

Determination of distribution areas and reserves for state accounting of Tajik Kavrak (*Ferula Tadshikorum* Pimenov) resources in the flora of Surkhandarya and Kashkadarya provinces, Uzbekistan

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Abstract. During the 1970s and 1980s, the chemical composition of more than 50 species found in Central Asia was studied, and about 250 terpenoid substances were isolated from them. Due to the growth of the species in various ecological conditions, about 40 species are also of great importance as fodder plants. This article presents the results of our research aimed at accounting for the natural resources of tajik kavrak (*Ferula tadshikorum* Pimenov) in Surxondary and Kashkadarya, the southern regions of the Republic of Uzbekistan. By reading the article, you can find out the distribution of tajik kavrak. During the last 20 years in Uzbekistan, the process of collecting Tajik kavrak sap by people has been intensively carried out in the southern regions of the republic, namely Kashkadarya and Surkhandarya provinces, which are the main distribution area of the plant. Unwise use of the plant's natural resources led to the threat of complete extinction of its current natural distribution areas, which, in turn, led to the inclusion of *Ferula tadshikorum* Pimenov species in the next edition of the "Red Book" of the Republic of Uzbekistan (2019) with the 3rd status. Keywords: Surkhandarya, Kashkadarya, *Ferula*, Red book, Pamir-Alay, Flora, Chumolisay, Smola.

1 Introduction

There are about 60 species of the *Ferula* family in the territory of the Republic of Uzbekistan, most of them have medicinal properties. In addition, *Ferula* is a valuable source of raw materials for the pharmaceutical industry not only in our country, but also in most countries of the world [1, 2].

During the last 20 years in our republic, the process of collecting Tajik kavrak sap by people has been intensively carried out in the southern regions of the republic, namely Kashkadarya and Surkhandarya provinces, which are the main distribution area of the plant. unwise use of the plant's natural resources led to the threat of complete extinction of its

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current natural distribution areas, which, in turn, led to the inclusion of *Ferula tadshikorum* Pimenov species in the next edition of the "Red Book" of the Republic of Uzbekistan (2019) with the 3rd status [3, 4].

Decision PQ-3617 of the President of the Republic of Uzbekistan dated March 20, 2018 was adopted in order to wisely use the natural resources of medicinal plants of the flora of the Republic of Uzbekistan, to establish plantations of certain medicinal plants, to process their raw materials and to increase export [5, 6]. This decision envisages the establishment of the "Association of Kavrak Growers and Exporters" on the territory of the republic. The main task of this organization is to organize plantations of two types (*Ferula foetida* L., *Ferula tadshikorum*), processing of raw materials and increasing export [7-12].

The implementation of the tasks defined in the above decision will create the basis for the reduction of the rate of use of the natural reserves of Tajik kavrak and the restoration of it.

2 Materials and Methods

This research was carried out on the basis of generally accepted methods [9, 10] and the annual amount of raw materials that can be collected, the method of determining the reserves of medicinal plants (State Forestry Committee of the USSR, 1986). At the same time, it was carried out using classic and modern route, observation and other methods used in botany, including floristry and geobotany. The location coordinates of the selected area were obtained for determining the vegetation reserve (Garmin180, Google Earth). The period and stages of ontogeny in the population of species of the studied species were carried out [4].

Kashkadarya and Surkhondarya regions of the republic: studies aimed at studying Tadjik kavrak populations were carried out in the areas that include the southwestern branches of the Hisar ridge and the mountain slopes of Bobotog at an altitude of 1200 meters above sea level.

3 Results and Discussion

Ferula L. species in Surkhondarya province are essential oil, honey-producing, nutritive and are widely used in medicine. During the 1970s and 1980s, the chemical composition of more than 50 species found in Central Asia was studied, and about 250 terpenoid substances were isolated from them. Due to the growth of the species in various ecological conditions, about 40 species are also of great importance as fodder plants. The genus *Ferula* (Tourn.) L. occupies a special place among representatives of the *Apiaceae* family, the species of the genus are widespread in the regions from the Canary Islands to the Western Mediterranean Sea, from the Middle East and Central Asia to Western China, as well as to Northern India.

180-185 species of *Ferula*, which is one of the large families of *Apiaceae* family, are distributed on earth, of which about 130 species are found in the local flora of Central Asia, and 100 of them have the status of endemic (Fig 1).



Fig. 1. *Ferula tadshikorum* Pimenov.

