Institute of Botany
Annual Report
2022

Institute of Botany
Academy of Sciences of the Republic of Uzbekistan

Note from the Director General

The year 2022 was remarkable for many events and productive in all areas of research pursued in the institute. The second stage of research carried out within the framework of state programs has been completed. Novel, of significant scientific value results have been obtained, and most of them published in high impact factor thematic journals. All six research projects were carried out exclusively in the priority areas of the institute. Floristic research has advanced significantly in Uzbekistan through the use of modern approaches such as map grid indexes. The latter were applied to the districts Western Hissar, Hissar-Darvaz and Pyandzh, and the Mountainous Central Asian province within the Surkhandarya region, Uzbekistan. The creation of a digital dataset with georeferencing and accumulation of data in the context of a map grid indexes greatly increased the results reliability and validity. Creation of the regional cadastre with plant diversity assessments and evaluation of impacts of various environmental and anthropogenic factors characterize our research as fundamental

Creation of the pasture vegetation cadastre for the Eastern Cliff of the Ustyurt plateau is another significant achievement of the last year institute research. Based on the earlier results of studying climate change effects on pasture vegetation communities, the current state of the pastures in the region has been evaluated and digital maps with pasture scores and seasonal usage created

In 2022, as a part of the project on creating the state cadastre, the list of vascular plants of Tashkent region, one of the richest in plant diversity administrative region of Uzbekistan, has been compiled. These cadastral studies evaluated the current state of populations of economically valuable wild plant species, and evaluated their quotas based on the dynamics over the past 10 years

The flora of Uzbekistan has been updated due to several new floristic discoveries. An updated list and an electronic database of wild relatives of the cultivated plants of the flora of Uzbekistan have been compiled. The living collections of 30 wild relatives of crops have been created in the Tashkent Botanical Garden and in the Kyzylkum desert station, creating a possibility for breeding new crop varieties

The institute mycologists identified for the first time in Uzbekistan several pathogenic fungi causing diseases in crops growing in Namangan and Bukhara regions, and determined the antifungal activity of some bacteria and fungi against the fungal pathogens

The area of origin of the Iridaceae family has been reconstructed using molecular data. A novel method to determine the number of chromosomes has been developed and approbated for the genus *Iris* L. The chloroplast genome data were submitted to the international database NCBI

It should be noted that in 2022 the institute scientific research was carried out within the framework of two fundamental and two applied projects funded by the Ministry of Innovative Development of the Republic of Uzbekistan. The first fundamental project investigated the long-term dynamics of the glaciers melting, and its effect on the Amu Darya River and the surrounding tugai forests

The result of the second fundamental project was publishing of the fourth volume of the new edition of “Flora of Uzbekistan” with the revisions of Heliotropiaceae, Boraginaceae and Hydrophyllaceae families. I’d like to express my deep gratitude to the editor of the volume prof. Sennikov A.N. (Curator at the Botanical Museum, Finnish Museum of Natural History, University of Helsinki, Finland) and the author prof. Ovchinnikova S.V. (Central Siberian Botanical Garden of the Russian Academy of Sciences)

The results of applied research are also significant. A highly promising *in vitro* technology to obtain seedlings has been developed for two rare species of the flora of Uzbekistan (*Ferula tadshikorum* and *Ungernia victoris*). The ethnobotanical survey of the usage of wild medicinal plants resulted in a creation of the database of medicinal and food plants of Uzbekistan

One more applied project was funded by the State Committee for Ecology and Environmental Protection of Uzbekistan. Within this project the institute staff evaluated the operational stock and quotas for 42 economically valuable wild plant species. The lists of vascular plants were compiled for seven protected natural areas

In addition, scientific work has been conducted within the framework of 17 agreements with different economic entities for identification of the operational stock of medicinal plants

The next significant event is publishing of the two issues of a new journal "Diversity of Plants of Central Asia", and several published articles have already been cited in the international scientific literature

2022 was also productive in international cooperation. We hosted guests from Pyrenean Institute of Ecology (Spain), Professor Sara Palacio and Senior Researcher of the Yerevan Botanical Garden Alexander Rudov, within the GYPWORLD project aimed to the studying of gypsophytes ecology

Seminar with participants from two leading arboretums of South Korea, headed by Professor Youngtae Choi (Director of the Korean National Arboretum) and Mr. Kwang-Su Ryu (Director of Baekdudaegan National Arboretum) and specialists from Kazakhstan, Kyrgyzstan and Tajikistan has been held, on the basis of laboratory “Flora of Uzbekistan”. The seminar subject was the assessment and conservation of biodiversity in Central Asia and Korea. A multilateral memorandum of understanding was signed on "Creating a Botanical Gardens network in South Korea and Central Asia"

Colleagues from the Data Strategy Center (DRB International Co., Ltd., South Korea) led by director Kim Joonsung visited our Institute to exchange ideas and explore a possibility of cultivation of rubber plants in Uzbekistan

It is worth to note, that doctoral student Bekhruz Khabibullaev has been selected as Scholar of the President’s Scholar Program. Five employees were rewarded for their scientific achivements

In general, the last year has been productive both in scientific and scientific-organizational activities. I sincerely thank all our scientific and technical staff for their excellent work, and also thank our foreign colleagues for their partnership and support

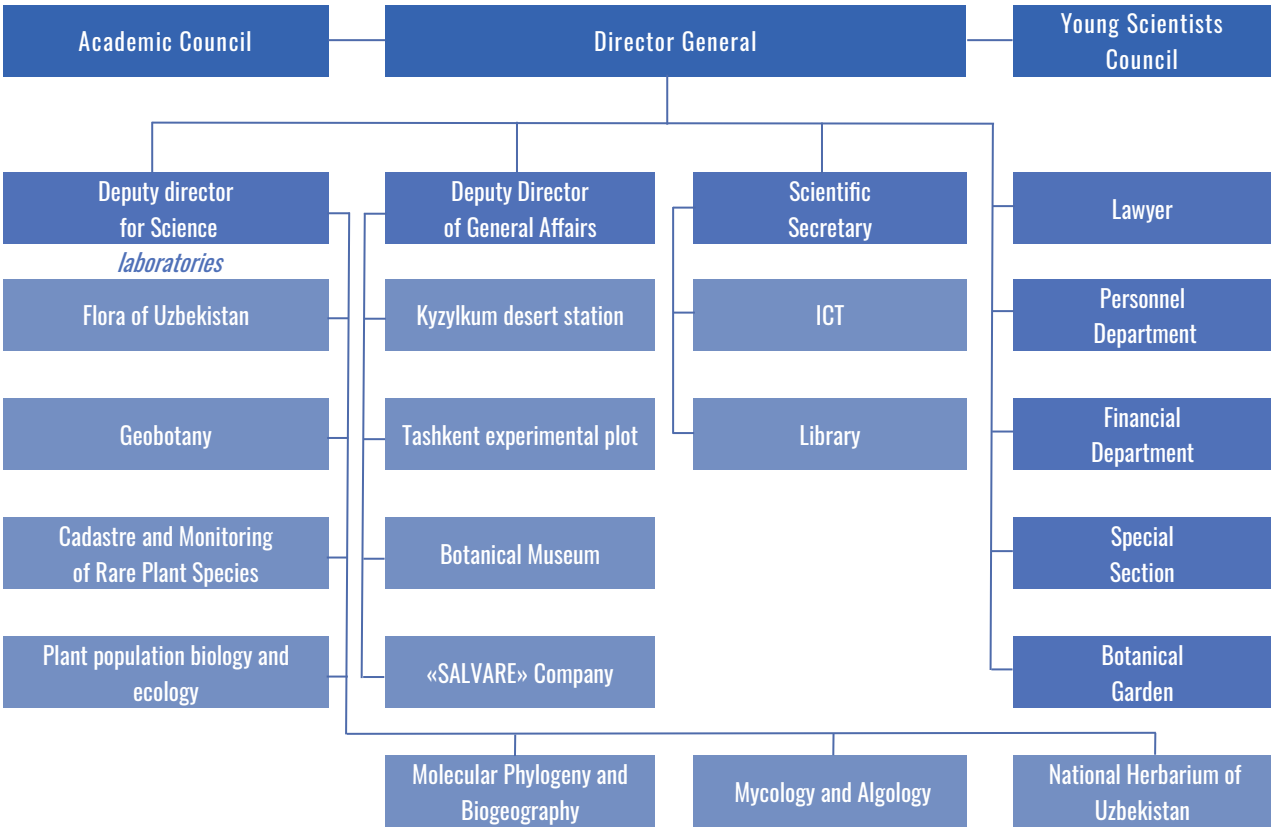
With appreciation,

Khabibullo Faizulloevich Shomurodov, Director General of the Institute of Botany

PART B

Organizational Structure

Structure



Staff members
Total: 117

1 Doctor of science, academician 6 Doctor of science, Professor 2 Doctor of science	8%
15 PhD, Senior scientist 5 PhD	17%
39 Junior researcher	33%
13 Specialists	11%
36 Technical staff	31%

PART II

Government programs

Laboratory
Flora of Uzbekistan

Grid mapping of the flora of South-Western Hisar, Hisar-Darvaz and Panj districts (part of Surkhandarya region)

Program Outline

Determining the species composition of the flora of southwestern Hisar, Hisar-Darvaz districts using grid system mapping

Key Achievement

Grid-based mapping of floristic diversity based on georeferenced data and the newly created digital platform made possible the analysis of the natural-historic and anthropogenic factors influencing biodiversity patterns

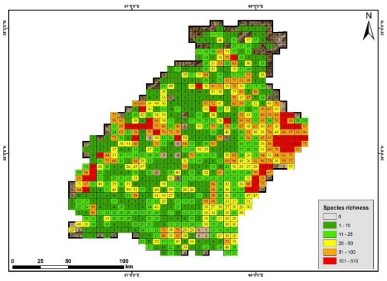
Territory

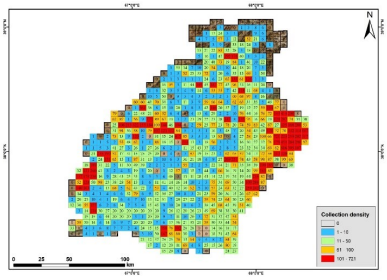
Hisar-Darvaz and Panj botanical-geographical districts of the mountainous Central Asia province are parts of southwestern Hisar, and in Uzbekistan mainly correspond to the territory of the Surkhandarya administrative region in the south-east of the country. The territory covers an area of 20,100 km^2. The altitude ranges from 270 m in the south to nearly 4000 m (3920 m, Piryakh Peak) in the north

Research Achievement

The flora of the Surkhandarya region was mapped using the grid system with cells 5 x 5 km and the botanical-geographical zonation. During more than 30 field surveys this year, 337 indices were covered and more than 2,200 km were covered on foot. As a result, 9439 herbarium specimens were collected, and 13696 species occurrence records obtained

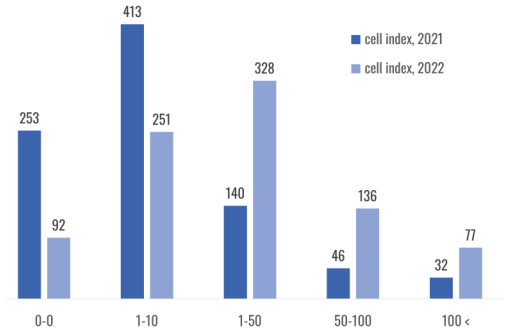
Research conducted in 2022 brought the composition of the flora in Central Asia to the next qualitative stage of grid system mapping





Research Achievement

Compared to 2021, the number of cells with a value of "0" was decreased to 161. This year, the number of georeferenced data was 35,080 entries, allowing us to provide values for 792 cells (89.54% of the research area) on the grid map

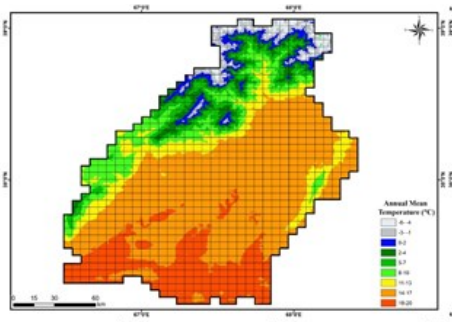


Based on the georeferenced data, floristic lists were created for the Hisar-Darvaz and Pyanjoldi botanical-geographic regions of southwestern Hisar

Baysun		Surkhan-Sherabad		Babatag		Kugitang	
Fabaceae	191	Asteraceae	119	Asteraceae	141	Asteraceae	150
Poaceae	113	Poaceae	99	Fabaceae	125	Fabaceae	134
Brassicaceae	74	Fabaceae	86	Poaceae	99	Poaceae	94
Asteraceae	74	Brassicaceae	67	Lamiaceae	58	Brassicaceae	75
Apiaceae	68	Amaranthaceae	62	Brassicaceae	54	Lamiaceae	75
Ranunculaceae	64	Lamiaceae	40	Apiaceae	53	Apiaceae	58
Boraginaceae	62	Apiaceae	31	Caryophyllaceae	40	Boraginaceae	51
Caryophyllaceae	47	Caryophyllaceae	29	Boraginaceae	35	Caryophyllaceae	44
Caprifoliaceae	37	Cyperaceae	28	Ranunculaceae	35	Ranunculaceae	38
Amaryllidaceae	35	Ranunculaceae	25	Amaryllidaceae	30	Amaryllidaceae	38
Subtotal 765		Subtotal 586		Subtotal 670		Subtotal 757	
Total 1278		Total 922		Total 1003		Total 959	

