

Effect of Gas Extraction on the State of *Euphorbia sclerocyathium*

Korov.et M.Pop. Population

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Abstract: This article cites the results of a three-year study of the modern state of a rare Central Asian species, *Euphorbia sclerocyathium* Korovin et Popov, the population of which is affected by gas extraction. The age composition and biometrical values of individuals were revealed to assess the state of populations of this species. The analysis of the obtained data shows that the ontogenetic structure of the species in Shahbahta is not complete as senile individuals are absent. However, in most cases biometric values are positive. Based on the aggregation of ontogenetic structures and biometric values, the vitality of the species in this cenopopulation is evaluated as moderate. It is noteworthy that the prevalence of a pre-generative age state and young generative individuals in a population is connected with plants supporting their population through vegetative breeding (*i.e.* the availability of rhizome).

Key Words: Cenopopulation, Ontogenetic structures, Species vitality, Ustyurt Plateau

1. Introduction

The Uzbek part of Ustyurt occupies the area of more than 7.2 million ha and is an elevated plateau occupying the northern part of the Aral-Caspian watershed. The Ustyurt escarpment in the east is formed by a former western coast of the Aral Sea. The extreme conditions resulting from the drying up of the Aral Sea have brought about the deterioration of the ecological complex of the Ustyurt, which significantly affected the natural vegetation.

Plant landscapes in Ustyurt have been forming owing to plants of a primary stony desert and heterogeneous flora (Popov, 1923), the fragments of which have been preserved in a modern plant cover in the form of rare species. Korovin (1943) assigned *Salsola chiwensis*, *Sisymbrium subspinescens*, *Cleome noeana*, *Seseli tenuifolium*, *S. cuneifolium*, *Zygophyllum macropterum*, *Z. brachypterum*, *Z. eichwaldii* and *Z. turcomanicum* to this group. According to this author, 402 plant species grow there, of which 19.7% belong to the family *Chenopodiaceae*. The most authentic data on the flora of the studied region are available in the work of Allaniyazov (Saribaev, 1983). In this work, the author cites 406 plant species of 208 genera belonging to 46 families.

While analyzing the flora of the entire Ustyurt, Saribaev (1987) established that the flora of this region is comprised 724 species of 295 genera and 60 families. According to Allaniyazov (1995), the families *Chenopodiaceae*, *Asteraceae*, *Brassicaceae*, *Poaceae* and *Fabaceae* prevail by their specific

diversity in Ustyurt. In the plant cover perennial herbs prevail, followed by annual herbs, semi-shrubs, biennial herbs, trees and shrubs.

The numbers of rare and endemic species in the plant cover of the Ustyurt Plateau is low. These include *Climacoptera ptiloptera* U.P.Pratov, *Euphorbia sclerocyathium* Korovin et Popov, *Malacocarpus crithmifolius* (Retz.) C.F.May., *Atriplex pratovii* Sukhor., *Crambe edentula* Fish. et Mey. and *Salsola chiwensis* Popov, growing in grey-brown gypsum bearing and saline soils of Ustyurt. The eastern border of the range of the latter two species to some extent overlaps the Kyzylkum desert. Besides, not far from the eastern escarpment of the plateau in 2010 we found and described *Allium ravenii* F.O.Khass., Shomuradov and Kadyrov from the subgenus *Allium* L. (Khassanov *et al.*, 2010). Four species of vascular plants from this region were included into the last edition of the Red Data Book of the Republic of Uzbekistan, namely, *Malacocarpus crithmifolius* (Retz.) C.F.May., *Climacoptera ptiloptera* U.P.Pratov, *Salsola chiwensis* Popov and *Euphorbia sclerocyathium* Korovin et Popov, to which the present article is devoted.

2. Materials and Methods

Euphorbia sclerocyathium Korovin et Popov belongs to the *Euphorbiaceae* family. It grows on stony and sandy soils, as well as on solonetz soils, saline grey-brown, stony and sandy soils. Outside Uzbekistan it also grows in Turkmenistan. To assess the cenopopulation of *Euphorbia*

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sclerocyathium on the south of Ustyurt Plateau four sites were set up in which the species composition was identified and projected cover of isolated sites was determined.

