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Ethnobotanical inventory and folk uses of indigenous plants from Pir Nasoora National Park, Azad Jammu and Kashmir

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PEER REVIEW

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Comments

This paper does contain valuable information. In this regard the paper presents baseline data on the use of plant resources by communities surrounding the Pir Nasoora National Park. As such it is valuable from a conservation point of view. Also it could lead to the identification of new and novel pharmaceutical leads from the medicinally used plant species.

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ABSTRACT

Objective: To document the medicinal and other folk uses of native plants of the area with a view to preserve the ethnobotanical knowledge associated with this area.

Methods: The fieldwork was conducted during a period of one year. Data were collected through a semi-structured questionnaire and interviews with indigenous tribal people and traditional health practitioners residing in the study area.

Results: The present study documented ethnobotanical uses of 104 plant species belonged to 93 genera and 51 families. Results revealed that most of the documented species were used medicinally (78 spp., 44.07%). Leaves were found to be the most frequently used part (69 spp., 42.86%) for the preparation of indigenous recipes and for fodder.

Conclusions: The current research contributes significantly to the ethnobotanical knowledge, and depicts a strong human-plant interaction. There is an urgent need to further document indigenous uses of plants for future domestication.

KEYWORDS

Ethnobotany, Pir Nasoora, Indigenous knowledge, Conservation

1. Introduction

Ethnobotany is the scientific study of the relationships between people and plants. It was first coined in 1896 by the US botanist John Harshberger; however, the history of ethnobotany began long before that[1,2]. Ethnobotany is the study of the relationship between plants, people and environment. Broadly viewed, ethnobotany is the cultural study of how the people perceive the plants, give names, use and organize the information about the plants around them[3,4]. It plays an important role in understanding the dynamic relationships between biological diversity and social and cultural systems[5-7]. Plants are essential for human beings as they provide food, fuel, fodder, timber, fruit and medicines[8-

10]. Ethnobotanical approaches are significant in highlighting locally important plant species, particularly for new crude drug sources. The use of plants as medicine is slowly increasing in the developed world[11] because they have minor or no side effects[12]. Documentation of indigenous knowledge, particularly medicinal values of plant species, provided various modern drugs[13]. The indigenous medicinal information of plants is also helpful to ecologists, pharmacologists, taxonomists, watershed and wild life managers in enhancing the prosperity of an area, besides listing the traditional uses[1,14].

Pakistan has a rich diversity of plants that are being used by local communities for medicinal purposes. Proper usages of local plants are common at the community and end-user level[15].

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According to Hocking[16], 84% of Pakistan's population is dependent on traditional medicines for their primary health care. A significant number of studies reported on this from various parts of the country[17-28]. With reference to Azad Jammu and Kashmir, some studies are reported from different areas including Kotli, Poonch, Muzaffarabad, Bagh and Bimber by various researchers[29-32]. Various studies contributed ethnobotanical enumerations from areas nearby to the Pir Nasoora National Park. For example, Pie and Manandhara reported that in the Himalayan ranges at least 70% of the medicinal plants and animals in the region consists of wild species and 70%-80% of the population in this region depends on traditional medicines for their primary health care[33]. As a further example, Bokhari investigated the ethnobotany and did a vegetation analysis of the Machyara National Park Muzafarabad Azad Jammu and Kashmir and reported 10 plant communities in different regions of the National Park[34]. Similarly, Zandial working on the ethnobotany of the National Park Machyara reported 104 important plants species used by local people[35]. People living in the mountains of Pakistan use plants in many ways such as medicines, timber wood, fire wood, food, and fodder[36]. The medicinal plants of Himalayas are specific[37] and their distribution is scattered and restricted to small areas. However, there are many parts of the country which remain unexplored from an ethnobotanical point of view. Since most of the population of the area is rural with a low literacy rate and lack modern health facilities, they are more dependent upon natural resources, especially plants for their healthcare and livelihood requirements. The present study reports on the ethnobotanically important resources from the Pir Nasoora National Park, Azad Jammu and Kashmir, Pakistan and analyzes the indigenous traditional knowledge on the utilization of the most commonly used plants. This research will contribute a lot in providing the useful information on the conservation and sustainable use of the natural resources of the area.

2. Materials and methods

2.1. Study area, climate and vegetation

Pir Nasoora National Park lies between 31.3° E latitude and 74.5° N longitude, covering an area of 1850 km, situated north of Kotli at an altitude of 1300 m to 2050 m. The investigated area has no population but the surrounding villages are densely populated. The area is covered with forest and residents from adjoining villages use it for a variety of purposes such as medicine and fuel timber amongst other. The climate of the area is of subtropical humid type in which chir pine [*Pinus roxburghii* (*P. roxburghii*)] and reen [*Quercus dilatata* (*Q. dilatata*)] are the most dominant tree species. Due to cool and humid conditions for most of the year, the vegetation in the area comprises a wide diversity of

trees, herbs, shrubs and climbers. Ground cover comprises a wide variety of angiosperms along with ferns and mosses.

2.2. Field work and data collection

Field surveys were conducted during August 2012-July 2013 to document ethnobotanical information through oral interviews and designed semi-structured questionnaire from local herbalists (Hakeems) and the elderly people who were familiar with traditional uses of plants particularly for medicinal, veterinary, fruit, vegetable, fodder, fuel and others. The queries were repeatedly made to increase the reliability of the data.

