trifolium pratense* L., *Geranium transversale* (Kar. & Kir.) Vved., *Artemisia vulgaris* L., *Arctium lappa* L., *Berteroa incana* (L.) DC., *Poa pratensis* L., *Poa annua* L., *Capsella bursa-pastoris* (L.) Medik., and *Xanthium strumarium* L.

The presence of weedy species such as *Urtica cannabina* L., *Arctium lappa* L., and *Xanthium strumarium* L. indicates significant anthropogenic pressure on the natural phytocenoses.

Ecological analysis revealed the mesoxerophytic and mesophytic nature of the mountain flora in the meadow habitats of the populations of *V. spicata* and *V. spuria* The main limiting factors for species distribution are high competition in phytocenoses, anthropogenic load, and strict ecological requirements.

According to I.G. Serebryakov's classification of plant life forms, *V. spicata* and *V. spuria* are perennial herbaceous polycarpics. Based on K. Raunkier's classification, these species are classified as mesophytes and mesoxerophytes. Their typical habitats in the surveyed area are meadow-grass communities of the forest belt, predominantly located on the northern exposures of mountain slopes (Table 4).

Table 4 – Main ecological groups of plants occurring in *V. spicata and V. spuria* populations.

№	Ecological groups	Number of species	% of total number of species
1	Mesophytes	106	80,3
3	Mesoxerophytes	24	18,8
5	Mesohygrophytes	2	1,5
Total:		132	100

The majority of *V. spicata* and *V. spuria* cenopopulations in the Kaskelen Gorge of the Ile Alatau are predominantly composed of immature and virginile age groups. This is primarily due to the predominance of vegetative reproduction, with no senile plants observed in these populations. In these cenopopulations, the dominance of the immature age group is particularly notable, accounting for 45% to 65% of individuals.

An analysis of field data revealed that all cenopopulations of *V. spicata* and *V. spuria* ex- hibit minimal differences in floristic composition and growing conditions. Furthermore, an exami- nation of the leading families within the flora of *V. spicata* and *V. spuria* populations identified the nine largest families based on the number of species (Table 5).

Table 3 shows that the largest family in the flora of *V. spicata* and *V. spuria* populations in the Kaskelen Gorge of the Ile Alatau is Poaceae, comprising 18 species, which accounts for 13.6% of the total flora. The second-largest family is Asteraceae, with 17 species (12.8%). The third and fourth places are occupied by Rosaceae and Apiaceae, each containing 10 species. Together with Fabaceae, Lamiaceae, Brassicaceae, Boraginaceae, and Polygonaceae, these nine families include more than 58 species (44.0%), representing 70.4% of the total flora of *V. spicata* and *V. spuria* populations. The remaining 22 families account for only 39 species (29.5%).

Table 5 – Taxonomic composition of the largest families of *V. spicata* and *V. spuria* populations.

№	Families	Number of genera	Number of species	% of total number of species
1	Poaceae	15	18	13,6
2	Asteraceae	14	17	12,8
3	Rosaceae	8	10	7,5
4	Apiaceae	8	10	7,5
5	Fabaceae	4	9	6,8
6	Lamiaceae	7	8	6,0
7	Brassicaceae	7	7	5,3
8	Boraginaceae	7	7	5,3
9	Polygonaceae	5	7	5,3
Total:		*75*	*93*	70,4
The remaining 22 families:		30	39	29,5

Thus, the largest families of the flora in *V. spicata* and *V. spuria* populations in the Kaskelen Gorge include 75 genera and 93 species, contributing significantly to the flora composition at 70.4% of the total species. This composition of leading families, distinguished by their high species richness, is characteristic of the flora in the eastern part of the Ancient Mediterranean. However, it also exhibits unique features influenced by both Old Mediterranean and boreal elements.

Analysis of the life forms of the flora of *V. spicata* and *V. spuria* populations in the Kaskelen Gorge, based on the classifications of I.G. Serebryakov and K. Raunkier [30], indicates that floristic diversity is largely shaped by ecological conditions, particularly climate and territorial heterogeneity. The dominant life form is perennial grasses or hemicryptophytes, which account for 70.6% of the flora. Shrubs and semi-shrubs (chamaephytes and microphanerophytes) constitute a smaller share at 11.3% (Ta- ble 6).

