

Sustainable Utilization of Biodiversity: Role of Pteridophytes in Livelihoods of Tharu Tribes of Uttar Pradesh

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Introduction

Biodiversity is perceived as variability among living organism of a particular area at certain time. It includes plants, animals, including microbial diversity. All the individuals in plants, animals and microbes kingdom impart significant role in ecosystem by production and transfer of energy to different tropic level. Such role of the plants, animals and microbes signify their potential importance. Human depend on plant kingdom including pteridophytes for fulfilling of their needs from immemorial period. Pteridophytes (commonly called as vascular cryptogams) evolved in Silurian period and dominated the earth in Carboniferous period of Mesozoic era. Therefore, Carboniferous period is also known as “ages of pteridophytes”. In evolution point of view, the pteridophytes get place between bryophytes and gymnosperms for the reason of phylogenetic relationship. In morphology, pteridophytes are comprised of rhizome, scale, frond, sorus, spore, and reproduce through spore. Their life cycle is comprised of gametophyte and sporophyte. Both the gametophytes and sporophytes are potential to synthesise food materials, thus are equally important for utilization. Broadly, the pteridophytes are divided into fern-allies and ferns. The fern-allies (*Lycopodium*, *Huperzia*, *Selaginella* and *Equisetum*) are distinct in having rhizomatous roots, reduced scaly leaves and microspore as well as megaspore, thus called as heterosporous ferns. The ferns (*Polypodium*, *Dryopteris*, *Asplenium*, *Nephrolepis*, *Pteris* and *Cyathea*) exhibit rhizome, scale, frond, similar spores, therefore called as homosporous ferns. Different tribal communities utilize pteridophytes for various purposes.

However, the sustainable utility of these plants are done by the tribes and men residing in the proximity of forests. They use the pteridophytes for food, fodder, medicines and house-hold articles. They meet out their needs either from entire plants or parts (roots, rhizome, stripe or fronds) of plant. The valuable knowledge about pteridophytes uses in traditional practice remains with the tribes, local communities, herbalist or society living in terrai areas. These traditional knowledge needs to be documented and disseminated. Many pteridophytes like *Selaginella bryopteris* (Sanjeevani), *Dryopteris cochleata* (Jatashankar) and *Helminthostachys zeylanica* (Kamraj) are sold in local markets of Terrai region. *Helminthostachys zeylanica* is potential plant and prescribed in treatment of sexual disorders. Previously, scattered contributions (Sah *et al.* 2005, Benjamin & Manickam 2007, Khare & Kumar 2007, Rao *et al.* 2007, Srivastava 2007, Mannan *et al.* 2008, Poonam & Singh 2009, Shil & Choudhury 2009, Rout *et al.* 2009, Singh *et al.* 2010, Sen & Ghosh 2011, Singh & Khare 2011) on potential uses of pteridophytes by different tribes in India was made. These contributions provided information about useful aspects and potentiality of pteridophytes to cure many diseases.

Tharu tribes hold a huge traditional knowledge about sustainable utilization of pteridophytes for their livelihood. Tharu community is spread all along the Indo-Nepal border of Uttar Pradesh, more particularly in Terrai regions of Pilibhit, Lakhimpur Kheri and Bahraich districts. Plant resources of Dudhwa National Park, Kishanpur Wildlife Sanctuary and Katarniaghat Wildlife Sanctuary in Lakhimpur Kheri and



Fig. 1. (a–b) Residence of Tharus; (c–d) Tharus going for fishing and agriculture; (e–f) Collecting information from Tharu tribe.



Baharaich districts provide needful materials including food, fodder, medicines and other household articles to Tharus.

