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Structure of local populations and phytocoenotic confinement of *Elwendia persica* in Turkestan Ridge, Uzbekistan

O.S. ABDURAIMOV[1,♥], I.E. MAMATKULOVA[2], A.V. MAHMUDOV[1]
[1]Institute of Botany Academy of Sciences of the Republic of Uzbekistan. Durmon yuli 32, Tashkent 100125, Uzbekistan. Tel.: +99-893-325-24-24, ♥email: ozodbek88@bk.ru
[2]Jizzakh branch of National University of Uzbekistan named after Mirzo Ulugbek. Sh.Rashidov 259, Djizzakh 130100, Uzbekistan

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Abstract. *Abduraimov OS, Mamatkulova IE, Mahmudov AV. 2023. Structure of local populations and phytocoenotic confinement of* Elwendia persica *in Turkestan Ridge, Uzbekistan. Biodiversitas 24: 1621-1628.* The study of ecological and biological features of cenotic and food plants is not only of important general biological significance, but also serves as a basis for the science-based study of resources and the preservation of species diversity. *Elwendia persica* (Apiaceae) grows in different regions of Central Asia and has been used regularly for several centuries, especially in traditional cuisines. In particular, local residents in mountainous areas collect this plant and benefit economically. This study aimed to assess the coenopopulation and phytocoenotic confinement of *E. persica* in Turkestan ridge, Djizakh region, Uzbekistan. The study was carried out between 2018 and 2022 and the ontogenetic structure of four coenopopulations of *E. persica* was studied. Evaluation of age (Δ - delta) and efficiency (ω - omega) of coenopopulations revealed that the studied populations were classified as young (coenopopulations 1, 3, 4) and transient (coenopopulations 2). Analysis of demographic results shows that the density of individuals in the studied communities ranged 1.4-2.05 ind./m^2, whereas the ecological density was 1.64-2.73 ind./m^2. The coenopopulations had an index of recreation of 0.52-3.57 and ageing index 0 to 0.13. These indicators show that the coenopopulations are in a normal state. The state of coenopopulations was positively affected by a large amount of annual rainfall on the territory.

Keywords: *Elwendia persica,* food, local populations, medicinal, ontogenetic structure, phytocoenotic

INTRODUCTION

Medicinal and food plants are of great importance in human life. Currently, the research of medicinal and food plants and their state in nature are among the important tasks in the field of economic botany. This is because their existence and population have been largely affected by the rapid environmental and climate changes in recent decades (Delgado et al. 2020; Ovaskainen et al. 2020; Roslin et al. 2021). Such research allows us to evaluate and monitor their sustainability in the long term. One example of important plant species for food and medicinal uses is the genus of *Elwendia*.

Plant population ecology and plant demography are consolidated research fields providing insights into how plant populations perform in their environments. In the context of conservation biology, understanding the functioning of plant populations is important since this knowledge has to do with our potential to develop comprehensive and effective conservation plans for endangered plant species. On the other hand, given that evolutionary change begins at the population level, population ecology studies shed light on the forces that affect the life and death and the fecundity of individual plants, determining therefore the fitness of all different variants of a population.

Phytocenosis is a plant community existing within a single biotope. It is characterized by relative uniformity of species composition, a certain structure and system of plant relationships with each other and with the external environment. According to Barkman (1989), phytocenosis is a specific segment of vegetation in which internal floral differences are less than differences with the surrounding vegetation. The term was proposed by the Polish botanist I. K. Pachosky in 1915. Phytocenoses are an object of study in the science of phytocenology (geobotany).

Coenopopulation is a collection of individuals of a species within a single phytocenosis occupying a certain habitat. The term is used primarily to describe plant communities since, firstly, establishing the boundaries of a genetic phytopopulation is fraught with certain difficulties, and secondly, the concept of a population as a group of freely interbreeding, that is showing panmixia, individuals is applicable only to cross-pollinated plants. In populations of self-pollinating, apomictic and vegetatively reproducing plants, panmixia is absent. Coenopopulation, unlike genetic, is characterized by genetic and morphophysiological polymorphism. In most cases, coenopopulations are smaller than genetic ones, occupying only a part of their population fields.