During the field survey, 155 local inhabitants of 12 villages were selected based on age and gender (Table 1).

Table 1

Age and gender wise distribution.

Age Group	Gender	No. of questionnaires
Old (50+)	Male	50
	Female	23
Middle age (25+)	Male	45
	Female	20
Youngster	Male	12
	Female	5
Total		155

2.3. Plant identification

Plant specimens were collected, pressed, dried and mounted on herbarium sheets and identified with the help of floristic literature[38,39]. The correctly identified specimens were deposited as voucher specimens in the herbarium of the Department of Botany, Pir Mehr Ali Shah Arid Agriculture University Rawalpindi, Pakistan.

3. Results

A total of 104 plant species belonging to 93 genera and 51 families are recorded in the present study, which are being used for a variety of purposes by native people. The detailed inventory is provided in Table 2, which includes botanical names, followed by local name, family and ethnobotanical uses.

The analysis of the ethnobotanical data showed that area was best suited to the medicinal plant and rangeland. Ethnobotanical use categories showed that major proportion of species were used for medicinal purposes (78 spp., 44.07%) as well as fodder for domesticated animals (51 spp., 28.81%). It was followed by others (25 spp., 14.12%), fuel (15 spp., 8.47%), timber wood (8 spp., 4.25%). With reference to their ethnobotanical uses (Figure 1), leaves were commonly used parts for making indigenous recipes and as a fodder (69 spp., 42.86%), followed by stem (29 spp., 18.01%) and fruit (20 spp., 12.42%).

Table 2
Ethnobotanical uses of plants of Pir Nasoora National Park, Azad Jammu and Kashmir.