The forests of terrai regions are comprised of mixed deciduous forests and savanna grassland with an altitudinal range of 500-600 ft. Terrai regions in Uttar Pradesh is connected with Bardia National Park of Nepal in north. It is spread up to Katarniaghat Wildlife Sanctuary in east, Upper Gangetic Plain in south, Kishanpur Wildlife Sanctuary and forests of Pilibhit district in the west. Geographical expanse of terrai regions begins from the foothills of Himalayas. Terrai regions are unique for varied environment, climatic conditions, natural resources, distinctive cultural practices and livelihood of Tharu tribes. The useful aspects of flowering plants by the Tharu tribes were investigated time to time (Acharya & Acharya 2009, Bhattarai *et al.* 2009, Joseph *et al.* 2003, Kumar *et al.* 2006, Kumar *et al.* 2012, Kumar *et al.* 2013, Kumar & Bharti 2014, Singh *et al.* 2011, Verma 2011). Nevertheless, no any attempt was made to document the useful aspects and sustainable utilization of pteridophytes by the Tharu tribes of terrai regions. Present study provides significant information about pteridophytes used by Tharu tribes in their daily life. Study also document detailed information of each pteridophytes to explore indigenous knowledge on food, fodder, medicines, house-hold articles, sustainable utilization and role in livelihood of Tharu tribes.

Materials and Methods

Survey and collection of pteridophytes from terrai regions in Dudhwa National Park, Kishanpur Wildlife Sanctuary, Katarniaghat Wildlife Sanctuary of Lakhimpur Kheri and Bahraich districts in Uttar Pradesh were made. Samples of each species were collected to prepare herbarium. Information about common name, uses of plants and their parts by Tharu tribes for various purposes were gathered. Interviews with the Tharus, herbalists, forest guards, watchers, medicine men, witch-men (ojha) and common men were conducted to retrieve information about sustainable utilization of pteridophytes. Knowledge about process of preparation of decoction and application for useful

purposes was also gathered. In total 14 species were found to be potentially utilized by the Tharu tribes for different purposes. Information about common name, ailments, medicinal uses, methods of preparation of pastes and dosage of cure were also recorded. A detailed account on sustainable utilization and useful aspects of pteridophytes in the livelihood of Tharu tribes are provided below.

Results

Survey on sustainable utilization of Pteridophytes in livelihoods of Tharu tribes residing near Indo-Nepal border and various localities of Lakhimpur Kheri and Bahraich districts of Uttar Pradesh was made. The information gathered from the Tharu tribes (Fig. 1 a-f; Fig. 2 a-f) has revealed that they utilize 14 species for a variety of purposes. A detailed account on 14 species of pteridophytes utilized by the Tharu tribes for various purposes are enumerated with their botanical name, family, common name, mode of use, part of the plant used, photo-plates (Fig. 3 e-f; Fig. 4 a-d) and locality of occurrence.

1. ***Adiantum capillus-veneris*** L. Sp. Pl. 1096. 1753 (Fig. 3 a).

Family: Adiantaceae; Common name: Hansraj.

Sustainable utilization: Stipe and rachis is used for piercing the ears. It is also used as ear studs by girls and women. Entire plant is used in witchery and jadu-tona. It is used in cough syrup (Singh & Khare 2011). Leaves with honey are used for treatment of catarrh, throat and bronchial disorders. Decoction of the leaves mixed with tea is given for curing irregularity in menstrual period. Extract of fronds with honey is applied in eye ailments, respiratory problem and menstrual disorders (Sen & Ghosh 2011, Singh & Khare 2011).

Distribution in study area: Uttar Pradesh: Bahraich: Katarniaghat Wildlife Sanctuary: Mihipurwa.

2. ***Adiantum philippense*** L. Sp. Pl. 2: 1094. 1753. (Fig. 3 b).

Family: Adiantaceae; Common name: Hanswati, Kaante Jhar, Kali Sundhiya.



Fig. 2. (a–d) Collecting information from Tharu tribe; (e–f) Tharu tribes exploiting woods.



