Ethnobotanical knowledge of medicinal plants from Bukhara Region of Uzbekistan

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Research

Abstract

Background: Plants have long been a vital source for traditional medicine preparations used for livestock and humans, both for preventive and curative purposes. The rural population's ongoing relationship with their environment has led to the development of distinctive indigenous knowledge regarding the uses of plant resources. It is necessary to document this important information now in existence before it is lost or disappears. Ethnobiological literature on Central Asia is scant, random, limited in scope and fraught with taxonomic inconsistencies. Hence, this study is based on an extant ethnobotanical treatise and aims to represent an integrative knowledge of the medicinal plants of Bukhara region, Uzbekistan.

Methods: Ethnobotanical data of Bukhara province were collected through direct observation, field interviews, community interviews, and interviews using open and semi-open structured questions. 249 informants (182 men and 67 women) were chosen at random for ethnobotanical interviews, which covered all of the districts in the Bukhara region. The acquired data was then analyzed using quantitative ethnobotanical measures such as Use Value (UV) and Relative Frequency of Citation (RFC).

Results: A total of 84 plant species were found through ethnobotanical research in the Bukhara region; these species were categorized into 72 genera and 39 plant families. The analysis of plants based on their life forms as a result of the surveys showed that herbaceous plants are most commonly used in ethnobotany, constituting 94% of all identified plants. Of the 84 identified species, 48 are natural and 36 are cultivated. The research also found that the primary parts of medicinal plants used are leaves (52.4% or 44 species), stems (32% or 27 species), fruits (31% or 26 species), roots (27% or 24 species), seeds (20% or 17 species), flowers (11% or 9 species), and other parts (bulbs, tubers, bark, raisins, spikes, cotton, seed husks, seed beaks) accounting for 11% (9 species) of usage. With a UV of 0.807, *Peganum harmala* had the highest value among the studied areas. *Cucurbita pepo* (0.743), *Mentha longifolia* (0.727), *Ziziphora pedicellata* (0.679), *Brassica rapa* (0.618), *Raphanus raphanistrum* subsp. *sativus* (0.574), *Allium sativum* (0.570), *Ferula foetida* (0.474), *Capparis spinosa* (0.422), and *Glycyrrhiza glabra* (0.414) were some of the other high-use species

Conclusion: The local populations residing in the desert regions of Bukhara possess substantial knowledge about medicinal plants. The current study documented 84 medicinal plants that were commonly utilized by local populations for the cure of various diseases. Rosaceae family topped the list with seven genera and nine species. Herbaceous plants were most commonly used, constituting 94% of all identified plants. In plant part use patterns, leaves (52.4% or 44 species) were mostly utilized for making various kinds of remedies. *Peganum harmala*, *Cucurbita pepo* and *Mentha longifolia* were the most important species in the study area. Due to the remoteness of the study area and the lack of modern healthcare facilities, the majority of population is dependent on these medicinal plants. The study presents the first detailed exploration of indigenous ethnomedicinal knowledge from remote desert areas in Bukhara region. The study emphasizes the importance of indigenous ethnomedicinal knowledge as well as the declining interest in gaining traditional knowledge among the younger generation, possibly due to an increase in allelopathic medicinal practices. The documentation of indigenous knowledge is essential for its preservation, sharing of information in the public domain, the invention of novel medicines, and future management for the conservation of threatened flora.

Key words: Medicinal plants, Bukhara region, Field survey, Ethnobotanical knowledge.

Background

Ethnobotanical research typically concentrates on minorities and indigenous people. Indigenous knowledge systems are important for planners and scientists working to better rural communities, as well as for the cultures from which they originate (Bhattarai, 1992). The rural population's ongoing relationship with the forests has led to the development of distinctive indigenous knowledge regarding the uses of plant resources. It is necessary to document this important information now in existence before it is lost or disappears.

The folk medicines in Middle Asia have a long history, which began many centuries ago, but the most notable period was in the tenth to eleventh centuries. The existence of the Great Silk Road, which covered most of the Eurasian mainland with caravan paths, contributed to the development of not only trade relations, but also gave a significant impetus to the cultural and scientific exchange of knowledge. The information received was further disseminated and improved, which significantly enriched knowledge on the use of biological species in medicine. Many scientists tried to explore the secrets of folk medicines; among them, Abu Raihon Beruni (973-1048) and Abu Ali ibn Sino (Avicenna) (980-1037) did a great contribution in herbal medicines (Tayjanov *et al.* 2021).

According to Khalmatov (Khalmatov 1999) and (Khojimatov et al. 1995), the number of medicinal plants in the flora of Uzbekistan exceeds 1157 species, and by the definition of Khojimatov (Khojimatov 2021), their number is even more than 1200 (Tayjanov *et al.* 2021). About 600 plant species are used in traditional medicine, but only around 200 species have been phytochemically investigated, and some 150 plants species were included in the original Pharmacopoeia of Uzbekistan (Khojimatov 2021).

Full and detailed information about the plants of the Bukhara region can be found in the research work of Esanov (2019) entitled "Analysis of the flora of the Bukhara oasis" which provided information on the natural growth of 59 families, 294 genera, and 528 species in the oasis. Of these, 186 species belonging to 147 genera and 50 families are considered medicinal higher plants. Ethnobiological literature on Central Asia is scant, random, limited in scope and fraught with taxonomic inconsistencies (Boboev *et al.* 2023, Eshonkulov & Esanov 2022, Islomova *et al.* 2023, Khojimatov et al. 2020, Khojimatov 2021, Khojimatov *et al.* 2023, Gafforov *et al.* 2024, Makhkamov *et al.* 2023, Makhkamov *et al.* 2024, Tayjanov *et al.* 2021).
Ethnobotany focuses on the documentation of traditional botanical knowledge, which includes culture and generational ideas passed down through cultural transmission (Balick 1996). Ethnoecological knowledge can help with long-term

management and conservation of biodiversity, including wild medicinal plants (Pedroso-Júnior & Sato, 2005). Ethnobotany is beneficial to the development of healthcare and conservation programs worldwide by preserving and promoting future medicinal plant research for the development of novel medications (Nagan & Hammer, 2013). Traditional remedies are also widely used for primary healthcare management in developing countries (Upton et al. 2011) and are in demand in developed countries due to the belief that "natural is better" (Lewis 2003).

Documentation of traditional knowledge is very essential to conserve and enable future research on the safety and effectiveness of medicinal plants, which can validate their traditional use (Bunalema et al. 2014). Traditional medicinal knowledge is generally passed down orally by elderly folks and hakims (Amiri & Joharchi, 2013). The risks of knowledge loss are raised by urbanization, modern healthcare, and generational gaps (Baydoun et al. 2015). Documenting indigenous ethnomedicinal knowledge is essential for cultural preservation, drug development, and natural resource management.

This research work explored the potential uses of the data within the realm of domestic healthcare among the local communities living in the Bukhara desert areas of Uzbekistan. The main objective of this study is to document the local ethnobotanical knowledge, and practices linked to medicinal plants in the Bukhara region of Uzbekistan.

Materials and Methods

Study area

The region surrounding Bukhara has a unique climate. Its nature is typical of arid lands because its territory is thousands of kilometers away from open seas and the ocean (Nurov, 1996). One of the areas contained in the internal basin is the Bukhara region, which is situated on the edge of the shift from a temperate to a subtropical climate. This location has a significant impact on the formation of climate geographically. The summertime dry tropical air masses and the wintertime cool air masses from the north and temperate latitudes shape the climate of the Bukhara oasis. The interaction of multiple factors shapes the climate of the region (Figure 1).

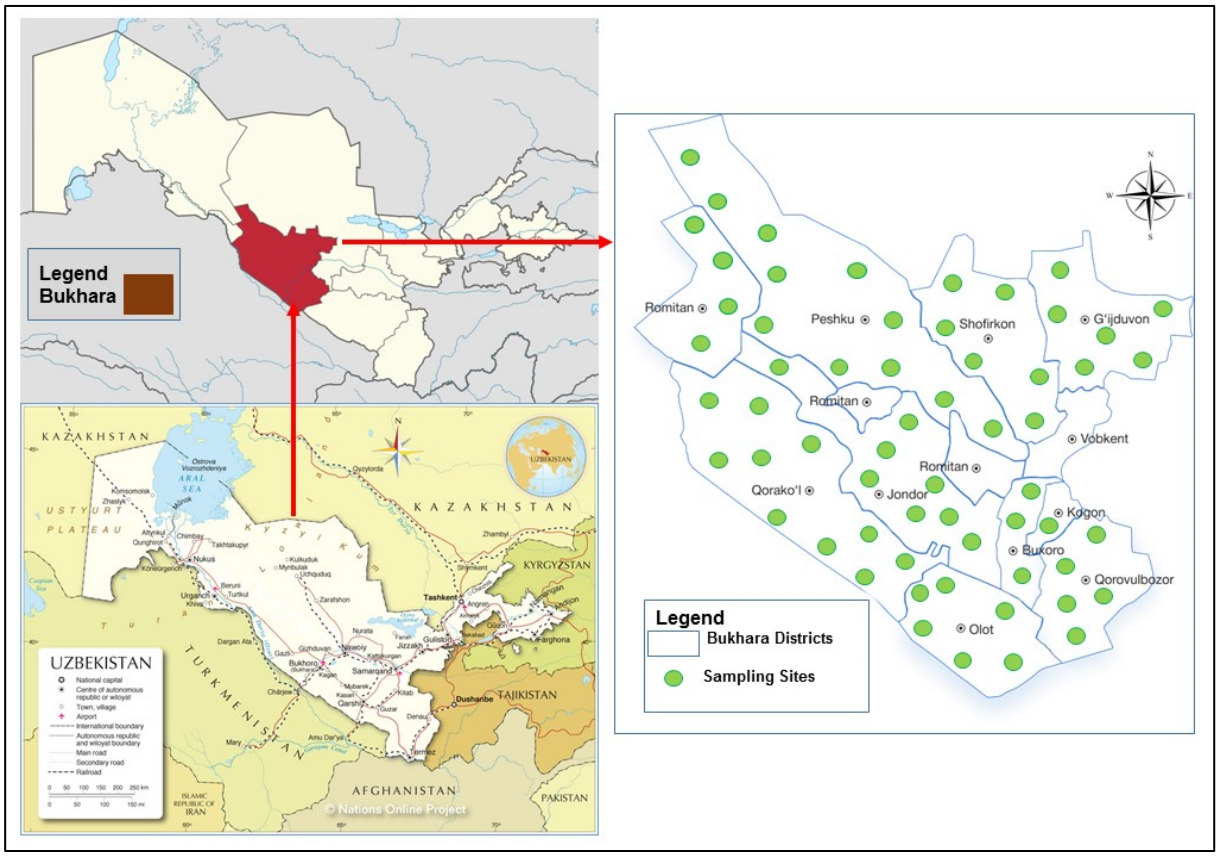

Figure 1. Study area map showing sampling locations in the Bukhara Region.