Grid-system mapping of the flora allowed us to improve the resolution of the state cadastre of the natural flora of Uzbekistan in the administrative regions. Previously, species composition and the distribution of vascular plants in the administrative and botanical-geographical regions existed only as lists of species. Now, for the first time in the Surkhondarya region, each of the 5 x 5 km cells of the grid has information on the species included within it. In total, 2151 species from 106 families and 652 genera were recorded for the territory of the Surhondarya region. The geospatial analysis of the data made it possible to move from the cadastre of plants in the regional sections, which was previously only of practical importance, to the level of regional flora synopses, which is now of fundamental importance and based on deep taxonomic analysis

Using the CHELSA-BIOCLIM+ and WorldClim v2.1 databases and the Nasa Power online platform, the annual averages of the 19 climatic variables were calculated and displayed on a grid-system map



Research Achievement

From the results of the bioclimatic modeling of endemic species in the Surkhandarya region and the rare species included in the Red Book performed with Maxent, the species can be divided into two groups. Compared to the current period, under the future climate predicted by the two models, Rcp2.6 and Rcp8.5, the suitable area will increase for 35% of the species and decrease for 65% of them

No	Species	Areas with optimal conditions, sq. km		
		Current period	SSP1-RCP2.6	SSP5-RCP8.5
1	*Ungernia victoris*	201	141	576
2	*Ferula tadshikorum*	1087	533	391
3	*Astragalus pseudanthylloides*	105	151	261
4	*Calispepla aegacanthoides*	194	77	72
5	*Calophaca reticulata*	199	83	84
6	*Dionysia hissarica*	139	21	48
7	*Eremurus jae*	99	10	62
8	*Moluccella bucharica*	24	57	26
9	*Oxytropis vvedenskyi*	39	114	1094
10	*Scutellaria villosissima*	279	194	176

Result Diffusion

Thesis publication: 15 theses have been produced

Thesis presentation: Twelve presentations are about grid mapping and taxonomic and geographic analysis of the studied flora

Objects of intellectual property: Certificate of official registration of the program for electronic

Expectation Effect

Developing a digital platform for the Surkhandarya region's flora based on a georeferenced database and grid system mapping

Laboratory of Geobotany

Assessment of the current state of vegetation cover and pasture resources in the Republic of Karakalpakstan

Program Outline

Assessment of the current state of vegetation cover and pasture resources in the Republic of Karakalpakstan accounting for the climate change and anthropogenic pressure

Key Achievement

Inventory and development of the state cadaster of pasture resources in the Eastern Chink of Karakalpak Ustyurt

Territory

The Eastern Cliff (EC) is a vast, morphologically rugged, arid and rocky desert. In the formation of pasture vegetation, the mesoclimatic coastal environment of the Aral Sea has played a special role, resulting in unique mesophytic vegetation in the deserts of Central Asia. At the same time, the catastrophic drying of the Aral Sea has negatively affected the pastureland ecosystems in the EC, requiring a need to study pastures from the point of view of preserving biodiversity and assessing the pasture potential of the territories for the development of livestock breeding in the Republic of Karakalpakstan

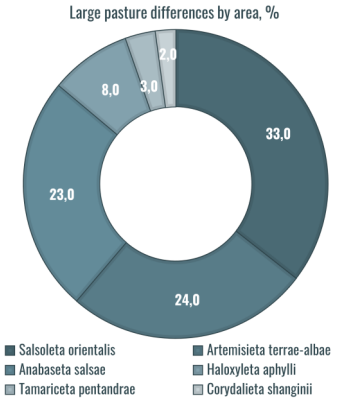
Research Achievement

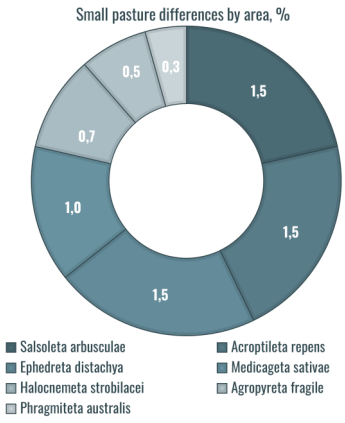
An objective of this study was a modern classification of the pasturelands of the Eastern Cliff (EC), which represent 33 pasture variations from 13 pasture types: *Artemisia terrae-albae, Salsoleta orientalis, Anabaseta salsae, Salsoleta arbusculae, Haloxyleta aphylly, Halocnemeta strobilacei, Tamariceta pentandrae, Corydalieta shanginii, Phragmiteta australis, Medicageta sativae, Agropyreta fragile, Acroptileta repens,* and *Ephedreta distachya*. This objective has been developed

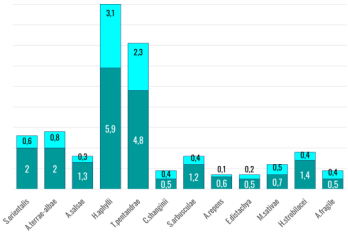
Territories of the EC (30,000 ha) were vectorized and digitized with georeferencing according to the established pasture types and variations based on the 20 cadaster criteria, including total area, yield, capacity, solvency and economic evaluation of pasture lands

Research Achievement

Pasture types	Area, ha	Yield, c/ha
Artemisieta terrae-albae	5443	2.0
Salsoleta orientalis	7460	2.0
Anabaseta salsae	5157	1.3
Salsoleta arbusculae	340	1.2
Haloxyleta aphylli	1877	5.9
Halocnemeta strobilacei	153	1.4
Tamariceta pentandrae	733	4.8
Corydalieta shanginii	445	0.05
Phragmiteta australis	107	1.1
Medicageta sativae	202	0.7
Agropyreta fragile	105	0.5
Acroptileta repens	311	0.6
Ephedreta distachya	343	0,5







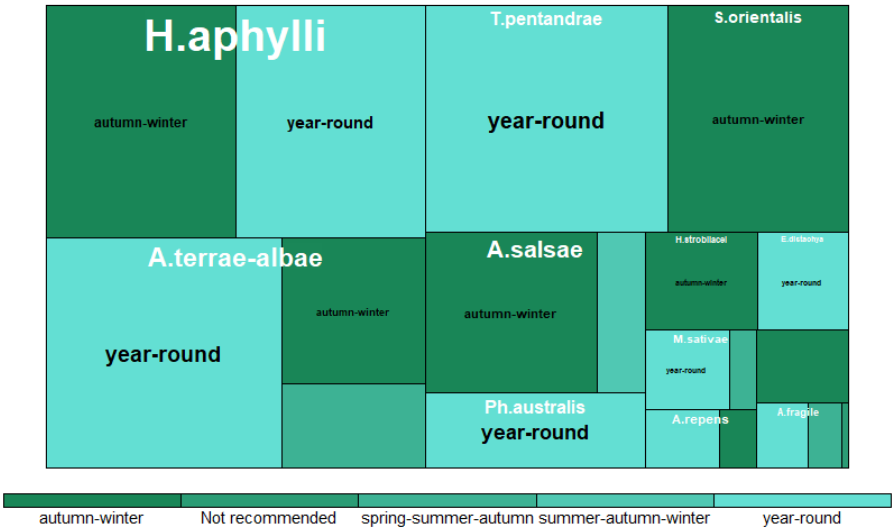
Throughout the EC area, representatives of the gypsophilous vegetation (*Artemisieta terrae-albae, Salsoleta orientalis, Anabaseta salsae, Salsoleta arbusculae*) predominate and occupy 80% of the pasture lands. A worrisome factor is the reduction in the area of ephemeral (*Corydalieta shanginii*) and meadow (*Phragmiteta australis, Medicageta sativae, Agropyreta fragile*) vegetation due to climate change. The appearance of a new mustard formation (Acroptileta repens) (105 ha) and the tendency of its expansion is a direct threat to the pasture resources of the EC area

The dynamics of the yield of consumed and gross mass and the yield relative to nutritional value have been studied. During the spring and early summer periods, the nutritional value of the forage mass doubles, especially in the winter season, due to a greater accumulation of digestible protein. It was found that with a decrease in nutritional value, the consumed and gross mass of forage increases, indicating a balanced quality of the pasture lands in the study area

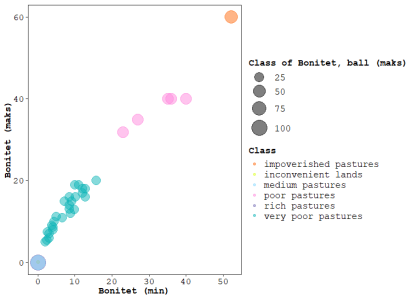
The ratios of dynamics of yield of consumed mass and yield by nutrient content (per forage unit) was estimated for all pasture types. Despite the low yield, representatives of ephemeral (*Corydalieta shanginii*) and meadow (*Phragmiteta australis*, *Medicageta sativae*, *Agropyreta fragile*) vegetation (0.05-0.7 c/ha) stand out for their high content of digestible protein, which exceeds other pastures in nutrient content, especially in the spring-summer period

Research Achievement

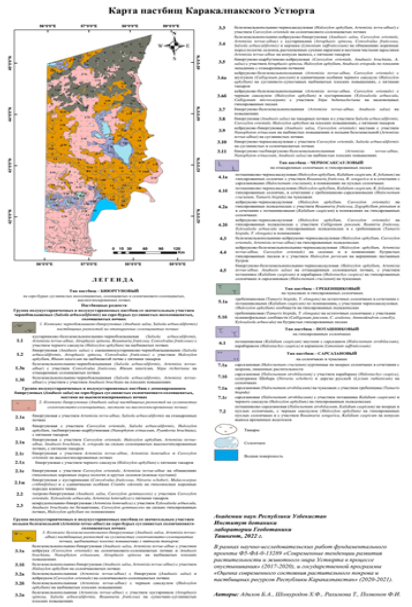
When analyzing the seasonal productivity of the different pasture types by seasonal use, we identified three groups: year-round, summer-autumn-winter and autumn-winter, and also established a degree of seasonal exploitation of the EC pastures. In terms of the degree of exploitation, representatives of gypsophilous (*Artemisieta terrae-albae*, *Salsoleta orientalis*, *Anabaseta salsae*, *Salsoleta arbusculae*) and halophytic (*Haloxyleta aphylly*, *Tamariceta pentandrae*) vegetation surpass other vegetation types. In contrast to the Ustyurt plateau, EC pastures are dominated by areas with year-round and autumn-winter use, which is considered acceptable for placing herds



The carrying capacity of pastures for small and large ruminants has been determined. The average capacity of pastures for small ruminants is 0.1, i.e., 10 ha for grazing 1 head of livestock. In a small part of the research area, pastures with an average capacity of 0.002 are 'not recommended' for grazing livestock. They were identified as *C.shanginii+Ch.vridiflorum* and *C.shanginii+Allium sp.*



According to the regional scoring system, the pastures of Ustyurt can be classified into three groups: 'very poor' (2-20 points), 'poor' (21-40 points) and 'depleted' (41-60 points). According to the scoring system, the pastures of EC reflect the spectrum of pasture classes of arid territories of Central Asia, i.e., 'very poor' and 'poor' pastures are widespread. They contain an average of 300 conditional feed units per hectare. There are no 'medium' and 'rich' pastures in the EC area



Using the ecological-phytocenotic classification scheme of pastures, we have identified 5 types, 3 groups, 3 complexes, and 43 pasture ranges, and created a 'Map of Pastures of the Karakalpak Part of the Ustyurt Plateau' and developed the 'Map of Pasture Capacity of the Karakalpak Ustyurt

Result Diffusion	Thesis publication: 13 abstracts including assessments of pasture vegetation in the Republic of Karakalpakstan Thesis presentation: 2 reports on the cadaster of pastures in Eastern Cliff Objects of intellectual property: Patent for industrial design 'Map of pastures on the drained bottom of the Aral Sea (SAP 2022 0051)
Expectation Effect	Data for the state cadaster of pasture resources of the Republic of Uzbekistan.

