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RESEARCH ARTICLE

Phytocoenotic Distribution of *Hulthemia persica* (Michaut ex Juss.) Bornm. (Rosaceae) under different ecological conditions in Uzbekistan

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Abstract

The paper presents some of the results of the 2020-2022 studies of 7 communities with the participation of a poorly studied forage and melliferous species, *Hulthemia persica*, in the Republic of Uzbekistan. The research goal is to identify the phytocenotic confinement of the poorly studied forage and melliferous species *H. persica* in various environmental conditions in the Republic of Uzbekistan. Phytocoenotic studies in 7 communities have shown that the population numbers of *H. persica* in the Tashkent Region (Parkentsay) are satisfactory. However, in recent years the strong impact of anthropogenic factors, primarily livestock grazing under natural growing conditions, has affected this species' abundance, which has gradually disappeared. Large-scale exploration and prospecting, with the development of the oil and gas industry and other techno genic factors, has harmed the state of *H. persica*; therefore, populations lack young individuals and the cover provided by this species is relatively low. Therefore, it is crucial to strengthen protection measures, which the authors also recommend using for degraded pastures in the desert and foothill regions of the Republic of Uzbekistan. A detailed survey of natural populations and monitoring their condition should be carried out. In particular, *H. persica* is a promising plant adapted to various environmental conditions and can be used in degraded pastures in desert and foothill regions of the Republic of Uzbekistan.

Keywords

Anthropogenic factors; Biodiversity conservation; Plant communities; Population; Ustyurt Plateau; Western Tien Shan

Introduction

In recent decades, interest among the scientific community in studying the vegetation of arid ecosystems and in particular, in plants that are more vulnerable to climate change has grown significantly. Labile plant communities, under the influence of various unstable and frequently extreme conditions in different ecological zones of Uzbekistan, are subject to significant changes that affect the limits of their growth. In recent years, the growth of industry and geological exploration on the Ustyurt Plateau has led to an increase in the degree of the adverse influence of technogenic factors on the vegetation in this region. Furthermore, environments on the Ustyurt Plateau are adversely affected by the drying of the Aral Sea and climate change, which adversely influences the state of the vegetation of the region. Therefore, it is essential to consider insufficiently studied species in economic terms and identify their current status. Numerous studies have

been carried out on the conservation of biodiversity, in particular on poorly studied species in various ecological conditions of Uzbekistan (1-22).

The materials of the TASH National Herbarium of the Institute of Botany, Academy of Sciences of the Republic of Uzbekistan, indicate that *Hulthemia persica* has been studied for a half-century. In recent decades, the habitats of many species, especially deserts and mountains, have undergone significant changes and many have been destroyed due to anthropogenic and technogenic factors. Therefore, it is necessary to study the current state of *H. persica* under various environmental conditions in Uzbekistan. There is little information in the literature concerning the useful properties of this species and data on its biological characteristics are almost completely lacking. However, the phytocoenotic features of *H. persica* under different environmental conditions have not been studied and there are only insignificant data on this species in the literature.

The research area is the Parkentsay River, a mountain river in the Parkent and Yukorichirchik districts of the Tashkent Region. The river is 40 km long and its catchment area is 198 km^2. The river receives water from seasonal precipitation, snow, rain, and melting glaciers. The Parkentsay River is full of water from March to June, which amounts to 75-80% of the annual flow. The Parkentsay River originates on the Chatkal Ridge on the Northwestern slope of the Kyzylnur Mountains. It flows in a general westerly direction. The total length of the Parkentsay River tributaries is 112 km^2.

The Ustyurt is an elevated plateau with absolute elevations of 160–300 m above sea level. On almost all sides, the plateau is bounded by cliffs or chinks. To the North, the Ustyurt Plateau borders the Caspian lowland; to the East, the drained bottom of the Aral Sea; to the South, the Amu Darya Delta and Sarykamysh Plain and to the west, the Caspian Sea. The borders of Uzbekistan, Turkmenistan, and Kazakhstan pass through the area covered by the plateau and the total area of the Ustyurt Plateau is 21.2 million ha, of which the Karakalpak part accounts for 7.2 million ha. The climate of the Ustyurt Plateau is highly continental, characterized by hot, dry summers and rather severe winters, accompanied by strong winds and low precipitation (12).



Fig. 1. General view of *Hulthemia persica* (Photo by Nodira Rakhimova).

