Ukrainian Journal of Ecology

Ukrainian Journal of Ecology 2020, 10(2), 92-105, doi: 10.15421/2020_70

RESEARCH ARTICLE

Ethnobotany of the Medicinal Plants Used by Indigenous Communities in the Mountain of Shishikoh Valley, Hindukush Chitral

K. Ullah, G.M. Shah, J. Alam, M. Hussain

Department of Botany, Hazara University, Mansehra, Pakistan

Corresponding author E-mail: kaif. botany11@yahoo. com

Received: 04.04.2020. Accepted: 04.05.2020

Background: Communities of the valley may cause restricted health conveniences and nutrient deficit, often caused various human disorders. Since centuries, however, the local communities in these areas have developed traditional method of treating various sickness and local food capes that can be significance for public health and nutrient facilities. However lack of herbal based research and geographical restrictions, the traditional knowledge is in risk. So this study is the first was intended to document the traditional knowledge in of the local people in the Shishikoh valley, Chitral Northern Pakistan.

Method: Ethno-botanical data were collected over a period from July, 2016 to October, 2017 from respondents, by using semi structured questionnaire. Details about the local uses of plants species were documentalong with demographic characterestics of the visit communities. Quantitative indices such as relative frequency citation (RFCs), fidelity level (FL) tools were intended to evaluate the cultural importance of the reported species.

Results: In total 50 plant species belonging to 34 families and 48 genera were recorded. Fabaceae was dominant with 7 species, followed by *Asteraceae*, *Lamiaceae* and *Rosacea* (6 species each). Leaves, root, flowers, seeds and fruits were the frequently utilized plant parts, whereas among drug formulations, decoction (49%) was ranked first. Majority of the plant species were used to treat abdominal, respiratory and dermal ailments (31, 12 and 12, respectively). RFCs value ranged 0.477 to 0.11 for *Tanacetum falconeri* and *Allium carolinianum*, respectively; while *Hippophe rhamnoides* and *Thymus linearis* depicted 100% FL. Comparative assessment with previous reports revealed that traditional uses of 26% plant species counting *Hedyserum falconeri*, *Aconitum violoceum* var. weileri, *Arnebia guttata, Biebersteinia odora*, *Clematis alpine* var. sibirica, *Corydalis adiantifolia* and *Saussurea simpsoniana* were reported for the first time.

Conclusion: The mountainous valley in the Northern Pakistan host significance traditional knowledge of local food and homoeopathic plant species, which need to reevaluated and reconsider by pharmacologist and health community. Additionally, the livelihood could be reinforced through launching collection sites, revolution and freshening centers for marketing of medicinal plant species.

Keywords: Medicinal plants; Shishikoh Valley; Hindukush Chitral

Introduction

Plants are considered the beneficial source for survive of human beings is dated back to the beginning of life on the globe. In the start, vegetation existed with uncountable potential from many features that have been used ordinarily and economically for comfort of human being. The dependency on wild plants increased both direct and indirectly (Ali et al., 2003; Ali, 2003; Ali & Qaiser, 2009).

The wild taxa remain quickly vanishing due to additional increase in human population, urbanization, habitat destruction and exploitation of resources in unsustainable way (Western, 2001; Woodruff, 2001; Ali, 2009). Furthermore, these taxa constitute main constituent of an ecosystem and ensure constancy and sustainability of that ecosystem. All animals are depending on these taxa for food, shelter and other requirements necessary for their survival (Alonson et al ., 2001). It is projected that there are about 35,000 to 70,000 curative plants, used as traditional medicinal in worldwide (Liwington, 1990; Farnsworth & Soyarto, 1991). Ethnobotany remains the flourishing interdisciplinary science field which covers all sorts of communication and association among plants and people. The history of homoeopathic plant use by human to treat various ailment dates back to early civilization (Ali, 1986; Ali, 2008). However the allopathic medication minimized the role of homoeopathic plants in favor of artificial drugs, little number of plants remedies have been based on medicinal plants used by indigenous people (Ali and Qaiser, 2009).

Pakistan represents approximately 6000 species of flowering plant (S. Ali and M. Qaiser, 1986; S. Ali., 2008). Of the total at least 12 % of the plants species are used as medicinally, numerous of which are being exported (Z.K, Shinwari and M. Qaiser, 2011).

The ingredients of approximately 500 species are known. Variations in plants and diversity in people plant communications are further influenced by the selection of wild floras for nourishment and other intrinsic cultural uses. The ethnobotanical investigations primary objectives is the documentation of indigenous knowledge related with these wild plant species which is weakening day by day (Ali and Nasir, 1989-1991).

Additionally, maximum of them are designated from hilly zone of Pakistan (Ali & Qaiser, 1986). The unique floral diversity of Chitral restricted about 1500 (27.16%) species of flowering plants (Ali, 2008; Shinwari & Qaiser, 2011). In Chitral the initial majority of documented plants are medicinal (Khan, 1996). The inhabitance of far-flung area in any region always trusts on native indigenous knowledge of plant resources in order to treat various health ailments (Ali and Qaiser 1993-2007; Alonson, et al., 2001).

Ethnobotanical information can provide an important feedback for public health and environmental policies through the understanding of sociocultural backgrounds and the analysis of ethnic-based strategies to combat diseases (Asase et al., 2005). Documentation of various significant medicinal plants was carried out in diverse valleys, in different time. Recently in literature the available research paper with respect to ethno botany are considered as Rashid awan et al., 2001, collected 35 medicinal plants from Chitral; Siraj et al., 2006 collected 75 medicinal plants from booni Valley; Farukh et al., 2007 collect 111 medicinal plants from mastuj valley; Ali and Qaiser, 2009, (83) plant taxa fromentire chitral; Khan et al., 2011, (31) plant taxa from chitral gole national park; Mukarram et al.,2012 (82) medicinal plants from Mastuj valley; Aftab et al., 2013, (40) medicinal plant from Chitral; Zahida et al., 2013, (20) medicinal plants from Booni valley; Asad et al., 2014 (62) taxa from Bumborate valley chitral ; Hadi et al., 2014 (31) weed plants from Rech valley district chitral, Hadi and Ibrar, 2014 (9) plant species from Bumborate valley District Chitral. At last Kifayat et al., 2015 from Mulkhow valley Distric Chitral. However, these all previous ethnobotanical investigations did not use quantitative methods and also Shishikoh valley is lack of ethnomedicinal literature so far. Therefore, the current study records and documents the remedial uses of plant species by the inhabitants, aiming to: (i) document traditional knowledge of herbal species used by the Shishi valley; (ii) quantify the ethnomedicinal plant uses retaining relative frequency of citation (RFCs) and Fidelity level (FL) indices; (iii) to highlight the supreme interest of the local community in medicinal plants collection and unique medicinal plants that have ever been previously been reported in nearby areas.

Methods

Study area

Geography: Shishikoh valley in Chitral is located (35º55´52˝ N and 71º50´03˝ E) at the elevation of 2000 to 7000 ft and covered area is 56586 hectares about 39 km away in the North of Tehsil Drosh district Chitral KP (Khyber Pakhtunkhwa). Administratively Drosh is the Headquarter despite being narrow the population of the valley 17580 (5.5%) of entire Chitral 318689 (Ali., 2009) according to the census 1998 (Akbar, 2014).

Climate and topography: The weather is tremendously harsh and cold in the wintertime and pleasant in the summer. Average temperatures in summer ranges from 25°C to 40°C, while in the winter the night time temperature occasionally drops to -10°C. The valley gets precipitation in the form of rain and snow where later is dominant in winter season. Furthermore infrequent rains also ensue during summer because of monsoon influence approaching from Swat. The climatic circumstances have remarkable effects on water convenience in the UC which is considered as water resourceful part in Chitral district contribution a fair share of vegetative cover. God has kindly blessed the area with natural resources. The chief sources of income of the valley's inhabitant are farming, laboring, shepherding, animal harboring, wood cutting and pine nut collection (Akbar, 2014).