According to the general distribution of the species of the category, they are distributed in Central and South-West Asia, North Africa, the Far East, Iran, Afghanistan, Pakistan, China, India and around the Mediterranean Sea, and Central Asia is recognized as a region with a high diversity of species. Mainly, it grows on slopes with sandy, stony, gravelly, pebbly and mottled red and gray sand soils in plains, hills, foothills and mountain regions. Species distributed in Central Asia, including the southern Pamirs, Alay are mainly found in the floretsenotypes of shiblyak and pineforest.

There are 104 species of this family in Central Asia, 45 of them are listed in "Flora Uzbekistana", and according to the research conducted in recent years, the number of species is accounted for 60 species. *Ferula oopoda* (Boiss. & Buhse) Boiss. *F. karategina* Lipsky ex Korovin, *F. hissarica* Pimenov ined., *F. ferganensis* Lipsky ex Korovin, *Ferula tadshikorum* Pimenov were also found in the flora of Uzbekistan.

During the last 20 years in our republic, the process of collecting Tadjik kavrak sap by the users of nature has been intensively carried out in the middle mountain regions of the southern regions of the republic, namely Kashkadarya and Surkhandarya provinces - the main distribution areas of the plant. As a result of such use of the natural resources of the plant, its current natural distribution areas are in danger of being completely lost, and in turn, the *Ferula tadshikorum* Pimenov species was included in the next edition of the Red Book of the Republic of Uzbekistan with the 3rd status.

Decision PQ-3617 of the President of the Republic of Uzbekistan dated 20.03.2018 was adopted in order to rationally use the natural resources of medicinal plants in the flora of the Republic of Uzbekistan, to establish plantations of some medicinal plants, to process their raw materials and to increase export. This decision envisages the establishment of the "Association of Kavrak Growers and Exporters" on the territory of the republic. The main task of this organization is to organize plantations of kavrak of two types (*Ferula foetida* L., *Ferula tadshikorum*), processing of raw materials and increasing export. Before that, it was observed that some farms and local residents in Kashkadarya and Surkhandarya provinces started planting Tajik kavrak and organizing mini-plantations. This creates the basis for the decrease in the rate of use of the natural populations of the Tajik kavrak and the restoration of natural reserves.

In the studied area, studies were conducted to study the status of distribution areas and natural populations of *Ferula kuhistanica* which is not industrially important, and Tajik kavrak, which is mainly of industrial importance.

***Ferula tadshikorum* Pimenov.** It is a perennial monocarp plant, 1.5-1.8 m tall, with a strong garlic smell. The root is thick, with a vertical rhizome. Normal caudex. The stem is

single, 5-9 cm in diameter at the base, black, smooth, full. The leaves are soft, fade quickly, the upper part is almost hairless, gray hairy on the outside, the leaves of the rhizome and the lower stem are banded, the bands are smooth or short hairy, full, circular in structure, with a large number of conductive tube-fiber strands, the plate is large, 40 cm long, up to 30 cm wide, ellipsoidal, three-fold, first-order segments two-three times feathery, upper stems unoccupied, lower leaves similar to rhizome leaves, but smaller in size, upper leaf lobes large, up to 20 cm long, 7-9 wide cm, lanceolate or ovate-lanceolate in shape, the margin is obtuse. Inflorescence is a wide shingle. The umbels are numerous, all fruit-bearing, the central umbels are densely banded, mostly forming a false ring, 20-30 rays, 3-6 cm long, inky, almost equal. The umbels have 10-15 flowers, without coiled leaves. Flowers are short, 0.5-0.8 cm. The teeth of the sepals are small and pointed. Petals are yellow, 2-2.5 cm long, oblong-elliptical, blunt, the tip is turned inward. The base is cup-shaped. The fruit is 1.9-2.7 cm long and 0.9-1.2 cm wide, inverted ovoid, oblong-ovoid, oval or ellipsoid, compressed on the back, flat, hairless. The back edges are threadlike, the edges are broadly winged. Excretory ducts are solitary in the outer mesocarp, 4 in total, large, 4-6 on the side of the commissure, 1 on the back edges and 3-4 on the edges. It blooms in April-May and bears fruit in June-July.