No.	Name of species	Common name (Pahari language)	Family	Growth form	Part used	Ethnobotanical uses	
1.	<i>Acacia modesta</i> L./sh-03	Phulahi	Mimosaceae	Tree	Woody	S, L	Branches are used as tooth stick (Miswak) for teeth cleansing and tooth decay. The gum is used as tonic and given in general weakness. Wood is used for agricultural implements e.g. hull, fuel, branches used for fencing fields and leaves browsed by goats.
2.	<i>Achyranthes aspera</i> Wall./sh-04	Puthkanda	Amaranthaceae	Annual herb	Non-woody	R, L	Roots and leaves are boiled in water to make decoction that is given in digestive problems. Leaf paste is applied externally on insect bite. The powder of roots is used in bloody diarrhea.
3.	<i>Adiantum venustum</i> D.Don./sh-06	Pata	Adiantaceae	Perennial herb	Non-woody	L, Rm	The fronds are used as diuretic, astringent, diuretic and tonic. They are also used in the treatment of headache and snake and scorpion stings. The paste of rhizome is used to heal cuts and wounds.
4.	<i>Agrostis canina</i> Auct./sh-07		Poac	Perennial grass	Non-woody	L	Used as a fodder.
5.	<i>Ajuga bracteosa</i> Wallich./sh-09	Karku	Lamiaceae	Perennial herb	Non-woody	W	Fresh plant is dried, powdered and its extract is used before dinner for ulcer, colic and jaundice.
6.	<i>Anaphalis margaritacea</i> (L.) Bth./sh-11		Asteraceae	Perennial herb	Non-woody	W, Fl	Young leaves cooked and used as vegetables. Plant is internally used for treating diarrhea, dysentery and pulmonary infections. Poultice made of whole plant is applied on burns, sores, ulcers, bruises and swellings. Steamed plant infusion is inhaled for treating headache. Flowers are used for incense.
7.	<i>Andropogon gerardii</i> Vitman./sh-14		Poaceae	Perennial grass	Non-woody	L	Used as a fodder.
8.	<i>Androsace rotundifolia</i> Hardw./sh-17	Marcholla	Primulaceae	Perennial herb	Non-woody	L	Aqueous leaf extract is used in treating stomach disorders and skin infections.
9.	<i>Arisaema jacquemontii</i> Blume./sh-01	Sapmakh	Araceae	Perennial herb	Non-woody	F, R	Fruit and rhizome poisonous. Excessive use can cause sedation. Very little quantity of rhizome is used during meal for relieving body pain. Powder of dried rhizome is also used in small quantity for psychic and nervous disorders.
10.	<i>Aristida adscensionis</i> L./sh-19		Poaceae	Perennial grass	Non-woody	L	Used as a fodder.
11.	<i>Berberis lycium</i> Royle./sh-22	Sumblu/komal	Berberidaceae	Shrub	Woody	R, F, L, B	The paste of root bark is externally applied on wounds. Powdered bark is mixed in water and the paste is applied on bone fracture. Crushed bark is soaked in water and the resultant extract is taken early morning to treat diabetes, scabies, boils and pimples. The extract possesses cooling effect and seldom used in winter season. Fruits are edible. Leaves are used as fodder and dried branches for fuel.
12.	<i>Bergenia ligulata</i> (Str.) Hot./sh-24	ZakamJat	Saxifragaceae	Perennial herb	Non-woody	W	Hot water extract of whole dried plant is employed for renal and urinary disorders and dysentery. The same is also applied externally on, cuts boils and wounds.
13.	<i>Brachiaria eruciformis</i> (J.E Smith) Griseb./sh-26	BubbrKha	Poaceae	Perennial grass	Non-woody	L	Used as a fodder.
14.	<i>Brachiaria repans</i> (L.) Gardner and Hubbard./sh-29	Sair	Poaceae	Perennial grass	Non-woody	L	Used as a fodder.
15.	<i>Bupleurum falcatum</i> L./sh-32	Janglizira	Apiaceae	Perennial herb	Non-woody	R	The root in combination with other drugs prescribed in liver troubles and as a diaphoretic. It is also effective in thoracic and abdominal inflammation, fever and useful in flatulence and indigestion.
16.	<i>Chrysopogon aucheri</i> (Boiss.) Stapf./sh-35	Beerankha	Poaceae	Perennial grass	Non-woody	L	Used as a fodder.
17.	<i>Colebrookia oppositifolia</i> Sm./sh-37	Lansa	Lamiaceae	Shrub	Woody	L, R	Leaves applied on wound and bruises and roots are used in epilepsy. Wood is used for fuel purpose.
18.	<i>Commelina benghalensis</i> L./sh-39	Chora	Commelinaceae	Annual herb	Non-woody	L, F	Medicinal (Diarrhea, fever, irritation by bristles of caterpillar, laxative, liver complaints refrigerant, scorpion bite, snake bite, sores, wounds), edible.
19.	<i>Contoneaster acuminatus</i> Linley./sh-44		Rosaceae	Shrub	Woody	S	The stolons are used as an astringent. The wood is also used for fuel and construction purpose.
20.	<i>Convolvulus prostratus</i> Forssk./sh-47	Lalhi	Convolvulaceae	Perennial herb	Non-woody	W	Leaves are used as spinach to get rid of intestinal worms. The plant possesses purgative effect and used against constipation.
21.	<i>Conyza canadensis</i> L./sh-51	Paleet	Asteraceae	Annual herb	Non-woody	L	Used as a fresh fodder and has diuretic and stimulant properties.
