

Species diversity and ethnobotanical inventory of wild flora used by the folk community of Shinghar Balochistan, Pakistan

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Abstract. Haq AU, Saeed S, Ahmed A. 2021. *Species diversity and ethnobotanical inventory of wild flora used by the folk community of Shinghar Balochistan, Pakistan. Nusantara Bioscience 13: 148-157.* Upper Suleiman Mountain of Shinghar Balochistan, Pakistan, is little known by outsiders, and the structural and floristic composition are poorly understood. The dominant socio-linguistic groups of the area are Pashtoon tribes, having a long history of medicinal plants utilization as a part of their indigenous primary health care system. The present study was carried out to describe the plant species diversity of Shinghar and to the inventory of some important wild medicinal, edible and endemic plants of the region. A total of 102 species belonging to 42 families and 88 genera were recorded. Herbs comprised 62% of documented plants, followed by shrubs (26%) and trees (14%). Medicinal plants of the area are being used in the treatment of many ailments like joint pains, stomach problems, skin allergies, and inflammation. Edible plants were 14% of the total recorded plants. The documented plants were also used for other use-categories than medicinal and edible purposes, including fodder, fencing, and ornamental. In addition, some of the medicinal plants were considered poisonous but used for medicine. The area's elevation ranged from 1,700 to 3,400 meters above sea level. The dominating tree was *Pinus gerardiana*, and the area is also known as the Chilghoza Forest. Asteraceae was the dominating family in the area with 14 species, followed by Lamiaceae (7 species), Poaceae (6 species), Solanaceae, Leguminosae, Fabaceae, and Apocynaceae with 5 species each. The results revealed the importance of the area's endemic and endangered plants that must be conserved. Moreover, the present study highlighted species diversity not earlier described from high altitudes.

Keywords: Floristic composition, folk uses, pinus forest, Shinghar, species diversity

INTRODUCTION

Plants play a key role in our daily life in different ways. Thousands of people have used plant resources since ancient times, such as food, medicine, daily households, live stocks, and many other ways (Cunningham 2001). Indigenous knowledge and traditional primary health care systems are predominantly common in communities throughout Asia. In addition, plant utilization by communities as medicines and religious and cultural rituals play a significant socioeconomic role (Niroula and Singh 2015; Zhu et al. 2016). Other than the rural areas, plant-based drugs are also used in urban cities. Plant-based drugs' use increases due to their afflictive role, being less expensive and having fewer side effects. Many researchers reported the different plant uses as essential oils, antioxidants, anti-inflammatory, and antidiabetic (Ahmed et al. 2020; Mustafa and Verpoorte 2007; Ntie-Kang et al. 2016).

Plants' primary and secondary metabolites are the major sources mostly used as phytomedicines and therapeutic that can be extracted from different plant parts like roots, stems, bark, leaves, flowers, seeds, and fruits, etc. (Nantongo et al. 2018; Pudziuleyte et al. 2020; Trong Le et al. 2020). Plants are a natural source of different remedies, including cough, stomach disorders, headaches, joint pains, cardiovascular diseases, diuretics, and inflammation. They are even successfully used against cancer and diabetes.

Moreover, plants are diverse in nature and effective against more than one disease at a time (Khan et al. 2018; Moattar et al. 2015).

Plant use has been in the practice of human beings since earlier times. Approximately 80% population of the world, mostly the rural regions of developing countries, continue using traditional resources in healthcare (Poonam and Singh 2009). In addition, the plants are used for food, shelter, culture, and many others. In recent years, various biophysical and socioeconomic factors have led to a depletion of natural resources across loss of ecosystem services, particularly regarding soil nutrients, water, biomass, and biodiversity. Earth is facing the threat of loss of biodiversity under excess use of plants by local communities, government and semi-government organizations, like the forest department, agriculture department, IUCN, and WWF need to work for biodiversity conservation as well as local communities work hand in hand with these organizations for saving biodiversity loss (Berkes and Turner 2006).

On the other hand, folk/traditional knowledge of the local communities decreased daily, possibly due to advanced medical techniques, allopathic medicines, and the stagnation of elder knowledge in the young generation (Pyke et al. 2001). Although ethnobotanical studies have been carried out in different parts of Pakistan, little work is documented from Northern Balochistan, Pakistan. The present study describes the floristic composition of

Shinghar Northern Balochistan, Pakistan. It will elaborate on the species diversity as well as the inventory of these plants concerning their ethnobotanical uses. It will also indicate the medicinal systems of the various indigenous people (Pushtoon tribes) of Shinghar.

MATERIALS AND METHODS

Study area

Shinghar valley is a part of the Suleiman Mountain range of Northern Balochistan, Pakistan. The hill is well-wooded with edible pine forests. The elevation ranges from 1,500 to 3,000 meters above sea level. The annual rainfall is recorded at about 8 to 10 inches. The summer is recorded as hot and dry. Although the dominant language is PUSHTO verbal by more than 90% of the inhabitants, District Sherani has not yet developed, and people spend their life beneath the shadow of ancient cultures. Many of the population rely on healing plants rather than modern medicines.