Sustainable utilization: Stipe and rachis are used as ear ornament (studs). Paste of the plant mixed with mustard oil is used as ointment for cure of the boils. A fresh leaf is used for cure of fits (Khare & Kumar 2007). Rhizome used for anti-fertility, fronds used as a decoction for the pulmonary infections. Rhizome is used for treating dysentery and glandular swelling (Sen & Ghosh 2011). Leaf paste is used in treatment of leprosy and hair fall. It is used to remove obsession. Rhizome is administered to women for sterility. Whole plant crushed and applied around navel region in flatulence. Fresh leaf (2 gm) paste is taken orally on empty stomach twice a day for ten days for relief from indigestion (Rout *et al.* 2009, Singh & Khare 2011).

Distribution in study area: Uttar Pradesh: Lakhimpur Kheri: Dudhwa National Park: Gauriphanta road, Chandan Chauki, Dudhwa, Sonaripur, Kila, Kakraha, Belrayan, Belapersua, Salukapur, Bankati; Kishanpur Wildlife Sanctuary: Jhaadi Taal; Bahraich: Katarniaghat Wildlife Sanctuary: Nishangarha: Chaphria Chowk, Tigda Beet, Rampurwa; Murthia; Kakraha; Motipur.

3. *Ampelopteris prolifera* (Retz.) Copel., Gen. Fil. 144. 1947. (Fig. 3 c).

Family: Thelypteridaceae; Common name: Kochiya, Macchi-neure.

Sustainable utilization: Entire plant but usually new frond is used as delicious vegetable. Juice of rhizome diluted with water is prescribed to cure sexual disorders in male. Diluted juice of rhizome is taken as aphrodite to tensile male sex organ.

Distribution in study area: Uttar Pradesh: Lakhimpur Kheri: Dudhwa National Park: Gauriphanta, Bankati, Sathiyana, Belaghat, Nishatnagar, Salukapur, Lodaria, Belrayan, Kila, Sonaripur, Chandan Chauki.

4. *Ceratopteris thalictroides* (L.) Brongn., Bull. Soc. Philom. Paris 1821, 186. 1822. (Fig. 3 d).

Family: Parkeriaceae; Common name: Sewali Jhar.

Sustainable utilization: Paste of entire plant is boiled in mustard oil and used as ointment for treatment of burn, fresh wounds and to stop bleeding. Cooked leaves are eaten as food (Sen & Ghosh 2011). Fronds are used as poultice in skin diseases (Rout *et al.* 2009), however leaf powder along with turmeric is applied to unhealed wounds (Rao *et al.* 2007, Singh & Khare 2011).

Distribution in study area: Uttar Pradesh: Lakhimpur Kheri: Dudhwa National Park: Digria, Bankati, Belrayan, Kakraha Taal, Belapersua, Salukapur, Dudhwa, Gauriphanta; Bahraich: Katarniaghat Wildlife Sanctuary: Semar Chowk Nishangarha.

5. *Christella dentata* (Forssk.) Brownsey & Jermy in Brit. Fern Gaz. 10: 338. 1973. (Fig. 3 e).

Family: Thelypteridaceae; Common name: Makargorwa.

Sustainable utilization: New and juvenile frond is used as vegetable. Paste of the rhizomes and leaves are used for boils treatment. Rhizome and sporophyll used as antibacterial agent (Parihar & Parihar 2006, Singh & Khare 2011).

Distribution in study area: Uttar Pradesh: Lakhimpur Kheri: Dudhwa National Park: Bankati, Jauraha Nala Setu near Chandan Chauki, Gajraula Chauki near Sathiyana, Sonaripur, Belrayan, Gauriphanta, Belaparsua, Dudhwa.

6. *Christella parasitica* (L.) Lev., Fl. Kouy-tescheon 475. 1915. (Fig. 3 f).

Family: Thelypteridaceae; Common name: Macchi-neure, Limra.

Sustainable utilization: Juvenile fronds used as vegetable, however entire plant is used as fodder. Paste of rhizome is used to get rid of evil spirits (Rao *et al.* 2007). Fresh rhizome (5 gm) along with fresh root (1 gm) of *Asparagus racemosus* and sugar (5 gm) boiled in water (250 ml). The decoction orally administered for 10 days to cure spermatorrhoea, gout and rheumatism (Sen & Ghosh 2011).