The genus *Elwendia* belongs to the Apiaceae family and consists of 27 species**.** The genus *Elwendia* was previously considered within the genus *Bunium*, which had about 50 species in the world with geographical distribution in Asia, Europe and North Africa. Recently, *Bunium* genus has been divided into two separate genera, namely *Elwendia* and *Bunium*; thus, some species were changed from *Bunium* to *Elwendia* (Degtjareva et al. 2009;

Degtjareva et al. 2013; Pimenov 2017). In recent years, much work has been done on the taxonomy of the genus of *Elwendia*. According to Korovin (1959), seven of these species are listed as part of the *Bunium* genus (Kljuykov et al. 2018a; Kljuykov et al. 2018b). The taxonomical classification and determination of the genus *Elwendia* is largely based on its anatomical-morphological structure, botanical-geographical distribution and cariology, as well as on the analysis of molecular, resulting in this genus being separated as an independent category from *Bunium* (Degtjareva et al. 2013). In particular, *Elwendia* and *Bunium* differ in the size of the fruit, geographical distribution and the number of chromosomes (Kljuykov et al. 2004).

The native distribution of *Elwendia* species includes Afghanistan, Baluchestan, India, Himachal Pradesh, Pamir Mountains, Uzbekistan, Tajikistan, Turkmenistan, Syria, Iran, as well as some European, and African countries. **(**Degtjareva et al. 2013). Among such regions, Central Asia is considered the richest area of *Elwendia* diversity, with 17 species distributed in this region (Sennikov et al. 2016). In particular, mountainous Central Asia (Western Tian-Shan and Pamir-Alai Mountain systems) is the main center of diversity for this genus. In Uzbekistan, the genus *Elwendia* is represented by twelve known species**,** namely *Elwendia angreni* (Korovin) Pimenov & Kljuykov, *Elwendia capusii* (Franch.) Pimenov & Kljuykov, *Elwendia kuhitangi* (Nevski) Pimenov & Kljuykov, *Elwendia hissarica* (Korovin) Pimenov & Kljuykov, *Elwendia chaerophylloides* (Regel&Schmalh.) Pimenov & Kljuykov, *Elwendia intermedia* (Korovin) Pimenov & Kljuykov, *Elwendia latiloba* (Korovin) Pimenov & Kljuykov, *Elwendia persica* (Boiss.) Pimenov & Kljuykov, *Elwendia salsa* (Korovin) Pimenov & Kljuykov, *Elwendia seravschanica* (Korovin) Pimenov & Kljuykov, *Elwendia setacea* (Schrenk) Pimenov & Kljuykov, *Elwendia vaginata* (Korovin) Pimenov & Kljuykov. The vegetative growth of *Elwendia* occurs during spring and summer (Roslin et al. 2021) with some species distributed in Central Asia flowering mainly in June-July. In recent years, as a result of a sharp change in climate, primarily in terms of annual precipitation and air temperature, the phenology of some *Elwendia* species has also changed (Delgado et al. 2020; Ovaskainen et al. 2020).

Several species from the genus *Elwendia* have been used by the peoples of Central Asia for a long period with the plant part mainly used is the seeds (Mohammadhosseini et al. 2021; Karaköse 2022; Şen et al. 2022). The seeds are small, elongated, dark-brown, and very fragrant. A number of studies have been carried out to reveal the chemical composition of the seeds which consist of 3-7% essential oil, 12-22 fatty oils, as well as flavonoids, coumarins, umbelliferon, scopoletine and other substances known as quercetin and campferol (Azizi et al. 2009; Mortazavi et al. 2010; Vatandoost et al. 2018). It has also been found to contain protein 10-23% and flavorings (Stappen et al. 2017).