The environmental conditions on the Ustyurt Plateau have changed adversely in recent decades concerning the growth of vegetation due to the drying of the Aral Sea and the development of the oil and gas industry. Large-scale exploration and prospecting have led to an increase in the number of hollow canal roads previously used to connect wells. The adverse influence on the health of plants of dust particles formed behind heavy trucks has been demonstrated. Along the dusty roads in the Southern Ustyurt Plateau, the health of plant species is low, juveniles are absent and the vegetative cover is rather low. Further from the roads, these indicators change in a positive direction. The state of plants in the area, the vegetative cover, and the species composition of the community improve with distance from the center of the wells. Given the suboptimal environmental conditions currently found in this region, there is interest in studying the distribution of the promising species – *Hulthemia persica*.

Materials and Methods

The research object is *Hulthemia persica*, a shrub similar to low rosehip (Fig. 1). In young generative plants, annual shoots reach 30-40 cm in height. The plant is shortly pubescent, with branchy stems. The spikes are single, alternate, paired, and opposite. The leaves are simple, stiff, hairy, obovate, up to 20-25 mm in length and up to 10-15 mm in width in the middle part of the shoot. The flowers are golden yellow with a dark purple spot at the base (Fig. 2). The length and width of the fruits are almost the same (approximately 10 mm). Flowering was observed in April and July and fruiting was observed in June and August. The plant grows from spring to the onset of autumn frosts.



Fig. 2. Flowering *Hulthemia persica* plant (Photo by Alim Gaziev).

In nature, *H. persica* plants are commonly found growing on takyrs, pebbles, and fixed sands, loams, and stony and gravelly slopes; in mountains and variegated low mountains and on fallow lands and croplands from the plains to the center of mountains (23). This species is widespread in Central Asia (Pamir-Alai, Kopetdag) and Iran.

Geobotanical descriptions of plant communities are made according to generally accepted methods (24). When describing plant communities (in other words, their ecological condition, species composition, and abundance), the scale described by P. Drude (25) is used. Latin names of plant species are given by the international taxonomic database The Plant List (26). It has been used to identify plants at the species level. The coordinates of the locations are imported from ESRI ArcGIS ArcView v.10.0 (27) to create a map of the locations of *H. persica*.

Results and Discussion

During the expeditions in the 2020–2022 period for comparison with the Ustyurt Plateau, 3 communities in the Tashkent Region (in Western Tianshan, on the Kuraminsky Ridge, and in the Parkent District) and 4 communities on the Ustyurt Plateau in the Eastern Chink (Karakalpakstan) that include *H. persica* have been studied (Fig. 3).

The first community (*Crataegus turkestanica*, *Lonicera nummulariifolia*, *Rosa divina*, *Hulthemia persica, Achillea biebersteinii*, *Festuca valesiaca*, *Hordeum bulbosum,* and *Poa bulbosa)* is described from the left shore of the Parkentsay River, 1300 m above sea level. The soil is light grey. The total vegetative grass cover is 80-90%. The floristic composition of the community is relatively rich and variable due to the presence of herbaceous plants. Over 50% of the 44 vascular plants are perennials. The keystone species are *Malus sieversii*, *Prunus divaricata*, *Lonicera nummulariifolia*, *Crategus turkestanica*, *Rosa divina*, *R. maracandica* (Sp1 and Sp2), and shrubs of *H. persica* (Sp2). The dominant plants are *Festuca valesiaca*, *Hordeum bulbosum*, *Origanum tyttanthum*, *Poa bulbosa*, *Galium pamiralaicum*, *Ziziphora pedisellata* etc. *Achillea biebersteinii, Acroptilon repens*, *Plantago lanceolata*, *Cichorium intybus,* and *Convolvulus arvensis* are considered adventive species in this community. Layering is clearly expressed. The first layer of plants is higher than the bushes (up to 300 cm in height): *Acer turkestanica*, *Malus sieversii*, *Prunus divaricata,* and *Crataegus turkestanica.* The second layer (150-200 cm in height) includes *Cotoneaster racemiflora*, *Lonicera nummulariifolia*, *Rosa divina,* and *Spiraea hypericifolia.* The third layer (50-100 cm in height) has a relatively diverse floristic composition, including primarily perennials like *Achillea biebersteinii*, *Hordeum bulbosum, Pimpinella puberula*, *Agropyron trichophorum*, *Ziziphora pedisellata*, *Hypericum perforatum*, *Origanum tyttanthum* and the biennial *Cousinia radians*. Other species, such as *Hulthemia persica*, *Poa bulbosa*, *Plantago lanceolata,* and *Festuca valesiaca*, belong to the fourth layer. In the studied community (20×4), a total of 209 individuals of *Hulthemia persica* are recorded. Among them, 63 are virginal, 40 are young generative, 76 are middle-aged, and 30 are aged generative, but mature species are not found. Self-renewal occurs through both seed and vegetative processes.