Ethnographic background: The narrow valley existed by different tribes with their own indigenous particular tradition and distinct language i.e., Khow, Gujer, Pakhtoons and Madaklashti. The valley comprises of 2588 Households. The total population of the area is 17580 souls having 9228 men (52.49%) and 8352 women (47.51%). Out of the total population, there are 4863 children and 224 people found above 80 years of age (Akbar, 2014).

Socio-economic profile: In Shishikoh, livestock resources are important component of rural economy and largely comprise of cattle, sheep and goat, additionally also some donkeys as pack animals. Domestic poultry is also kept for household consumption and utility. These animals are basically reared for meat, milk, wool, manure and transportation of wood. For many people, livestock is also used as a source of cash income at the time of urgent need (Akbar, 2014).

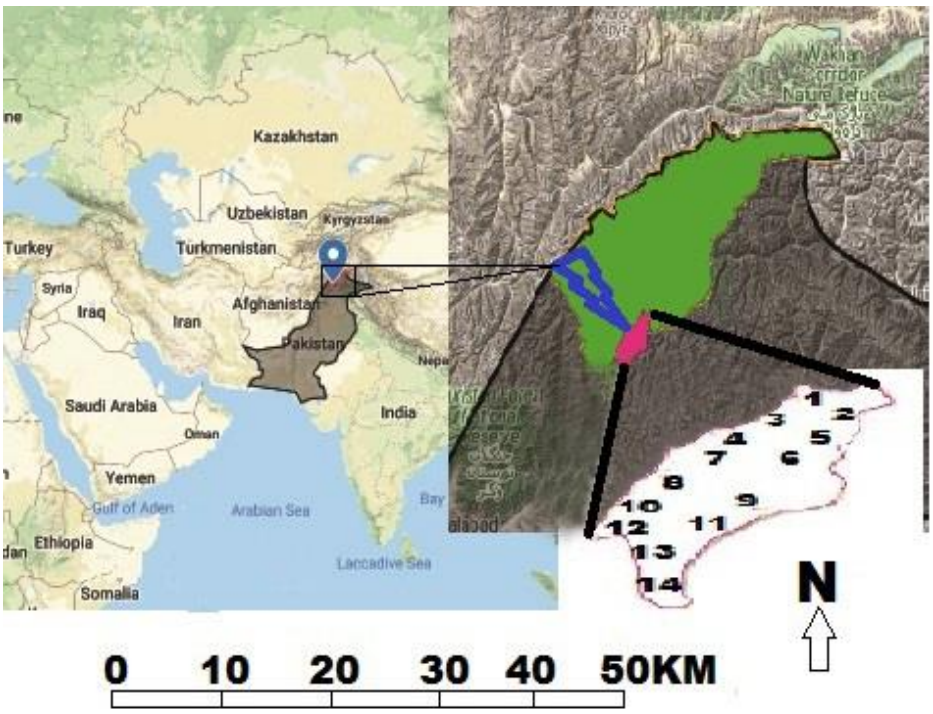

Figure 1. Map of study area; Shishikoh Valley District Chitral; 1 Madaklasht, 2 Tangalgol, 3 Balpanch, 4 Kawash, 5 Tingel Gol, 6 Goren gol, 7 Kashendel, 8 Birga nisar, 9 Purgal. 10 Istroom, 11 Pursat, 12 Muzdeh, 13 Huzoor Begandeh, 14 Shishi.

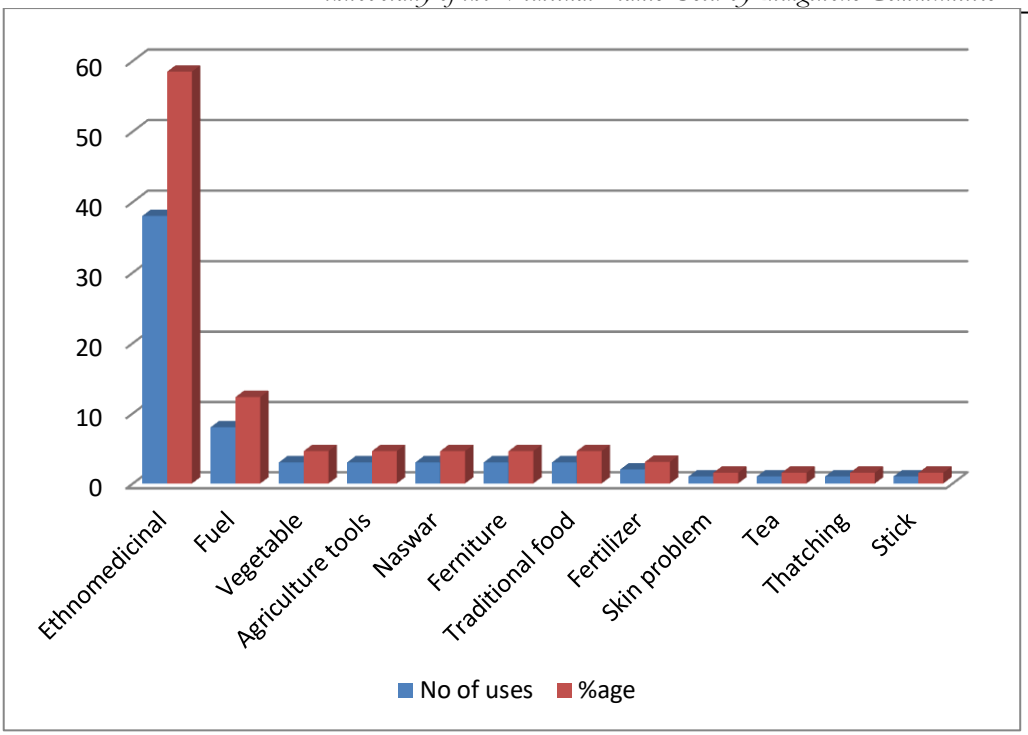

Figure 2. Use categories of ethnobotanical plant.

Ethnobotanical data collection: Ethnobotanical data was collected from 69 different informants (including 37 males, 27 females and five local herbalists) in the valley villages of Shishi, Huzoor Begandeh,Istroom, Shirati, Birganisar, Tingel, Ziarat, Kashidel, Khotik and Madaklasht (Figure 1). Formal agreement was received from informers regarding data collection and publication; previously the Participatory rural assessment approach as revealed in the Kyoto Protocol remained practical with the agreement of the informant. Ethical Strategies of the International Society of Ethnobiology (http:// www.ethnobiology.net) were rigorously followed. The methodology was considered through the sole purpose of attaining the invaluable wealth of local knowledge, with special importance on homoeopathic plant use (M.H. Hasrat, 2007; Muthul et al., 2006; Abbas et al., 2016).
All the informants were categorized into six age groups, i.e., 11– 20, 21–30, 31–40, 41–50, 51–60 and above 60 years of age (Tables 1 and 2).
Question concerning the vernacular name, part (s) used, availability, diseases treated, modes of preparation and administration and cultural practices were asked in the native language. Within the chosen question, females often disliked talking with foreigners due to their remote social association and religious traditions.
Therefore, feminine informants continually had to be familiarized through their masculine relatives (e.g. brother, father or husband) (Muthul et al., 2006; Abbas et al., 2012).

Table 1. Characteristics of the study participants.

Catagoery	**Number**	**Percentage**
Gender		
Men	37	71.15
Women	15	28.84
Total	52	
Education level		
Illetrate	18	34.61
Middle	2	3.84
Metric	5	9.61
secodary	7	13.46
Graduate	8	15.38
Master	12	23.07
Socioeconomics		
Labour	8	15.38
Farmer	16	30.76
Carpenter	3	5.76
Shephered	3	5.76

House wives	3	5.76
Students	13	25
Teacher	6	11.53

Later on the collected plant species were identified by means of the Flora of Pakistan and additional literature sources (Nasir et al., 1972; Shinwari et al., 2006). The botanical names and respective families were confirmed through the Angiosperm Phylogeny Group (K. Mesfin et al., 2013). All the collected specimens were properly identified and and stored in the Herbarium of Hazara University, Mansehra, Pakistan.

