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# The Distribution of *Astragalus* L. (Fabaceae) Species in the Central Fergana Botanical-Geographical District

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**Abstract** Ecological change in arid landscapes has elevated the need for rigorous flora assessments and conservation planning. This study evaluates the current status of Astragalus species distributed across the Central Fergana region. Drawing on coordinated field surveys, verified herbarium vouchers, and a synthesis of prior scientific literature, we compile an updated inventory of regional Astragalus taxa. All occurrence records were geo – referenced and visualized in a GIS environment to confirm species identities and delineate distribution areas. The resulting checklist and maps provide a consolidated, evidence-based view of Astragalus diversity and spatial patterns in Central Fergana, offering a practical baseline for future population monitoring, habitat assessments, and conservation prioritization. By integrating ground-based observations with archival sources, the study strengthens regional floristic knowledge and supplies a reproducible framework for assessing other xerophytic plant groups in arid Central Asia.

**Keywords** Endemic, Astragalus, Central Fergana, Red Book

## 1. Introduction

Human pressures–especially uncontrolled development and climate change–have intensified the threatened status of numerous plant species and habitats [2]. For many taxa, distribution, ecology, and conservation status remain poorly documented. Addressing this knowledge gap and placing greater emphasis on this critical component of Earth's biodiversity is a pressing research priority. The Fergana Valley is distinguished by a unique climate, a rich concentration of rare flora, and an abundance of species in need of protection. Targeted studies of the valley's flora have focused mainly on floristics, systematics, and geobotany, while efforts to identify areas of particular botanical significance have helped delineate the ranges of rare species [1].

Astragalus L. (Fabaceae) is the largest genus of vascular plants worldwide, comprising roughly 2,900 annual and perennial species [3]. One of the earliest monographers of the genus, A. Bunge, recorded 971 species in "Generis Astragali species gerontogeae" (1868–1869), classifying them into eight subgenera and 105 sections [4]. Building on this foundation, R. V. Kamelin provided identification keys for 39 genera and 926 species of Fabaceae in Volume VI of the "Flora of Central Asia: Plant Identifier," including keys for 108 sections of the highly polymorphic and species-rich genus Astragalus [5]. In the same volume of Conspectus Florae Asiae Mediae, Kamelin recorded 592 Astragalus species for the region. Later, F. Khassanov's Volume XI of Conspectus Florae Asiae Mediae (2015) added 57 new taxa to the genus [6]. Despite this progress, the ecology and geographic distributions of many Astragalus species remain insufficiently resolved. Important contributions to the genus come from A. Bunge (1868), R. V. Kamelin (1981), F. Khassanov (2015), Mohammad (2019), and Dietrich Podlech and Shahin Zarre (2013), among others.

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## 2. Materials and Methods

To compile species occurrence records and GPS coordinates, we used the Global Biodiversity Information Facility (GBIF; gbif.org), physical collections housed in the TASH herbarium, virtual specimens from the Herbarium of Moscow State University (MW; plant.depo.msu.ru), and the Plantarium online plant atlas (plantarium.ru). Authorship and citation of plant names follow Brummitt, R.K. & Powell, C.E. (1992) [10], *Authors of Plant Names*. Geographic coordinates for herbarium localities were obtained and verified in Google Earth Pro v7.1 and integrated with records from our field surveys conducted in the central Fergana Valley during 2024–2025.