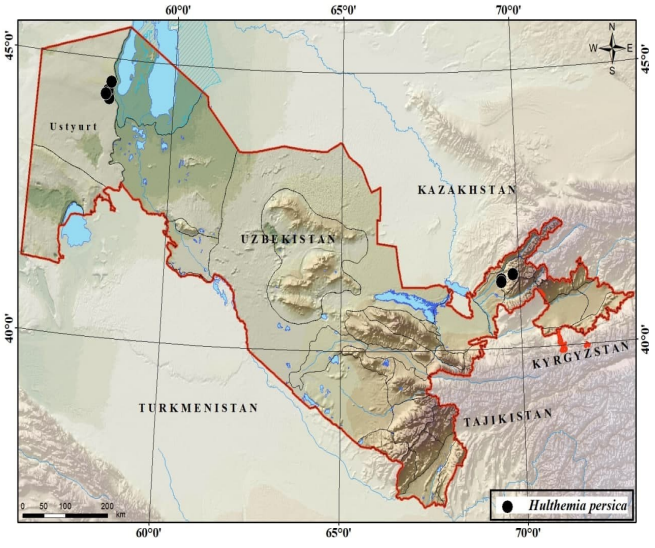


Fig. 3. Map of the distribution of *Hulthemia persica* in the Tashkent Region and on the Ustyurt Plateau (the Karakalpakstan Region of Uzbekistan).

The second community (*Rosa divina*, *R. maracandica*, *Lonicera nummulariifolia*, *Hulthemia persica,* and *Cynodon dactylon*) studied occurred along the Parkentsay River, 200 m above sea level. The soil is light grey and there are large stones in the area studied. There is a vegetative cover over 60-70% of the area. The species composition of this community is similar to that of the previous community. This community is also characterized by a shrubby first layer with a height of 100-200 (300) cm; *Cerasus erythrocarpa*, *Lonicera nummulariifolia*, *Rosa maracandica,* and *R. divina,* and less often, *Crataegus turkestanica* and the tree *Acer semenovii* tree are keystone species. The second layer is 50-60 cm in height and includes *Artemisia tenuisecta*, *Achillea filipendulina*, *A. millefolium*, *Hordeum bulbosum*, *Ziziphora pedicellata* and *Agropyron trichophorum.* The third layer has a height of 20-40 cm. It is dominated by *Hulthemia persica*, *Taraxacum officinale*, *Plantago lanceolata*, *Cynodon dactylon*, *Polygonum aviculare*, *Galium pamiro-alaicum* and *Diarthron vesiculosum.* In total, 27 species are observed in this community. A total of 135 individuals of *H. persica* are found in a 10x4 m area. Of these individuals, 15 are juveniles, 21 are immature, 27 are virginal, 18 are young generative, 34 are medium-generative and 20 are aging generative, and mature individuals are not observed. At the study time, the plants are in the mass flowering phase. However, there are already faded individuals.

The third community (*Hulthemia persica* + *Cynodon dactylon* + *Alhalgi Psuedahalgi*) is distributed along the right side of the river. The Parkentsay River is 950 m above sea level on the Western slope of the Kirgiz Village. The soil is light grey. The vegetative cover is 30-40%. *H. persica*, *Cynodon dactylon,* and *Alhagi pseudalhagi* account for 30% of the vegetative cover. The floristic composition consists of only 16 species (Table 1). *H. persica, Cynodon dactylon,* and *Alhagi pseudalhagi* usually act as keystone species. Trees and shrubs are not found in this community. Since

Table 1. Species composition and abundance of selected communities in the Tashkent Region.