Data analysis

All collected data were analyzed after field survey based on use reports of plant part (s) of each species to treat a particular health complaint. The traditional remedies of each taxon along with diseases cured were calculated using the number of citations through the informants. The importance of each plant species was estimated by the relative frequency citation index (RFCi), which designates the indigenous status of each species. RFCi values were calculated via the frequency of citation (FC, the number of informants mentioning the use of the species) divided by the total number of informants participating in the survey (N), without considering the use-category values as reported previously (Khan and Khatoon, 2007; Comaraet al., 2009; Abbas et.,al 2016).

Fidelity Level (FL) remained recognized by Friedman et al. (1986) is the proportion between the number of informants who mentioned the use of a plant for a particular purpose and the total number of informants who mentioned the use of the plant for any purpose (regardless the category). Fidelity Level (FL) is calculated using the following formula:

FL (%)= (Ip/Iu) 100, where Ip is the number of informants who independently recommended the use of a plant for a particular purpose, and Iu is the total number of informants who mentioned the plant for any use or purpose.

The preference ranking index was calculated, as explained by Asase et al., 2005, according to the level of effectiveness of the reported plant species. Each rank was given a numeral (1, 2, 3, 4 or 5), with the most effective plants assigned a value of 5.

Table 2. Total number and percentage of interviewees per age group.

Age group	No of interviever	Male	Female	Percentage
11-20	9	5	4	17.3
21-30	10	7	3	19.23
31-40	11	8	3	21.15
41-50	16	…	16	30.76
51-60	4	…	4	7.69
60-onward	2	…	2	3.84

The concern valley is out of the reach of researcher and lack of data related to Medicinal plants. So the concern study is considered.

Results and Discussion

The research area showed great taxonomic diversity. In spite of the arid habitats at most of the research area, all the three major groups of spermatophytes are well represented in the research area. Spermatophytes in the research area are represented by gymnosperms and angiosperms including both monocots and dicots. The research area showed great variation in the composition flora at different sites.

The diversity increased gradually along the valley and reached its top at Madak Lasht, the last village of the valley having the highest altitude i.e., 2800 m. Similar diversity records have also been reported by Ali and Qaiser (1986) and Ali (2000 & 2008) for various regions of Pakistan.

The current research work reported a total of 29 plants belonging to the 19 genera of four (4) Major families of the research area, Shishi Koh Valley Chitral Pakistan. Family Lamiaceae contributed the largest number of species (10), followed by family Rosaceae (8), followed by family Apiaceae (7) and family Euphorbiaceous (4) as shown in Table 1.

Ethno botanical data Analysis

Traditional ecological knowledge of the valley is understand through this work in which data analysis also include how the knowledge is possible, adapted, linked and transmitted through generation.

Informant demographics: Ancient time the informants, who were mostly shepherds, wood cutters, farmers, teachers, tourist monitors and housewives, show additional ethnobotanical information as compared to younger informents. These must be possible and adopt due to fluctuating lifestyles, expansion and urbanization of towns such as cities extension, greater dependency on allopathic drugs , poetry and the lack of attention in current generations. Two-thirds of the informants remained illiterate owing the nonexistence of education facilities, while the remaining one-third were educated (mostly secondary school level or below) (Table 1).

Taxonomic diversity: According to Khan, 2005; Nasser and Dickoré, 2002; Sher, 2002, Floristically Chitral District in northern Pakistan show some rich in cultural, geophysical and biological diversity. Available composition of flora resources exhibits a diverse basic resources such as food, medicines and building materials for inhabitants of the valley. The reduction of preferred plants,

particularly therapeutic plant resources, results in the suffering of personally deficiency and loss of economic opportunities for the inhabitants of the area.

In total, 50 plant species belonging to 33 families and 48 genera were documented as used by the Shishikoh Valley. The most important families was *Asteraceae* with 8 species and *Lamiaceae*, *Umbellifarae* and *Rosaceae* with 3 species in each, followed by 5 Families with 2 (species in each) in the terms of ethnobotanical usage. Twenty four families were represented by single species each. Among genera, Artemisia and Mentha each featured two ethno medicinally important species. With respect to growth habit, herbs were the dominate form 28 (56%), followed by trees 14 (28%) and shrubs 8 (16%). Reported species were classified into different classes on the basis of their nature of usage, i.e., ethno medicinal (38 spp. 58 %), fuel perpose (8 spp. 12%), Vegetable, Argiculture, Ferniture, Naswar formation with (3 spp. 4%), Fertilizer (2 spp. 3%) and Thatching, Ttea, Skin problem, Stick (1 spp. 2%) in each.

Table 3. Table 3 Folk medicinal plant uses recorded in Tormik Valley, Karakorum Mountain Range.

Botanical name/Local name/ Families/Voucher No	**Locality**	**Availability**	**Habit**	**Part use**	**Drug description**	**Disease treated**	**RFCs n=55**	**FL**
Alcea rosea L. Cav./Layn/ MalvaceaeHUP4089	Birga nisar	Non.	Shrub	Whole plant	Paste is made by chopping and roots powder	Joindic problem, bone infection, applied on boils to dry the puss and improve hair brighness	0.21	41 %
Allium cepa L./ Theshto/ Alliaceae HUP 4080	Huzoor begande h	Cult.	Herb	Bulb	Decoction is taken two time and bulb heated within hot ashe than the paste is applied	Cough , cool, scorpian bites, ear problem in children, joindic problem and Gastrointestinal problem	0.32	44 %
Anthemis cotula L./ Shirisht/Asteraceae HUP4082	Madakla sht	Non.	Herb	Aerial part	Decoction is taken 3 times a day	Stomach pain, abdominal pain and abdominal worms.	0.38	66 %
Artemisia maritima L./ Phespok/Asteraceae/ HUP4083	Muzh Deh	Non.	Herb	Aerial parts	Decoction is taken 3 times a day	Worm repelent, abodminal pain, stomach pain , fuel purpose	0.36	65 %
Artemisia parvifolia Roxb ex. D. Don. /Kharkhalich/ Asteraceae HUP4097	Kharkhal ich	Non.	Herb	Whole plants	Aerial parts grind into powdered and decoction obtain a glass from 2g per day.	Sugar reductase, worm repellent and stomach pain, small doses with mother milk is given to new born baby to improve the fluency of tongue	0.2	72 %
Berberis lycium Royle./ Chowenjh/ Berberidaceae HUP4099	Tingeel	Non.	Shrub	Whole plant	Decoction is used 2 time a day	Used against typhoid, worm repellent, juindic, chronic and diarrhea. Also root bark use as liver infection	0.41	78 %
Bergenia ciliata (Haw.) Sternb./Besabr/Saxifragaceae HUP4100	Madakla sht	Non.	Herb	Roots	Paste from roots are applied	Sun block and skin diseases and improve the beauty	0.23	10 0 %

