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

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Manuscript received: 30 July 2021. Revision accepted: 16 August 2021.

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, 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 were dominant comprising 62% of documented plants, followed by shrubs (26%), and trees (14%). Medicinal plants of the area are being used in treatments of many ailments like joint pains, stomach problems, skin allergies and inflammation. Edible plants were 14% of 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. Elevation of the area ranged from 1700 to 3400 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 endemic and endangered plants of area which are need to be conserve. 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 around the world were using plant resources since ancient times that may be as food, medicine, daily households, live stocks, or many other different ways (Cunningham 2001). Indigenous knowledge and traditional primary health care systems are predominantly common in communities throughout Asia. Plants utilization by communities as medicines, religious and cultural rituals play a significant socio-economic role (Niroula and Singh 2015; Zhu et al. 2016). Other than the rural areas, nowadays, plant-based drugs are used in urban cities as well. The uses of plant-based drugs increase 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; Nite-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; Pudziuvelyte et al. 2020; Trong Le et al. 2020). Plants are a natural source used for different remedies including cough, stomach disorder, headache, joint pains, cardiovascular diseases, diuretic, inflammation, and even are successfully used against cancer and diabetes. Plants are diverse in nature, effective against more than one disease at a time (Khan et al. 2018; Moattar et al. 2015).

Plant use is 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). The plants are being used as 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 in terms of 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 forest department, agriculture department, IUCN, and WWF need to work for the biodiversity conservation as well as local communities work hand in hand with these organizations for saving biodiversity looses (Berkes and Turner 2006). On the other hand, folk/traditional knowledge of the local communities was decreasing day by day, it may be due to the use of advanced medical techniques, allopathic medicines, and stagnation of elder knowledge in the young generation (Pyke et al. 2001). Although ethnobotanical studies have been carried out in different parts of Pakistan, a 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 in relation to 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 Suleiman Mountain range of Northern Balochistan Pakistan. The hill is well wooded with edible pine forest. The elevation ranges from 1500 to 3000 meters above sea level. The annual rainfall is recorded at about 8 to 10 inches. The summer is recorded hot and dry. Although the dominant language is PUSHTO verbal by more than 90% of the inhabitants, District Sherani has not yet developed, people spend their life beneath the shadow of ancient cultures. A large number of the populations rely on healing plants rather than using 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 Abrahim Khail. Data were collected from 100 informants (male and female) by 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, (vi) chemical, (vii) timber and other usages of wood, and (viii) fibers.

**Voucher specimens**
All the documented plants were collected through community walks 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 in Botanical Garden Herbarium, 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 their families. 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 of the area and there relevant data. The use-value (UV) is also calculated to estimate valuate the relative importance (RI) based on the number 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 $D = \sum p_i^2$ and Shannon index $H = -\sum p_i \ln p_i$.

