

# Phytocenological description of populations of rare species of genus *Crambe* L. in Crimea

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**Olga Mykhailova\***

Botanical Garden of  
Taurida National  
V. I. Vernadsky University

The author considers it is important to study eight rare species of *Crambe* L. (*Brassicaceae*) because they are listed in the Red Data Book of Ukraine, *Cr. koktebelica* (Junge) N. Busch – in the Bern Convention, *Cr. mitridatis* Juz. – in the European Red List. Since there were little data on these species, the aim of the study was to obtain new information about the state of coenopopulations of four species: *Cr. maritima* L., *Cr. koktebelica*, *Cr. tataria* Sebeok., *Cr. mitridatis* in the Crimea and about the characteristics of their plant communities.

The material for the study was coenopopulations of these species and plant communities. The range of species was given according to the Vascular plants of Ukraine. The study of distribution was conducted by the route-field method. To determine the main characteristics of coenopopulations the technique developed by Rabotnov was used. Geobotanical description was done according to the technique described by Shennikov.

The article presents the data of 2010–2012. In the Crimea there were found five coenopopulations of *Cr. maritima*, four coenopopulations of *Cr. koktebelica*, two coenopopulations of *Cr. tataria* and *Cr. mitridatis*. Plant communities were analyzed on the floristic composition and biomorphic structure. New data about the size and structure of populations are presented.

During the study the location and area of coenopopulations of four species of *Crambe* were found. Given the new data, the author finds it impossible to consider *Cr. koktebelica* local endemic in south-eastern Crimea. It was proved that *Cr. maritima*, *Cr. mitridatis* and *Cr. koktebelica* exhibit coenophobic properties. Plant communities have several features in common: poor floristic composition; the most numerous families are *Asteraceae* and *Poaceae*; the prevalence of heliophytes xeromesophytes herbaceous perennials. Protection of areas with rare species was recommended.

**Key words:** coenopopulation, phytocenosis, rare species

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\* Corresponding author. E-mail: eola\_tseza@mail.ru

## INTRODUCTION

To assess the degree of threat of species extinction it is important to accumulate data on their distribution, size and population structure, plant communities with rare species. The study of rare species has become one of the priorities of modern botany, however, as shown in the latest edition of the Red Data Book of Ukraine (hereinafter the RDBU) (Diduh, 2009), not all of them have a complete characterization. Among them, eight species of *Crambe* L. (family *Brassicaceae*). For all species in the RDBU, the need to monitor the status of populations was highlighted and it was recommended to clarify their distribution. It is noteworthy that four species are endemic to Crimean Peninsula. Particularly relevant is the observation of the local endemic which are *Cr. koktebelica* (Junge) N. Busch (known only from the Kara-Dag Nature Reserve and Koktebel valley) and *Cr. mitridatis* Juz. (Mount Opuk, Tract Dzhangul, Kazantip Peninsula). In addition, *Cr. koktebelica* is listed in the Bern Convention and *Cr. mitridatis* – in the European Red List of Globally Threatened Animals and Plants.

Thus, the purpose of the study was to obtain new information about the state of coenopopulations of four species: *Crambe maritima* L., *Cr. koktebelica*, *Cr. tataria* Sebeok., *Cr. mitridatis* in the Crimea and about the characteristics of plant communities. In this regard the following objectives were set:

1. To identify the location and the limits of distribution of coenopopulations of these species.
2. To determine the size and density of the population, their age range.
3. To study the spatial structure of *Crambe* populations.
4. To describe floristic composition and biomorphic structure of plant communities in which they grow.

## MATERIALS AND METHODS

The material for the study was coenopopulations of four species of genus *Crambe*: *Cr. maritima*,

*Cr. koktebelica*, *Cr. tataria*, *Cr. mitridatis* which are mainly located in the eastern part of the Crimean Peninsula. Another subject of the study was plant communities in which they grow. The range of species is given according to the Vascular plants of Ukraine (Mosyakin, Fedoronchuk, 1999). Search of coenopopulations and the study of their distribution were conducted by the route-field method during twenty-three multi-day trips in 2010–2012, as a result there were surveyed the entire coastline of the Black Sea from Feodosiya to Koktebel village, Mount Tepe Oba, range of the Greater and Lesser Enishar, the northern coast of the Kerch Peninsula, the vicinity of Schelkino and Lenino towns, Opuk Nature Reserve and the surroundings, shore of Lake Donuzlav, the environs of Chernomorskoe town, the southern coast from village to village Rybachye Privetnoye, towns Novyi Svet, Sudak and the neighbourhood.

