Phytocenological Structure, Population Abundance And Conservation Priorities Of Phlomoides Anisochila And Phlomoides Sogdiana In The Nuratau Mountains

Xolbutayeva Muqaddas Mamatmuratovna
Uzbekistan

ABSTRACT

This study compares the phytocenological position, local abundance and conservation significance of the rare endemic species Phlomoides anisochila (Pazij & Vved.) Salmaki and Phlomoides sogdiana (Pazij & Vved.) Salmaki in the Nuratau Mountains of Uzbekistan. Field investigations were conducted in 2019–2023 using route surveys, geobotanical descriptions, herbarium collection and abundance estimation according to the Drude scale. Ten local populations were examined: four of P. anisochila and six of P. sogdiana. Both species occur mainly at 1000–1800 m a.s.l. on dry, gravelly and stony slopes. P. anisochila was recorded chiefly in mixed-herb–wormwood and wormwood–almond communities and usually showed sp or sol abundance. P. sogdiana occurred in a broader range of mixed-herb, wormwood and thorny-almond communities and reached cop1 in some stands. The studied P. sogdiana associations contained 11–31 species and 18–43% total vegetation cover. Conservation assessment shows that P. anisochila has an extremely restricted distribution and small fragmented populations, while P. sogdiana is more widespread but is also declining under grazing, tourism, drought and habitat transformation. The results demonstrate that community position and local abundance should be integrated with spatial criteria when planning conservation of endemic Phlomoides species.

KEYWORDS: Phlomoides anisochila, Phlomoides sogdiana, phytocenology, plant community, population abundance, endemic species, Drude scale, conservation, Nuratau Mountains.

INTRODUCTION

Mountain endemics often persist in small habitat patches where substrate, slope, moisture and disturbance strongly determine local population structure. For such species, conservation assessment should not rely only on geographic range. It is also necessary to identify the plant communities in which the species occurs, its abundance within those communities and the pressures acting on the habitat. Phytocenological data therefore provide a direct ecological basis for monitoring rare plants and for translating floristic information into site-level management [1, 2].

The Nuratau Mountains are a distinctive floristic territory of Uzbekistan with xeric relief and mosaic vegetation. The dissertation reports more than 1,100 plant species for the Nuratau flora and 843 species within the Nuratau State Reserve, 32 of which are included in the national Red Data Book. Lamiaceae is represented by 68 species. Vegetation composition changes markedly with altitude, slope, exposure and soil texture, and xerophytic shrub and herb communities are especially typical of the 1000–1800 m belt [1, 3].

Among the endemic representatives of Phlomoides Moench, P. anisochila and P. sogdiana are especially important for conservation. P. anisochila is a narrow endemic confined to the central Nuratau Mountains, whereas P. sogdiana is an endemic of Uzbekistan with a wider Pamir-Alay distribution [4, 5]. Previous field work described their participation in Nuratau vegetation [6], but comparison of community position, local abundance and conservation indicators is required to explain their unequal vulnerability. The aim of this article is therefore to compare the phytocenological structure of their habitats, characterize population abundance and relate these observations to the conservation assessment obtained in the dissertation research.

Materials And Methods

Field investigations were carried out during 2019–2023 in the Nuratau Mountains, especially within the Nuratau State Reserve and adjacent parts of Forish District. Route-based and semi-stationary surveys were used to locate populations and describe habitats. Ten local populations were analysed: four of P. anisochila and six of P. sogdiana. Principal localities included Novi Olim, Xotinon and Tikchasoy for P. anisochila and Sop, Uxum, Tikchasoy and Po'dak for P. sogdiana. The plants were mainly recorded on dry stony, gravelly or gravelly-fine-earth slopes at approximately 1000–1800 m a.s.l.