Fig. 3. (a) *Adiantum capillus-veneris*; (b) *Adiantum philippense*; (c) *Ampelopteris prolifera*; (d) *Ceratopteris thalictroides*; (e) *Christella dentata*; (f) *Christella parasitica*; (g) *Diplazium esculentum*; (h) *Equisetum ramosissimum* subsp. *debile*.



Distribution in the study area: Uttar Pradesh: Lakhimpur Kheri: Dudhwa, Bankati, Belapersua, Gauriphanta (15 km from Dudhwa), Sathiyana, Kila, Lodaria compartment Belrayan, Salukapur, Belaghat near Kema Chauki, Dudhwa; Kishanpur Wildlife Sanctuary: Jhaadi Taal; Bahraich: Katarniaghat Wildlife Sanctuary: Girijapuri, Bicchia Beet, Semar Chowk Nishangarha, Sadar Beet, Murthia in Dharampur range.

7. ***Diplazium esculentum*** (Retz.) Sw. in Schrad. Journ. Bot. 180(1): 312 (1803). (Fig. 3 g).

Family: Athyriaceae; Common name: Kochiya, Lukda, Dheki, Pani-neure.

Sustainable utilization: New fronds are used as vegetable. Entire plant is used as fodder for cow and goat. Crozier or tender leaf is used as salad and pickles (Sen & Ghosh 2011). Young and fresh frond is boiled with salt and taken for maintain all-round health (Shil & Choudhury 2009). Rhizome is used as insect inhibitor in seed storage. Decoction of rhizome along with 2 ml of honey is taken in empty stomach to cure spermatorrhoea (Rout *et al.* 2009, Singh & Khare 2011).

Distribution in the study area: Uttar Pradesh: Lakhimpur Kheri: Dudhwa, On the way to Gauriphanta, On the way to Chandan Chauki, on the way to Sathiyana, Bankati, Sonaripur, Kila, Lodaria compartment Belrayan range, Belapersua, Salukapur; Kishanpur Wildlife Sanctuary: Taar Kothi, Jhaadi Taal; Bahraich: Katarniaghat Wildlife Sanctuary: Sadar Beet, Morahwa Badkhadia Beet, Bicchia, Semar Chowk Nishangarha range, Chapharia Chowk Nishangarha range.

8. ***Equisetum ramosissimum*** Desf. subsp. debile Hauke. Amer. Fern Journal. 52: 33. 1962. (Fig. 3 h).

Family: Equisetaceae; Common name: Jod-Tod, Ankhchimka.

Sustainable utilization: Macerated plant mixed with red-mud is applied topically for treatment and joining of fractured bone (Singh & Khare 2011). Plant paste prepared in water is

applied twice a day in bone fracture. Used for polishing wood and brass. Shoot and rhizomes is used in gonorrhoea (Rout *et al.* 2009). Plant paste is topically applied to cure scabies, itches and skin infections. Powdered stem dissolved in water is used for enema in children (Rout *et al.* 2009, Singh & Khare 2011).

Distribution in the study area: Uttar Pradesh: Lakhimpur Kheri: Kishanpur Wildlife Sanctuary: Jhaadi Taal; Bahraich: Katarniaghat Wildlife Sanctuary: Sadar Beet, Bichhia Beet.

9. ***Helminthostachys zeylanica*** (L.) Hook. Gen. Fl. t. 47. 1840. (Fig. 4 a).

Family: Ophioglossaceae; Common name: Kamraj, Majurkutti, Majurpair, Bankand, Jhotphokri.

Sustainable utilization: Strobilus of the plant is used as vegetable. Extract of rhizome and entire plant is used as aphrodisiac. Rhizome mixed with other plants is used as tonic for the cure of waist pain. Plant and its part is a potential herbal formulation in sexual disorders. It has anodyne properties and prescribed as tonic (Poonam & Singh 2009, Singh & Khare 2011). Rhizome is used as memory enhancer, to promote strength and vitality and cure impotency or erectile dysfunction (Singh & Khare 2011, Kumar & Bharti 2014).