Cappris spinosa L./Kaveer/ Capparaceae HUP4104	Muzh Deh	Non.	Shrub	Flower	Flower soaked and decoction	Diuretic, tonic, rheumetism, typhoid, malaria, blood purifier and "Parpi" a legendary drug is obtained which is very expesive remedies in the field of medicine	0.25	78 %
Capsella bursa-pastoris. (L) Medic./Hardi phato/Brassicaseae HUP4095	Shishi	Non.	Herb	Leaves and floewr	Leaves and floewr cooked as vegetable	Vegetable and fodder	0.23	76 %
Carthamus tinctorius L. Poom/Asteraceae HUP4109	Shishi	Cult.	Herb	Flower	Extract is made from flower and dry flower is used	Cough, diuretic and diaphoretic and dry floweris used in traditional food for improve its colour and taste, children disease.	0.25	64 %
Celtis australis L./ Binjoo/Ulmaceae HUP4013	Ziarat	Non.	Tree	Stem	Stem cut and piece	Hange with children against Evil eye.	0.23	100 %
Chenopodium murales L./ Kunakh/ Chenopodiaceae HUP4112	Shishi	Non.	Herb	Whole plants	Cooked and then used	Abdominal pain , blood thinner and Diuretic	0.27	60 %
Cichorium intybus L./ Khasti/Asteraceae HUP4113	Shishi	Non.	Herb	Whole plants	Decoction of whole plants is taken 3 times a day	Typhoid, high fever, diarrhea and malaria. Also used to promote digestion.	0.34	73 %
Coriandrum sativum L./ Shonjmook/Umbelliferae HUP4115	Shishi	Cult.	Herb	Aerial parts	Herbal tea made from fruits is drunk thrice a day	Carminative, fever, abdominal pain and stomach pain, control the risk of heart attack	0.25	100 %
Cotoneaster acuminata Lindl. / Ishkorelik/Rosaceae HUP4114	Istroom	Non.	Tree	Stem, fruits	Wood and brach cut off and fruits choped and colour fluid is obtained	Handle for different instrument,	0.23	100 %
Cratagus sonagarica G. Koch./ Gooni /Rosaceae HUP4116	Birga nisar	Cult.	Tree	Fruits	Obtained decoction is made and used twice a day.	Heart tonic and improve blood flow, Asthma and abdominal pain	0.3	100 %
Datura stramonium L./ zharjosho/Solanaceae HUP4117	Madakla sht	Non.	Herb	Aerial parts	Leaves are dried small doses used towice a day	Small doses used as Sedative, asthma, cough and whooping. High doses may cause death	0.23	69 %

Elaeagnus angustifolia L. var angustifolia./ Shinjoor/ Elaeagnaceae HUP4122	Tingeel	Cult.	Tree	Fruits and latex	Soaked in water and extraction made from fruit then used 3 times a day . Latex is dried and use weekly	The extraction used against cool, cough and worm repellent, Fresh fruit juice is used against cough,throught infection and latex is used as hair tonic	0.38	80 %
Ephedera gerardiana Wall. Ex Stapt./Soomani/ Ephederaceae HUP4132	Pinda Och	Non.	Shrub	Aerial parts	Steam at the time of sleeping and Exrtact is applied on joints 3 times a day. Wood burn and ashe is used	Bronchitis, hay fever, cough, asthma, bronchitis and joints problem. Ashe used to improve the quality of Naswar and abdominal worm release in children	0.25	78 %
Equisetum arvensis L./Rom/ Equisetaceae HUP4124	Shishi	Non.	Herb	Whole plants	Decoction of plant is taken twice a day	Urinary tract infection	0.23	100 %
Foeniculum vulgare L./ Bodyong/Umbelliferae HUP4133	Shishi	Cult.	Shrub	Aerial parts	Powedered is used three time a day	Stomach pain, cough and cool,chest pain, vission, abdominal pain and mouth wash	0.32	83 %
Fumaria indica (Hausskn.) Pugsley/ Shatara/Fumaricaceae HUP4135	Birga	Non.	Herb	Whole plants	Decoction	Constipation, abdominal pain and Diarrhea	0.29	81 %
Glycerhiza glabra L./ Moyo/ Papilionaceae 4127	Shishi	Non.	Shrub	Leaves	Extraction is taken therice a day and ashe paste is applied externally sun blocker	Asthma, anthelmintic and skin problem. Ash paste used as sun block	0.27	73 %
Helianthus annuus L./ Yorotmokhno korak/ Asteraceae 4128	Huzoor begande h	Non.	Shrub	Seed	Seed grind into powder	Oil of seed used for cooking, hair restorer, bronchial disorder, given to hen to enhance egg production	0.25	71 %
Hippophae rhamnoides L./ Mirghez/ Eleagnaceae HUP4137	Shishi	Non.	Tree	Fruits and Barriers	Barries are chopped and taken thrice a day	Diabates and joindics, High blood pressure, skin protector.	0.29	81 %
Iris germanica L./Soosan / Iridaceae HUP4129	Taar	Non.	Herb	Rhizome	Bioled and extraction is given 3 to 4 times a day	Abdominal ailment when Large intestine blocked in cattle and kidney disorder	0.36	100 %
Juglans regia L./Birmogh /Juglandaceae HUP4130	Tingel	Cult.	Tree	Nut,bar k, wood and leaves	Wood, bark powdered and then used, fresh leaves used directly and dried fruits	Ferniture, cleaning of teeth and lipsticks, heart tonic, fruits used as BP reducer	0.25	100 %

Juniperus excelsa M. Bieb. / Sarooz/Cupressaceae HUP4161	Birga Dap	Non.	Tree	Leaves/ Twigs	Ashe and aerial parts	Improve quality of naswar and plants is respected by the people thus its steam ans smoke is use against evil eye in children	0.32	100 %
Krascheninmkovia ceratoides (L.) Guldonist./ Godroon/ Chenopodiaceae HUP4164	Huzoor begandeh		Herb	Aerial parts	Extraction is made obtained in the form of oil	Abdominal pain specially against stomach pain	0.2	100 %
Linium usitatissimum L./ Shentheeki/Linacaea HUP4139	Madaklasht	Cult.	Herb	Seed	Grind and extract	Traditional food locally (Sanabachi, Halwa, Ghazhaghazhi) The oil is used against spot in face or skin.	0.21	100 %
Melia azedarach L./ Bakayeeni /Meliaceae/HUP4141	Shishi	Cult.	Tree	Aerial parts	Stem and leaves	Fertilizer and insecticide which applied against insect in field.	0.25	100 %
Mentha arvensis L./Podina/ Lamiaceae HUP4165	Madaklasht	Cult.	Herb	Aerial parts	Powedered is used three time a day	Abdominal pain, stomach pain.	0.4	100 %
Mentha longifolia (L.) L./Bain/Lamiaceae/ HUP4142	Shishi	Cult.	Herb	Whole	Paste is made by chopping	Joindic problem	0.27	100 %
Morus alba L./Mrach / Moraceae HUP4143	Common	Cult.	Tree	Fruits	Dried fruits are soaked in water for one week then filtered	Throat remedy, worm repellent	0.23	69 %
Nepeta cataria L./ Motrich/Lamiaceae HUP4166	Birga ghari	Non.	Herb	Whole plants	one time a dayBoiled in water and used	Malaria, bones infection, worm Repellent	0.3	82 %
Papaver somniferum L./ Afyun/Papavaraceae HUP4190	Birga Bala	Cult.	Herb	Fruit	Cut the unripe fruit and the milky exudate from capsule is collect	Low doses used mind refreshment, Joindic problem and reduce fever, smoked for mental excitement	0.38	52 %
Plantago lanceolata L./ Ispaghool/Plantaginaceae HUP 4150	Shishi	Non.	Herb	Seed/ Leaves	Seed used	Stomach pain, Bronchial problem	0.3	58 %
Platanus orientalis L./ Chinar/Platanaceae HUP4151	Shishi	Cult.	Tree	Stem and bark	Powder of bark is used orally 3 time	Control diarrhea and stem is used making gun carriage, small boxes and paneling	0.23	84 %
Podophyllum emodi Wall. Ex Royle / Mamekhi/ Podophylaceae/ HUP4152	Shishi	Non.	Herb	Roots	Roots are boiled and used Orally	Blood purifier, joindic problem, spinal card problem, tonic and used against urine disease	0.09	40 %