The flora of *V. spicata* and *V. spuria* populations in the Kaskelen Gorge of the Ile Alatau includes a small group of therophytes (5 species) and geophytes (3 species). In general, the flora of these populations is dominated by species typical of mountain meadows, shrub-grass, and meadow-grass habitats. As noted earlier, the leading life forms in the studied area are herbaceous perenni- als and annuals, which are characterized by a wide ecological range. Shrubs are well-represented with 13 species, while woody life forms are represented by only 2 species due to narrowly limited environmental conditions.

Table 6 – Spectrum of major plant life forms found in *V. spicata and V. spuria* populations.

№	Life form	Number of species	% of total number of species
1	Hemicryptophytes	107	81,0
2	Therophytes	5	3,7
3	Chamaephytes	2	1,5
4	Microphanerophytes	13	9,8
5	Phanerophytes	2	1,5
6	Geophytes	3	2,2
Total:		132	100

The life form composition of the flora in the populations of *V. spicata* and *V. spuria* in the Kaskelen Gorge is indicative of the climatic conditions of the region, highlighting its mesoxerophytic nature.

A geographical analysis based on available data on the current distribution of flora representatives shows that species within the populations of *V. spicata* and *V. spuria* in the Kaskelen Gorge are distributed across 30 habitat types, grouped into 8 categories with similar distribution characteristics. As is well known, each regional flora consists of species with varying ranges in both area and geographical location. Therefore, the geographical analysis follows a classification system widely used in Central Asia by authors such as E.P. Lavrenko, M.S. Baitenov, V.P. Goloskokov, A.I. Tolmachev, and R.V. Kamelin.

In the Kaskelen Gorge, the geographical distribution of the studied species is predominantly confined to mountain habitats (Table 7).

Table 7 – Geographical relationships of plant species occurring in populations of *V. spicata* and *V. spuria* with the flora of other regions.

Group of distribution types	Distribution types	Number of species (% of total number)	Species
1	2	3	4
Palaearctic	East Palaearctic	18 (13,6)	*Salix hastata* L. *Cotoneaster uniflorus* Bunge *Cotoneaster melanocarpus* Fisch. ex Blytt *Rubus idaeus* L. *Plantago major* L. *Prunella vulgaris* L. *Geranium albiflorum* L. *Dactylis glomerata* L. *Senecio nemorensis* L. *Myosotis suaveolens* Waldst. & Kit. ex Willd. *Thalictrum petaloideum* L. *Bromus squarrosus* L. *Thalictrum minus* L. *Hyoscyamus niger* L. *Anthriscus nemorosa* (M.Bieb.) Spreng. *Brachypodium pinnatum* (L.) Beauv. *Aegopodium alpestre* Ledeb. *Anthriscus sylvestris* (L.) Hoffm.
	West Palaearctic	11 (8,3)	*Geranium collinum* Stephan ex Willd. *Elytrigia repens* (L.) Nevski *Berteroa incana* (L.) DC. *Veronica spicata* L. *Vicia tenuifolia* Roth. *Marrubium vulgare* L. *Echium vulgare* L. *Helictotrichon pubescens* (Huds.) Pilg. *Phleum pratense* L. *Solidago dahurica* Kitag. *Elymus caninus* (L.) L.
Irano-Turanian	Mountainous Central Asian	3 (2,2)	*Rosa beggeriana* Schrenk *Pedicularis macrochila* Vved. *Elymus tianschanigenus* Czerep.
	Mountainous Central Asian-Irano-Himalayan	3 (2,3)	*Lonicera stenantha* Pojark. *Vicia subvillosa* (Ledeb.) Boiss. *Cortusa brotheri* Pax ex Lipsky
	Mountainous Central Asian-Mountainous Central Asian.	1 (0,75)	*Stipa orientalis* Trin.
Pamir-Alai-Tian Shan	Altai-Tian Shan-Pamir-Alai	4 (3,0)	*Spiraea lasiocarpa* Kar. & Kir. *Euonymus semenovii* Regel & Herder *Saxifraga sibirica* L. *Schulzia crinita* (Pall.) Spreng.
	Tian Shan-Pamir-Alai	2 (1,5)	*Codonopsis clematidea* (Schrenk ex Fisch. & C.A. Mey.) C.B. Clarke *Euphorbia alatavica* Boiss.
	Kashgar-Tian Shan-Pamir-Alai	1 (0,75)	*Rheum wittrockii* Lundstr.
	Tarbagatai-Tian Shan-Pamir-Alai	2 (1,5)	*Galium aparine* L. *Gentiana tianschanica* Rupr.