The region of Bukhara is surrounded by Central Asian deserts and has a climate typical of southern (subtropical) deserts. To put it briefly, the climate of this area is harsh continental desert (Nazarov & Allayorov, 1994).

There are 2800-3000 sunshine hours in a year (2852 hours in Tashkent and 3053 hours in Termez). January is the coldest and July is the warmest month in the area. The area does not receive enough natural moisture, with only 90-150 mm of precipitation per year, with up to 2000 mm of evapotranspiration. Bukhara's territory is part of an extremely arid zone in this sense. Most often, precipitation takes the form of rain. The snow cover is erratic, flimsy, and transient. Precipitation is distributed very unevenly throughout the year, with 45-55 % of the annual precipitation in spring. The summer months are extremely dry with low relative humidity dropping to 10-20 %. Because the Bukhara oasis borders the desert, wind greatly affects the bioecology of plants growing on its territory. Especially in years with long periods of warm weather, salt marshes and sandy lands expand.

Data Collection

Interviews were conducted in all districts of Bukhara region in 2019-2023. Field surveys were conducted to document ethnobotanical information about the flora of the study area, mainly through interviews, rapid assessment and collection of specimens. Interviews with local residents were conducted in accordance with the ISE Code of Ethics 2006 (The ISE Code of Ethics 2006). The importance of each informant's contribution to recording the ethnomedical knowledge of medicinal plants in the territory of Bukhara region was emphasized in the questionnaires. Ethnomedical knowledge was documented using an open-ended, semi-structured and pre-tested questionnaire. Interviews and focus group discussions on medicinal use of plant species were used to collect data. After the initial analysis, a group of individuals was selected, and information was collected about their interests and abilities in identifying and using plants. Discussions were conducted in local languages (Uzbek, Tajik and Kazakh) to facilitate communication with informants. The collected data included local names of medicinal plants, their habitats (natural or cultivated), plant parts used, ethnomedicinal uses, common diseases that can be treated with medicinal plants, methods of drug preparation and administration. Herbariums were prepared from all the plants used by the respondents, that is, the informants, during the inquiries. Collected plant specimens were dried, pressed and herbarium prepared following standard protocols. Voucher samples were handed over to Bukhara State University for safekeeping.

A total of 249 randomly chosen informants (182 men and 67 women) from all parts of the Bukhara region were interviewed. Data were collected on informants' demographic characteristics, gender ratio, age level, education level, and socioeconomic background.

The majority of informants, (25%), were in the 61-70 age range, although participants ranged from 30-over 80 years (Table 1). According to the data, knowledge of ethnobotany grew with age. This trend may be explained by the growing preference as people age for natural products for prevention or treatment, as well as the fact that older people typically experience more severe side effects from chemical medications.

The participants included herbalists, entrepreneurs, herb and spice sellers, doctors (Physicians), shepherds, farmers, foresters, and elderly retirees, according to an analysis of the social status of the informants. The results of the studies showed that the respondents' ethnobotanical knowledge and abilities declined with increasing literacy levels. Higher educated people are more likely to favor modern medical systems over traditional medicine, which helps to explain this situation (Table 1).

Table 1. Demographic features of informants, gender ratio, age level, education level, and socio-economic background

Information about informants	**Number of informants is 249, N=249**	**%**	**Age indicators**				
			31-40	**41-50**	**51-60**	**61-70**	**71-80**
Gender							
Male	182	73,1	5	11	47	63	56
Female	67	26,9	2	6	19	22	18
Education							
Highly educated	80	32,1	4	6	25	24	21
Moderately educated	118	47,4	3	7	31	43	34
Completed school	51	20,5	-	4	10	18	19
Occupation							
Local Hakims	19	7,63	-	1	6	7	5

Traders or sellers of herbs and spices	17	6,82	4	6	5	2	-
Doctors (Physicians)	31	12,4	-	5	10	12	4
Shepherds	23	9,23	-	2	11	8	2
Farmers	16	6,42	-	1	9	6	-
Foresters	32	12,8	3	2	25	2	-
Retired elderly people	111	44,6	-	-	-	48	63

Quantitative data analysis

First, a thorough inventory of all the plants was made, including information on the parts of the plants that were used for phytoremediation and any therapeutic qualities, for later review. Next, specific indices were computed:

Use value (UV)

The local identification and citation of plants within a certain region determines their significance, which is referred to as Use Value (UV) and it was calculated by following (Mirzaman *et al.* 2023, Sharif *et al.* 2022). It was calculated as follows:

$$UV = \sum Ui/N$$

Where Ui' is the use reports of the particular species while 'N' is the total no of informants in the study.

Frequency of citation (FC)

The most frequently used plant species by the local population of the area were determined using frequency of citation (FC) as followed by Tardío & Pardo-de-Santayana (2008) findings.

FC = Number of times a particular species was mentioned /total no of times that all species were mentioned *100

Relative frequency citation (RFC)

It indicates the significance of each species and is determined using the formula provided by Tardío & Pardo-de-Santayana (2008) based on the frequency of citation (FC) (the number of informants mentioning the use of species). The FC value is divided by the total number of informants who took part in the survey (N), without taking the disease categories into account. Its value ranges from "0" to "1".

$$RFC = FC/N$$

Results and Discussion

Medicinal plants Diversity

A total of 84 plant species were found through ethnobotanical research in the Bukhara region; these species were categorized into 72 genera and 39 plant families. Informants used more plants in rural than in urban areas (Table 2). This could be because of the distance from hospitals or clinics and a predilection for ethnobotanical services over contemporary medical services in rural areas. Furthermore, a sizable portion of the informants from rural areas were elderly individuals. With more than 4500 species, Uzbekistan occupies a pivotal position in Asia and is recognized as one of the primary hubs of the diversity of medicinal plants and a large proportion of native endemism. In Uzbekistan, there are over 600 kinds of medicinal plants that are used to cure a wide range of illnesses, many of which are indigenous (Khojimatov et al., 2020). Abduraimov et al. (2023) updated the checklist of the arid areas of Uzbekistan with a total of 529 medicinal species from 70 families and 269 genera. In the present study. The study area exhibited a wide range of medicinal plant diversity and their utilization patterns among local communities, with the aim of improving health. The predominant plant families in the study area were Asteraceae, Amaranthaceae, and Alliaceae. These plant families are abundant in medicinal compounds (Manzoor et al. 2023; Gillani et al., 2024; Mirzaman et al., 2023). Various studies from around the globe support the results of the present study regarding ethnomedicinal applications (Singh et al., 2017; Rossato et al., 1999; Pala et al., 2019; Manzoor et al., 2024).

Medicinal plants are thought to be inexpensive, and extremely important to the local population. They are crucial to the conventional treatment of illnesses (Abduraimov et al., 2023). The majority of genera was represented by a single species. Upon conducting an analysis of the plant species, it was discovered that 58% of the total number of plants were found in the top 10 families (Table 3).

Table 2. List of medicinal plants with ethnobotanical uses, as well as ethnobotanical indices, recorded from Bukhara region, Uzbekistan.

Plant name (POWO) & Voucher No.	Family	Local name	Status	Life form	Part used	Traditional Ethnobotanical uses	ΣUi	UV	FC	RFC
Allium cepa L. BSU0024	Alliaceae	Piyoz	Introduced - cultivar	Pe	R, St	It is used against flu, colds and various viral diseases. Improves appetite and digestive system. It is used in the treatment of bronchitis and pneumonia, as well as in the treatment of cough. Bark tincture strengthens the heart and prevents hair loss.	23	0,092	0,389	0,002
Allium suworowii Regel BSU0073	Alliaceae	Anzur piyozi	Native - wild	An	R, St	Strengthens the immune system. Increases the body's resistance to infections and bacteria and lowers blood sugar levels. The flowers of the plant are used to prevent hypovitaminosis.	56	0,225	0,946	0,004
Allium sativum L. BSU0102	Alliaceae	Sarimsoq piyoz	cultivar	An	On, L, St	It is used against colitis, enteritis, goiter and worm diseases. It is used in rheumatism, respiratory and digestive diseases. Anti-influenza, expectorant, remedy for purulent wounds. It is used as a medicine against microbes, fungi, diphtheria bacilli, tuberculosis mycobacteria, staphylococcus and streptococcus. Strengthens the nervous system and memory, lowers cholesterol and increases immunity. It slows down the aging process, increases appetite and improves digestion. strengthens hair roots.	142	0,570	2,399	0,010

Atriplex tatarica L. BSU0241	Amaranthaceae	Tatar olabutasi, dumma sho'ra	Native - wild	An	L	It is used to treat sore throats, coughs, improve the nervous system, and remove stones and toxins from the urinary tract and kidneys. It has a nutritious, pleasant and mild taste.	42	0,169	0,710	0,003
Beta vulgaris L. BSU0065	Amaranthaceae	Qizil lavlagi	cultivar	An	R	Beets have rejuvenating properties. The folic acid contained in it creates the basis for the formation of new cells in the human body. Eating beets is also very useful for patients suffering from excess weight. Beetroot not only cleans the blood, but also the kidneys and liver. This vegetable removes poisons (toxins) from the body. Because of this, the brain works clearly. As it relieves constipation and dissolves toxins, your mood will rise, and your soul will be refreshed. Due to the high content of vitamin B, beets strengthen the walls of blood vessels. It is recommended for hypertension, atherosclerosis and other cardiovascular diseases as it cleans the blood and expands the vessels. Prevents the appearance or growth of oncological tumors.	69	0,277	1,166	0,005
Chenopodium album L. BSU0094	Amaranthaceae	Qizil sho'ra, eshak sho'ra	Native - wild	An	L, S.	It is used as an emollient, pain reliever, and anti-inflammatory agent. it thins the mucus of the pathological changes in the vocal	43	0,173	0,727	0,003