22.	<i>Cymbopogon jwarancusa</i> (Jones) Schult./sh-54	Khavi	Poaceae	Perennial grass	Non-woody	S, L	The matrices made up of stem are prescribed to the patient of typhoid fever. The smoke of plant is supposed useful to treat measles.
23.	<i>Cynodon dactylon</i> (L.) Pers./sh-56	Kabbal	Poaceae	Perennial grass	Non-woody	L	Decoction is used as blood purifier and to control nose bleed; chewed and placed on wound to stop bleeding and as topical anti-septic.
24.	<i>Cynoglossum lanceolatum</i> Forssk./sh-59	Nilakanrai	Boraginaceae	Perennial herb	Non-woody	W	The powder of plant taken with the decoction of <i>Coriandrum sativum</i> as laxative.
25.	<i>Cyperus difformis</i> L./sh-62	Motkopraghaa	Cyperaceae	Perennial sedge	Non-woody		The plant is crushed and made into paste which is externally applied on skin infections. It is also used as fodder.
26.	<i>Cyperus globosus</i> Forssk./sh-65		Cyperaceae	Perennial herb	Non-woody	L	Used as a fodder.
27.	<i>Cyperus niveus</i> Retz./sh-67	Dilla	Cyperaceae	Perennial herb	Non-woody	L	Used as a fodder.
28.	<i>Cyperus rotundus</i> L./sh-70	Muthri	Cyperaceae	Perennial Sedge	Non-woody	Rm, L	The rhizome used for the treatment of irregular menstruation, diarrhea and vomiting. It is also used as diuretic, anthelmintic and stimulant.
29.	<i>Debregeasia salicifolia</i> (D.Don) Rendle./sh-73	Sandari	Urticaceae	Shrub	Woody	F, L, S	The fruits are grinded and are used against bloody diarrhea. Leaves and branches are used as fodder.
30.	<i>Dichanthiu manulatum</i> (Forssk.) Stapf./sh-75	Murghakha	Poaceae	Perennial grass	Non-woody	L	Fresh and dried grass is used as cattle fodder.
31.	<i>Dicliptera roxburghiana</i> Nees./sh-77	Somni	Acanthaceae	Annual herb	Non-woody	W	Whole plant is used to avoid sun stroke in buffaloes.
32.	<i>Dodonaea viscosa</i> L. Jack./sh-79	Sanatha	Sapindaceae	Shrub	Woody	F, S, L	The leaves are boiled in water and steam is inhaled to get relief from respiratory problems such as cold, cough and asthma. Dried branches are used for fuel.
33.	<i>Dryopteris ramosa</i> (C. Hope) C. Chr./sh-81	Pakha	Dryopteridaceae	Perennial herb	Non-woody	L	Collection of young leaves is made in spring season and used as vegetable that is effective in gastric ulcer and constipation. Leaves are used as fodder.
34.	<i>Elaeagnus parvifolia</i> Wall. ex Royle./sh-84	Kankoli	Elaeagnaceae	Shrub	Woody	F, Sd, S, Fl	The plant is anti-cancer and cardiac stimulant. The flowers are stimulant, cardiac and astringent. The seeds are used in curing cough and pulmonary infections. Fruit is juicy, sweet and pleasant, used as a raw jam and preservative. The wood is used as fuel.
35.	<i>Eragrostis japonica</i> (Thunb.) Trin./sh-87		Poaceae	Perennial grass	Non-woody	L	Used as a fodder.
36.	<i>Eriophorum comosum</i> Wall./sh-90	Babia Ka	Cyperaceae	Perennial herb	Non-woody	S	It is fodder of low quality.
37.	<i>Euphorbia helioscopia</i> L./sh-93	Doodal	Euphorbiaceae	Annual herb	Non-woody	R, S, Sd	Roots used as anthelmintic, shoots used in constipation, seeds used in cholera.
38.	<i>Euphorbia prostrata</i> Ait./sh-97	Dudhli,	Euphorbiaceae	Perennial herb	Non-woody	W	Whole plant is crushed and given with water to buffaloes to cure fever. This crushed form of plant when mixed with butter is remedy for jaundice. Leaves are also used as fodder.
39.	<i>Ficus carica</i> L./sh-101	Tosi	Moraceae	Tree	Woody	F, L, S, W	Fruits are eaten fresh or dried and being laxative used in constipation. Leaves are used as fresh fodder. Also used as fuel wood and in making various agricultural tools.
40.	<i>Ficus palmata</i> Forrrk./sh-104	Phagwara	Moraceae	Tree l	Woody	L, S, F, W	The fruits are edible, used as laxative, tonic and demulcent. The leaves used as fodder. The ash of the leaves used in snuff preparation (Naswar). The wood used for burning.
41.	<i>Fragaria nubicola</i> Landle ex Lacaita./sh-109	Budamawa	Rosaceae	Annual herb	Non-woody	W	Fruit is edible and has a very pleasant strawberry flavor. Plant juice is used to treat profuse menstruation and tongue blemishes. The fruit mixed with <i>Berberis lycium</i> leaves is used to treat stomach ulcers and as an antiseptic. Leaves are mildly astringent and diuretic and used in children's diarrhea and infections of the urinary organs. Tea is prepared from the roots and leaves.
42.	<i>Galium elegan</i> Wall./sh-112	Khrrhatani	Rubiaceae	Annual herb	Non-woody	L	Leaves are used in treatment of jaundice. Poultice made up of leaf is externally applied on wounds as an antiseptic.
43.	<i>Geranium rotundifolium</i> L./sh-114	Bhanda	Geraniaceae	Annual herb	Non-woody	R	The roots are dried and grounded, sugar and milk are added in it and used for joints pain and also as antispasmodic. Its roots are grinded and along with brown sugar used against blockage of urine and also believed to be having cooling effect.