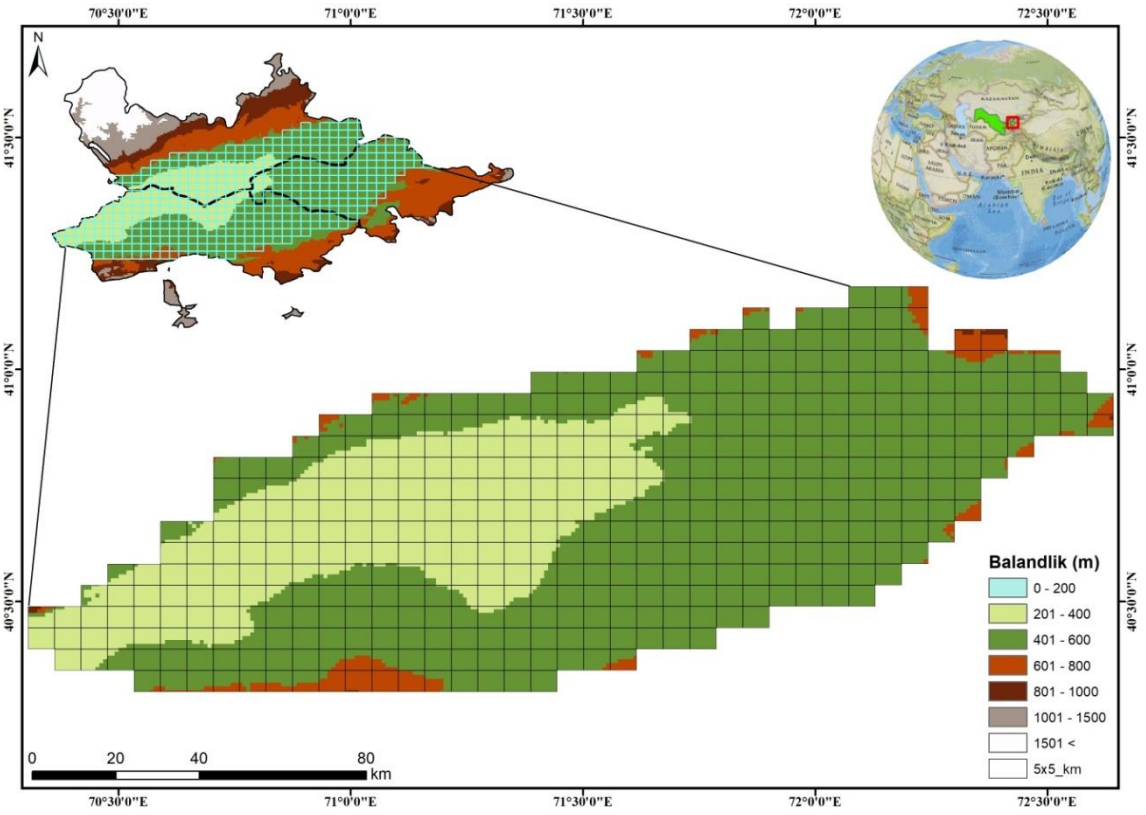


**Figure 1.** Central Fergana Botanical and Geographical District

## 3. Analysis and Results

During the 2024–2025 field season, we surveyed the flora of the central Fergana Valley–specifically the Qayroqqum, Yozyovon, and Eastern Fergana districts. Combined with the examination of herbarium material from the principal collections (MW, TASH, LE) and a review of the relevant literature, these efforts documented four species of the genus *Astragalus*.

Globally, recent multispecies studies have tended to emphasize the discovery of new taxa together with analyses of phytochemistry, morphology, and ontogeny, whereas the geography of species, their natural resource base, and current conservation status have been addressed less extensively. Species of *Astragalus* in particular often require conservation attention. This contribution provides concise accounts of the *Astragalus* species recorded from the flora of the central Fergana Valley, accompanied by brief notes on distribution and mapped occurrences.

Astragalus rubellus Gontsch., 1941, Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk S.S.S.R. 9: 94.

Holotype: Uzbekistan, Systema fl. Syrdarja, Distr. Ferghana, in arenis mobilibus prope Kara-kalpak, 1.V.1913, fl. et fr., G. I. Dolenko 4167 (LE). (Fig. 3F)

This species is endemic to the Fergana Valley and is associated primarily with sandy desert habitats [7]. Based on our 2024–2025 fieldwork and the study of available herbarium specimens, *A. rubellus* is confirmed from the following localities (herbarium label wording retained where appropriate):