In recent years, there has been increasing interest in studying the ecology and population of the native flora of Central Asia, including Uzbekistan, due to various reasons including the need for such flora for protection (Shomurodov et al. 2021), their importance as food and medicinal sources (Abduraimov et al. 2022; Saribaeva et al. 2022), the state that some species are rare and endangered (Rakhimova et al. 2020; Saribaeva et al. 2022). In particular, there is scientific importance to study the flora and vegetation cover of the Turkestan Ridge and the bordering territories bordering several existing studies include Suleymanov (2008), Batirova (2011), Tirkasheva (2011), Esankulov (2011), Azimova (2018), Abdullaeva (2020) and Saribaeva et al. (2022). Despite the large body of literature, there is limited information regarding the population focusing on particular species. Therefore, this study aimed to assess the coenopopulations of *E. persica* in Turkestan Ridge.

MATERIALS AND METHODS

Study area and period

This study was conducted in Turkestan ridge (Uzbekistan) from 2018-2022. Turkestan ridge is a high-altitude ridge of the latitudinal direction, about 340 km long, belonging to the Hissar-Alai mountain system. Through the Matcha Mountain junction, the ridge closes with the Alai Ridge in the east and extends to the Samarkand Plain in the west (Figure 1). The northern slope is long and gentle, with juniper forests and sparse woodlands; the southern one is short and steep, with rocks and scree. From the south, the valley of the Zeravshan River is separated from the Zeravshan ridge. The highest points are Rocky Peak (5621 m) and Pyramidal Peak (5509 m). The crest of the ridge, especially in the eastern part, is covered with mountain glaciers. The largest glaciers are Tolstoy, Shurovsky and Zeravshan glaciers which serve as the source of the Zeravshan River. The Dushanbe-Khujand highway passes through one of the passes of the ridge (Shakhristan) at an altitude of 3378 meters. The slopes are dissected by the valleys of the Isfara, Ak-Suu, Kara-Suu rivers. Aikel Mountain Lake is located on the northern slope.

Data collection procedure

The object of the study is *Elwendia persica* (Boiss.) Pimenov & Kljuykov (Figure 2). The ontogenetic structure of local populations was studied using generally accepted methods as prescribed by Zlobin et al. (2013). Ontogenesis of the species was studied into the following stages: juvenile (j), immature (im), virginile (v), young generative (g1), middle generative (g2), old generative (g3), subsenile (ss), and senile (s) following the research by Rahimov (2007). Ontogenetic spectrum of the local populations (forth CPs) was determined as the ratio of plants of different ontogenetic statuses, expressed as a percentage of the overall number of individuals. The density of populations was determined by the number of individuals per unit area. At the same time, special attention was paid to the parameters of average density, i.e. number of individuals per unit of area (overall area), and ecological density - number per unit of the inhabited area, which can be practically taken by a population (Odum 1986).

Indexes of coenopopulations were determined using methods described by Ishbirdin and Ishmuratova (2004) and Glotov (1988). The type of cenopopulation was determined using Zhivotovsky (2001) delta-omega classification. This classification indicates the age state of the coenopopulations. Research on the ontogenesis of the species in 2000-2007 were carried out by Rahimov (2007) on the territory of Tajikistan of the western Pamir Alai. In recent years, many studies have been carried out in Uzbekistan in this direction (Abduraimov et al. 2022). Botanical descriptions were made for all the communities where the population structure of species had been studied according to the generally accepted methods on 100 m^2 plots.