Distribution in the study area: Uttar Pradesh: Lakhimpur Kheri: Gauriphanta, Bankati, Sonaripur, Lodaria compartment Belrayan range, Belapersua, Chandan Chauki; Kishanpur Wildlife Sanctuary, Kataiya Chauki, Taar Kothi; Bahraich: Katarniaghat Wildlife Sanctuary: Bicchia, Semar Chowk Nishangarha range, Kakraha range, Murthia Dharampur range.

10. ***Lygodium flexuosum*** (L.) Sw., in Schrad. J. Bot. 1800 (2): 106. 1801. (Fig. 4 b).

Family: Lygodiaceae; Common name: Dhengrajua, Neem-Jhar, Bisma.

Sustainable utilization: Juvenile part of plants is used as vegetable. Rhizome extract is boiled with mustard oil to make thick paste, which is

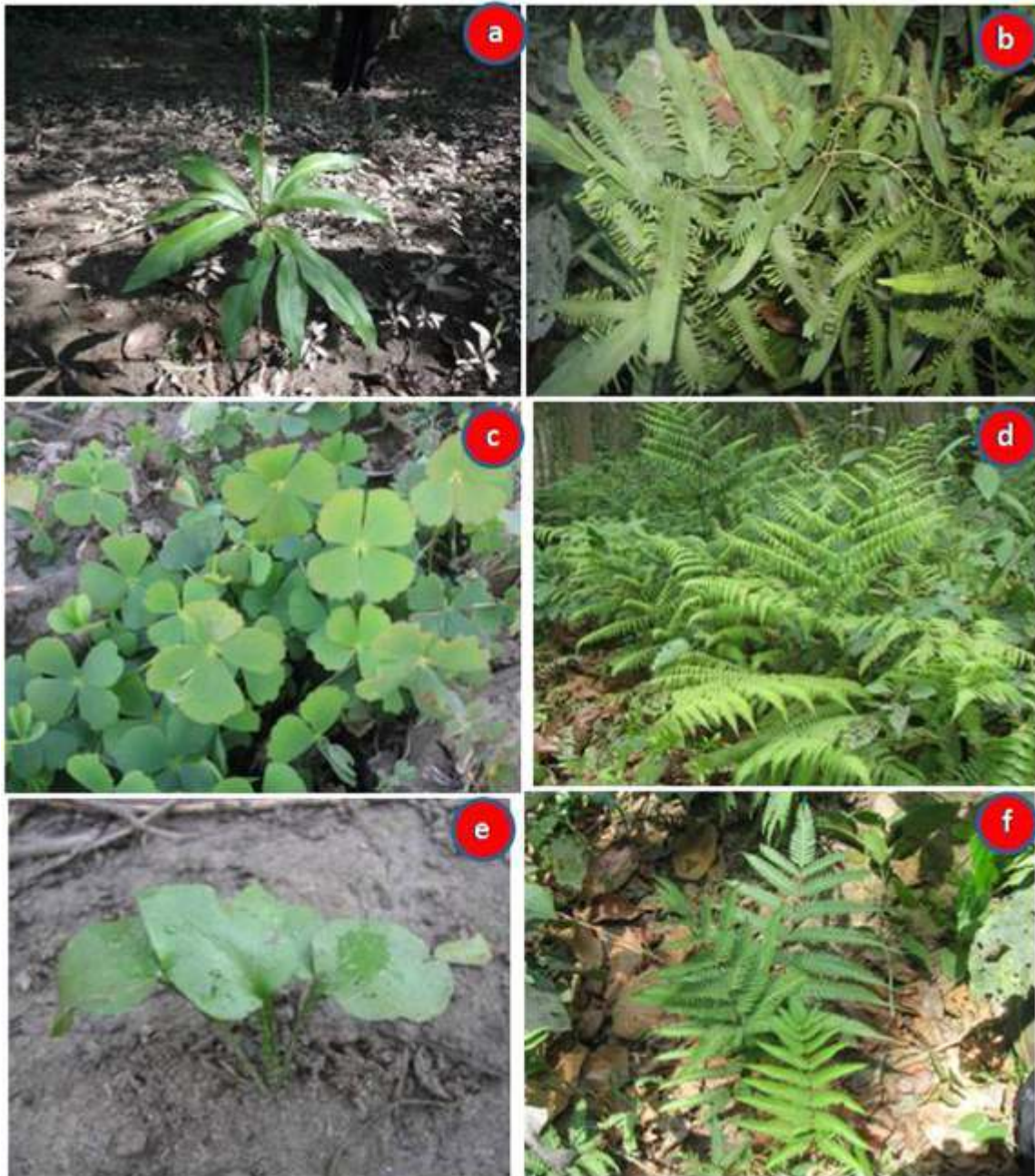


Fig. 4. (a) *Helminthostachys zeylanica*; (b) *Lygodium flexuosum*; (c) *Marsilea minuta*; (d) *Microlepia speluncae*; (e) *Ophioglossum reticulatum*; (f) *Pteris biaurita*.

topically applied for the treatment of arthritis and sore discharging water. Decoction of leaf cures jaundice (Sen & Ghosh 2011). Fresh rhizome boiled with mustard oil is used in rheumatism, sprains, scabies, ulcers, eczema, cut wound, however aqueous extract is used to cure spermatorrhoea. Leaf paste is used in skin

diseases, however rhizome powder mixed with cow urine is potential formulation of skin diseases. Rhizome and black pepper paste given twice a day for dysmorrhoea. Rachis tied over forehead reduces headache, while on arm secure from evil spirit (Shil & Choudhury 2009). Leaf powder mixed in milk is prescribed to enhance memory (Rao et al. 2007). One



teaspoonful plants juice given twice a day to relief fever (Rout et al. 2009, Singh & Khare 2011). Rhizomes extract (100 ml) twice daily for 2 weeks given orally for premature ejaculation (Kumar & Bharti 2014).