Pronus armanica L./ Zholi/ Rosaceae HUP 4153	Shishi	Cult.	Tree	Fruits ,Stem and flower	Ripen fruit is taken orally, Paste of Flower.	Laxative, Sun block and skin disease	0.07	100 %
Quercus baloot Giff./ Banj/Fagaceae/HUP4154	Birga bala	Non.	Tree	Ashes	Leaf collected and given to cattle in winter and ash of aerial part	Improve the qaulity of naswar and useas winter fodder for cattle.	0.12	100 %
Rheum emodi D.Don, Prodr./ Ishpar/Polygonaceae/HUP4155	Tingeel	Non.	Herb	Aerial parts	Boiled and the vapours or steam applied on fracture	Bone fracture.	0.09	80 %
Salix babylonica L./ Teeli/Salicaceae /HUP4156	Madaklasht	Cult.	Tree	Stem	Stem and branch cut off	Fuel purposes, plough, ploughing stick , different instrument locally (Shakarai, ingot, Basket, Chay) which are locally used for different	0.14	100 %
Seriphidium chitralense (Podlech) Y. R. Ling./ Droon/Asteraceae/HUP4157	Shishi	Non.	Herb	Aerial parts	Fresh plants is boiled in water and used 2 times a day while paste is applied on bite spot	Atomach pain, worm repellent, abdominal pain and scorpian bites.	0.2	72 %
Sisymbrium irio L./ Khelikheli/Brassicaceae/HUP4158	Shishi	Non.	Herb	Aerial parts	Leaves are dried into Powdered	Improve the qaulity of naswar.	0.29	100 %
Sophora mollis Stocks./ Beshoo/ Papiliomaceae/HUP4159	Dap birga	Non.	Shrub	Whole plants	Collected and applied in field of rice.	Fertilizer and insecticide which applied against insect in rice field.	0.16	100 %
Tanacetum pamiricum Burnm. /Kharkhalich / Asteraceae/HUP4170	Shishi	Non.	Herb	Aerial parts	Paste in applied on scorpion bite. Powdered is used 3 times a day	Scorpian bite, Stomach pain and worm repellent.	0.12	85 %
Urtica dioca L./ Dozoono/Urticaceae/HUP4171	Birga Bala	Non.	Tree	Whole plants	Decoction is taken thrice a Day	Joints pain and blood tonic	0.07	50 %
Verbascum thapsus L./ Gordogh karo/ Scrophulariaceae/ HUP4172	Madaklasht	Non.	Herb	Whole plants	The aerial part and roots grinded and poweder is used	Arial parts are given to cow for enhance milk production and makes it dense. The powder of roots used to reduce suger level in	0.25	50 %
Vicatia coniifolia DC./ Danoo/Umbelliferae/HUP4173	Shishi	Non.	Herb	Aerial parts	Extraction make from leaves and taken orally	The extraction from leaves used as worm repellent and digestion problem.	0.2	100 %

Furthermore, cultural plants were further categorized into 11 use categories, i.e., beverages (4 spp.), hut and fencing (9 spp.),

thatching (3 spp.), agricultural tools (4 spp.), domestic fuel (7 spp.), fodder and forage (11 spp.), wool weaving tools (6 spp.), bio-repellant (1 sp.), evil repellant (1 sp.), fragrance and affection (5 spp.), and polo stick making (3 spp.) (Figure 2).

Vernacular nomenclature

Plant species locally assign by name known as Vernacular nomenclature for medicinal or cultural purposes. Sometime the native designations of plant species provide signs about myths, community associations, habitation type, growth habit, stem morphology, fruit and medicinal uses. So some plants in the study area also given name due to their nature for instance, the vernacular name of *Podophyllum emodi* Wall. Ex Royle " Mamekhi" is derived from meekh (nail). Like nail, the plants utilize against joint problem or join the fracture bones or spinal card, thus it is named mamekhi. *Artemisia parvifolia* Roxb ex. D. Don. Locally known as Kharkhalich which is assign by this due to the bitter nature on taste. *Helianthus annuus* L. locally (Yorotmokh no korak means opposing sun) this name is assign to this plants due to changing direction against sun in day time *Datura stramonium* L. locally zharjosho (Zhar means venom and josh means herbs) thus the species is full of venom, even any cattle of human ate it mistakenly will not beable to survive. *Verbascum thapsus* L. *Gordogh karo* (gordogh means donkey and kar means ear) thus the leaf of the plants is look like that of ear of donkey so the name is assigned. However, the etymology of many other local names of plant species was not known; for instance.

Ethnomedicinal uses

Traditional Medicines show global economic significance due to its medicinal uses in worldwide (Hadi et al., 2014). In developing countries, Traditional Medicine are frequently the only available and cheap source of medications (Lemieux et al., 2012). That's reason the herbal medicines are the worlds beneficial means to contest illnesses for a huge percentage of individuals in developing countries, in both urban areas and rural areas (Hussain et al., 2007).

A total of 26 species representing 26 genera and 26 families were used to treat 11 different human ailments, namely gastro-intestinal diseases, dermatitis, jaundice, hepatitis, cancer, pneumonia, tonic, asthma, urinary disorders, joint pain and eye pain (Table 3).

Recorded plant species were also examined for part (s) used, remedy preparation, route of administration and given dosage for a particular ailment. Eleven different parts of these 26 plants were being utilized in the region (Figures 3 and 4). Regarding routes of administration, 62 % of species were taken orally and 15 % of species were reportedly applied externally, while 23.07 % were used either orally or externally.

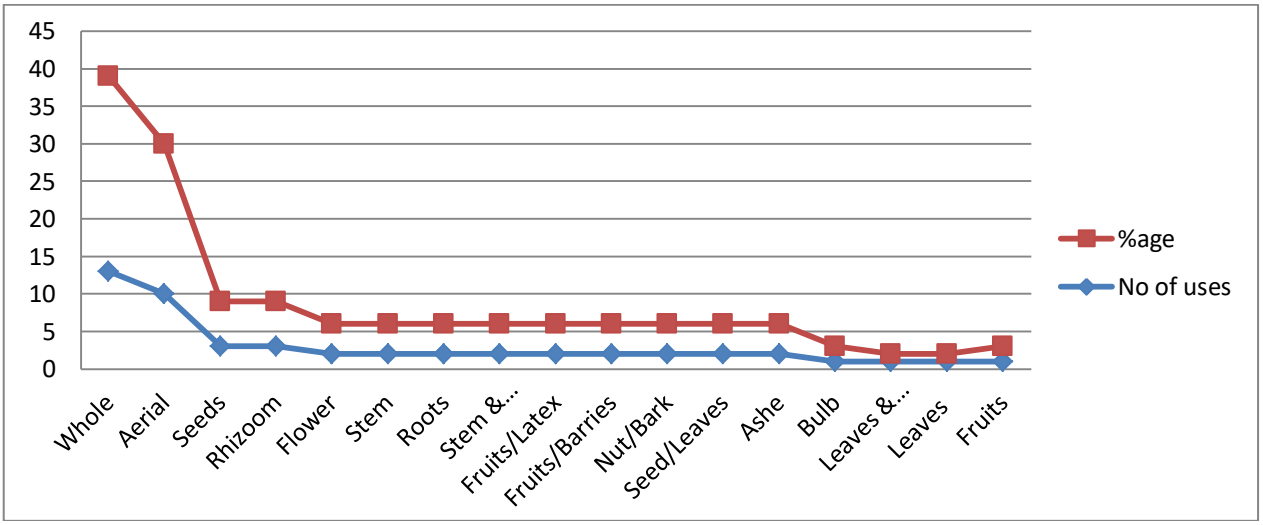

Figure 3. Ethnomedicinal uses of various plant parts.