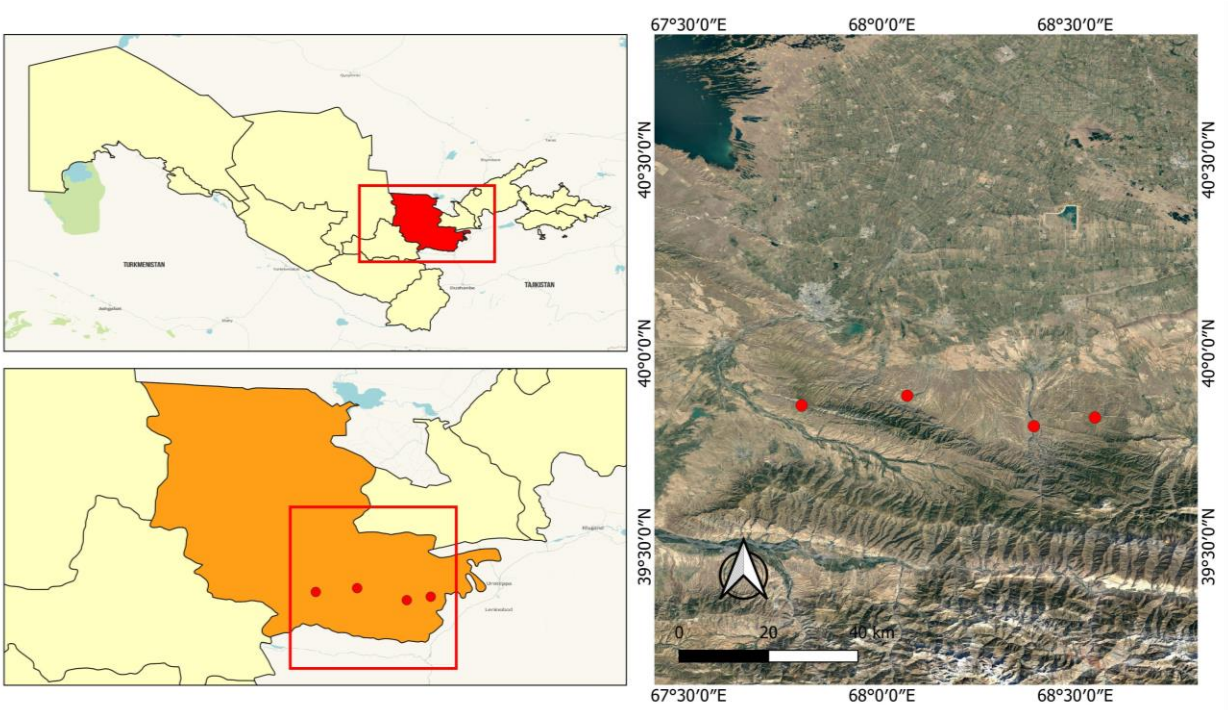

Figure 1. Map of the study area in Turkestan Ridge, Uzbekistan

Figure 2. The population of *Elwendia persica* in Turkestan Ridge, Uzbekistan

RESULTS AND DISCUSSION

Results

In many countries of the world, the assessment of the state of rare species is based on the study of the modern state of their coenopopulation. Particular attention is paid to the determination of their ontogenetic structure and analysis of organism and populational signs. The totality of the sum of signs is formed in the ecological-phytosenotic optimum of the species, and this is important in maintaining natural populations.

The first local coenopopulation (LP1) was separated from the area around Pishshagarsoy (Khaltasoy) of the Molguzar ridge of the Jizzakh region. The plant community of regions consisted of herbaceous *Eremurus*-shrub. This plant community was isolated from rocky soils, and the level of soil cover with plants was 17-20%. Fourteen vascular plants were documented in this plant community. The degree of coverage of the *E. persica* was 2 %.

The second local coenopopulation (LP2) in Zomin district was separated from the community of *Eremurus*-*Prunus* (Shirachli-Bodomzor) plants around the village of Yettikechuv. This cenopopulation was distributed in gravel spills on the slopes of the mountains. The floristic composition of the plant community consisted of 20 species. The degree of soil cover with plants was 15-20%. *Prunus bucharica* (Korsh.) Hand.-Mazz. and *Eremurus regelii* Vved. species were observed to dominate. The degree of soil cover with plants was 16%. The degree of coverage of the *E. persica* was 1%. Livestock feeding was observed in these regions. At the same time, the settlements of the population were located nearby.

The next local coenopopulation (LP3) was separated from the eastern part of the village of Dugoba of the Turkestan Mountain, Zamin district. It should be noted that regular feeding of livestock throughout the year was noted around this territory. The plant community of the area consisted of a variety of herbaceous shrubs. It was noted that about 30 higher plants spread in this coenopopulation. The degree of soil cover with plants was 30-35%. The degree of coverage of the *E. persica* was 1 %.