						cords and relieves the swelling of the vocal cords. It is used to treat bruises and wounds. Young leaves of the plant are used to prepare salad and borsch.			
Chenopodium rubrum L. BSU0081	Amaranthaceae	Oq sho'ra	Native - wild	An	L	Gastrointestinal diseases, inflammation of the stomach from herbal decoction, against various wounds, tuberculosis, bronchitis, cough, liver and spleen, gout, radiculitis, giardia. The ash of the plant stem is used in the elimination of lice and congenital conditions	35	0,141	0,591	0,002
Spinacia oleracea subsp. *turkestanica* (Iljin) Del Guacchio & P.Caputo BSU0032	Amaranthaceae	Turkiston ismalog'i, ismaloq.	Native - wild	An	L	Anti-inflammatory, immunomodulatory, antioxidant, removes slag and blood toxins, strengthens the walls of blood vessels, restores vision, normalizes digestive processes, prevents anemia, prevents the development of atherosclerosis, strengthens bones and tooth enamel, provides an anti-cancer effect and increases immunity. is used. Nutritious, used in the body to lose excess weight and improve digestion.	87	0,349	1,470	0,006
Anethum graveolens L. BSU0055	Apiaceae	Shivit, ukrop	cultivar	An	St, L	Useful in digestive system, intestinal pain and hiccups. It is used to treat abdominal pain and restlessness. It helps to reduce cholesterol and blood sugar. It ensures the strength of the respiratory system, blood vessel	92	0,369	1,555	0,006

						wall and immunity. The seed strengthens the cardiovascular system. It is useful in eye diseases, in removing dark spots under the eyes and in removing bacteria from the eyes, and in blood supply to eye tissues. Cleans skin color, removes fat deposits on skin, strengthens hair roots and prevents shedding.				
Carum carvi L. BSU0038	Apiaceae	Zira	Native cultivar	-	Pe	S	It improves the digestive system, stimulates the appetite, is a diuretic and removes excess mucus from the body. Due to its diuretic effect, it is often used in diseases of the urinary tract. It is used in diseases of respiratory organs and gastrointestinal tract. It has the property of dissolving fats in the body, it helps to get rid of obesity when brewed with tea. The oil provides breast elasticity in women, is used to strengthen hair, reduce dandruff and prevent shedding.	76	0,305	1,284	0,005
Coriandrum sativum L. BSU0089	Apiaceae	Kashnich	cultivar		An	St, S, L	It is used as a remedy against gastrointestinal diseases, anthelmintic diseases, respiratory tract diseases. It is used in eye diseases, especially glaucoma. The seed is widely used in baking and as a spice. It is used in salads and meat dishes. The presence of zinc in	86	0,345	1,453	0,006

						coriander, which is necessary for human health, is the most necessary for hair, nails and skin. It has been found that the plant contains a product that causes or directs sexual desire in women and men. It moisturizes the skin and prevents aging.			
Daucus carota subsp. *sativus* (Hoffm.) Schübl. & G.Martens BSU0074	Apiaceae	Sabzi	Introduced - cultivar	An		It is used against gastritis, enteritis and kidney, liver, bladder stone cases. It has the property of calming the heart and dilating and strengthening blood vessels. It is used against the development of oncological diseases and rapid aging of the body. It is used in anemia and weakness. It is used to treat skin burns, scabies, and purulent wounds that are difficult to heal.	75	0,301	1,267	0,005
Ferula foetida (Bunge) Regel BSU0022	Apiaceae	Sassiq kovrak	Native - wild	Pe	R	Mainly the root and the resin extracted from the root are used. Improves digestion and metabolism. It is used as an antidote for diseases of the gastrointestinal system, new tumors in the stomach and breast. It is used in the treatment of gout, polyarthritis, radiculitis, osteochondrosis, bronchial asthma, tuberculosis, diabetes, syphilis and burns, and to increase libido in men.	118	0,474	1,994	0,008
Petroselinum crispum (Mill.) A.W. Hill	Apiaceae	Petrushka	Introduced - cultivar	An	St, L	A plant rich in antioxidants, fights inflammation. Parsley has an	62	0,249	1,048	0,004

BSU0053						extremely positive effect on the immune system and fights inflammation. Parsley is a real treasure of ascorbic acid, beta-carotene, vitamins V, K, E, RR, zinc, magnesium, iron, phosphorus, potassium and calcium. It protects against bacteria and eliminates various swellings in the body. It is eaten together with food and added to salads. As it helps to produce glutathione in the body, it has skin rejuvenating properties.			
Pimpinella anisum L. BSU0087	Apiaceae	Arpabodiyon, oq zira	Introduced - cultivar	An	Fr, S.	It is used as an expectorant for inflammation of respiratory organs, bronchitis, asthma, pulmonary tuberculosis, asthma and expectorant. It is also used to increase breast milk in lactating women and during painful menstruation. It has diuretic and laxative properties. It is used as a spice for food. Stimulates skin cell renewal and rejuvenates. Makes the skin smooth and elastic.	39	0,157	0,659	0,003
Cynanchum acutum subsp. *sibiricum* (Willd.) Rech.f. BSU0005	Apocynaceae	Sibir ilonpechagi, sutli pechak	Native - wild	Pe	St, L, R.	It is used in diseases of the gall bladder, increasing immunity and increasing milk in lactating women. It is used as an antidote for pancreatic, tumor, viral diseases and snake bites.	25	0,100	0,422	0,002

Artemisia annua L. BSU0302	Asteraceae	Burgan shuvoq yoki bir yillik shuvoq	Native - wild	An	St, L	It is used to treat rheumatism, skin diseases. An ointment is prepared from dry leaves to treat scabies and eczema. It is a drug against malaria and leishmania. It is used in gastric and duodenal ulcers, as a diuretic, as an antipyretic, and as an anthelmintic.	26	0,104	0,439	0,002
Artemisia scoparia Waldst. & Kit. BSU0071	Asteraceae	Supurgi shuvoq, qizil burgan, jo'rop	Native - wild	An, Bi	St, L, R	It is used for respiratory tract, menstrual disorders in women, rheumatism and as a diuretic. It is used to improve the digestive system, stomach ulcers and epilepsy. It is included in evening masks that restore the face of women.	16	0,064	0,270	0,001
Artemisia vulgaris L. BSU0012	Asteraceae	Oddiy shuvoq	Native - wild	Pe.	St, Fl, L, R	It is used in gastric and duodenal ulcers, in the treatment of anemia and as an appetite stimulant. It is used for insomnia, various neuroses, colds, malaria, flu and epilepsy.	28	0,112	0,473	0,002
Calendula officinalis L. BSU0251	Asteraceae	Tirnoqgul	Introduced - cultivar	An, Bi	Fl, S	It has been used in the treatment of spots on the body, ureter, urolithiasis, hepatitis, stomach ulcer, hypertension, sore throat, and as a sedative for the nervous system, lowering blood pressure, and regulating heart function. It is also used in liver, spleen, kidney and bile duct diseases. Useful for delicate skin, strengthens the capillaries in the skin, quickly restores	81	0,325	1,369	0,005

						inflammation and soothes the skin.			
Taraxacum bicorne Dahlst. BSU0046	Asteraceae	Qoqio‘t, momaqaymoq	Native - wild	Pe	St, Fl, L, R	It is used for liver diseases, gall bladder, jaundice, gastritis, constipation, hemorrhoids, digestion, skin diseases and as an appetite stimulant. It increases the acidity of gastric juice, is used as an anti-inflammatory, anti-tumor, hepatoprotective, anti-atherosclerosis agent. Root extract has a refreshing, soothing effect on the skin, relieves irritation and itching. Fragrant wine, jam, and leaves are used to make salads and broths from flowers.	42	0,169	0,710	0,003
Xanthium strumarium L. BSU0083	Asteraceae	Oddiy qo‘ytikan	Native - wild	An	St, L, S, R	It is used in the treatment of thyroid disorders, gastrointestinal diseases, diarrhea, dysentery and even cholera. It is used in the treatment of eczema, damaged areas of the skin.	32	0,129	0,541	0,002
Brassica oleracea L. BSU0027	Brassicaceae	Karam	Introduced - cultivar	An	Fr	It is used as a remedy for stomach and intestinal ulcers and liver pain. It is used for diabetes, upper respiratory tract, spleen and jaundice diseases. It is used for expectoration, insomnia, constipation, as a medicine against sore throat. Prevents obesity and improves skin color.	89	0,357	1,504	0,006

Brassica rapa L. BSU0030	Brassicaceae	Sholg‘om	Introduced - cultivar	An	R	It was used to soothe the chest and throat, lung and respiratory diseases, high fever, and heart trouble. Boiled and crushed is a cure for gout, mouthwash is used for toothache and sore throat. It has diuretic, wound healing, and antiseptic, pain-relieving properties, used for bronchial asthma, when a severe cough occurs in whooping cough, acute laryngitis, loss of voice due to a cold, and insomnia.	154	0,618	2,602	0,010
Capsella bursa-pastoris (L.) Medik. BSU0010	Brassicaceae	Oddiy jag‘-jag‘, mador o‘t.	Native - wild	An	L, St, R.	Use as an infusion for uterine and other internal bleeding is effective, especially as a hemostatic agent. In women, it reduces the intensity of the menstrual cycle, normalizes the cycle and relieves pain. The plant has astringent properties and is used in the treatment of acute and chronic inflammatory bowel diseases, stomach and duodenal ulcers. Due to its astringent properties, it effectively removes bruises on the body after blows, restores the epidermis from wounds and burns. It gives a special taste and smell to the food, whets the appetite.	102	0,410	1,724	0,007
Eruca sativa Mill. BSU0031	Brassicaceae	Ekma indov, sho‘racha	Native - wild	An	L, St	Strengthens immunity, nervous system, blood vessels and capillaries and has a beneficial effect on the skin. It improves	16	0,064	0,270	0,001

						heart function and dilates blood vessels, reduces high blood pressure. It is used to smooth out small wrinkles on the face, make the skin color of the face more pleasant and restore its previous brightness. It is widely used in cosmetology due to the high content of vitamin B complex, thiamin, riboflavin, niacin and pantothenic acid.			
Isatis tinctoria L. BSU0015	Brassicaceae	O'sma	Introduced - cultivar	An	L	Kills some eye infections and brightens eyesight. Provides strength and darkening of eyebrows, eyelashes and hair, prevents hair loss.	27	0,108	0,456	0,002
Raphanus raphanistrum subsp. *sativus* (L.) Domin BSU0023	Brassicaceae	Turp	Introduced - cultivar	An	R	Its juice is used for the proper functioning of the intestinal tract and for strengthening the hair. Having a positive effect on the digestive system, its consumption is beneficial in preventing atherosclerosis, tumors, gall bladder and urinary tract stones. In folk medicine, grated radish is used to treat radiculitis. It has a healing effect that expels excess fluid from the body, dissolves and discharges stones in urinary tract diseases. In folk medicine, it is recommended to add radish to food for gout and kidney stone diseases. Radish improves appetite, digestion, metabolism	143	0,574	2,416	0,010

						in the body, and helps in normal secretion of gastric juice and bile.			
Capparis spinosa L. BSU0278	Capparaceae	Tikanli kovul.	Native - wild	Pe	Fr, R	The root is chewed in diseases of the oral cavity and toothache. A decoction of the root bark is used for hypochondria, paralysis, diseases of the spleen, colds and rheumatic pains. Because the plant contains rutin, it is used for high blood pressure. Due to its fiber content, it has a positive effect on the digestion process. It contains vitamin A, which is necessary for healthy hair, nails and skin. The fruit is eaten by adding it to hot and cold dishes and salads.	105	0,422	1,774	0,007
Acanthophyllum pungens (Bunge) Boiss. BSU0264	Caryophyllaceae	Tikanli yetmak	Native - wild	Pe	St, L, R	It is used in the prevention and treatment of atherosclerosis, diseases of the central nervous system, and cardiovascular diseases. It is used as an antitussive, expectorant and as a fast-healing agent for skin wounds.	47	0,189	0,794	0,003
Convolvulus arvensis L. BSU0174	Convolvulaceae	Dala pechagi, qo‘ypechak, pechak	Native - wild	Pe	St, R, Fl, L.	A decoction made from the leaves and roots of the plant is used for rashes and skin diseases. It is used as a healing and hemostatic agent for scabies and wounds. It is used in the treatment of upper respiratory tract, bronchitis and asthma. Prevents hair loss and promotes hair growth.	16	0,064	0,270	0,001