We used cenopopulation methods (Vorontschova *et al.*, 1976) to assess the state of *Euphorbia sclerocyathium*, included to the Red Data Book of Uzbekistan under the status 2. As well as dominants and subdominants of plant communities, we took into account: ontogenetic structures of species (juvenile - j, immature - i, adult virgin - v, young generative - g1, mid-aged generative - g2, old generative - g3 and senile individuals - s); height of the shrub; length of skeleton shoots; length of annual shoots; number of annual vegetative shoots; and percentage of perennial shoots. Vitality of studied species as described by Cheremushkina (2004) is divided into three categories: low, average and high.

3. Results and Discussion

Along with the alarming ecological condition connected with the drying Aral Sea, gas exploration has been intensively carried out by various oil-gas extracting companies in the last several years which has negatively affected the vital state of both the dominants and rare endangered species in Ustyurt Plateau (Shomurodov, 2012; Bykova *et al.*, 2012). In this article we discuss the modern state of one of the rare Ustyurt species, *Euphorbia sclerocyathium*. In the Uzbek part of Ustyurt, *Euphorbia sclerocyathium* has been known from three areas, namely, the vicinity of the well Tabansu, Village Karyn-Aruk and Village Barsakelmes. During the field trips conducted in 2011-2013 we have found another population of this species in the south of Ustyurt, not far from the Turkmenistan border.

The relief of the described area is uneven. The soil is gypsum bearing and speckled. The plant cover is sparse; the edificatory is *Anabasis salsa*. This most widespread dominant in Ustyurt shows an exceptional ecological plasticity growing on grey-brown and takyrs soils varying in levels of salinity. It is noteworthy that the studied population is 7-10 km from the currently exploited gas well. Net-like roads have emerged around the wells; many of them emerged in areas of *E. sclerocyathium* growth. These roads show a dubious effect on the vitality of plants of adjoining areas. First, heavy trucks destroy all the vegetation with their wheels. The roads become constantly deeper thus forming deep ruts, which makes the use of these roads difficult. Thus, new roads emerge in parallel with the old ones. Sands gradually fill these ruts and owing to a favorable water regime they become overgrown with annual herbs to be followed by perennial ones. As a result, a column of as many as 30 individuals of *E. sclerocyathium* is formed in these ruts. Unfortunately, 3-4

Table 1. The list of species and projected cover of communities with *Euphorbia sclerocyathium*.

Plant community	Motley grass - <i>Salsola arbuscula</i>	<i>Salsola orientalis</i> - <i>Haloxylon aphyllum</i>	<i>Caragana grandiflora</i> - <i>Haloxylon aphyllum</i>	Motley grass - <i>Salsola orientalis</i>
Coordinates	N 42°36.592' E 056°16.964'	N 42°36.604' E 056°16.982'	N 42°36.812' E 56°17.913'	N 42°36.631' E 056°17.147'
Projected cover, %	12	5	10	20
Areas occupied by trees, %	1	1	5	1
Shrubs, %	9	2	3	6
Semi-shrubs, %	-	2	1	8
Motley grass, %	2	-	1	5
List of species				
Trees				
<i>Haloxylon aphyllum</i>	1	1	-	1
Shrubs				
<i>Astragalus scleroxylon</i>	2	-	+	+
<i>Atraphaxis spinosa</i>	-	-	-	+
<i>Caragana grandiflora</i>	-	-	3	1
<i>Calligonum junceum</i>	2	-	-	-
<i>Convolvulus fruticosus</i>	-	-	-	2
<i>Halocnemum strobilaceum</i>	-	1	-	-
<i>Lycium ruthenicum</i>	-	-	-	1
<i>Salsola arbuscula</i>	5	1	-	2
Semi-shrubs				
<i>Salsola orientalis</i>	1	2	-	4
<i>Limonium suffruticosum</i>	+	-	+	2
<i>Artemisia diffusa</i>	-	-	1	2
Perennial plants				
<i>Anabasis brachiata</i>	+	-	+	-
<i>Aeluropus litoralis</i>	-	-	-	+
<i>Euphorbia sclerocyathium</i>	1	+	+	+
<i>Haplophyllum obtusifolium</i>	-	-	+	+
<i>Jurinea multiloba</i>	-	-	+	2
<i>Onosma stamineum</i>	-	-	-	+
<i>Taktajianantha pusilla</i>	-	-	-	+
<i>Stipa caspica</i>	-	-	+	+
<i>Zygophyllum turcomanicum</i>	-	-	-	+
Annual plants				
<i>Climacoptera lanata</i>	+	-	-	-
<i>E. orientale</i>	-	+	-	1
<i>Euphorbia inderiensis</i>	+	-	+	-
<i>Lactuca undilata</i>	+	-	-	-
<i>Senecio subdentatus</i>	-	-	-	+

years later these roads are again used by heavy trucks and all the vegetation including the young population of the studied species is again destroyed. Second, the studies showed that salt-dust particles raised by trucks adversely affected the growth and development of plants. The latest studies have documented that the radius of the effect of these salt-dust particles reaches as far as 400-500 m.