The fourth local coenopopulation (LP4) was separated from the slopes in the central part of the Molguzar Ridge. The plant community of the area consisted of a variety of herbaceous-wormwood-shrub. The degree of soil cover with plants was 40-45%. The botanical composition of the territory consisted of 25 species. The degree of coverage of *E. persica* was 1%. Livestock feeding was observed in these regions. At the same time, the settlements of the population were located nearby.

During the study, a floristic list of species was created. A total of 61 species belonging to 46 genera and 24 families were recorded in the composition of 4 local coenopopulations (Table 1). It was found that these species belong to 2 trees, 7 shrubs, 3 semi-shrubs, 35 perennials, 1 biennial and, 10 annual life forms. Sixty-one species were determined in total in the floristic surrounding of the four populations. The families with the largest number of species were: Asteraceae (10 species), Poaceae (7 species), Rosaceae (5 species), Lamiaceae (4 species), Apiaceae (4 species) and the other families were represented by 1-3 species.

The ontogenetic structure of coenopopulations in various parts of the range is an integral indicator of their condition, reflects their organization in space and time, adaptive features of the species at the population level, and prospects for its self-maintenance. In this study, the ontogenetic structure of the populations was initially analyzed. The ontogenetic structure of the population makes it possible to assess their future progress and determine their monitoring. It was found that coenopopulations are left-sided (LP 1, 4) and centralized (LP 2, 3) type-specific (Figure 3). The potential seed productivity of the genus is very high. For this reason, most of the time, the coenopopulations are left-sided.

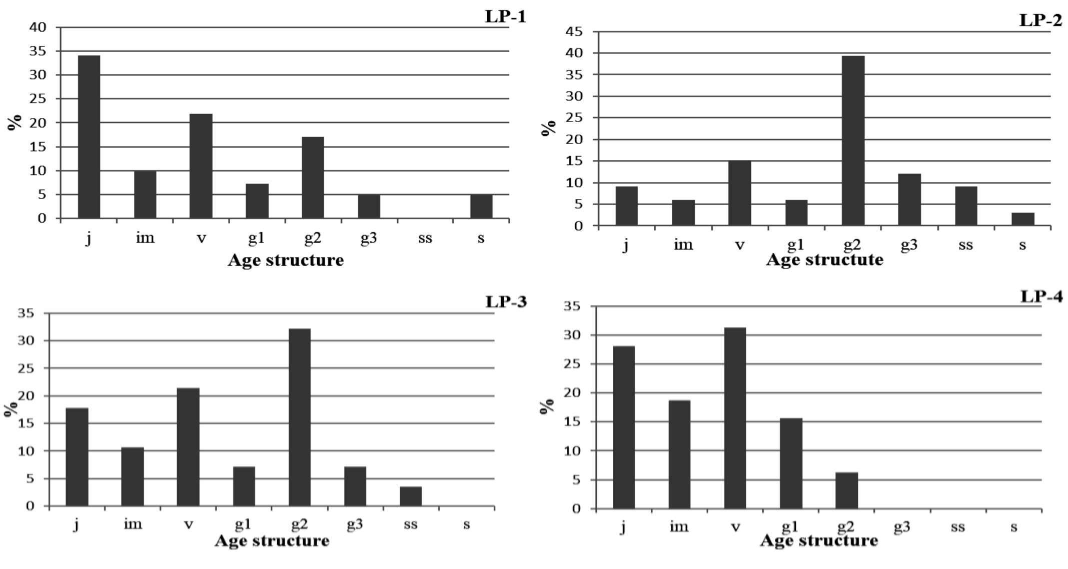

Figure 3. The ontogenetic spectrum of local populations of *Elwendia persica* in Turkestan Ridge, Uzbekistan. Note: X-axis: ontogenetic states (j: juvenile, im: immature, v: virginile, g: generative, ss: subsenile, s: senile); Y-axis: percentage of species of different ontogenetic groups (%)

Table 1. Species composition of coenopopulations with the presence of *Elwendia persica* in Turkestan Ridge, Uzbekistan

