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The current state of the coenopopulation of *Capparis spinosa* L. (Capparaceae) in the semi-desert of Uzbekistan

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Abstract

The article is devoted to the assessment of the current state of the ruderal, medicinal, food, honey-bearing, forage plant *Capparis spinosa* L. in the semi-desert (lower foothills) in the Tashkent, Namangan and Jizzakh regions of the Republic of Uzbekistan. Studies have shown that the ecological and cenotic conditions in these areas of the studied coenopopulations are normal, mostly full-fledged, except for the Jizzakh regions. The duration of ontogenesis in natural conditions lasts about 30 years. Coenopopulations in the 4 studied plant communities are young and middle-aged. The growing season of *C. spinosa* in the semi-desert conditions of Uzbekistan lasts 7 months-from April to October. Self-maintenance of the coenopopulation occurs due to seed renewal and vegetative reproduction.

1. Introduction

In recent years, with the development of desert and semi-desert zones, the influence of anthropogenic factors has sharply increased (construction of settlements, roads and railways, gas pipelines, deforestation of shrubs and semi-shrubs, collection of medicinal plants, development of rain-fed lands for agricultural crops, *etc.*) on the dynamics of landscapes, biodiversity of flora and its biological products. Many plant species are drastically reducing their distribution area, the structure is changing, and more valuable plant species are dying. In this regard, it is relevant to study poorly studied species in economic terms, including clarifying the current state of cenotic populations of promising species, such as *Capparis spinosa* L.

Currently, much attention is paid to the study of the current state of the coenopopulation of rare, endangered, promising species of the Republic of Uzbekistan. At the same time, special attention is paid to the identification of the ontogenetic structure. On this basis, ecological and phytocenotic optima of species of great importance in the preservation of their natural populations are established. In recent years, due to global climate change, noticeable changes have been observed in the structure of populations of both edificatory and rare flora elements (Abduraimov, 2017; Shomurodov, 2018; Coenopopulations of rare..., 2018).

The aim of the study was to study the current state of the coenopopulation of the economically poorly studied medicinal, forage and honey species, *C. spinosa* in the conditions of the semi-desert of Uzbekistan.

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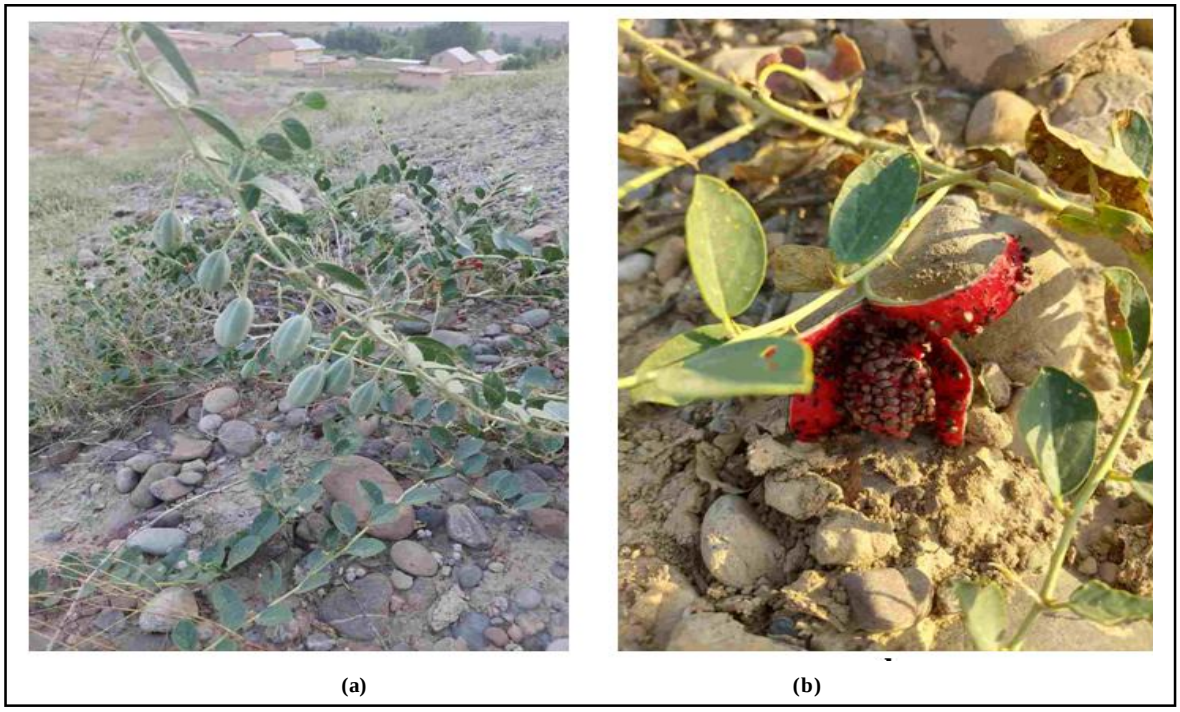
2. Materials and Methods