Name of plant/community	Family	***Crataegus turkestanica*, *Lonicera nummulariifolia*, *Rosa divina*, *Hulthemia persica* + *Achillea biebersteinii*, *Festuca valesiaca*, *Hordeum bulbosum*, *Poa bulbosa***	***Rosa divina*, *R. maracandica*, *Lonicera nummulariifolia*, *Hulthemia persica* + *Cynodon dactylon***	***Hulthemia persica* + *Cynodon dactylon* + *Alhagi pseudalhagi***
Community number		1	2	3
Vegetative cover, in %		80–90	60–70	30–40
Trees				
Acer semenovii Regel & Herder	Aceraceae	-	Sol	-
A. turkestanicum Pax	Aceraceae	Sol	-	-
Malus sieversii (Ledeb.) M. Roem.	Rosaceae	Sol-Sp1	-	-
Prunus divaricata Ledeb.	Rosaceae	Sol-Sp1	-	-
Shrubs				
Cerasus erythrocarpa Nevski	Rosaceae	-	Sp1	-
Crataegus turkestanica Pojark.	Rosaceae	Sp1	Sol	-
Cotoneaster multiflorus Bunge	Rosaceae	Sol	-	-
Hulthemia persica (Michx. ex C. Juss.) Bornm.	Rosaceae	Sp2	Sp2	Sp3
Lonicera nummulariifolia Jaub. & Spach	Caprifoliaceae	Sp1	Sp1	-
Rosa divina Sumnev.	Rosaceae	Sp1	Sp2	-
Rosa maracandica Bunge	Rosaceae	Sp1	Sp2	-
Spiraea hypericifolia L.	Rosaceae	Sol	-	-
Semi-shrubs				
Artemisia tenuisecta Nevski	Asteraceae	-	Sp1	-
Perennials				
Achillea biebersteinii Afan.	Asteraceae	Sp1-Sp2	-	-
Achillea filipendulina Lam.	Asteraceae	-	Sp1	-
Achillea millefolium L.	Asteraceae	-	Sp1	-
Acroptilon repens (L.) DC.	Asteraceae	Sol-Sp1	-	-
Agropyron trichophorum (Link) K. Richt.	Poaceae	Sol	Sp1	-
Alhagi pseudalhagi (M. Bieb.) Fisch.	Fabaceae	-	-	Sp2-Sp3
Anchusa italica Retz.	Boraginaceae	-	-	Sol
Cynodon dactylon (L.) Pers.	Poaceae	Sp1	Sp3	Sp3
Cichorium intybus L.	Asteraceae	Sol-Sp1	Sol	Sol
Cousinia resinosa Juz.	Asteraceae	-	Sol	-
Convolvulus arvensis L.	Convolvulaceae	Sol-Sp1	-	Sol
C. lineatus L.	Convolvulaceae	Sp1	Sp1	Sp1
Enneapogon persicus Boiss.	Poaceae	Sol	Sol	-
Festuca valesiaca Gaudin	Poaceae	Sp2	-	-
Galium pamiro-alaicum Pobed.	Rubiaceae	Sp1	Sol	Sol
Glycyrrhiza glabra L.	Fabaceae	Sol	-	-
Hordeum bulbosum L.	Poaceae	Sp1-Sp2	Sol	-
Hypericum perforatum L.	Hypericaceae	Sol	-	-
Medicago sativa L.	Fabaceae	Sol	Sol	-
Origanum tyttanthum Gontsch.	Lamiaceae	Sp1	-	-
Plantago lanceolata L.	Plantaginaceae	Sp1	Sp1	Sp1
Phlomis sewerzowii Regel	Lamiaceae	Sol	-	-
Pimpinella puberula (DC.) Boiss.	Apiaceae	Sp1	-	-
Poa bulbosa L.	Poaceae	Sp1-Sp2	-	-
Polygonum fibrilliferum Kom.	Polygonaceae	Sp1	-	-
Poterium polygamum Waldst. & Kit.	Rosaceae	Sol	-	-
Potentilla orientalis Juz.	Rosaceae	-	Sol	-
Ranunculus repens L.	Ranunculaceae	Sol	-	-
Taraxacum officinale F.H. Wigg.	Asteraceae	Sol	Sp1	-
Trifolium pratense L.	Fabaceae	Sol	Sol	-
Trifolium repens L.	Fabaceae	Sol	-	-
Ziziphora pedicellata Pazij & Vved.	Lamiaceae	Sp1-Sp2	Sp1	Sp1
Biennials				
Cousinia radians Bunge	Asteraceae	Sp1	-	-
Melilotus officinalis (L.) Pall.	Fabaceae	Sol	-	-
Annuals				
Bromus danthoniae Trin.	Poaceae	Sol	-	-
Capsella bursa-pastoris (L.) Medikus	Brassicaceae	Sol	-	-
Cymbolaena longifolia (Boiss. & Reut.) Smoljan.	Asteraceae	-	Sol	-
Diarthron vesiculosum (Fisch. & C.A. Mey. ex Kar. & Kir.) C.A. Mey.	Thymelaeaceae	Sol	Sol	-
Eremodaucus lehmannii Bunge	Apiaceae	Sp1	-	-
Erigeron umbrosus (Kar. & Kir.) Boiss.	Asteraceae	Sp1	-	Sol
Koelpinia linearis Pall.	Asteraceae	Sol	-	Sol
Heliotropium lasiocarpum Fisch. & C.A. Mey.	Boraginaceae	-	-	Sol
Malva neglecta Wallr.	Malvaceae	-	-	Sol
Polygonum aviculare L.	Polygonaceae	-	Sp3	Sol
Tithymalus falcatus (L.) Klotzsch & Garcke	Euphorbiaceae	-	-	Sol

Note: * Sol – single instance; Sp1 – rare; Sp2 – realtively rare; Sp3 – moderately rare. *Source*: Compiled by the authors.

this community is located near settlements, it experiences strong impacts from anthropogenic factors, primarily cattle grazing. According to the obtained data, up to 47-50 individuals are found per 1 m^2, often located in groups, with reproduction occurring through root suckers.