Tajik kavrak (*Ferula tadshikorum* Pimenov). Its status in the Red Book of Uzbekistan is 3rd status. An endemic plant with a divided area, decreasing in number in southwestern Pamir-Alay. The author included in the Red Book is A.V. Mahmudov. Kashkadarya and Surkhandarya provinces: distributed in the southwestern branches of the Hisar ridge and in Babatag. Outside Uzbekistan: it grows on slopes and rocks in the lower and middle parts of the mountains of Southern Tajikistan. In nature, it grows singly or forming small populations. The total number has not been determined. During the last 20 years, as a result of unplanned and uncontrolled harvesting of plant sap by nature users, the growth areas of natural resources and populations have been drastically reduced.

Aqbash Forest Department of Dehkanabad Forestry - total area 150 hectares:

Field No. 1 (10x10 - 1392 meters above sea level. N 38.015203; E 66.59362) – the total number of plants of different ages is 24; 9 of them are 1-year-old, 8 are 2-3-year-old, and 7 are 5-6-year-old (adult - it is possible to collect sap) plants. (Fig. 2).

Field No. 2 (10x10) - 1360 meters above sea level. N 38.016445; E 66.586963) – the total number of plants of different ages is 20; 9 of them are 1-year-old, 7 are 2-3-year-old, and 5 are 5-6-year-old (adult - it is possible to collect sap) plants.

Field No. 3 (10x10) - 1329 meters above sea level. N 38.015689; E 66.59028) – the total number of plants of different ages is 28; 13 of them are 1-year-old, 8 are 2-3-year-old, and 7 are 5-6-year-old (adult - it is possible to collect sap) plants.

Field No. 4 (10x10) - 1379 meters above sea level. N 38.015992; E 66.592669) – the total number of plants of different ages is 34; 16 of them are 1-year-old, 11 are 2-3-year-old, and 7 are 5-6-year-old (adult - it is possible to collect sap) plants.

Military unit No. 9257 border Ilondara Massif - total area 200 hectares:

Field No. 1 (10x10) - 1405 meters above sea level. N 38.015015; E 66.587973) – the total number of plants of different ages is 31; 14 of them are 1-year-old, 9 are 2-3-year-old, and 8 are 5-6-year-old (adult - sap can be collected) plants (Figure 2).



Fig. 2. A general view of the area where the *Ferula tadshikorum* Pimenov is spread in the Aqbash Forest Department of Dehghanabad Forestry.

Field No. 2 (10x10) - 1430 meters above sea level. N 38.014559; E 66.58751) – the total number of plants of different ages is 26; 17 of them are 1-year-old, 5 are 2-3-year-old, 4 are 5-6-year-old (adult - sap can be collected) plants.

Field No. 3 (10x10) - 1448 meters above sea level. N 38.014684; E 66.586469) – the total number of plants of different ages is 32; 15 of them are 1-year-old, 8 are 2-3-year-old, 9 are 5-6-year-old (adult - sap can be collected).

Field No. 4 (10x10) - 1400 meters above sea level N 38.015446; E 66.58437) – the total number of plants of different ages is 29; 12 of them are 1-year-old, 10 are 2-3-year-old, and 7 are 5-6-year-old (adult - it is possible to collect sap) plants.

The border village of Khojaipok - total area of 800 hectares:

Field No. 1 (10x10 - 799 meters above sea level. N 38.067735; E 66.331775) – the total number of plants of different ages of Tajik kavrak (*F. tadshikorum*) is 9; it was found that there are no 1-year-old individuals, 5 2-3-year-old plants, 4 5-6-year-old plants (adult - sap can be collected).

Field No. 2 (10x10 - 806 meters above sea level. N 38.065716; E 66.344669) – the total number of plants of different ages of Tajik kavrak (*F. tadshikorum*) is 23; 3 of them are 1-year-old, 11 are 2-3-year-old, and 9 are 5-6-year-old (adult - it is possible to collect sap) plants.

Field No.3 (10x10) - 851 meters above sea level. N 38.056227; E 66.360667) – the total number of plants of different ages of Tajik kavrak (*F. tadshikorum*) is 25; 14 of them are 1-year-old, 11 are 2-3-year-old, and 5-6-year-old (adult - sap can be collected) plants were found.

Boztepa village, border of military unit No. 9257 - total area 1000 hectares: (Figure 3)

Field No. 1 (10x10) - 1091 meters above sea level. N 38.034475; E 66.526395) – the total number of plants of different ages of Tajik kavrak (*F. tadshikorum*) is 33; 7 of them are 1-year-old, 16 are 2-3-year-old, and 10 are 5-6-year-old (adult - it is possible to collect sap) plants.