The object of the study is *Capparis spinosa* L., a perennial herbaceous plant from the family Capparidaceae (Figure 1, 2). A plant with creeping branched stems, up to 4 m long. The leaves are rounded, obovate, 5-6 cm long, with a small prickly tip at the tip, green, glabrous, short-stemmed. The flowers are large, 5-8 cm wide, white, pinkish when blooming. Fruits are obovate, multi-seeded, berry-shaped, fleshy, green, 2.5-5 cm long, 1.5-3.5 cm wide. The seeds are kidney-shaped, brown, dotted, with spouts. Blooms in May-June, bears fruit in June-August. The plant, both weedy and ruderal, is found along the edges of roads, along railways. Sometimes, they form whole thickets on large areas in autumn, they are eaten by sheep, camels and horses.

Figure 1: General view of *Capparis spinosa* L.

Geobotanical descriptions were carried out according to the generally accepted methodology on sites of 100 m^2 (Guidelines, 1980). Latin names of taxa are given in accordance with the international database The plant list (http://www.theplantlist.org), abundance of plants – on the Drude scale (1907): singly-sol, rarely-sp1, quite rarely-sp2, mediocre-sp3, often-cop1, very often-cop2, copiously- cop3. The coenopopulation is characterized according to the classifications of Uranov and Smirnova (1969).



(a) (b)

Figure 2: (a) Immature and (b) Mature fruits of *Capparis spinosa* L. in natural growing conditions.

C. spinosa are used in folk medicine: Medicinal remedies are prepared from its aboveground and underground organs against hemorrhoids, throat diseases, as well as for headache and toothache with rheumatism, tuberculosis, various tumors and ulcers. *C. spinosa* leaves contain about 1% rutin (Zakirov and Khudaiberganov, 1972; Toizhanov *et al*., 2016). The fruits of capers strengthen the liver, heart, lungs and spleen, and also help with goiter, diabetes, angina. The juice from the leaves has an anthelmintic effect (Khodzhimatov *et al*., 1995). In beekeeping, capers are used as a first-class honey plant and perganos. Its flowers secrete nectar in very large quantities. Especially valuable, from the point of view of beekeeping, is the duration of the flowering period-from the beginning of May to November. Paints are obtained from the roots (Khozhimatov, 2021).

In the flora of Central Asia, two genera are found in the family Capparidaceae: the genus *Capparis* L. It occurs with two species: *C. rosanowiana* B. Fedtsh, *C. spinosa* L; genus *Cleome* L. with eleven species (Khassanov, 2015). Both species of the genus *Capparis* L. are found in Uzbekistan, and 4 species of the genus *Cleome* L.

