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RESEARCH ARTICLE

Status and life strategy of *Orchis punctulata* Steven ex Lindl. (Orchidaceae) in the South-Eastern Crimea

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Abstract

This article presents the results of the population studies of rare protected species *Orchis punctulata* (Orchidaceae). Based on analysis of local floras in eastern and southeastern Crimea and personal observations, we identified the three most numerous populations of *O. punctulata*: two in the steppe (on the Tepe-Oba mountain ridge) and one in forest communities (on the Kiziltash mountain ridge). The ontogenetic, demographic, and vitality structures of the populations were studied. We also assessed the life strategies of the species in different habitats. The populations in steppe communities were characterized by high number and density parameters. *O. punctulate* often formed large clusters and was dominated here. A small number and low density characterized the population in the forest community; the distribution of individuals within the population was scattered. The age spectra were also different. The populations in steppe communities had a left-sided spectrum with a maximum in immature individuals, while in forest communities, it had a bimodal spectrum with maximums in generative (with a predominance of mature and old generative) and immature individuals. Specimens from forest communities were more extensive than those of steppe communities, they had longer leaves and inflorescences, and their inflorescences had a more significant number of flowers. As a result, the population in the forest community had a higher vitality index. It included individuals of the highest and middle class of vitality. The populations in the steppe community consisted of all classes of vitality or only of middle and lower classes. Thus, optimal environmental conditions for the growth of species are in forests. At the same time, a low level of regeneration and competition from other plants hinder its wide distribution. As a result, the species exserts as a phytocenotic patient (S-strategy). In steppe communities, the species is characterized by a mixed patient-explerant-violant strategy (SRC strategy).

Keywords
Crimea, *Orchis punctulata*, population, monitoring, demography, ontogenetic spectrum, vitality, life strategy

Introduction

Orchis punctulata Steven ex Lindl. (Orchidaceae) is an herbaceous perennial plant of 30–60 cm in height with a large root tuber. There are 5 to 7 leaves from wide to narrow lanceolate on the stem. The inflorescence is densely oblong. Flowers have the yellow color of different shades. The flower labellum often has a brown edge of the lobes with a base spotted by purple-brown tubercles and streaks. The helmet includes all the tepals except the labellum. The labellum is divided into three segments; the inner one is larger than the two outers, and it finishes in two lobes separated by a tooth (Fateryga et al. 2019).

Orchis punctulata is distributed in Europe (Balkan Peninsula and Crimea), Caucasus, and West Asia. There is the subspecies *O. punctulata* subsp. *adenocheila* (Czerniak.) Aver. in Transcaucasia. In the Russian part of the Caucasus, *O. punctulata* occurs only in Krasnodar Krai, where it is quite common in the area from Anapa to Dzhubga, rare from Magri to Lazarevskaya, and scarce between the River Sochi and the River Psou (Sochi Urban Okrug) (Efimov 2020; Popovich et al. 2020). In other parts of the Caucasus, it was marked in Armenia (Asatryan 2018; Tamanyan et al. 2010) and Azerbaijan (Salmanova 2020). Crimea *Orchis punctulata* occurs in the western and eastern parts of the Crimea Mountains (there is no in the central part). It inhabits oak forests (*Quercus pubescens* Willd.) and juniper forests (*Juniperus excelsa* M. Bieb.) and forest, scrubs, and forests edges (Baumann and Kunkele 1982; Fateryga et al. 2019). *Orchis punctulata* often produces hybrids with *O. purpurea*, less often with *O. simia* (Fateryga et al. 2019; Shevera et al. 2020), and very rarely with *O. italica* (Kreutz 2002).

O. punctulata is a rare protected species listed in the Red Data Book of the Russian Federation (2008) with category 3g (rare species), the Crimea Republic (2015), as well as in other regional Red Data Books (Krasnodarsky Krai, Sochi, Sevastopol). *O. punctulata* is also listed in the Bern Convention on the Conservation of European Wildlife and Natural Habitats (Appendix I), the Convention on International Trade in Endangered Species of Wild Fauna and Flora (Appendix II), and in the IUCN Red List of Threatened Species as vulnerable (Rankou 2011).