Table 2, continued

Ethnobotanical uses of plants of Pir Nasoora National Park, Azad Jammu and Kashmir.

No.	Name of species	Common name (Pahari language)	Family	Growth form	Part used	Ethnobotanical uses	
44.	<i>Gerbera gossypina</i> Royle./sh-117	Kofe	Asteraceae	Annual herb	Non-woody	R	Root decoction is used to treat menstrual disorders, blood pressure. Paste is used to control the bleeding from newly cut wounds.
45.	<i>Grewia villosa</i> Willd./sh-119	Thaman	Malvaceae	Shrub	Woody	L, S	Leaves are given to cattle especially during delivery for quick discharge of after birth. It is also given to young animals to induce puberty. Branches are soaked in water and the detached bark is used for making ropes. Leaves are used as fodder.
46.	<i>Hedra nepalensis</i> K. Koch./sh-122	Plaismar	Araliaceae	Perennial climber herb	Non-woody	L, F	The leaves and berries are stimulating, diaphoretic, cathartic, used in indolent ulcers, abscesses, etc. The berries are used in febrile disorder, rheumatism. The paste of leaves is applied externally to destroy vermin from the heads of children.
47.	<i>Heteropogon contortus</i> L./sh-125	Sariyalagass	Poaceae	Perennial grass	Non-woody	L	Used as a fodder.
48.	<i>Hypericum perforatum</i> L./sh-127	Shin jai	Hypericaceae	Perennial herb	Non-woody	Shoot	Used as diuretic, analgesic, antiseptic and expectorant.
49.	<i>Ipomea purpurea</i> (L.) Roth./sh-131	Aerh	Convolvulaceae	Perennial climber herb	Non-woody	W	Leaves are grinded and the extract is used for washing hairs to get rid of lice. Whole plant is used as fodder.
50.	<i>Impatiens edgeworthii</i> H.K.f./sh-133	Buntil	Balsaminaceae	Annual herb	Non-woody	W	The plant is used internally for gonorrhoea and externally for burns.
51.	<i>Imperata cylindrica</i> L./sh-137	Kulfighass	Poaceae	Perennial grass	Non-woody	L	Used as a fodder.
52.	<i>Indigofera heterantha</i> Wall./sh-139	Kanthi	Fabaceae	Shrub	Woody	S, L	Juice of bark used as vermifuge. Shoot used as fodder. Branches used as a rope, broom and fuel.
53.	<i>Lepedeza sericea</i> (Thunb.) Miq./sh-142		Fabaceae	Annual herb	Non-woody	L, S	The young aerial parts from the plant are boiled in water to made decoction which is orally applied on teeth to cure toothache.
54.	<i>Loranthus pulverulentus</i> Wall. in Roxb./sh-144	Parwikh	Loranthaceae	Shrub	Woody	L	Leaves juice is used for diabetes. Leaves powder is used for wound healing.
55.	<i>Mallotus philipinensis</i> (Lam.) Muell./sh-146	Kamlila	Euphorbiaceae	Tree	Woody	F, L, S	The fruits are crushed and used orally to treat bloody diarrhea. The leaves are used as "Koochan" to wash utensils. The leaves are used as fodder and branches for fuel.
56.	<i>Malva parviflora</i> L./sh-149	Sonchal	Malvaceae	Annual herb	Non-woody	S, L	Shoot is used for constipation. Leaves are used for dry cough, bladder worm and also for diabetes. Leaves are cooked as vegetable and fodder.
57.	<i>Malvastrum coromandelianum</i> L./sh-151	Gogibooti	Malvaceae	Annual herb	Non-woody	L, Fl	Leaves are crushed and made into paste and externally applied to relieve pain. Flowers are used as diaphoretic. Decoction is resolvent.
58.	<i>Medicago denticulata</i> Willd./sh-153	Maina	Fabaceae	Annual herb	Non-woody	W	The plant is used as vegetable as well as fodder.
59.	<i>Melilotus indica</i> (L.) All./sh-157	Sinji	Fabaceae	Annual herb	Non-woody	L, S	The infusion is made from aerial parts and used to cure bronchial disorder and abdominal pain. Aerial parts are cooked as potherb which is believed to be digestive. Plant is used as fodder.
60.	<i>Micromeria biflora</i> (Ham.) Bth./sh-159	Narayshamakay	Lamiaceae	Annual herb	Non-woody	Fl, L, R	The dried flowers and young leaves are used to make a tea and a flavoring agent in curries and soups. Root paste is used for toothaches and as a poultice to treat wounds.
61.	<i>Myrsine africana</i> L./sh-162	Gugal	Myrsinaceae	Shrub	Woody	L, S	Leaves are used as blood purifier. Grinded fruits are used against intestinal worms. Leaves are used as fodder and branches for fuel.
62.	<i>Nerium indicum</i> Mill./sh-165	Kandira	Apocynaceae	Shrub	Woody	L, S	The branches are used as toothbrush (Miswak) to get rid of worms, but its liquid extract in the branches and leaves is highly poisonous so extreme care should be taken not to be taken orally. The plant is used as ornamental due to its beautiful flowering.
63.	<i>Oenothera rosea</i> (L.) Her./sh-167	Janglinashtar	Onagraceae	Perennial herb	Non-woody	L	Plant is used as fodder.
64.	<i>Olea ferruginea</i> Royle./sh-171	Kahu	Oleaceae	Tree	Woody	L, S	Leaves are used in early days to make tea that was used against cough, cold, flu and skin diseases. Young leaves are chewed to avoid toothache and mouth ulcers. Young branches are used as tooth sticks (Miswak). The wood is extremely durable and is extensively used. Its elongated logs are used as guarders in roof thatching. The straight branches are used as handles for labor's tools. The leaves are used as fodder and dry branches are used for fuel. The wood yield more heat without smoke so its wood is especially used during extreme winter. The wood is also insect resistant.
65.	<i>Origanum vulgare</i> L./sh-173	Ganeyar	Verbenaceae	Perennial herb	Non-woody	W	Leaves are cooked as vegetable and used raw as a salad. Leaves are used to treat digestive and respiratory problems as well as to promote menstruation. Internally, plant is used for the treatment of colds, flu, asthma, fevers and painful menstruation. Plant paste is externally applied for muscular pains and arthritis. Plant is often cultivated to repel insects from flower beds and nurseries.
66.	<i>Otostegia limbata</i> (Bth.) Boiss./sh-177	Ghawareja	Lamiaceae	Shrub	Woody	L	Leaves are boiled and the extract is taken orally against mouth ulcers and skin diseases. Young leaves are also chewed against mouth ulcers. The leaves are browsed by goats.
67.	<i>Oxalis corniculata</i> L./sh-179	Seriri	Oxalidaceae	Annual herb	Non-woody	W	Leaves are crushed and the extract is used orally against jaundice. The whole plant is used for fodder.
68.	<i>Phalaris minor</i> Retz./sh-182		Poaceae	Perennial herb	Non-woody	L	Mixed with wheat grains in storage to keep away mice. Cattle eat it as fodder.
69.	<i>P. roxburghii</i> Sargent./sh-185	Chir	Pinaceae	Tree	Woody	L, S, Sd	Juvenile apex of the stem is grinded and is used against bloody diarrhea. Tuberculosis patients are advised to keep sitting under its shade for quick recovery. The wood of the plant is used for timber and fuel purpose. Therein obtained is used in soap industry. The seeds are edible. Dried leaves and logs are used in roof thatching. The heartwood is highly inflammable and its small pieces are used for ignition purpose at homes.
70.	<i>Plantago lanceolata</i> L./sh-189	Batthi	Plantaginaceae	Perennial herb	Non-woody	L	The leaves are crushed and mixed with brown sugar that is used as cooling agent for stomach.
71.	<i>Plectranthus rugosus</i> Wall./sh-191	Safiadmanja	Lamiaceae	Shrub	Woody	L	Used in fever.
72.	<i>Poa annua</i> L./sh-193	Jaie	Poaceae	Perennial grass	Non-woody	L	Used as cattle fodder.
73.	<i>Poa inferna</i> H.Bk./sh-197	Kandail	Poaceae	Perennial grass	Non-woody	L	Used as cattle fodder.
74.	<i>Polygonum aviculare</i> L./sh-201		Polygonaceae	Annual Herb	Non-woody	W	Young leaves are cooked. The powder of seeds is used for the treatment dysentery, hemorrhoids and pulmonary complaints. The decoctions of plant are used for the treatment of wounds, bleeding, piles and removing stones. The juice of plant is used externally to stop nose bleeding and sore throats.
75.	<i>Prunella vulgaris</i> L./sh-203	Ustakhodus	Lamiaceae	Perennial herb	Non-woody	L	The powder of leaves is used for the treatment of wounds, ulcers, sores. The decoction of leaves is also taken internally as a tea for the treatment of fevers, diarrhea, sore mouth and internal bleeding.
76.	<i>Prunus persica</i> (L.) Bastch./sh-205	Dandali	Rosaceae	Tree	Woody	F	Fruit used as anti pyretic, killings of worms and germs.
77.	<i>Pteris cretica</i> L./sh-207	Pata	Pteridaceae	Perennial herb	Non-woody	L	The paste made up of leaves is tied with cloth and applied over the affected part to heal wounds.
78.	<i>P. granatum</i> L./sh-211	Droni	Punicaceae	Shrub	Woody	Sd, F, S	The seeds along with young fruits of <i>Zanthoxylum alatum</i> , leaves of <i>Mentha longifolia</i> and green chilies are used to make "Chattni" which is a digestive stimulant. Its seeds are highly carminative. Extract of seeds have cooling effect and is especially used in summer. The rind of fruits is dried, powdered and mixed with sugar is used against diarrhea for both humans and cattle. Branches are used for fuel and also for fencing the fields. Seeds are edible which are dried for making "Anardana" which is used as condiment.