Data collection

The study was conducted in communities of four villages, i.e. (i) Shinghar, (ii) Hassanzi, (iii) Omza, and (iv) Khankhai, between 2017 and 2018. Major tribes in the study area were Khankhai, Omza, Hassanzi, Harifal, Shana, and Abraham Khail. Data were collected from 100 informants (male and female) through semi-structured interviews with the households and healers who served as key informants. In addition, we carried out community walks and plant collections. The informants were asked about age, education, occupation, and the medicinal plants, including the name of the plant, which part of the plant is used, which remedy is chosen, which disease is treated, how the plant is collected, and in which season/time, collected personally or purchased, how they store/preserve the collected plant part. Ethnobotanical uses are denoted by a numerical code as follows: (i) food, (ii) fodder, (iii) forage, (iv) medicinal, (v) ornamental, (vii) chemical, (vii) timber and other usages of wood, and (viii) fibers.

Voucher specimens

All the documented plants were collected through community walk with local communities and were examined to determine the botanical family and species name. The plants were preserved and identified with the help of a taxonomist. The plant specimens were submitted to the Botanical Garden Herbarium, the University of Balochistan Quetta, for future recodes.

Data analysis

Data were tabulated to analyze the total number of medicinal plants. Each plant is listed according to its family. Plants were also arranged according to their uses reported by the informants. The collected data were analyzed into two objectives, i.e. (i) The inventory listed the records of plants in the area and their relevant data. The use-value (UV) is also calculated to estimate the relative importance (RI) based on the number of plant use reported

and the number of informants, (ii) Floristic compositions were calculated by (Whittaker 1972). Species diversity was calculated by (Nei and Li 1979) by using the formula Simpson index $D = \frac{1}{\sum p_i^2}$ and Shannon index $H = -\sum p_i \ln p_i$.

RESULTS AND DISCUSSION

Plant floristic composition and diversity represented the variation along the altitudinal gradient. A total of 102 plant species belonging to 42 families were recorded at 1,700 to 3,400 meters above sea level (Table 1). The highest record was the Asteraceae family with 14 species, followed by Lamiaceae (7 species), Poaceae (6 species), Solanaceae, Leguminosae, Fabaceae, and Apocynaceae with 5 species each. The recorded numbers of Rosaceae were 4 species, including an economically important tree, *Prunus dulcis*. The record showed Chenopodiaceae, Convolvulaceae, Rhamnaceae, and Zygophyllaceae with 3 species each. The recorded numbers of Anacardiaceae, Boraginaceae, Caryophyllaceae, Ephedraceae, Euphorbiaceae, Malvaceae, Oleaceae, Pinaceae, and Salicaceae were 2 species each. The economically important tree species included *Pinus gerardiana* (Chilghoza tree; Pinaceae) and *Olea ferruginea* (Zaitoon; Oleaceae).

All other families with 1 species included Amaryllidaceae, Apiaceae, Asparagaceae, Berberidaceae, Brassicaceae, Buxaceae, Campanulaceae, Gentianaceae, Menispermaceae, Moraceae, Morinaceae, Myrtaceae, Nitrariaceae, Papaveraceae, Plantaginaceae, Plumbaginaceae, Polygonaceae, Rubiaceae, Sapindaceae, Tamaricaceae, and Thymelaeaceae.

Table 2. Species richness based on Simpson's Index of Diversity along the altitudinal gradient

Elevation	No. of individuals	F	RF	D
Low	34	306	0.24	0.12
Mid	47	423	0.33	0.22
High	62	558	0.43	0.38
Total	143	1287	1	0.72