– Distr. Kokand, near Kyzyl-tola, Dauduk, 23.VI.1913, Minkwitz 884 (LE);
– Margelan district, Kara-Kalpak, 01.V.1913, Dessiatoff 383, 314 (LE);
– Kuyganyar irrigation district, ca. 6 km W of Yaka-Duka village, 16.VII.1928, Ioffe 706 (TASH);
– Distr. Margelan, Yazyavan, 13.V.1952, Arifkhanova 289 (LE);
– Road between Margilan and Andijan, vicinity of Kora village, 19.V.1952, Arifkhanova & Gringof 497 (TASH);
– Yazyavan steppe, Uroch. Sofa, ca. 4 km NW, 13.V.1952, Arifkhanova & O. Gringof 289 (TASH);
– Yazyavan district, Talkuduk massif, 26.IV.1953, Saidaliev s.n. (TASH);
– Yazyavan district, Stalinabad, 19.V.1957, Saidaliev s.n. (TASH);
– Fergana Region, Toshloq district, Takalik-2 village, small sandy desert, 09.V.2024, I. Sharipov, 40.739344, 71.649421;
– Fergana Region, Yozyovon district, Yozyovon Natural Monument area, 21.IV.2024, I. Sharipov, 40.674586, 71.487581;
– Namangan Region, Mingbulok district, Alami village, Karakalpak desert, 05.V.2024, I. Sharipov;
– Andijan Region, Ulug‘nor district, sand dunes near Haydarabad village, 28.IV.2024, I. Sharipov. (Fig. 2)

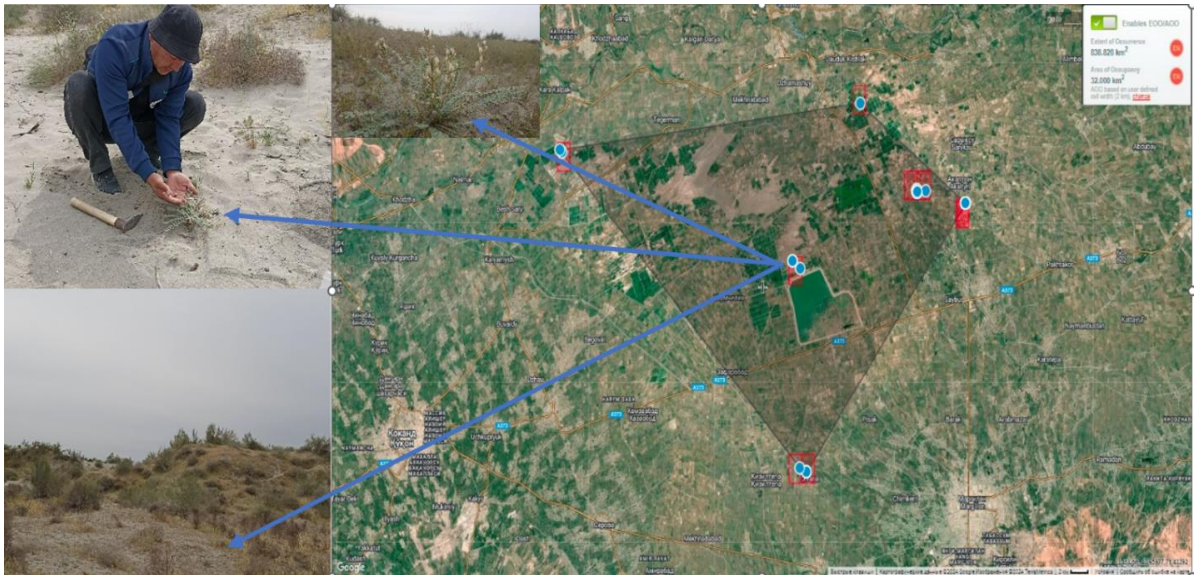

**Figure 2.** GeoCAT map of the distribution of the species *Astragalus rubellus* Gontsch

Astragalus alopecias Pall., Astrag. (1800)

During our surveys in the central Fergana Valley, *A. alopecias* was found to be widespread. It occurs predominantly on humus-rich soils with fine gravel and pebbles along roadsides (Fig. 2A). Representative records: Fergana Region, Furkat district, Bog‘ibo‘ston village, sandy soils, 05.VI.2024, I. Q. Sharipov; Namangan Region, Mingbulok district, Dovduq village, field banks, humus soils, 25.IV.2024, I. Q. Sharipov; Fergana Region, Rishton district, Yoyilma village, field banks, 02.V.2024, I. Q. Sharipov; Fergana Region, Margilan city, Yoyilma village, roadside, 15.VI.2024, I. Q. Sharipov; Namangan Region, Mingbulok district, Tegirmon village, roadside, 15.V.2024, I. Q. Sharipov; Fergana Region, Yozyovon district, Yangiabad village, roadside, humus soils, 02.VI.2024, I. Q. Sharipov.