3. Results

In the period from 2021-2022, we examined four cenotic populations of *C. spinosa*, growing in different ecological and phytocenotic conditions of the semi-desert of Uzbekistan. The first coenopopulation (CP) of *Capparis* spp. was described in the Tashkent region, Parkent district (Buston village) as part of a cereal-amber-caper (*Hordeum bulbosum, Avena fatua, Poa bulbosa, Anisantha tectorum-Alhagi pseudalhagi-Capparis* spp.) community 583 m above sea level. Geographical coordinates: 41°36’31" 69°61’10". The soil of the described territory is a typical serozem. The plant community is dominated by *-Alhagi pseudalhagi* (Sp2), *Hordeum bulbosum* (Sp2), *Cousinia radians* (Sp1), *Eremodaucus lehmannii* (Sp1), *Achillea biebersteinii* (Sp1), *etc*., whose height reaches 60-80 cm and forms the first tier. Dominant-*C. spinosa* with an abundance of Sp3-Cop1 annual growth reaches 200-300 cm. The second tier of cereals is dominated by *Avena fatua* (Sp2), *Poa bulbosa* (Sp2), *Cynodon dactylon* (Sp1-Sp2), *Bromus oxyodon* (Sp1), etc. 25-40 cm in height. The projective cover of the herbage is 70-80%. Cereals are very abundant. The botanical composition of the community consists of 27 species of flowering plants, where the vast majority are perennial herbaceous plants. Around the village of Buston, capers are being destroyed. Here, the bushes have been cut down by the local population and vineyards have been created instead.

The second CPU of the studied species was isolated in the Tashkent region, the upper Chirchik district along the edges of the Kirghizaul roads and the Parkent canal as part of a yarrow-cereal-caper (*Achillea biebersteinii-Eremopyrum bonaepartis, Cynodon dactylon, Bromus oxyodon, Aegilops cylindrica -Capparis* spp.) community 572 m above sea level. The soil is gravelly serozem. Geographical coordinates: 41°34’82" 69°56’41". The dominant plant is *C. spinosa*, on one bush, there are 13-15 annual shoots, the length of which is up to 3 m, in addition, there are 40-50 immature fruits, 40-50 mature fruits, 20-30 bloomed. The diameter of the bush is

3 × 3 m. As part of the community, capers cover 40% of the soil, 30% of cereals, and the remaining 5-10%. Here, *Aegilops cylindrica, Alhagi pseudalhagi, Achillea biebersteinii* (Sp2) 60-80 cm high form the upper tier. In the lower tier of cereals, there is an abundance of Sp2. The total projective cover of the herbage is 70-80%. The species composition of the community consists of 24 plant species.

The third CP is described in the Papsky district of Namangan region on stony-gravelly soil. Geographical coordinates: 40°81'84" 70°85'62". This CP was studied in a caper-amber (*Capparis spinosa -Alhagi pseudalhagi*) community 600 m above sea level. The total projective cover of the herbage is 25-30%, the share of the studied species in it is 10%. The botanical composition of the community is relatively not rich, it consists of 17 species. Along with the dominants, *Cynodon dactylon, Artemisia sogdiana, Girgensohnia oppositiflora, Salsola sclerantha* grow in different abundance.

The next fourth CP was studied in the wormwood-caper (*Artemisia diffusa-Capparis spinosa*) community. Geographical coordinates: 40°47'29" 67°19'13". The community was described in the Jizzakh region, Farish district, 10 km west of Farish, 412 m above sea level. The soil is finely gravelly, sandy gray-brown. The total projective coverage is 30-35%. The species composition is not rich, there are only 16 species. The vegetation cover is dominated by *C. spinosa, Artemisia diffusa, A. ferganensis, Peganum harmala, Poa bulbosa, Carex pachystylis* (Table 1).

Table 1: Species composition and abundance of studied communities with the participation of *C. spinosa*