Species name	Life form	Family	LP1	LP2	LP3	LP4
Crataegus songarica C. Koch.	Tree	Rosaceae	12	-	-	-
Prunus bucharica (Korsh.) Hand. - Mazz.	Tree	Rosaceae	2	7	-	10
Prunus erythrocarpa (Nevski) Gilli	Shrub	Rosaceae	-	-	1	+
Atraphaxis spinosa L.	Shrub	Polygonaceae	-	-	6	2
Ephedra equisetina Bunge	Shrub	Ephedraceae	-	-	2	-
Lonicera nummulariifolia Jaub. & Spach	Shrub	Caprifoliaceae	-	-	+	+
L. humilis Kar. & Kir	Shrub	Caprifoliaceae	-	-	+	-
Rosa webbiana Wall.ex Royle	Shrub	Rosaceae	-	-	-	+
Spiraea hypericifolia L.	Shrub	Rosaceae	-	-	-	+
Artemisia tenuisecta Nevski	Semi shrub	Asteraceae	-	-	+	5
Artemisia ferganensis Krasch. Ex Poljak.	Semi shrub	Asteraceae	-	+	+	2
Salvia scrophularifolia (Bunge) B.T.Drew	Semi shrub	Lamiaceae	-	-	1	-
Leuzea repens (L.) D.J.N.Hind	Perennial	Asteraceae	-	-	+	+
Agropyron badamense Drobow	Perennial	Poaceae		+	-	-
Allium caesium Schrenk	Perennial	Amaryllidaceae	+	-	-	-
Allium oschanii O. Fedtsch.	Perennial	Amaryllidaceae	-	+	-	-
Allium praemixtum Vved.	Perennial	Amaryllidaceae	1	-	-	-
Astragalus schmalhausenii Bunge	Perennial	Fabaceae	-	-	1	-
Lepidium chalepense L.	Perennial	Brassicaceae	-	-	+	
Carex pachystylis J.Gay	Perennial	Cyperaceae	-	-	-	2
Carex turkestanica Regel	Perennial	Cyperaceae	+	-	-	-
Convolvulus arvensis L.	Perennial	Convolvulaceae	-	-	+	-
Arctium ayreum Kuntze	Perennial	Asteraceae	-	-	-	+
Arctium chloranthum (Kult.) S.López, Romasch., Susanna & N.Garcia	Perennial	Asteraceae	-	-	-	+
Cousinia resinosa Juz.	Perennial	Asteraceae	-	+	-	-
Arctium umbrosum (Bunge) Kuntze	Perennial	Asteraceae	-	+	-	-
Cynodon dactylon (L.) Pers.	Perennial	Poaceae	-	-	-	+
Dodartia orientalis L.	Perennial	Mazaceae	+	-	-	-
Elwendia persica (Boiss.) Pimenov & Kljuykov	Perennial	Apiaceae	2	1	1	1
Eremopyrum bonaepartis (Spreng.) Nevski	Perennial	Poaceae	-	+	+	-
Eremurus olgae Regel	Perennial	Asphodelaceae	-	5	+	-
Eremurus regelii Vved.	Perennial	Asphodelaceae	4	-	-	-
Ferula kokanica Regel & Schmalh.	Perennial	Apiaceae	+	-	-	-
Ferula kuhistanica Korovin	Perennial	Apiaceae	-	-	+	-
Gentiana olivieri Griseb.	Perennial	Gentianaceae	+	-	-	-
Hordeum bulbosum L.	Perennial	Poaceae	-	+	-	-
Inula grandis Schrenk ex Fisch. & C.A.Mey.	Perennial	Asteraceae	-	+	-	-
Ixiolirion tataricum (Pall.) Schult & Schult. f.	Perennial	Ixioliriaceae	+	-	-	-
Muscari neglectum Guss. ex Ten.	Perennial	Asparagaceae	+	-	-	-
Origanum tyttanthum Gontsch.	Perennial	Lamiaceae	+	-	-	-
Pedicularis olgae Regel	Perennial	Orobanchaceae	-	-	-	+
Phlomis thapsoides Bunge	Perennial	Lamiaceae	-	-	+	
Plantago lanceolata L.	Perennial	Plantaginaceae	-	-	-	+
Poa alpina L.	Perennial	Poaceae	-	+	-	-
Poa bulbosa L.	Perennial	Poaceae	-	1	+	-
Tulipa turkestanica (Regel) Regel	Perennial	Liliaceae	-	+	-	-
Tulipa korolkowii Regel	Perennial	Liliaceae	-	+	-	-
Daucus carota L.	Biennial	Apiaceae	-	+	-	-
Artemisia annua L.	Annual	Asteraceae	-	+	-	-
Bromus danthoniae Trin	Annual	Poaceae	-	+	-	-
Carthamus oxyacanthus M.Bieb	Annual	Asteraceae	-	-	-	+
Cephalaria syriaca (L.) Schrad	Annual	Caprifoliaceae	-	-	-	1
Delphinium barbatum Bunge	Annual	Ranunculaceae	-	-	-	1
Garhadiolus angulosus Jaub. & Spach	Annual	Asteraceae	-	-	-	+
Holosteum umbellatum subsp. glutinosum (M.Bieb) Nyman	Annual	Caryophyllaceae	-	-	-	+
Hypecoum parviflorum Kar&Kir	Annual	Papaveraceae	-	-	-	+
Papaver pavoninum Schrenk	Annual	Papaveraceae	-	1	-	-
Valerianella leiocarpa (K.Koch) Kuntze	Annual	Caprifoliaceae	-	-	+	-
Veronica campylopoda Boiss.	Annual	Plantaginaceae	-	-	+	-
Ziziphora pamiroalaica Juz.	Annual	Lamiaceae	-	+	-	-