Plant communities and associations were described through dominant, subdominant and accompanying species. Abundance was estimated according to the Drude scale; in the dissertation cop3 represents occurrence up to about 50%, sp categories indicate low or scattered occurrence up to about 25%, and sol represents very sparse occurrence up to about 10%. Counts on 100 m^2 plots were used where appropriate. Community composition was supported by herbarium material [2, 6]. Conservation interpretation used the dissertation's IUCN-related assessment, including extent of occurrence (EOO), area of occupancy (AOO), population estimates and threats. GeoCAT-based spatial information was considered together with field abundance; these values were interpreted, not recalculated, in the present article [8–10].

Results And Discussion

The general vegetation pattern of the Nuratau Mountains is xerophytic and strongly heterogeneous. Some northern and western herbaceous communities reach 80–90% projective cover and contain 70–80 species, whereas dry southern and eastern rocky slopes support much sparser vegetation. This mosaic explains why the two Phlomoides species occur in small and discontinuous local populations even inside the same altitudinal belt [1].

P. anisochila was associated with a relatively narrow set of dry mountain communities. At Novi Olim it occurred in mixed-herb–wormwood vegetation, while in Tikchasoy it was recorded in a mixed-herb–wormwood–almond community among xerophytes and petrophytes. Its abundance on 100 m^2 plots was generally sp or sol. In the cited observations, sp corresponded to approximately 12–18 plants and sol to about 4–10 plants. This pattern reflects scattered individuals or small groups rather than continuous stands. Associated species included Atraphaxis seravschanica, Ferula ovina, Prunus spinosissima, Prunus verrucosa, Artemisia tenuisecta and several annual and perennial herbs.

P. sogdiana had a broader phytocenological amplitude. It was recorded in mixed-herb, mint-dominated, narrow-leaved wormwood and thorny-almond communities. At Sop, the species

reached cop1 in a Ferula–thorny almond association, where about 55–60 individuals were observed; in an ephemeral–thorny almond association it showed sp abundance with approximately 15–20 plants. In the Uxum area abundance ranged from cop3 in mixed shrub–mixed herb–wormwood vegetation to sp or sol in other associations. The investigated communities generally contained 11–31 species, and total vegetation cover ranged from 18% to 43%. Thus, P. sogdiana may be a locally noticeable component of open mountain vegetation even though its populations remain fragmented.

The contrast between the species is therefore ecological as well as geographical. P. anisochila is consistently sparse within the communities in which it occurs. P. sogdiana participates in more associations and can reach higher abundance categories. This difference is important for monitoring: a naturally sparse P. anisochila plot should not be interpreted in the same way as a formerly dense P. sogdiana locality that has declined. The dissertation specifically notes that P. anisochila populations contain fewer and more widely spaced individuals than P. sogdiana populations [6].

Table 1. Comparative phytocenological characteristics

Characteristic	P. anisochila	P. sogdiana	Interpretation
Populations studied	4	6	Ten local populations in total
Main habitat	Dry rocky/gravelly slopes, 1000–1800 m	Dry gravelly, stony and fine-earth slopes, 1000–1800 m	Both are mountain xerophytes
Typical communities	Mixed-herb–wormwood; wormwood–almond	Mixed-herb, wormwood, mint-dominated and thorny-almond	P. sogdiana has broader community amplitude
Abundance	Mostly sp–sol; about 4–18 plants/100 m² in cited plots	sol/sp to cop1/cop3; up to 55–60 plants in a cited stand	P. anisochila is distinctly sparser
Community structure	Open xeric communities	11–31 species; 18–43% cover in studied sites	Open stony habitats are central to both species

The field pattern is consistent with the spatial conservation assessment. P. anisochila was assigned in the dissertation to EN – B1ab(ii, iii, iv) + B2ab(iii, iv) + C2a(i). Its estimated EOO is approximately 108.683 km^2 and AOO approximately 36 km^2. The total number in Uzbekistan is estimated at roughly 500–700 plants, with local populations generally containing only tens of individuals. These values correspond closely to the sp and sol abundance categories documented in the vegetation plots.

