

The State of Coenopopulations of *Crambe Edentula* Fisch. & C.A. Mey. Ex Korsh in the Conditions of Karakalpak Ustyurt

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Abstract: The state of 4 cenopopulations of a rare species *Crambe edentula* for the Republic of Uzbekistan has been studied. The ontogenetic structure of the species is associated with the ecological-cenotic conditions of growth and fluctuations in weather conditions. *C. edentula* can be considered a threatened species because all studied cenopopulations are incomplete, due to the absence of a fraction of young individuals. This is evidenced by the types of cenopopulations, which are assessed as young, maturing, transitional, and mature. The investigated species is recommended for inclusion in the Red Book of the Republic of Uzbekistan.

Key words. Coenopopulation, ontogenetic spectrum, juveniles, succession, Red Book.

Introduction

Crambe Edentula Fisch. & C.A. Mey. Ex Korsh – katran toothless (Brassicaceae) perennial; root thin, woody; several stems, 45-70 cm tall, glabrous, ribbed, branched, deciduous from below, leafless from above; leaf blades ovate, somewhat diamond-shaped, 4-8 cm long, 3-6 cm wide, slightly wedge-shaped at the base, PET-iols (2-2.5 cm long) rigidly hairy, especially from below, also along veins and edges, angularly toothed or subtentire; upper stem leaves linear-awl-shaped, small. Inflorescence loose, branching, elongated branches; the leaves are oblong, up to 3 mm long, glabrous; the petals are white, 4-5 mm long, oblong-ovate, tapering at the base, up to 2.5-3 mm wide; all filaments are toothless, longer, slightly expanded on both sides; the peduncles are 3-7 mm long, upright; the gynophore is very short, but distinct (1-1.5 mm long), elliptical, firm, smooth, glaucous. Flowering time: May-June; fruiting: July. (Mohammad Sadegh Amiri, Shahryar Saeidi Mehrvarz & Mohammad Reza Joharchict 243 – 247,)

According to P. V. Veselova (2012), *Crambe edentula* is included in the Red Book of Kazakhstan (1981), a Southwestern Turan (or East Caspian) rare, relict species. Within the Northern Turan, it is found in Mangishlak and Ustyurt. According to the literature, *Crambe edentula* – katran toothless (Brassicaceae) is found in Karakalpakia (Ustyurt) on the slopes of ravines. It usually grows in places that are difficult for humans and livestock to reach, in particular, along the edges of chinks, canyons, and chalk hills. It is protected in the Ustyurt Nature Reserve. According to the research conducted within the framework of the creation of the "State

Plant Cadastre of the Mangistau region" (2004-2006), the state (number, dynamics of age composition, etc.) of the natural populations of the toothless katran does not cause concern. This circumstance, together with the inclusion of *C. edentula* in the Red Book of the Mangistau region and the protection of the species at the regional level, gives grounds for the recommendation to exclude it from the list of rare species of the Republican Red Book.

Two rare and interesting species of *Crambe edentula* (Brassicaceae) and *Crinitariagrimmii* (Asteraceae) have been studied in Iran (Amirietal., 2018). *C. edentula* is very rare in Iran and only one location is known. In particular, its habitat has recently been severely affected by road construction and intensive grazing. Therefore, it is recommended to protect the territory and propagate the species in Botanical gardens. The article presents diagnostic morphological features, taxonomic observations, conservation status, and the distribution map.

The article by H. F. Shomurodov and others (2015) describes the distribution of some rare species not listed in the Red Book of Uzbekistan growing in the Karakalpak part of Ustyurt (*Crambe edentula*, *Lagochilus acutilobus*, *Crataegus korolkowii*, *Allium delicatulum*), provides geographical coordinates, information about the habitat, the species composition of communities with these species, and the number of individuals. *Crambe edentula*, which grows on the scree, rocks and on the clay slopes of ravines, is mainly distributed on the eastern coast of the Caspian Sea (Mangishlak, Ustyurt, Bolshiye Balhani) and in Kopet-Daga.

However, there is still no data about the state of the population of *Crambe edentula* in the conditions of the Karakalpak Ustyurt – the rarest relict species of the Turan deserts. Current climate data shows a sharp increase in drought in the last 15 years in the territory of Southern Ustyurt, where the populations of the species are confined, which confirms the need to study the current state of the coenopopulation of the species.

Research methods

The objects of the study are *Crambe edentula* Fish. Et Mey.