**RESULTS AND DISCUSSION**
The floristic composition and diversity of plants represented the variation along the altitudinal gradient. A total of 102 plant species belonging to 42 families were recorded at 1700 to 3400 meters above sea level (Table 1). The highest record was the Asteraceae family with 14 species, followed by Lamiaceae (7 species), Poaceae (6 species), and 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 on the basis of 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](image-url)
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 |
|--------------------------------|----------------------|------------|------------|--------|-----------|---------------------|-----------|------|--------|----------------|
| Allium griffithianum Boiss.     | Amaryllidaceae       | Pyaz       | WP         | *      | *         | *                   | Yes       |      |        |                 |
| Pistacia atlantica Desf.        | Anacardiaceae        | Shiney     | F, L       | *      | *         | *                   | Yes       |      |        |                 |
| Pistacia chinij Stock           | Anacardiaceae        | Shinay     | F, L       | *      | *         | *                   | Yes       |      |        |                 |
| Foeniculum vulgare Mill.        | Apiaceae             | Kaga       | WP         | *      | *         | *                   | Yes       |      |        |                 |
| Calotropis procera (Aiton) Dryand| Apocynaceae          | Spelmi     | WP         | *      | *         | *                   | Yes       |      |        |                 |
| Caralluma tuberculata N.E.Br.   | Apocynaceae          | Unknown    | F          | *      | *         | *                   | Yes       |      |        |                 |
| Periploca aphylla Decne.        | Apocynaceae          | Bara       | WP         | *      | *         | *                   | Yes       |      |        |                 |
| Nerium oleander L.              | Apocynaceae          | Gandeeri   | WP         | *      | *         | *                   | Yes       |      |        |                 |
| Pistacia atlantica              | Anacardiaceae        | Shiney     | WP         | *      | *         | *                   | Yes       |      |        |                 |
| Caralluma tuberculata N.E.Br.   | Apocynaceae          | Unknown    | F          | *      | *         | *                   | Yes       |      |        |                 |
| Periploca aphylla Decne.        | Apocynaceae          | Bara       | WP         | *      | *         | *                   | Yes       |      |        |                 |
| Tragopogon gracilis D.Don       | Asteraceae           | Unknown    | NUR        | *      | *         | *                   | Yes       |      |        |                 |
| Lactuca serriola L.             | Asteraceae           | Unknown    | NUR        | *      | *         | *                   | Yes       |      |        |                 |
| Phagnalon niveum Edgew.         | Asteraceae           | Unknown    | NUR        | *      | *         | *                   | Yes       |      |        |                 |
| Pulicaria undulata (L.) C.A.Mey | Asteraceae           | Unknown    | NUR        | *      | *         | *                   | Yes       |      |        |                 |
| Tugetes minuta L.               | Asteraceae           | Unknown    | NUR        | *      | *         | *                   | Yes       |      |        |                 |
| Xanthium strumarium L.          | Asteraceae           | Unknown    | NUR        | *      | *         | *                   | Yes       |      |        |                 |
| Verbesina encelioides (Cav.) Benth. & Hook.f. ex A.Gray | Asteraceae | Unknown | NUR | *      | *         | *                   | Yes       |      |        |                 |
| Berberis calliobotrys Bien. ex Koehne | Berberidaceae | Unknown | F | *      | *         | *                   | Yes       |      |        |                 |
| Lappula barbata (M.Bieb.) Gürke | Boraginaceae         | Unknown    | NUR        | *      | *         | *                   | Yes       |      |        |                 |
| Onosma limitaneum L.M. Johnst.  | Boraginaceae         | Unknown    | NUR        | *      | *         | *                   | Yes       |      |        |                 |
| Sisymbrium ired L.              | Brassicaceae         | Jangli sarso | S | *      | *         | *                   | Yes       |      |        |                 |
| Buxus papillosa C.K.Schneid.    | Buxaceae             | Unknown    | NUR        | *      | *         | *                   | Yes       |      |        |                 |
| Campanula salamanicae Nasir.    | Campanulaceae        | Unknown    | NUR        | *      | *         | *                   | Yes       |      |        |                 |
| Dianthus crinitus L.             | Caryophyllaceae      | Unknown    | NUR        | *      | *         | *                   | Yes       |      |        |                 |
| Saponaria subrosularis Rech. f. | Caryophyllaceae      | Unknown    | NUR        | *      | *         | *                   | Yes       |      |        |                 |
| Chenopodium album L.             | Chenopodiaceae       | Sarma      | L          | *      | *         | *                   | Yes       |      |        |                 |
| Haloxylon griffithii (Moq.) Boiss| Chenopodiaceae       | Showri     | WP         | *      | *         | *                   | Yes       |      |        |                 |