O. punctulata populations are often threatening and tend to degrade (Fateryga et al. 2019) due to the negative human impact. The other cause of the rarity of the species is its morphological characteristics. *O. punctulata* is nectarless (Claessens and Kleynen 2011). This fact limits the number of insect pollinators: the plants are visited by inexperienced bumblebees and bees searching for nectar, and after some unsuccessful trials, they move from one plant to another (Dressler 1990). So, the species suffers from low visitation rates and has a lower percentage of fruit set than the nectariferous species (Tremblay et al., 2005; Jersáková et al., 2006). As a result, the number of plants has fallen rapidly in the last 30 years, and many locations have already disappeared in the countries where it is distributed (eg, Turkey, Cyprus, and Greece) (Kreutz, 2004; Tsiftsis and Djordjević, 2018). Monitoring the state of the populations is recommended as one of the conservation measures (Fay 2018; Gale et al. 2018; Wraith et al. 2020). However, there are few articles on the population biology of *O. punctulata* (Perebora 2007a, 2007b; Letukhova 2017; Letukhova and Potapenko 2018).

The current study aimed to analyze the structure and number of *Orchis punctulata* populations in the southern part of Crimea to evaluate the life strategy of species in different plant communities and environments.

Material and methods

According to the number of publications on regional flora of East and South-East Crimea (Mironova and Shatko 2001, 2011, 2013; Korzhenevsky and Ryff 2006; Korzhenevsky et al. 2006; Kamenskikh 2011; Shatko and Mironova 2008, 2011), *O. punctulata* is located on Karadag Nature Reserve, in the Echki-Dag, Uzun-Syrt, Kiziltash and Tepe-Oba mountain ridges (Fig.1). At the beginning of the XXth century, *O. punctulata* was marked on Agarmysh; however, it was not found here later (Kamenskikh 2011). According to our observation, *O. punctulata* is rare in Karadag Nature Reserve and on the Echki-Dag, Uzun-Syrt ridges. It is met sporadically with the locus of 1–2 individuals. Some large populations of *O. punctulata* we found in Tepe-Oba and Kiziltash.

The current publication contains information on *O. punctulata* in Tepe-Oba and Kiziltash, obtained in 2014–2019.

Studied Area

The Tepe-Oba mountain range located near the city of Feodosia stretches 8-10 km from east to west and has a maximum altitude of 290 m. The climate is transitional from the Mediterranean to the temperate type, with more pronounced features of continentality and aridity compared to southern and western Crimea. Vegetation is a degraded deciduous forest (dominated by *Quercus pubescens* Willd. and *Carpinus orientalis* Mill.), thickets of shrubs (species of the genera *Crataegus* L., *Rosa* L., and *Ligustrum vulgare* L., *Cotinus coggygria* Scop., *Cornus mas* L.), friganoids, steppes (true, meadow, petrophytic), as well as savannah communities (Shatko and Mironova 2011). A considerable part of the northern slope and the tops of the ridge is occupied by artificial planting of *Pinus nigra* subsp. *pallasiana* (Lamb.). Holmboes and sometimes deciduous trees and shrubs (*Acer tataricum* L., *Fraxinus excelsior* L., *Juglans regia* L., *Prunus mahaleb* L., *Laburnum anagyroides* Medik., *Rhus coriaria* L., and others) were heavily degraded. On the Tepe-Oba ridge, there is a regional-status state nature botanical reserve with 1200 hectares.

The Kiziltash mountain ridge is part of the Main Ridge of the Crimean Mountain System. The climate is characterized as a northern variant of the Mediterranean, transitioning to temperate. The area is dominated by juniper (*Juniperus excelsa* Bieb.), oak ash (*Quercus pubescens*, *Quercus petraea* (Mattuschka) Liebl., *Fraxinus excelsior*), oak hornbeam (*Quercus pubescens*, *Carpinus betulus* L., *Carpinus orientalis*) and hornbeam (*Carpinus betulus*, *Carpinus orientalis*) forests. Currently, the Kiziltash mountain group has no conservation status.

Description of the habitats studied

Pop1 was identified in the eastern part of the Tepe-Oba at the bottom of a small flat gully, on gentle (10^0) north-east slopes at altitudes of 101 m. *O. punctulata* formed here a rather large patch due to a better moisture regime. The total area of the population was 50 m^2. The steppe community is characterized by a poorly developed shrub layer (5%) and a well-developed grass layer (cover of 70%). It is dominated by *Festuca valesiaca* Gaudin and *Galatella villosa* (L.) Reichenb. Fil., *Orchis punctulata*. There are also such species as *Stipa lessingiana* Trin. et Rupr., *Koeleria pyramidata* (Lam.) P.Beauv., *Achillea setacea* Waldst. et Kit., *Thymus tauricus* Klok. et Shost. The cover of the moss-lichen layer is 10%.