Crambe edentula is a perennial herb. It is found in the scree, rocks, on the clay slopes of ravines. Collected in the vicinity of the wells of Dahli, Goklenkui, Kazahli and on the northern shore of the Sarikamish Lake. It grows in thickets, sometimes separately on the washed-out slopes of ravines, on stony-gravelly and fine-grained soils. The range of the species is Ustyurt, Kizilkum, Mangishlak Peninsula, the eastern coast of the Caspian Sea, Bolshiye Balhani and Kopet-Daga (Allaniyazov and Saribaeva, 1983).

The material was collected in 2019-2020. Route studies cover various ecotopes of the Karakalpak part of the Ustyurt plateau. Familiarized with the herbarium samples of *Crambe edentula*, stored in the fund of the National Herbarium (TASH) of the Institute of Botany of the

Academy of Sciences of the Republic of Uzbekistan.

Geobotanical descriptions were made in all communities where the population structure of the species was studied, according to the generally accepted method on sites of 100 m² (Field Geobotany, 1964; Shennikov, 1964).

The degree of participation is indicated by numbers according to the 7-point Drude system [1907]: single-sol, rarely-sp¹, quite rarely-sp², mediocre-sp³, often-cop¹, very often-cop², copiously-cop³.

The names of plants are given according to the latest summary of S. K. Cherepanov [Cherepanov, 1995] and according to the site www.theplantlist.org. The life form of plants is given according to the 11-volume "Plant Determinant of Central Asia" [1968-2016].

Coenopopulations are described according to the classifications of A. A. Uranov and O.V. Smirnova [1969] and "delta-omega" by L.A. Jivotovskiy [2001]. Delta (Δ) is the age index [Uranov,1975], which evaluates the age level of a coenopopulation at any given time, and omega (ω) is the efficiency of a plant of the i – th ontogenetic state (the value of the "load" on the energy resources of the environment, expressed as a fraction of the load produced by plants of the average age generative state of this population). According to this classification, coenopopulations can be young, mature, transitional, aging, and old.

Population density is determined by the number of individuals per unit area. At the same time, special attention was paid to the average density, that is, the number per unit of total space, or ecological density – the number per unit of inhabited space that can actually be occupied by a population [Odum, 1986].

Results and discussion

In the course of field studies on Ustyurt (2019-2020), four communities with the participation of *Crambe edentula* were identified. A brief ecological and phytocenotic description of these coenopopulations (CP) is given below.

The first coenopopulation of *C. Edentula* is found in the Kaplankir area as part of the goji-katran community (figure 1.1). The soil of the territory described is sandy. Geographic coordinates: N41, 2221E56, 0401. The plant community is dominated by *C. edentula*. The projected grass cover is 8%. In the place where this coenopopulation grows, 18 species of vascular plants have been recorded (table 1.1). Of these, shrubs - 3, semi-shrubs - 5, perennials - 4 and annuals - 6.



Figure 1.1 – The first coenopopulation of *C. edentula* (A, B).

In the salsola-saxaul-caragan community (studied in the Shorja region), *C. edentula* is found as a member of the community (figure 1.2). The soil of the territory described is gypsum – bearing. Geographical coordinates: N42, 2148 E57, 4128. CP 2 grows under cliffs, where *Caragana grandiflora*, *Haloxylon aphyllum* and *Salsola orientalis* are dominant and subdominant in the plant community. The projected grass cover is 12%. The botanical composition of the community consists of 19 species of flowering plants (table 1.1). Of these, shrubs - 3, semi-shrubs - 4, perennials - 6 and annuals - 6.



Figure 1.2 – Salsola-saxaul-caragan community (A)
and the image of *C. edentula* (B).

The third coenopopulation of the studied species is found in the northern part of the lake Sarikamish in the sagebrush-saxaul community between the chinka gorges in the say (figure 1.3). The soil of the territory described is gypsum – bearing. Geographic coordinates: N56, 6511E42, 2154. The plant community is dominated by *Haloxylon aphyllum*. The projected grass cover is 15%, *C. edentula* is found as a member of the community. Where this coenopopulation grows, 13 species of vascular plants have been recorded (table 1.1). Of these, shrubs - 4, semi-shrubs - 2,

perennials - 5 and annuals - 2.



A



B

Figure 1.3 – The third coenopopulation *C. edentula* (A)
and senile individuals of the studied species (B)

The fourth coenopopulation of *C. Edentula* was recorded in the eastern part of the lake Sarikamish (8 km north of the border of Turkmenistan) as part of the atraphaxis-white sagebrush community along the dry watercourse (say) (figure 1.4). The soil of the territory described is sandy. Geographical coordinates: N57, 6458E42, 2138. The plant community is dominated by *Artemisia terrae-albae*. The projected grass cover is 10%, *C. edentula* is found as a member of the community. In the place where this cenopopulation grows, 10 species of vascular plants have been registered (table 1.1). Of these, shrubs - 2, semi-shrubs - 4, perennials - 3 and annuals - 1.