Table 2. Demographic indices of coenopopulations of *Elwendia persica* in Turkestan Ridge, Uzbekistan

No. CP	Overall number of ind	Density ind./m^2	P_{ecol} (1 m^2)	I_a	I_r	Δ	ω	Types of LP
1	41	2.05	2.73	0.05	2.25	0.40	0.22	Young
2	33	1.65	2.06	0.13	0.52	0.66	0.43	Transient
3	28	1.4	1.64	0.03	0.97	0.57	0.29	Young
4	32	1.6	1.77	0	3,57	0.37	0.12	Young

Note: ind.: individuals, P_{ecol}: ecological density, I_a: ageing index, I_r: restoration index, Δ: age index), ω: efficiency index, LP: local population

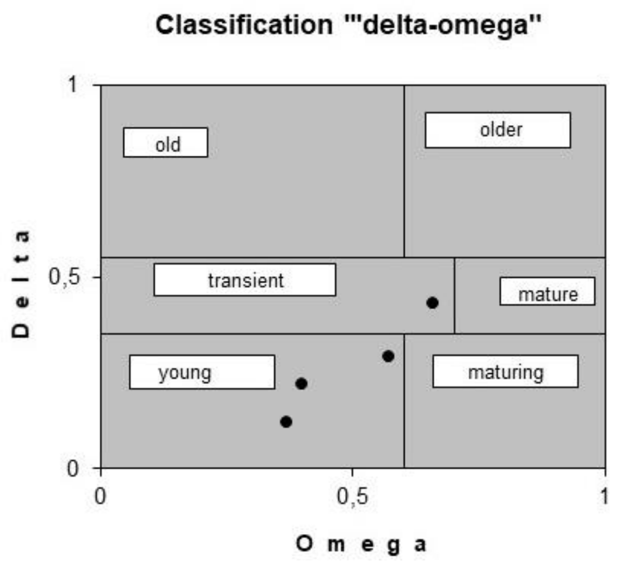

Figure 4. Types of local coenopopulations of *Elwendia persica* according to the "delta-omega" classification (Zhivotovsky 2001)

In this study, the demographic indicators of coenopopulations were also analyzed. Following the method described by Jivotovsky (2001), it was noted that the number of individuals in these coenopopulations was from 28 to 41. Through this method, it is also possible to have information about the natural reserve of the species. Strong variation in density both within the CPU and across all studied coenopopulations indicates this indicator as a sign that is sensitive to environmental, phytocenotic features of the habitat and anthropogenic impact on them. (Table 2).