Continuation of the table

Group of distribution types	Distribution types	Number of species (% of total number)	Species
1	2	3	4
Tian Shan	Proper Tian Shan	3 (2,3)	*Picea schrenkiana* Fisch. et Mey. *Rumex tianschanicus* Losinsk. *Stellaria soongorica* Roshev.
	Mountainous Siberian-Altai-Tian Shan	1 (0,75)	*Mentha asiatica* Boriss.
	Northern Tian Shan	4 (3,0)	*Crataegus songarica* K. Koch *Pedicularis alberti* Regel *Helictotrichon tianschanicum* (Roshev.) *Henrard* *Astragalus* lepsensis Bunge
	Dzhungar-Ile	1 (0,75)	*Aulacospermum rupestre* Popov.
	Pannonian-Kazakhstan	1 (0,75)	*Linum perenne* L.
	Dzhungar-Eastern Tian Shan	3 (2,3)	*Phlomoides pratensis* (Kar. & Kir.) Adylov, Kamelin & Makhm. *Ligularia narynensis* O. Fedtsch. & B. Fedtsch. *Hedysarum semenowii* Regel & Herder
	Tarbagatai-Tian Shan	2 (1,5)	*Viola acutifolia* (Kar. & Kir.) W. Becker *Ferula akitschkensis* B. Fedtsch. ex Koso-Pol.
	Dzhungar-Northern Tian Shan	2 (1,5)	*Astragalus chlorodontus* Bunge *Achoriphragma.lancifolium* (M.Pop.) Sojak.
	Altai-Northern Tian Shan	1 (0,75)	*Potentilla chrysantha* Trevir.
	Altai-Tian Shan	5 (3,7)	*Viola altaica* Ker Gawl. *Achillea asiatica* Serg. *Ligularia macrophylla* (Ledeb.) DC. *Cirsium polyacanthum* Kar. & Kir. *Bupleurum aureum* Fisch. ex Hoffm.
Altai-Mountainous Central Asian	Altai-Pamir-Alai-Mountainous Central Asian	7 (5,3)	*Salix alatavica* Kar. ex Stschegl. *Rosa alberti* Regel *Lonicera hispida* Pall. ex Schult. *Ribes meyeri* Maxim. *Dracocephalum origanoides* Stephan. *Gentiana turkestanorum* Gand. *Aconitum leucostomum* Vorosch.
	Altai-Mountainous Central Asian-Mountainous Central Asian	2 (1,5)	*Dracocephalum integrifolium* Bunge. *Carum atrosanguineum* Kar. & Kir.
	Mountainous Central Asian	5 (3,7)	*Geranium transversale* (Kar. & Kir.) Vved. *Polygonum songaricum* Schrenk *Astragalus fedtschenkoanus* Lipsky *Ephedra equisetina* Bunge Arctium lappa L.
	Altai-Mountainous Central Asian	1 (0,75)	*Phlomoides oreophila* (Kar. & Kir.) Adylov, Kamelin & Makhm.
	Mountainous Siberian-Mountainous Central Asian-Mongolian	1 (0,75)	*Atragene sibirica* L.
	Altai-Iranian	1 (0,75)	*Solenanthus circinnatus* L.