A



B

Figure 1.4 – The fourth coenopopulation of *C. edentula* (A, B)

Table 1.1 - Characteristics of plant communities with the participation of the studied coenopopulations of *Crambe edentula*

№	Names of the plants	Abundance of community species			
		CP 1	CP 2	CP 3	CP 4
Shrubs					
1	<i>Atraphaxis spinosa</i> L.	-	-	+	3
2	<i>Caragana grandiflora</i> (M. Bieb.) DC.	-	5	-	-
3	<i>Convolvulus fruticosus</i> Pall.	+	+	+	1
4	<i>Haloxylon aphyllum</i> (Minkw.) Iljin	1	3	8	-
5	<i>Lycium ruthenicum</i> Murray	2	-	1	-
Semi-shrubs					
6	<i>Anabasis salsa</i> (C.A. Mey.) Benth. ex Volkens	+	-	-	+
7	<i>Artemisia diffusa</i> Krasch. ex Poljakov	+	+	6	-
8	<i>A. terrae-albae</i> Krasch.	1	-	-	4
9	<i>Nanophyton erinaceum</i> (Pall.) Bunge	-	+	-	+
10	<i>Salsola arbuscula</i> Pall.	+	+	-	2
11	<i>S. chiwensis</i> Popov	-	-	+	-
12	<i>S. orientalis</i> S.G. Gmel.	+	3	-	-
Herbaceous perennials					
13	<i>Acroptilon repens</i> (L.) DC.	+	-	+	-
14	<i>Allium borszczowii</i> Regel	-	-	-	+
15	<i>Anabasis brachiata</i> Fisch.&C.A. Mey. ex Kar. &Kir.	-	+	-	+
16	<i>Capparis spinosa</i> L.	+	+	+	-
17	<i>Cistanche salsa</i> (C.A. Mey.) Beck	-	+	-	-

18	<i>Crambe edentula</i> Fisch.&C.A. Mey. ex Korsh.	3	+	+	+
19	<i>Echinops dubjanskyi</i> Iljin	-	-	+	-
20	<i>Haplophyllum obtusifolium</i> (Ledeb.) Ledeb.	+	+	-	-
21	<i>Meristotropis triphylla</i> (Fisch.&C.A. Mey.) Fisch.&C.A. Mey.	-	+	-	-
22	<i>Zosima absinthifolia</i> (Vent.) Link	-	-	+	-
Annuals					
23	<i>Astragalus bakaliensis</i> Bunge	-	+	-	-
24	<i>Diptychocarpus strictus</i> (Fisch. ex M. Bieb.) Trautv.	+	+	-	-
25	<i>Eremopyrum bonaepartis</i> (Spreng.) Nevski	+	+	+	-
26	<i>Koelpinia linearis</i> Pall.	+	+	-	-
27	<i>Salsola pestifer</i> A. Nelson	+	-	-	+
28	<i>Strigosella scorpioides</i> (Bunge) Botsch.	+	+	+	-
29	<i>Ziziphora tenuior</i> L.	+	+	-	-

To assess the state of coenotic populations in various habitats, the ontogenetic structure of four *C. edentula* CP were studied. The ontogenetic structure of coenotic populations of the studied species have not been studied before. According to the classification of A. A. Uranov and O. V. Smirnova (1969), the studied coenopopulations of *C. edentula* are normal, but incomplete. According to the peculiarities of the biology of the species, the characteristic ontogenetic spectrum for *C. edentula* should be centered due to an increase in the life span of individuals in the mature generative state and poor seed renewal. The studies of the ontogenetic structure of the studied coenopopulations revealed two types of spectrum: left-sided (CP 1, 2, and 3) and right-sided (CP 4). The ontogenetic spectra of the CP do not coincide with the characteristic one.