Plant communities	*Hordeum bulbosum, Avena fatua, Poa bulbosa, Anisantha tectorum- Alhagi pseudalhagi - Cappar is spinosà*	*Achillea biebersteinii-Eremopyrum bonaepartis, Cynodon dactylon, Bromus oxyodon, Aegilops cylindrica-Capparis spinosà*	*Capparis spinosa-Alhagi pseudalhagi*	*Artemisia diffusa-Capparis spinosa*	Height (cm)
Shrubbery					
Kalidium caspicum (L.) Ung.-Sternb.	-	-	Sp1	-	60-80
Semi-shrubbery					
Artemisia diffusa Krasch. ex Poljakov	-	-	-	Sp2	30-35
A. ferganensis Krasch. ex Poljakov	-	-	-	Sp1	50-60
A. sogdiana Bunge	-	-	Sp1	-	20-30
Halothamnus subaphyllus (C.A. Mey.) Botsch.	-	-	Sp1	-	40-50
Herbaceous perennials					
Achillea biebersteinii Afan.	Sp1	Sp1	-	-	60-70
A. millefolium L.	Sp1	Sol	-	-	60-65
Acroptilon repens (L.) DC.	Sp1	-	Sp1	-	30-35
Alhagi pseudalhagi (M. Bieb.) Desv. ex Wangerin	Sp2	Sp2	Sp3	-	50-60
Capparis spoinosa L.	Sp3-Cop1	Sp3-Cop1	Sp2	Cop1	200-300
Carex pachystylis J. Gay	-	-	-	Sp1	10-15
Cynodon dactylon (L.) Pers.	Sp1-Sp2	Sp2	Sp1	-	20-30
Cichorium intybus L.	Sol-Sp1	Sp1	-	-	50-60
Convolvulus arvensis L.	Sol	Sp1	Sol	-	40-60
Cousinia pseudomollis C. Winkl.	Sp1	-	-	Sp1	40-45
C. resinosa Juz.	-	-	-	Sp1	50-60
Eremodaucus lehmannii Bunge	Sp1	-	-	-	50-55
Galium pamiro-alaicum Pobed.	Sp1	Sp2	-	-	30-50
Hordeum bulbosum L.	Sp2	-	-	-	70-80
Medicago sativa L.	Sol	-	-	-	60-70

Iris songarica Schrenk	-	-	-	Sol	40-50
Ixiolirion tataricum (Pall.) Herb.	-	Sp1	-	-	15-20
Plantago lanceolata L.	Sp1	Sp1	-	-	15-20
Peganum harmala L.	-	-	-	Sp1-Sp2	20-30
Polygonum aviculare L.	Sp1	Sp1	-	-	15-20
Poa bulbosa L.	Sp2	Sp2	-	Sp1	15-25
Psoralea drupacea Bunge	Sol	-	-	-	40-50
Salvia sclarea L.	-	Sol	-	-	30-40
Solanum nigrum L.	-	Sol	-	-	40-50
Taraxacum officinale F.H. Wigg.	-	-	Sol	-	15-20
Tribulus terrestris L.	-	-	Sol	-	60-70
Trichodesma incanum (Bunge) A. DC.	-	-	-	Sol	40-45
One-two-year-olds					
Aegilops cylindrica Host	-	Sp2	-	-	50-60
Amaranthus retroflexus L.	-	-	Sp1	-	30-35
Anisantha tectorum (L.) Nevski	Sp2	Sp2	-	-	20-25
Artemisia scoparia Waldst. & Kit.	-	Sol	-	-	50-60
Avena fatua L.	Sp2	-	-	-	15-20
Bromus oxyodon Schrenk	Sp1-Sp2	Sp2	-	Sp1	20-25
Carduus albidus M. Bieb.	-	-	Sp1	-	20-30
Chenopodium album L.	-	Sol	Sp1	-	15-20
Cousinia microcarpa Boiss.	Sp1	-	-	-	40-50
C. radians Bunge	Sp1	-	-	-	40-50
Diarthron vesiculosum (Fisch. & C.A. Mey. ex Kar. & Kir.) C.A. Mey.	-	-	-	Sp1	15-20
Eremopyrum bonaepartis (Spreng.) Nevski	-	Sp2	Sol	-	10-15
Girgensohnia oppositiflora (Pall.) Fenzl	-	-	Sp1	-	15-20
Heliotropium lasiocarpum Fisch. & C.A. Mey.	-	Sol	-	Sp1	50-60
Koelpinia linearis Pall.	Sol	-	-	Sp1	10-15
Lactuca serriola L.	Sp1	-	-	-	15-20
Malva neglecta Wallr.	-	Sp1	-	-	20-25
Matricaria recutita L.	-	Sp1	-	-	10-15
Onopordum acanthium L.	Sol	-	-	-	70-80
Papaver pavoninum Schrenk	Sol	-	-	-	20-25
Portulaca oleracea L.	-	-	Sp1	-	25-30
Salsola sclerantha C.A. Mey.	-	-	Sp1	-	15-20
Sisymbrium altissimum L.	Sol	-	-	-	50-60
Strigosella africana (L.) Botsch.	-	-	-	Sp1	15-18
Taeniatherum crinitum (Schreb.) Nevski	-	-	-	Sol-Sp1	15-20
Tragopogon capitatus S.A. Nikitin	-	Sol	-	-	15-20