Note: F: Frequency, RF: Relative Frequency, D: Simpson's Index of Diversity

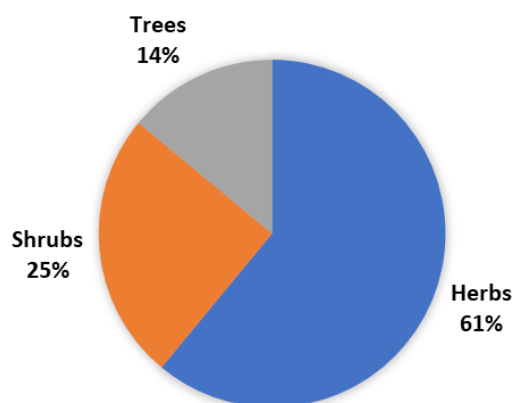


Figure 1. Distribution of life-form

Table 1. List of plants reported from the study area

Botanical name	Family	Local name	Parts used	Fodder	Medicines	Vegetables/ fruits	Livestock	Fuel	Others	Earlier reports
<i>Allium griffithianum</i> Boiss.	Amaryllidaceae	Pyaz	WP	*	*	*				Yes
<i>Pistacia atlantica</i> Desf.	Anacardiaceae	Shiney	F, L		*	*		*		Yes
<i>Pistacia khinjuk</i> Stocks	Anacardiaceae	Shinay	F, L		*	*		*		Yes
<i>Foeniculum vulgare</i> Mill.	Apiaceae	Kaga	WP		*	*				Yes
<i>Calotropis procera</i> (Aiton) Dryand	Apocynaceae	Spelmi	WP	*	*					Yes
<i>Caralluma tuberculata</i> N.E.Br.	Apocynaceae	Unknown	F		*	*				Yes
<i>Periploca aphylla</i> Decne.	Apocynaceae	Bara	WP	*	*	*		*		Yes
<i>Nerium oleander</i> L.	Apocynaceae	Gandeeri	WP						*	Yes
<i>Rhazya stricta</i> Decne.	Apocynaceae	Ghanderay	WP		*	*		*		Yes
<i>Asparagus capitatus</i> Baker	Asparagaceae	Unknown	WP	*						No
<i>Ajania fruticulosa</i> (Ledeb.) Poljakov	Asteraceae	Unknown	NUR							Yes
<i>Artemisia stenocephala</i> Krasch. Ex Poljakov	Asteraceae	Tharkha	WP		*					Yes
<i>Cirsium arvense</i> (L.) Scop.	Asteraceae	Spinboti azghi	WP		*					Yes
<i>Cousinia prolifera</i> Jaub. & Spach	Asteraceae	Da vezo azghi	WP	*						Yes
<i>Launaea acanthodes</i> (Boiss.) Kuntze	Asteraceae	Aghzai/Zoz	WP	*						Yes
<i>Launaea acaulis</i> (Roxb.) Babc. ex Kerr	Asteraceae	Unknown	NUR							No
<i>Lactuca dissecta</i> D.Don	Asteraceae	Unknown	NUR							Yes
<i>Lactuca serriola</i> L.	Asteraceae	Markwraka	WP	*	*	*	*			Yes
<i>Phagnalon niveum</i> Edgew.	Asteraceae	Unknown	NUR							Yes
<i>Pulicaria undulata</i> (L.) C.A.Mey	Asteraceae	Unknown	NUR							Yes
<i>Tagetes minuta</i> L.	Asteraceae	Unknown							*	Yes
<i>Tragopogon gracilis</i> D.Don	Asteraceae	Gwaryshlgi	WP	*						Yes
<i>Xanthium strumarium</i> L.	Asteraceae	Genjali	F	*	*					Yes
<i>Verbesina encelioides</i> (Cav.) Benth. & Hook.f. ex A.Gray	Asteraceae	Unknown	NUR							Yes
<i>Berberis calliobotrys</i> Bien. ex Koehne	Berberidaceae	Unknown	F	*	*					Yes
<i>Lappula barbata</i> (M.Bieb.) Gürke	Boraginaceae	Unknown	NUR							Yes
<i>Onosma limitaneum</i> I.M. Johnst.	Boraginaceae	Unknown	NUR							Yes
<i>Sisymbrium irio</i> L.	Brassicaceae	Jangli sarso	S	*	*					Yes
<i>Buxus papillosa</i> C.K.Schneid.	Buxaceae	shamshad	NUR							Yes
<i>Campanula sulaimanii</i> Nasir.	Campanulaceae	Unknown	NUR							Yes
<i>Dianthus crinitus</i> Sm.	Caryophyllaceae	Unknown	NUR							Yes
<i>Saponaria subrosularis</i> Rech. f.	Caryophyllaceae	Unknown	NUR							No
<i>Chenopodium album</i> L.	Chenopodiaceae	Sarma	L	*	*	*				Yes
<i>Haloxyton griffithii</i> (Moq.) Boiss	Chenopodiaceae	Showri	WP					*	*	Yes
<i>Salsola kali</i> subsp. <i>tragus</i> (L.) Čelak.	Chenopodiaceae	Calbi	WP	*						Yes
<i>Convolvulus arvensis</i> L.	Convolvulaceae	Unknown	WP	*	*					Yes
<i>Convolvulus spinosus</i> Burm. f.	Convolvulaceae	Unknown	WP	*						Yes
<i>Evolvulus alsinoides</i> (L.) L.	Convolvulaceae	Shankh Pushpi	WP							No
<i>Ephedra intermedia</i> Schrenk & C.A.Mey.	Ephedraceae	Oman	WP		*			*		Yes