The botanical composition of the described sites is not big. From 6 to 26 species of vascular plants were recorded in these sites. The projected cover constitutes 5.0-20.0%. Shrubs prevail in the plant cover of these sites, followed by semi-shrubs, motley grass and trees (Table 1). A similar

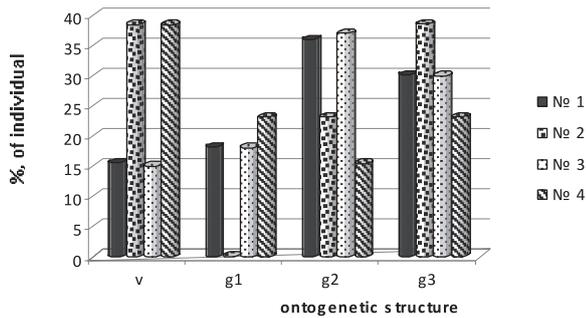


Fig. 1. Age states of *Euphorbia sclerocyathium* in studied cenopopulations (No 1-4).

trend is typical for heterogeneous plants throughout Ustyurt. In the first site, where the dominant in plant cover was *Salsola arbuscula*, we recorded 33 individuals of *E. sclerocyathium*, of which 84.3% were generative and 15.6% virgin. Of generative plants, mid-aged individuals (g2) prevailed -35.8%; plants at the post-senile age (g3) constituted 30.0%, while g1 were only 19.0%.

The length of shoots in virgin individuals reached 4.5-10.8, but was 17.2-32 cm in generative ones. The ratio of generative shoots to vegetative ones was 32.4%. In the described site there were no dried or partly dried plants. By the aggregate of these values, the vitality of the species in this cenosis was assessed as moderate. In the second site we recorded six species; the projected plant cover is below 5%, which is connected with the effect of the motor road crossing the center of this site. The vitality of the dominants and *E. sclerocyathium* was low in this site. We recorded 13 individuals of the species, of which v constituted 38.5%, g1 - 23.1% and g3 -38.5%. The height of the plants ranged within 7 to 21 cm. In the described site no dried plants were recorded; however, dried shoots were recorded in some young and old generative individuals. The prevalence of old generative plants, presence of dried shoots and absence of senile plants suggested a low vitality of this species in the given cenopopulation.

Another site was set up along a dried up stream in the southern slope. The edificatory of the plant cover were *Haloxylon aphyllum* and *Caragana grandiflora*. The species composition of the community consists of thirteen plant species, where the herbs constitute 54.0% of the total number of plant species. Of 25 individuals recorded in this cenopopulation, 15.0% are v, while g1, g2 and 3 constitute 19.1, 35.9 and 30.0%, respectively (Fig. 1). Senile plants were absent in this site. The height of the above-soil part is recorded within 5.1-27.0 cm depending on the ontogenetic state of the individuals. Despite relatively positive biometric indices and ontogenetic structures in this site, the share of dry shoots is high, which enables the assessment of the vitality as

moderate. In the last site we recorded 13 individuals, of which 4 were immature (30.7%), 1 adult virgin (7.6%), g1 constituted 23.0%; g2, 15.3% and g3, 23.0%. The prevalence of young and absence of dried individuals suggests the moderate vital cenopopulation.

4. Conclusion

The analysis of the vital state of *E. sclerocyathium* in four isolated sites situated not far from wells and roads showed that it was mostly assessed as average. Practically in all studied sites, plants at the senile age were absent, which suggests a high anthropogenic effect on vegetation. The portion of suppressed individuals is insignificant, while the ratio of dry shoots to the assimilating ones in some cases reached 46.1%. In general, based on the results obtained from four sites, we assess the vitality of *E. sclerocyathium* in this population as average. However, it should be noted that these plants propagate by vegetative mean (the presence of roots) which supports their population. Under the intensive anthropogenic pressure on the plant cover in the studied area, which is currently observed, this population in the near future will be on the brink of extinction. To conserve the Shahpahta population of this species it is recommended to significantly reduce the negative effect by constructing asphalt roads and regulating the traffic of heavy trucks.

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