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New and rare plant species of the Caspian region and adjacent territories

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Summary. The article presents the results of an integrative floristic study conducted in 2025 in the western Caspian region (Kazakhstan and Turkmenistan) and the Sistan region (SE Iran). The study aimed to systematize and analyze new data on the distribution of rare, relict, and alien vascular plants in the Inder salt-dome area of Kazakhstan, in key regions of western Turkmenistan (Southern Pre-Ustyurt, the Bolshoy Balkhan Range, and Ogurchinsky Island) and southeastern Iran (Sistan Basin, the bottom of the former Hamun lake and its surroundings). Based on field expeditions (during which 236 herbarium specimens were collected) and critical analysis of regional floras, several new taxa were identified: *Sabulina tenuifolia* for Kazakhstan; *Amberboa nana*, *Senecio glaucus* subsp. *coronopifolius* and *Polygonum neglectum* for Turkmenistan. *Juncus minutulus*, previously known in Kazakhstan only from the Tian Shan, is reported for the first time from western Kazakhstan (Atyrau Province). In Turkmenistan, new regional records were obtained for the Southern Pre-Ustyurt, and 12 new species were documented for the flora of Ogurchinsky Island, reflecting rapid anthropogenic transformation of ecosystems due to forage importation for gazelles. Additionally, 5 new plant records are reported for the poorly studied Sistan region. These findings highlight the conservation importance of karst landscapes as biodiversity refugia and the need for enhanced monitoring of invasive species in Caspian ecosystems.

Новые и редкие виды растений Прикаспийского региона и прилегающих территорий

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Ключевые слова: инвазивные виды, Индерский солянокупольный район, Иран, Казахстан, редкие виды, рефугиумы, Туркменистан, флористические находки.

Аннотация. Настоящая статья продолжает серию публикаций о новых и редких сосудистых растениях аридных территорий Прикаспия и сопредельных регионов и обобщает результаты флористических исследований 2025 г. в трёх странах – Казахстане, Туркменистане и Иране. Полевые работы охватили Индерский солянокупольный район (Западный Казахстан), ряд районов Западного Туркменистана (Южное Предустюртье, остров Огурчинский, хребет Большой Балхан) и Систанский бассейн юго-восточного Ирана (сухое дно бывшего озера Хамун и окружающие территории). Собрано 236 гербарных образцов; определения выполнены с использованием региональных флористических сводок, номенклатура уточнена по современным таксономическим базам (IPNI, WFO, POWO). Для национальных флор впервые приводятся 4 таксона: *Sabulina tenuifolia* (Казахстан), *Amberboa nana*, *Senecio glaucus* subsp. *coronopifolius* и *Polygonum neglectum* (Туркменистан). Кроме того, *Juncus minutulus*, ранее известный в Казахстане только с Тянь-Шаня, впервые указывается для Западного Казахстана (Атырауская обл.). Казахстанские находки приурочены к галофитным приручьевым сообществам вдоль питаемых грунтовыми водами ручьёв, впадающих в озеро Индер, что подчёркивает роль этой территории как аazonального эдафического рефугиума. Для Туркменистана, помимо новых для страны видов, зафиксированы региональные находки: *Astragalus testiculatus* и *Haplophyllum pedicellatum* в Южном Предустюртье. Список флоры острова Огурчинский, ранее включавший 65 видов, пополнен 12 таксонами – как ценными природными компонентами приморских песков (*Cakile euxina*, *Suaeda altissima*), так и заносными рудеральными видами, натурализовавшимися вследствие завоза кормов для джейранов, что свидетельствует о быстрой антропогенной трансформации островной экосистемы. Для малоизученного Систанского бассейна Ирана приводятся 5 новых видов (*Bromus sewerzowii*, *Jurinea gabrieliae*, *Anastatica hierachuntica*, *Tribulus macropterus*, *Achillea eriophora*), существенно расширяющих их известные ареалы в восточном Иране. Полученные данные актуализируют региональные флористические списки, обосновывают необходимость придания охранного статуса карстовым ландшафтам Индерского района и усиления фитосанитарного мониторинга инвазивных видов в прикаспийских экосистемах.

Introduction

The Republic of Kazakhstan is characterized by high biodiversity. Although the greatest species richness in the region is concentrated in its mountain systems, the arid and semi-arid lowlands harbour a specialized, often relict flora that remains insufficiently explored. The Caspian Lowland, which is part of the Irano-Turanian desert region, is notable for substantial floristic diversity: within

its limits, more than 945 species of vascular plants belonging to 371 genera and 88 families have been recorded. Despite the overall floristic richness of the region, many taxa still require taxonomic revision, and extensive areas remain poorly studied.