<i>Ephedra major</i> subsp. <i>procera</i> (C.A.Mey.) Bornm.	Ephedraceae	Oman	WP		*			*	Yes
<i>Chrozophora tinctoria</i> (L.) A.Juss.	Euphorbiaceae	Gujri	WP	*				*	Yes
<i>Ricinus communis</i> L.	Euphorbiaceae	Sharwan	L		*			*	Yes
<i>Alhagi maurorum</i> Medik	Fabaceae	Zoz	WP	*					Yes
<i>Caragana ambigua</i> Stocks	Fabaceae	Makhi	WP	*				*	Yes
<i>Lotus corniculatus</i> L.	Fabaceae	Spasti	WP	*					Yes
<i>Sophora mollis</i> (Royle) Baker subsp. <i>griffithii</i> (Stocks) Ali	Fabaceae	Ghozera	WP	*				*	Yes
<i>Vigna adiate</i> (L.) R.Wilczek	Fabaceae	Shin mong	S	*					No
<i>Gentiana kuroo</i> Royle	Gentianaceae	Unknown	NUR						No
<i>Marrubium vulgare</i> L.	Lamiaceae	Sperboti	L		*				Yes
<i>Moluccella otostegioides</i> Prain (Prain) Hedge & Rech.f.	Lamiaceae	Unknown	NUR						No
<i>Phlomidioschema parviflorum</i> (Benth.) Vved.	Lamiaceae	Spranda	L		*				No
<i>Salvia moorcroftiana</i> Wall. ex Benth.	Lamiaceae	Spera boti	WP	*					Yes
<i>Salvia nubicola</i> Wall. ex Sweet	Lamiaceae	Khar kwage	R		*				Yes
<i>Scutellaria petiolata</i> Hemsl. ex Lace & Prain	Lamiaceae	Unknown	NUR						No
<i>Vitex negundo</i> L.	Lamiaceae	Marmandi	L		*				Yes
<i>Astragalus corrugatus</i> Bertol.	Leguminosae	Unknown	WP	*					No
<i>Astragalus stocksii</i> Bunge	Leguminosae	Unknown	WP	*					No
<i>Astragalus subumbellatus</i> Klotzsch.	Leguminosae	Unknown	NUR						No
<i>Prosopis juliflora</i> (Sw.) DC.	Leguminosae	Kekar / afghani	WP	*				*	Yes
<i>Taverniera cuneifolia</i> (Roth) Ali	Leguminosae	Spera barara	WP					*	No
<i>Abutilon bidentatum</i> Hochst. ex A.Rich.	Malvaceae	Unknown	NUR						Yes
<i>Malva neglecta</i> Wallr	Malvaceae	Unknown	R		*				Yes
<i>Cocculus pendulus</i> (J.R.Forst. & G.Forst.) Diels	Menispermaceae	Unknown	NUR						No
<i>Ficus carica</i> L.	Moraceae	Anzar	L		*		*		Yes
<i>Morina persica</i> L.	Morinaceae	Unknown	WP		*		*		No
<i>Eucalyptus camaldulensis</i> Dehnh	Myrtaceae	Lachi	WP					*	Yes
<i>Peganum harmala</i> L.	Nitrariaceae	Spanda	L, S		*				Yes
<i>Fraxinus xanthoxyloides</i> (G.Don) Wall. ex A.DC.	Oleaceae	Unknown	WP					*	Yes
<i>Olea ferruginea</i> Wall. ex Aitch.	Oleaceae	Kao	S		*		*		Yes
<i>Papaver decaisnei</i> Hochst. & Steud. ex Elkan	Papaveraceae	Unknown	WP					*	Yes
<i>Pinus gerardiana</i> Wall. Ex D.Don	Pinaceae	Chalguza	S		*		*		Yes
<i>Pinus wallichiana</i> A.B.Jacks	Pinaceae	Unknown	WP					*	Yes
<i>Plantago major</i> L.	Plantaginaceae	Parpanra	L		*				Yes
<i>Limonium cabulicum</i> (Boiss.) Kuntze	Plumbaginaceae	Gowagi	L		*				Yes
<i>Aristida adscensionis</i> L.	Poaceae	Masali	WP						Yes
<i>Melica persica</i> Kunth.	Poaceae	Unknown	WP					*	Yes
<i>Paspalum dilatatum</i> Poir	Poaceae	Shokholi	WP	*					Yes
<i>Pennisetum orientale</i> Rich.	Poaceae	Unknown	WP	*					Yes
<i>Polypogon monspeliensis</i> (L.) Desf.	Poaceae	Sphera washa	WP	*					Yes
<i>Saccharum spontaneum</i> L.	Poaceae	Sarghsa	WP	*				*	Yes
<i>Pteropyrum olivieri</i> Jaub. & Spach	Polygonaceae	Unknown	L		*				Yes
<i>Sageretia thea</i> (Osbeck) M.C. Johnst.	Rhamnaceae	Manrey	F		*		*		Yes
<i>Ziziphus jujuba</i> Mill.	Rhamnaceae	Unknown	WP	*	*	*		*	Yes
<i>Ziziphus oxyphylla</i> Edgew.	Rhamnaceae	Unknown	WP	*	*	*		*	No