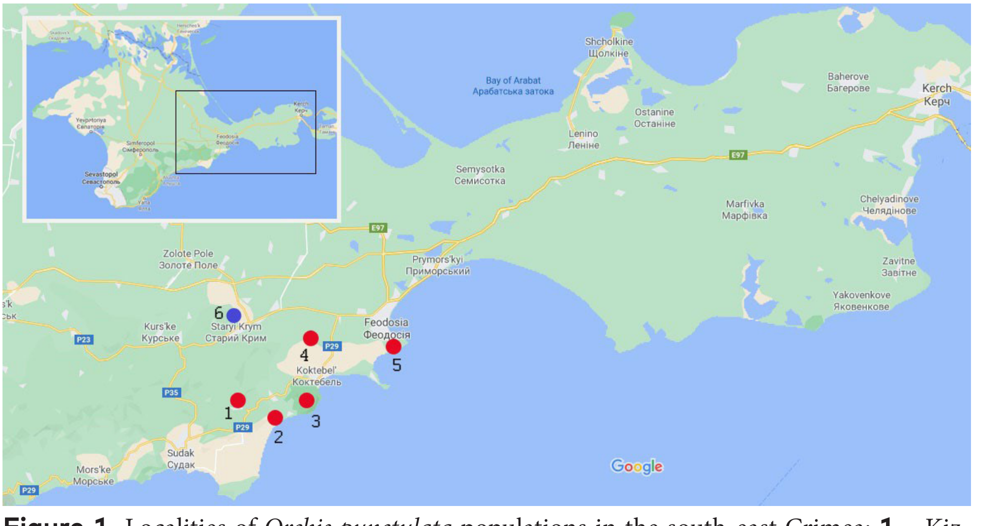

Figure 1. Localities of *Orchis punctulata* populations in the south-east Crimea: **1** – Kiziltash; **2** – Echki-Dag; **3** – Karadag; **4** – Uzun-Syrt; **5** – Tepe-Oba; **6** – Agarmysh. Note: Red points mark the presence of the species confirmed by modern reports; the blue point is used because the reports have not been confirmed since 1990.

Pop2 was identified in the eastern part of Tepe-Oba at the edge of degraded pine (*Pinus nigra* subsp. *pallasiana*) plantations (Fig. 2), occurring on a gentle (5°) north slope at an altitude of 186 m. The total area of the population was 25 м^2. The community is characterized by single trees of *Fraxinus excelsior*, well-developed shrub layer (cover 20%, average height – 1 m) consisting of *Ligustrum vulgare*, *Crataegus rhipidophylla* Gand., *Crataegus monogyna* Jacq., *Rosa canina* L.) and grass layer (cover of 80%) dominated by *Festuca valesiaca*, *Galatella villosa*, *Orchis punctulata*, and *Jurinea stoechadifolia* (Bieb.) DC. There are also *Stipa lessingiana*, *Galium xeroticum* (Klokov) Pobed., *Teucrium chamaedrys* L., *Teucrium polium* L., *Achillea setacea*. The moss-lichen cover is 10%.

Following the classification of Crimean vegetation (Korzhenevsky et al. 2003), described plant communities belong to the order Festucetalia valesiacae Br.-BI. et Tx. 1943 (continental xerothermic and semixerothermic herbaceous communities of Central and Eastern Europe).

Pop3 was identified in the Kiziltash oak-hornbeam forest (Fig. 3), occurring on a gentle (10°) southern slope at an altitude of 303 m. The population area was 400 м^2. The tree layer is 3 to 5 m in height; the canopy density is 70 to 80%. It consists of *Carpinus orientalis*, *Quercus pubescens*, *Juniperus oxycedrus* L., *Fraxinus excelsior*. The shrub layer (cover 10%) is dominated by *Ligustrum vulgare* and *Cotinus coggygria*. The herb layer is very sparse. The cover of herbs is 20%. The main dominant is *Carex halleriana* Asso. There are also other species: *Festuca rupicola* Heuff., *Aegonichon purpureo-caeruleum* Holub, *Orchis punctulata*, *Dictamnus albus* L. Forest litter is 100%. The community was classified as the alliance Carpino orientalis - Quercion pubescentis Korzh et Shelyag 1983. It is represented by oak forests of the southern macroslope of the Crimea Mountain System. They occur on gentle and steep slopes with thin brown soils formed on the rocks of the Jurassic system (Korzhenevsky et al. 2003).

Methods

We studied the ontogenetic structure of populations according to standard methods (Uranov et al. 1977). To estimate the number of plants in the population, we counted all plants considering their ontogenetic states, and an aboveground shoot was considered a counting unit. We determined the following ontogenetic stages of the plants: juvenile (j) – with one leaf, immature (im) – with two leaves, vegetative (v) – with three leaves, plants formed four and more leaves were assigned to the generative group. We took into account that some *O. punctulata* plants that entered the generative period do not form generative organs in the current year. We often found nonflowering plants with four leaves or more, but we retained last year's inflorescences. The generative group was also divided into young generative plants (g_1) – with four leaves, mature generative plants (g_2) – with five leaves, and old generative plants (g_3) – with six or more leaves.