To determine the size and density of coenopopulations within each of them 10 plots measuring 1 sq. m. were laid. Age spectrum and phytocenosis composition were analyzed by the technique developed by Rabotnov (Rabotnov, 1978). Geobotanical description of phytocenoses, in which the studied species grow, was also given. Definition of projective cover of grass was conducted by the technique of Ramensky, determination of occurrence was carried out by the technique created by Raunkier (Shennikov, 1964). Biomorphic description was listed according to Biological flora of Crimea (Golubev, 1996). In the phytocenosis classification the physiognomic (dominant) system was used.

## RESULTS

In the Crimea, five coenopopulations of *Cr. maritima* which are located along the coast of the Black Sea and Azov Sea were found (Fig. 1).

During the reporting period observations were made on two coenopopulations. The plants of the studied species were located on Cape Elias and in Bay Tihaya. They occupy a narrow coastal strip with the width from 0.5 to 2 m, on



Fig. 1. Arrangement of *Cr. maritima* coenopopulations

the border of gravel or sandy beach and eroded clay slopes. The length of coenopopulations is 0.8 and 1.1 km. These areas have a relatively poor floristic composition and very sparse vegetation, projective cover of grass does not exceed 63%. In some areas it may increase significantly due to formation of thickets cereals such as *Elytrigia trichophora* (Link) Nevski. *Cr. maritima* grows in the community of *Calciketo euxinae*, but can also participate as a dominant (Cape Elias).

Floristic diversity of plant communities is not great, it varies from 14 to 24 species. In both communities, the most numerous are families *Asteraceae*, *Brassicaceae* and *Poaceae*. In addition to the studied species, the plant communities may contain other species included into the RDBU: *Cr. koktebelica* and *Isatis littoralis* Steven ex DC, the last is listed in the European Red List.

Most of the species involved in the phytocenosis are herbs, mostly perennial polycarpous (up to 71.4% of the total number of species in the community). Shrubs are noticed occasionally. Ecobiomorphic composition varies mar-

ginally, most of the species are heliophytes. With respect to moisture, as in the entire flora of the region, xeromesophyte group dominates. Euxerophytes, mesoxerophytes can also occur in small numbers.

In 2011 at Cape Elias the quantity of *Cr. maritima* coenopopulations was 147 individuals, including 68 generative and 79 vegetative plants. It is slightly more than in 2012: 132 individuals, 50 generative and 72 vegetative plants. The number of individuals was given without seedlings, because seedlings of various species of *Crambe* morphologically are very similar. In the field conditions it is difficult to distinguish them apart, given that the areas of *Cr. maritima* and *Cr. koktebelica* overlap. Group senile individuals were not fixed, because as yet there is not any system of qualitative features that allows us to differentiate individuals of this age. Density is 0.15 plants in sq. m. Plants are not uniformly spread, they form clean beds (up to 5 individuals per 1 sq. m) or are sporadically found among *Elytrigia trichophora* and *Senecio vernalis* Waldst. & Kit. Apparently, irregularity of spatial structure is associated with inter-



Fig. 2. Schematic layout of coenopopulations *Cr. koktebelica*

species relationships since the number of cramboid plants increases in places with sparse vegetation. In Bay Tihaya, coenopopulation has a smaller number of individuals – 57, 33 are generative and 24 – vegetative (according to data of 2011). Spatial distribution of individuals is uniform, which is probably due to a relatively small variation of density in the grass cover in the community. Density is less than in the above phytocenosis *Cr. maritimae* – 0.05 plants per sq. m.

In the Crimea there were found four coenopopulations of *Cr. koktebelica*, three of which are located along Koktebel Bay, but, unlike the previous species, they expand in more locations than the coastal strip (Fig. 2). They are on scree, clayey and stony slopes, rising to 100 meters above the sea level. Another coenopopulation located along the coast of Lake Donuzlav occupies a narrow coastal strip (width from 2 to 5 meters) along the dam and rocky slopes.

One of coenopopulations is located at the foot of Mount Djan Kutaran and covers an area of about 300 square meters. This area is

with a quite abundant vegetation cover of up to 70%. The part of the investigated species is  $23.7 \pm 6.2\%$  coverage. Phytocenosis *Anisantheto tectorumae-Artemisiosum caucasici* involving this species was described by us earlier.