<i>Prunus brahuica</i> (Boiss.) Aitch. & Hemsl.	Rosaceae	Zargha/Kundzari	F		*	*	*	Yes
<i>Prunus dulcis</i> (Mill.) D.A.Webb	Rosaceae	Badam	F		*	*	*	Yes
<i>Prunus rechingeri</i> (Browicz) R.R.Stewart	Rosaceae	Unknown	F		*	*	*	No
<i>Cotoneaster persicus</i> Pojark.	Rosaceae	Sharave	L		*			No
<i>Plocama macrantha</i> (Blatt. & Hallb.) M.Backlund & Thulin.	Rubiaceae	Kharbat	WP	*				Yes
<i>Dodonaea viscosa</i> (L.) Jacq	Sapindaceae	Unknown	L		*			Yes
<i>Populus euphratica</i> Oliv.	Salicaceae	Spana	ST		*		*	Yes
<i>Salix acmophylla</i> Boiss.	Salicaceae	Wana	WP		*		*	Yes
<i>Datura innoxia</i> Mill.	Solanaceae	Badboya Boti	L		*			Yes
<i>Hyoscyamus insanus</i> Stocks	Solanaceae	Unknown	WP		*			Yes
<i>Solanum rostratum</i> Dunal.	Solanaceae	Marhaghonay	WP	*	*			Yes
<i>Solanum surattense</i> Burm.f	Solanaceae	Marhaghonai	WP	*	*			Yes
<i>Withania coagulans</i> (Stocks) Dunal	Solanaceae	Khamazura	S		*			Yes
<i>Tamarix aphylla</i> (L.) H.Karst	Tamaricaceae	Ghaz	WP	*		*	*	Yes
<i>Daphne mucronata</i> Royle.	Thymelaeaceae	Laghoni	WP		*			Yes
<i>Fagonia bruguieri</i> DC	Zygophyllaceae	Azghi	WP		*			Yes
<i>Tribulus pentandrus</i> Forssk	Zygophyllaceae	Kroundki/wazi	S	*	*			Yes
<i>Tribulus terrestris</i> L.	Zygophyllaceae	Kroundki/wazi	S	*	*			Yes

Note: S: Seeds, WP: Whole Plant, F: Flowers, ST: Stem, L: Leaf, R: Root, NUR: No use report

The species reported were classified based on their life form (Figure 1). The herbs were dominant in the area, represented by 62 species (61%), followed by shrubs (26 species; 25%) and tree species (14 species; 14%).

Plant parts used and modes of preparation

Different plant parts used for medicinal purposes are listed in Table 1. The most dominant plant part was whole plants (51), followed by leaves (15), flowers (10), and seeds (8), whereas a few roots and stems were also reported. The most common method of preparing the medicinal plants was decoction, followed by crushing the plant material for making a poultice (23.1%), broth (4.1%), and soaking in alcohol (2.5%). Some species were mixed with other natural materials, such as the preparation of tonics made of medicinal plants combined with brown sugar, grains, chicken, pork, and other materials.

Plant uses

The documented plants included medicinal as well as some other plants. The medical plants recorded 36% of the reported plants, followed by fodder (26%), edible/food (14%), and fuel (13%). Livestock was recorded at 4%, and the remaining uses (9%) included construction, fencing, cloth dye, ornamental, and yokes. The results showed that the community used medicinal plants in different ways. Some uses were unique to the region and not reported earlier from any region of Balochistan. In contrast, other uses were common to other communities of neighboring villages in other parts of Balochistan, Pakistan.

Plants used as a food

Some fruits were edible and used by the community of Shinghar listed in Table 1. They included *Pinus gerardiana*, which is very important in the area. Fruit is very popular and taken as dry fruit. Fruits/berries of *Pistacia atlantica*, *P. khinjuk*, and *Berberis calliobotrys* are important medicinal plants used as dry fruits by local communities. *Foeniculum vulgare* (Apiaceae) seeds are flavoring agents used in baking different things, as well as cooking meat and fish to improve flavor. *Allium griffithianum* was used as a vegetable in cooking different types of food. *Caralluma tuberculata*, also known as Pamanky in Pashto, was cooked and eaten as a vegetable. *Artemisia stenocephala* was used to give a taste to milk. The leaves of *Chenopodium album* were boiled in water and eaten as a vegetable. The fruit of *Ficus carica* is used as dry fruit and also consumed as fresh fruit. The fruit of *Olea ferruginea* was a very healthy and valuable source of food in the area. The leaves of *Morina persica* were used to make tea.