Cuscuta campestris Yunck. BSU0052	Convolvulaceae	Zarpechak, chirmovuq, adg'ash	Native - wild	An	St, S	Use in liver diseases, especially liver cirrhosis, gives a positive result. As a sedative drug, it is used in the treatment of various pathological conditions of the kidneys, prostatitis.	16	0,064	0,270	0,001
Citrullus colocynthis (L.) Schrad. BSU0115	Cucurbitaceae	Achchiq tarvuz	Introduced - cultivar	An	Fr	A tool that lowers blood pressure and improves digestion. A decoction of its fruit is used as a strong antipyretic. It is used to relieve pain around and below the navel, and to treat nausea caused by neuralgia. It is used for dizziness, severe pain in the eyeball, and inflammatory diseases of the testicles.	35	0,141	0,591	0,002
Cucumis sativus L. BSU0203	Cucurbitaceae	Bodring	Introduced - cultivar	An	Fr	Cucumber strengthens the heart as it is a source of potassium. Strengthens bones and improves gastrointestinal function. It expels cholesterol, cleanses the gall bladder, liver, and kidneys. A decoction of its flowers cures malaria. In folk medicine, fresh juice is a sedative, a pain reliever in stomach (stomach)-intestinal attacks. Its juice mixed with real honey and consumed is a cure for upper respiratory tract and cough. When crushed cucumber is placed on the skin burn, it becomes an ointment. Its sap and aqueous tincture (with bruised bark) are used to remove some pigmented spots and	64	0,257	1,081	0,004

						blemishes on the face. When applied to sunburned skin, it removes blemishes and rejuvenates the skin.				
Cucurbita pepo L. BSU0343	Cucurbitaceae	Oshqovoq, kadi	Introduced - cultivar	An	Fr, S	Pumpkin is rich in vitamins A, C, E, K, T and B. Pumpkin seeds have beneficial properties in the treatment of prostatitis for men's health. Pumpkin seeds are used as a remedy for worms and parasites. Due to the presence of magnesium and zinc in its composition, it is useful for heart diseases. It is used against inflammation in the body, against colds and flu. used to prevent diabetes. Due to the presence of vitamins A and E in pumpkin, it is used to prevent skin aging.	185	0,743	3,126	0,013
Cyperus rotundus L. BSU0057	Cyperaceae	Salomalaykum	Native - wild	Pe	T	It has the properties of cleansing and rejuvenating the complexion. Strengthens the nervous system, improves the functioning of all digestive organs. It is used in the treatment of obesity. It is used as an anti-tumor, anti-seizure, anti-diabetic, anti-diarrheal, anti-inflammatory, anti-malarial agent.	12	0,048	0,203	0,001
Elaeagnus angustifolia L. BSU0043	Elaeagnaceae	Jiyda	Native - wild	Tr	Fr	ida treats hepatitis. Recommended for respiratory and gastrointestinal diseases. Dzhida stops diarrhea, removes	48	0,193	0,811	0,003

						bile pouring into the internal organs of a person, and is useful for coughs caused by heat. It is useful against excessive urination, nausea and vomiting.			
Alhagi pseudalhagi (M. Bieb.) Desv. ex Wangerin BSU0079	Fabaceae	Yantoq	Native - wild	Pe	Fl, S, L	It is used as an antitussive and antiperspirant, a decoction of the root is used as a diuretic, choleretic agent, and the flowers of the plant are used for anemia. It is noted that the mixture prepared from the seeds, roots and stems of the plant is used as an immunostimulant, a remedy for coughs and sunburn.	38	0,153	0,642	0,003
Glycyrrhiza glabra L. BSU0008	Fabaceae	Shirinmiya, Achchiq bo‘yon, eshakmiya.	Native - wild	Pe	R	A decoction made from the root is used for kidney, bladder, stomach inflammation, fever, lung, shortness of breath, whooping cough, sore throat. A decoction prepared from the root is mixed with alcohol and kept in a dark place for a certain period of time, and it is used in the treatment of diseases of the respiratory organs, diseases of the stomach and duodenum.	103	0,414	1,740	0,007
Melilotus officinalis (L.) Lam. BSU0054	Fabaceae	Dorivor qashqar beda	Native - wild	Bi	St, L	It is used in the treatment of inflammation of the upper respiratory tract, insomnia and purulent wounds. It stabilizes the cardiovascular system and arterial pressure.	68	0,273	1,149	0,005
Sophora alopecuroides L.	Fabaceae	Oddiy achchiqmiya	Native - wild	Pe	R	It is used as a tool that lowers blood pressure and improves	42	0,169	0,710	0,003

BSU0068						digestion. Its roots are used in the treatment of cardiovascular diseases, lowering high body temperature, improving digestion, anti-eczema, and treating rheumatism. The plant has a bitter taste and is rich in protein, fat and fiber.				
Crocus sativus L. BSU0013	Iridaceae	Za'faron shafran	Introduced - cultivar	Pe	Fl, Stigma	It is used as an antitussive, diaphoretic, diuretic, cardiac tonic, and wound healer. Increases eye power, improves heart, stomach, intestinal tract, liver and respiratory tract. Stops bleeding. It has skin cleansing and rejuvenating properties. It is used to color food additives.	56	0,225	0,946	0,004
Juglans regia L. BSU0124	Juglandaceae	Yong'oq	Introduced - cultivar	Pe	L, Fr, S	Its juice is used to reduce excess body fat, regulate blood sugar and heart rate, reduce the risk of memory loss, treat constipation, and fight liver disease. It is used to improve the functioning of the thyroid gland, to treat rickets and angina in children. It is used to strengthen the nervous system, intestines, memory, and treat insomnia. Not recommended for people with diarrhea and allergies. Strengthens hair and nails.	75	0,301	1,267	0,005
Mentha longifolia (L.) L. BSU0090	Lamiaceae	Yalpiz, hilbo'y	Native - wild	Pe	St, L, R	It is used in the treatment of gastrointestinal, urinary tract diseases, cough and headache. It is used to clean the respiratory	181	0,727	3,058	0,012

						tract and increase the strength of the body with a mixture of honey and mint. It is used to prevent asthma, bronchitis and stomach disorders. It is used to protect dried fruits from the damage of various insects and to prepare mood-boosting drinks. Improves brain function and increases alertness. Peppermint tea drunk on an empty stomach helps to lose weight by speeding up the metabolism and acts as a diuretic, ridding the body of excess water.				
Ziziphora pedicellata Pazij & Vved. BSU0062	Lamiaceae	Xushbo‘y kiyik o‘t, cho‘l yalpizi.	Native - wild	Pe	St, L	Strengthens the spirit, expels urine, the preparation of the plant with alcohol stops vomiting. It is used in the treatment of headaches, sore throats, and digestive disorders.	169	0,679	2,856	0,011
Ziziphora tenuior L. BSU0035	Lamiaceae	Kiyik o‘t	Native - wild	An	St, L	It keeps the blood pressure at the same level, stimulates the appetite, and is a diuretic. It is used against gout and colitis. It is used in ischemic heart diseases, atherosclerosis and headache prevention. It is used to calm the nerves and in some skin diseases.	98	0,394	1,656	0,007
Aloe vera (L.) Burm. f. BSU0136	Liliaceae	Aloy, sabur	Introduced - cultivar	Pe	L, St	It is used in neurosis, headache, pneumonia, bronchitis, pulmonary tuberculosis, women's diseases, as an anti-bacterial and anti-inflammatory agent. It is used to strengthen	67	0,269	1,132	0,005

						the body's immune system against constipation, gastric ulcer, gastritis and other diseases. It is used in various skin and eye diseases, hair strengthening, facial skin clarification and rejuvenation.			
Punica granatum L. BSU0175	Lythraceae	Anor	Introduced - cultivar	Pe	Fr	It is used in diabetes, cardiovascular system, improving glucose metabolism, reducing the amount of fat tissue, preventing ulcers and inflammation of the stomach and duodenum. It reduces the division of dangerous cells and prevents their development in oncological diseases. Normalizes the amount of cholesterol in the body, prevents atherosclerosis in blood vessels. Pomegranate substances are an agent against harmful microbes and a source of nitrates that improve blood circulation in tissues. Pomegranate seeds are not digestible in the body, but they remove unnecessary substances during the passage through the intestines. The seeds are dried and drunk as tea. It provides skin tension, elasticity and smoothness and reduces skin pores. Pomegranate peel moisturizes the skin and increases its elasticity, cleanses	94	0,378	1,588	0,006

							the skin of various viruses damaged by the external environment. A decoction of the bark prevents stomachache and diarrhea. Decoctions made from the peel of pomegranate fruits are an effective tool for inflammation of the female genital organs, treatment of fungal diseases and ensuring its elasticity.			
Ficus carica L. BSU0033	Moraceae	Anjir	Native cultivar	-	Pe	Fr, L	Strengthens blood vessels, increases the regenerative properties of the skin and fights against infections. The fiber contained in it improves constipation and digestion. The leaves have antioxidant and anticarcinogenic properties and contain more substances than the fruit. The leaves contain ficin, which reduces blood clotting, and furocoumarin, which helps produce pigment in problem areas of the skin. It is used in the treatment of psoriasis, asthma, bronchitis and eczema. It is used in the treatment of prostatitis and impotence in men. It is not recommended for gastritis, stomach ulcer, gout.	87	0,349	1,470	0,006
Morus alba L. BSU0009	Moraceae	Tut	Native cultivar	-	Pe	L, Fr	Oral ulcers were effectively treated in folk medicine with mulberry fruit or its juice. For this, the fruit is boiled, and the	69	0,277	1,166	0,005

