Assessment of the state of the cenopopulation of
*Cousinia mindschelkensis* B. Fedtsch. of Karakuys Gorge in the Karatau Reserve

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Abstract. The article presents an assessment of the state of the cenopopulation of *Cousinia mindschelkensis* B. Fedtsch. of Karakuys gorge in Karatau reserve. The data on distribution and cenoflora of the rare endemic species *Cousinia mindschelkensis* were obtained. Herbarium materials from the main herbarium funds were studied to further clarify the places of distribution of the species. Cenopopulations of the studied species were located on the northern slope of the Syrdarya Karatau, in the Karakuys Gorge on stony and rubble, rocky slopes, steppe areas of the lower belt of the mountains, occupying small areas of 1100 to 1300 meters. The study of the number, density and age spectrum of cenopopulations showed that most of them have an age spectrum with two maxima, the highest density of *Cousinia mindschelkensis* plants is observed in cenopopulation. The study of *Cousinia mindschelkensis* cenopopulations revealed that they are located within their optimum, there is no special threat of extinction for this species here.

1 Introduction

Today, the current global problem is the conservation of biodiversity of rare and endemic plants [1]. On the slopes of the Syrdarya Karatau, on the territory of the Republic of Kazakhstan grows a unique flora, which is characteristic of the North-Western spur of the Tien Shan [3, 4]. The vegetation cover develops under the combined action of two mountain systems: the Western Tien Shan, which forms the border with Kyrgyzstan, and the Karatau Range. Within the Karatau Range there is the Karatau Nature Reserve, the history of which began in 1980, under the leadership of the Academy of Sciences of the Kazakh SSR, with the result of its opening in 2004. The reserve occupies a total area of 340300 hectares. The species composition of plants in the Karatau Reserve has about 650-750 species of higher vascular plants, of which more than 150 species are rare, endemic plants [2].

In Kazakhstan, in recent years, special attention has been paid to the study of endangered plant species. One of such plants that require special attention in terms of preserving the

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biodiversity of the flora of Kazakhstan is undoubtedly a rare, endemic species *Cousinia mindschelkensis* B. Fedtsch. inhabiting the mountain slopes of the Karatau Reserve [5].

### 2 Materials and Methods

The object of study is an endemic species - *Cousinia mindschelkensis*, listed in the Red Book of Kazakhstan. The species grows on stony - rubbly slopes and sites, less often in bushes. [4].

In the work were used classical botanical methods: route studies, ecological systematics, methods of studying cenopopulations. As a result, herbarium was collected to determine the floristic community. Collection of herbarium was carried out according to the method of Skvortsov. Collection of material and processing of herbarium specimens was carried out according to classical methods. In addition, herbarium material of collection Kazakhstan and international funds was studied during the work. [6].

When determining plants were used "Flora of Kazakhstan" and "Illustrated identifier of plants of Kazakhstan", "Identifier of Central Asia". The name of plants was checked according to S.A. Abdulina and S.K. Cherepanov. Ecological groups of plants life forms of plants were allocated according to the classification of Raunkier and Serebryakov. Age states were identified according to the scheme of A.A. Uranov. Phytoecological and ecological characteristics of habitats were determined by key parameters. Species composition was studied and biomorphology was determined. The abundance, fertility and projective cover were measured on the sample plots.

![Fig.1. Location map of Cousinia mindschelkensis in the Karakuys Gorge.](image1)

![Fig.2. Cousinia mindschelkensis](image2)
3 Results and Discussion

*Cousinia mindschelkensis* is a species of the family Asteraceae. Perennial 10-30 cm tall forms powerful cushions, root is thick, black-haired with caudices. Leaves on both sides, denser from below, thinly gray-veined, stems white-webbed, baskets especially near the tops, reddish-webbed. VII-VIII, fruiting IX.

On the territory of Turkestan region were carried out scientific, research works, during the work were found 2 populations, 4 cenopopulations of *Cousinia mindschelkensis* in Turkestan region, in Sozak district, in Karatau mountains, in Karakuys gorge. The area of cenopopulation, geographical position, GPS coordinates, altitude and vegetation were described in detail. The floristic composition of the plant community in which *Cousinia mindschelkensis* occurs was determined and geobotanical studies were conducted. Plant species occurring in cenopopulations were collected in order to study, systematize and create herbariums of plant communities for each population.