Plants used as traditional medicines

A total of 36% of reported plants were used in traditional medicines (Table 1). *Allium griffithianum* was used as food as well as medicinal importance, used to treat jaundice and flatulent dyspepsia. The fruits of *Pistacia atlantica* and *P. khinjuk* were edible sources for the community of Shinghar; the medicinally important fruit was used to treat stomach diseases, renal disorders,

wounds, and coughs. *Foeniculum vulgare* (Apiaceae), commonly known as fennel, was a well-known and important medicinal and aromatic plant widely used as a carminative, digestive, galactagogue, diuretic, and treating respiratory and gastrointestinal disorders. *Caralluma tuberculata* was also used as a folk medicine to treat diabetes and rheumatism. *Periploca aphylla* is used to treat tumors, and swellings latex of the plant is applied on infected areas and joints with inflammation. The plant is also known as "Bata" or "Barara." The plant is also used to treat cough and flu. *Rhazya stricta* is also known as a Blood purifier plant used to treat diabetes. The powder of *Cirsium arvense* (Syn *Carduus arvensis*) was used for toothache. *Launaea acanthodes* is a very important plant, and many studies are found on its essential oil extraction. *L. acaulis* was used as a diuretic and stomachic. *Berberis calliobotrys* are the local communities of Shinghar that also use a very important medicinal plant, the roots of *Berberis*. The seed powder of *Sisymbrium irio* was used for treating asthma and produced a cooling effect to treat stomach disorders, constipation, and abdominal pain. The whole plant of *Evolvulus alsinoides* was used to treat fever and neuro disorders. *Ephedra intermedia* was used to treat asthma, and *E. major* subsp. *procera* juice was used for treating asthma. The powder of *Ricinus communis* was used for stomach pain. The decoction of leaves of *Marrubium vulgare* was used for gastric gas. The ground leaves powder of *Phlomischema parviflorum* was used for wound recovery. The decoctions of roots of *Salvia nubicola* were used for cough and cold. The leaves of *Vitex negundo* were used for gastric gas and pain. *Ficus carica* was used for blood purification. The leaves of *Peganum harmala* were mixed with oil and boiled for a few minutes, and then filtered juice was used for muscle and joint pains, while seeds were used for gastric problems. The leaves of *Plantago major* were used for tonic and antiseptics. The juice of ground leaves of *Limonium cabulicum* was used for stomach problems. The seeds of *Withania coagulans* were put into the water for a night and, early in the morning, drank it, which was useful against malaria. The power of *Fagonia bruguieri* was used for asthma diseases. *Tribulus terrestris* was used for kidney disorders.

Plants used for fuel

Plant diversity was disturbed due to the excessive use of plants as fuel (Table 1). It mostly included *Populus euphratica*, *Pistacia atlantica*, *P. khinjuk*, *Berberis calliobotrys*, *Buxus papillosa*, *Caragana ambigua*, *Sophora mollis* subsp. *griffithii*, *Prosopis juliflora*, *Taverniera cuneifolia*, *Eucalyptus camaldulensis*, *Fraxinus xanthoxyloides*, *Olea ferruginea*, *Pinus gerardiana*, *Pinus wallichiana*, *Ziziphus jujube*, *Ziziphus oxyphylla*, *Prunus brahuica*, *Prunus dulcis*, *Prunus rechingeri*, *Populus euphratica*, *Salix acmophylla*, *Tamarix aphylla*, *Ephedra intermedia*, and *E. major* subsp. *procera*.

Plants used as fodder

One of the key roles of the plants was their use as fodder (Table 1). Reported fodder plants were *Alhagi maurorum*, *Buxus papillosa*, *Cousinia prolifera*, *Caragana*

ambigua, *Lotus corniculatus*, *Vigna adiate*, *Salvia moorcroftiana*, *Prosopis juliflora*, *Aristida adscensionis*, *Paspalum dilatatum*, *Polypogon monspeliensis*, *Saccharum spontaneum*, *Prunus dulcis*, *Solanum rostratum*, *S. surattense*, *Tragopogon gracilis*, *Tribulus pentandrus*. Whole plants were used as fodder.

Plants to treat animal bites and mosquito repellent

Calotropis procera leaves were used to treat Scorpion bites (Table 1), while the leaves of *Daphne mucronata* were used as a mosquito repellent. *Verbesina encelioides* was used as an insecticide.

Plants used to treat skin diseases

The leaves of *Daphne mucronata*, *Periploca aphylla*, *Buxus papillosa*, and *Ziziphus jujuba* were used to treat skin diseases/infections. In addition, the latex of *Calotropis procera* was used to treat skin diseases known as Sponi in the local language (Table 1).

Other uses

Nerium oleander, *Tagetes minuta*, and *Papaver decaisne* were used for ornamental purposes (Table 1). *Tamarix aphylla* and *Chrozophora tinctoria* were used to dye the clothes. *Caragana ambigua* was used for fencing, while *Fraxinus xanthoxyloides* was used to make yokes.

Species diversity

A total of 102 plants reported from the study area showed species diversity along the altitudinal gradient. Rich species diversity was obtained at high altitudes followed by middle elevation, and low diversity was obtained at low elevation zone. Therefore, the species richness of the Shinghar mountain range was assessed along the altitudinal gradient shown in Table 2. Simpson's Index of Diversity was higher at high elevations, followed by middle and low elevations (Table 2).