One of such poorly studied yet biogeographically significant area is the Inder salt-dome region, situated on the left bank of the Ural (Zhaiyk) River in western Kazakhstan. Together with several arid areas of western Turkmenistan (the Southern Pre-

Ustyurt, Ogurchinsky Island, and the Greater Balkhan Range) and the Sistan Basin of southeastern Iran, it constitutes an insufficiently explored territory whose flora is examined in the present study; detailed physiogeographic characterizations of these areas are given in the Materials and Methods. This study builds upon previous research in the western Caspian region (Pavlenko, 2020; Pavlenko et al., 2023; Laktionov et al., 2024, 2026). To investigate the flora and vegetation of understudied arid territories comprehensively, three field expeditions were undertaken in the first half of 2025. In spring 2025, a joint expedition of Astrakhan State University, West Kazakhstan University, and the Botanical Garden of the Ural Branch of the Russian Academy of Sciences (RAS) was conducted in the Inder region, where 236 herbarium specimens representing 187 taxa of vascular plants were collected. Additionally, surveys were conducted from April to June 2025 in three areas of western Turkmenistan: the Southern Pre-Ustyurt and southwestern Ustyurt (18–27 April), Ogurchinsky Island in the Caspian Sea (21–24 May), and the Bolshoy Balkhan Range (28–30 June). In parallel, a two-month joint expedition (April–June 2025) by M. Dehghani (University of Zabol) and A. Rudov (Institute of Botany after A. L. Takhtajyan of the National Academy of Sciences of Armenia) documented the flora and vegetation of the Iranian Sistan Basin. The combined data broaden our understanding of the spatial structure of biodiversity in the arid ecosystems of the northern Caspian and adjacent regions of Central Asia.

Materials and Methods

Brief characterization of the study areas

The study areas encompass several arid regions of the northern Caspian and adjacent Central Asia, notable for considerable landscape heterogeneity and floristic significance. A brief physiogeographic description of these areas is provided below, grouped by country.

Kazakhstan

Inder salt-dome region. The area is situated on the left bank of the Ural River, 350 km south of Uralsk, on the border between West Kazakhstan and Atyrau regions. From a physiogeographical perspective, it is recognized as a distinct landscape district within the Ural–Emba lowland province (Akhmedenov, Seitkireeva, 2015; Akhmedenov et al., 2022). It forms a plateau rising 20–25 m above

the surrounding Caspian Lowland and covers ~250 km². Its formation is associated with two large salt domes, which determine the area's unique landscapes (Petrishchev et al., 2011; Akhmedenov et al., 2016). The karst field of the Inder Hills is the largest in the Caspian Lowland and developed within Jurassic–Cretaceous carbonate and clay deposits (Akhmedenov, Seitkireeva, 2015). The principal hydrological feature is Lake Inder, an endorheic salt lake and one of Kazakhstan's largest evaporite lakes, with a surface area of ~425 km² (Lake Inder..., 1953); it lacks surface outflow and is fed predominantly by groundwater. Along the northern and eastern shores more than 32 springs emerge, forming streams with discharge rates ranging from hundredths of a liter to several tens of liters per second (Golovachev, 2010; Akhmedenov et al., 2018). Originating in karst caves, these waters are often cold and exhibit a distinctive chemical composition – including elevated levels of hydrogen sulfide and various minerals – constituting a hydrogeochemical anomaly: chemically, they belong to the chloride type, with high concentrations of bromine and other trace elements (Lake Inder..., 1953; Kenzhegaliev et al., 2018). The Inder region's climate is highly continental and highly arid, with prolonged hot summers and sparse precipitation. Despite these harsh conditions, the area shows high floristic value, as evidenced by the recent description of a new endemic *Astragalus*, *A. ivanovii* Knjaz., Laktionov et Akhmedenova, which underscores the need for further taxonomic and eco-geographical study. During our survey, particular attention was paid to halophytic vegetation typical of the banks of such streams and adjacent solonchaks (Goryaev, Korablev, 2020).

Turkmenistan

Southern Pre-Ustyurt and Southern Ustyurt.

These areas were surveyed from 18 to 27 April 2025. We surveyed the southernmost part of the Ustyurt Plateau and its southwestern tip bordering the Kara-Bogaz-Gol Gulf, as well as the Pre-Ustyurt zone bounded to the south by the ancient Uzboy riverbed (Fig. 1). The topography of the Pre-Ustyurt is highly complex, combining flat plateau surfaces with flat-bottomed valleys, terraces, enclosed depressions, and sandy massifs. Some authors distinguish three main macrorelief forms: undulating ridges, gently sloping surfaces, and basins (Gerasimov, 1937). Much of the Southern Ustyurt surface is composed of Sarmatian marls and limestones; older deposits are rare (Kogan, 1954). The plateau escarpments form steep vertical cliffs up to 200 m



Fig. 1. Chink of the southern Ustyurt (left) and the valley of the southern Pre-Ustyurt (right) (photo by A. P. Laktionov).

high, dissected by gullies. Soils are represented by sierozem variants, often with varying gypsum content or high chalk content; saline gypsiferous soils and puffy solonchaks prevail in depressions. In sandy areas, soils are weakly developed or absent. The climate is highly continental and arid, with a pronounced moisture deficit. According to the Chagyl meteorological station (1971–2024), the mean annual air temperature is 15.0 °C, and the mean annual precipitation in 2021–2024 was 80.3 mm (Weather archive..., 2025).