							oral cavity is rinsed. Mulberry juice is also widely used to purify the blood and increase blood circulation. A decoction of the leaf has been used as an antipyretic for angina and other colds. Mulberry bark is crushed and mixed with sesame oil to treat various types of severe wounds. A decoction of tree bark is used as an expectorant for colds and lung diseases. White mulberry contains resveratrol, a natural antibiotic that helps treat chronic diseases. It is used to relieve unpleasant symptoms such as profuse sweating and hot flashes, which are observed in women. In traditional medicine, white mulberry fruit is used to treat anemia, gastrointestinal diseases, and gastritis. The leaf and the newly opened bud are good for metabolic disorders in the body.				
Peganum harmala L. BSU0086	Nitrariaceae	Isirig', ispand	hazor	Native - wild	Pe	L, St, S	It is used as a remedy for malaria, toothache, wound and body weakness. It improves the functioning of the nervous system and memory, is used in the treatment of asthma, rheumatism, antibacterial and viral diseases. Eliminates foot pain and odor. Harmala is used not only as a medicinal raw	201	0,807	3,396	0,014

						material, but also as an incense for fumigating rooms.. Excessive amounts of plant smoke are toxic.				
Cistanche flava (C.A.Mey.) Korsh. BSU0039	Orobanchaceae	Sistanxe, zo'ri-zamin	Native - wild	Pe	R	It is used to prevent infertility, improve impotence, treat arterial hypertension, increase immunity, and treat inflammatory diseases of the urinary tract, genitals, and cystitis. It helps in kidney failure diseases. It has the property of calming the body, reducing stress and raising mood.	38	0,153	0,642	0,003
Cistanche salsa (C.A.Mey.) Beck BSU0047	Orobanchaceae	Sistanxe, zo'ri-zamin	Native - wild	Pe	R	It is used to prevent infertility, improve impotence, treat arterial hypertension, increase immunity, and treat inflammatory diseases of the urinary tract, genitals, and cystitis. It helps in kidney failure diseases. It has the property of calming the body, reducing stress and raising mood.	45	0,181	0,760	0,003
Roemeria pavonina (Schrenk) Banfi, Bartolucci, J.-M.Tison & Galasso BSU0044	Papaveraceae	Lolaqiz	Native - wild	An	Fl, St, L	It is used as a cough and cold remedy. It is used for insomnia, stopping nosebleeds, anti-virus, anti-tumor, immune booster and sedative. If the plant is added to the food of lactating women, an increase in breast milk is observed. It is used in the treatment of sunstroke in children and to increase immunity.	35	0,141	0,591	0,002

Sesamum indicum L. BSU0143	Pedaliaceae	Kunjut	Introduced - cultivar	An	S	Improves brain function, improves memory and attention. It is used in the treatment of insomnia, asthma, throat, lung, anemia and internal bleeding diseases. Strengthens the cardiovascular system and normalizes blood pressure. Provides strength of bones, hair and nails, increases immunity. Due to the richness of vitamin E, it is considered to increase potency in men. Roasted sesame seeds mixed with honey give high results. It dissolves injuries caused to the body as a result of blows, blood accumulated under the skin and bruises. Clears skin color, improves blood circulation and has rejuvenating properties.	64	0,257	1,081	0,004
Piper nigrum L. BSU0129	Piperaceae	Murch	Introduced - cultivar	An	Fr	It is used as a remedy for flu, asthma, sore throat, chest pain, itching and various poisons in the body. Body cleansing is not recommended for people with gastrointestinal disorders or severe allergies. Diuretic, nervous system tonic, memory enhancer and appetite stimulant.	78	0,313	1,318	0,005
Plantago lanceolata L. BSU0042	Plantaginaceae	Nashtarbarg zubturum	Native - wild	Pe.	L, S, R	Improves the digestive system, normalizes the functioning of the stomach and intestines. When the stomach and intestines are inflamed, it has the ability to restore the inner mucosa. A	38	0,153	0,642	0,003

						wound-healing, body-invigorating agent. Information about the treatment of a person with a tumor in the stomach was recorded.			
Plantago major L. BSU0063	Plantaginaceae	Yirik zubturum	Native - wild	Pe	L, S, R	Improves the digestive system, normalizes the functioning of the stomach and intestines. When the stomach and intestines are inflamed, it has the ability to restore the inner mucosa. It prevents spitting of blood, is effective in treating liver and kidney diseases. Information about the treatment of a person with a tumor in the stomach was recorded.	94	0,378	1,588	0,006
Triticum aestivum L. BSU0059	Poaceae	Bug‘doy	Introduced - cultivar	An	S	It improves heart function, increases the elasticity of blood vessels and normalizes the digestive system. The pectin contained in it absorbs dangerous and harmful substances in the stomach and helps to heal inflammations that have appeared in the stomach. Increases the rapid healing of wounds and the body's resistance to unfavorable external factors. Phytoestrogens in it prevent the development of some types of cancer, especially breast, uterine and prostate cancer. Removes spots and	24	0,096	0,406	0,002

						wrinkles on the face, cleans and whitens the skin.			
Zea mays L. BSU0082	Poaceae	Makkajo‘xori	Introduced - cultivar	An	Corn silk, S	Corn silk is used as a drug that accelerates blood clotting, displaces bile and urine, and improves metabolism. It is used for diseases of the kidneys, bladder, and diabetes. Used in the treatment of inflammation of the liver and gallbladder. Enriches the body with vitamins B12 and K3. Cleanses the skin.	94	0,378	1,588	0,006
Rumex dentatus subsp. *halacsyi* (Rech.) Rech.f. BSU0225	Polygonaceae	Xalachi otqulog‘i, otquloq	Native - wild	An	L, St	The leaves cure jaundice, strengthen the liver, calm the stomach, improve appetite, and are used against scorpion venom. If consumed with sumac, it cures intestinal ulcers. Improves digestion, gall bladder, liver and cardiovascular system. Effective as an antiallergic agent for skin rashes and itching. It has a pleasant and mild taste. A green color can be obtained from the stems and leaves.	56	0,225	0,946	0,004
Portulaca oleracea L. BSU0067	Portulacaceae	Semiz o‘t	Native - wild	An	L	An herbal decoction is used as a diuretic, gonorrhoea, kidney and liver diseases, as a detoxifier for snake, bee, and moth bites, avitaminosis, syphilis, and paralysis. It is used as a medicine for liver, kidney, diuretic, heart, hypertension, diabetes, swelling, gout, and fever. It is beneficial in preventing stroke and	67	0,269	1,132	0,005

						strengthening the nervous system. Pastries and salads are prepared and eaten from it throughout the year.			
Nigella sativa L. BSU0084	Ranunculaceae	Sedana	Introduced - cultivar	An	Fr, Fl	It is used to improve immunity and respiratory diseases. It opens blockages in the sphenoid bone, removes worms, helps to remove stones from the bladder and kidneys, and is used for eye diseases. It was used for liver, lung, skin, flatulence, poisoning and women's diseases. It is used in the treatment of insomnia, against hair loss and to improve skin color. It is a sedative and rejuvenating agent. It is used as BAD in many countries.	94	0,378	1,588	0,006
Cydonia oblonga Mill. BSU0247	Rosaceae	Behi	Introduced - cultivar	Tr	L, S, Fr	It is used as a polyelit, nephrite, diuretic, laxative. It is used as a treatment for diabetes, hypertension, gastritis, and cough. It is used as an anti-inflammation of the respiratory and digestive organs, and as an expectorant. Stops bleeding. It has cleansing and energizing properties.	83	0,333	1,403	0,006
Fragaria × *ananassa* (Weston) Duchesne ex Rozier BSU0048	Rosaceae	Qulupnay	Introduced - cultivar	Pe	Fr	It is very useful in heart diseases and eye diseases. Strawberries have been found to prevent the development of molecular degeneration of the retina, cataracts, dry eyes and other changes. Due to its unique	62	0,249	1,048	0,004

						biochemical composition, it can not only prevent most vision-related diseases, but also treat some of them. Strawberries reduce body temperature and thin the blood. Provides energy to the body and cures dysbacteriosis. Rejuvenates the skin by solving all skin and hair problems.			
Prunus amygdalus Batsch BSU0078	Rosaceae	Bodom	Native - cultivar	Pe	Fr, S	Accelerates metabolism, improves heart function, normalizes cholesterol, diabetes, bowel function. It is used in blood pressure, eye diseases, cancer prevention and brain function improvement. It reduces the risk of aging-related diseases and is used for hair growth and removal of freckles on the skin.	67	0,269	1,132	0,005
Prunus armeniaca L. BSU0064	Rosaceae	O‘rik	Introduced - cultivar	Pe	Fr, S	It is used in cardiovascular diseases, gastrointestinal system. It is rich in vitamins A, C and iron to prevent obesity. Apricots contain vitamins, carotenes, flavonoids, phytosterols, phytoestrogens, antioxidants, organic acids, carbohydrates, pectins, amino acids, micro and macro elements, fiber. magnesium regulates the activity of the gastrointestinal tract; calcium strengthens bones and teeth; restores the level of	92	0,369	1,555	0,006

						potassium electrolytes, strengthens heart muscles, ensures absorption of calcium; iron increases the number of erythrocytes, increases hemoglobin, prevents anemia; iodine normalizes the activity of the thyroid gland; strontium serves to prevent caries and osteoporosis.			
Prunus persica (L.) Batsch BSU0077	Rosaceae	Shaftoli	Introduced - cultivar	Tr	Fr, L, S	It is used for diabetes, gastritis, enterocolitis, acne, wounds, infectious, skin diseases and as an immunity booster. Improves kidney, liver and heart function. Peach leaves are used to prevent headaches, gout and cancer. Stimulates the nervous system, elevates the mood and provides peace of mind. It has skin protecting and cleansing properties. It stimulates the production of collagen in human skin and destroys free radicals that are the cause of aging.	74	0,297	1,250	0,005
Pyrus communis L. BSU0148	Rosaceae	Nok	Native - cultivar	Tr	Fr, L	It is used as an antitussive, diuretic and antipyretic. Improves digestion and calms the heart. It is used in urolithiasis, goiter and gallstones. A tincture is made from the leaves to prevent pregnancy. It helps dissolve kidney and bladder stones by making uric acid salts soluble.	79	0,317	1,335	0,005

