



RESEARCH ARTICLE

Ethnomedicinal uses of the Ferns of Shishikoh Valley, District Chitral, Pakistan

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Abstract

The indigenous communities of Shishikoh valley are often using various ferns taxa regularly. The current research work was intended for documenting the ethnomedicinal knowledge of ferns. A total of 18 taxa were recorded that belonged to 9 genera and 6 families being used in the treatment of different ailments. Pteridaceae was the leading family with 6 taxa (33.33%), followed by Aspleniaceae with 4 taxa (22.22%), Athyriaceae and Equisetaceae each with 3 taxa (16.67%) followed by Dryopteridaceae and Marsileaceae each with 1 taxon (5.56%). The reported ferns taxa were used as anthelmintic, anti-rheumatic, astringent and wound healing agents and in the treatment of different ailments such as asthma, bronchitis, diarrhea, dysentery, gonorrhoea, hepatitis, infertility, influenza, kidney disorders, measles, oral ulcer, oral thrush, pneumonia, pyelonephritis, pharyngitis, scorpion bite, sinusitis, tonsillitis and tuberculosis. Ethnomedicinal knowledge is a valuable source for the innovation of different allopathic, homeopathic and herbal drugs that are used for the treatment of different ailments. The fern species may be used commercially for medicinal purposes through sustainable way. Their proper cultivation and awareness about medicinal values among local communities leads to discover new drugs.

Keywords

Chitral, Ethnomedicine, Ferns, Pakistan, Shishikoh valley

Introduction

Shishikoh is a beautiful valley having diverse ethnic tribes with their own linguistics i.e. Madaklashti, Khow, Dangarik, Pathan and Gujer. It is situated in the Hindukush Mountain with 565.86 Sq. km covered area. Its geographical distribution is between 35° 55' 52" N and 71° 50' 03" E. The altitude varies from 1420 m cultivated area to 4200 m high thick snow covered peak. It is bordered with Golen valley in West, district Upper Dir in the East, Laspur to the Northern side and Drosh headquarter lies towards the South. The environmental condition is drastically fluctuating i.e. from July to August, the temperature goes high with 37 °C or more and from December to February the temperature falls below – 10 °C (1, 2).

Pteridophytes are one of the important group of primitive flora, since millions of years, and are distributed as aquatic, epiphytic, lithophytic and terrestrial habitats (3, 4). Since time immemorial, the plant species were used by local indigenous tribes of different communities (5, 6). About 70

percent population of the world depends upon the ethnomedicinal uses of plants, but currently allopathic medications are replacing the ethnomedicinal uses (7-10). About 700 medicinal plants taxa are used ethnomedicinally in Pakistan due to poverty and high cost of allopathic medicines in the rural and tribal communities (11).

There are about 11916 Pteridophyte taxa in the world belonging to 337 genera and 51 families with 14 orders and 2 classes (12). Pakistan lacks comprehensive Cryptogamic Flora although researchers have been working since thirteen decades. Currently 168 taxa of pteridophytes belonged to 45 genera and 19 families have been reported from Pakistan, that had highest diversity in Azad Jammu and Kashmir, followed by district Mansehra, Abbottabad, Swat and Gilgit-Baltistan (13-16). A total of 36 taxa of pteridophytes belonged to 18 genera and 13 families were reported ethnobotanically and taxonomically from Punjab, Pakistan (17); 14 taxa of pteridophytes belonged to ten genera and eight families were reported from Miandam valley, district Swat, Pakistan (18) and 16 taxa belonged to 10 genera and 9 families have been reported from Utror valley, district Swat, Pakistan (19). A list of 28 taxa of Pteridophytes belonged to 15 genera and 10 families were reported from Jelar valley, district Upper Dir, Pakistan (20); 41 taxa belonged to 20 genera and 10 families were documented from district Torghar, Pakistan (21).