The first population grows in Turkestan region, in Sozak district, Karatau state natural reserve, in Karatau mountains, in Karakuys gorge as a part of arboreal - shrub community. Here 2 cenopopulations of *Cousinia mindschelkensis* are marked. The total projective coverage is 60%. The vegetation is composed of 3 tiers: The first tier consists of *Malus sieversii*, 2-6 m high, the second tier - *Cerasus erythrocarpa*, *Ferula tenuisecta* 70 cm high, the third tier - *poa bulbosa*, *Galium verum*, *Hypericum scabrum* 8-30 cm high. This population can be characterized as middle-aged and stable.

In the areas where *Cousinia mindschelkensis* occurs, the leading families such as Asteraceae (7 species, 12.06%), Rosaceae (10 species, 17.2%), Apiaceae (5%), Poaceae (4 species, 6.8%) are found (Fig. 3).

From life forms it was established that perennial herbaceous plants predominate (41.3%), the second place is occupied by shrubs (24.13%), from annual plants only one species (*Erigeron umbrosus* (Kar. & Kir.) Boiss.) was found, from trees three species (*Sorbus persica* Hedl., *Acer semenovii* Regel & Herder, *Pyrus regelii* Rehd.) were found. According to the classification of N.A. Pavlov, 15 groups of useful plants were registered in the first population. 1. Essential oil plants - 7 (12.6 %); 2. Medicinal plants - 9 (15.5 %); 3. Ornamental plants - 12 (20.6 %); 4. Honey bearing plants - 11 (18.9 %); 5. Food plants - 13 (22.4 %); 6. Poisonous plants - 4 (6.8 %); 7. Fat-oil plants

![Population 1](image)

**Fig.3.** Leading families of plant communities (Population 1)

The second population grows in Turkestan oblast, in Sozak district, Karatau State Nature Reserve, in the Karatau mountains, on the northern slope in the Kishikarakuys gorge, as part of a herbaceous artemisietum community. Two more cenopopulations were recorded here. RPF - 50 %. Soils are mountain-chestnut. Vegetation is composed of 2 tiers: Shrubby 90-120 cm - *Crataegus songarica*, *Spirea hypericifolia*, *Cerasus erythrocarpa*, *Atraphaxis spinosa*. The second tier, a belt of low grasses 25-30 cm - *Thymus karatavicus*, *Ziziphora clinopodioides*, *Stipa caucasica*. The population is characterized by predominance of old
generative individuals of *Cousinia mindschelkensis*. On the territory of *Cousinia mindschelkensis* cenopopulation 46 plant species belonging to 37 genera were collected and identified. The leading families include Asteraceae - 17 species (15.5 %), Rosaceae - 11 species (18.9 %), Apiaceae - 8.6 % (Fig.4). The number of representatives of other genera is small. Their total sum makes 62 % of the flora. According to Raunkier's classification on the studied territory, in the second population with predominance there are phanerophytes 29.3 %, then there are 18.9 % xerophytes, other groups with small amount are hemicycrophytes, geophytes, hasmophytes, mesophytes, mesophanerophytes, therophytes, cryptophytes, microphanerophytes. Of ecological types, petrophytes prevail here on stony small stony areas, steppe plants are in the second place, followed by meadow, forest - meadow plants. According to the characteristic of life forms, herbaceous perennial plants prevail 46.5 %, the second place is occupied by shrubs 27.5 %, the third place is occupied by trees 5.1 %. In the second population of *Cousinia mindschelkensis*, useful plants in plant communities were divided into 14 groups according to the classification of N.V.Pavlov. 1- Essential oil plants - 7 species, medicinal plants - 14 species, ornamental plants - 12, food plants - 10 species, vitamin plants - 2, rubber-bearing plant - 1 species (*Chondrilla aspera* Poir.), honey plants - 13 species, fodder plants - 5 species, weed plant - 1 species, fat oil plants - 2 species, technical plant - 1 species (*Ziziphora clinopodioides* Lam.), dye plants - 2 species, poisonous plants - 4 species, tannin plant - 1 species (*Sorbus persica* Hedl.).