Laboratory of cadaster and monitoring of rare plant species

Cadaster of the flora of Tashkent region

Program Outline

The program devoted to the flora of the Tashkent region it is a new stage in the inventory of the flora of the administrative regions of the Republic of Uzbekistan

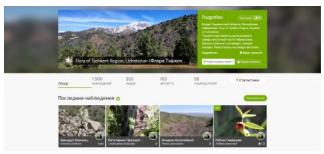
Key Achievement

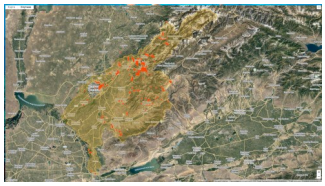
The inventory of the flora of the Tashkent region, compilation of the cadaster of threatened and resource plant species

Territory

The territory of the Tashkent region lies in a range of altitudes from 250–260 m to 4395 m above sea level. Most types of ecosystems and landscapes of Uzbekistan, from riparian forests and a small area of sandy desert to highlands, are represented there. There are several protected areas in the Tashkent region: Chatkal State Biosphere Reserve (24.7 thousand ha), Ugam-Chatkal National Park (506.9 thousand ha), Ugam-Chatkal Biosphere Reserve (42.9 thousand ha), natural monument Urungach (43 ha), Dalverzin hunting farm (5.3 thousand ha). In addition, the mountainous part of the Tashkent region belongs to the Central Asian Mountains global biodiversity hotspot and to the Western Tien Shan transboundary area, included in the list of UNESCO World Natural Heritage Sites

Research Achievement

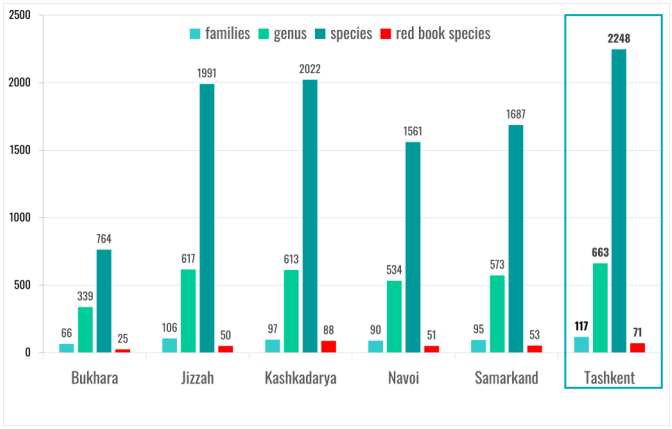




The checklist of the flora of the Tashkent region was compiled, it enumerates 2248 species in 663 genera and 117 families of vascular plants, including 22 species of ferns, 7 species of gymnosperms, 476 species of monocots and 1742 species of dicots. A regularly updated online version of the checklist (with a digital photo library) was created on the Plantarium Internet portal (https://www.plantarium.ru/page/flora/id/1123.html). The project 'Flora of Tashkent Region, Uzbekistan' was also created on the iNaturalist portal (https://www.inaturalist.org/projects/flora-of-tashkent-region-uzbekistan-flora-tashkentskoy-oblasti-uzbekistan)

Research Achievement

In terms of species richness, the flora of the Tashkent region ranks first among the six administrative regions of Uzbekistan, where the inventory of the flora was compiled



Nine new records for the flora of Uzbekistan were found (including three alien species new to Central Asia), among them, seven species were collected during field surveys, and two were revealed as a result of a revision of the herbarium material. Also, four new species for the Uzbek part of the Western Tien Shan were recorded. One new species of Corydalis was found in the Pskem river basin. In total, two new species of Corydalis and 14 new records for the flora Uzbekistan (including five alien species) were found during the project

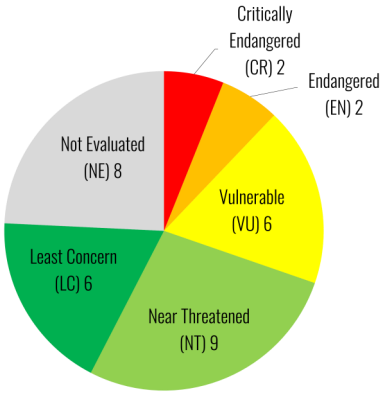
Corydalis sp. nov.

Corydalis sp. nov.

Fritillaria rugillosa

Actual checklists of the flora of two protected areas of the Tashkent region were compiled: the Chatkal State Biosphere Reserve (770 species of 318 genera and 71 families, including 25 nationally red-listed and 14 alien), and the Dalverzin state forestry and hunting farm (260 species of 55 families, 38 of them are alien)

The status of 25 species of tulips in the flora of Uzbekistan was assessed according to the IUCN Red List categories and criteria. The results were published on the official website of the IUCN Red List. Taking into account this assessment of the status of the species of tulips in the IUCN Red List, the existing threats, as well as the state of populations. Two species of tulips, *Tulipa borszczowii* and *Tulipa butkovii*, were recommended for entry into the next edition of the Red Book of Uzbekistan



Research Achievement

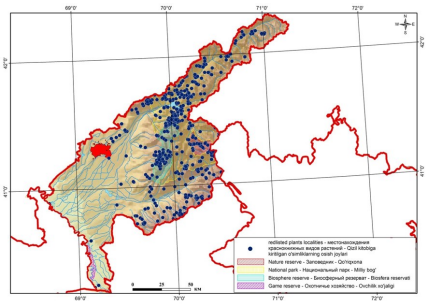
Seventy one species of the flora of Tashkent region are listed in the Red Data Book of Uzbekistan (2019) (three species of category 0, 16 species of category 1, 32 species of category 2 and 20 species of category 3). Among them, 58 species (81.7%) grow in the protected areas: 25 in the Chatkal Reserve, 74 in the Ugam-Chatkal National Park, 36 in the Ugam-Chatkal Biosphere Reserve, 13 species are not protected. Within the Tashkent region, 768 localities of rare plant species listed in the Red Book of Uzbekistan have been identified; the number, density and distribution area of their populations have been determined

Hedysarum drobovii

Aconitum talassicum

Allium pskemense

The list of national endemics in the flora of the Tashkent region has been compiled, it includes 49 species in 18 families; 20 of those species (40.8%) are listed in the Red Data Book, incl. 2 species of category 0, 7 species of category 1, 10 species of category 2 and 1 species of category 3. 38 national endemics (77.6%) grow in the protected areas (8 in the Chatkal Reserve, 29 in the Ugam-Chatkal national park, 21 in the Ugam-Chatkal Biosphere Reserve), but 11 national endemics are not protected (including 4 red-listed). A conservation status assessment has been performed for 11 nationally red-listed endemic species, in accordance with the IUCN Categories and Criteria



The locations of thickets and resources of 50 medicinal plants were determined, and maps of their distribution in the Tashkent region have been compiled. The dynamics of the decline in plant resources in the Tashkent region in 2001–2022 was analyzed, and proposals for their sustainable use were prepared

Indicators	2001	2008	2021–2022
Achillea millefolium			
Area, ha	313	870	620
Reserves, t	13,9	22,62	5,1
Urtica dioica			
Area, ha	36	186	148
Reserves, t	0,8	12,00	4,1
Codonopsis clematidea			
Area, ha	56	55	20
Reserves, t	1,2	1,12	0,5

Result Diffusion	Thesis publication: 14 conference papers published, incl. 5 – in proceedings of international conferences Thesis presentation: 6 presentations at the conferences or workshops, incl. Regional workshop on IUCN Red List assessment of Central Asian tulips Databases: online database of TASH type collection uploaded on Global Biodiversity Information Facility (GBIF) web-site Assessment of 25 species of Tulipa published on the IUCN Red List web-site Guidelines: 2 guidelines for state accounting and monitoring of rare and endangered, as well as resource species of wild plants in the Republic of Uzbekistan
Expectation Effect	Data for the state cadaster of flora, the new edition of the "Flora of Uzbekistan" and the "Red Data Book of Uzbekistan"

Laboratory of population biology and ecology of plants

Assessment of the current state of populations of wild crop relatives of economic importance in the flora of Uzbekistan and creation of a living collection of them

Program Outline

Assessment of the current state of populations of wild relatives of cultivated plants (WRCP) in the flora of Uzbekistan and creation of living collections of them

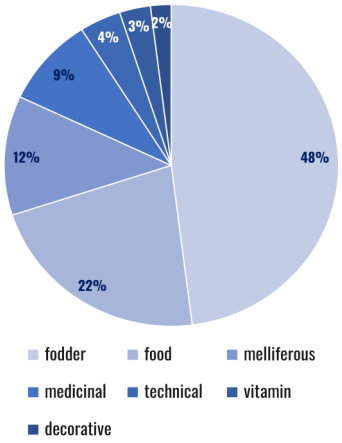
Key Achievement

Study of the biological characteristics of the Poaceae, compilation of a database of WRCP and maps of their distribution, assessment of the current state of cenopopulations and creation of a living collection of WCR

Territory

The flora of Uzbekistan has about 4,400 species of vascular plants belonging to 1007 genera and 171 families. Of these, 217 species from 102 genera and 24 families belong to the WRCP. In general, wild relatives of cultivated plants make up 4.93% of the entire flora

Research Achievement



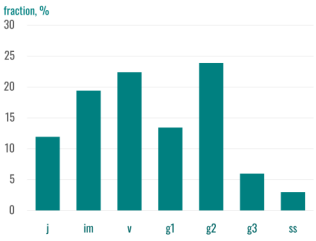
From the existing WRCP in Uzbekistan, 48% are fodder plants, 22% are food plants, 12% are crops for honey, 9% are medicinal, 4% are technical, 3% are for vitamins, 2% are decorative, and so on

The current status of 99 cenopopulations of 20 species from 13 genera of Poaceae from Uzbekistan's biogeographical regions was evaluated. One thousand five hundred herbarium specimens were collected during the research, and more than 200 geobotanical records were filled

Research Achievement

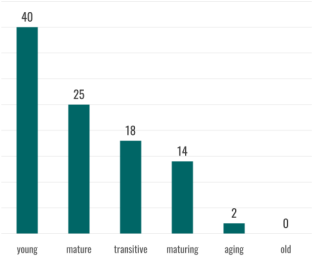
Cereals are among the most important and oldest fodder and food crops. The life cycle of the species studied has been found to extend from 1 to 22 years. All cenopopulations of the studied representatives of the Poaceae family are normal, but incomplete

The ontogenetic spectra of cenopopulations are represented by centered and left-sided spectrum types. A high percentage of middle–aged generative individuals in all the cenopopulations examined, on the one hand, is associated with a lower elimination of individuals in this age state, and on the other hand, with gradual increase in life expectancy of individuals in the mature generative period.)



Types of cenopopulations in different botanical-geographic regions of Uzbekistan) were determined

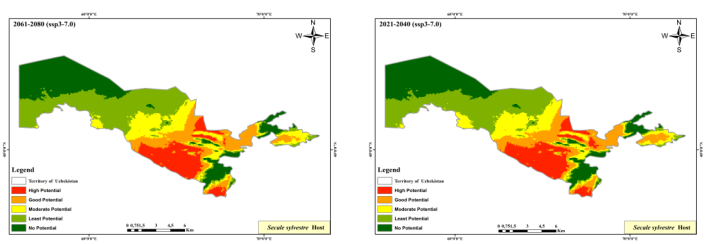
According to the age status and efficiency index of the ceno-populations, 40% were young, 25% mature, and transitional (18%), maturing (14%) and older (2%). The density of indi-viduals was 0.6-16 and the ecological density was 0.82-47 per 1 m^2. The highest index of individual density was observed in *Elymus repens* (16.55), the lowest index was observed in *Bromus inermis* (0.6). The highest ecological density was observed in *Elymus repens* (47.28) and the lowest in *Alopecurus pratensis* (0.82)



Natural resources of fodder (*Poa bulbosa*) and food (*Hordeum bulbosum*) were determined to be 200.0 hectares of *Poa bulbosa* at 16 monitoring sites. High yields were noted in the Uriklisay tract on the Turkestan ridge (3715.5 kg/ha) and in the vicinity of Kentala village in the Baysun district on the Gissar ridge (2461.2 kg/ha). It was determined that areas with critical reserve value are 50.0 ha, and those areas correspond to the Konimekh-Zafarabad (2.5 hec) and Fergana regions (2.5 hec)

Monitoring area									
1	2	3	4	5	6	7	8	9	10
The distributionarea of the species, ha									
4,5	12	8	20	11	25	5,5	7	4	30
Average yield, kg/ha									
1497,6	394,4	2461,2	134,2	209,5	3715,5	1513,1	642,6	355,4	445,9
Total yield, kg									
1684,8	1183,3	4922,5	671,2	576,2	23222	2080,5	1125	355,4	3344,7

Bioclimatic modeling was conducted for species with fodder and food value (*Agropyron fragile*, *Ely-mus dahuricus*, *Secale sylvestre*) and a narrow distribution area. *Agropyron fragile* is found mainly in the northern regions of Uzbekistan. *Secale sylvestre* is widespread in the arid zone of Uzbekistan in areas with an average annual precipitation of 80-170 mm and *Elymus dahuricus* grows mainly in the mid-mountain belt in the mountainous part of the republic



Research Achievement

Phenological observations of species were carried out in the Tashkent Botanical Garden and Kyzylkum biological desert station. In 2022, seeds of 21 species of wild crop relatives collected from natural conditions were planted in the collection area of Tashkent Botanical Garden and Kyzylkum desert biological station

Result Diffusion

Thesis publication: Publications: 19 theses
Thesis presentation: 6 presentations on the modern status of wild relatives of cultivated plants (WRCP) populations

Expectation Effect

The data will be used for the next editions of the state cadastre of the flora of regions, 'Flora of Uzbekistan' and 'Red Book of Uzbekistan'.