| Salsoila kali subsp. tragus (L.) Čelak. | Chenopodiaceae | Unknown | Calbi | WP | *      | *                   | Yes       |      |        |                 |
| Convolvulus arvensis L.          | Convolvulaceae       | Unknown    | WP         | *      | *         | *                   | Yes       |      |        |                 |
| Convolvulus spinosus Burm. f.    | Convolvulaceae       | Unknown    | WP         | *      | *         | *                   | Yes       |      |        |                 |
| Evolvulus alsinoides (L.) L.     | Convolvulaceae       | Shanka Pushpi | WP | *      | *         | *                   | Yes       |      |        |                 |
| Ephedra intermedia Schrenk & C.A.Mey. | Ephedraceae   | Oman      | WP         | *      | *         | *                   | Yes       |      |        |                 |
| Species Name                        | Family                 | Use       | Habitat/Altitude | Status |
|------------------------------------|------------------------|-----------|------------------|--------|
| Ephedra major subsp. procera (C.A.Mey.) Bornm. | Ephedraceae            | Oman      | WP               | * Yes  |
| Chrozophora tinctoria (L.) A.Juss. | Euphorbiaceae          | Gujri     | WP               | * Yes  |
| Ricinus communis L.                | Euphorbiaceae          | Sharwan   | L                | * Yes  |
| Alhagi maunorum Medik              | Fabaceae               | Zoz       | WP               | * Yes  |
| Caragana ambigua Stocks            | Fabaceae               | Makhi     | WP               | * Yes  |
| Lotus corniculatus L.              | Fabaceae               | Spasti    | WP               | * Yes  |
| Sophora mollis subsp. griffithii (Stocks) Ali | Fabaceae               | Ghozera   | WP               | * Yes  |
| Vigna adiate (L.) R.Wilczek        | Fabaceae               | Shin mong | S                | No     |
| Gentiana kuroo Royle               | Gentianaceae           | Unknown   | NUR              | No     |
| Marrubium vulgare L.               | Lamiaceae              | Sperboti  | L                | Yes    |
| Moluccella otostegioideae          | Lamiaceae              | Unknown   | NUR              | No     |
| Phlomidoschema parviflorum (Benth.) Vved. | Lamiaceae              | Spranda   | L                | No     |
| Salvia moorcroftiana Wall. ex Benth. | Lamiaceae              | Spera boti| WP               | Yes    |
| Salvia nubicola Wall. ex Sweet     | Lamiaceae              | Khar kwage| R                | Yes    |
| Scutellaria petiolata Hemsl. ex Lace & Prain | Lamiaceae              | Unknown   | NUR              | No     |
| Vitis negundo L.                   | Lamiaceae              | Marmandi  | L                | Yes    |
| Astragalus corrugatus Bertol.       | Leguminosae            | Unknown   | WP               | No     |
| Astragalus stocksii Bunge          | Leguminosae            | Unknown   | WP               | No     |
| Astragalus subumbellatus Klotzsch. | Leguminosae            | Unknown   | NUR              | No     |
| Prosopis juliflora (Sw.) DC.       | Leguminosae            | Kekar / afghani | WP       | Yes    |
| Taverniera canefolia (Roth) Ali    | Leguminosae            | Spera barara| WP       | No     |
| Abutilon bidentatum Hochst. ex A.Rich. | Malvaceae              | Unknown   | NUR              | Yes    |
| Malva neglecta Wallr               | Malvaceae              | Unknown   | R                | Yes    |
| Cocculus pendulus (J.R.Forst. & G.Forst.) Diels | Menispermaceae        | Unknown   | NUR              | No     |
| Ficus carica L.                    | Moraceae               | Anzar     | L                | * Yes  |
| Morina persica L.                  | Morinaceae             | Unknown   | WP               | * *    |
| Eucalyptus camaldulensis Dehnh     | Myrataceae             | Lachi     | WP               | Yes    |
| Peganum harmala L.                 | Nitrariaceae           | Spana     | L S              | Yes    |
| Fraxinus santhoxyloides (G.Don) Wall. ex A.DC. | Obleaceae             | Unknown   | WP               | * Yes  |
| Olea ferruginea Wall. ex Aitch.    | Oleaceae               | Kao       | S                | * Yes  |
| Papaver decaisnei Hochst. & Steud. ex Elkan | Papaveraceae         | Unknown   | WP               | * Yes  |
| Pinus gerardiana Wall. ex D.Don    | Pinaceae               | Chalguza  | S                | * Yes  |
| Pinus wallichiana A.B.Jacks        | Pinaceae               | Unknown   | WP               | * Yes  |
| Plantago major L.                  | Plantaginaceae         | Parpanra  | L                | Yes    |
| Limonium cabalicum (Boiss.) Kuntze | Plantaginaceae         | Parpanra  | L                | Yes    |
| Aristida adsensionis L.            | Poaceae                | Masali    | WP               | Yes    |
| Melica persica Kunth.              | Poaceae                | Unknown   | WP               | * Yes  |
| Paspalum dilatatum Poir            | Poaceae                | Shokholi  | WP               | Yes    |
| Pennisetum orientale Rich.         | Poaceae                | Unknown   | WP               | Yes    |
| Polygogon monspeliensis (L.) Desf. | Poaceae                | Spherha   | WP               | Yes    |
| Saccharum spontaneum L.            | Poaceae                | Sarghsa   | WP               | * Yes  |
| Pieropyrum oligieri Jaub. & Spach  | Polygonaceae           | Unknown   | L                | Yes    |
| Sageretia thea (Osbeck) M.C. Johnst. | Rhmnaecae             | Manrey    | F                | * Yes  |
| Ziziphus jujuba Mill.              | Rhmnaecae              | Unknown   | WP               | * Yes  |