Astragalus arpilobus Kar. & Kir., Bull. Soc. Imp. Naturalistes Moscou 15: 336 (1842).

= *Astragalus harpilobus* Kar. & Kir., Bull. Soc. Imp. Naturalistes Moscou 15: 336 (1842), orth. var.

Fieldwork undertaken in April–May 2024 recorded *A. arpilobus* from sandy habitats in the Fergana, Andijan, and Namangan regions. Given the species’ preference for desert ecological conditions, the Qayroqqum–Yozyovon district aligns well with its natural range within the study area.

Astragalus chodshenticus B. Fedtsch., Trudy Tadzhiksk. Bazy 2: 152 (1936).

Recorded from sandy deserts of the central Fergana Valley. Representative specimens and observations: Uzbekistan, Namangan Region, Mingbulak sands, 15.V.2021, Tillaev T. S.; Uzbekistan, Fergana Valley, Yazyavan sands near the reservoir, 26–27.IV.2021, Tillaev T. S.; Fergana Region, Yozyovon District, Takalik-1 village, sandy soils, 11.V.2025, I. Q. Sharipov; Fergana Region, Yozyovon District, Yozyovon Natural Monument, sandy desert, 21.IV.2024, I. Q. Sharipov & A. R. Batoshov; Namangan Region, Mingbulok District, sandy deserts south of Madyorovul village, 10.V.2024, I. Q. Sharipov; Fergana Region, Yozyovon District, Yangiabad village, Yozyovon Natural Monument, 03.V.2025, I. Q. Sharipov, K. Sh. Tojiboyev & F. I. Karimov.

Astragalus cognatus C. A. Mey., in Schrenk, Enum. Pl. Nov.: 81 – “Cognatus astragalus.”

Chamaephyte. On sandy to coarse-sandy substrates in the desert zone, 350–400 m. Records: Yozyovon Natural Monument (forestry unit), 22.V.2022, Daminova & Turdiboev; desert tract between the Yozyovon Natural Monument and the Mingbulok Natural Monument, 20.V.2024, I. Q. Sharipov.

Astragalus alopecias Pall., in Sp. Astragal.: 12 (1800).

Widely distributed in the central Fergana Valley, chiefly on humus-rich soils with stony gravel, often along roadsides and irrigation features. Historical and recent records: Central Fergana, 17 km from the station, on the road from Jamashoy to Balikchi village, No. 124, 23.VII.1974, Nabiev, Pakhomova, Kazakbaev, Tsukervanik & Makhmedov; Fergana Valley, state farm “Electro-rassada,” along the edge of an irrigation ditch, 10.VIII.1931, T. Paziy; Fergana Valley, Kuygan-Yor irrigation district, along a stony stream, G. Sursap, No. 397, 21.VI.1928, A. F. Ioffe; Fergana Valley, Balikchi District, outskirts of Minbulak village, ancient fertile land, low rise, 27.V.1932, Garshin; Fergana Valley, Andijan District, 1 km SE of Kaunchi village, mudflow bed, 16.V.1932, Paziy; Fergana Region, Furkat District, Bog‘ibo‘ston village, sandy soils, 05.VI.2024, I. Q. Sharipov; Namangan Region, Mingbulok District, Dovduq village, field margin, humus soils, 25.IV.2024, I. Q. Sharipov; Fergana Region, Rishton District, Yayilma village, field banks, 02.V.2024, I. Q. Sharipov; Namangan Region, Mingbulok District, Tegirmon village, field margin, humus soils, 15.V.2024, I. Q. Sharipov; Fergana Region, Margilan city, Yayilma village, roadside, 02.VI.2024, I. Q. Sharipov. Observed mainly on humus-rich, gravelly substrates and along roadsides.