Laboratory of Molecular Phylogeny and Biogeography

Tree of life: Monocots of Uzbekistan

Program Outline

To study the phylogeny, biogeography and evolution of selected genera of Amaryllidaceae and Iridaceae belonging to the Asparagales distributed in Uzbekistan, to create specific primers for the express identification of medicinal, rare and endemic species of economic importance under laboratory conditions

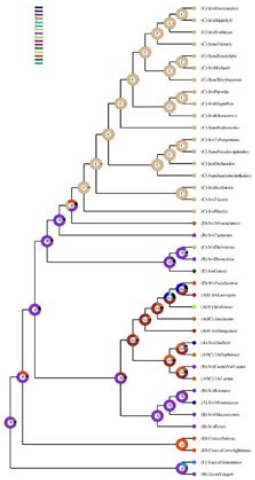
Key Achievement

Patent application for Plant.uz mobile application, creation of specific primers for the genera *Iris* and *Allium*, determination of evolutionary age and regions of origin of *Allium* and *Iris*. Study of phylogenetic and biogeographic relationships of species of *Allium* based on seed micromorphology

Territory

The Republic of Uzbekistan is located between the Amudarya and Syrdarya rivers. Its total area is 447,400 km^2. The territory of the republic is 1,425 km from east to west and 930 km from north to south; the highest point is 4643 m and the lowest point is -12.8 m. The climate is continental

Research Achievement



Within the framework of this year's state program, representatives of the Iridaceae were field-collected in Uzbekistan. Complete chloroplast genomes of 18 representatives of the genus *Iris* in Uzbekistan were sequenced. Analysis using chloroplast genomes showed that the age of the Iridaceae is 75 My, the subgenus *Iris* 44.2 My, and subgenus *Scorpiris* is – 22.48 My.

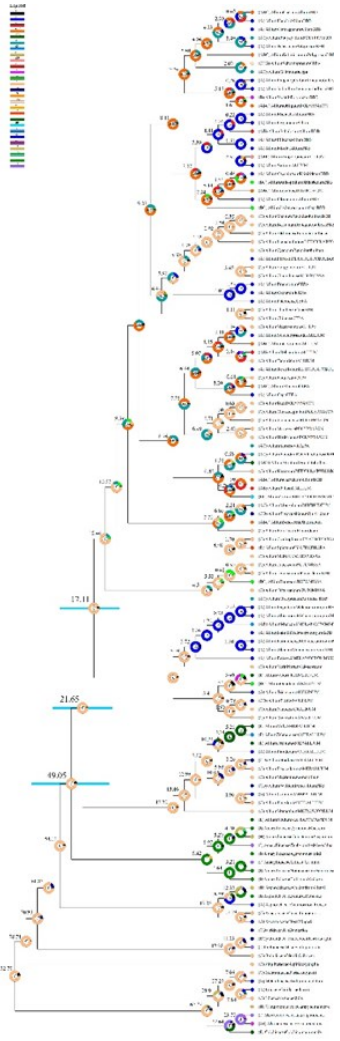
Addition, after the identification of genetic regions with high polymorphism in the sequenced chloroplast genomes, the most suitable primers for the *Scorpiris* group were recommended for use in future studies.

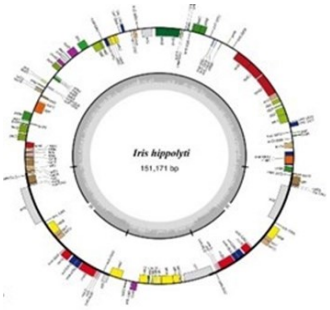
Research Achievement

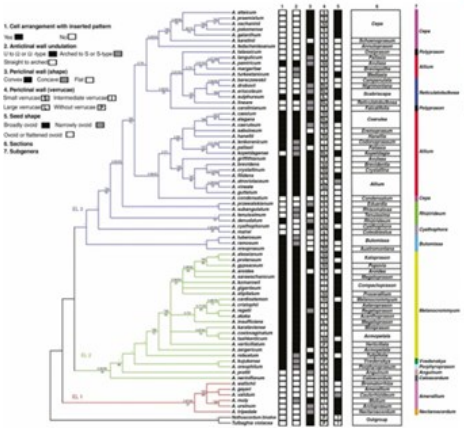
To date, it is known that *Allium*, belonging to the family Amaryllidaceae, has 3 evolutionary lineages (clades EL1, EL2, and EL3). However, it is not known when these lines evolved. We tried to solve this problem based on an analysis of the complete chloroplast genome

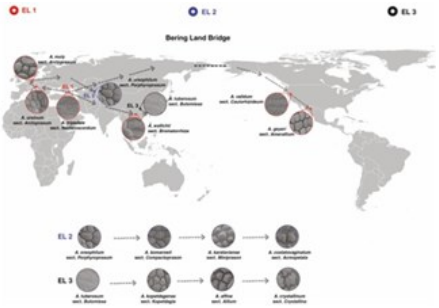
The results showed that clade EL1 (the earliest group) originated 21.65 Mya, and the divergence of the EL2 and EL3 evolutionary groups occurred 17.11 Mya. The 46 sequenced chloroplast genomes were uploaded to the NCBI international database and received accession numbers

Not only the evolutionary age of the *Allium*, but also the historical biogeographic distribution of the genus is a highly debated issue. To solve this problem, electron microscopic images of seed testa cells, which have taxonomically important characteristics, were taken. Based on the results, it was concluded that the ancestors of *Allium* originated in the regions bordering the Caucasus, Central Asia and Iran. Also, it was proposed that the distribution of the representatives of *Allium* to South and North America occurred through the Bering Strait. The results of the research were published in the famous journal, Annals of Botany (IF = 5.4)









Research Achievement

A new species of wild onion was identified during the field research carried out within the framework of the program. This species is morphologically very similar to *A. brevidens*, but can be distinguished from the latter by the unevenness of its tepals. Molecular analysis using nuclear ITS markers showed that the new species indeed is close to *A. brevidens* and belongs to section *Brevidentia*. A description of the new species, named *Allium sunhangii*, was published in the popular journal PhytoKeys

DNA samples of representatives of *Allium, Ungernia, Gladiolus, Crocus* and *Iris* were obtained

Additionally, macro-morphological illustrations of 38 species of *Allium* and 30 of *Iris* were prepared

A universal methodology was developed for counting chromosomes. This method does not involve any mutagenic or expensive chemicals such as colchicine and is absolutely effective

Result Diffusion

Thesis publication: 14 theses, including 10 abroad

Thesis presentation: presented at five international and one national conferences

Databases: chloroplast genomes of 46 species were uploaded to the NCBI international database

Implementation: Plant.uz mobile application was tested

Expectation Effect

The collected information will enrich the NCBI international database, Flora of Uzbekistan, Plant.uz mobile application, GBIF, Plantarium and APG systems, will help to prevent the illegal plant trade within and outside Uzbekistan and will aid in creating a plant molecular reference database

Laboratory of Mycology and Algology

Pathogenic fungi of economically important plants, exported crops: diversity, monitoring and creation of an electronic database (on the example of Bukhara and Namangan regions)

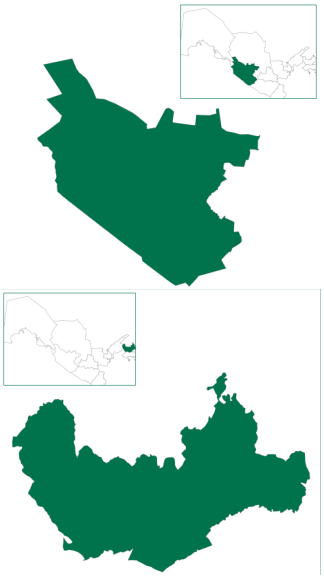
Program Outline

The program objective is a large-scale study of pathogenic fungi of economically important crops

Key Achievement

Identification of pathogenic fungi of the crops, assessment of the phytosanitary state of areas, and creation of an electronic database

Territory



Bukhara region is located in the southwestern part of Uzbekistan. Its area is 39,400 km². The highest part is between 134-785 m above sea level. About 90% of the territory falls on the desert zone. Agriculture and tourism are well developed

Namangan region is located in the east of the republic, in the northwestern part of the Ferghana Valley, on the slopes of the branches of the Tien Shan Range - the mountains of Kurama and Chotkal. It borders with the Jalal-Abad region of the Kyrgyz Republic, Andijan region from the north and northeast, Fergana region from the south, Tashkent region from the north and northwest, and Sughd region of Tajikistan. The area is 7.44 thousand km². Horticulture and vegetable growing are developed in the region

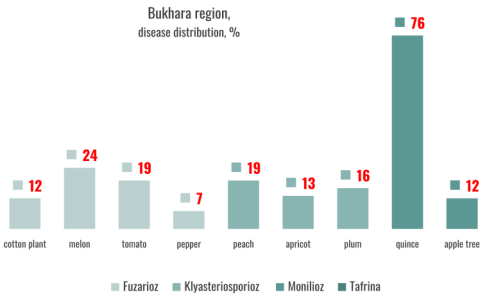
Research Achievement

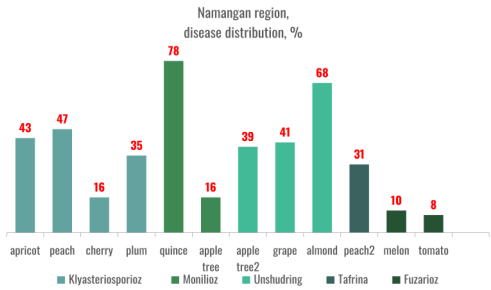
A modern synopsis of pathogenic fungi of crops cultivated in Bukhara and Namangan regions. In the Bukhara region, 29 species (3 forms, 1 variation) of pathogenic fungi belong to 22 genera, 14 families, 12 orders, and 7 classes. In the Namangan region, 50 species (4 forms and 1 variation) belong to 28 genera, 19 families, 16 orders and 8 classes from divisions of fungi and fungus-like organisms (Ascomycota, Basidiomycota, Oomycota) were identified

Research Achievement

For the first time in the territory of Uzbekistan, a pathogenic fungus causing gummy stem blight – *Stagonosporopsis cucurbitacearum* (syn. *Didymella bryoniae*) was found on *Cucumis melo* L. (Muskmelon)

Alternaria pruni McAlpine causing Alternaria was found on the leaves of *Prunus amygdalus* (Almond). For the first time in the Namangan region *Alternaria brassicae* causing alternaria leaf spot of *Raphanus raphanistrum* subsp. *sativus* and *Brassica rapa* was found





The spread of dangerous crop diseases in the research areas was estimated. The most common diseases in the Bukhara region are moniliosis - on quinces (76%), fusarium - on melons (24%), cotton (12%), tomatoes (19); in the Namangan region the most common diseases are moniliosis - quinces (78%), clasterosporiasis - on apricots (43%), peaches (47%), plums (35%), powdery mildew - on apple trees (39%), grapes (41%), almonds (68%), tafrina - on peaches (31 %). It was noted that powdery mildew is widespread and severely damages apple trees, especially in Kosonsoy and Uchkurgan districts of the Namangan region

Result Diffusion	Thesis publication: 13 theses, including pathogenic mycobiota of cultivated plants in the Bukhara and Namangan regions Thesis presentation: 6 reports, including assessments of the phytosanitary state of the study areas and individual crops
Expectation Effect	Phytosanitary monitoring of pathogens of cultivated plants within the administrative districts of the Republic

PART III

Research projects

Taxonomic revision of polymorphic families in the flora of Uzbekistan

A fundamental project A-FA-2021-427

Research has been conducted within the framework of the long-term project, the objective of which is a comprehensive taxonomic and geographical revision of the species-rich families in the flora of Uzbekistan.

Task for 2022 — Apiaceae.