Continuation of the table

Group of distribution types	Distribution types	Number of species (% of total number)	Species
1	2	3	4
Holarctic	Proper Holarctic	26 (19,6)	*Polygonum aviculare* L. *Pyrola rotundifolia* L. *Goodyera repens* (L.) R. Br. *Poa nemoralis* L. *Fragaria vesca* L. *Alchemilla vulgaris* L. *Poa pratensis* L. *Artemisia absinthium* L. *A. vulgaris* L. *A. annua* L. *Erigeron acris* L. *Verbascum thapsus* L. *Anisantha tectorum* (L.) Nevski. *Bistorta vivipara* (L.) Delarbre *Xanthium strumarium* L. *Taraxacum officinale* F.H. Wigg. *Melandrium apetalum* (L.) Fenzl. *Descurainia sophia* (L.) Webb ex Prantl *Eritrichium villosum* (Ledeb.) Bunge *Cirsium arvense* (L.) Scop. *Phalaroides arundinacea* (L.) Rauschert *Anthoxanthum odoratum* L. *Hierochloe odorata* (L.) P. Beauv. *Rumex acetosa* L. *Carum carvi* L. *Astragalus alpinus* L.
	Pluriregional	4 (3,0)	*Daucus carota* L. *Trifolium repens* L. *Setaria viridis* (L.) P. Beauv. *Capsella bursa-pastoris* (L.) Medik.
Ancient Mediterranean	European-Ancient Mediterranean	1 (0,75)	*Sisymbrium loeselii* L.
		9 (6,8)	*Plantago lanceolata* L. *Trifolium pratense* L. *Origanum vulgare* L. *Veronica chamaedrys* L. *Achillea millefolium* L. *Onopordum acanthium* L. *Lithospermum officinale* L. *Asperugo procumbens* L. *Cichorium intybus* L.
	European-Ancient Mediterranean	1 (0,75)	*Rhytispermum tenuiflorum* (L. f.) Link
	Eastern Mediterranean		*Cardaria draba* (L.) Desv.
	Eurasian	3 (2,3)	*Agropyron pectiniforme* Roemer & Schultes *Veronica spuria* L. *Rúmex confértus* Willd. *Hesperis sibirica* L.

A geographical analysis of the species constituting the flora of *V. spicata* and *V. spuria* populations in the Kaskelen Gorge of the Ile Alatau revealed a spectrum ranging from widespread cosmopolitan or pluri-regional species to narrowly endemic species. In the study area, 30 habitat types were identified and grouped into 8 broader habitat categories: Ancient Mediterranean, Holarctic, Altai-Mountain-Middle

Asian, Tianshan, Pamir-Alai-Tianshan, Iranian-Mountain-Middle Asian, and Palearctic (Table 5).

The Old Mediterranean habitat group comprises 14 species confined to mountain habitats, representing the Southern Old Mediterranean, Eastern Mediterranean, and European-Alder Mediterranean subtypes. These account for 17.8% of the species.

The Holarctic group includes two range types: Holarctic proper and pluri-regional. The Palaearctic group encompasses East Palaearctic and West Palaearctic ranges. Species with wide distributions dominate these groups, accounting for approximately 44.6% of the flora of the studied populations (59 species).

Species widespread across Mountain Central Asia contribute significantly to the flora of *V. spicata* and *V. spuria* populations, with 73 species (55.3%) identified. Of these, 23 species (17.4%) are restricted to the Tianshan mountain province, with 13 species (9.8%) belonging to Tianshan proper. The Altai-Mountain-Middle Asian, Pamir-Alai-Tianshan, and Iranian-Mountain-Middle Asian habitat groups are well-represented, comprising 31 species (23.4%).

The predominance of *V. spicata* and *V. spuria* populations in the mountainous flora of the Kaskelen Gorge underscores the Mountain Middle Asian character of the studied flora. The significant presence of species with Holarctic and Palaearctic distributions highlights historical connections with Northern Hemisphere floras.

With the intensive economic development of natural resources in the Ile Alatau, particularly in recent decades, the importance of plant-based products has grown. The flora of *V. spicata* and *V. spuria* populations in the Kaskelen Gorge is rich in wild useful plants, including species with fodder, food, medicinal, ornamental, tannin, honey, vitamin, dye, and oil-producing properties, offering potential as natural plant raw materials (Table 8).

Table 8 – Occurrence in populations of *Veronica spicata* L. and *Veronica spuria* L., useful plant groups

№	Group of Raw Material Plants	Number of species	% of total species
1	Fodder	100	75,7
2	Medicinal	27	20,4
3	Poisonous	4	3,0
4	Honey-bearing	80	60,0
5	Food	20	15.5
6	Essential oil	20	15,5
7	Ornamental	45	34,0
8	Dyes	6	4,5
9	Technical	14	10,6
10	Vitaminiferous	15	11,3
11	Weeds	25	19,0

Useful groups of plants occurring in the flora of populations of *V. spicata* and *V. spuria* species of the Kaskelen Gorge in Ile Alatau were compiled according to the classification of H.M. Ilyin and N.V. Pavlov. These groups are quantitatively represented as follows: weeds – 25 species (19%), food – 20 species (15.5%), medicinal – 27 species (20.4%), honey-bearing – 80 species (60%), essential oilseeds – 20 species (15.5%), fodder – 100 species (75.7%), ornamental – 45 species (34%), dyeing – 6 species (4.5%), vitamin-bearing – 15 species (11.3%), technical (rubber plants, resinous plants, gum trees, paper plants, wicker plants, etc.) – 14 species (10.6%).