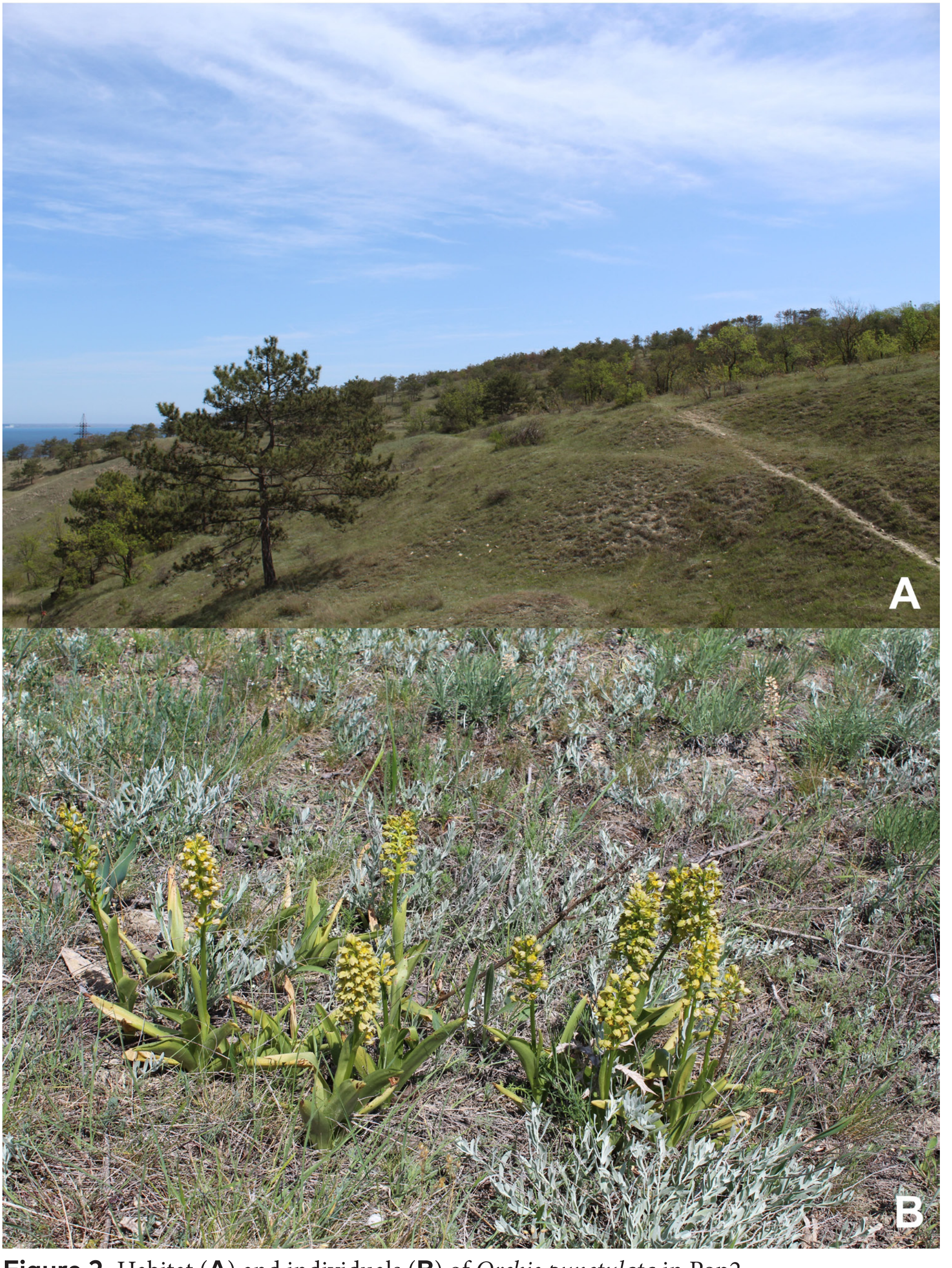

Figure 2. Habitat (**A**) and individuals (**B**) of *Orchis punctulata* in Pop2.