Ogurchinsky Island. Located in the eastern Caspian Sea south of the Cheleken Peninsula, the island is meridionally oriented, approximately 40 km long and averaging 2.5 km in width. Nearly the entire territory consists of loose and semi-fixed sands of Middle Pliocene age; the central part has denser substrates with higher clay content, while shell-rich sands occur along the shores. The island is of great importance as a breeding site for waterbirds and as a haul-out for the Caspian seal. Since 1982, it has been part of the Ogurdzhali sanctuary (within the Hazar State Nature Reserve), where goitered gazelles were reintroduced; the current population numbers ~700 individuals. Currently, the island is a strictly protected area under heightened border control.

Greater Balkhan Range. In late June 2025, we conducted a reconnaissance survey of the Greater Balkhan Range (Pavlenko et al., 2025), a small

mountain massif in western Turkmenistan, 70–80 km long and up to 40 km wide, isolated within the desert between the ancient Uzboy channel and the Chilmamedkum Sands. The range forms a plateau gently dipping to the south; its southern slopes are gentle, while the northern slopes are precipitous and rocky, dissected by deep gorges. The climate is highly continental and hyperarid. The mean annual air temperature is 17.8 °C, although on the ridge crest it is 10–15 °C lower due to the altitudinal gradient (Molchanov, 1926). The mean annual precipitation is 141 mm, but, according to the same author, it reaches 350–400 mm on the upper plateau of the range. Geologically, the range consists of Mesozoic and Cenozoic rocks. The oldest are black argillaceous shales found at lower elevations; while sandstones and limestones are common. Jurassic deposits form the most extensive sequences, overlain by limestones up to ~250 m thick (Proskuryakova, 1964).

Iran

Sistan Basin. The Sistan region is located in southeastern Iran, in the northern part of the Sistan and Baluchestan Province. It occupies an area of approximately 16947 km², with an average elevation of 470–500 m a. s. l. (Masoudi et al., 2017). This area constitutes the western part of the Sistan Basin, which extends eastwards into Afghanistan. The basin once harboured the Hamun lake system, one of Asia's major lakes systems. However, extensive dam construction in Afghanistan and intensive irrigation

practices have drastically altered the hydrological regime of the rivers feeding the lakes, particularly the Helmand River and its tributaries. This has led to the complete desiccation of the Hamun lakes, leaving behind vast saline and gravel flats, as well as sand dunes. The Sistan Basin is bordered by two major deserts: the Dasht-e Margo gravel desert to the east, and the extensive Rig-e Yalan sand dune massif of the Lut Desert to the west. The basin is separated from Lut Desert by the Palangkuh Mountains, with reach elevations of nearly 2000 m a. s. l. Rising from the former Hamun lakebed is Mount Khajeh (Kuh-e Khajeh), an isolated volcanic hill and former island reaching an elevation of 609 m a. s. l. The flora of this area was systematically explored only once, approximately a century ago, by the Soviet botanist Yekaterina Chernyakovskaya (1930).

Collection and processing of material

Floristic and vegetation studies were carried out as part of the international expedition “Inder-2025”, (28 April – 8 May 2025). The expedition adopted an integrative approach and aimed to address the following priority objectives: 1) visiting the loci classici of several taxa for subsequent analysis of florogenetic processes in the northern Caspian region using methods of analytical floristics; 2) discovering and collecting specimens of potentially new taxa for subsequent molecular-genetic studies; 3) expanding the herbarium collections of leading research institutions – the Komarov Botanical Institute RAS (LE), Astrakhan State University (AGU), West Kazakhstan University (M. Utemisov) (PPIU), and the Botanical Garden of the Ural Branch RAS (SVER); 4) searching for species new both to science and to the flora of the Republic of Kazakhstan, particularly its western regions (West Kazakhstan and Atyrau regions); 5) conducting a full floristic inventory of the Inder salt-dome region with the aim of preparing a scientific rationale for the establishment of a specially protected natural area (Akhmedenova, Laktionov, 2024).

Fieldwork was carried out using the route surveys method, supplemented by visual landscape assessment of plant communities. Survey routes varied from 2 to 5 km depending on terrain complexity and accessibility. The geographical coordinates of each collection site were recorded with a Garmin GPS receiver and Locus Pro software, an accuracy of a few meters. A total of 236 herbarium specimens were collected, representing 187 taxa of vascular plants. A portion of this

material was transferred to the Herbarium of the Komarov Botanical Institute RAS (LE), digitized, and made available on the official herbarium website (URL: <https://herbariumle.ru/>). Digital images were scanned at a resolution of 600 dpi and accompanied by complete label data, including georeferencing, collection date, and habitat descriptions.

Additionally, we examined a photographic archive and a small set of herbarium specimens from the Caspian deserts provided by the herpetologist A. A. Shestopal, who surveyed the area in late April to early May 2025 during an expedition of the Desert Institute, Academy of Sciences of Turkmenistan.

Photodocumentation of landscapes, microhabitats, and plant communities was performed using Canon EOS 6D Mark II, Canon EOS 70D, and Canon EOS 80D DSLR cameras.