Table 2, continued

Ethnobotanical uses of plants of Pir Nasoora National Park, Azad Jammu and Kashmir.

No.	Name of species	Common name (Pahari language)	Family	Growth form	Part used	Ethnobotanical uses	
79.	<i>Q. dilatata</i> Lind./sh-213	Rein	Fagaceae	Tree	Woody	S	Galls produced on the tree are strongly astringent and are used in the treatment of chronic diarrhea, joint swelling and dysentery. Wood is very strong and durable. IT is the most favorite and preferred fuel wood tree in the area. Used for construction and agricultural instruments.
80.	<i>Rabdopsia rugosa</i> (Wall. ex Benth.) H.Hara./sh-216		Lamiaceae	Shrub	Woody		The leaves are grinded and eaten to relieve stomach pain. Extract of leaves is used as vermicide especially for children. Whole plant is used as insecticide.
81.	<i>Ranunculus muricatus</i> L./sh-2018	Kabikaj	Ranunculaceae	Annual herb	Non-woody	W	The plant is used for the treatment of intermittent fever, gout and asthma. A decoction of the plant is used as a purgative for goats.
82.	<i>Rhus cotinus</i> L./sh-222	Tilian	Acanthaceae	Shrub	Woody	Fl	Paste of leaves and flowers is used inskin diseases as blood purifier.
83.	<i>Rhynchosia hirta</i> /sh-224	Lahr	Fabaceae	Shrub	Woody	L	Leaves are used as tonic and stomach disorders.
84.	<i>Rubia tinctorum</i> L./sh-226		Rubiaceae	Perennial herb	Non-woody		The roots contain a red coloring matter which is used to expel kidney and bladder stones.
85.	<i>Rubus ellipticus</i> Smith./sh-229	Peelaakra	Rosaceae	Shrb	Woody	F	Fruit is edible, carminative and tonic.
86.	<i>Rubus fruticosus</i> Wallich./sh-231	Akhari	Rosaceae	Shrub	Woody	F, S, L	Fruits are edible and have cooling effect. Spiny branches are used for fencing. Leaves are browsed by goats.
87.	<i>Rumex hastatus</i> D.Don./sh-233	Khatimmer	Polygonaceae	Perennial herb	Non-woody	L, R	Leaves are grinded and used against jaundice. Decoction of roots is also used against jaundice. Fresh leaves are crushed and used to stop bleeding from wounds, to clean rusted vessels and as a fodder.
88.	<i>Rumex nepalensis</i> D.Don./sh-235	Hand	Polygonaceae	Perennial herb	Non-woody	L	The extract of the leaves is used as antiseptic against wounds and skin problems. Young leaves are used as vegetable.
89.	<i>Saccharum spontaneum</i> L./sh-237	Kai	Poaceae	Perennial grass	Non-woody	L	Used as fodder and in roof thatching.
90.	<i>Sarcococca saligna</i> (D.Don) Muel./sh-239	Nathrooni	Buxaceae	Shrub	Woody	S, L	Aqueous extract of leaves is used as antipyretic and carminative. Local people use the dried branches as roof thatching (Suthra).
91.	<i>Seteria viridis</i> /sh-243	Jeshay	Poaceae	Perennial grass	Non-woody	S, Sd	Seeds are roasted and grinded into a powder. Coffee is made from this powder and used to remove extra fats from body. The seed is diuretic, febrifuge and tonic. Crushed plant with water is externally used to treat bruises.
92.	<i>Solanum nigrum</i> L./sh-245	Mako	Solanaceae	Annual herb	Non-woody	L, F	Leaves and fruits are cooked and used against abdominal swellings and stomachache. It is also used as spinach by cardiac patients.
93.	<i>Solanum surattense</i> Burm. f./sh-247	Kandiari	Solanaceae	Annual	Non-woody	L, Sd, F	The extract of leaves is applied on body swellings to get relief. Its seeds are burnt in "Chehlum" and the smoke is inhaled to get relief from toothache. Fruits and leaves are boiled and the decoction is mixed in water and used for taking bath against skin diseases.
94.	<i>Sonchus arvensis</i> L./sh-249	Hand	Asteraceae	Annual herb	Non-woody	W	Used as a fodder.
95.	<i>Sonchus asper</i> Hill./sh-253	Dodak	Asteraceae	Annual herb	Non-woody	L	Leaves are cooked as vegetable which is considered good for abdominal pain.
96.	<i>Sorghum halepense</i> (L.) Pers./sh-255	BruGhas	Poaceae	Perennial herb	Non-woody	L, R, Sd	It is very fine grass and good source of fresh and dry fodder. It is also dried in to hay and used as winter fodder.
97.	<i>Taraxacum officinale</i> Weber./sh-257	Kali Hand	Asteraceae	Perennial herb	Non-woody	L	Leaves decoction is used as tonic, diuretic, blood purifier and used to cure jaundice. Leaves cooked as a wild vegetable (saag).
98.	<i>Themeda anathera</i> (Hack)/sh-259	Bari ghas	Poaceae	Perennial herb	Non-woody	L	Used as fodder and in broom making.
99.	<i>Trifolium repens</i> L./sh-261	Shtall	Fabaceae	Perennial herb	Non-woody	W	The plant is used as anti-rheumatic and depurative. An infusion is used in the treatment of coughs, colds, fever and leucorrhoea. Leaf tincture is used as an ointment to treat gout. An infusion of the flowers is used as eyewash. The plant is also used as fodder.
100.	<i>Viburnum grandiflorum</i> Wallich ex DC./sh-263	Okloon	Caprifoliaceae	Shrub	Woody	L, F, B	Leaves and fruits are given to cattle for constipation. Fruits are used as a stomachic. Fruit is delicious and edible. Bark is used to make ropes
101.	<i>Viola odorata</i> Linn./sh-265	Banafsha	Violaceae	Annual herb	Non-woody	W	The powder of leaves and flower is mixed with brown sugar and used in cough, cold and other respiratory problems. The stem and fragrant blossom flowers are placed in the clothes cupboard to impart a nice smell to the clothes.
102.	<i>Woodfordia fruticosa</i> (L.) Kurz./sh-267	Samu	Lythraceae	Shrub	Woody	Fl, L, S	Flowers are dried and powdered and used locally for abortion. The same is also used in little amount s to ease menstrual flow. Leaves are used as fodder and branches as fuel.
103.	<i>Zanthoxylum alatum</i> Roxb./sh-269	Timber	Rutaceae	Shrub	Woody	F, L, S	Young fruits are grinded with seeds of <i>P. granatum</i> , leaves of <i>Mentha longifolia</i> and green chilies to make "Chatni". Its fruits are highly carminative and also used against stomachache and dyspepsia. Young branches are used as toothbrush (Miswak). Leaves are browsed by goats. Spiny branches are used for fencing around fields. Straight branches are used as walking sticks.
104.	<i>Ziziphus mauritiana</i> Lam./sh-271	Beri	Rhamanaceae	Shrub	Woody	F, L, S	Fruits are edible and used as digestive stimulant. Leaves are browsed by goats. The spiny branches are used for fencing the fields.