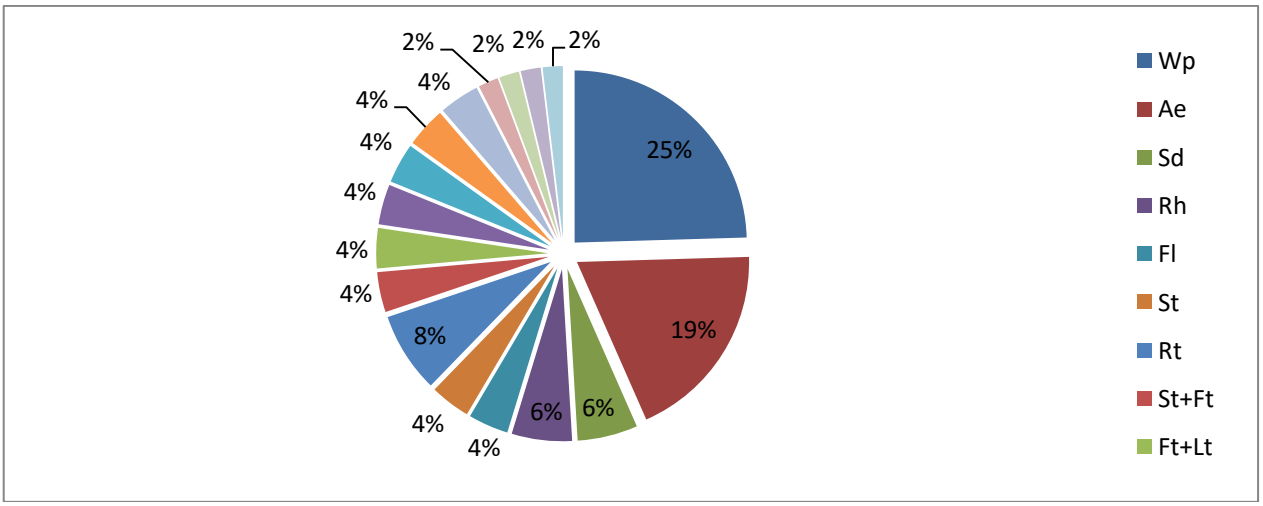

Figure 4. Classification of plant species based on part (s) used in traditional medicines Whole plants (Wp), Aerial (Ae), Seed (Se), Rhizome (Rh), Flower (Fl), Stem (St), Roots (Rt), Stem and Fruits (St+Ft), Fruits/Latex (Ft+Lt), Fruits/Barries (Ft+Br), Nut/Bark (Nt+Br), Seed/Leavea (Sd+Lvs), Ashe (As), Bulb (Bu), Leaves /Flower (Lvs+Fl), Leaves (Lvs) and Fruit (Ft).

Comparative analysis of our finding with previous work

The present study is the first ever comprehensive ethnobotanical investigation of Shishikoh valley. However, the findings of the current study were compared with those of previous ethnobotanical investigations carried out in neighboring Vallies of Chitral. This study revealed that most medicinal plants were herbaceous, followed by trees and shrubs. The dominant herbaceous medicinal species in the region are similar to those reported by previous studies. Some of the mentioned plant, *Equisetum arvensis* L. , *Fumaria indica* (Hausskn.)Pugsley, *Datura stramonium* L., *Krascheninmkovia ceratoides* (L.) *Seriphidium chitralense* (Podlech) Y. R. Ling. are first time introduced as medicinally important plants in Shishikoh Valley, no any visitor mentioned these species in their medicinal research work from entire Chitral. Remaining plants were also found in the adjacent valleys but our findings are in contrast to certain previous ethnobotanical studies in neighboring regions, where different plant species were reported with respect to their preferred use (Abbasi et al., 20013; Abbasi et al., 2015; Abbasiet al., 2016; Afolayan anf Jimoh 2008; Akber, 2014; Ali, 1986; Ali, 2008; Ali and Qaiser 2009).

As far as ethnobotanical importance is concerned, the uses of certain medicinal plants are the most significant (Table 3), as there is some similarities in uses with (Abbasi et al., 20013; Abbasi et al., 2015; Abbasiet al., 2016; Afolayan anf Jimoh 2008; Akber, 20145) and few dissimilar with (Abbasi et al., 2013; Abbasi et al., 2015; Abbasiet al., 2016; Afolayan anf Jimoh 2008; Akber, 2014).

This study reveals that the medicinal plant species were reported for the first time from Shishikoh valley regarding their use (Table 3). Interestingly, indigenous knowledge of plants and their uses change with respect to geographic area and ethnic group. For instance, the bulb of *Allium cepa* L. is used to treat cough and cool, ear problem and digestive ailment (Mukkarm shah and kifayat), but in Shishi Valley the whole plant is additionally use to treat scorpion bites. Powder made from the leaves of *Sisymbrium irio* L. is used as worm repellent and stomach (Asad, Nasirullah, Siraj, Kifayat), but in Shishikoh Valley the same species is used as Blood pressure rerductase. According to previous worker (Nasir ullah, Hadi et al., Siraj, kifayat) *Artemisia parvifolia* Roxb ex. D. Don. Is used against stomach pain, worm repellent, Bp reductase and abdominal pain but the concern valley is investigate that the people use this species against BP reductase as well as used against scorpion bite and given to new born infant with mother milk for tongue fluency. Coriandrum sativum L. (Rashid awan, Asad, Sadia and Hadi etal) is used by neighbouring area as Stomach pain, Diarrhea,malaria diuretic and abdominal pain while in concern area the same species used against heart problem risk of heart attack.

Relative frequency of citation and preference ranking

Ethnobotanical various tools such as relative cultural importance indices are applied to measure cultural preference of plant taxa in a specific area. We applied the Relative Frequency of Citation index (RFCi), Fidelity level (FL) and the proportion of entities with traditional knowledge to evaluate the ethnobotanical knowledge of the local informants concerning the medicinal uses of the described plant species; as in Table 3. From a therapeutic point of view *Berberis lyceum*, *Anthemis cotula*, *Elaeagnus angustifolia* L. var. *angustifolia*, *Papaver somniferum* exhibited significant RFCi values (0.41, 0.38, 0.38, 0.38, 0.38 and 0.37 respectively). Fidelity level of the valley is also examined, the highest FL is 100% (21 species), followed 6 species show FL between 81-90%, 16 species (61%-80%) and 8 species show below 60% respectively. The high RFCs *Berberis lyceum*,s used remedies is decoction from leaves and roots followed by *Anthemis cotula* (Decoction from aerial parts), *Elaeagnus angustifolia* L. var. *angustifolia* (Fruits and latex), *Papaver somniferum* (Fruits) *artimisia maritima* (aerial parts).

Cultural aspects of botanical taxa

The results presented in Table 4 demonstrate that 24 plant species have various indigenous uses among local peoples according to their cultural requirements. Inhabitants of Shishikoh Valley use 12 plant fuel perpose. Cotoneaster acuminate Lindl, *Elaeagnus angustifolia* L. var. *angustifolia* , *Hippophae rhamnoides* L., *Juglans regia* L.,
Morus alba L., *Platanus orientalis* L and *Salix babylonica* L are cut and use as the perpose of different Agricultural tool and handle of tools. *Cappris spinosa* L, *Capsella bursa-pastoris*. (L) Medic, *Carthamus tinctorius* L., *Chenopodium murales* L, *Mentha longifolia* (L.), *Linium usitatissimum* L. are used as traditional food and domestic food. Moreover, *Hippophae rhamnoides* L. and *Sophora mollis* Stocks are used as thatching perpose built around home gardens, vegetable patches and other crop fields to protect them from herbivorous animals. How ever Juglans regia L and *Juniperus excelsa* M. Bieb locally used as furniture formation juglans species is very strong wood for furniture. *Melia azedarach* L. and *Sophora mollis* Stocks used as best fertilizer in the study area. The braches cut down and place below the ground in winter and later the soil may be best fertile for each crops. *Chenopodium murales* L, *Urtica dioca* L, *Verbascum thapsus* L The aerial parts of these species are used as best source of vegetable in the valley, the species like *Celtis australis* L., *Juniperus excelsa* M. Bieb are considered as a remedies against evil eye. Again *Cotoneaster acuminate* Lindl and *Salix babylonica* L utilize as ploughing stick and walking stick. Our findings of the cultural uses are very important for economic improvement and cultural development. The studied cultural uses are introduced first time in the study area as well as Chitral valley.