Taxonomic identifications were based on the principal regional sources: “Flora Kazakhstana” (1956–1966), “Conspectus florae Asiae Mediae” (1968–2015), “Flora Turkmenii” (1932–1960), “Flora Iranica” (1963–2015), as well as the work by V. V. Nikitin and A. M. Geldikhanov (1988). We also incorporated data from recent floristic accounts and specialized studies on the flora of Kazakhstan (Abdulina, 1999; Imanbaeva et al., 2024; Kubentayev et al., 2026), as well as global biodiversity web databases “Global Biodiversity Information Facility” (GBIF. URL: <https://www.gbif.org/>), “iNaturalist contributors” (iNaturalist, URL: <https://www.inaturalist.org/>), “Plantarium” (URL: <http://www.plantarium.ru>) and digitized herbarium data from Moscow State University (MW) (Seregin, 2026) and the Komarov Botanical Institute (LE) (Virtual Herbarium..., 2026). All scientific names were standardized according to current taxonomic databases: “International Plant Names Index” (IPNI. <http://www.ipni.org>), “World Flora Online” (WFO. URL: <https://wfoplantlist.org/>), and “Plants of the World Online” (POWO. URL: <https://powo.science.kew.org/>).

The “Inder-2025” expedition continues a series of recent field investigations in the Caspian macroregion aimed at refining the taxonomic composition and spatial distribution of flora in western Kazakhstan (Pavlenko et al., 2023; Laktionov et al., 2024).

Field investigations in the Iranian Sistan Basin were conducted between April and June 2025 across Sistan and Baluchestan Province. This work was carried out by M. Dehghani and A. Rudov as part of an ongoing project to document the flora and map the vegetation of the entire Sistan region of Iran. Several hundred herbarium specimens from

this survey are deposited in the Herbarium of the University of Zabol (UOZ).

Results and Discussion

During the field investigations conducted in the first half of 2025, new floristic data were obtained for all study areas. Three taxa are reported here as new to the national floras: one for Kazakhstan (*Sabulina tenuifolia* (L.) Rchb.) and two for Turkmenistan (*Amberboa nana* (Boiss.) Iljin and *Senecio glaucus* subsp. *coronopifolius* (Maire) C. Alexander). Additionally, new regional records are presented for Kazakhstan (*Juncus minutulus* (Albert et Jahand.) Prain, new to western Kazakhstan) and Turkmenistan (including 12 species new to the flora of Ogurchinsky Island). Furthermore, five new records are documented for the Iranian Sistan Basin.

Kazakhstan

New records for the national flora

Sabulina tenuifolia (L.) Rchb. (Caryophyllaceae): “Kazakhstan, Atyrau Region, Inder District, bank of a saline stream flowing into the eastern part of Lake Inder, 48°25′48.7″N, 52°01′04.7″E. 5 V 2025. M. Knyazev, S. Akhmedenova, A. Laktionov” (LE 01309696; LE 01309695) (Fig. 2). – This species is recorded here for the first time in the Republic of Kazakhstan, as it was not mentioned by M. B. Baytenov and N. V. Pavlov (1960) in “Flora Kazakhstana” or by S. A. Abdulina (1999) in her checklist.

The distribution of the species extends from Western and Central Europe to Central Asia,

Pakistan, and the Arabian Peninsula (POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:156395-1>). Ecologically, it is a eurytopic psammophyte and halophyte that prefers dry, often saline, sandy or stony substrates. In the Inder region, *S. tenuifolia* grows in association with other halophytes along saline streams, demonstrating microzonation within these communities, where the species occupies the adjacent, drier saline slopes. A closely related species, *Sabulina turcomanica* (Schischk.) Dillenb. et Kadereit, is distributed in Turkmenistan (Kopet-Dag), Tajikistan (Mogoltau), and the Pamir-Alai (Adylov, 1971).

New regional records

Juncus minutulus (Albert et Jahand.) Prain (Juncaceae): “Kazakhstan, Atyrau Region, Inder District, bank of a saline stream flowing into the eastern part of Lake Inder, 48°25′59.9″N, 52°00′39.1″E. 04 V 2025. M. Knyazev, S. Akhmedenova, A. Laktionov” (LE 01309697; LE 01309693) (Fig. 3). – In Kazakhstan, *J. minutulus* was previously known only from the Tian Shan (Filimonova, 1976); this is the first record for western Kazakhstan (Atyrau Province) and the Caspian Lowland. The species is typical of ephemeral and brackish habitats in arid zones. Its range extends broadly from Western Europe to Central Asia, including the Mediterranean, the Middle East, and Iran (POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:77084798-1>). In the Inder region it occurs in microhabitats with highly mineralized soils, forming a component of halophytic streamside communities.



Fig. 2. Appearance of *Sabulina tenuifolia* (L.) Rchb. (photo by A. P. Laktionov).



Fig. 3. Appearance of *Juncus minutulus* (Albert et Jah-and.) Prain (photo by A. P. Laktionov).