The size of coenopopulations of *Cr. koktebelica* for the reporting period was strongly reduced. In 2011, we recorded 54 generative and 61 vegetative individuals. In 2012, the total population was 74 individuals, including 27 generative. Due to the fact that the species are monocarpic and die after flowering, there are no senile individuals. The spatial distribution of plants is contagious, the density is 0.4 per sq. m, but in some places rises to four individuals per sq. m. The highest density is observed in the thinning of vegetation, on exposed areas of talus slope.

On Crimean Peninsula *Cr. tataria* was discovered in two locations: Mount Djan Kutaran, at an altitude of 130 meters above the sea level, in phytocenosis *Brometo squarossae-Aegilopsum triunciali*; and in the steppe, in the vicini-



Fig. 3. Schematic layout of coenopopulations *Cr. tataria*

ty of village Lenino, in community of *Stipeto capillatae-Festucosum rupicolii* (Fig. 3).

Both coenopopulations have a small area (100 sq. m.) and a small number of individuals. On Mount Djan Kutoran we found 12 plants, of which three were generative, near village Lenino – seven plants, of which four were generative. In both areas the vegetation is not so thinned – projective cover of grass sometimes exceeds 100%. In contrast to the previous communities, these have a richer floristic composition – up to 55 species. The most widely represented families are *Asteraceae* and *Poaceae*. It should be noted that five endemic species were discovered in phytocenosis on Mount Djan Kutoran, two of which are included in the RDBU – *Salvia scabiosifolia* Lam., *Astracantha arnacantha* (M. Bieb.) Podlech. As in the previous cenoses, *Isatis littoralis* occurs. Perennial plants dominate in the community, the share of semishrubs is increased. Sporadic shrubs occur. With respect to moisture, in the plant communities xeromesophytes dominate, mesoxerophytes percentage is higher. Helio-

phytes dominate as in the previously described communities.

Coenopopulations *Cr. mitridatis* were found on Mount Opuk rocks, on the rocky slopes of the coast of the Azov Sea, near village Schelkino (Fig. 4). Coenopopulation on Mount Opuk occupies small areas of rocky cliffs to the sea, southern exposure, a total area of 400 sq. m. In 2011 coenopopulation was composed of 51 generative and 33 vegetative plants. The location of plants in the phytocenosis depends on the density of grass cover, i. e. the higher it is, the less *Crambe* can be found. On a monolithic rock site pure thickets occur.

Floristic diversity of phytocenosis is not great – 22 species. The dominant species in the community is *Anisantha tectorum* (L.) Nevski. By number of species the most abundant is family *Asteraceae*.

In phytocenosis most species are herbs, mostly perennial polycarpous, as in earlier described communities. Biomorphic composition is typical for petrophytic vegetation, most species are xeromesophytes, heliophytes.



Fig. 4. Schematic layout of coenopopulations *Crambe mitridatis*

## DISCUSSION

Recent data collected about the ecology and biology of the studied four species were analyzed and summarized in the RDBU, 2009. Over three years of research we managed to get data which was absent there: the spatial distribution of plants in the population of the studied species, the floristic and biomorphic composition of plant communities with their participation, for *Cr. mitridatis* and *Cr. koktebelica* – about plant communities. For the other two species we described new communities that are not listed in the Red Book. For *Cr. maritima* there were indicated only *Cakiletea maritimae* and *Ammophiletea*, and we described the community in which *Cr. maritima* dominates. In the southern part of the area *Cr. tataria* was indicated in *Centaureo carbonati-Koelerion talievii* community, however, we have described the coenopopulations of this plant in communities *Brometo squarossae-Aegilopsosum triunciali* and *Stipeto capillatae-Festucosum rupicolii*.

The data on the distribution of these species fall within stated ranges, except for *Cr. koktebelica*, which has been found by us on the shores of Lake Donuzlav. In the RDBU this species is indicated as a narrow endemic plant in the south-eastern Crimea. However, a number of other investigators (Rubtsov, 1972; Vul'f, 1947) suggest finding it on Tarkhankut Peninsula, Kazantip Peninsula and in the Caucasus Mountains. Thus this species cannot be considered as local endemic. *Cr. tataria* was indicated only for the steppe, and by us and other investigators (Belyanina, Shatko, 1998) the species has been found in the steppe slopes of the eastern end of the Crimean Mountains.