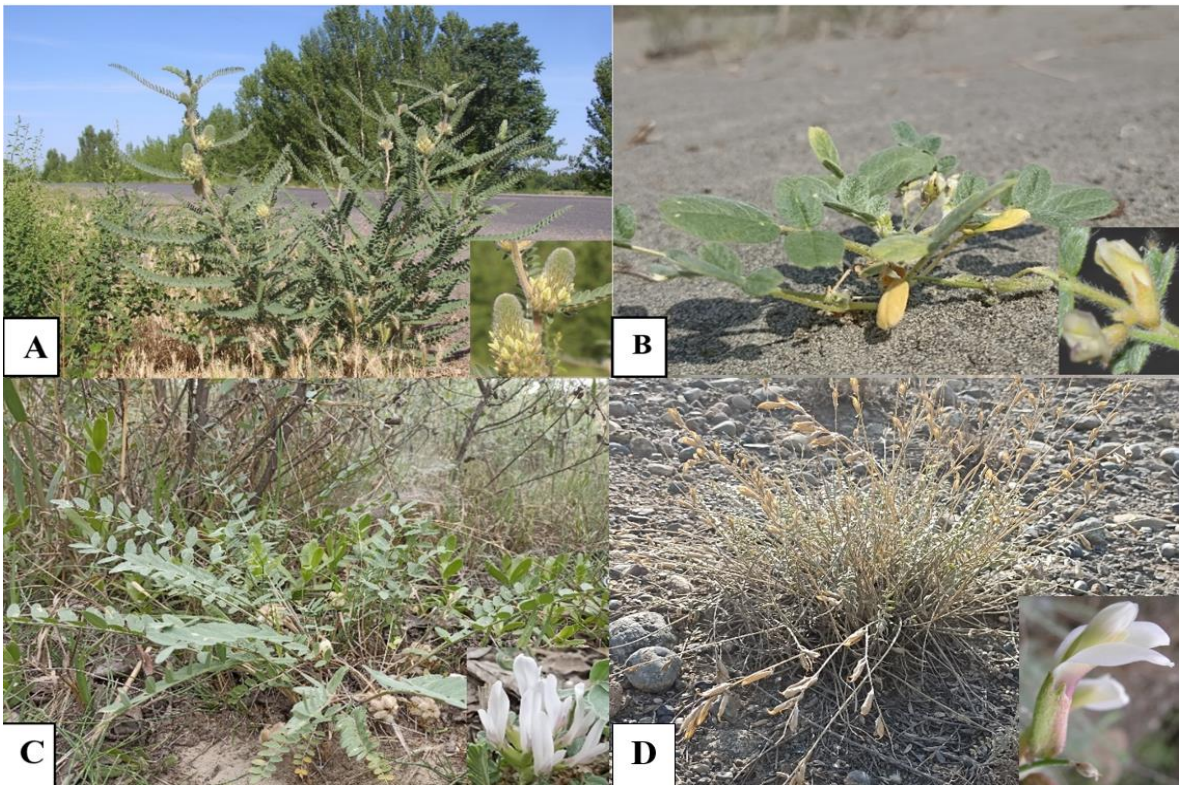


**Figure 3.** **A**-A.alopecias; **B**-A.arpilobus; **C**- A.lasiopetalus; **D**-A.namanganicus; **Astragalus lasiopetalus Bunge** in Index Seminum (TU, Dorpatensis) 1839: vii (1841)