H. persica is widespread from the plains to the central ridge of mountains and four communities in which this species is found in the Eastern chink of the Ustyurt Plateau are studied. A brief description of these communities is as follows:

The *Medicago sativa* + *Crataegus korolkowii* community is found 4 km North of the Karakuduk well in stony-gravelly fine-earth soils. *Crataegus korolkowii* accounts for 20% of the vegetative cover in this community. *Medicago sativa* is considered a subdominant species (with 10% cover); in addition, xerophytic species, such as *Anabasis salsa* (2%) and *Artemisia terrae-albae* (2%), are observed here. The grass cover is rich; it includes 23 species, but it is not constant and depends on microecological conditions. Since grasses are widespread in narrow gorges, other species are not found in these areas except for hawthorn bushes. The vegetation is rich in mesophytic species in open areas, but representatives of xerophilic groups are also found. An ecological analysis of the species composition of this community reveals the predominance of Tugai grassland species among the herbage of this group, in combination with xerophytic species. *H. persica* occurs as a member of this community. Herbaceous species account for 30-35% of the vegetative cover.

The *Medicago sativa* + *Agropyron fragile*, *Cardaria pubescens*, *and Ferula syreitschikowii* communities, are distributed from the Korgansha fortress to the Kassarma tract. In the Korgansha Region, 17 species are recorded in the community, including 2 shrubs, 1 semi-shrub, 12 perennials, and 2 annuals. The basis of the herbage consists of *Medicago sativa*, *Cardaria pubescens,* and *Agropyron fragile.* In addition to these species, mesophytic species grow in this community and are indicators of xerophytisation (*Artemisia terrae-albae*, *Atraphaxis spinosa,* and *Hulthemia persica*). *H. persica* is also a member of this group. Grass cover accounts for 50-60% of the vegetative cover.

An *Agropyron fragile* + *Medicago sativa* community is described from the vicinity of the Korgansha slope. This community consists of 21 species, involving 4.8% shrubs, 77.6% herbaceous perennials and 17.6% annuals. Grass cover accounts for 35-45% of the vegetative cover. *Poa bulbosa* is also observed in this community, along with the dominant species *Agropyron fragile* and *Medicago sativa*. This community includes 21 varieties of vascular plants, most of which belong to herbaceous perennials. Certain annuals are often found, such as *Asperugo procumbens*, *Ceratocephala testiculata*, *Descurainia sophia,* and *Lappula spinocarpos*.

A comparative floristic analysis of communities described 36 years ago demonstrates that very large changes have occurred in the species composition of communities since the first survey. Only 14% of the species reported by B. Saribaev (28) have survived. Additionally, a distinctive feature of the current *Medicago sativa* + *Agropyron fragile* community is the presence of xerophilous species, especially *Hulthemia persica* (approximately 5%) and *Ephedra distachya* and *Anabasis brachiata*, which have not been found by B. Saribaev (28).

The *Agropyron fragile* + *Artemisia terrae-albae* + *Medicago sativa* community is recorded in the vicinity of Dzhidalibulak, on the Eastern slope of the chink on grey-brown soils. This community grows on the upper part of the Eastern slope and occurs in individual locations. The basis of the herbage consists of *Agropyron fragile* (25%), *Artemisia terrae-albae* (15%), *Medicago sativa* (10%), and *Hulthemia persica* (3%). In terms of floristic composition, this community is not ideal (15 species); there are only 2 shrubs and 1 semi-shrub, little involvement of annual grasses (1 species), and many (11 species) different herbs (Table 2). The vegetative cover is 50-55%.

One should note that on the Ustyurt Plateau, in most of the identified areas, *H. persica* occurs as a member of all communities except the *Medicago sativa* + *Agropyron fragile* community.

Conclusion

Recently, the strengthening of urbanization processes, the intensification of road construction, and the expansion of geological exploration in areas of Uzbekistan with various environmental conditions (characterized by certain kinds of flora) have caused the transformation of the flora of this territory and an environmental crisis. Therefore, there is a need to determine the current state of the plant species found in this area and protect the endangered species. With this aspect in mind, the determination of the ecological state of representative plants, their adaptation to soil-climatic conditions, and the introduction of the production of promising species against the background of transformed habitats are priority directions for the preservation of biodiversity of natural ecosystems.