Pteridophytes have been ethnomedicinally used to treat various human disorders such as dysentery, wound healing, hair fall, sterility, urinary, respiratory disorders, ulcer and vomiting (22), used as source of nutrition, improves the environmental attractiveness and reduces pollution, provides beauty to parks, gardens and lawns, increase the environmental charm of restaurants, schools, offices and hospitals (23).

The most dominated genera of Pteridophytes in Khyber Pakhtunkwa, Pakistan are *Adiantum*, *Aleuritopteris*, *Asplenium*, *Athyrium*, *Cystopteris*, *Dryopteris*, *Equisetum*, *Hypodematum*, *Marsilea*, *Oeosporangium*, *Onychium*, *Polystichum*, *Pteridium*, *Pteris* and *Selaginella* (24).

Previously different explorations have been carried out regarding ethnomedicinal and traditional uses of Angiosperms from district Chitral, Pakistan. Due to the availability of suitable climatic conditions the Pteridophytes are highly distributed in Shishikoh valley, Chitral, Pakistan; but their literature is lacking regarding the ethnomedicinal and traditional uses. Therefore, the current study was documented for the first time to provide the baseline information regarding the ethnomedicinal uses of the ferns of Shishikoh valley, district Chitral, Pakistan.

Materials and Methods

After thorough field survey, the fern flora was documented from May 2020 to September 2021 and collections were made from seven different localities of Shishikoh valley. All the relevant ethnomedicinal information were collected from different communities and ethnic groups, viz. farmers, invaders, nut collectors and shepherd from alpine

zone by using semi structured questionnaire. A total of 80 questionnaires were distributed among the informers to document the indigenous knowledge of pteridophytes from different tribes of the area. After collection, the specimens were properly pressed, poisoned and mounted on herbarium sheets then identified with the previous literature (25). The specimen was deposited in the herbarium of Hazara University, Mansehra, Pakistan (HUP).

To evaluate the cultural preferences of the ethnomedicinal and traditional uses of the ferns, various tools viz. (UVs), (RFCs) and (FL) were recorded for every taxon.

Use value was evaluated according to the given equation (26).

$$UVs = \sum U_i / N$$

Use value offers the relative significance of remedial uses of plant taxa; UVs is the number uses of individual species, U_i is the number of uses recorded for each species and N is the number of total informants. UV shows the virtual importance of reported plant taxa in an area. High UV indicate that plant taxa have great use reports and is most important in the area, while low use value shows that taxa have limited use reports in regard of its use. However, the use report is not significant to separate whether a plant species is used for single or various purposes.

RFCs calculation was used to assess the native importance of plant taxa (27).

$$RFCs = \frac{Fcs}{N}$$

In calculation of RFCs, number of respondents refer as useful taxa (Fcs) is divided by whole number of informants in the field report (N). It may vary from 1 (when the entire informant's refer to taxa as useful taxa) to 0 (when no one refers to a plant as useful taxa). Fcs is the number of informants using the plant species, N is the total number of informants (1). Fidelity level "FL" means the % of informants who stated the practice of flora for identical purpose. FL of plant species was considered by using the procedure (28).

$$FL (\%age) = \frac{I_p}{I_u} \times 100$$

" I_p " is the sum of informants who separately suggested the uses of a plant taxa for a particular disease and " I_u " means the entire number of informants who report the similar taxa for any illness.

Results

A total of 18 taxa belonged to 9 genera and 6 families were recorded that were used in the treatment of different ailments. Pteridaceae remained the leading family with 6 taxa (33.33%), followed by Aspleniaceae with 4 taxa (22.22%), Athyriaceae and Equisetaceae each with 3 taxa (16.67%), followed by Dryopteridaceae and Marsileaceae each with 1 taxon (5.56%). *Asplenium* was the most dominant genus with 4 taxa (22.22%), followed by *Adiantum*

and *Equisetum* with 3 taxa each (16.67%), *Diplazium* and *Pteris* with 2 taxa each (11.11%), *Marsilea*, *Polystichum*, *Cryptogramma*, *Cystopteris* with 1 taxon each (5.56%) (Table 1).

plant taxa were used by indigenous community's i.e frond of 5 taxa (27.78%), rhizome of 4 taxa (22.22%), whole plant of 4 taxa (22.22%), young stem of 3 taxa (16.67%), while young leaves of 2 taxa (11.11%) were used.