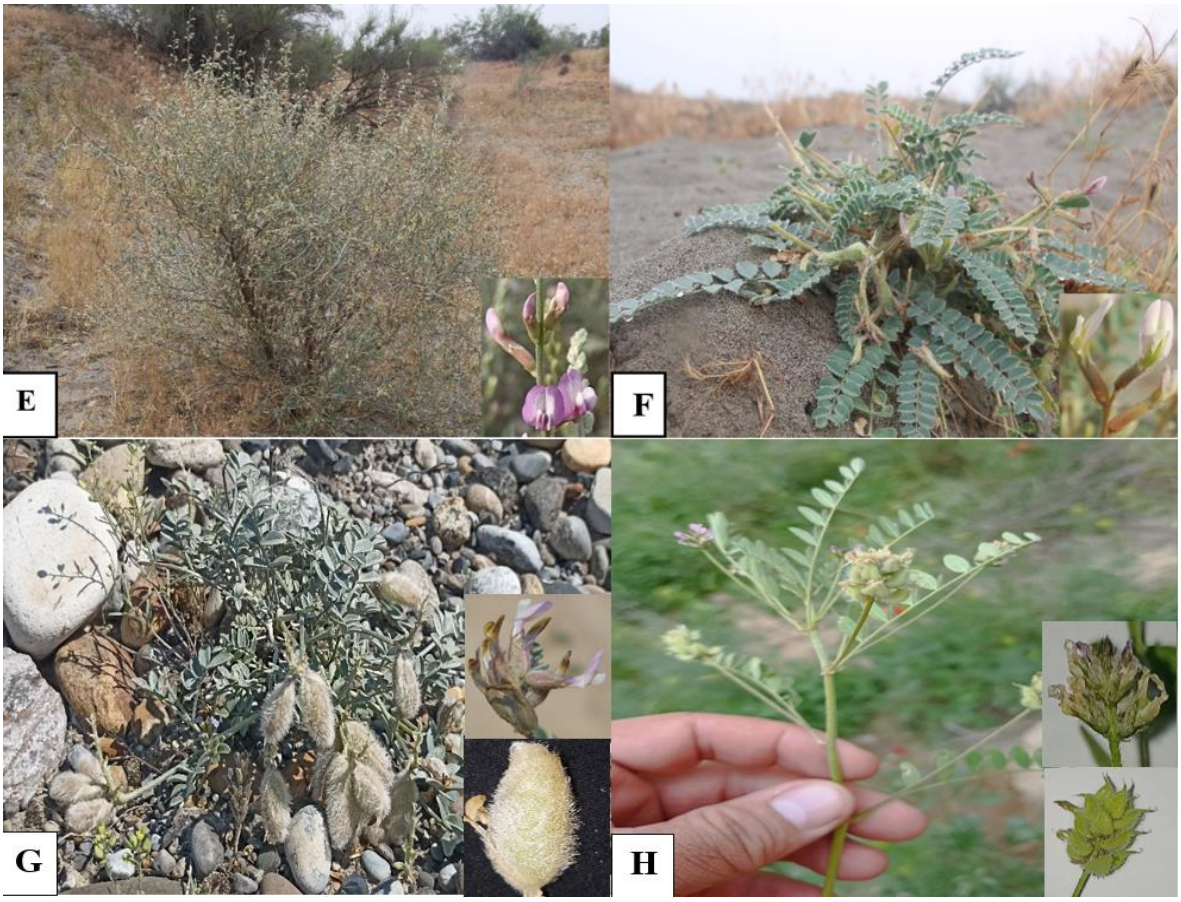


**Figure 4.** **E**- *A.chodshenticus*; **F**-*A.rubellus*; **G**-*A.Ferganensis*; **H**-*A.filicaulis*

**Native to:** Afghanistan, Iran, Kazakhstan, Kirgizstan, Tadzhikistan, Turkmenistan, Uzbekistan, Xinjiang.

Fergana soil expedition. Sharikhan district. Chek village. Cultivated and irrigated lands. №. 164, 165. 21.05.1932. Zakrjevskiy; Fergana soil expedition. Shirikhansky district. On the E from Shirikhan to Kazy-Kurgan. Cultural-irrigated wetlands. №. 201. 05.22.1932. Zakrjevskiy; On the road 10 km from the city of Chinabod towards the city of Andijan. №. 7. 07.28.1962. Puchkova;

Fergana Valley. Balykchinsky district. 3 km from Chinabod, in the village. Maslahat, wasteland. №. 1036. 05.26.1932. Garshin; Namangan region. Mingbulok district. Sandy desert between Okqum and Tolovul villages. №. 482,483,484, 486,487. 10.05.2024. I.Q. Sharipov;

**Native to:** Kazakhstan, Kirgizstan, Mongolia, Tadzhikistan, Uzbekistan, Xinjiang.

***Astragalus filicaulis* Fisch. & C.A.Mey. ex Ledeb.** in Fl. Ross. 1: 637 (1843). Fergana Valley. On the road from Andijan to Madaniyat village. Rocky soils. №. 609. 20.05.1952. Arifkhanova, Gringof; Fergana Valley. Village Yangi-aryk. 7-10 km west of the villages. Madaniyat. №. 733. 05.21.1952. Arifkhanova and Gringof; Fergana Valley. Andijan district. Uch-Kurgan steppe. Northern section. Wormwood steppe. №. 58. 03.05.1929. A.F. Ioffe; Fergana Valley. Vicinity of the Dzhide-say tract. №. 880, 05.22.1952. Arifkhanova, Gringof; Namangan region, Uychi district, Onhayot village area. gray soils. 20.04.2025. I.Q. Sharipov; The growth conditions of this species are mainly at altitudes of 650-800 meters above sea level, but it has also been found on small hills preserved in the Central Fergana District.