The studied species, *H. persica*, is a promising melliferous and forage plant adapted to different environmental conditions. Phytocoenotic studies in seven communities have shown that the population numbers of *H. persica* in the Tashkent Region (Parkentsay) are satisfactory. However, in recent years (2020), the strong impact of anthropogenic factors, primarily livestock grazing under natural growing conditions, has affected this species' abundance, which has gradually disappeared. Large-scale exploration and prospecting, with the development of the oil and gas industry and other technogenic factors, has harmed the state of *H. persica*. Therefore, the population lacks young individuals and the cover provided by this species is relatively low. Therefore, it is crucial to strengthen protection measures, which the authors also recommend using for degraded pastures in the desert and foothill regions of the Republic of Uzbekistan. A detailed survey of natural populations and one should monitor their condition.

Table 2. Species composition and abundance of selected communities on the Ustyurt Plateau.

Name of plant/ community	Family	*Medicago sativa* + *Crataegus korolkowii*	*Medicago sativa* + *Agropyron fragile*, *Cardaria pubescens*, *Ferula syreitschikowii*	*Agropyron fragile* + *Medicago sativa*	*Agropyron fragile* + *Artemisia terrae-albae* + *Medicago sativa*
Shrubs					
Atraphaxis spinosa L.	Polygonaceae	Sol	Sol	-	-
Crataegus korolkowii L. Henry	Rosaceae	Cop1	-	-	-
Ephedra distachya L.	Ephedraceae	-	-	Sol	Sol
Hulthemia persica (Michx. ex C. Juss.) Bornm.	Rosaceae	Sol	Sol	Sp1	Sol
Semi-shrubs					
Anabasis salsa (C. A. Mey.) Benth. ex Volkens	Chenopodiaceae	Sp1	-	-	-
Artemisia terrae-albae Krasch.	Asteraceae	Sp1	Sp1	Sol	Sp3
Salsola orientalis S. G. Gmel.	Chenopodiaceae	Sol	-	-	-
Perennials					
Agropyron fragile (Roth) P. Candargy	Poaceae	Sol	Sp1	Cop2	Cop1
Asparagus inderiensis F. K. Blum ex Pacz.	Asparagaceae	Sol	Sol	-	-
A.breslerianus Schult. & Schult. f.	Asparagaceae	-	-	Sol	-
Anabasis brachiata Fisch. & C. A. Mey. ex Kar. & Kir.	Chenopodiaceae	Sol	-	Sol	-
Acroptilon repens (L.) DC.	Asteraceae	-	Sol	-	-
Capparis herbacea Willd.	Capparaceae	Sol	-	-	-
Cardaria repens (Schrenk) Jarm.	Brassicaceae	-	-	Sol	-
C. pubescens (C. A. Mey.) Jarm.	Brassicaceae	-	Sp1	-	-
Centaurea apiculata Ledeb.	Asteraceae	Sol	-	Sol	-
Chenopodium album L.	Chenopodia ceae	-	-	Sol	-
Cistanche trivalvis (Trautv.) Korsh.	Scrophulariaceae	Sol	-	-	-
Cynoglossum viridiflorum Pall. ex Lehm.	Boragi naceae	Sp1	-	-	-
Convolvulus arvensis L.	Convolvulaceae	-	Sol	-	-
Echinops meyeri (DC.) Iljin	Asteraceae	Sp1	Sol	-	Sol
Erianthus ravennae (L.) P. Beauv.	Poaceae	-	-	Sol	-
Ferula syreitschikowii Koso-Pol.	Apiaceae	-	Sp1	Sol	-
Galium pamiro-alaicum Pobed.	Rubiaceae	-	-	-	Sol
Glycyrrhiza aspera Pall.	Fabaceae	-	Sol	-	Sol
Gypsophila diffusa Fisch. & Mey. ex Rupr.	Caryophyllaceae	Sol	-	-	-
Rheum tataricum L.	Polygonaceae	Sol	-	-	-
Rindera tetraspis Pall.	Boraginaceae	-	Sol	-	-
Onosma staminea Ledeb.	Boraginaceae	Sol	-	-	-
Peganum harmala L.	Peganaceae	-	Sol	Sol	-
Poa bulbosa L.	Poaceae	Sol	-	Sp1	Sol
Potentilla supina L.	Rosaceae	-	Sol	-	-
Plantago minuta Pall.	Plantaginaceae	-	-	Sol	-
Seseli glabratum Willd. ex Spreng.	Apiaceae	Sol	-	-	Sol
Silene nemoralis Waldst. & Kit.	Caryophyllaceae	Sol	-	-	-
Sisymbrium subspinescens Bunge	Brassicaceae	-	-	Sol	-
Lactuca tatarica (L.) C. A. Mey.	Asteraceae	-	-	-	Sol
Medicago sativa L.	Fabaceae	Sp2	Cop2	Sp2	Sp2
Thalictrum isopyroides C. A. Mey.	Ranunculaceae	Sol	-	-	-
Tragopogon marginifolius Pavlov	Asteraceae	-	-	Sol	Sol
Tanacetum santolina C. Winkl.	Asteraceae	-	-	-	Sol
Tulipa buhseana Boiss.	Liliaceae	-	-	-	Sol
Zygophyllum turcomanicum Fisch. ex Bunge	Zygophyllaceae	Sol	-	-	-
Annuals					
Asperugo procumbens L.	Boraginaceae	-	-	Sol	-
Ceratocephala testiculata (Crantz) Besser	Ranunclaceae	-	-	Sol	-
Descurainia sophia (L.) Webb ex Prantl	Brassicaceae	-	-	Sol	-
Climacoptera lanata (Pall.) Botsch.	Chenopodiaceae	-	Sol	-	-
Chenopodium album L.	Chenopodiaceae	-	Sol	-	-
Lappula spinocarpos (Forssk.) Asch.	Boraginaceae	-	-	Sol	-
Rochelia bungei Trautv.	Boraginaceae	-	-	-	Sol