P. sogdiana was assessed as EN – B2b,c(ii, iii, iv). Its estimated EOO is approximately 38,484.154 km^2 and AOO about 188 km^2. Field data indicate up to about 3,500 plants in Uzbekistan, with the largest concentrations reported from the Nuratau and Kugitang ranges. Nevertheless, most local populations contain only dozens of individuals, and the populations are fragmented. A wider distribution therefore does not eliminate conservation risk.

The main threats act directly through habitat quality and regeneration. Livestock grazing and trampling reduce vegetation cover and damage plants, while tourism increases disturbance in accessible slopes and valleys. For P. sogdiana, drought and transformation or leasing of forest lands were also identified as pressures. For P. anisochila, low reproductive potential and possible reduction of insect pollinators add to the risk. The dissertation's analysis of the reserve landscape indicates that most accessible areas are influenced to some degree by human or livestock activity, while only difficult steep slopes are nearly unaffected [1].

The conservation recommendations follow directly from these observations. The dissertation proposes restriction of grazing in known localities, systematic mapping and monitoring, seed banking, ex situ cultivation in botanical gardens and reintroduction of propagated plants. For P. sogdiana, additional protection of localities such as Qo'li Kach, Sari Guzar, Boloi Aftoda, Sop,

Xasanbulbul and Po'dak is recommended. For both species, seedlings produced from laboratory-germinated seeds are proposed for reintroduction into fine-stony and gravelly habitats. Such measures are consistent with the broader principle that rare-plant conservation must combine spatial assessment with site-level ecological information [8–10].

Table 2. Conservation indicators and management priorities

Indicator	P. anisochila	P. sogdiana	Management meaning
Proposed status	EN – B1ab(ii,iii,iv) + B2ab(iii,iv) + C2a(i)	EN – B2b,c(ii,iii,iv)	Both require active conservation
EOO / AOO	~108.683 / 36 km²	~38,484.154 / 188 km²	P. anisochila is extremely range-restricted
Estimated abundance	~500–700 plants; small local populations	Up to ~3,500 plants; fragmented populations	Repeated population counts are needed
Main threats	Grazing, trampling, tourism, low reproductive capacity, pollinator decline	Grazing, drought, tourism, land-use change	Protect habitat and regeneration
Priority measures	Monitoring, grazing control, seed bank, ex situ propagation, reintroduction	Same measures plus stronger protection of unprotected localities	Combine in situ and ex situ actions

Taken together, the results show that local abundance is an informative indicator of vulnerability when interpreted within the correct community context. P. anisochila combines consistently sparse occurrence, a very narrow range and small fragmented populations. P. sogdiana is locally more abundant and geographically wider, but its habitats are discontinuous and many populations remain small. Repeated 100 m^2 plots in representative associations can therefore provide a practical monitoring framework for abundance class, individual counts, community cover and changes in dominant vegetation. GeoCAT and distribution mapping can then connect these plot-level observations with EOO and AOO, providing an integrated phytocenological and spatial basis for conservation [9, 10].

Conclusion

Field investigations conducted in 2019–2023 show that P. anisochila and P. sogdiana occupy related but distinguishable phytocenological positions in the Nuratau Mountains. Both occur mainly on dry stony slopes at 1000–1800 m, but P. anisochila is usually a very sparse component of mixed-herb–wormwood and wormwood–almond communities, whereas P. sogdiana occupies a broader set of mixed-herb, wormwood and thorny-almond associations and may reach higher local abundance. These differences correspond to their conservation profiles: P. anisochila has an extremely restricted EOO and AOO and small fragmented populations, while P. sogdiana has a wider range but remains threatened by fragmentation and declining habitat quality. Grazing, trampling, tourism, drought and habitat transformation are the principal pressures identified in the dissertation. Effective management should combine repeated phytocenological monitoring, spatial assessment, protection of occupied sites, grazing regulation, seed banking, ex situ propagation and reintroduction. Community-level data are therefore essential for understanding the true vulnerability of endemic Phlomoides species and for designing site-specific conservation measures.

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