4. Discussion

To assess the state of cenotic populations, the ontogenetic structure of the coenopopulations of *C. spinosa* has been studied. In the scientific literature, foreign scientists mainly paid attention to the medicinal properties of the plant. In particular, in Iran, Ramezani *et al.* (2008) conducted studies on the extraction of rutin from different parts of the plant. Cao Yue-lan *et al.* (2010) found that it is a medicine for skin diseases. Husseini *et al.* (2013) effectiveness in the treatment of diabetes, Italian scientists Erdogan *et al.* (2015) determined that it is a powerful remedy against colds. Nabavi *et al.* (2016) pharmacological properties, Anwar *et al.* (2016) studied its importance in food. Uzbekistan contains data on medicinal values, the composition of macro- and microelements, introduction into culture, agrotechnical methods of cultivation, distribution in the globe, botanical and genetic features, biotechnology, *etc.* (Zakirov and Khudaiberganov, 1972; Toizhanov *et al.*, 2016; Khojimatov *et al.*, 1995; Khojimatov, 2021). The ontogenetic structure of the coenopopulation in Uzbekistan of the Ferghana region was studied by Isagaliev *et al.* (2020). It has not been studied in the widespread Namangan, Tashkent and Jizzakh regions before.

According to the classification of Uranov and Smirnova (1969), the studied coenopopulations (CP) of *C. spinosa* are normal, but incomplete. Juvenile and immature individuals are not found in CP 3, and juvenile individuals are not marked in CP 4. The studied CPUs 1, 3, 4 of the centered and CPUs 2 of the right-hand type (Figure 3).

The absence of a pregenerative fraction in CP 3, 4 is probably due to the ecological condition of the habitat with an arid climate. Another factor determining the absence of individuals of the young fraction during the years of research is the irregularity of the seed renewal of the species.

The accumulation of middle-aged generative plants in three coenopopulations is associated with the long-term development of individuals of this ontogenetic group. The renewal of capers in natural conditions is carried out by seed and vegetative means, but rather weakly. In the soil, caper seeds persist for a long time, the seeds are very hard and can sprout in a few years. Therefore, it is necessary to store seeds underground from December to March to undergo cold stratification. Low seed germination is one of the biological features of this plant. These biological conditions allow us to assume that the characteristic spectrum of coenopopulations of this species is centered. The ontogenetic spectra of CP 1, 3, 4 coincide with the characteristic one.

Centered ontogenetic spectrum: In CP, 1, 3, 4, the absolute maximum in the spectrum falls on middle-aged generative individuals (22.7-31.2%). The accumulation of mature generative individuals in these CP is associated with the long-term development of individuals of this ontogenetic group. The absence of 3, 4 young groups in the CP is due on the one hand to the irregularity of seed renewal, and on the other hand, in conditions of intensive grazing by the local population.

Right-sided ontogenetic spectrum: In CPU 2, individuals of the old generative state accumulate (33.3%). This variant in the spectrum: is formed along the Parkent channel. The low proportion of virginal and young generative individuals is associated with the rapid pace of development and transition to the next stage of development.