The revision was based on an inventory and critical analysis of herbarium materials stored in St. Petersburg (LE), the Faculty of Biology of Moscow State University (MW), the Institute of Botany of the Academy of Sciences of the Republic of Uzbekistan (TASH), the Institute of Botany and Phytointroduction (AA) in Almaty, Kazakhstan, and the Institutes of Botany, Plant Physiology, and Genetics (TAD) in Dushanbe, Muséum National d'Histoire Naturelle (P, Paris, France), Conservatoire et Jardin botaniques de la ville de Genève (G, Geneva, Switzerland), also in virtual collections in the international JSTOR database (https://www.jstor.org/)

A taxonomic, nomenclatural, and botanical-geographic revision of the Apiaceae has been completed. The new synopsis of the family in the flora of Uzbekistan includes 70 genera and 211 species

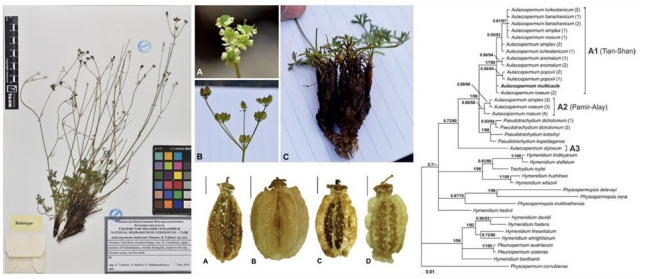
Distribution maps of all species have been compiled using over 5,000 georeferenced samples collected between 1902 and 2022

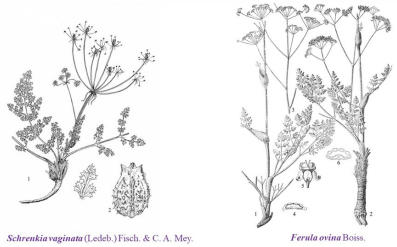
One species new to science was discovered and described: *Aulacospermum multicaule* Pimenov & Tojibaev (published in Phytotaxa 579 (3): 162–174, 2023)

In the genus *Elwendia* Boiss, two new sections (*Elwendia* sect. *Dicotylaria* (Kljuykov) Kljuykov comb. nov., *Elwendia* subsect. *Salsa* (Kljuykov) Kljuykov comb. nov.) and five subsections (*Elwendia* subsect. *Aliformia* (Kljuykov) Kljuykov comb. nov., *Elwendia* subsect. *Setacea* (Kljuykov) Kljuykov comb. nov., *Elwendia* subsect. *Buniella* (Schischk.) Kljuykov comb. nov., *Elwendia* subsect. *Stricta* (Kljuykov) Kljuykov comb. nov., *Elwendia* subsect. *Salsa* (Kljuykov) Kljuykov comb. nov.) were described

New illustrations of the species of Apiaceae drawn by Yelena Mzhelskaya (Botanical Garden of MSU) were published in the fifth volume of the Flora of Uzbekistan. The illustrations of the species of the genus *Ferula* L. were taken from the works of Ye. P. Korovin

Rich taxa by species		
Genus	Flora of Uzb., 1959	Flora of Uzb., 2022
Ferula	45	47
Seseli	4	20
Elwendia	9	14
Elaeosticta	-	13
Prangos	8	8
Aulacospermum	4	6
Schrenkia	4	4





Schrenkia vaginata (Ledeb.) Fisch. & C. A. Mey. *Ferula ovina* Boiss.

The history of formation and current trends in the development of tugai vegetation in Uzbekistan against the background of global hydroclimatic changes and anthropogenic transformation

A fundamental project F-FA-2021-450

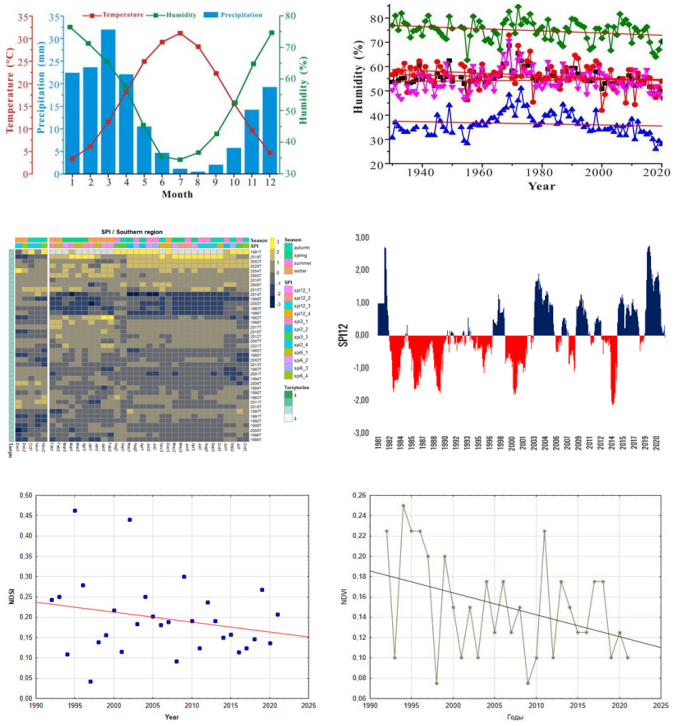
This project is dedicated to solving fundamental problems aimed at studying the interaction of ecosystems and their components with environmental factors in the context of global changes related to hydro-climatic dynamics and anthropogenic transformation of biota

The subject of research in 2022 was the natural tugai forests of the Amu Darya basin. Field studies covered over 75,000 hectares of tugai forests for a distance of almost 800 km.

The modern floristic and phytocenotic diversity of the Amu Darya tugai forests was studied based on a literature survey (176) and field studies (157). From more than 337 geobotanical records with geographical references in the IBIS software, representing forest, shrub, meadow, marsh and salt marsh types. A database, 'Communities of Tugai Plants,' was created

We also assessed the effect of climate change on the Amu Darya tugai forests. The results showed an increase in meteorological drought in the territory of the Amu Darya basin. Frequent occurrence of drought, especially in the winter season, is a worrying indicator. One of the main reasons for the reduction or transformation of tugai forests in the territory of the Amu Darya basin is the intensity of water level changes or significant changes in the direction of tributaries along the river, resulting in the formation of arid areas

A correlation has been established between the ongoing melting of glaciers in the Amu Darya sector and long-term changes in the state of the tugai forests. A decrease in winter snow cover and the resulting decrease in runoff (NDSI) has been confirmed, which can lead to a sharp reduction in water in the river, which was also confirmed by the results of NDVI

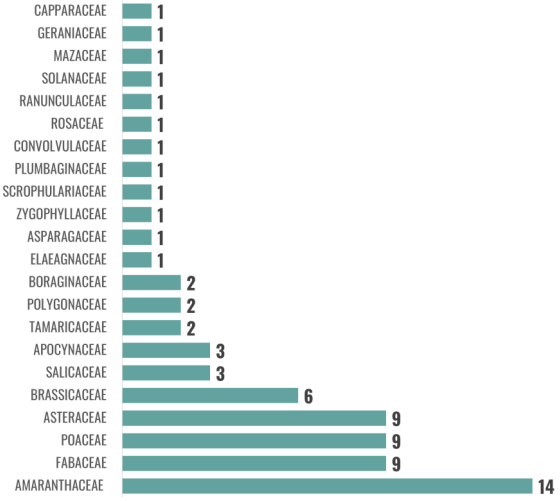


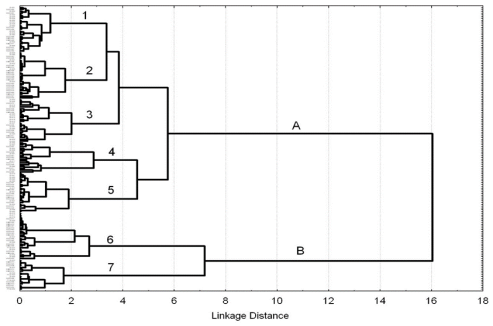
In the Amu Darya basin, the vegetation can be classified into 10 associations belonging to the xeromesophytic-mesothermic (POTAMODENDRA), shrubby (POTAMOTHAMNA), and marsh (POTAMOPOIA) tugai vegetation groups, namely Turan-grove, comb-grass-Turan, sweetgrass-Turan, eriante-Turan, mixed-grass-Turan-Loch, reed-Loch-willow, comb-grass, Akbash-Karabarak-comb-grass, mixed-grass-comb-grass, and comb-grass-sweetgrass. In addition, 74 plant species from 55 genera and 22 families were recorded in the study areas of the Amu Darya basin

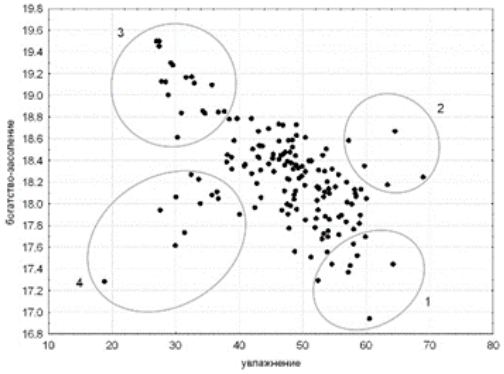
To study the history of the development of tugai forests in Uzbekistan against the background of changing hydroclimatic conditions, samples of annual rings (160) of dominant tugai species in the Amu Darya basin (*Populus pruinosa*, *Populus euphratica*, *Salix songarica*) were taken. Dendrochronological research is being conducted in cooperation with scientists from the Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences

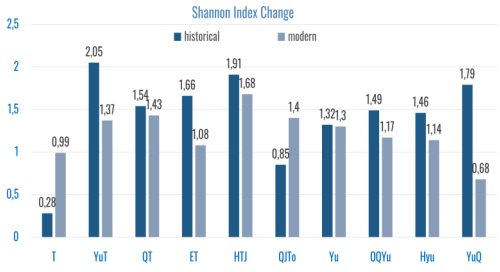
An ordination analysis of geobotanical data along ecological gradients (moisture and salinity levels) has been conducted, and four ecological groups have been identified. The first group consists of Turan-Loch meadow communities in areas with high moisture and low salinity, with dominant species such as *Elaeagnus angustifolia*, *Populus euphratica*, *Glycyrrhiza glabra*, *Phragmites australis*, *Populus pruinosa*, *Salix songarica*, *Tamarix ramosissima*, and *Calamagrostis dubia*. The active core of the cenoflora is composed of these species. The second group is formed by Turan-reed communities in regions with significantly higher moisture and relatively low salinity, dominated by species such as *Phragmites australis*, *Populus pruinosa*, *Tamarix ramosissima*, *Glycyrrhiza glabra*, *Trachomitum lancifolium* and *Populus euphratica*. The third group consists of halophytic shrubs in arid and saline areas and is characterized by a small number of dominant species (*Tamarix ramosissima*, *Alhagi pseudalhagi*, *Karelinia caspia*), which is due to dynamic changes associated with anthropogenic pressure and climate change in tugai ecosystems. The fourth group is composed of shrub tugais in arid and relatively saline areas and is dominated by *Halimodendron halodendron*, *Tamarix ramosissima*, *Lycium ruthenicum*, *Populus euphratica*, *Populus pruinosa* and other species, with a significant contribution from annual ruderal plants that are strongly influenced by human activities and reflect the characteristics of secondary communities

Cluster analysis of geobotanical data revealed two distinct floristic differences in the plant communities. The first cluster (A) consists of riparian forest communities that include two species of the genus *Populus*, as well as shrubs and perennial mesophytes. The second group consists of phytocenoses of halophytic vegetation in the riparian forests that have degraded due to progressing soil salinization









Development of *in vitro* technology for the organization and propagation of medicinal plants

Applied project A-FA-2021-146

Development of technology for micropropagation of promising medicinal plants for use in agricultural production
Development of a microclonal propagation protocol for four valuable medicinal plant species.
1. Tadjik's ferula *Ferula tadshikorum* from Kashkadarya and Surkhandarya provinces
2. Muscat ferula *Ferula sumbul* from Djizzak, Samarkand, Kashkadarya, and Surkhandarya provinces
3. Sewertzov's ungernia *Ungernia sewertzowii* from Tashkent Province
4. Viktor's ungernia *Ungernia victoris* from Surkhandarya Province

Development of optimal conditions (solution concentration and duration of sterilization) for successful sterilization of plant material. The optimal protocol includes the use of disinfectants, 4-6% sodium hypochlorite, 5-10% hydrogen peroxide, 70% ethanol, 15-18% sulfuric acid. The appropriate fungicides and antibiotics were also identified

The optimal nutrient medium for propagation: Murashige & Skoog medium for plants of the genus *Ferula*, Vollosovich medium and Murashige & Skoog medium for plants of the genus *Ungernia*

Different parts of the germinated seeds were successfully used as explants, including cotyledon, hypocotyl and rootlets of both *Ferula* and *Ungernia*, as well as bulbs of *Ungernia*. The process of callusogenesis for both *Ferula* and *Ungernia* was observed on the hypocotyl, and embryos developed on the bulbs of *Ungernia*

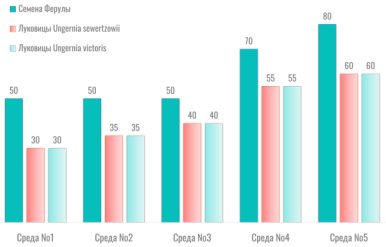
The optimal concentrations of phytohormones for initiating callusogenesis, organogenesis and embryogenesis were determined from 93 combinations: 2.4D (0, 0.5, 1.0 and 2.0 mg/l), IAA (0, 0.5, 1.0 and 2.0 mg/l), NAA (0, 0.5, 1.0 and 2.0 mg/l), kinetin (0, 0.5, 1.0, 2.0 and 5.0 mg/l), BAP (0, 0.5, 1.0, 2.0 and 5.0 mg/l), zeatin (0, 0.5, 1.0, 2.0 and 5.0 mg/l). (IAI 0.5), 18 (IAI 0.5+BAP 1.0), 23 (IAI 1.0+BAP 2.0), 24 (IAI 2.0), 26 (IAI 2.0+BAP 1.0)

Ferula tadshikorum

Ferula sumbul

Ungernia sewertzowii

Ungernia victoris



Creation of an electronic depository of medicinal and endangered plants of traditional medicine of Uzbekistan