Evaluation of age (Δ - delta) and efficiency (ω - omega) of coenopopulations revealed that the studied coenopopulations were classified as young (coenopopulations 1, 3, 4) and transient (coenopopulations 2) (Figure 4).

Discussion

In this area, 300-400 mm of rain falls during the year. This condition is one of the characteristic features for the mountainous province of Central Asia. This condition has also been reported in previous studies from us. Many of these species, too, are regularly used by humans. Local residents use them as medicinal and food plants, especially the annual and perennial grasses.

One of the most important indicators of the state of coenopopulation is its ontogenetic structure, which is the age composition of plants over a certain period of time. Analysis of the ontogenetic structure makes it possible to diagnose the current state of the studied coenopopulations and assess their future state. It should be noted that, to date, research has not been carried out to assess the ontogenetic structure of the species of the genus distributed in Uzbekistan, as well as the state of coenopopulations.

Left-sided ontogenetic spectrum. In the left-sided ontogenetic spectrum, the amount of pregenerative individuals is greater. During the study, it was observed that local coenopopulations of 1 and 4 (LP1 and LP4) had the characteristic of a left-sided spectrum. It was found that the share of pregenerative tubers in these coenopopulations was high. The first coenopopulation (LP1) had one peak, in which the share of juvenile tubers was 34.14%. On the other hand, there were 2 peaks of coenopopulation 4 (LP4) in which there were 28.12% of juvenile tubers and 31.25% of virginil tubers. The high presence of pregenerative tubers in these local coenopopulations was due to the high fertility of the potential productive seeds in which up to 80-120 potential seed formed was observed in one plant.

Centered ontogenetic spectrum. In the centralized ontogenetic spectrum, the number of generative individuals was greater. The coenopopulations 2 and 3 (LP2 and LP3) were typical of a centralized type in which there was a large number of tubers in the middle generative stage. According to Rahimov (2007), the duration of this stage was observed to be 6-7 years. In our studies, it was also noted that the middle generative stage was around 5-8 years.

The first and fourth coenopopulations (LP1 and LP4) had the characteristics of the young type, and it was observed that in these coenopopulations, there were many tubers up to the generative stage. It was found that their share in these coenopopulations was around 50.12-65.84%. We can conclude that in these coenopopulations, seed reproduction continued at a pace.

In the second coenopopulation (LP2), the proportion of tubers in the generative stage was high, accounting for 57.57% of the total tubers. The third coenopopulation (LP3) was in an almost equal share of tubers up to the generative stage (49.98), as well as the share of generative tubers (46.42), and it was observed that this coenopopulation had the characteristic of the bimodal spectrum. The results obtained show that only 2 coenopopulations were found to be fully membered.

The preservation of rare and endangered species and the study of the state of their population at the same time (distribution, number, density, especially age composition) makes it possible not only to assess their current state but also to draw clear conclusions on these species in the future. The demographic indicators of the coenopopulations allow long-term monitoring work on these areas and sustainable use of plant natural resources.

In conclusion, the study of coenopopulations helps to identify available natural resources, including plants used by humans. In recent years, coenopopulations of fodder and medicinal plants have been studied, including those in Uzbekistan. Our study investigating the coenopopulations of *E. persica* in Turkestan Ridge indicated different ecological-coenotypical living conditions and found the examined populations, in general, had normal population structures. The optimal condition of the coenopopulations allows us to assume that the ecological and coenotic conditions, despite the powerful anthropogenic pressure, can be considered optimal. The species of the genus *Elwendia* (zira) has been widely used in human economic activities for several centuries. It is recognized by the local people mainly as plants of little value. The main way to protect species of the genus *Elwendia* (zira) is to preserve its habitats due to the significantly increased recreational activities and uncontrolled collection of plants in recent years. Our study makes it possible to assess the dynamics of natural coenopopulations of plants of this species. At the same time, studies of this species serve as primary data in the region. In this regard, the state of the natural thickets of the above-mentioned variations requires careful study and constant monitoring.

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