Discussion

Ethnobotanical inventory in the folk community of Shinghar

The 102 documented plant species belong to 42 families, and the highest record was the Asteraceae family, with 14 species. Medicinal plants of the Asteraceae family have previously been shown to be commonly used by rural communities in Pakistan Balochistan (Durrani and Hussain 2005; Sarangzai et al. 2013; Tareen et al. 2010). Asteraceae is one of the advanced families of seed plants worldwide and is easily available in local communities to be used as a vegetable, fruit, seasoning, and starch (Sui et al. 2011). *Ajania fruticulosa* was recorded from the informants of Shinghar earlier, but the essential oils of *A. fruticulosa* were isolated by (Liang et al. 2016) and (Abbas et al. 2020). *Artemisia stenocephala* was used to taste milk; the earlier study was reported from Northern Areas of Pakistan (Ashraf et al. 2010). The powder of *Cirsium arvense* (Syn *Carduus arvensis*) was used for toothache; in earlier reports, it was found to improve digestion and used for child worms (Tufail et al. 2020; Yasine et al. 2013). The whole *Cousinia prolifera* plant was used as fodder; in an earlier study, the plant was reported for treating diabetes

mellitus II in South-West Pakistan (Zain-ul-Abidin et al. 2018). *Launaea acanthodes* is a very important plant; many reports were found on its essential oil extraction and medicinal uses around the world (Mood 2008; Taherian et al. 2018), while *L. acaulis* was used as a diuretic, stomachic, and blood purifier (Jain et al. 2010). *Lactuca serriola* is a medicinally important plant; earlier reports were from different ecological zones of Pakistan, the Wana District of South Waziristan, and Balochistan. In the present study, *L. serriola* was reported for livestock. *Lactuca dissecta* was reported from the Himalaya and Hindukush ranges of Pakistan Dir, Timergara KPK, Pakistan (Shuaib et al. 2019). *Phagnalon niveum* was reported from the Biodiversity of Shinghar area, but the use report was not recorded from the communities of Shinghar. In earlier reports from Balochistan, the plant was used as an anticancer, also reported from Nowshera KPK, Pakistan (Ali et al. 2019). *Pulicaria undulata* (Syn. *Pulicaria crispa*) was earlier reported from Indus plans Pakistan (Khan and Qaiser 2006). No use report was recorded from the communities of Shinghar. Essential oils of *P. undulata* are used for antimicrobial activity (Mohamed et al. 2020). No use report of *Tagetes minuta* was recorded from the communities of Shinghar; leaves paste typically used for wound healing, has anti-inflammatory and bronchodilatory (Abbasi et al. 2010), and is also used as a bio-herbicide for weed control (Sadia et al. 2013). *Tragopogon gracilis* was reported as fodder from the Shinghar. In earlier records, *T. gracilis* was reported from Dir Upper, Khyber Pakhtunkhwa, Pakistan (Awasthi et al. 2003). *Xanthium strumarium* is a noxious weed; earlier reports were found from the Takht-e-Suleman range FR D.I. Khan, Pakistan (Samreen et al. 2016). As a traditional herbal medicine, *X. strumarium* has been extensively applied to treat many diseases, such as rhinitis, nasal sinusitis, headache, gastric ulcer, urticaria, rheumatism bacterial, fungal infections, and arthritis (Fan et al. 2019). *Verbesina encelioides* is regarded as a notorious weed and an ornamental garden; the plant has been found to have various uses in folk medicine in different parts of the world. It possesses analgesic, emetic, febrifuge, and insecticidal properties (Jain et al. 2008). The Lamiaceae family comprises aromatic plants, the second dominating family used by Shinghar community. The family includes the taxa used for a stomach disorder. It was also reported from Balochistan, Pakistan, that the decoction of leaves of *Marrubium vulgare* and *Vitex negundo* were used for gastric gas (Bibi et al. 2014). Five species of *Ephedra* were found in Balochistan (Saeed et al. 2015). Medicinal plants have been used by local communities of Balochistan, Pakistan, for centuries (Adnan et al. 2014; Ahmad and Husain 2008; Ahmed 2020). The *E. intermedia* was used as a source of fuelwood and ephedrine nasal drops. It is mixed with tobacco for the preparation of good quality, and it was also used for the treatment of asthma. The juice of *Ephedra major* subsp. *procera* was used for treating asthma (Bibi et al. 2014). *Allium griffithianum* was used as food and had medicinal importance, used to treat jaundice and flatulent dyspepsia for people of any age, including children, as reported by (Amjad et al. 2020; Arshad et al. 2014; Jan et al. 2016). The fruits of *Pistacia*