| Ziziphus oxyphilla Edgew.          | Rhmnaecae              | Unknown   | WP               | * Yes  |
| Scientific Name                      | Family        | Common Name         | Type | Use | NUR |
|-------------------------------------|---------------|---------------------|------|-----|-----|
| *Prunus brahuica* (Boiss.) Aitch. & Hemsl. | Rosaceae      | Zargha/Kundzari     | F    | *  | *  | Yes |
| *Prunus dulcis* (Mill.) D.A.Webb    | Rosaceae      | Badam               | F    | *  | *  | Yes |
| *Prunus rechingeri* (Browicz) R.R.Stewart | Rosaceae    | Unknown             | F    | *  | *  | No  |
| *Cotoneaster persicus* Pojark.      | Rosaceae      | Sharave             | L    |    |    | No  |
| *Plocama macrantha* (Blatt. & Hallb.) M.Backlund & Thulin. | Rubiaceae    | Kharbat             | WP   | *  |    | Yes |
| *Dodonaea viscosa* (L.) Jacq        | Sapindaceae   | Unknown             | L    |    |    | Yes |
| *Populus euphratica* Oliv.          | Salicaceae    | Shana               | ST   | *  |   | Yes |
| *Salix acmophylla* Boiss.           | Salicaceae    | Wana                | WP   | *  |   | Yes |
| *Datura innoxia* Mill.              | Solanaceae    | Badboya Boti        | L    |    |    | Yes |
| *Hysocyamus insanus* Stocks         | Solanaceae    | Unknown             | WP   | *  |   | Yes |
| *Solanum rostratum* Dunal.          | Solanaceae    | Marhaghanay         | WP   | *  |   | Yes |
| *Solanum surattense* Burm.f         | Solanaceae    | Marhaghanai         | WP   | *  |   | Yes |
| *Withania coagulans* (Stocks) Dunal | Solanaceae    | Khamazura           | S    |    |   | Yes |
| *Tamarix aphylla* (L.) H.Karst      | Tamaricaceae  | Ghaz                | WP   | *  | *  | Yes |
| *Daphne macronata* Royle.           | Thymelaeaceae | Laghoni             | WP   | *  |   | Yes |
| *Fagonia bruguieri* DC              | Zygophyllaceae| Azghi               | WP   | *  |   | Yes |
| *Tribulus pentandrus* Forssk         | Zygophyllaceae| Kroundki/wazi       | S    | *  |   | Yes |
| *Tribulus terrestris* 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 on the basis of their life-form (Figure 1). The herbs were dominated 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 were used for medicinal purposes were listed in Table 1. The most dominant plant part was whole plants (51), followed by leaves (15), flowers (10), and seeds (8), whereas few use of roots and stems were also reported. The most common method of preparing the medicinal plants were the 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 were recorded 36% of the reported plants, followed by fodder (26%), edible/food is (14%), and fuel (13%). Livestock was recorded 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 not reported earlier from any region of Balochistan, while other uses were common to other communities of neighboring villages of 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* were very important medicinal plants and used as dry fruits by local communities. *Foeniculum vulgare* (Apiaceae) seeds are flavoring agents, used in baking of 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% 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, 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 carminative, digestive, galactagogue, diuretic, and treating respiratory and gastrointestinal disorders. *Caralluma tuberculata* was also used as a folk medicine for the treatment of diabetes and rheumatism. *Periploca aphylla* used to treat tumors and swellings latex of plant is applied on infected area as well as joints having inflammation. The plant is also known as “Bata” or “Barara”. The plant is also used to treat cough, and flu. *Rhaya stricta* is also known as a Blood purifier plant and was used to treat diabetes. The powder of *Cirsium arvense* (Syn. *Carduus arvensis*) was used for toothache. *Launaea acanthodes* is a very important plant, many studies are found on its essential oil extraction. *L. acutilis* was used as a diuretic, stomachic. *Berberis calliobotrys* is a very important medicinal plant, the roots of *Berberis* were also used by the local communities of Shinghar. The seed powder of *Sisymbrium irio* was used for treating asthma, produced a cooling effect to treat stomach disorder, constipation, and abdominal pain. The whole plant of *Evolvulus alsinoides* was used for the treatment of fever, and neuro disorders. *Ephedra intermedia* was used for the treatment of 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 *Phlomidoschena parviflorum* were used for wound recovery. The decoctions of roots of *Salvia radicata* 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 few minutes then filtered juice was used for muscles, and joints pain, 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 caeruleum* was used for stomach problems. The seeds of *Withania coagulans* were put into the water for a night and early in the morning drink it which was useful against malaria. The power of *Fagonia bruquieri* was used for asthma diseases. *Trilobus terristrus* was used for a 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*, *Prospis juliflora*, *Tavenniera cuneifolia*, *Eucalyptus camaldulensis*, *Fraxinus xanthoxyloides*, *Olea ferruginea*, *Pinus gerardiana*, *Pinus wallichiana*, *Ziziphus jujube*, *Ziziphus oxyphylia*, *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 Allagi maurorum, Buxus papillosa, Cousinia prollfera, Caragana ambiguus, Lotus corniculatus, Vigna adiate, Salvia moerocryptiana, Prosopis juliflora, Aristida adsensionis, 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