The absolute maximum in CP 2 (50%) and 3 (31.8%) falls on the young generative fraction. Such a variant of the ontogenetic spectrum is formed with the longest duration of development of individuals in a given age state, the least elimination of them and difficult seed germination. The examined CP grow in a dry say in the shade under a cliff. The absence of juvenile and immature

individuals in CP 2 is the result of irregular seed renewal. This is due to the environmental conditions of the habitat (with the nature and humidity of the substrate and fluctuations in weather conditions). Autumn-winter-spring precipitation easily wash out the seeds from the scree and, thus, prevent the widespread dispersal of plants. In addition, cliff collapses often destroy young individuals. The extreme dryness of the climate and the persistence of strong winds create extremely unfavorable conditions. Due to difficulties in water supply, individuals of different age states of the studied species are forced to quickly move from the virginal period to the generative one. The onset of the period of forced rest is accelerated. During the growing season, new seedlings appear both vegetative and by seed. But in most cases, they do not live up to the generative or senile periods. Their individuals die off in different age states and periods of a larger life cycle (Shalpikov, 2014). The absence of sub-senile and senile individuals indicates the successive state of CP 1, 2, 4. Significant fluctuations in CP 3 of sub-senile age groups are the response of plants to extreme environmental conditions (figure 2.1.).

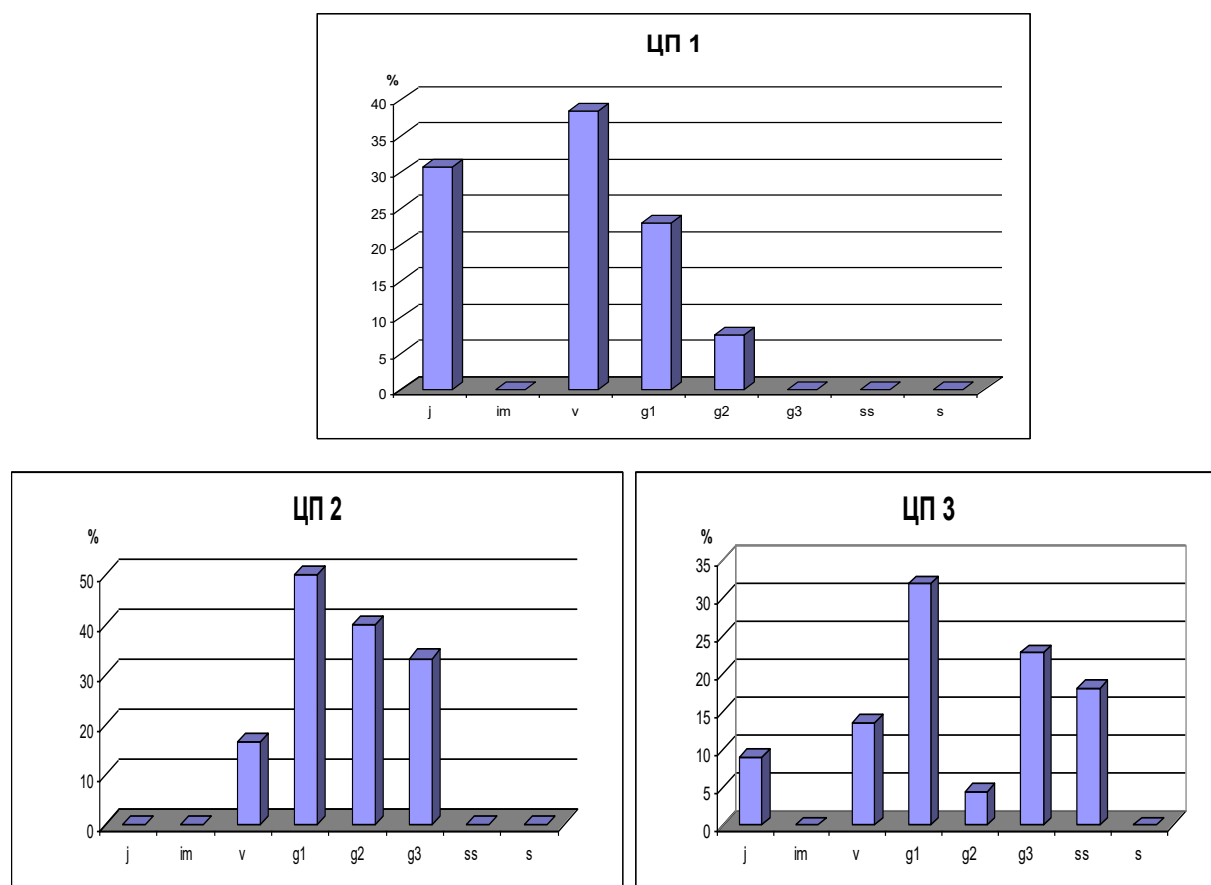


Figure 2.1. - Left-sided ontogenetic spectrum *Crambe edentula* .

In CPU 4, individuals of the old generative state accumulate (40%). This variant of the spectrum is formed in a more open area and is more provided with sunlight throughout the day. This is the response of individuals to extreme conditions, in which the old generative plants slow

down the life processes, and the young fraction of plants, on the contrary, accelerates (figure 2.2.).