Ribes nigrum L. BSU0072	Rosaceae	Smarodina	Introduced - cultivar	Pe	Fr	Medicinal properties of currant leaves are no less than the fruit. They are rich in esters, tannins, they contain a large amount of vitamin C and other useful substances, which stabilize the activity of the nervous and circulatory systems. It has a positive effect on the cardiovascular system: it activates the heart, lowers blood pressure and increases the elasticity of blood vessels. It has a diuretic effect and removes excess fluid from the body. The acids contained in the fruit reduce the risk of blockage of blood vessels, relieve stress, and reduce the risk of developing cancer and heart disease. Black currant strengthens the immune system, destroys pathogenic bacteria, relieves fever and pain.	88	0,353	1,487	0,006
Rosa canina L. BSU0088	Rosaceae	Atirgul	Introduced - cultivar	Pe	L	Rose flower jam made with honey prevents indigestion and is used to improve digestion. If the petals are boiled and attached to swellings without squeezing, it will repel them. If rose and grape juice is boiled and applied to the gums, their strength will increase. It also works well for earache. Moisturizes the skin and increases its tension. Cleanses	78	0,313	1,318	0,005

						the skin, reduces facial blemishes and prevents facial oiliness. It delays the appearance of wrinkles on the skin of the face, helps in the rapid regeneration of skin cells and itching, and maintains the pH level of the skin. Nourishes and strengthens hair follicles.			
Rosa cinnamomea L. BSU0075	Rosaceae	Na'matak	Introduced - cultivar	Pe	Fr, Fl.	Prevents the development of diabetes, arthrosis, arthritis, cancer, arterial hypertension and cardiovascular diseases. It has a beneficial effect on carbohydrate metabolism, bone marrow, liver and gall bladder functions. It is used in the treatment of kidney, liver and intestinal diseases. Helps narrow enlarged pores on the face, perfectly nourishes, moisturizes and softens dry skin. Enhances cell renewal, heals cracks, wounds, removes scars and scars, improves skin elasticity.	65	0,261	1,098	0,004
Populus alba L. BSU0034	**S**alicaceae	Oq terak	Native - wild	Tr	B, Sh	Young shoots and leaves are used against intestinal parasites of humans and animals. It is used in the treatment of diseases of the digestive system, rheumatism and gout.	68	0,273	1,149	0,005
Capsicum annuum L. BSU0051	Solanaceae	Qalampir	Introduced - cultivar	An	Fr	It is used in the treatment of respiratory system, digestive system, cardiovascular system, cancer. It neutralizes viruses,	92	0,369	1,555	0,006

						increases immunity and rejuvenates the body. It contains endorphin hormone that improves mood and camsaicin substance prevents liver cancer. It warms the body, improves the activity of sensory organs. Strengthens the hair root.				
Lycopersicon esculentum Mill. BSU0058	Solanaceae	Pomidor	Introduced - cultivar	An	Fr	Eating more tomatoes strengthens bones, maintains their density and protects muscles from various damages. Potassium in its composition normalizes blood pressure and reduces the risk of heart and blood vessel diseases, while folic acid helps prevent heart attacks. Regular consumption of tomatoes slows down the development of neurological diseases - Alzheimer's and Parkinson's. Tomato reduces the damage of brain cells caused by alcohol, reduces the risk of prostate cancer by 18% due to the presence of calcium, selenium and lycopene. For this, men should eat at least 10 tomatoes per week. Its juice eliminates irregular heartbeat and anxiety, and the carotenoids in it reduce the risk of skin cancer by 50 percent. If applied to the roots of the hair from time to time, it provides strength, and	64	0,257	1,081	0,004

						if applied to the face, wrinkles do not increase. Tomatoes are a natural source of folic acid, which can replace some medications. Therefore, it can be consumed during pregnancy. It reduces defects in the fetal neuter tube.				
Solanum nigrum L. BSU0211	Solanaceae	Qora ituzum	Native - wild	An	Fr	As the fruit lowers blood pressure, it is useful for hypertension and atherosclerosis. It has a positive effect on cleaning the liver from fats and treating cirrhosis of the liver. It is used for neuroses, bladder spasms, stomach and intestinal pains, gout, rheumatism, cough, bronchial asthma and menstrual disorders in women. Due to its antiseptic, anti-inflammatory and antioxidant and tonic properties, it is included in natural moisturizing creams.	57	0,229	0,963	0,004
Tamarix hispida Willd. BSU0207	Tamaricaceae	Yulg‘un	Native - wild	Shrub	L, R, S.	Strengthens immunity and increases the body's protective function. A tincture made from its flowers is used as a remedy against diarrhea and stomach inflammation, uterine bleeding and spleen diseases. It is used against rheumatism, arthritis and open wounds, stomach ulcers and toothache.	43	0,173	0,727	0,003

Camellia sinensis var. *sinensis*	Theaceae	Choy	Introduced - cultivar	Shrub	L	It is used in diseases of the gastrointestinal system, nervous system, respiratory tract, eyes and heart. Having a positive effect on the body, it saturates the body with moisture, quenches thirst and relieves fatigue. Cleans the blood and face.	58	0,233	0,980	0,004
Urtica dioica L. BSU0069	Urticaceae	Gazanda yoki qichitqi o‘t	Native - wild	Pe	L	It is used to prevent anemia, gout, kidney, diabetes and as a diuretic. Strengthens hair and reduces inflammation in the body. Not recommended for pregnant women. It is used as a component with strengthening, tonic and vitaminizing, anti-inflammatory, antiseptic and restorative effects on the skin.	85	0,341	1,436	0,006
Verbena officinalis L. BSU0037	Verbenaceae	Dorivor tizimgul	Native - wild	Pe	L, St	In the treatment of diseases of the oral cavity and toothache. It is used to prevent nervous tension, disorders of the digestive system and insomnia. It is not recommended for people with high blood pressure and pregnant women. Strengthens hair, tightens face and neck skin, eliminates sarcomas. Reduces swelling of the skin and improves its color. Vegetable oil is used in rejuvenating massages and baths.	57	0,229	0,963	0,004
Vitis vinifera L. BSU0090	Vitaceae	Uzum	Native - cultivar	Pe	Fr, S	Strengthens immunity and heart muscles, increases flexibility of	75	0,301	1,267	0,005

						lymph vessels, dilates vessels, reduces headache, cholesterol content in blood, relieves constipation. Stops the development of tumors in the mammary glands, and also increases the immunity of pregnant women. Grapes prevent the development of prostate cancer in men. It has a positive effect on children's body - it improves immunity, nervous system and eyesight. Removes excess water from the body and activates metabolism. Strengthens bones, stimulates blood formation and prevents premature aging of skin and cells. Useful for skin and hair care.				
Zingiber officinale Roscoe	Zingiberaceae	Imbir	Introduced - cultivar	Pe	R	It is used to increase immunity, treat and prevent digestive system, headache, circulatory system, rheumatism, atherosclerosis, osteoarthrosis and viral diseases. It reduces blood cholesterol, increases brain activity, improves memory and reduces the risk of heart disease. It is added to various types of drinks, tea and food. It clears skin tone, heals inflammation and tightens oily skin and closes pores.	96	0,386	1,622	0,007

Tribulus terrestris L. BSU0049	Zygophyllaceae	Chag'ir temirtikan	Native - wild	An	L, St	Fruits and leaves are used to treat diseases of the kidneys and urinary tract. The roots of the plant are used as a body tonic. Tribulus herb is used as a sexual stimulant. It is used to increase the energy level in the body, to treat depression, male and female infertility, to improve the body's strength and endurance. It is used to increase impotence in men and to treat some diseases of the genitals.	69	0,277	1,166	0,005
Zygophyllum oxianum Boriss. BSU0113	Zygophyllaceae	Amudaryo tuyatavoni	Native - wild	Pe	L, Fr	It is used as an anti-inflammatory agent for treating rheumatism, eczema and wounds on the body. It has antidiabetic, hypoglycemic and antibacterial properties.	37	0,149	0,625	0,003

Abbreviations: where An=Annual, Bi=Biennial, Pe=Perennial, Shr=Shrub, Tr=Tree, B=Buds, F=Flower, Fr=Fruit, Sh=Shoots, Rh=Rhizome, R=Root, St=Stem, L=Leaves, On=Onion.

Table 3. Proportion of dominated plant families and genera recorded from the study area

Families	Number of genera / % of total genus		Number of species / % of total species	
Rosaceae	7	9.7	9	10.7
Apiaceae	7	9.7	7	8.3
Brassicaceae	5	6.9	6	7.1
Asteraceae	4	5.6	6	7.1
Amaranthaceae	4	5.6	5	5.95
Fabaceae	4	5.6	4	4.8
Cucurbitaceae	3	4.2	3	3.6
Solanaceae	3	4.2	3	3.6
Lamiaceae	2	2.8	3	3.6
Alliaceae	1	1.4	3	3.6

The top 10 families had three to nine species each, as the table above illustrates. The Cucurbitaceae, Solanaceae, Lamiaceae, and Alliaceae families each have three species, placing them in the top ten families. Whereas Asteraceae, Brassicaceae, Poaceae were found as leading medicinal plant families by Abduraimov et al. (2023). In contrast Khojimatov et al. (2020f documented Amaryllidaceae, Apiaceae and Asteraceae as the highly used in Uzbekistan. Currently, the Rosaceae family topped the list with seven genera and nine species. While Orobanchaceae, Plantaginaceae, and Poaceae have with one genus and two species each, Convolvulaceae, Moraceae, and Zygophyllaceae families each contained two genera and two species. Apocynaceae, Capparaceae, Caryophyllaceae, Cyperaceae, Elaeagnaceae, Iridaceae, Juglandaceae, Liliaceae, Lythraceae, Nitrariaceae, Papaveraceae, Pedaliaceae, Piperaceae, Polygonaceae, Portulacaceae, Salicaceae, Tamaricaceae, Urticaceae, Verbenaceae, Vitaceae, Zingiberaceae, and Zingiberaceae each contained one genus and one species (Figure 2).