The following morphological parameters of flowering plants were measured: plant height, length and width of the first and second leaves, length of inflorescence, and counted leaves and flowers. Statistical data processing was carried out for each parameter. The arithmetic means with standard error (M±m) and variation coefficient (CV) were determined. To assess the age level of the population, we applied the age index developed by Uranov et al. (1977). When assessing population regeneration, we applied the replacement index, which was calculated as the percentage of the number of juvenile and immature individuals to the number of generative individuals (Kricsfalusy and Mező-Kricsfalusy 1994). To assess the vitality of individuals, we applied the vitality index (IVC) determined by the size range of individuals in the population. The following formula was used (Ishbirdin and Ishmurativa 2004; Ishbirdin et al. 2005):

$$IVC = \frac{\sum_{i=1}^{N} X_i / \overline{X_i}}{N} ,$$

where X_i is the value of the i-th characteristic of the population, $\overline{X_i}$ is the average value of the i-th characteristic of the entire population, and N is the number of features.

The plasticity index was calculated using the following formula: $ISP = IVC_{max} / IVC_{min}$ (Ishbirdin and Ishmurativa 2004). The study of the vitality structure of populations was carried out according to Zlobin (1989). To assess the degree of the thriving or depression of population, the Q index was used. The names of the species are provided according to 'The Plant List' (www.theplantlist.org).

Figure 3. Habitat (**A**) and individuals (**B**) of *Orchis punctulata* in Pop3.

Results and discussion

The number of *O. punctulata* samples within Pop1 varied from 517 to 725 (Table 1). The population density ranged from 20 to 29 plants/m^2. The distribution of the specimen was compact and formed a large cluster throughout the entire area of the gully and dominated the plant community. The population was incomplete normal (no senile plants) with a predominance of immature plants. Most of the specimen was pregenerative; thus, we marked a lower age index (0.12–0.15) and a higher renewal index (average 498%).

Monitoring within Pop2 was performed for two years. During that period, the number of *O. punctulata* specimens varied from 770 to 825. The population density there was the highest (31-33 plants / m^2). The distribution of plants was regularly in groups, and they formed two large clusters on the stationary plot and dominated the plant community. Outside the stationary plot, *O. punctulata* was met regularly throughout the entire ecotope and often formed clusters consisting mainly of individuals in pregenerative state. This population was incomplete normal (senile individuals were also absent) with a predominance of immature plants. Similarly to Pop1, a low age index (0.12–0.14) and a high renewal index (on average 570%) were observed.

The number of specimens within Pop3 ranged from 16 to 24, and the population density was very low (4 to 6 individuals per 100 m^2). It was the smallest one. The distribution of the specimens in the population was scattered; the plants were separated by 2 to 3 m, some individuals by 10 to 15 m. The plants did not dominate the plant community and were met once upon 1.5 km of the route. This population was normal and incomplete, there were no senile individuals, and in 2016 and 2019, there were no virginal ones. During years of observations, different plants predominated here: in 2016 – immature individuals, in 2017 and 2018 – mature generative individuals, in 2019 – old generative individuals. Due to the predominance of mainly generative plants, the age index was quite high (0.33–0.51). The renewal index was the lowest and varied greatly over years (from 29% in 2018 to 100% in 2016).

Table 1. The demographic structure of *Orchis punctulata* populations

Year	Total number of individuals	Age-related states (number of individuals)						Demographic parameters		
		j	im	v	g_1	g_2	g_3	The density of plants (individuals/ m2)	Age index	Replacement index, %
					Pop 1					
2014	601	204	212	126	49	9	1	24.04	0.12	705
2015	725	223	233	160	82	23	4	29	0.14	418
2016	549	185	190	115	41	14	4	21.96	0.13	636
2017	613	170	206	133	73	21	10	24.52	0.15	362
2018	517	137	182	111	79	7	1	20.68	0.14	367
2019	498	164	176	90	61	6	1	19.92	0.13	500
					Pop 2					
2018	825	179	322	222	89	11	1	33	0.14	497
2019	770	264	275	147	79	4	1	30.8	0.12	642

Year	Total number of individuals	Age-related states (number of individuals)						Demographic parameters		
		j	im	v	g_1	g_2	g_3	The density of plants (individuals/ m2)	Age index	Replacement index, %
					Pop 3					
2016	24	5	7	0	4	4	4	0.06	0.33	100
2017	21	3	4	2	2	7	3	0.05	0.40	58
2018	20	1	3	2	4	6	4	0.05	0.46	29
2019	16	3	2	0	2	1	8	0.04	0.51	46

All studied populations were in a stable equilibrium state; the number of individuals, indexes of age, and renewal have not changed for many years, or their fluctuations are insignificant. The exception was the renewal index in Kiziltash: in 2016 it differed significantly from other years of observations. Thus, *O. punctulata* has a wide ecological amplitude with respect to illumination and soil moisture, and it can grow in both steppe communities (in whole light) and forest communities (withstanding strong shading).