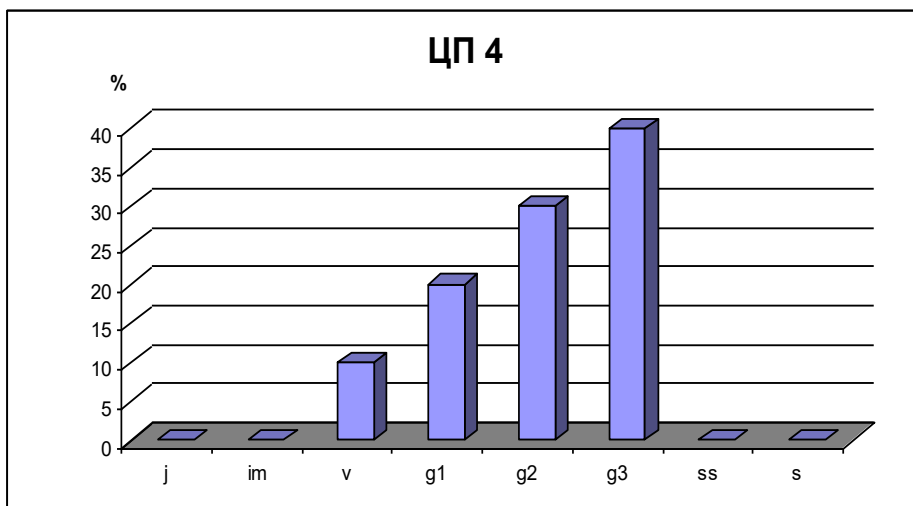


Figure 2.2. - Right-sided ontogenetic spectrum *Crambe edentula*.

Here, too, there are no seedlings. Zero undergrowth values are most likely due to soil erosion. A low proportion of generative individuals is associated with a rapid rate of development and transition to the next stage of development.

The first coenopopulation of *Crambe edentula*, based on the delta-omega ratio, is estimated as young ($\Delta = 0.15$; $\omega = 0.44$), the second – as maturing ($\Delta = 0.32$; $\omega = 0.79$), the third – as a transition ($\Delta = 0.45$; $\omega = 0.61$), and the fourth – as mature ($\Delta = 0.50$; $\omega = 0.81$) (figure 2.3.).

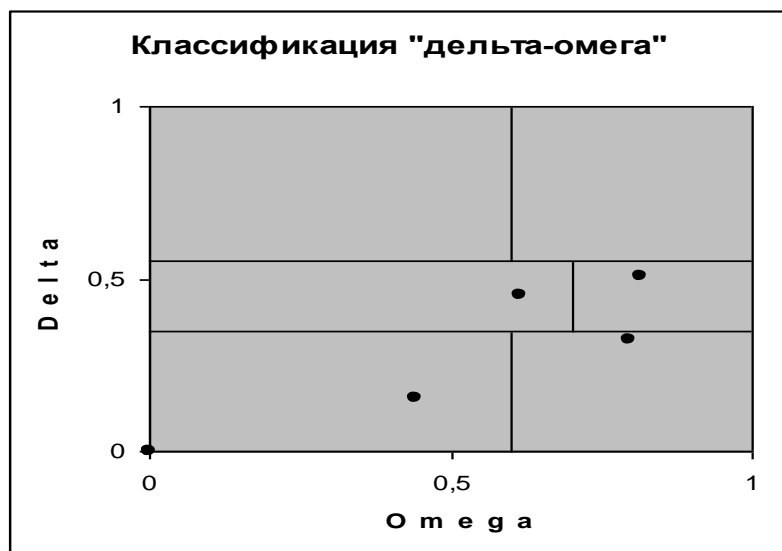


Figure 2.3. - Types of *Crambe edentula* coenopopulations

Conclusion. Thus, the studied coenopopulations of *Crambe edentula* are normal, but incomplete. The ontogenetic spectra of specific coenopopulations are left-sided and right-sided. The ontogenetic spectrum of coenopopulations does not correspond to the characteristic one and does not reflect the biological characteristics of individuals of this species. The ontogenetic

structure of the species is related to the ecological and coenotic conditions of growth and fluctuations in weather conditions. *C. edentula* can be considered a threatened species, since all the studied coenopopulations are incomplete, due to the lack of a fraction of young individuals. This is also evidenced by the types of coenopopulations that are evaluated as young, mature, transitional, and mature.

The studied species is recommended for inclusion in the Red Book of the Republic of Uzbekistan. The total area of the populations is no more than 6 hectares. The number of populations within the studied coenopopulations does not exceed 500 individuals.

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