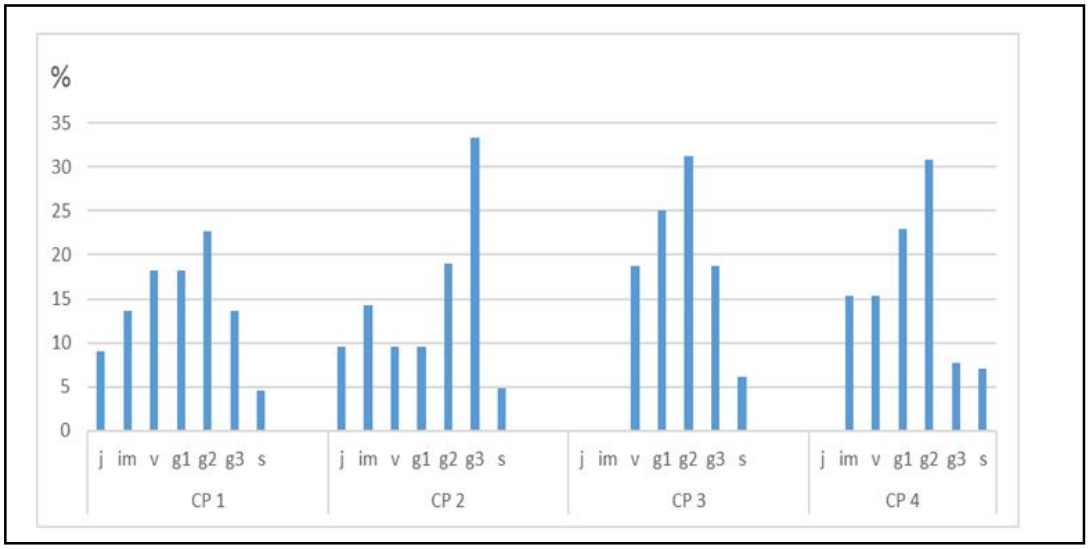


Figure 3: Ontogenetic spectra of the studied cenopopulations of *Capparis spinosà* L.

5. Conclusion

It should be noted that *C. spinosa* participates in many plant communities. Sometimes dense *Capparis* thickets are found in the places of growth. This species, in comparison with other components, has the highest competitive ability. The intensity of growth and development of *C. spinosa* in spring largely depends on meteorological conditions. Under favorable conditions, the vegetation of the plant begins in early April, blooms in early May, bears fruit in June-August. If there are no frosts, then the growing season ends in late October-November.

The versatile beneficial properties of *C. spinosa* indicate the possibility of its integrated use, first of all, as an object for the

development of empty arid territories of the republics of Central Asia, as a first-class honeybee in beekeeping, as well as oilseed, sugar-bearing, vegetable and fodder species in karakul farming.

Thus, the studied CPUs of *C. spinosa* are normal, incomplete, CPUs 1, 3, 4 centered with an absolute maximum on individuals of the middle-aged generative state. This is due to a gradual increase in the life expectancy of individuals in the generative period and the elimination of individuals in the juvenile state. The ontogenetic structure of CP 2 of the right-sided type with an absolute maximum on individuals of old generative groups. *C. spinosa* is characterized by: a seminal and vegetative method of self-maintenance of coenopopulations, a long stay in the middle-aged generative state. These biological states allow us to assume that the characteristic spectrum of coenopopulations of this species is centered. It should be noted that the ecological optimum of *C. spinosa* is located in the semi-desert zone (lower foothills) of the Tashkent region, where precipitation falls 300-400 mm per year. The soil is fine-grained, typical serozem (in the area of Bustanlyk, Parkent and Akhangaran), which indicates the favorable environment for this species. However, in recent years, the strong impact of anthropogenic factors (development of the territory, sowing of agricultural crops) has led to a reduction in the natural areas of capers. In addition, during the budding period of Namangan and Jizzakh regions, local residents collect the fruits of this plant and pickle them, and this negatively affects their natural renewal. In this regard, it is necessary to carry out nature conservation measures to preserve *Capparis spinosa*.

Conflict of interest

The authors declare no conflicts of interest relevant to this article.

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