As can be seen from Table 6, the largest group is represented by fodder species. To create a solid fodder base for livestock breeding, forage crops are of primary importance. The vegetation of the Kaskelen Gorge in Ile Alatau is rich in forage plant species, which serve as high-quality fodder for domestic animals. The richest pastures and hayfields are concentrated here. The best fodder species are recognized as members of the families Fabaceae, Poaceae, Asteraceae, and others. Cereal grasses are particularly valuable forage grasses for several reasons: high nutrient content, good digestibility, high yield, environmental tolerance, fibre content, and

species diversity. These factors make cereal grasses an essential part of livestock feed.

Among them are *Dactylis glomerata* L., *Bromus squarrosus* L., *Brachypodium pinnatum* (L.) Beauv., *Elytrigia repens* (L.) Nevski, *Helictotrichon pubescens* (Huds.) Pilg., *Phleum pratense* L., *Elymus caninus* (L.) L., *Setaria viridis* (L.) P. Beauv., *Elymus tianschanigenus* Czerep., *Stipa omentalis* Trin., *Helictotrichon tianschanicum* (Roshev.) Henrard, *Poa nemoralis* L., *Poa pratensis* L., *Anisantha tectorum* (L.) Nevski., *Phalaroides arundinacea* (L.) Rauschert, *Anthoxanthum odoratum* L., *Hierochloe odorata* (L.) P. Beauv.

Legumes are also valuable forage plants, with species such as *Hedysarum semenowii* Regel & Herder, Medicago falcata, *Trifolium pratense* L., *Vicia subvillosa* (Ledeb.) Boiss., *Vicia crassa*, and *Vicia tenuifolia*. Among herbs, many species are readily consumed by cattle and sheep, such as Ajania fastigiata, Geranium saxatile, and many spe- cies of Asteraceae (e.g., Taraxacum, Tragopogon). These include *Ajania fastigiata, Geranium saxatile*, and many Asteraceae species (such as Taraxacum and Tragopogon). Among food-palatable plants, the family Rosaceae is notably represented with five species, categorized as vitamin-sugar-bearing. These are primarily fruit and berry plants, including strawberry (*Fragaria vesca L.*), raspberry (*Rubus idaeus L.*), hawthorn (*Crataegus songarica K. Koch.*), and rosehip (*Rosa beggeriana Schrenk, Rosa alberti Regel.*). The family Grossulariaceae includes the fruit-berry species currant (*Ribes meyeri Maxim.*).

Food species are also abundant in families such as Polygonaceae, Apiaceae, Asteraceae, and Fabaceae. Notable examples of food plants include *Rumex tianschanicus, Ephedra equisetina Bunge, Rumex acetosa L., Cichorium intybus L., Rheum wittrockii Lundstr.*, and *Carum atrosanguineum Kar. & Kir.*

Medicinal plants are particularly significant among the flora, with species like *Ephedra equisetina, Inula macrophylla, Arctium lappa L., Origanum vulgare L., Aconitum leucostomum Vorosch., Achillea asiatica Serg., Capsella bursa-pastoris (L.) Medik., Daucus carota L., Aegopodium alp- estre Ledeb., Anthriscus sylvestris (L.) Hoffm.*, and *Plantago major L.*offering wide-ranging therapeutic properties.

The flora of *V. spicata* and *V. spuria* populations in the Kaskelen Gorge of Ile Alatau highlights significant potential for medicinal, alkaloid-bearing, essential oil, tannidaceous, and honey-bearing plants. Plants of the *Veronica* genus, particularly *V. spicata* and *V. spuria* are characterized by their diverse chemical composition. These species contain flavonoids, anthocyanins, nitrogenous compounds, phenolic compounds (including coumarins, iridoids, alkaloids, amino acids, pectin substances, saponins, cardenolides, choline, and phenolcarboxylic acids such as caffeic, ferulic, isoferulic, lilac, p-coumaric, protocatechuic, and veratric acids), tannins, coumarin, carbohydrates, and many other bioactive substances.