Analysis of age spectra averaged over the years showed the similarity of populations on the Tepe-Oba and their difference from that on the Kiziltash (Fig. 4). The populations of *O. punctulata* in the Tepe-Oba steppe communities are characterized by a left-sided spectrum with a maximum number of immature individuals. The population in the Kiziltash forest community is characterized by a bimodal spectrum with an absolute maximum in the generative part of the spectrum (with a predominance of mature and old generative individuals) and a local maximum in immature individuals.

Morphological parameters are the most informative features that reflect the adaptation of the specimens to different environmental conditions. *O. punctulata* plants that occur in steppe and forest ecotopes differ in morphometric parameters (Table 2). The most favorable environments for plant growth were observed in Kiziltash. The average plant height in Pop3 was 35.85 cm, which was 10 cm higher than the average plant height in Pop1. Data on the height of plants in Pop2 turned out to be unreliable, as the coefficient of variation above 33% (35.46%) indicates the heterogeneity of the sample. The plants in the Kiziltash had higher parameters than those of the Tepe-Oba, namely the length of the first and second leaves, the length of the inflorescence, and the number of flowers in the inflorescence (Fig.4). Data on inflorescence length in Pop1 plants should be excluded from this analysis since the variation coefficient is higher than 33%. The widths of the first and second leaves were the least plastic characters; their mean values were the same for the three populations.