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Authors' contributions

Tashkhanim T. Rakhimova and Nodira K. Rakhimova studied the species composition and abundance of chosen communities on the Ustyurt Plateau. Vasila K. Sharipova did field research, and studied common methods. Nargiza K. Rakhimova and Eldor E. Temirov studied the species composition and abundance of selected communities in the Tashkent region.

Compliance with ethical standards

Conflict of interest: The authors do not have any conflicts of interest to declare.

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References

1. Abduraimov OS, Maxmudov AV, Kovalenko I, Allamurotov AL, Mavlanov BJ, Saribaeva ShU, Mamatkasimov OT. Floristic diversity and economic importance of wild relatives of cultivated plants in Uzbekistan (Central Asia). Biodiversitas. 2023;24(3):1668-75. https://doi.org/10.13057/biodiv/d240340
2. Akhmedov A, Nomozova Z, Umurzakova Z, Turdiboev O, Atayeva Sh, Jumayev N. Assessment of the current condition of populations of the red list species *Salvia submutica* Botsch. & Vved. (Lamiaceae Lindl.) in Nuratau mountain ridge, Uzbekistan. Ekológia (Bratislava). 2022;41(4):322-28. https://doi.org/10.2478/eko-2022-0033
3. Akhmedov A, Rog I, Bachar A, Shomurodov H, Nasirov M, Klein T. Higher risk for six endemic and endangered *Lagochilus* species in Central Asia under drying climate. Perspectives in Plant Ecology, Evolution and Systematics. 2021;48:1-9. https://doi.org/10.1016/j.ppees.2020.125586
4. Akramov DKh, Mamadalieva NZ, Porzel A, Hussain H, Dube M, Akhmedov A, Altyar AE, Ashour ML, Wessjohann LA. Sugar containing compounds and biological activities of *Lagochilus setulosus.* Molecules. 2021;26(1755):1-7. https://doi.org/10.3390/molecules26061755
5. Halimova Sh, Rakhimova T. Biomorphological features of some medicinal plants under the conditions of Bukhara (Uzbekistan). Journal of Pharmaceutical Negative Results. 2022;13(9):2325-33. https://doi.org/10.47750/pnr.2022.13.S09.277
6. Khamraeva DT, Bussmann RW, Abduraimov OS, Rakhimova NK. Adaptive mechanisms of conservation populations of rare and endemic species of *Kamelinia tianschanica* F.O. Khass & I.I. Malzev in Uzbekistan. Pak J Bot. 2023;55(3):1065-74. https://doi.org/10.30848/pjb2023-3(18)
7. Rajabov TF, Ramsey RD, Mardonov BK, Rakhimova T, Valiev ShA. Sensitivity of Landsat 7 & 8-derived vegetation indices on semi-arid rangelands of southwestern Uzbekistan. 2020;(3):1-16. https://doi.org/10.1080/10106049.2020.1723715
8. Rakhimova NK, Rakhimova T. The current state of endemic species, *Iris magnifica* (Vved.) F.O. Khass. (Iridaceae) in Kashkadarya region of Uzbekistan. Annals of Phytomedicine. 2022;11(2):612-18. https://doi.org/10.54085/ap.2022.11.2.0
9. Rakhimova NK, Rakhimova T. The status of *Salsola arbusculiformis* and *Anabasis salsa* shrub grasslands on the Usturt plateau in Karakalpakstan (Uzbekistan). Arid Ecosystems. 2022;12(3):286-95. https://doi.org/10.1134/S2079096122030106
10. Rakhimova NK, Shomurodov KhF, Sharipova VK, Saitjanova USh, Sadinov JS. Using biodiversity indices to assess the current state of tugai vegetation of the Amu darya river, Uzbekistan. Biodiversitas. 2023;24(1):467-72. https://doi.org/10.13057/biodiv/d240153