atlantica and *P. khinjuk* were edible sources for the community of Shinghar and were medicinally used to treat stomach diseases, renal disorders, wounds, and coughs. Our findings agreed with earlier reports of *Pistacia* species (Bibi et al. 2014; Mahjoub et al. 2018; Sarangzai et al. 2013). *Foeniculum vulgare* aromatic plant has medicinal importance and is commonly known as fennel, and its commonly used for treating digestive problems. Seeds are also used to improve flavor in cooking meat etc. (Xiong et al. 2020). Phytochemicals of *F. vulgare* include different Phenols, phenolic glycosides, and volatile aroma, trans-anethole, estragole, and fenchone (Andrade-Cetto 2009). Earlier, its many *in vitro* and *in vivo* uses are reported as antifungal, antibacterial, antioxidant, antithrombotic, and hepatoprotective (Rather et al. 2016; Samreen et al. 2016). The fruit and latex of *Calotropis procera* have medicinal properties; leaves were used to treat Scorpion bites, while latex was used to cure skin diseases known as Sponi in the local language. The root powder of *C. procera* mixed with goat milk was used in epilepsy, as earlier reported by (Bhatti et al. 1998; Panhwar and Abro 2007; Parihar and Balekar 2016). *Caralluma tuberculata*, also known as Pamanky in Pashto, was cooked and eaten as a vegetable. It is used to treat diabetes and rheumatism by folk communities (Rauf et al. 2013; Bibi et al. 2014). *Periploca aphylla* is earlier reported for treating skin diseases, ulcers, and constipation (Iqbal et al. 2012; Samreen et al. 2016). In many cases, *Nerium oleander* is a potentially lethal plant and reported poisoning, used for ornamental purposes. The leaves and flowers have been reported to have medicinal properties (Farooqui and Tyagi 2018). Earlier reported uses were cardiotoxic, diaphoretic, diuretic, anticancer, antibacterial, and anticancer. Flowers, leaves, leaf juice or latex, bark, and roots have been used against corns, warts, cancerous ulcers, carcinoma, ulcerating or hard tumors (Begum et al. 1999).

Rhazya stricta is also known as a blood purifier plant and is used to treat diabetes. Some uses against the allergy were also reported in the current study. Earlier reports from different areas of Balochistan used different decoctions for various unrelated illnesses like diabetes mellitus, fever, sore throat, inflammatory conditions, and helminthiasis (Panhwar and Abro 2007; Bibi et al. 2014; Samreen et al. 2016). *Asparagus capitatus* is described as food and medicine for various ailments. The earlier report from Balochistan was (Attaullah and Muhammad 2016). *Berberis calliobotrys* is a very important medicinal plant. The berries have been reported to have medicinal importance and are consumed as dry fruits. The plant root is also used by the local communities of Shinghar (Saeed et al. 2016). Also, earlier reports were for anti-inflammatory, analgesic, and antipyretic activities (Alamgeer et al. 2016). No use report of *Lappula barbata* is from the communities of Shinghar, but earlier reports elaborated on its importance in antiviral and anti-inflammatory activities (Soliman et al. 2016). Also, no use report of *Onosma limitaneum* is from the interviews of communities during the survey of Shinghar, but the plant has been identified to have great medicinal importance (Sarangzai et al. 2013). Different species of *Onosma* are reported to have anti-inflammatory,

anticancer, and anti-nociceptive activities (Tosun et al. 2008). The seed powder of *Sisymbrium irio* was used for treating asthma and producing a cooling effect to treat stomach disorders, constipation, and abdominal pain. Earlier studies reported the plant had been used in folk medicine to treat febrifuge, asthma, and fevers (Al-Qudah and Abu Zarga 2010; Bibi et al. 2014; Samreen et al. 2016). *Buxus papillosa* was traditionally used for food, shelter, fodder, health care, and other cultural purposes. Earlier studies reported the plant had been extensively utilized in the indigenous medicinal system for treating common ailments, including skin infections, malaria, and rheumatism (Asif et al. 1992; Saleem et al. 2019). *Campanula sulaimanii* was used as fodder in the Shinghar. The plant is endemic to the region; Our findings agree with an earlier report (Badshah et al. 2016). The leaves of *Peganum harmala* are mixed with oil and boiled for a few minutes, and then filtered juice was used for muscle, and joint pain, while seeds were used for gastric problems. *Fagonia bruguieri* was used for asthma diseases, while *Tribulu terrestris* was used for kidney-related issues (Bibi et al. 2014; Ahmed et al. 2020).

Species richness and conservation

The species diversity of edible, medicinal, and other ethnobotanical plants reported from Shinghar showed a different pattern than earlier reports from different zones of Balochistan. Few plants were reported in species diversity, but no use was recorded from the Shinghar communities of four studied villages. Whereas some medicinal plants used were reported by Shinghar communities but not found in our field surveys. The uses of medicinal plants and remedies we have documented indicate the vast knowledge of the old age community, which may serve to supplement the whole medicinal system in the area so that they should be protected and maintained.

In conclusion, medicinal plants used by the Pashtoon tribes in Shinghar Balochistan are very diverse. One hundred and twenty-one species belonging to 54 families were documented for treating various ailments based on ethnobotanical appraisal in four villages of the study area. Few ethnobotanical records were documented for the first time. According to reported information by local communities, the leaves and whole plants used reports were higher. However, this indigenous knowledge of the communities must be conserved urgently as, with time, this knowledge is depleting daily. That is best accomplished by documenting the unique knowledge and practice of ethnic groups concerning medicinal plants.

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