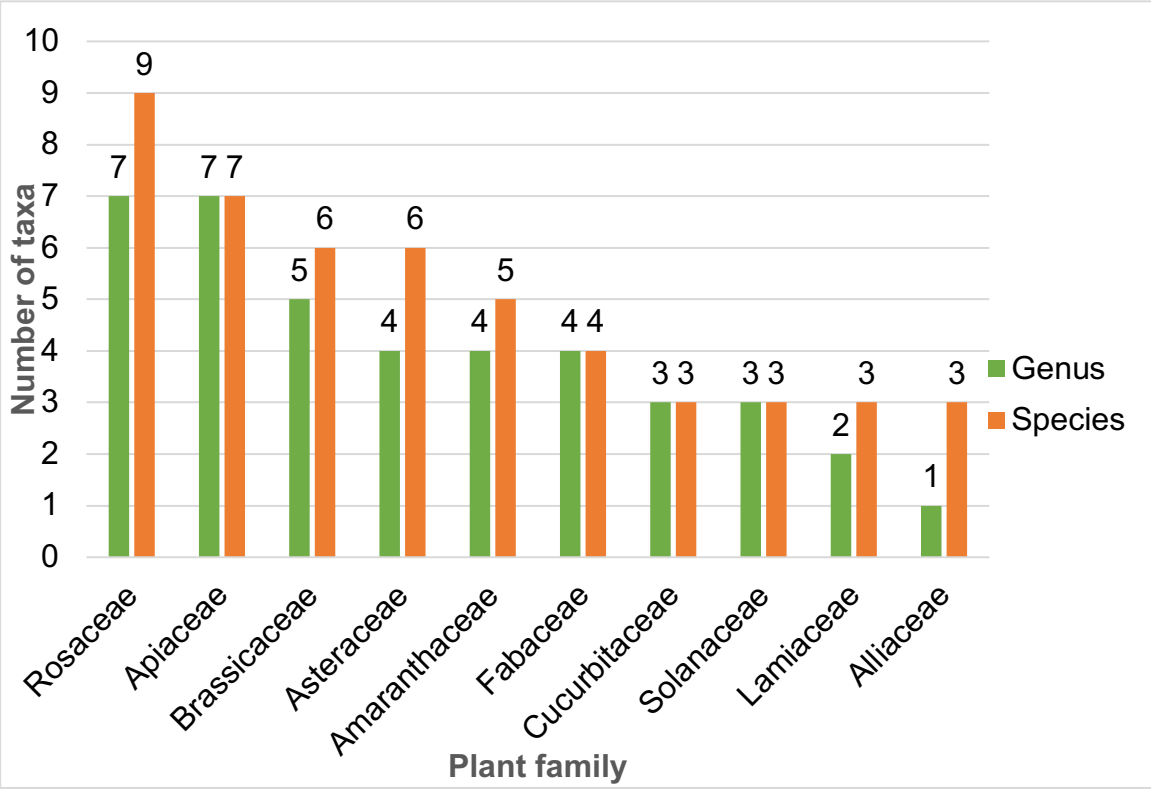

Figure 2. Proportion of dominated plant families and genera recorded from the study area

The analysis of plants based on their life forms as a result of the surveys showed that herbaceous plants were most commonly used, constituting 94% of all identified plants. Among these, annuals accounted for 41 species, biennials for 3 species, and perennials for 36 species. Life forms such as shrubs (2 species) and trees (3 species) were very rare, comprising only 6% of the total number of plants (Figure 3). Herbs are commonly used medicinally due to their ease of collection, and versatility in preparing remedies. These plants are predominantly soft, making it effortless to create remedies. Local communities readily gather herbs from their surroundings and integrate them into their daily lives for treating different ailments (Kayyani et al.,

2024). In the Bukhara region of Uzbekistan, the traditional medicinal system relies heavily on herbs with green parts, as they contain a higher concentration of active chemical compounds (Haydarovich & Kurbanovich, 2022). The findings of the present study support previous research, highlighting that herb are the primary form of medicine utilized by local communities (Khojimatov et al., 2023; Rao et al., 2015; Manzoor et al., 2023; Tangjitman et al., 2015). The plants identified during the research were divided into natural (distributed in nature) and cultivated (available as crops) species. Out of the 84 species identified, 48 were wild collected and 36 cultivated species (Figure 4).

Thirty of the cultivated species are adventive, and six are native. *Pimpinella anisum* L., Daucus sativus, *Calendula officinalis* L., *Isatis tinctoria* L., *Brassica rapa* L., *Brassica oleracea*, *Raphanus raphanistrum* subsp. *sativus*, *Cucumis sativus* L., *Citrullus colocynthis*, and other adventive cultivated species are among them. *Cucurbita pepo* L., *Crocus sativus* L., *Juglans regia* L., *Aloe vera*, *Sesamum indicum* L., *Piper nigrum* L., *Triticum aestivum*, *Zea mays* L., *Nigella sativa* L., *Rosa majalis*, *Prunus armeniaca* L., *Rosa* sp., *Fragaria* sp., *Ribes nigrum* L., *Cydonia oblonga*, *Capsicum annuum* L., *Lycopersicon esculentum* Mill., *Thea* sp., and *Zingiber officinale* L.

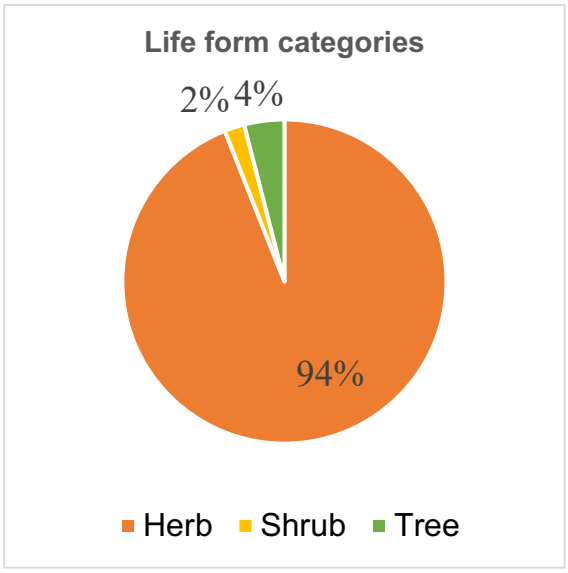

Figure 3. Life form categories of medicinal plants recorded from Bukhara Region

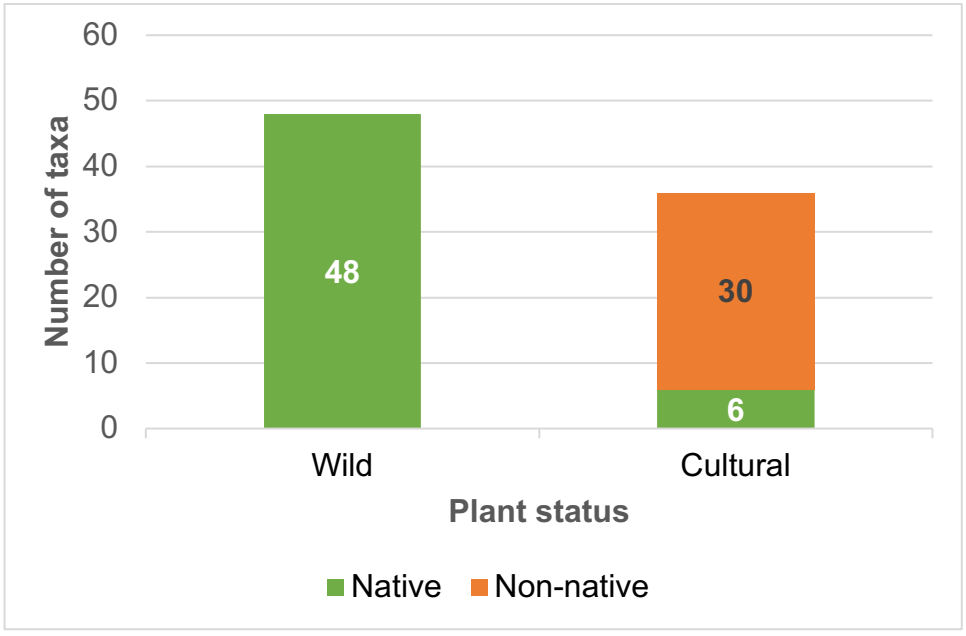

Figure 4. The role of wild and cultivated crops in ethnobotanical research

It cannot be said that the ethnobotanical surveys covered all the types used in traditional medicine. For example, adventive cultivated types such as lemon and garlic were not recorded in the surveys.

According to the analysis, 49% of the medicinal plants recognized by the local population and healers were used in infusions, while 51% were used in decoctions, ointments, and other forms. The results indicate that the infusion remedy is the most commonly used remedy in the Bukhara region of Uzbekistan. Local communities collect different parts of medicinal plants and prepare an infusion by adding these parts to hot water. This infusion is then used for treating various diseases (Motti et al., 2021). The study findings are consistent with similar patterns of medicinal remedies (Guimarães et al., 2011; Gillani et al., 2024; Talib et al., 2020). The research also found that the primary parts of medicinal plants used are leaves (52.4% or 44 species), stems (32% or 27 species), fruits (31% or 26 species), roots (27% or 24 species), seeds (20% or 17 species), flowers (11% or 9 species), and other parts (bulbs, tubers, bark, raisins, spikes, cotton, seed husks, seed beaks) accounting for 11% (9 species) of usage (Figure 5). Due to the presence of alkaloids, leaves can serve as both food and a potential source of valuable pharmaceuticals (Manzoor et al., 2024; Haq et al., 2021).