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

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. 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, Papaver decaisne was used for ornamental purposes (Table 1). Tamarix aphylla and Chrozophora tinctoria were used to dye the clothes. Caragana ambiguus was used for fencer, while Fraxinus xanthoxyloides was used to make yokes.

Species diversity

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

Discussion

Ethnobotanical inventory in the folk community of Shinghar

The 102 documented plant species belong to 42 families, 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 over the world, and is easily available in local communities to be used as a vegetable, fruit, seasonings, 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 (Li et al. 2016) and (Abbas et al. 2020). Artemisia stenocephala was used to give taste to milk, the earlier study was reported from Northern Areas of Pakistan (Ashraf et al. 2010). The powder of Cirsium arvense (Syn Cardaus 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 plant of Cousinia prollfera was used as fodder, an earlier study the plant was reported for the treatment of 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, 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 Hindkush ranges of Pakistan Dir, Timergara KPK, Pakistan (Shuaib et al. 2019). Phagnalon niveum was reported from the Biodiversity of Shinghar area, but no use report was recorded from the communities of Shinghar. In earlier reports from Balochistan, the plant was used as an anti-cancer, also reported from Nowshera KPK, Pakistan (Ali et al. 2019). Pulicaria undulata (Syn. Pulicaria crisp) was earlier reported from Indus plains 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 is typically used for wound healing, has anti-inflammatory, bronchodilatory (Abasi et al. 2010), also used as a bio-herbicide for weed control (Sadia et al. 2013). Tragopogon gracilis was reported as fodder from the Shingar. In earlier records, T. gracilis was reported from Dir Upper, Khyber Pakhtunkhwa, Pakistan (Awasti et al. 2003). Xanthium strumarium is the noxious weed, earlier reports were from Takht-e-Suleman range F.R 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 are being in use by local communities of Balochistan, Pakistan from 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 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 as well as having medicinal importance, used to treat jaundice and also 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 an edible source for the community of Shinghar, and medicinally used to treat stomach diseases, renal disorders, wounds, and coughs. Our findings were in agreement 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 commonly known as fennel. 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* includes different Phenols, phenolic glycosides, and volatile aroma trans-anethole, estragole, and fenchone (Andrade-Cetto 2009).

Earlier its many its *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 milk of goat 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 threatening skin diseases, ulcer, and constipation (Iqbal et al. 2012; Samreen et al. 2016). *Nerium oleander* is a potentially lethal plant in many cases and reported poisoning, used for ornamental purposes. The leaves and the flowers have been reported to have medicinal properties (Faroqqui and Tyagi 2018). Earlier reported uses were cardiotonic, 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 strigata* is also known as a blood purifier plant and is used to treat diabetes. Some uses against the allergy were also reported from the current study. Earlier reports from different areas of Balochistan used differently as in the form of decoctions for a variety of 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 (Alameer et al. 2016). No use report of *Lappula barbata* is from the communities of Shingar, but earlier reports elaborated its importance as antiviral and anti-inflammatory activities (Soliman et al. 2016).

Species richness and conservation

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 belong 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. Leaves and whole plants used reports were higher according to reported information by local communities. However, this indigenous knowledge of the communities must be conserved on an urgent basis as with time this knowledge is depleting day by day. This is best accomplished by documenting the unique knowledge and practice of ethnic groups in relation to medicinal plants.

ACKNOWLEDGEMENTS

We are grateful to the local people in study areas who have provided valuable information about the medicinal plants and shared their prestigious knowledge for the
betterment of ethnobotanical uses. Also, we would like to thank Nazer Khan for his help in plant identification.

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