Furthermore, we have specified the number of individuals in the populations of *Cr. mitridatis* and *Cr. maritima*. In the RDBU it was shown that they grow in small groups, while we have described a fairly large coenopopulation of more than 80 plants.

## CONCLUSIONS

1. As a result, we found the location and size of four species of coenopopulations *Crambe*. Regarding finding location *Cr. koktebelica* along Lake Donuzlav, we think it impossible to consider this species as the local endemic in the south-eastern Crimea.

2. The obtained data on the number and structure of coenopopulations are only primary, monitoring should be continued in order to identify dynamics. We found that generative and vegetative plants are present in coenopopulations of all four species. For biennial and perennial monocarpic plants age spectrum described above indicates the stability of coenopopulations.

3. The study of the spatial distribution of individuals showed that the number of plants *Cr. maritima*, *Cr. mitridatis* and *Cr. koktebelica* increases with the decrease of projective cover of grass in the plant community, i. e. they exhibit coenophobic properties, except *Cr. tataria* which does not show such properties.

4. Phytocenosis with the studied species has a number of features in common: poor floristic composition, among the leaders in the number of species are families *Asteraceae* and *Poaceae*, which is typical for the whole flora of the region, in some cases, increasing the role of family *Brassicaceae*; the prevalence of heliophytes xeromesophytes herbaceous perennials. Greater biomorphological diversity was observed in phytocenosis *Brometo squarrosae-Aegilopsosum triunciali*. In the studied plant communities on Mount Djan Kutaran we found four species listed in the RDBU, one species is included in the RDBU and the European Red List, which certainly increases the importance of this area for the conservation of rare species. In phytocenosis near village Schelkino *Stipa capillatae* which is included in the RDBU is one of dominant. Protection areas with rare species are recommended.

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## Olga Mykhailova

### FITOCENOLOGINIS RETŲ CRAMBE L. GENTIES RŪŠIŲ POPULIACIJŲ KRYME APIBŪDINIMAS

#### Santrauka

Svarbu ištirti aštuonias retas *Crambe* L. (*Brassicaceae*) genties rūšis, nes jos įtrauktos į Ukrainos raudonąją knygą, *Cr. koktebelica* (Junge) N. Busch – į Berno konvenciją, *Cr. mitridatis* Juz. – į Europos raudonąjį sąrašą. Kadangi apie šias rūšis yra nedaug duomenų, tyrimo tikslas buvo aptikti naują informaciją apie keturių ksenopopuliacijų – *Cr. Maritima* L., *Cr. koktebelica*, *Cr. tataria* Sebeok., *Cr. Mitridatis* – Kryme būklę ir augalų bendrijų charakteristiką. Tyrimo medžiaga – šių rūšių ksenopopuliacijos ir augalų bendrijos. Rūšių paplitimas nustatytas pagal Ukrainos induočius augalus. Pasiskirstymo tyrimas atliktas pagal kelio-lauko metodą. Pagrindinės ksenopopuliacijų charakteristikos nustatytos Rabotnov sukurtu metodu, geobotaninis aprašymas atliktas remiantis

Shennikov metodu. Straipsnyje pateikiami 2010–2012 metų duomenys. Kryme rastos penkios *Cr. maritima*, keturios *Cr. koktebelica*, dvi *Cr. tataria* ir *Cr. mitridatis* ksenopopuliacijos. Augalų bendrijos analizuotos pagal floristinę sudėtį ir biomorfinę struktūrą. Pateikiami nauji populiacijų dydžio ir struktūros duomenys. Tiriant ksenopopuliacijų augavietes ir jų plotus rastos keturios *Crambe* rūšys. Nustatyta, kad *Cr. koktebelica* negalima laikyti vietine, pietryčių Krymui būdinga rūšimi. Įrodyta, kad *Cr. maritima*, *Cr. mitridatis* ir *Cr. koktebelica* yra nepakančios kitai aplinkai. Augalų bendrijos turi keletą bendrų bruožų: menka floristinė sudėtis, gausiausios *Asteraceae* ir *Poaceae* šeimos, helofitų, kseromezofitų žolinių daugiamečių augalų paplitimas. Rekomenduojama retų rūšių augaviečių apsauga.

**Raktažodžiai:** ksenopopuliacija, fitocenozė, retos rūšys