Table 1. Ethnobotanical uses of the ferns of Shishikoh valley, Chitral, Pakistan

Species name	Family	Part used	Application	UVs	RFCs	FL
<i>Asplenium ceterach</i> L.	Aspleniaceae	Yf	Powder is used against problem of infertility, acute kidney injury and pyelonephritis	0.037	0.1	50
<i>Asplenium dalhousiae</i> Hook.	Aspleniaceae	R	Decoction is used to relieve gonorrhoea and influenza	0.037	0.08	50
<i>Asplenium trichomanes</i> L. subsp. <i>trichomanes</i>	Aspleniaceae	Yf	Paste applied on hands by young girls in winter, also used to relieve bronchitis and pneumonia	0.025	0.08	66
<i>Asplenium viride</i> Huds.	Aspleniaceae	R	Decoction is used orally against gonorrhoea in children, influenza, measles and relieve hepatitis A.	0.05	0.07	33
<i>Cystopteris fragilis</i> (L.) Bernh. subsp. <i>fragilis</i>	Athyriaceae	Wp	Powder is mixed with butter and used to treat pharyngitis, tonsillitis, oral ulcer and oral thrush	0.05	0.11	50
<i>Diplazium maximum</i> (D.Don) C.Chr.	Athyriaceae	Wp	Powder is orally used with milk against pneumonia, bronchitis and Tuberculosis in high elevated area by shepherd	0.037	0.1	50
<i>Diplazium longifolium</i> (D.Don) T.Moore	Athyriaceae	R	Powder is orally used as anthelmintic and hair tonic	0.025	0.08	50
<i>Polystichum lonchitis</i> (L.) Roth	Dryopteridaceae	Yf	Powder is given to children orally for controlling diarrhea, tuberculosis in alpine community	0.025	0.05	50
<i>Equisetum arvense</i> L. subsp. <i>diffusum</i> (D.Don) Frser-Jenk.	Equisetaceae	Ys	Orally the powder is used to relieve the acute kidney injury. The paste of leaves and frond is used to improve skin and hair brightness.	0.037	0.08	66
<i>Equisetum arvense</i> L. subsp. <i>arvense</i>	Equisetaceae	Ys	Decoction is used to protect skin and good remedy against pyelonephritis	0.025	0.06	50
<i>Equisetum ramosissimum</i> Desf.	Equisetaceae	Ys	Powder is used to relieve hepatitis, wound healing, vision and treatment of edema	0.05	0.02	33
<i>Marsilea minuta</i> L.	Marsileaceae	Yf	Powder is used in nasal disorder, rhinitis and oral ulcer and oral thrush in Children	0.05	0.02	50
<i>Adiantum capillus-veneris</i> L.	Pteridaceae	Yl	Paste is applied in face for protection and powder is used as worm repellent	0.025	0.11	50
<i>Adiantum incisum</i> Forssk. subsp. <i>incisum</i>	Pteridaceae	Wp	Orally in powdered form it is used against scorpion bites and insect bites	0.025	0.08	50
<i>Adiantum pedatum</i> L.	Pteridaceae	Yl	Powder is used as astringent and anti-rheumatic	0.025	0.08	50
<i>Cryptogramma stelleri</i> (S.G. Gmel.)	Pteridaceae	Wp	Powder is mixed with olive oil and applied on chest of children to relieve pneumonia and asthma	0.025	0.06	50
<i>Pteris vittata</i> L. subsp. <i>emodi</i> Fraser Jenk.	Pteridaceae	R	Decoction is useful to treat edema, inflamed and irritated parts of skin and also used against pneumonia in children	0.05	0.06	50
<i>Pteris cretica</i> L. subsp. <i>cretica</i>	Pteridaceae	Yf	Powder is used in the treatment of dysentery and healing of wound	0.025	0.07	50