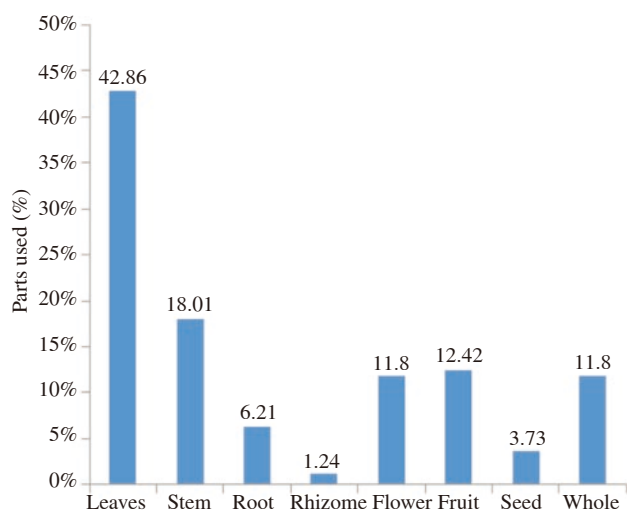
L: Leaves, S: Stem, R: Root, W: Whole plant, Fl: Flower, F: Fruit, Sd: Seed, Rm: Rhizome. *P. granatum* L.: *Punica granatum* L.

Figure 1. Parts used for ethnomedicinal purpose of flora of Pir Nasoora National Park, AJK.

4. Discussion

The interaction between plant and humans is very strong and can never be separated as the dependence is obligate. Plant resources lead to the economic wealth of inhabitants of an area. The utility and use of plants are linked to the importance of them in that area [4,33]. Within the same context, it was found that the people of the study area depend on native plants for acquiring their basic livelihood requirements such as fodder, medicines, fodder, fuel, fruits, vegetables, fuel, furniture, and roof thatching, use from the Pir Nasoora National Park. One of the major reasons could be that the whole area is rural in nature and most of the people are not very well off. Therefore, most of them keep livestock as a source of income.