Its discovery in the Inder region confirms the presence of specialized pioneer hydrophytic communities linked to groundwater discharge.

Both taxa, *Juncus minutulus* and *Sabulina tenuifolia*, frequently co-occur as components of halophytic streamside communities along tributaries entering Lake Inder. Associated species include *Polygonum patulum* M. Bieb., *Halocnemum strobilaceum* (Pall.) M. Bieb., *Myosurus minimus* L., *Hymenolobus procumbens* (L.) Nutt. ex Schinz et Thell., *Frankenia pulverulenta* L., *Spergularia diandra* (Guss.) Heldr. et Sart., and *Strigosella africana* (L.) Botsch.

Turkmenistan

New records for the national flora

Amberboa nana (Boiss.) Iljin (Asteraceae). “Turkmenistan, southeastern coast of the Kara-Bogaz-Gol Bay, vicinity of the Khojassu well, semi-fixed sands, 41°13'48.2"N, 54°36'50.2"E. 24 IV 2025. A. V. Pavlenko” (ASH) (Fig. 4). – This species is an ephemeroïd of open sands and semi-deserts and is considered an indicator species

of relatively undisturbed natural rangelands. Its distribution extends from the Ustyurt Plateau to eastern Kazakhstan, southwards to Iran (Isfahan) and the South Caucasus (POWO, 2025; Amberboana, 2026). This represents the first confirmed record of the species in Turkmenistan. M. M. Iljin (1960) suggested its possible occurrence in the country based on specimens in adjacent areas of Ustyurt in Kazakhstan. The species is typical of sandy deserts and semi-deserts with sparse vegetation. It currently holds no formal conservation status, but its populations are fragmented due to the degradation of desert ecosystems. Overall distribution: East Transcaucasus to Iran and Uzbekistan (POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:176006-1>).

Polygonum neglectum Besser (Polygonaceae). “Turkmenistan, Ogurchinsky Island, sands near the fishermen’s camp, 39°05'54.06"N, 53°05'6.96"E. 24 V 2025. A. V. Pavlenko”, sub nom. *P. aviculare* L. (ASH). – The discovery of this species in Turkmenistan extends its known range southward. Overall distribution: Siberian, Kazakhstan, Turkiye and Southern Europe (POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:696123-1>).

Senecio glaucus subsp. ***coronopifolius*** (Maire) C. Alexander (= *S. noeanus* Rupr.) (Asteraceae). “Ogurchinsky Island, sands in the central part of the island, 39°05'31.9"N, 53°03'33.5"E. 23 V 2025. A. V. Pavlenko” (ASH) (Fig. 5).

This subspecies was not previously known from Turkmenistan, although it occurs across the Caspian region – from Iran to Kazakhstan and Russia. On Ogurchinsky Island it was found in a typical habitat: mobile and semi-fixed coastal sands. Analysis of photographic material from the Caspian deserts revealed an additional location ~100 km north of the island, near the Kara-Bogaz-Gol Strait.

The taxon is an annual belonging to a group of plants with a broad Eurasian-Afro-Asian distribution (from the Canary Islands to the western Himalayas). Adapted to the arid subtropical environments, it successfully colonizes mobile coastal and often saline sands (Alexander, 1979; POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:878279-1>).

New regional records

Astragalus testiculatus Pall. (Fabaceae): “Turkmenistan, Balkan Region, Southern Pre-Ustyurt, 3 km north of Akmolla Cemetery, 40°40'27.2"N, 54°38'51.8"E. 22 IV 2025. A. V. Pavlenko” (ASH). –



Fig. 4. Appearance of *Amberboa nana* (Boiss.) Iljin (photo by A. V. Pavlenko).



Fig. 5. Appearance of *Senecio glaucus* subsp. *coronopifolius* (Maire) C. Alexander (photo by A. V. Pavlenko).

It was previously known from the Greater Balkhan Range and a single locality in the central Kopetdag (Nikitin, Geldikhanov, 1988). The new record indicates a wider distribution of the species across the arid plains. Overall distribution: Western and Central Russia, Turanian region, Xinjiang, North Caucasus and Ukraine (POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:480184-1>).

Haplophyllum pedicellatum Bunge (Rutaceae): “Turkmenistan, Balkan Region, Southern Pre-Ustyurt, alluvial sands, 40°38′37.3″N, 54°46′00.4″E. 25 IV 2025. A. V. Pavlenko” (ASH). – In Turkmenistan, the species had previously been recorded only from southern regions (Nikitin, Geldikhanov, 1988). This new finding indicates either northward range extension into arid zones or that its distribution was previously underestimated. Overall distribution: Turkmenistan, Uzbekistan, Tajikistan, Iran, Afghanistan, Pakistan (POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:771309-1>).