The state of *Cousinia mindschelkensis* population on this territory can be said to be satisfactory. *Cousinia mindschelkensis* grows well in open, well sunlit areas. In this population, different age states can be found, from young to medium-generative. Here, plant regeneration is normal, meaning that there is no particular risk to the population.

![Figure 4](image)

**Fig.4.** Dominant community families (Population 2)

**Table 1.** Age status data of Cousinia mindschelkensis

<table>
<thead>
<tr>
<th>Ontogenetic state</th>
<th>Population 1, pieces /%</th>
<th>Population 2, pieces /%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CP -1</td>
<td>CP -2</td>
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<tr>
<td>Juvenile (j)</td>
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</tr>
<tr>
<td>Imature (im)</td>
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<td>0</td>
</tr>
<tr>
<td>Virginal (v)</td>
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<td>0</td>
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<tr>
<td>Young generative (g1)</td>
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<td>0</td>
</tr>
<tr>
<td>Medium generative (g2)</td>
<td>2/22,2</td>
<td>1/16,7</td>
</tr>
<tr>
<td>Old generative (g3)</td>
<td>3/33,4</td>
<td>2/33,3</td>
</tr>
<tr>
<td>Sub-senile (ss)</td>
<td>2/22,2</td>
<td>2/33,3</td>
</tr>
<tr>
<td>Senile (s)</td>
<td>2/22,2</td>
<td>1/16,7</td>
</tr>
<tr>
<td>Total, pcs.</td>
<td>9</td>
<td>6</td>
</tr>
</tbody>
</table>
According to the results of the analysis, in the first cenopopulation the species im (immature), v (virginate), g1 (generative) individuals are the least absent. More generative individuals of *Cousinia mindschelkensis* occur in the first cenopopulation, with the absolute maximum in CP1 occurring in group g3 (33.4%) (Table 1).

No species im, v, g1 individuals occurred in the second cenopopulation. A large percentage occurs in group g3,ss. (33.3%) as generative individuals in this cenopopulation were found in the highest number.

The third cenopopulation has an age composition with two maxima: the first (g2 - 37.5%) and the second (ss-37.5%). This is because the natural conditions in this habitat are more favorable than where the fourth population occurs.

The majority of generative individuals are old generative individuals (28.6%), and the proportion of im,v,g1 individuals is very low, almost in all studied cenopopulations.

### 4 Conclusion

A study of *Cousinia mindschelkensis* populations in the Karatau Mountains, in the Karakays Gorge was carried out. According to the results of the analysis of plants occurring in different communities is represented by 42 species from 34 genera and 11 families. The number of species is concentrated in the families of Compound- *Rosaceae, Asteraceae, Fabaceae*. Analysis of taxa showed predominance of shrubs and herbaceous perennials. The age spectrum of the populations is dominated by young and middle-aged generative individuals of *Cousinia mindschelkensis*. Populations 1 and 3 can be described as stable middle-aged, while 4 cenopopulations can be characterized as stable young. The obtained data can serve as a basis for the creation of a program for monitoring of *Cousinia mindschelkensis* populations in the Karatau Mountains in order to preserve the rare endemic plant in its habitat.

As a result of the conducted scientific works, communities of *Cousinia mindschelkensis* growing in Turkestan region, in Sozak district gradually increase the number of individuals and thus restore the local flora or create conditions for the formation of new communities and populations of other species. The processed results indicate the presence of some factors influencing the favorable growth of cenopopulations in natural habitats of *Cousinia mindschelkensis*: humidity, presence of stony soil and plant community.

### References


5. A. A. Ivashenko. Nekotorye endemichnye predstaviteli semejstva Asteraceae v kazahstanskoj chasti Zapadnogo Tyan'-SHany i Karatau. Some endemic representatives of the family Asteraceae in the Kazakhstan part of the Western Tien Shan and Karatau.