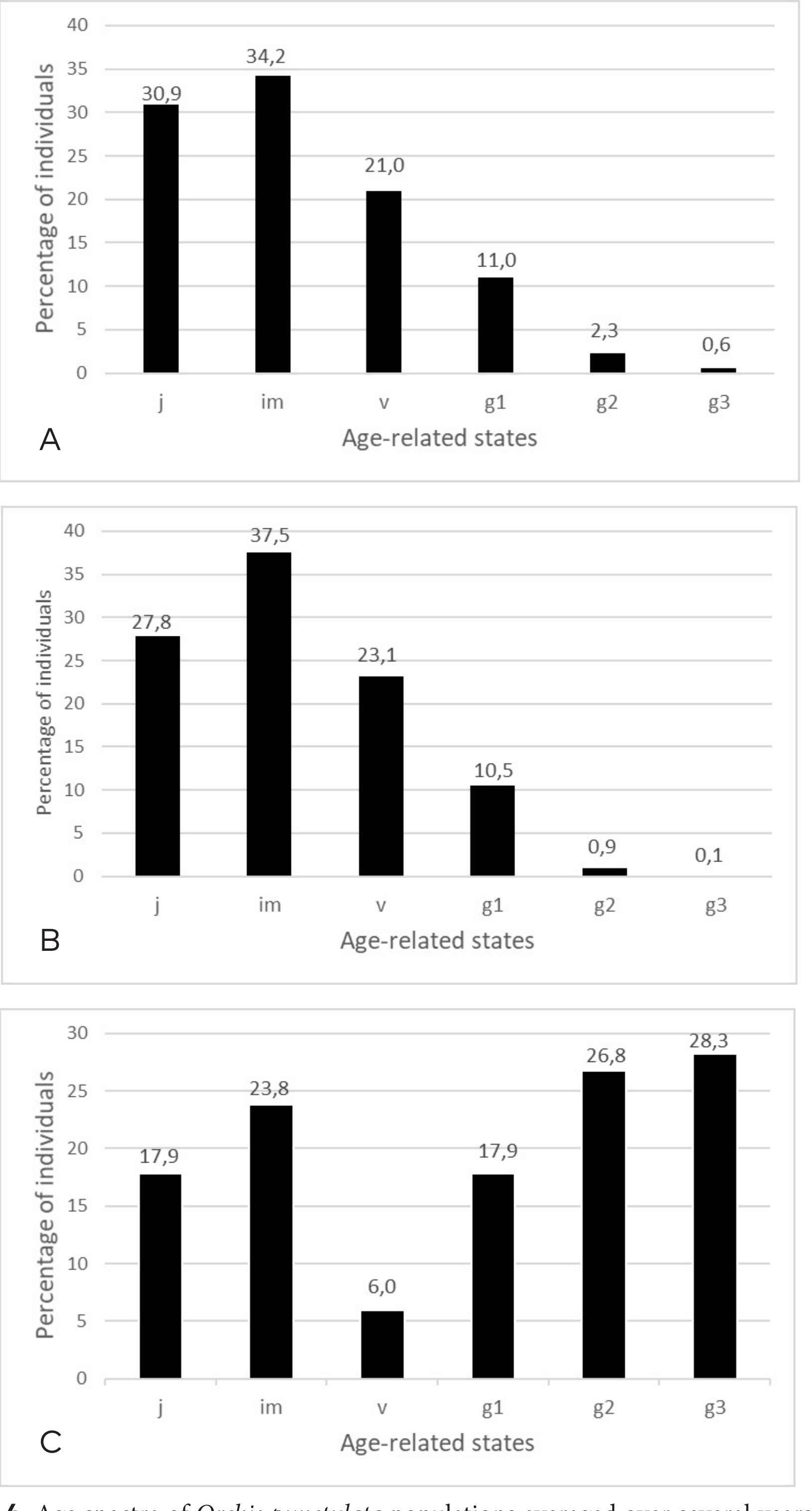

Figure 4. Age spectra of *Orchis punctulata* populations averaged over several years of observations. **A** – Pop1; **B** – Pop2; **C** – Pop3.

Table 2. Morphological parameters and variability of generative *Orchis punctulata* individuals in populations

Morphological parameter	Pop1		Pop2		Pop3	
	m±M	CV	m±M	CV	m±M	CV
Plant height (cm)	25.49±1,53	31.89%	16.37±1.71	35.46%	35.85±2.73	20.91%
First leaf length (cm)	7.01±0.46	29.61%	8.00±0.71	13.50%	9.45±0.97	28.08%
First leaf width (cm)	2.68±0.13	23.11%	2.95±0.33	23.92%	3.00±0.25	23.16%
Second leaf length (cm)	8.77±0.41	22.62%	9.92±0.95	20.19%	12.44±0.65	14.52%
Second leaf width (cm)	2.81±0.13	23.21%	3.05±0.28	21.19%	3.46±0.22	17.49%
Inflorescence length (cm)	8.55±0.63	38.69%	6.78±0.60	29.99%	14.86±1.43	25.89%
Number of flowers	29.14±2.99	52.95%	25.98±2.34	30.42%	46.76±4.74	27.38%

The assessment of the vitality of the *O. punctulata* populations also showed that the most favorable habitats for the species are located in forest communities under conditions of increased shading and humidity (Table 3). The vitality index of the population (IVC) in Kiziltash ranged from 1.144 to 1.457. On the Tepe-Oba, this indicator was lower: Pop1 ranged from 0.925 to 1.185 and Pop2 from 0.829 to 1.138. The lowest vitality index in Pop2 is probably due to the high density of this population, in which plants compete with each other. The plasticity index was high only in Pop1 (4.04); in other plots, it had the usual values for orchids (Letukhova and Potapenko, 2018).

Table 3. Vitality index (IVC) and plasticity index in the populations by years

Population	Vitality index (IVC)					Plasticity index (ISP)
	2015	2016	2017	2018	2019	
Pop1	0.925	1.045	1.105	0.939	1.185	4.04
Pop2	–	–	–	0.829	1.138	2.27
Pop3	1.343	1.144	1.456	1.457	1.409	2.32

According to the morphological parameters of the plants, it is impossible to compare the vitality of populations due to the variable age structure. Species of old generative states (g_3) are larger than those of young ones (g_1). Therefore, based on the morphometric characteristics of plants from all plots studied, we developed a scale of the vitality of *O. punctulata* for various ontogenetic states (Table 4). The scale includes three classes of vitality: a – the highest, b – average, c – lower (close to critical).

The vitality structure is as follows (Fig. 5). Pop3 includes only individuals of the highest and middle class of vitality. Pop1 includes individuals of all vitality classes; however, the middle class predominated. Pop2 includes individuals of the middle and lower classes with a predominance of the latter. According to the Q criterion, Pop1 and Pop3 are thriving populations; Pop2 has signs of a depressive population.

Table 4. Vitality scale of individuals with generative *O. punctulata* (by vitality classes)

Age class	Vitality class	Plant height (cm)	Inflorescence length (cm)	Number of flowers
g_1	A	30 and more	11 and more	30 and more
	B	15–30	6–11	15–30
	C	15 and less	6 and less	15 and less
g_2	A	35 and more	13 and more	40 and more
	B	20–35	8–13	25–40
	C	20 and less	8 and less	25 and less
g_3	A	40 and more	15 and more	50 and more
	B	25–40	10–15	30–50
	C	25 and less	10 and less	30 and less