Ogurchinsky Island: new and confirmed species

Despite its designation as the Ogurdzhali Sanctuary in 1982, Ogurchinsky Island remains poorly studied botanically. The first botanical data were obtained in the mid-19th century, when G. S. Karelin collected a small herbarium collection now preserved at the Komarov Botanical Institute (LE). Subsequent studies were carried out more than a century later, in the 1980s, by the Turkmen botanist J. Kurbanov. He also published a list of the island's vascular plants, comprising 65 species in 21 families and 53 genera (Kurbanov, 1999). Since then, no other data on the flora and vegetation of the island have been published. During the 2025 expedition to Ogurchinsky Island, several taxa new to the island and the country were recorded, and the presence of previously overlooked species, which are listed below, was confirmed.

Astragalus ammodendron Bunge (Fabaceae): “Turkmenistan, Balkan Region, Ogurchinsky Island (Caspian Sea), semi-fixed sands in the central part of the island, 39°04′47.5″N, 53°02′58.1″E. 24 V 2025. A. V. Pavlenko” (ASH). – This species is frequently encountered, and in our opinion was overlooked by previous researchers either due to its inconspicuousness during certain seasons or underestimation of its ecological role. The native range of this species is Southern European Russia

to Central Asia (POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:476098-1>).

Cakile euxina Pobed. (*C. maritima* subsp. *euxina* (Pobed.) Nyar.) (Brassicaceae):

“Turkmenistan, Balkan welayaty, Ogurchinsky Island (Caspian Sea), coastal zone, 39°05′48.2″N, 53°05′04.3″E, 22 V 2025, A. V. Pavlenko” (ASH). – A halophytic species of coastal habitats (*C. maritima* s. l.), it rapidly colonizes open seashores and demonstrates significant dispersal ability (Davy et al., 2006). It was first discovered in 2019 on the mainland coast, 30 km from Ogurchinsky Island near the settlement of Ekrem (Pavlenko, 2020). At present, it is widely distributed along the coast of Turkmenistan and throughout the Dagestan coast of the Caspian Sea (including Nordovy and Chechen Islands), actively colonizing coastal sands (Satuyeva et al., 2012). The native range of this species is Black Sea and Aegen Sea coasts to Caspian Sea (POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:77250091-1>).

Suaeda altissima (L.) Pall. (Amaranthaceae): “Turkmenistan, Balkan Region, Ogurchinsky Island (Caspian Sea), coastal sands, 38°55′33.4″N, 53°02′54.6″E, 24 V 2025. A. V. Pavlenko” (ASH). – This species forms small, scattered populations occurring as distinct synusiae within coastal plant communities. Overall distribution: Irano-Turanian region, Caucasus and Southern Europe (POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:167402-1>).

Anthropogenically introduced species

A number of species from different families have been accidentally introduced over the years. The growing population of goitered gazelles (*Gazella subgutturosa*), which in the early 21st century reached over 3000 individuals, required substantial supplementary feeding, especially in drought years.

Consequently, hay bales of cereal crops and mountain grasses of the Kopetdag were regularly transported to the island. Accompanying this forage, seeds of several plant species were introduced, among which mainly ruderal (weedy) taxa became naturalized:

Avena barbata Pott ex Link (Poaceae): “Turkmenistan, Balkan Region, Ogurchinsky Island (Caspian Sea), on sands near a feeding site for gazelles, 39°06′16.3″N, 53°05′42.8″E. 23 V 2025. A. V. Pavlenko” (ASH). – Overall distribution: Middleteranian region (POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:391337-1>).

Hordeum spontaneum K. Koch (= *H. vulgare* subsp. *spontaneum* (K. Koch) Asch. et Graebn.) (Poaceae): “Turkmenistan, Balkan Region, Ogurchinsky Island (Caspian Sea), sands near a feeding site for gazelles, 39°06′16.3″N, 53°05′42.8″E. 23 V 2025. A. V. Pavlenko” (ASH). – Overall distribution: Eastern Mediterranean and China (POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:77259495-1>).

Lepidium pinnatifidum Ledeb. (Brassicaceae): “Turkmenistan, Balkan Region, Ogurchinsky Island (Caspian Sea), sands near the meteorological station, 39°06′03.5″N, 53°05′26.0″E. 22 V 2025. A. V. Pavlenko” (ASH). – The native range is Caucasus to Central Asia and Western Himalaya (POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:286346-1>).

Lolium rigidum Gaudin (Poaceae): “Turkmenistan, Balkan Region, Ogurchinsky Island (Caspian Sea), sands near a feeding site for gazelles, 38°55′00.2″N, 53°03′08.5″E. 24 V 2025. A. V. Pavlenko” (ASH). – The native range is Mediterranean region and Eastern Asia (POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:407503-1>).

Malva parviflora L. (Malvaceae): “Turkmenistan, Balkan Region, Ogurchinsky Island (Caspian Sea), sands near a pile of construction debris, 39°06′16.9″N, 53°04′56.6″E. 23 V 2025. A. V. Pavlenko” (ASH). – Overall distribution: Mediterranean region to Central Africa (POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:561830-1>).

Melilotus indicus (L.) All. (Fabaceae): “Turkmenistan, Balkan Region, Ogurchinsky Island (Caspian Sea), sands near a pile of construction debris, 39°06′16.9″N, 53°04′56.6″E. 23 V 2025. A. V. Pavlenko” (ASH). – Overall distribution: Mediterranean region to Southern Asia (POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:1207360-2>).