Applied project A-FA-2021-144

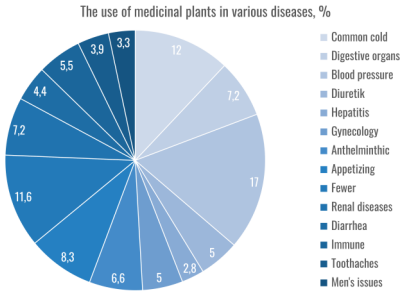
Development of an electronic depository of medicinal plants and mushrooms of traditional medicine, containing information on ethnobotany, microscopy of the aerial and underground parts, phytochemical composition, toxicological and pharmacological effects for the most promising species of plants and fungi, as well as their raw material base, proposed mechanisms for sustainable use, reproduction and protection

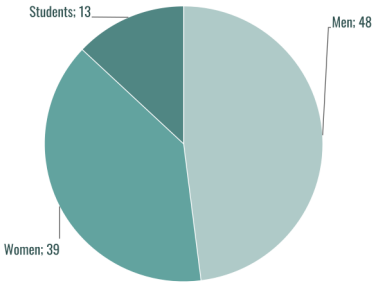
Research routes covered Andijan, Namangan, Samarkand, Syrdarya, Tashkent, Khorezm, Fergana regions

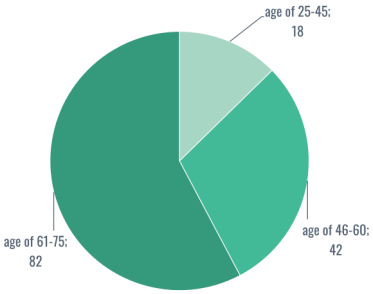
Ethnobotanical information, samples and digital photographs of medicinal plants and their parts used in folk medicine were collected. The data collected in this way were summarized and systematized. The result was the creation of a primary database in Microsoft Excel of wild medicinal, food and plant species introduced in Uzbekistan. At the moment, the database includes 411 species used for medicinal purposes, belonging to 145 genera from 85 families

In the course of interviews in the Tashkent region, 235 ethnobotanical records of medicinal plants belonging to 11 families, 28 genera and 94 species were collected. According to ethnobotanical data, species belonging to the Lamiaceae family are most often used by the local population for medicinal purposes. The leading families were Asteraceae (9.3%) and Apiaceae (7.2%). The most widely used species were: *Mentha longifolia* L., *Origanum vulgare* subsp. *gracile* (K.Koch) Ietsw., *Peganum harmala* L. and *Ziziphora pedicellata* Pazij & Vved.

As a result of a survey of respondents in the Tashkent region and analysis of personal data, it was found that among the respondents there were 68 men (48%), 55 women (39%) and 19 students (13%). The informants were divided into three age groups (1) 25-45 years old, (2) 46-60 years old and (3) 61-75 years old. Most of the informants were between the ages of 61 and 75. These are 82 people from 61 to 75 years old, 42 people from 46 to 60 years old and 18 people from 25 to 45 years old







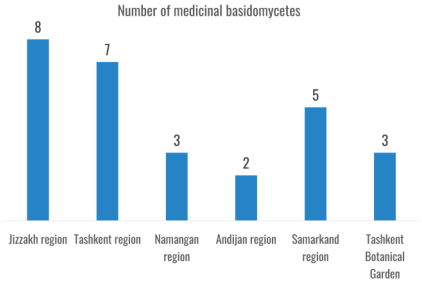
As a result of mycological field studies in the Tashkent, Namangan, Fergana, Andijan, Dzhizak, Samarkand regions in 2022, 15 species of medicinal basidiomycetes were installed in the Tashkent Botanical Garden., They can be referred to 12 genera (*Verpa*, *Morchella*, *Xylaria*, *Daldinia*, *Ganoderma*, *Trametes*, *Lentinus*, *Laetiporus*, *Phellinus*, *Inonotus*, *Calvatia* and *Coprinellus*), 9 families, 5 orders and 3 classes

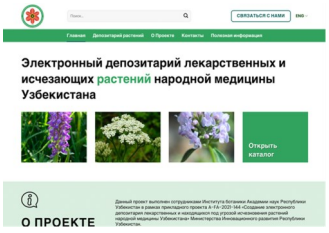
The dominant species in the study area are in the Polyporales and Pezizales. Polyporales includes 4 species (*Ganoderma lucidum* (Complex), *Trametes versicolor*, *T. pubescens*, *Lentinus tigrinus*, *Laetiporus sulfureus*) belonging to 4 genera. The order Pezizales also includes 4 species belonging to 2 genera. Of the 15 species of fungi identified, 6 species belong to the Ascomycota; the remaining 9 species to the Basidiomycota

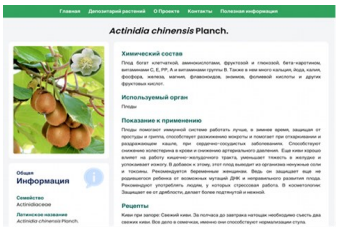
Currently, a control panel has been created for the web database application, that is easy to use. In the Control Panel, all keywords can be entered into a separate form and other forms are created from it for further use. One of the great features of the platform is its intuitive and user-friendly interface. The database will be presented in 2 languages: Uzbek and Russian

Morchella conica

Laetiporus sulphureus





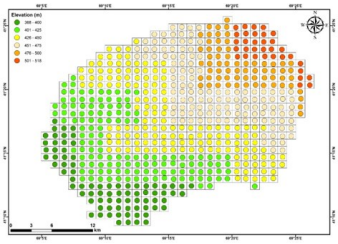


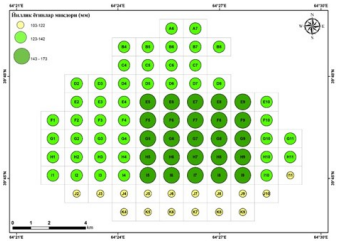
Features of the formation of the urban flora under different personal natural-climatic and anthropogenic conditions (examples from Belarus and Uzbekistan)

Applied project MRB-2021-529

The study of patterns of formation and ecological structure of urban floras of Uzbekistan and Belarus (Tashkent, Bukhara, and Minsk), identification of the main directions of anthropogenic transformation of the native component of urban floras, and establishment of zonal and anthropogenic factors for the formation of urban floras that form in various natural and climatic conditions

Grid mapping systems of the cities of Tashkent (591 indexes) and Bukhara (85 indexes) were created to collect georeferenced and digital data on the urban flora of those two regions. The level of urbanization, average annual temperature, the maximum temperature of the hottest month, minimum temperature of the coldest month, annual amount of atmospheric precipitation and altitude gradient were determined in a cross-section of the indices of the grid system maps.

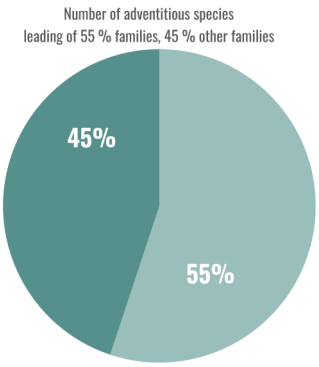




The primary taxonomic composition of the urban flora of Tashkent and Bukhara was determined. According to preliminary data, 620 species belonging to 48 families and 292 genera are in Tashkent, and 207 species belonging to 40 families and 154 genera are in Bukhara

Leading families	Number of species
Asteraceae	16
Fabaceae	14
Solanaceae	12
Brassicaceae	11
Всего:	54

The composition of the adventitious fraction of the urban flora was determined. In the city of Tashkent, this fraction includes 98 types, and in Bukhara, 81 types. The Asteraceae, Fabaceae, Solanaceae and Brassicaceae are the leading families in terms of the number of adventive species, making up 55% of the total number of adventive species.



Studies have shown that the spread of adventitious species and transformation of the flora is increasing due to an increase in the scale of anthropogenic factors. The main influencing factors were divided into three groups: 1. Unconscious impact by people; 2. The rapid development of transport and logistics systems; 3. Introduction of plant species to urban conditions

Lamium purpureum L.

A fossil album containing more than 200 species in the urban flora of Tashkent was created. It contains scientific, Uzbek, and Russian names of species and photographs taken from different areas of the city of Tashkent

PART IV

Commercial contracts

Providing scientific opinions to determine annual quotas for the use of floristic objects

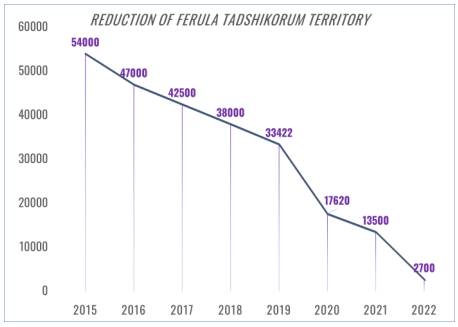
Determination of natural reserves for species in high demand: *Ferula tadshikorum* Pimenov, listed in the 'Red Book' of the Republic of Uzbekistan (2019), in the Kashkadarya and Surkhandarya regions and *Ferula foetida* (Bunge) Regel in the Jizzakh, Samarkand, Navoi and Bukhara regions

The research was carried out within the framework of economic agreements between the subjects of nature management and the Institute of Botany. The number of contracts in 2022 amounted to more than 872 million UzB

Ferula tadshikorum

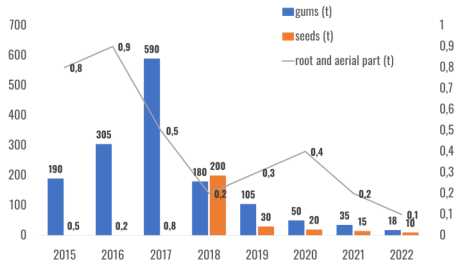
Ferula foetida

It has been established that the number of individuals of *Ferula tadshikorum* in registered sites (10 x10 m) at 18 monitoring sites in the Kashkadarya region averages 18-24, the number of mature individuals is 8-10, the number of individuals allocated for exploitation is 3 or 4. Accordingly, these figures in the Surkhandarya region are 12/6/3. The area of thickets of the species in the Kashkadarya region is 420 hectares, in the Surkhandarya region 2300 hectares. According to 2022 data, the stock of raw materials (resin) in the studied areas is 18.0 tons



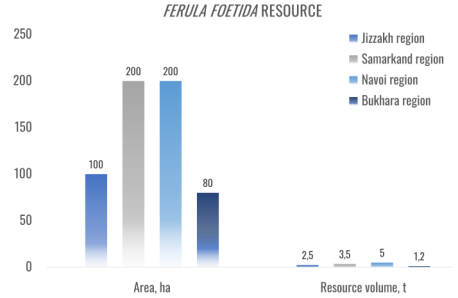
According to the results of studies over the past 8 years, there has been a tendency for a sharp reduction in the reserves of raw materials and the area of thickets of *Ferula tadshikorum.* Compared to the resource indicators from 2015, in 2022 the area of commercial thickets decreased by 95%, the stock of raw materials decreased by 83%

Dynamics of harvesting raw materials Ferula tadshikorum



At present, the populations of *Ferula tadshikorum* are mainly in the border zone and in some areas of forestry enterprises. The most critical areas for populations of *Ferula tadshikorum* were noted in the Baysun and Sherabad districts; 95% of the surviving populations grow in the border zone (Kumkurgan district). It was established that the number of individuals of *Ferula foetida* in the registered sites (10 x 10 m) in the Jizzakh region was 30, the number of mature individuals was 9, the number of individuals allocated for exploitation was up to 5. Accordingly, these figures in the Samarkand region are 33/7/4, in the Navoi region 35/8/5 and in the Bukhara region 24/5/3

FERULA FOETIDA RESOURCE



The commercial area for *Ferula foetida* is 100 ha in Jizzakh, 200 ha in Samarkand, 200 ha in Navoi and 80 ha in the Bukhara region. According to 2022 data, the total stock of raw materials (resin) in the studied areas is 12.2 tons

Compilation of the official check-list and state cadaster of promising raw plants of the Bukhara, Surkhandarya and Khorezm regions, inventory of the flora of protected areas situated in these regions

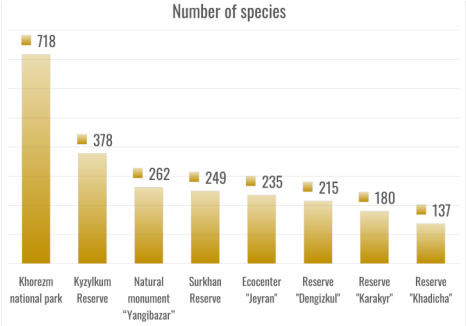
Compilation of the official checklist and state cadaster of promising wild plant species, inventory of the flora of protected areas, assessment of the current state of the most in-demand resources and included in annual quotas of wild-growing plants (medicinal, food, technical) for the Bukhara, Surkhandarya, and Khorezm regions