Field No. 2 (10x10) - 1092 meters above sea level. N 38.033791; E 66.537955) – the total number of plants of different ages of Tajik kavrak (*F. tadshikorum*) is 28; 14 of them are 1-year-old, 9 are 2-3-year-old, and 5 are 5-6-year old (adult - sap can be collected).

Field No. 3 (10x10) - 1086 meters above sea level N 38.014684; E 66.586469) – the total number of plants of different ages of Tajik kavrak (*F. tadshikorum*) is 33; 15 of them are 1-year-old, 8 are 2-3-year-old, and 10 are 5-6-year-old (adult - sap can be collected).

Taking into account that **Usmondara (20 ha)**, **Larik (50 ha)**, **Kaklikbulok (30 ha)**, **Ogzikent (15 ha)** regions are located next to each other, the state and natural resources of the species of the *F. tadshikorum* family spread over a total of 115 hectares of these regions. The analysis of 10x10 fields is as follows:

Field No. 1 (10x10 m - 1512 meters above sea level. N 38.138071; E 66.555217) – the total number of plants of different ages of Tajik kavrak (*F. tadshikorum*) is 32; it was found that the number of 1-year-old plants is 6, 2-3-year-old individuals are 17, and 9 are 5-6-year-old (adult - sap can be collected) plants.

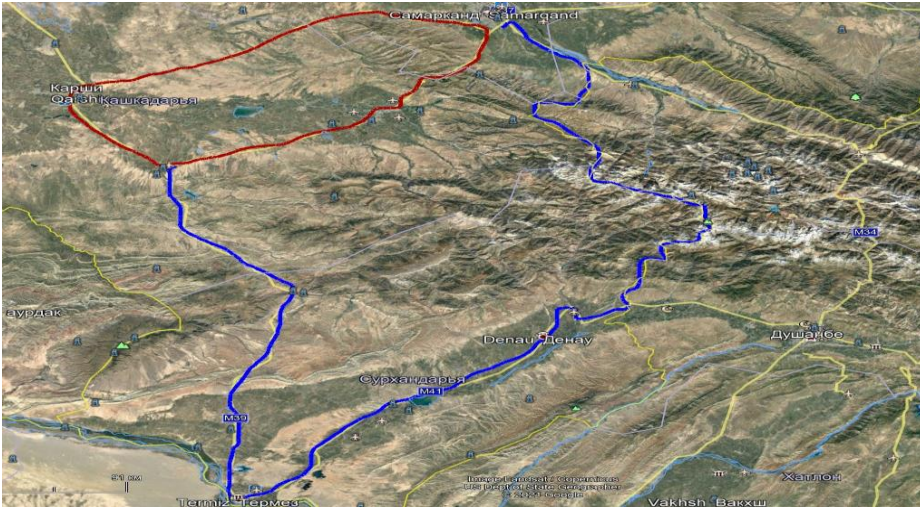


Fig. 3. Research area: Boztepa and Khojaipok villages, Dehqonabad district, Kashkadarya province, state border and border areas.

Field No. 2 (10x10 m - 1371 meters above sea level. N 38.135816; E 66.546318) - 35 plants of different ages of Tajik kavrak (*F. tadshikorum*); 8 of them were 1-year-old, 13 were 2-3-year-old, and 14 were 5-6-year-old (adult - sap can be collected) plants.

Field No. 3 (10x10 m - 1195 meters above sea level N 38.13573; E 66.524257) - 35 plants of different ages of the Tajik kavrak (*F. tadshikorum*); It was found that there are 11 1-year-old plants, 18 2-3-year-old plants, and 6 5-6-year-old plants.

Taking into account that **Kurgontash (10 ha)** and **Tally (20 ha)** areas are located next to each other, the analysis of the 10x10 m areas according to the condition of the scattered *F. tadshikorum* species and natural reserves of a total of 30 hectares of these areas is as follows:

Field No. 1 (10x10 - 1557 meters above sea level N 38.138432; E 66.555394) - 34 plants of different ages of the Tajik kavrak (*F. tadshikorum*); it was found that there are 16 1-year-old plants, 9 2-3-year-old individuals, and 9 5-6-year-old plants (adults - sap can be collected).

Field No. 2 (10x10 - 1471 meters above sea level N 38.136415; E 66.545602) - 18 plants of different ages of Tajik kavrak (*F. tadshikorum*); it was found that there are 8 1-year-old plants, 10 2-3-year-old plants, and 5-6-year-old plants (adults - sap can be collected).