Phalaris minor Retz. (Poaceae): “Turkmenistan, Balkan Region, Ogurchinsky Island (Caspian Sea), sands near the meteorological station, 39°06′03.5″N, 53°05′26.0″E. 23 V 2025. A. V. Pavlenko” (ASH). – Overall distribution: Mediterranean region to India (POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:415632-1>).

Populus euphratica Olivier (Salicaceae): “Turkmenistan, Balkan Region, Ogurchinsky Island (Caspian Sea), on sands, introduced, 39°05′59.9″N, 53°05′38.6″E. 23 V 2025. A. V. Pavlenko” (ASH). – A relict Afro-Asian tree, highly resistant to drought and salinity, it plays a key structural role in floodplain

and desert ecosystems of Eurasia. It is a keystone element of riparian woodlands, noted for ecological plasticity and the capacity for recovery even after extreme stress (Fan et al., 2023; Zhu et al., 2024). An introduced species on Ogurchinsky Island, it has successfully acclimatized, with several populations currently observed (10–25 individuals each). It is a valuable species for sand stabilization and the creation of shelterbelts in arid zones of Central Asia.

During the Soviet and post-Soviet periods, reserve staff attempted introductions of several taxa from the genera *Artemisia* L., *Calligonum* L., and *Populus* L. On the island, attempts with the first two genera failed, whereas the introduction of the third genus was successful. Overall distribution: Mediterranean region to Mongolia and China (POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:776672-1>).

Rapistrum rugosum (L.) All. (Brassicaceae): “Turkmenistan, Balkan Region, Ogurchinsky Island (Caspian Sea), loose sands, within *Nitraria* thickets, 39°05′50.2″N, 53°04′10.8″E. 23 V 2025. A. V. Pavlenko” (ASH). – Overall distribution: Mediterranean region (POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:1061021-2>).

All of these species (except *Populus euphratica*) were collected in the vicinity of feeding stations, the meteorological station, fishermen’s camps, and construction debris sites, which highlights the role of anthropogenic factors in the transformation of the island’s flora.

Iran

New records for the Sistan Basin

Achillea eriophora DC. (Asteraceae): “Sistan and Baluchestan: Zabol, 82 km from Zabol towards Nehbandan. 31°23′53.23″N, 60°50′06.06″E. 27 IV 2025. M. Dehghani, A. Rudov” (UOZ 1770) (Fig. 6). – Previously, the species was known from the provinces of Khuzestan, Fars, Hormozgan, Yazd, Kerman, Sistan and Baluchestan, and South Khorasan, located in the southern and eastern parts of the country (Mozafarian, 2008). *Achillea eriophora* is reported here for the first time from the Sistan region (Sistan and Baluchestan Provinces). Although the species has been previously reported in Sistan and Baluchestan Provinces, the nearest known localities are over 200 km to the north and 150 km to the south of the newly recorded site. The new locality fills a considerable gap in the species’ known distribution range.



Fig. 6. Appearance of *Achillea eriophora* DC. (photo by A. V. Rudov).

Overall distribution: endemic to Iran (POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:173962-1>).

Anastatica hierachuntica L. (Brassicaceae): “Sistan and Baluchestan: Zabol, 55 km after Zabol towards Zahedan. 30°39′45.46″N, 61°23′40.39″E. 20 IV 2025. M. Dehghani, A. Rudov” (UOZ 1791). – The species was previously reported from Hormozgan and the southern part of Sistan and Baluchestan Provinces (Assadi et al., 2017). This new record was found over 600 km (straight-linedistance) from the nearest known locality in northern Sistan and Baluchestan Province, around a playa dominated by halophytic species such as *Tamarix* spp., *Suaeda fruticosa*, and *Soda rosmarinus*.

Overall distribution: North Africa, Palestine, Saudi Arabia, Syria, Iraq, Iran, and Pakistan (POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:277877-1>).

Bromus sewerzowii Regel (Poaceae): “Sistan and Baluchestan: Mohammad Abad, 30 km SW Mohammadabad, Kuh-e Khajeh 30°56′30.12″N, 61°15′10.49″E. 18 IV 2025. M. Dehghani, A. Rudov”

(UOZ 1776). – This species was previously known in Iran only from a single record collected by V. Mozaffarian in 1989 near Serakhs, Khorasan Razavi Province (Assadi et al., 2017). The present finding from Zabol, in Sistan and Baluchestan Provinces, represents the second occurrence of the species for the country. It was found in a depression covered with ruderal plant species on Mount Khajeh (Kuh-e Khajeh).

Overall distribution: Central Asia, Afghanistan, China, and Iran (POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:394109-1>).