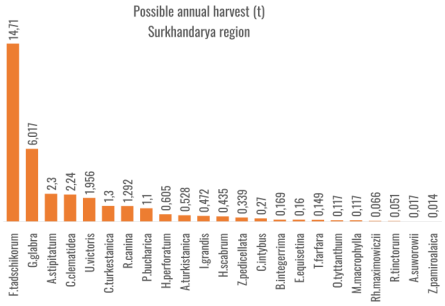
The research was carried out within the framework of the contract between the Ministry of Natural Resources and the Institute of Botany. The amount of the contract in 2022 was more than 1.2 million UZB

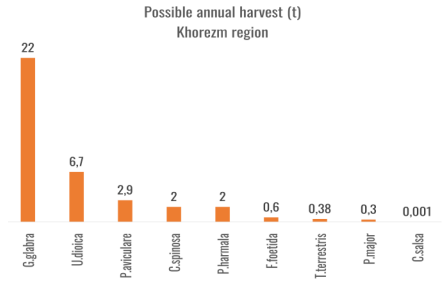
For the Bukhara region, the areas for possible harvesting and biological and operational reserves were determined for the following 10 species: *Cichorium intybus* L., *Cistanche salsa* (C.A. Mey), *Ferula foetida* (Bunge) Regel, *Ferula varia* (Schrenk) Trautv., *Peganum harmala* L., *Phragmites australis* (Cav.) Trin. ex Steud., *Plantago major* L., *Polygonum aviculare* L., *Tribulus terrestris* L. and *Ziziphora tenuior* L. Inventories of the flora of four protected areas, including the Bukhara specialized wildlife nursery 'Jeyran', the wildlife sanctuaries Dengizkul, Karakyr and Khadicha, were compiled

For the Khorezm region, the following 11 species were evaluated: *Capparis spinosa* L., *Cistanche salsa* (C.A. Mey., *Ferula foetida* (Bunge) Regel, *Glycyrrhiza glabra* L.) Beck, *Peganum harmala* L., *Phragmites australis* (Cav.) Trin. ex Steud., *Plantago major* L., *Polygonum aviculare* L., *Tribulus terrestris* L., *Urtica dioica* L., *Ziziphora tenuior* L. An inventory of the flora of three protected areas, including Kyzylkum State Nature Reserve, Khorezm National Park, and the nature monument Yangibazar, was compiled

For the Surkhandarya region, the above was done for the following 21 species: *Ajuga turkestanica* (Regel) Briq., *Allium stipitatum* Regel, *Allium suworowii* Regel, *Berberis integerrima* Bunge, *Cichorium intybus* L., *Codonopsis clematidea* C.B.Clarke, *Crataegus turkestanica* Rojark., *Ephedra equisetina* Bunge, *Ferula tadshikorum* Pimenov, *Glycyrrhiza glabra* L., *Hypericum perforatum* L., *Hypericum scabrum* L., *Inula grandis* Schrenk, *Mediasia macrophylla* (Regel et Schmalh.) Pimenov, *Origanum vulgare* subsp. *gracile* (K.Koch) Ietsw., *Prunus bucharica* (Korsh.) Hand-Mazz., *Rheum maximowiczii* Losinsk., *Rosa canina* L., *Rubia tinctorum* L., *Tussilago farfara* L., *Ziziphora pamiroalaica* Juz., *Ziziphora pedicellata* Pazij & Vved. and *Ungernia victoris* Vved. An inventory of the flora of one protected area, Surkhan State Nature Reserve, was compiled







PART V

International cooperation

International cooperation

Currently, the Institute of Botany has international cooperation with foreign organizations and institutions from the USA, Russia, China, Korea, Japan, Germany, Spain, Israel, Kazakhstan, Tajikistan, Kyrgyzstan and more than 18 other countries

- Plant Collecting Collaborative in the United States
- Succow Foundation, Greifswald
- Pyrenean Institute of Ecology
- Agricultural University of Iceland
- Institute of Experimental Botany, National Academy of Sciences of Belarus
- Institute of Genetics and Cytology, National Academy of Sciences of Belarus
- School of Biological sciences, Seoul National University
- Korea National Arboretum of the Korea Forest Service
- Baekdudaegan National Arboretum
- Thailand National Center for Genetic Engineering and Biotechnology
- Xinjiang Institute of Physics and Chemical Technology, CAS
- Fudan University
- Xinjiang Institute of Ecology and Geography, CAS
- Kunming Institute of Botany CAS
- Institute of Microbiology, CAS
- National Research Tomsk State University
- Siberian Branch of the Institute of General and Experimental Biology, Russian Academy of Sciences
- Institute of Botany and Phytointroduction
- Kazakhstan engineering-pedagogical of people's friendship University
- Miras University

With a view to strengthening the capacity of the Institute of Botany of the Academy of Sciences of Uzbekistan, the scientific and organizational activities of the institute are aimed at strengthening mutually beneficial scientific collaboration with leading botanical institutions of other countries, training qualified young personnel and popularizing scientific achievements in this field. On November 25-27, 2022, an international seminar "2022 International Workshop of CABCN and MoU signing Ceremony of Central Asia Botanical Gardens Network" was held with the participation of scientists from research institutes, botanical gardens of South Korea, Kazakhstan, Kyrgyzstan, Tajikistan. The main goal of the international seminar is the further development of joint research work within the framework of the Central Asian Biodiversity Conservation Network. With a view to expanding international scientific relations, to wide the scientific research areas, a Memorandum on cooperation and "*Creation of a network of Korean and Central Asian botanical gardens*" was signed

On April 23, 2022, Professor Sara Palacio Blasco (Prof. of the *Pyrenean Institute of Ecology*, Spain), and Alexander Rudov, (Senior researcher of the *Yerevan Botanical Garden*, Armenia) visited our Institute for the purpose of strengthening mutually beneficial scientific cooperation within the framework of the international project "*A Global initiative to understand gypsum ecosystem ecology*" aimed to the studying of gypsophytes ecology.

During this visit, our researchers with foreign scientists took a part in a scientific expedition to various regions of Uzbekistan (Surkhandarya, Kashkadarya regions and the Ferghana Valley) for ininvestigate gypsum ecosystems. Professor Sara Palacio Blasco made a presentation on the "*Plant life on gypsum: living at the edge*" in seminar hold in Institute

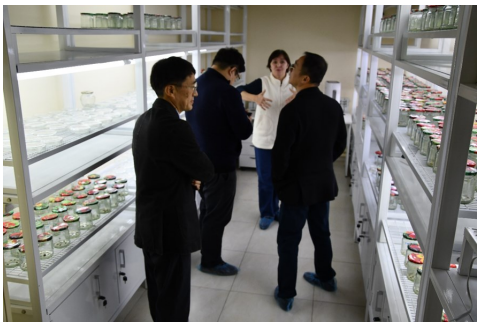
On May 9-13, 2022, our scientist also delivered reports: "*Gypsophilic vascular plants of Uzbekistan: taxonomic composition, endemism and the state of populations of rare species*" at the symposium "*3 - International GYPWORLD Workshop*", organized by the University of Almeria (Spain). Negotiations were held on the organization of the joint project "Promoting Research on gypsum Ecosystems in Western and Central Asia", with Asian countries participation

On September 23, 2022, to develop mutually beneficial scientific cooperation in the field of forest research, foreign delegation was accepted, with Mr. Ricardo Calderon, Chairman of the Asian Forest Cooperation Organization (AFoCO, Asian Forest Cooperation Organization) and Ms. Aidai Dzhumasheva - employee of the Department of Cooperation and Projects. Negotiations between the Institute of Botany and the Asian Forestry Cooperation Organization were held. During the discussion, an agreement to further strengthen scientific communication and implement possible projects in the future was reached

Akoev M.A., the Head of the laboratory of the Ural Federal University named after the first President of Russia B.N. Yeltsin, visited our Institute. During this visit, experts and scientists discussed the challenges of articles publishing in a high index foreign journals.

On July 7th, 2022, a roundtable with the director of the South Korean Data Strategy Center (DRB International co., Ltd.) Kim Joonsung and the manager Shin Jeong was held. The views exchange on the topic of breeding the species, growing in the flora of Uzbekistan as a source of natural rubber raw materials took a place on this meeting. The issue of possible investment in future projects was considered.

On December 07th, 2022, to establish and further develop scientific cooperation with the South Korean Research Institute of Bioscience and Biotechnology, a meeting with Dr. Sangho Choi, Dr. Jin Hyub Paik and Dr. San In Jo. (Korea Research Institute of Bioscience and Biotechnology KRIBB) was held. In this regard, a seminar was organized. During interactive discussions, an exchange of ideas on scientific cooperation and stimulation to further development and other areas took place.



On November 25th, 2022, to implement the joint international project "*Conservation of genetic biodiversity through the beneficiation of the seed collection Malus sp. (Apples) in the Tashkent Botanical Garden*" and following the results of the project "*Conservation of plants biodiversity in Central Asia*", a seminar "*Ex situ* conservation of plant biodiversity in the Bekdudegan National Arboretum (South Korea) "was held in the Tashkent Botanical Garden.

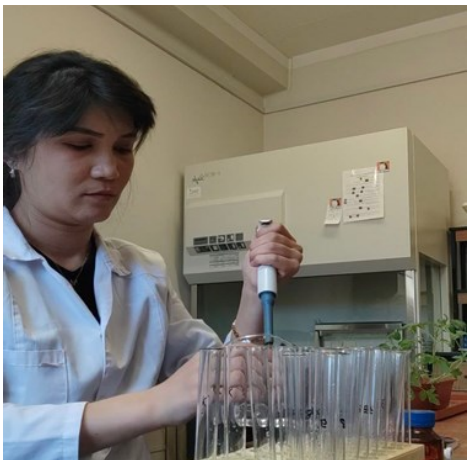
On September 30th, 2022, to implement the international project "*Kick-starting the biodiversity data publication process for Tajikistan*", carried out in Dushanbe in cooperation with Norway and Eurasia countries. The training courses "*Collection and publication of GBIF data for Tajikistan*" were conducted to popularize the achievements of modern science. Our young employees, along with local and foreign experts, took part in the event to familiarize with the latest scientific achievements and data in ecology, botany and biodiversity conservation, experience exchange.

Scientific internships

Kurbaniyazova Gulsauir Tanirbergen kizi successfully passed the competitive selection and was awarded a scholarship from the "*El-Yurt Umidi*" Foundation at supportting professional development, organize internships and providing the education of gifted youth in master's and doctoral programs abroad

As part of this internship, Kurbaniyazova G.T. conducted scientific research at the Institute of Botany named after V.L. Komarov (Russian Academy of Sciences) on the thesis topic "The genus *Gagea* Salisb. In Pamir-Alay mountain range within the Republic of Uzbekistan

Zhamalova Dilafruz Nematilla kizi became the winner of the competition for short-term scientific internships for young scientists in leading foreign scientific organizations, organized by the Ministry of Innovative Development. As a part of her internship at the Department of Cell Biology and Plant Bioengineering of the Faculty of Biology of the Belarusian State University, she improved her skills in microclonal propagation of plants *in vitro*, callus and suspension cultures methods, analysis of biologically active substances, including phenolic compounds, flavanoids methods



Students attending international universities

The following students study at the University of the Chinese Academy of Sciences:

Makhmudzhanov Dilmurod Ibrokhim ugli

PhD student

Research topic: “Phylogeny and biogeography of the genus *Eremurus* M.Bieb.”