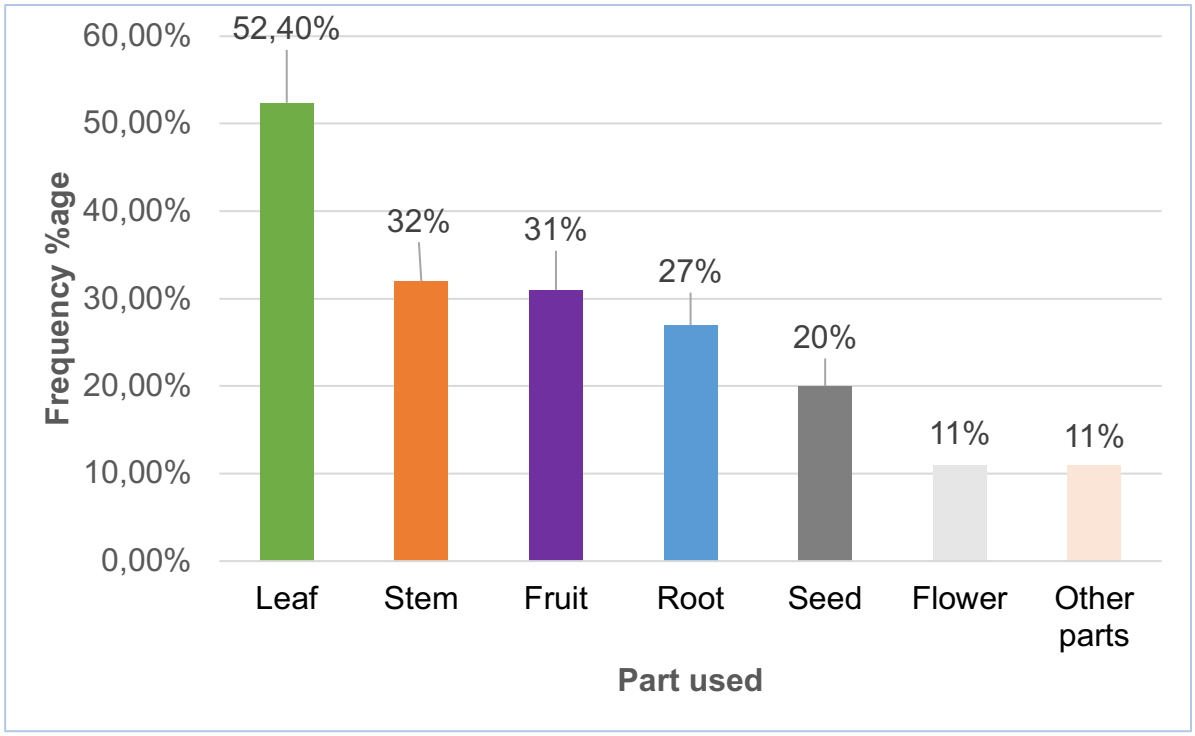

Figure 5. Proportion of plant parts used by medicinal plants for remedies

Use Value (UV) of Medicinal Plants

When assessing the level of usefulness and the awareness of medicinal plants among the local population, the use value (UV) of these plants is an important metric. A list of the species that were mentioned the most often was compiled during the research (Kosimov et al., 2023). With a UV of 0.807, *Peganum harmala* had the highest value among the studied areas. *Cucurbita pepo* (0.743), *Mentha longifolia* (0.727), *Ziziphora pedicellata* (0.679), *Brassica rapa* (0.618), *Raphanus raphanistrum* subsp. *sativus* (0.574), *Allium sativum* (0.570), *Ferula foetida* (0.474), *Capparis spinosa* (0.422), and *Glycyrrhiza glabra* (0.414) were some of the other high-use species (Table 4). The widespread use and reliance on these plants by indigenous communities highlights the strong connection between them and the local flora, particularly for treating common ailments (Manzoor et al., 2023). The presence of active biochemical components that effectively combat diseases makes these plants valuable sources of food and medicine (Murad et al., 2013). It is expected that in the future, species with high medicinal value will serve as the basis for developing new drugs. The availability of these plants, combined with the expertise of local herbalists, contributes to their high usage and makes them the preferred choice for therapy. However, it is important not to overlook the significance of medicinal plant species with low usage value. Failing to pass on their importance to future generations could result in the loss of invaluable traditional knowledge (Kayani et al., 2024).

Table 4. List of the most frequently recorded species in ethnobotanical surveys

Species	**ΣUi**	**UV**	FC	RFC
Peganum harmala	201	0,807	3,396	0,014
Cucurbita pepo	185	0,743	3,126	0,013
Mentha longifolia	181	0,727	3,058	0,012
Ziziphora pedicellata	169	0,679	2,856	0,011
Brassica rapa	154	0,618	2,602	0,010
Raphanus raphanistrum subsp. *sativus*	143	0,574	2,416	0,010
Allum sativum	142	0,570	2,399	0,010
Ferula foetida	118	0,474	1,994	0,008
Capparis spinosa	105	0,422	1,774	0,007
Glycyrrhiza glabra	103	0,414	1,740	0,007

The results of surveys indicated that plants with the lowest use values included *Cyperus rotundus* (0.048), *Artemisia scoparia*, *Eruca sativa*, *Convolvulus arvensis*, and *Cuscuta* sp., each with a use value of 0.064, making them some of the least mentioned species.

The aforementioned table indicates that in the studied region, "isiriq" (*Peganum harmala*) was the most frequently utilized and preferred species in local traditional medicine. Isiriq as mostly used in the winter and is a ceremonial plant used in a variety of rituals (Moloudizargari et al. 2013). In order to ward off the evil eye, it was also hung on house entrance doors and street gates, which may have added to the local population's growing awareness of this species. Because of their therapeutic qualities, pumpkin seeds are also well-liked by the locals in Bukhara; they are mostly used to treat digestive disorders. Many respondents noted that this plant was frequently roasted in special dishes or cooked on home heaters during the winter.

The local population used mint to make mood-boosting drinks and to shield dried fruits from various insects. It enhances mental clarity and attentiveness. When ingested on an empty stomach, mint tea increases metabolism, which contributes to weight loss, and acts as a diuretic, removing surplus water from the body (Kosimov et al., 2023). Deer grass was used to treat digestive issues, headaches, sore throats, and increased urine production. It stimulates appetite in certain ways. The local population mainly uses it to improve heart health and lower blood pressure.

Turnips were primarily used to treat respiratory conditions, high fevers, chest and throat discomfort, and heart problems. Turnips can be used to treat gout by cooking and mashing them, and their juice can be used as a mouthwash for sore throats and toothaches. It is used to treat bronchial asthma, severe cough in tuberculosis, acute laryngitis, voice loss from colds, and insomnia. It also has diuretic, wound-healing, antiseptic, and pain-relieving properties.

Relative Citation (RFC)

With the highest relative frequency citation (RFC) of 0.68 for *Peganum harmala*, the informants appeared to use it extensively. The next species with high RFC values are *Cucurbita pepo* (0.013), *Mentha longifolia* (0.012), *Ziziphora pedicellata* (0.011), *Brassica rapa*, *Raphanus raphanistrum* subsp. *sativus*, and *Allium sativum* (0.010). In contrast Kosimov et al. (2023) observed RFC values 0.055 for *Mentha longifolia*, 0.065 for *Ziziphora pedicellata*, 0.016 for *Brassica juncea*, and 0.009 for *Allium sativum*.

The local population's frequent use of these plants can be attributed to their availability and sufficient knowledge of medicinal plants. The fact that there are no rare or endangered species among these plants is comforting.
The plants with the lowest RFC values were *Artemisia scoparia (Kosimov et al., 2023)*, *Eruca sativa*, *Convolvulus arvensis*, *Cuscuta* sp., and *Cyperus rotundus* (Table 5).

Even though some plants had low RFC values, this does not necessarily mean they have poor medicinal qualities; rather, it might mean that people in the area are less aware of these plants' health benefits. Consequently, it is essential to educate the local populace about the therapeutic benefits of these plants with low RFC values.

The importance of natural plants is being highlighted more and more by the negative effects of chemical medications. Growing interest in cultivating these plants among the local population is a result of the recent trend of using natural medicinal plants for healing or prevention. The area is abundant with plant species that have high RFC values. The locals

have extensive knowledge about these plants, particularly from an ethnomedicinal perspective (Gillani et al., 2024). They have been familiar with their unique abilities to treat specific ailments for a long time, and this knowledge is deeply ingrained in the local culture. These plants, with their special properties for treating specific diseases, are much like the local remedies that are widely recognized (Pavithra et al., 2023). The plant species with high RFC values would be beneficial for phytochemical and pharmacological profiling, commercial-level authentication, and potential future drug discovery (Sher et al., 2017).

Table 5. Least frequently recorded species

Species	ΣUi	UV	FC	RFC
Isatis tinctoria	27	0,108	0,456	0,002
Artemisia annua L	26	0,104	0,439	0,002
Cynanchum acutum subsp. *sibiricum*	25	0,100	0,422	0,002
Triticum aestivum	24	0,096	0,406	0,002
Allium cepa	23	0,092	0,389	0,002
Artemisia scoparia	16	0,064	0,270	0,001
Eruca sativa	16	0,064	0,270	0,001
Convolvulus arvensis	16	0,064	0,270	0,001
Cuscuta campestris.	16	0,064	0,270	0,001
Cyperus rotundus	12	0,048	0,203	0,001

Conclusions

The local populations residing in the desert regions of Bukhara possess substantial knowledge about medicinal plants. The current study documented 84 medicinal plants that were commonly utilized. The Rosaceae family topped the list with seven genera and nine species. The herbaceous plants were most commonly used, constituting 94% of all identified plants. In plant part use patterns, leaves (52.4% or 44 species) were mostly utilized for making various kinds of remedies. *Peganum harmala*, *Cucurbita pepo* and *Mentha longifolia* are the most important species in the study area. Due to the remoteness of the study area and the lack of modern healthcare facilities, the majority of populations are dependent on these medicinal plants to treat various diseases. The study presents the first detailed exploration of indigenous ethnomedicinal knowledge from remote desert areas in Bukhara region. The desert region of Bukhara is home to diverse wild medicinal plants and traditional knowledge, both of which play a significant role in treating various ailments through primary healthcare. The study emphasizes the importance of indigenous ethnomedicinal knowledge as well as the declining interest in gaining traditional knowledge among the younger generation, possibly due to an increase in allelopathic medicinal practices. The documentation of indigenous knowledge is essential for its preservation, sharing of information in the public domain, the invention of novel medicines, and future management for the conservation of threatened flora. The elderly were most knowledgable, and as time passes, there are fewer opportunities to preserve this knowledge. Given that herbal knowledge is usually passed down from generation to generation, those practicing traditional medicine now often cannot do not fully impart their knowledge. Despite the abundance of medicinal plants in the area, not enough of the local population is aware of them. There are certain species that grow among crops and are referred to as "weeds," which many people either don't use at all or don't know about their advantageous qualities.

Declarations

List of abbreviations: Not applicable.

Ethics approval and consent to participate: All participants provided oral prior informed consent.

Conflict of interest: We all authors have no conflict of interest to declare.

Consent for publication: “Not applicable” in this section.

Availability of data and materials: All data generated or analyzed during this study are included in this published article.

Competing interests: The authors have no relevant financial or non-financial interests to disclose.

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Authors' contributions: M.T, M.Z., and R.B. designed and supervised the entire study, A.E., T.M. and O.K. conducted field surveys and collected data. O.K., A.E., T.M., M.A., G.K., N.A., A.S., D.K. and A.P. contributed in data arrangement, presentation and analysis. R.B., A.E., O.K., A.P., U.R. and N.E. played a role in the statistical interpretation of data. T.M. and M.Z. wrote the first draft of the manuscript.

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