Jurinea gabrieliae Bornm. (Asteraceae): “Sistan and Baluchestan: Zabol, 82 km from Zabol towards Nehbandan. 31°23′53.23″N, 60°50′06.06″E. 27 IV 2025. M. Dehghani, A. Rudov” (UOZ 1772) (Fig. 7). – *Jurinea gabrieliae* is a rare endemic species previously known only from two localities in Kerman and South Khorasan Provinces (Mozafarian, 2008). During the present study, it was recorded for the first time from Sistan and Baluchestan Provinces (eastern Iran), where it was found growing in a stony valley. The most prominent associated species included



Fig. 7. Appearance of *Jurinea gabrieliae* Bornm. (photo by A. V. Rudov).

Ficus johannis, *Cenchrus divisus*, and *Zygophyllum atriplicoides*.

Overall distribution: endemic to Eastern Iran (POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:226933-1>).

Tribulus macropterus Boiss. (Zygophyllaceae): “Sistan and Baluchestan: Zabol, Sefidabeh, 55 km after Sefidabeh towards Zahedan. 30°31′22.1″N, 60°51′06.4″E. 20 IV 2025. M. Dehghani, A. Rudov” (UOZ 1781). – The species has previously been recorded from the provinces of Esfahan, Yazd, Kerman, Hormozgan, Sistan and Baluchestan, Khorasan, Tehran, and Semnan (Akhiani 1992). The newly identified locality also lies within Sistan and Baluchestan Province; however, given the province’s vast extent, it is situated more than 200 km (aerial distance) from the nearest known site in Baluchestan. Interestingly, the species appears to be relatively widespread across various parts of Sistan, despite being previously unrecorded in this region in the available literature.

Overall distribution: Iraq, Iran, Afghanistan, Pakistan, India, and Africa (Akhiani, 1992;

POWO. URL: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:873447-1>).

Conclusion

Field investigations carried out in the first half of 2025, in the Republic of Kazakhstan (Inder salt-dome area), Turkmenistan (southern Pre-Ustyurt, Ogurchinsky Island, and the Bolshoy Balkhan Range) and southeastern Iran (Sistan Basin), have substantially broadened our current understanding of the floristic diversity of arid and halophytic ecosystems of the northern Caspian and adjacent territories.

1. Flora of Kazakhstan. *Sabulina tenuifolia* is reported as new to the flora of the country, and *Juncus minutulus* previously known in Kazakhstan only from the Tian Shan – as new to western Kazakhstan (Atyrau Region). Both were found in unique halophytic communities along saline streams flowing into the Lake Inder, underscoring the high biogeographic and conservation value of this poorly studied region. These findings highlight the need

for in-depth study of Inder's riparian ecosystems and provide strong justification for the initiative to establish a specially protected natural area there.

2. Flora of Turkmenistan. Two new taxa were recorded: *Amberboa nana* and *Senecio glaucus* subsp. *coronopifolius*, discovered in the southeastern Kara-Bogaz-Gol Gulf and on Ogurchinsky Island, respectively. Additionally, *Astragalus testiculatus* and *Haplophyllum pedicellatum* were reported for the first time from the southern Pre-Ustyurt, extending their known distribution in western Turkmenistan.

3. Flora of Ogurchinsky Island. The floristic list of the island, which previously included only 65 species (Kurbanov, 1999), has been expanded by 12 additional taxa representing 6 families of vascular plants, including 3 families new for the island: Fabaceae (*Astragalus ammodendron*), Salicaceae (*Populus euphratica* – introduced), and Malvaceae (*Malva parviflora*). Among them are both naturalized alien species (mainly ruderal weeds introduced via forage for gazelles) and valuable natural components such as *Cakile euxina* and *Suaeda altissima*, which are actively colonizing the coastal sands of the shrinking Caspian Sea.

4. Flora of Iran (Sistan Basin). Five species are newly recorded for the Sistan region – *Bromus sewerzowii*, *Jurinea gabrieliae*, *Anastatica hierochuntica*, *Tribulus macropterus*, and *Achillea eriophora* – considerably extending their known ranges in eastern Iran and providing a baseline for future floristic and conservation work in this poorly studied basin.

The collected data demonstrate that even in geographically well-known regions of the Caspian Lowland, there remain significant gaps in our knowledge of the flora. The new records confirm the hypothesis of a high degree of hidden taxonomic and ecogeographical complexity in the arid landscapes of Central Asia.

Priority actions highlighted by the results:

1. Conservation in Inder: development of measures for the protection of unique halophytic communities and karst refugia of Inder, including expediting the designation of the territory as a protected area.

2. Protected area management: a critical revision of management strategies for the Ogurdzhali Sanctuary and the introduction of phytosanitary

controls to prevent further biological invasions via the imported forage.

3. Caspian monitoring: continuation of systematic floristic studies and monitoring of coastal ecosystems in response to Caspian Sea level fluctuations (transgression / regression), focusing on the role of new colonizers such as *Cakile euxina*.

Looking ahead, molecular-genetic studies are planned for a number of the recorded taxa to clarify their taxonomic status and phylogeographic relationships within the broader framework of floristic evolution in the Irano-Turanian region.

Ultimately, the results have significantly expanded our understanding of the floristic composition of poorly studied arid territories of the northern Caspian, and underscoring the necessity of continued investigations – particularly in the context of establishing new protected areas and monitoring invasive and alien species.

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