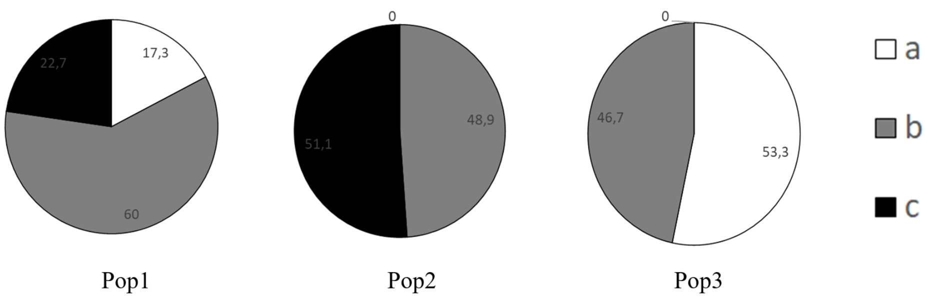

Figure 5. Vitality structure of *Orchis punctulata* populations (a, b, c – vitality classes).

Thus, the morphological parameters of the plants, the vitality, and the vitality structure of the populations indicate that the optimal conditions for the growth of *O. punctulata* were in forests. However, there we noted the smallest number of specimens. This is probably due to the low renewal rate. It may be caused by: the absence (or insufficient number) of pollinating insects and, consequently, low fertilization of seeds; the insufficient number of symbiotic fungi in the soil necessary for seed germination. However, these hypotheses require further investigation and confirmation. These results confirm the statement of Tsiftsis and Djordjevic (2018) that significantly more fruits are planted on pastures than in forests. They also noted that the pollination success of *O. punctulata* can be influenced by the distance to the nearest neighbor and the illumination.

Based on the data obtained, we tried to assess the life strategy of *Orchis punctulata*. Currently, the assessment of plant life strategies is one of the main tasks of population botany because it allows identifying the features of functioning and determining the state of coenotic populations in nature (Rabotnov 1975; Chadaeva and Shkhagapsoev 2016). According to the Ramensky-Grime classification (Grime 1977; Mirkin et al. 1999), there are three primary types of strategy: C (violant or competitive), S (patient or stress-tolerant), and R (explerant or ruderal). However, species often demonstrate secondary intermediate types of strategy that combine treats of two or even three primary types. Each type of strategy is characterized by complex adaptive traits that ensure species survival under stress conditions.

First, all populations are characterized by rapid development and finality of the plant life cycle before the hot summer period. It indicates that this species is a patient. Furthermore, we consider this type of strategy (S-strategy) to be predominant. Comparison of the vitality of individuals and the vital structure of populations shows that the most stressful conditions for *O. punctulata* are in steppe communities due to the lack of moisture and extremely high temperatures. Under stress conditions, the species has a tactic to reduce the size of generative plants. This process can occur under the influence of both abiotic and biotic environmental factors when increasing the population density reduces plant size – this so-called 'opportunistic' way of regulating population density, as noted by B.M. Mirkin (Mirkin et al. 1999) is typical for explerents. The high value of plasticity index noted in Pop1, also indicates here the explerance of the species (see Table 3). Under unfavorable weather conditions, explosive plants "stop visible growth, reduce or even eliminate juvenile phases, which leads to an acceleration of the beginning of flowering and seed formation" (Mirkin et al. 1999).

Violence characteristics are also present in populations in steppe communities. Under any conditions, this species continues to maintain vegetative growth, forms large populations, constantly presents in plant communities, and (albeit for a short time) plays the role of dominants and co-dominants. In the Kiziltash, we did not observe any violant or explerant qualities: the population is not large, the species did not dominate in the plant community, and the size plasticity of the generative individuals was small. The low level of regeneration in forest communities prevents this species from going beyond the framework of phytocenotic patience.

Thus, our studies have shown that *O. punctulata* populations in steppe communities demonstrate a mixed SRC strategy. In conditions of low regeneration in forest communities, this species exhibits a stress-tolerant ecological-coenotic strategy (S-strategy).

Conclusion

The largest population of *O. punctulata* in southern Crimea was recorded in Tepe-Oba in communities of forb-cereal steppes with a predominance of *Festuca valesiaca*, *Galatella villosa*, *Orchis punctulata*. All studied populations were in a stable equilibrium state: the number, density, age, and renewal indices are stable over several years or fluctuate within small limits. *O. punctulata* has two types of primary ontogenetic spectra: the left-sided spectrum with a maximum on pregenerative individuals for populations growing in steppe communities and the bimodal one with an absolute maximum on the generative part of the spectrum for populations growing in forests. According to the morphological parameters of the individuals, the vitality structure of the populations, the optimal environmental conditions for *Orchis punctulata* were in forests. The species has a broad ecological range; it can grow in both steppe and forest communities. We evaluate the ecological-cenotic strategy: in steppe communities – as a mixed SRC strategy, in forest communities – as a stress-tolerant (S) strategy.

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