**Native to**: Afghanistan, East European Russia, Iran, Kazakhstan, Kirgizstan, Pakistan, Tadzhikistan, Turkmenistan, Uzbekistan, Xinjiang.

**Figure 5.** Development of the sands of the Fergana Valley

***Astragalus ferganensis* (Popov) B. Fedtsch. ex Korol**. in Fl. Tadzhiksk. S.S.R. 5: 414 (1937). Fergana Valley. Yangi-Aryk irrigation region. 1 km from the railway line to the south near the village of Dzhandzhal. №. 414. 20.06.1928. A.F. Ioffe; Fergana region, Beshariq district, Yangi Hayot village, Forestry area, stony-gravel soils. 23.03.2025. I.Q. Sharipov;

**Native to**: Kirgizstan, Tadzhikistan, Uzbekistan.

***Astragalus namanganicus* Popov** in Byull. Sredne-Aziatsk. Gosud. Univ. 14: 140 (1926).

Western Tien Shan. Foothills north of Namangan. Hills north of Namangan. Vicinity of Chash-Tyube village. Rocky slopes. No. 25. 04.07.1933.S. Kudryashev, P. Krasovsky; During field research conducted in the Central Fergana botanical-geographical region in 2024-2025, this species: Fergana region, Oltiariq district, Jonibek village, field bank. 19.07.2024. I.Q. Sharipov.


**Figure 6.** Herbarium type specimen of Astragalus austroferganicus (TASH)

**Figure 7.** *Astragalus ammodendron* Bunge (Yazyavon Natural Monument)

***Astragalus ammodendron* Bunge** in Arbeiten Naturf. Vereins Riga 1: 233 (1847).

This species was recorded for the Fergana Valley for the first time. During field research, this species was recorded in the Yozyavon natural monument area, Yozyavon district, Fergana region (Fig. 7).

***Astragalus subauriculatus* Gontsch.** in Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk S.S.S.R. 10: 36 (1947).

This species was first collected from the central part of the Fergana Valley by Kuschakewicz in 1878. Andijan region, Balikchi district, 27.3.1878. Kuschakewicz; Fergana: distr. Margelan, Kara-Sakal, 12.04.1919. Dessiatoff N; The areas where the species are distributed are currently being intensively developed, and these species are becoming endangered (Fig. 5).

***Astragalus orbiculatus* Ledeb**. First published in Fl. Altaic. 3: 311 (1831).

During field research, this species was identified in abandoned lands near the village of Karasokol, Yozyavon district, Fergana region.

***Astragalus austroferganicus* Kamelin & V.M. Vinogr.** First published in Opred. Rast. Sred. Azii 6: 356 (1981).

The first herbarium specimen was collected from the Fergana Valley in 1928 by Ioffe. The first herbarium specimen was collected from the Fergana Valley in 1928 by Ioffe. This species is distributed in very small areas and is endemic to the Fergana Valley (**Fig. 6**).

Uzbekistan. Fergana Valley. Yangi-aryk irrigation district. 21.06.1928, Ioffe; Fergana Valley. Yangi-aryk irrigation district. 3 km from the station. Janjal to the west. 23.06.1928, Ioffe.

## 4. Discussion

The integrated dataset–spanning 2024–2025 field surveys, verified vouchers from MW, TASH and LE, and curated literature–clarifies the distribution and habitat preferences of several Astragalus taxa within the central Fergana Valley. Sandy substrates associated with the Qayroqqum–Yozyovon system emerge as the principal habitat template, while roadside and field-margin microhabitats also contribute substantively to the record set.