Table 4. Food and other non-medicinal plant uses recorded in Shishikoh Valley, Chitral.

Botanical name/ Families/ V.No	Local name	Uses										No of uses
		AT	DF	EE	FP	TP	WS	PS	VP	Fu	Fe	
Artemisia maritima L./ Asteraceae /HUP4083	Phespok	-	-	-	+	-	-	-	-	-	-	1
Artemisia parvifolia Roxb ex. D. Don. / Asteraceae /HUP4097	Kharkhalich	-	-	-	+	-	-	-	-	-	-	1
Cappris spinosa L. / Capparaceae /HUP4104	Kaveer	-	+	-	-	-	-	-	-	-	-	1

Capsella bursa-pastoris. (L) Medic./ Brassicaseae/ HUP4095	Hardi phato	-	+	-	-	-	-	-	-	-	-	1
Carthamus tinctorius L. /Asteraceae /HUP4109	Poom	-	+	-	-	-	-	-	-	-	-	11
Celtis australis L. / Ulmaceae/HUP4013	Binjoo	-		+	+	-	-	-	-	-	-	2
Chenopodium murales L./ Chenopodiaceae/ HUP4112	Kunakh	-	+	-	-	-	-	-	+	-	-	2
Cotoneaster acuminate Lindl./ Rosaceae/ HUP4114	Ishkorelik	+	-	-	+	-	+	+	-	-	-	4
Cratagus sonagarica G. Koch./ Rosaceae/ HUP4116	Gooni	-	-	-	+	-	-	-	-	-	-	1
Elaeagnus angustifolia L. var. *angustifolia.*/ Elaeagnaceae/ HUP4122	Shinjoor	+	-	-	+	-	-	-	-	-	-	2
Hippophae rhamnoides L. / Eleagnaceae/ HUP4137	Mirghez	+	-	-	-	+	-	-	-	-	-	2
Juglans regia L./ Juglandaceae/ HUP4130	Birmogh	-	-	-	-		-	-	-	+	-	1
Juniperus excelsa M. Bieb./ Cupressaceae/ HUP4161	Sarooz	-	-	+	-	-	-	-	-	+	-	2
Linium usitatissimum L./ Linacaea / HUP4139	Shentheeki	-	+	-	-	-	-	-	-	-	-	2
Melia azedarach L. / Meliaceae/ HUP4141	Bakayeeni	-	-	-	+	-	-	-	-		+	2
Mentha longifolia (L.)/ Lamiaceae/HUP4142	Bain	-	+	-		-	-	-	-		-	1
Morus alba L./ Moraceae HUP4143	Mrach	+		-	+	-	-	-	-	+	-	3
Platanus orientalis L./ Platanaceae/ HUP4151	Chinar	+	-	-	+	-	-	-	-	+	-	3
Pronus armanica L./ Rosaceae/ HUP 4153	zooli	-	-	-	+	-	-	-	-	-	-	1
Quercus baloot Giff./ Fagaceae/ HUP4154	Banj	-	-	-	+	-	-	-	-	-	-	1
Salix babylonica L./ Salicaceae/ HUP4156	Teeli	+	-	-	+	-	-	+	-	-	-	3
Sophora mollis Stocks./ Papiliomaceae/ HUP4159	Beshoo	-	-	-	+	+	-	-	-	-	+	2
Urtica dioca L. / Urticaceae/ HUP4171	Dozoono	-	-	-		-	-	-	+	-	-	1
Verbascum thapsus L./ Scrophulariaceae/ HUP4172	Gordogh karo	-	-	-	-	-	-	-	+	-	-	1

Conclusion

The present study revealed that the Shishikoh valleys in Chitral show a extraordinary Traditional Knowledge. Indigenous knowledge of these plants have represented the sign of the traditional food systems and could still represent as a support of the local food authority, while medicinal plants play a vital role, which need to be reconsidered and carefully reevaluated by ethno pharmacologists and public health actors. The collected data may be also of interest to initiatives aimed at fostering sustainable rural development in an area that faces serious economic problems, widespread illiteracy, and isolation. The findings of this paper to ensure the dynamic conservation of invaluable local knowledge systems, as well as plant diversity in Pakistani mountain regions.

Acknowledgement

We are very grateful to the inhabitants of Shishikoh Valley for sharing their indigenous knowledge. We are also very grateful to Sajjad Ahmad engineer SRSP Chitral, Pakistan, who provided GPS for field survey.

Funding; This paper is a part of PhD study conducted by Kifayat ullah (first author), PhD student in Hazara University Mansehra-Pakistan. No funding was provided by any source to conduct this survey.

Competing Interests

The authors declare that they have no competing interests.

Consent for Publication

Our manuscript does not contains any individual's person data.

References

Abbasi A.M., Khan M.A., Shah M.H., Shah MM., Pervez A., Ahmad M. (2013). Ethnobotanical appraisal and cultural values of medicinally important wild edible vegetables of Lesser Himalayas-Pakistan. J Ethnobiol Ethnomed. 9:84.

Abbasi, A.M., Shah, M.H., T.Li, Fu . X, Guo X, R.H. Liu. (2015). Ethnomedicinal values, phenolic contents and antioxidant properties of wild culinary vegetables. Ethnopharmacol.;162:333–45.

Abbas, Z. (2012). "Floristic diversity, cultural uses and phytosociology of Tormic valley Baltistan". M. phil Thesis, Quaid-i-Azam University Islamabad, Pakistan.

Afolayan, A, F. Jimoh. (2008). Nutritional quality of some wild leafy vegetables in South Africa. Int J Food Sci;Nutrit.;60 (5):424–31.

Akbar, S. (2014). Background Of Shishi Valley (Shishikhoh WUMP Database) C DF- W4L project-IC.

Ali S, M. Qaiser. (1986). A phytogeographical analysis of the phanerogams of Pakistan and Kashmir. In: Proc Royal Soc Edinburgh B. 1986: Cambridge Univ Press. 89–101

Ali S. I.2 (008).. Significance of Flora with special reference to Pakistan; Pak. J. Bot. 40 (3):967-971. Ali. H and M. Qaiser, (2009). The Ethnobotany of Chitral Valley, Pakistan with Particular reference to Medicinal Plants pak. j. bot., 41 (4): 2009-2041, 2009.

Ali & Qaiser (Eds). (1993-2010). Flora of pakistan Nos. (194-219).

Ali, H. (2003). Trade of Medicinal plant in Mingora City. MSc. Thesis Department of Botany, Government Postgraguate College, Bannu.

Ali, H, H. Ahmad and M. Yousuf. (2003). Trade f local medicinal plants in Mingora city. Shop on in: Proceeding of work conservation and sustainable uses of Medicinal and aromstic plants of Pakistan.

Ali, S. I & Y. J. Nasir (Eds) (1989-1991). Flora of Pakistan, Nos; (191-193) Karachi & Islaabad.

Ali. H & M. Qaiser (Eds) 1993-2007. Flora of Pakistan Nos. (194-215). Karachi.

Ali, H. (2009). Floristic studies of chitral. Threatened plants and conservation strategies, University of Karachi in the fulfillment of the requirement for the degree. "Doctor of philosophy" Department of botany University of Karachi, Karachi, 2009.

Alonson, A, F. Dalmeier, E. Granek and P. Raven. (2001. Biodiversity: Connecting with the
Tpastry of life, Smithsonian institude/monitoring and Assesment of Biodiversity Programe and President, s Comittee of Advisor on Science and Technology Charter Printing, Washington DC, USA.