Ethnobotanical use categories indicated that a major proportion

of species were used for medicinal purposes (78 spp., 44.07%). Exploitation of medicinal plants by locals, collectors and herbal drug dealers was increasing in line with the demand by the pharmaceutical industry. This caused a drastic decrease in the occurrence and products of medicinal plants. Grazing, browsing, deforestation and soil erosion were mainly responsible for a reduction in the medicinal flora. *Ajuga bracteosa*, *Mallotus philippensis*, *Micromeria biflora*, *Butea monosperma*, and *Zanthoxylum armatum* have become critically endangered in Kotli Azad Kashmir due to extensive utilization for medicinal and other purposes. It is therefore essential to have conservation strategies for these medicinal plants. Due to overexploitation, only remnant vegetation remained, which grows at high elevation where humans and grazing animals cannot easily reach them. The increasing human population has placed pressure on the medicinal plant populations, which has dramatically decreased the species richness and population size of medicinal plants[32]. The nomads collect the medicinal plants for an income. They uproot and collect each part of the medicinal plants in non scientific way. Prior to this study, no reference exists on the medicinal plant species of this area. Most species in the present study have also been reported as medicinal by other research[5,40-46].

The next major utility of plants was as fodder (51 spp., 28.81%). The area is a rangeland blessed with high number of palatable species, so there is great potential for livestock farming. Local live stocks grazed most of the medicinal plant species. It is therefore essential to have conservation strategies for these species. The collection of plants must be correlated with their phenological cycle. The plants are susceptible to grazing and collection pressure. Similarly, the plants grazed or collected for root, rhizome, bulb and flower become more threatened due to their inability to develop seed and flowers, while the rhizomatous plants are destructively collected. This will reduce the chance of their regeneration.

In the investigated area, most people are poor and lack the basic facilities. They depend upon the forest for fuel wood. There are 15 (8.47 %) species used for fuel wood. Virtually all woody species is being used as fuel wood in the study area. *Q. dilatata*, *P. granatum*, *P. roxburghii*, *Plectranthus rugosus* and *Zizyphus nummularia* are popular fuel wood species in the area. A number of studies stated that most of the species were preferred for fuel wood and therefore were under heavy stress, which is similar to present findings[1,19,47,48]. The use of plants as fuel wood from adjoining areas has been reported by other researchers[32,44,59]. Furniture wood from *P. roxburghii* is also a valuable source of earning an income. A number of these plants have the similar uses[29,50,51].

Timber wood harvest from forest resources has become one of the major ecological problems. In recent times, there is pressure on species for burning and construction material. This has led

to the creation of barren areas. Building timber plantations will not replace the current ecosystem benefits. Previous studies have suggested that shifts from subsistence agriculture to cash crops have adversely affected labor, the economic status, and natural productivity in other parts of world[52]. Plants such as *Contoneaster acuminatus*, *Ficus palmata*, *P. roxburghii* and *Q. dilatata* are highly valuable as timber wood with high selling and buying prices. The researchers observed that increased human population has resulted in increased demands for natural resources[53], leading to severe resource depletion, especially deforestation for fuel and timber wood in Siran Valley Pakistan, which is in line with the present study. The low proportion of forest land and continuing degradation of existing forest cover are serious threats to the sustainability of forestry in Pakistan[54], which is also true for the study area.

The present study proved very fruitful in depicting the traditional affiliation and dependence of rural people with plant resources of the area. The resources have to be conserved for future as a refuge for animals, birds and future bioresources. The investigated area is faced with a multitude of problems like deforestation, overgrazing, soil erosion and over exploitation of medicinal and fuel wood species. A plant subjected to multiple pressures *viz.* grazing, medicinal utility and fuel wood is under immense biotic pressure that arrests its spread and surviving capability. It is an urgent need to take action and create awareness about the usefulness of the flora so that people can save this wealth. Cultivation of threatened medicinal plants should be encouraged by the local community in order to relieve pressure on these plants. It is hoped that this research will contribute a lot in providing a useful information on the conservation and sustainable use of the natural resources of the area.

Conflict of interest statement

We declare that we have no conflict of interest.

Comments

Background

Pakistan has a rich diversity of plants that are being used by local communities for medicinal purposes. Pir Nasoora National Park is one of the richest biodiversity areas of Azad Jammu and Kashmir. Being remote there is a strong ethnobotanical culture prevailed in this area since ancient time.

Research frontiers

This study attempted to document the medicinal and other folk uses of native plants of the Pir Nasoora National Park, Azad Jammu and Kashmir, with a view to preserve the ethnobotanical knowledge associated with this area.

Related reports

Pie and Manandhara reported that in the Himalayan ranges at least 70% of the medicinal plants and animals in the region consists of wild species and 70%–80% of the population in this region depends on traditional medicines for their primary health care. As a further example, an ethnobotany investigation of the nearby Machyara National Park Muzafarabad Azad Jammu and Kashmir revealed 10 plant communities in different regions of the National Park. Similarly, an ethnobotanical study of the adjacent National Park Machyara reported 104 important plant species used by local people.

Innovations and breakthroughs

The present study proved very fruitful in depicting the traditional affiliation and dependence of rural people on the plant resources of the area. The study further found that the investigated area is faced with a multitude of problems like deforestation, overgrazing, soil erosion and over exploitation of medicinal and fuel wood species.

Applications

It was found that resources have to be conserved for future as a refuge for animals, birds and future bioresources.

Peer review

This paper does contain valuable information. In this regard the paper presents baseline data on the use of plant resources by communities surrounding the Pir Nasoora National Park. As such it is valuable from a conservation point of view. Also it could lead to the identification of new and novel pharmaceutical leads from the medicinally used plant species.

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