Taking into account that **Boztepa (150 ha)**, **Jonabulok (100 ha)**, **Sebatlisoy (300 ha)** regions are located next to each other, a total of 550 hectares of these regions are divided into 10x10 m according to the state species of the scattered *F. tadshikorum* series, natural reserves. The analysis of the fields is as follows:

Field No. 1 (10x10 m - 1095 meters above sea level. N 38.031784; E 66.540263) – the total number of plants of different ages of Tajik kavrak (*F. tadshikorum*) is 33; it was found that there are 6 1-year-old plants, 20 2-3-year-old plants, and 7 5-6-year-old plants (adults - sap can be collected).

Field No. 2 (10x10 - 1071 meters above sea level. N 38.021951; E 66.554119) – the total number of plants of different ages of Tajik kavrak (*F. tadshikorum*) is 35; 8 of them were 1-year-old, 13 were 2-3-year-old, and 14 were 5-6-year-old (adult - sap can be collected) plants.

Field No. 3 (10x10 - 1030 meters above sea level N 38.02192; E 66.554475) - total number of plants of different ages of Tajik kavrak (*F. tadshikorum*) 30; it was found that there are 11 1-year-old plants, 10 2-3-year-old plants, and 9 5-6-year-old plants.

Sargay Ata, Momauldisay (50 ha), Ilondara (200 ha), Qoplondara (150 ha), Jalil mergan (50 ha), Khachcha ota (30 ha), Tollibulaq (30 ha), Ajdar (20 ha) belonging to **Kungiroi Karakolchilik LLC**. The analysis of the types of *F. tadshikorum* series on a 10x10 m area as a sample by areas is as follows:

Field No. 1 (10x10 - 1175 meters above sea level. N 38.135764; E 66.523422) – the total number of plants of different ages of Tajik kavrak (*F. tadshikorum*) is 37; Among them, the number of 1-year-old plants is 24, 2-3-year-old individuals are 6, and 7 are 5-6-year-old (adult - sap can be collected) plants.

Field No. 2 (10x10 - 1171 meters above sea level. N 38.138432; E 66.555394) – the total number of plants of different ages of Tajik kavrak (*F. tadshikorum*) is 24; it was found that there are 8 1-year-old plants, 9 2-3-year-old plants, and 7 5-6-year-old plants (adults - sap can be collected).

Field No. 3 (10x10 - 1236 meters above sea level. N 38.138677; E 66.556094) – the total number of plants of different ages of Tajik kavrak (*F. tadshikorum*) is 30; it was found that there are 14 1-year-old plants, 7 2-3-year-old plants, and 9 5-6-year-old plants (adults - sap can be collected).

Massif No. 6 of the Aqbash Forest Department, Dehkanabad Forestry (100 ha):

Field No. 1 (10x10 m) - 1329 meters above sea level. N 38.015689; E 66.59028) – the total number of plants of different ages is 28; 13 of them are 1-year-old, 8 are 2-3-year-old, and 7 are 5-6-year-old (adult - it is possible to collect sap) plants.

Field No. 2 (10x10) - 1379 meters above sea level. N 38.015992; E 66.592669) – the total number of plants of different ages is 34; 16 of them are 1-year-old, 11 are 2-3-year-old, and 7 are 5-6-year-old (adult - it is possible to collect sap) plants.

4 Conclusions

The result of the field research conducted in the growing season of 2021 shows that the biological reserve of Tajik kavrak in the above-mentioned areas will be around 22,000 (twenty two thousand) tons. During the last 20 years, as a result of unplanned and uncontrolled harvesting of plant sap by nature users, the growth areas of natural resources and populations have been drastically reduced.

Based on generally accepted methodical instructions, it was determined that the operational reserve of the plant, which does not harm natural populations and can be isolated from nature, is around 2,925 (two thousand nine hundred and twenty five) kg.

From the above indicators, it became clear that in order to preserve the natural populations of the Tajik kavrak, to create a basis for its natural regeneration and to use it rationally, it is necessary to demand measurements to stop the collection of raw materials (root juice - resin) of the plant in these areas within the next 5-8 years was determined. It was found that Tajik kavrak populations are densely distributed in only 297.0 ha of the total area of 4,085.0 ha where these indicators were studied, and the number of individuals and age indicators of the plant in these populations have decreased sharply.

On the other hand, in order to prevent the extinction of natural populations of Tajik kavrak (*Ferula tadshikorum* Pimenov) and to meet the continuous demand for plant raw materials, it is recommended to create and expand industrial plantations in the region of the plant's growth (Surkhandarya and Kashkadarya regions).

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