Asase, A, A. A. Oteng-Yeboah, G.T. Odamtten. (2005). Simmonds MS. Ethnobotanical study of some Ghanaian anti-malarial plants. J Ethnopharmacol. ; 99 (2): 273–9.

Asad, A. Rashid and N. Parveen, (2014) Medicinal Plants Used in the Isolate Region of Bumburate, Kalash Valley, District, Chitral, Pakistan. Pak. J. Weed Sci. Res., 20 (3): 359-373, 2014.Awan, M.R, M. Shah, G. Akbar & S. Ahmad. (2001).Traditionally Uses of Economically
Important Plants of Chitral District, Malakand Division, NWFP Pakistan. Pakistan museum of Natural History, Islamabad, Pakistan. Pak. J. Bot.33.

Balick, M. J, P.A. Cox. (1996). Plants, people, and culture: the science of ethnobotany: Scientific American Library, New York.

Bano, Z, A. Begum and K. Bano. (2013). Ethno-Botanical Studies of Some Seleted Plants in Mastuj, Chitral Valley, Khyber Pakhtunkhaw,2013.. Canadian Journal of Applied Sciences. 1 (3): 413- 426.

Cornara L, La Rocca A, S. Marsili, M. Mariotti. (2009). Traditional uses of plants in the Eastern Riviera (Liguria, Italy). J Ethnopharmacol.2009; 125 (1):16–30.

Ermias Lulekal, Z.A. Kelbessa E, P.V. Damme. (2011). Wild edible plants in Ethiopia: a review on their potential to combat food insecurity. Afrika Focus.;24:71–121.

Fransworth, N. R and Soejarto. (1991). Global importance of Medicinal Plant. In. O., Akerel, V. H. Wood and H. Synge, Eds.: The conservation of Medicinal plant; Proceeding of an international consultation 21-27 March 1988, Cheang Mai, Thailand Cambridge University Press, Cambridge, pp.25-51.

Hadi, F and M. Ibrar. (2014). Ethnobotanical Profile of Gymnospermic Flora of Kalash Valley, District Chitral, Hindo-Kush Range, Pakistan. American-Eurasian J. Agric. & Environ. Sci., 14 (12): 1405-1408, 2014

Hadi,F, I. Aziz, Muhammad, D. Ghulam, A. Muhammad, N. Khalid and A. Muhammad. (2014). Weed Diversity in Wheat and Maize with special reference to their Ethnomedicinal Uses at Rech Valley, Hindokush range, Chitral, Pakistan. Pak. J. Weed Sci. Res., 20 (3): 335-346, 2014

Hasrat,M. H. (2007). Baltistan Tehzeeb-o-Saqafat. Baltistan Book Point and Publications Naya Bazar Skardu. Hussain.F , M. Shah and H. Sher. (2007). Traditionnal Resource Evaluation of Some Plants of Mastuj,District Chitral, Pakistan. Pak. J. Bot., 39 (2): 339-354.

Kifayat, U, J. Alam, H. Ali, H. Ahmad and S. Muhammad. (2017). The Traditional Knowledge of Some Phanerogames of Mulkhow - Valley District Chitral. Science Arena Publications Specialty Journal of Biological Sciences Available online at www.sciarena.com 2017, Vol, 3 (2): 16-31.

Khan, A. (2005). Joint forest management plan Madaklasht Valley Chitral (Qashqar Conservancy). Technical Report Prepared for Pakistan Mountain Areas Conservation project. IUCN-Pakistan, Islamabad, Pakistan.25.

Khan, A. A. (1996). Ethnobotany with particular reference to medicinal plants of upper Chitral Region. Proc. Ethnobotany workshop NARC, Islamabad.

Khan. N, M. Ahmed, A. Ahmed, S. S. Shaukat, M. Wahab, M. Ajaib, M.F. Siddiqui and M. Nasir. (2011). Important Medicinal Plants of Chitral Gol National Park (cgnp) Pakistan Pak. J. Bot., 43 (2): 797-809.

Khan, S.W. and S. Khatoon. (2007). Ethnobotanical studies on useful trees and shrubs of Haramosh and Bugrote Valleys, in Gilgit northern areas of Pakistan. Pak J Bot.;
39 (3):699–710.

Khan, A, T. Akhtar, Ambreen, Obaid, S. K. Shereni, I. Ahmad and I. Hussain. (2013). Medicinal Value and Bio Efficacy of Important Traditional Plants of Garum Chashma Valley,Chitral. Phamaceutical research and Bio science Vol 2 (4); 207-226.

Lemieux C.J, P.F. Eagles, D.S. Slocombe, S.T. Doherty, S.J. Elliott, S..E. Mock. (2012). Human health and well-being motivations and benefits associated with protected area experiences: An opportunity for transforming policy and management in Canada.

Parks;18 (1):71–85.
Liwington, A. (1990). Plant for people. Natural History Museum Publication, London. Map of Chitral https://www.bing.com/images/search?q=map+of+chitral&FORM=HDRSC2.
Mesfin, K, G. Tekle, T. Tesfay. (2013). Assessment of threatening factors of medicinal plant species in Samre district, south-eastern Tigray, northern Ethiopia. J Med Plants;1 (4):38–42.
Mukarram, S and F. Hussain. (2012). Ethnomedicinal plant wealth of Mastuj valley, Hindukush range, District Chitral, Pakistan. Department of Botany, University of Peshawar, Pakistan. Journal of Medicinal Plants Research Vol. 6 (26), pp. 4328-4337, 11 July, 2012
Muthul, C, A. Muniappan, R. Nagappan, I. Savarimuthu. (2006). Medicinal plants used by traditional healers in Kancheepuram District of Tamil Nadu. J Ethnobiol Ethnomed.;2:43.
Nasir, E, S. I. Ali, R.R. Stewart. (1972). Flora of West Pakistan: An annotated catalogue of the vascular plants of West Pakistan and Kashmir. Fakhri, Karachi, Pakistan; 1972
Nüsser, M, W.B. Dickoré. (2002). A tangle in the triangle: vegetation map of the eastern Hindukush (Chitral, northern Pakistan). Erdkunde, 37–59.
Sher, H. (2002). Some medicinal and economic plants of Mahodand, Utror, Gabral Valleys (district Swat), Gabur,Shinwari Z. K & M. Qaiser. (2011). Effect on conservation & sustainable use of Medicinal plant
of Pakistan, Pak. J. Bot. 43: 5-10. Shinwari ZK, Qaisar M. Efforts on conservation and sustainable use of medicinal plants of Pakistan. Pak J Bot. 2011;43:5–10
Siraj , A, H. Ali, H. Beg, A. Ahmad Dasti and Z. K. Shinwari. (2006). EthnobotanicaL Studies On Some Medicinal Plants of Booni Valley, District Chitral Pakistan . Pak. J. weed Sci,Rs. 12 (3); 183-190. 2006.
Silva, F. S, M.A. Ramos, N. Hanazaki, U.P. Albuquerque. (2011). Dynamics of traditional knowledge of medicinal plants in a rural community in the Brazilian semi-arid region. Revista Bras de Farmacog;21 (3):382–91.
Western, D. (2001). Human-modified ecosystems and future of evolution. PNAS 98 (10): 5458-5465.
Woondruff, D. S. (2001). Declines of Biomes and Biotas, the future of evolution, Colloquium. 98 : 5471-5476.
Zabta, K.S, T. watanabe, M. rehman, T. yoskikawa. (2006). Pictorial guide of medicinal plants of Pakistan. Kohat university of science and technology kohat.

Citation:
Ullah, K., Shah, G. M., Alam, J., Hussain, M. (2020). Ethnobotany of the Medicinal Plants Used by Indigenous Communities in the Mountain of Shishikoh Valley, Hindukush Chitral. *Ukrainian Journal of Ecology, 10* (2), 92-105.