Biogeographic patterns and habitat partitioning. The focal assemblage exhibits a gradient from habitat generalists to narrow psammophytes. Astragalus alopecias is widespread and tolerant of disturbed, humus-enriched roadside soils, whereas A. rubellus–endemic to the Fergana Valley–shows a strong association with mobile or semi-fixed sands, consistent with prior regional syntheses [7,1]. Records of A. arpilobus and A. chodshenticus further underscore the importance of dune and proto-dune mosaics. Elevational notes (ca. 350–400 m for A. cognatus; ca. 650–800 m for A. filicaulis) suggest fine-scale partitioning along moisture and substrate-texture axes within an otherwise low-relief desert–steppe ecotone. This partitioning has practical implications: conservation planning should treat “sandy desert” not as a single habitat but as a set of micro-habitats (mobile dunes, stabilized dunes, interdune flats, sandy fallows) supporting different Astragalus guilds.

Conservation signals. Multiple lines of evidence indicate heightened vulnerability in the study landscape: long-term agricultural development, irrigation infrastructure, sand extraction, off-road traffic, and settlement expansion collectively reduce suitable psammophytic patches and increase fragmentation. GeoCAT outputs (mapped for A. rubellus) highlight spatial restriction and clumped occurrences; although formal IUCN categories require quantitative Extent of Occurrence/Area of Occupancy estimates, the observed pattern is consistent with a narrow-ranged taxon potentially sensitive to further habitat loss. Given that several Astragalus taxa in Uzbekistan are red-listed and that herbarium-based rarity signals can underestimate true risk when sampling is sparse [9,7], precautionary management is warranted.

Taxonomic and nomenclatural notes. The treatment of A. arpilobus (including the orthographic variant A. harpilobus) exemplifies persistent nomenclatural and identification challenges in large, morphologically complex genera. Historical labels often use legacy toponyms or imprecise locality strings, complicating georeferencing; likewise, diagnostic characters (e.g., pod pubescence, calyx teeth, indumentum density) can vary with substrate and phenology. Future work should pair updated regional keys (sensu Kamelin, 1981) with molecular markers to test species limits and to detect possible cryptic diversity within psammophytic clades.

Data completeness and bias. The record set blends historical vouchers (1928–1974) with recent observations (2021–2025). While this temporal breadth is a strength, it also embeds biases: early collections cluster along irrigation canals and road networks, and modern records are denser near accessible dunes and protected units (Yozyovon Natural Monument). Following evidence-based guidance on sampling sufficiency [9], systematic resurveys should target under-sampled dune fields, interfluves, and privately managed sandy fallows to improve detection probabilities and trend inference.

Regional context. POWO/IPNI range summaries show that several documented species extend beyond the Fergana Basin into Xinjiang and the western Tian Shan forelands, whereas others (e.g., A. rubellus, A. austroferganicus) appear locally restricted. Peripheral or patch-center populations within Fergana may harbor distinct genetic diversity due to isolation by habitat; targeted population-genetic work would clarify whether central Fergana functions as a refugial "island" for psammophytes or as a corridor along the Syr Darya sands.

Management recommendations. In the near term, (i) designate micro-reserves within the Yozyovon/Qayroqqum dune complex that capture mobile–fixed dune transitions; (ii) regulate sand extraction and off-road traffic in occupied patches; (iii) integrate Astragalus hotspots into local land-use plans (buffering irrigation expansions and settlement); (iv) establish seed banks and living collections for narrowly distributed taxa, prioritizing A. rubellus and A. austroferganicus; and (v) institutionalize a five-year monitoring cycle using fixed photo-points and plot-based occupancy to quantify population trends. These steps align with Uzbekistan's red-listing practice and broader IPA/KBA principles [1,7].

Outlook. The updated distributional evidence provides a practical baseline for conservation action and for hypothesis -driven research on psammophytic plant resilience in arid Central Asia. By combining repeated field surveys, voucher reinterpretation, and geospatial analysis across the dune mosaic, future work can move from presence-only mapping toward robust demographic assessments and threat attribution–essential for prioritizing limited conservation resources in this rapidly changing landscape.

## 5. Conclusions

As a result of the fact that the Central Fergana Botanical and Geographical District has been under strong anthropogenic influence for the past 80 years, the number of plant species naturally distributed in the district has been decreasing. During the field research conducted in the central part of the valley in 2024-2025, it was found that the *Astragalus* genus of the *Fabaceae* family has also been preserved in limited numbers. Since the species of this genus are mainly found on sandy, stony-gravelly soils, the development of natural areas puts the preservation of these species in doubt.

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