: Yf: Young frond, R: rhizome, Yl: Young leaves, Wp: whole plant, Ys: Young stem

The reported taxa were used as anthelmintic, anti-rheumatic, astringent and wound healing agents and in the treatment of different ailments viz. asthma, bronchitis, diarrhea, dysentery, gonorrhoea, hepatitis, infertility, influenza, kidney disorders, measles, oral ulcer, oral thrush, pneumonia, pyelonephritis, pharyngitis, scorpion bites, sinusitis, tonsillitis and tuberculosis. Different parts of

All the mentioned disorders were treated by different plants for more than single purpose such as edema was the most treated disease by 7 taxa, bronchitis and pneumonia were treated by 5 taxa each, kidney disorders and pyelonephritis were treated by 4 taxa each, gonorrhoea, influenza and mouth ulcer were treated by 2 taxa each, diarrhea, dysentery, hepatitis, pharyngitis, tonsillitis

and tuberculosis were treated by single taxa each (Table 1).

The effectiveness of the treatments described has not been tested, as the present study aimed to rescue and record the knowledge contained in traditional populations regarding ferns and how they were used by these inhabitants.

Use Value

Use value is used to recognize the plant taxa that were widely used amongst ethnic groups for various disorders. In present study the use value of ferns flora ranged from 0.025 to 0.05. *Adiantum incisum* subsp. *incisum* and *Pteris vittata* subsp. *emodi* each showed highest use value with 0.05, followed by *Asplenium trichomanes* subsp. *trichomanes*, *A. viride* and *Diplazium maximum* each with 0.037, *Equisetum arvense* subsp. *diffusum* and *E. ramosissimum* each with 0.03, followed by *Adiantum capillus-veneris*, *A. pedatum*, *Asplenium ceterach*, *A. dalhousiae*, *Cryptogramma stelleri*, *Diplazium maximum*, *Cystopteris fragilis* subsp. *fragilis*, *Diplazium longifolium*, *Equisetum arvense* subsp. *arvense*, *Marsilea minuta*, *Polystichum lonchitis* and *Pteris cretica* subsp. *cretica* each with 0.025 (Table 1).

Relative frequency citation

In present study the relative frequency citation (RFC) of the ferns taxa ranged from 0.02 to 0.11 with highest value of *Adiantum capillus-veneris* and *Cystopteris fragilis* subsp. *fragilis* each with 0.11, followed by *Diplazium longifolium*, *Equisetum arvense* subsp. *diffusum*, *Asplenium trichomanes* subsp. *trichomanes*, *A. dalhousiae* and *Adiantum incisum* subsp. *incisum* and *A. pedatum* each with 0.08, *Asplenium viride* and *Pteris cretica* subsp. *cretica* each showed 0.07, *Pteris vittata* subsp. *emodi*, *Cryptogramma stelleri* and *Equisetum arvense* subsp. *arvense* each with 0.06, followed by *Polystichum lonchitis* with 0.05, *Equisetum ramosissimum* with 0.03, *Marsilea minuta* with 0.02, followed by *Diplazium maximum* and *Asplenium ceterach* each with 0.01 (Table 1).

Fidelity level

The fidelity level (FL) of Pteridophytes taxa ranged from 33% to 66% with highest value of *Asplenium trichomanes* subsp. *trichomanes* and *Equisetum arvense* subsp. *diffusum* each with (66%), followed by *Adiantum capillus-veneris*, *A. incisum* subsp. *incisum*, *Asplenium ceterach*, *A. dalhousiae*, *Pteris vittata* subsp. *emodi*, *Cryptogramma stelleri*, *Diplazium longifolium*, *D. maximum* and *Cystopteris fragilis* subsp. *fragilis* each with (50%), followed by *Equisetum ramosissimum* and *Asplenium viride* each with (33%) (Table 1).