Additionally, *V. spicata* and *V. spuria* contain 12 to 20 trace elements. Trace elements detected in *V. spicata* include K, Ca, Mg, Si, P, Al, Fe, Mn, Na, Sr, Ti, Zn, Pb, Cu, and Mo.

Herbal infusions of *V. spicata* and *V. spuria* are traditionally used for treating respiratory infections, bronchitis, tuberculosis, bronchial asthma, liver diseases, kidney and bladder ailments, peptic ulcers, and as a cardiotonic and detoxifying agent in snake bites. They also exhibit antibacterial activity. Externally, these infusions are applied for washing and baths to treat various skin conditions, such as acne, pustules, fungal skin infections, itchy rashes, cuts, abrasions, and burns.Beekeeping in the Kaskelen Gorge study area, with its favorable natural conditions, has the potential to become a vital part of agriculture. Mountainous beekeeping significantly impacts both the ecosystem and the economy. Bees, as primary pollinators, enhance crop yields and support biodiversity conservation. In mountain areas, where unique plant species thrive, beekeeping can yield high-quality honey with distinctive flavors and medicinal properties.

Technical plants hold significant importance across various sectors. Tannin plants produce tannins, which are essential in the leather industry and dye production. Dyeing plants serve as sources of natural dyes used in textiles and food production. Essential oil plants are widely used in perfumery, cosmetics, and medicine due to their versatile chemical properties. Rubber-bearing plants supply natural rubber, critical for manufacturing rubber products and related materials. Saponin-bearing plants contain saponins, utilized in medicine and as foaming agents in various industries. Gutta-percha-bearing plants yield gutta-percha, used in manufacturing rubber-like products.

Essential oils, which are extracted from various plant parts such as flowers, leaves, needles, seeds, roots, and rhizomes, display a wide range of pharmacological activities depending on their chemical compositions. Examples include plants from the Umbelliferae family, such as *Daucus carota* and A*egopodium alpestre*, Asteraceae family, including *Conyza canadensis, Achillea millefolium, Arctium*

tomentosum, *Artemisia vulgaris*, and *Artemisia absinthium*, and Lamiaceae, including *Origanum vulgare*.

Plants in the Kaskelen Gorge exhibit remarkable ornamental potential, making them suitable for landscaping. Their use enhances the aesthetic value of landscapes and creates a favorable ecological environment. Among these ornamental species, *V. spicata* and *V. spuria* stand out. Commonly known as spiked speedwell (*V. spicata*) and false speedwell (*V. spuria*), these species boast attractive flowers and forms, making them excellent choices for landscaping projects. Their inclusion in gardens and landscapes can add diversity and beauty while attracting beneficial pollinators like bees and butterflies.

Conclusion

The comprehensive assessment of *V. spicata* and *V. spuria* populations in the Kaskelen Gorge of the Ile Alatau revealed that the first cenopopu- lation (CP) is in good condition, while the second and third CPs are in satisfactory condition. Most of the studied CPs are classified as normal, non-degenerated populations, with no senile individuals present. These populations are found sporadically, often as single specimens or in small patches within herbaceous meadows of the forest zone, primarily in moist meadow-herbaceous habitats with good light conditions.

Analysis of the age spectra of the studied cenopopulations revealed a dominance of young and generative plants. *V. spicata* and *V. spuria* which belong to the ecological group of mesophytes and mesoxerophytes, are primarily distributed in the middle forest zone. Their populations demonstrate strong adaptive capabilities, indicating significant ecological flexibility.

Both species are notable for their ornamental qualities and resilience, making them attractive for landscaping applications. They exhibit high winter hardiness, allowing them to adapt to adverse conditions successfully. Their excellent seed and vegetative reproduction capabilities make them suitable for cultivation and use in various landscape designs. Additionally, their natural resistance to diseases reduces the need for chemical treatments, thereby preserving ecosystem balance.

The characteristic habitus and decorative value of *V. spicata* and V. *spuria* make them excellent candidates for creating flower compositions, borders, and other landscape elements. Their appeal extends to both public and private landscaping projects, where they serve as valuable resources for attracting bees and other pollinators. These attributes make *V. spicata* and *V. spuria* highly recommended for use in sustainable and aesthetically pleasing landscaping practices.

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