Zhuramurodov Inom Zhalilovich

PhD student

Research topic: “Phylogeny and biogeography of the genus *Hedysarum* L. in the flora of Central Asia”

Asatulloev Temur Nusratilloevich

PhD student

Research topic: “Evolution and biogeography of wild tulips in Central Asia”

Ergashov Ibrohimjon Abduvali ugli

Master’s degree

Research topic: “Genetic assessment of populations of the ornamental plant *Allium karataviense* using modern sequencers”

Kurbonalieva Mamura Bakhodir kizi

Master’s degree

Research topic: “Phylogenomics of species of the genus *Iris* Tourn. ex L. widespread in Uzbekistan”

Tojiboeva Umida Komiljon qizi

Master’s degree

Research topic: “Phylogeography of *Tulipa korolkowii* (Liliaceae) and its application in delineating phylogeoregions in the mountainous province of Central Asia"

Munavvarov Abduhalimkhon Anvarkhon ugli

Master’s degree

Research topic: “Phylogeny and biogeography of the subgenus *Allium* in Uzbekistan”

B

Publications

Monographs

Publishing house	Name of the monograph	Paper title	Authors	Volume
Springer Nature	Biodiversity, Conservation and Sustainability in Asia	A Taxonomical Revision of Genus *Allium* L. (Amaryllidaceae) in the Flora of Middle Asia	Khassanov F. O., Yusupov Z.	2
Springer Nature	Biodiversity, Conservation and Sustainability in Asia	Prospects and Challenges in South and Middle Asia	Münir Öztürk Shujaul Mulk Khan Volkan Altay Recep Efe Dilfuza Egamberdieva Furkat O. Khassanov	2
Springer Nature	Biodiversity, Conservation and Sustainability in Asia	Current status of vegetation of the dried bottom of the Aral Sea	Shomurodov Kh., Rakhimova T., Adilov B. and Beshko N.	2
Springer Nature	Biodiversity, Conservation and Sustainability in Asia	An overview of common medicinal plants of Middle Asia	Khojimatov O.K., Khassanov F.O.	2

Research papers

Journal	Paper title	Author	Co-authors	Volume
Biosystems Diversity	Ontogenetic structure of cenopopulations of *Allium* pskemense (Amaryllidaceae) in Uzbekistan	Abduraimov O. S.	Kovalenko I. N., Makhmudov A. V., Allamurotov A. L., & Mavlanov B. J.	30(1)
Botanica Pacifica	*Chenopodium ficifolium* Sm. (Amaranthaceae): In: Findings to the flora of Russia and adjacent countries: New national and regional vascular plant records, 4 (A.V. Verkhozina, ed.)	Esanov H. K.	Tajetdinova D. M., Jabborov A.M.	11(1)
Plant science today	Impact of long-term climate change on *Moluccella bucharica* (B. Fedtsch.) Ryding population decline in Uzbekistan	Khabibullaev B.Sh.	Shomurodov Kh. F. Adilov B.A.	9
Plant Diversity	*Oreocharis xieyongii*, an unusual new species of Gesneriaceae from west-ern Hunan, China	Lv Z.	Yusupov Z., Zhang D., Zhang Y., Zhang X., Lin N. & Deng T.	44(2)
Ekológia (Bratislava)	Assessment of the population status of *Allium oschaninii* O. Fedtsch. in the mountains of Uzbekistan	Saribaeva Sh.	Abduraimov O., Allamuratov A.	41
Arid Ecosystems	Ontogenesis and Ontogenetic Structure of Local Populations of the *Astragalus holargyreus* Bunge (Fabaceae) of the Narrow-Local Endemic of Kyzylkum	Saribaeva Sh. U.	Shomurodov Kh. F., Abduraimov O. A.	12

Research papers

Journal	Paper title	Author	Co-authors	Volume
Memoranda - Societatis pro Fauna et Flora Fennica	*Iris bucharica* (Iridaceae): A century of confusion is resolved with the description of I. chrysopetala, a new species from southern Central Asia	Sennikov A. N.	Khassanov, F. O., Pulatov, S. O.	98
PhytoKeys	A new species of *Ranunculus* (Ranunculaceae) from Western Pamir-Alay, Uzbekistan	Shchegoleva N. V.	Nikitina EV, Juramurodov IJ, Zverev AA, Turginov OT, Jabborov AM, Yusupov Z, Dekhkonov DB, Deng T, Sun H	193
Malayan Nature Journal	Investigation of changes in the species composition within the plant community containing relict shrub *Moluccella bucharica* for half a century	Shomurodov Kh. F.	Habibullaev B.Sh.	74(1)
Nature Conservation	Important plant areas (IPAs) in the Fergana Valley (Central Asia): The badlands of the northern foothills	Tojibaev K. Sh.	Tojibaev K.Sh., Karimov F.I., Hoshimov H.R., Jang C-G, Na N-R, Park M-S, Chang K-S, Gil H-Y, Baasanmunkh S, Choi HJ	49
Israel Journal of Ecology and Evolution	Dark-colored Oncocyclus irises in Israel analyzed by AFLP, whole chloroplast genome sequencing and species distribution modeling	Volis S.	Zhang, Y., Deng, T., Yusupov, Z.	68
Phytopathology	Species Diversification of the Coniferous Pathogenic Fungal Genus *Coniferiporia* (Hymenochaetales, Basidiomycota) in Association with Its Biogeography and Host Plants	Wang X. W.	Jiang JH, Liu SL, Gafforov Y, Zhou LW.	112(2)
Cladistics	Phylogeny and biogeography of the northern temperate genus *Dracocephalum* s.l. (Lamiaceae)	Ya-Ping Ch.	Turginov Orzimat Turdimatovich, Maxim S. Nuraliev, Predrag Lazarevi, Bryan T. Drew, Chun-Lei Xiang	38(2)
Phytotaxa	Three new records of Lamiaceae from China and Uzbekistan	Zhao Y.	Chi, J. C., Chen, Y. P., Liang, C. Z., Turginov, O. T., Pulatov, S. O., & Xiang, C. L.	531(2)
Annals of Botany	Seed macro- and micro- morphology in *Allium* (Amaryllidaceae) and its phylogenetic significance	Yusupov Z.	Ibrokhimjon Ergashov, Sergei Volis, Dilmurod Makhmudjanov, Davron Dekhkonov, Furkat Khassanov, Komiljon Tojibaev, Tao Deng, Hang Sun	129
Arid Ecosystems	Ontogenesis and Ontogenetic Structure of Local Populations of the *Astragalus holargyreus* Bunge (Fabaceae) of the Narrow-Local Endemic Of Kyzylkum	Saribaeva Sh. U.	Kh. F. Shomurodov, O. A. Abduraimov	28

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Arid ecosystems	The status of *Salsola arbusculiformis* and *Anabasis salsa* shrub grasslands on the Usturt plateau in Karakalpakstan (Uzbekistan)	Rakhimova N. K.	T. Rakhimova	12
Ethnobotany Research and Applications	Prospects for the introduction of *Ferula tadshikorum* Pimenov in the conditions of the Tashkent region	Khamraeva D. T.	Khojimatov O.K., Bussmann R.W., Khujanov A.K., Kosimov Z.Z.	23(6)
Plant Cell Biotechnology and Molecular Biology	DNA extraction techniques for some wild species from Uzbekistan	Nikitina E. V.	-	23 (13)
IOP Conference Series: Earth and Environmental Science	Species diversity and phylogenetic relationships within the tribe Mentheae (Lamiaceae) in Uzbekistan using ITS sequence data	Nikitina E. V.	-	1042
IOP Conference Series: Earth and Environmental Science	Assessment of plant species diversity (Lamiaceae Lindle.) in Uzbekistan based on DNA barcoding	Nikitina E. V.	Beshko N.Yu.	1042
Journal of Molecular Structure	Design of Competitive Inhibitory Peptides for HMG-CoA Reductase and Modeling Structural Preference for Short Linear Peptides	Pak V. V.	Khojimatov O.K., Pak A.V., Sagdullaev Sh.Sh.	1261
International Journal of Peptide Research and Therapeutics	Design of Tetrapeptides as a Competitive Inhibitor for HMG-CoA Reductase and Modeling Recognized Sequence as a β-Turn Structure	Pak V. V.	Khojimatov O.K., Pak A.V., Sagdullaev Sh.Sh., Yun L.	28
Botanica Pacifica	*Salvia insignis* Kudr. (Lamiaceae): current status, rarity, and prospects for conservation in situ	Baikova E. V.	Turdiboev O.A., Pulatov S., Madaminov F., Baikov K.S., Sheludyakova M.D.	11(2)
Adansonia	Contribution of French explorers to the study of Middle Asian flora: the herbarium collections by Guillaume Capus (1857–1931)	Turdiboev O. A.	Rouhan G., Allamurotov A.L., Madaminov F.M., Akbarov F.I., Tojibaev K.Sh.	44(22)
Molecules	GC-MS Chemical Profiling, Biological Investigation of three Salvia species growing in Uzbekistan	Gad H. A.	Mamadalieva R.Z., Khalil N., Zengin G., Najar B., Khojimatov O.K., Al Musayeib N.M., Ashour M.L., Mamadalieva N.Z.	27
Journal of Natural medicines	Environmental and soil characteristics in Ephedra habitats of Uzbekistan	Motoyasu M.	Fujii Taichi, Yukako Honda, Kaoru Ueno, Junichi Shinozaki, Susumu Itoh, Akihito Takano, Jolibekov Berdiyar, Ivan Ivanovich Maltsev, Takahisa Nakane	75(1)
Plant science today	Current state of *Anabasis salsa* pasture varieties in Karakalpak Ustyurt (Uzbekistan) due to Aral Sea drying	Rakhimova N. K.	Tashkhanim Rakhimova, Jasur S. Sadinov	9

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Botanica Pacifica	Findings to the flora of Russia and adjacent countries: new national and regional vascular plant records	Verkhozina A. V.	Anisimov A.V., Beshko N.Yu., Esanov H.K., Gaziev A.D., Biryukov R.Yu., Bondareva V.V. et al.	11(1)
Plant science today	The impact of changes in climatic factors of the Aktumsuk region on the formations of Medicageta sativae	Saitjanova U. Sh.	Shomurodov Kh.F.	9
Science of the Total Environment	Challenges and solutions to biodiversity conservation in arid lands	Yuanming Z.	Akash Tariq, Alice C. Hughes, Deyuan Hong, Fuwen Wei, Adilov Bekzod	827
Phytotaxa	Synopsis of the Central Asian Salvia species with identification key	Turdiboev O. A.	Shormanova, A.A., Sheludyakova, M.B., Akbarov, F., Drew, B. T., Celep, F.	543 (1)
Mycosphere	2022 – Mycosphere notes	Manawasinghe I. S.	Calabon MS, Jones EBG, Zhang YX, Liao CF, Xiong Y, Gafforov YS, Chaiwan N, Kularathnage ND et al.	13(1)
Frontiers in Fungal Biology	Biodiversity and Conservation of Fungi and Fungus-like organisms	Haelewaters D.	Gafforov Y., Zhou LW.	3
Flora –Germany	Comparative petiole histology using microscopic imaging visualization among Amaranthaceous taxa	Majeed S.	Zafara M., Althobaitic A. T., RamadF.M., Ahmad M., Makhkamov T., Gafforov Y., Sultana S., Yaseen G., N.	297
International Journal of Early Childhood Special Education	The influence of separation of aboveground part on the root system of phytomeliorants	Yulchieva M. T.	Dusmuratova Faxriddinova D.K. Abdinazarov S.X.	14
Journal of Pharmaceutical Negative Results	Structural features and growth development of *Hyssopus officinalis* L. in Tashkent and Jizzakh conditions	Duschanova G. M.	Dusmuratova F.M., Begmatova D.K., Abdinazarov S.X.	13
Phytotaxa	The synopsis of the genus *Tulipa* (Liliaceae) in Uzbekistan	Tojibaev K.	Dekhkonov, D., Ergashov, I., Sun, H., Deng, T., & Yusupov, Z.	573(2)
Journal of Asia-Pacific Biodiversity	Suitable habitat prediction with a huge set of variables on some central asian tulips	Dekhkonov D.	Asatulloev Temur*; Tojiboeva Umida; Idris Sari; Tojibaev Sh. Komiljon	16
Memoranda - Societatis pro Fauna et Flora Fennica	The nomenclatural history of Iris *orchioides* (Iridaceae)	Sennikov A. N.	Khassanov F.O., Lazkov G. A.	98
Biodiversity Data Journal	Species conservation profile and revision of *Salvia korolkowii* (Lamiaceae, Lamiales), a narrow endemic of the Western Tian-Shan	Turdiboev O. A.	Sennikov A.	10

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Plant Science Today	Bioecological features of *Nigella sativa* L. in different conditions of Uzbekistan	Mahmudov A. V.	Abduraimov O.S., Erdonov Sh. B., Gayibov U. G., Izotova L. Yu.	9(2)
American Journal of Plant Sciences	Ontogenesis of *Elytrigia trichophora* (Link) Nevski in the Conditions of Uzbekistan (Biometric Indicators)	Mahmudov V.	Mahmudov A.V., Abduraimov O.S.	13
Plant Science Today	Seed productivity of *Linum usitatissimum* L. in different ecological conditions of Uzbekistan	Mahmudov A. V.	Abduraimov O S, Erdonov Sh.B, Allamurotov A L, Mamatkasimov O T, Gayibov U G, Izotova L Y.	9(4)
BMC Genomics	Analysis of complete chloroplast genome sequences and insight into the phylogenetic relationships of *Ferula* L.	Yang L.	Ozodbek Abduraimov, Komiljon Tojibaev, Khabibullo Shomurodov, Yuan Ming Zhang, Wen Jun Li	23
E3S Web of Conferences	Current state of local populations Tulipa *greigii* Regel (Liliaceae) in Uzbekistan	Abduraimov O. S.	Azizbek V. Maxmudov, Azizbek S. Abduraimov	351
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Italian Botanist	Global and Regional IUCN Red List Assessments: 14	Fenu G	Al-Rammahi HM, Cambria S, Cristaudo AE, Khabibullaev BS, Mohammad MK, Shomurodov KF, Tavilla G, Orsenigo S	14
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Annals of Phytomedicine: An International Journal	The current state of endemic species, *Iris magnifica* (Vved.) F.O. Khass. (Iridaceae) in Kashkadarya region of Uzbekistan	Rakhimova N. K.	Rakhimova T.	11(2)
Phytotaxa–Auckland	Lophiostomataceae (Dothideomycetes): Introducing Lophiostoma khanzadakirgizbaeva sp. nov. and *Paucispora xishanensis* sp. nov	Aluthmuhandiram A. V.	Wanasinghe D.N., Chethana T., Gafforov Y., Saichana N., Li X.H., Yan J., Mamarakhimov O.M.	559(3)