11. Rakhimova NK, Rakhimova T, Adilov BA, Tamambetova SB, Polvonov FI. Current condition of *Crambe edentula* Fisch. & C.A. Mey. ex Korsh. on the Ustyurt plateau in Uzbekistan. Arid Ecosystems. 2021;11(4):377-82. https://doi.org/10.1134/S2079096121040090
12. Rakhimova NK, Rakhimova T, Sadinov JS. Current state of *Anabasis salsa* pasture varieties in Karakalpak Ustyurt (Uzbekistan) due to aral sea drying. Plant Science Today. 2022;9(sp3):25-30. https://doi.org/10.14719/pst.1804
13. Rakhimova NK, Rakhimova T, Shomurodov KhF, Sharipova VK. The status of coenopopulations of *Xylosalsola chiwensis* (Popov) Akhani & Roalson and *Scorzonera bungei* Krasch. & Lipsch. on the Ustyurt plateau (Uzbekistan). Arid Ecosystems. 2023;13(2):189-95. https://doi.org/10.1134/S2079096123020117
14. Rakhimova T, Rakhimova N, Sharipova V, Beshko N, Hayitov R. Current state of coenopopulations of some rare endemic species in Navoi region, Uzbekistan. Ekológia (Bratislava). 2021;40(4):357-63. https://doi.org/10.2478/eko-2021-0037
15. Rakhimova T, Rakhimova N. Ontogenesis and ontogenetic structure of cenotic populations of *Eremurus anisopterus* (Asphodelaceae) in the Kyzylkum desert (Uzbekistan). Botanica Pacifica. 2022;11(2):39-44. https://doi.org/10.17581/bp.2022.11218
16. Rakhimova T, Rakhimova NK, Shomurodov KhF, AbduraimovO S. Ontogenetic structure of rare species on the Ustyurt plateau in Uzbekistan. Arid Ecosystems. 2020;26/3(84):238-43. https://doi.org/10.24411/1993-3916-2020-10109
17. Saitjanova USh, Shomurodov KhF. Dynamics of Medicageta sativae formation on the Ustyurt plateau under climate change and drying of the aral sea. Plant Science Today. 2022;9(sp3):71-78. https://doi.org/10.14719/pst.1862
18. Saribaeva Sh, Abduraimov O, Allamuratov A. Assessment of the population status of *Alium oschaninii* O. Fedtsch. in the mountains of Uzbekistan. Ekologia (Bratislava). 2022;41(2):147-54. https://doi.org/10.2478/eko-2022-0015
19. Sharipova VK, Rakhimova T, Rakhimova NK. Ecological state of some pasture differences of *Haloxylon ammodendron* of Karakalpak Ustyurt (Uzbekistan). E3S Web of Conferences, Yogyakarta, Indonesia. 2022;361(04028):1-10. IConARD. https://doi.org/10.1051/e3sconf/202236104028
20. Temirov E, Rakhimova N. The bioecological features of some species of the Cupressaceae introduced in the conditions of Tashkent city, Uzbekistan. Biodiversitas. 2022;23(10):5532-38. https://doi.org/10.13057/biodiv/d231065
21. Vaisova G, Rakhimova T, Matkarimova A. The current state of the coenopopulation of *Capparis spinosa* L. (Capparaceae) in the semi-desert of Uzbekistan. Annals of Phytomedicine. 2022;11(2):619-24. https://doi.org/10.54085/ap.2022.11.2.76
22. Shomurodov KhF, Rakhimova NK, Saitjanova USh, Zhao Zhenyong. The ecological-phytocenotic characteristics of *Halocnemum strobilaceum* (Pall.) Bieb. Grasslands on the Ustyurt plateau in Karakalpakstan. Arid Ecosystems. 2023;13(4):507-17. https://doi.org/10.1134/S2079096123040145
23. Key to plants of Central Asia, I-X. Tashkent. 1968;415.
24. Field geobotany. Under. ed. E.M. Lavrenko, A.A. Korchagin. Vol. 3. Moscow: 1964; 230.

25. Drude P. Handbuch der Pflanzengeographie. Engelhorn, Stuttgart. 1907;582.
26. The Plant List. URL:http //www.theplantlist.org/
27. ArcGIS Pro. ESRI:2020. Official website. http://www.esri.com/ru-ru/arcgis/products/arcgis-pro
28. Saribaev B. Flora and vegetation of the Eastern Chink. Tashkent. 1981;90.