Discussion

The Pteridophytes were mostly dominated in damp soil, hill slope, wet soil, rocky mountainous, shaded streams and under forest. The specimens were collected from different localities of Shishikoh valley viz. Balpanj, Birga, Birga bala, Law Hill, Madaklasht hill, Shishi, Tangal gol hills. Like other plants groups Pteridophytes also repre-

sent remedial importance and numerous of them were used ethnomedicinally from pre-historic period. The indigenous population and ethnic communities throughout the world are consuming different parts of plants such as frond, pinnae, rhizome, stem and spores by different techniques for the therapy of several ailments (29).

Similar study was documented about the pteridophytes diversity from Pachmarhi hills, central India (30). Another study reported about the peculiarity of ferns flora of Pachmarhi, Satpura, hills, India (31). Furthermore, it has been investigated that Pteridophytes has great ornamental values and played a pivotal role in environmental Protection (32). Ethnobotanical investigation of *Actiniopteris radiata* and *Isoetes coromandelina* were carried out at Aravali mountain Rampura region (33). Similarly, 81 taxa of lycophytes and ferns belonged to 27 genera and 11 families were reported from district Shopian, Kashmir valley, India (34).

From the present study it was clear that hilly areas, damp soil, rocky mountain and forests cover represent majority of ferns with their ethnomedicinal and traditional importance. The inhabitants frequently used the frond, leaves and rhizome as an extract and their decoction as a source of ethnomedicine for various ailments. The usage of some taxa was found to be alike with other communities from different regions (35). The Pteridophytes taxa showed much strong potential for ulcer and skin care that's why the cosmetics industry exploits the plant taxa for earning. Chiefly the species are edible and the inhabitants sell in local market from alpine zone. Our findings matched with earlier work of (36).

Many workers contributed from Pakistan chiefly focused on Azad Jammu and Kashmir and different districts of Hazara and Malakand division (37-48). Similar study of 66 Pteridophytes taxa belonged to 26 genera and 16 families with their traditional uses were reported from district Mansehra, Pakistan (49), another researcher (50) documented 25 Pteridophytes taxa belonged to 13 genera and 8 families from Maidan valley, district Lower Dir, Pakistan.

Conclusion

The current study was carried out to document the ethnomedicinal uses of the ferns of Shishikoh valley, district Chitral, Pakistan. A total of 18 taxa belonged to 9 genera and 6 families were recorded. They were used by the local inhabitants in the treatment of various ailments i.e. anthelmintic, anti-rheumatic, asthma, astringent bronchitis, diarrhea, dysentery, gonorrhoea, hair tonic, hepatitis, infertility, influenza, kidney disorders, measles, oral ulcer, oral thrush, pneumonia, pyelonephritis, pharyngitis, scorpion bites, sinusitis, tonsillitis, tuberculosis and wound healings. The ferns taxa may be consumed commercially for new drugs discovery by sustainable utilization. Their cultivation for medicinal purpose is needed urgently. Different areas of the valley are still insufficiently explored, especially Tangal gol hill, Law hill, Madak lasht, Birga stream should be declared as protected areas. The awareness

amongst local communities about the ethnomedicinal values of Pteridophytes and their collection in a conservative way is highly recommended.

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Authors contributions

KU wrote the manuscript, GMS supervised the study, JA co-supervised the study, AG helped in identification of species and MI reviewed and revised the manuscript.

Compliance with ethical standards

Conflict of interest: The authors declare that they have no known competing financial interest or personal relationships that could have appeared to influence the work reported in this article.

Ethical issues: None

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