Distribution in the study area: Uttar Pradesh: Lakhimpur Kheri: On the way to Gauriphanta, Chandan Chauki, Choti Paliya Sonaripur, Dudhwa, Bankati, Sonaripur, Lodaria compartment Belrayan range, Belapersua, Salukapur, On the way to Sathiyana; Kishanpur Wildlife Sanctuary: Jhaadi Taal, Kataiya Chauki; Bahraich: Katarniaghat Wildlife Sanctuary: Nishangarha, Kakraha range, Girijapuri, Karikot, Rampurwa, Tigda beet, Murthia (Dharpur range).

11. *Marsilea minuta* L. Mant. 308, 1771. (Fig. 4 c).

Family: Marsileaceae; Common name: Chilchilejhar.

Sustainable utilization: Leaves mixed with mint are macerated to prepare extract, which is used for pacification of heat stroke. Plant juice is used in treatment of eye disease. Stalk and leaves are used as vegetable, consumed as tonic after fever and in insomnia and mental problems (Sen & Ghosh 2011, Singh & Khare 2011). Cakes of sporocarp called 'nardoo' are eaten. Decoction of leaves mixed with ginger is used in cough and bronchitis. Juvenile leaves juice is applied in the nostrils twice a day for cure of migraine (Rout et al. 2009).

Distribution in the study area: Uttar Pradesh: Lakhimpur Kheri: Dudhwa National Park: On the way to Chandan Chauki, Kaima Chauki Sathiyana, Sonaripur, Kakraha Taal Salukapur range, Nighasan Road, Nishatnagar near Sathiyana, Gauriphanta; Bahraich: Katarniaghat Wildlife Sanctuary: Morahwa Badkhadia Beet, Semar Chowk Nishangarha range, Kakraha range.

12. *Microlepia spelunca* (L.) Moore, Index Fil. 93 (1857). (Fig. 4 d).

Family: Dennstaedtiaceae; Sustainable utilization: Plant is used as fodder for cow feed. Dried plants are also sprayed in the cattle shed

as supplementary fodders and also to protect the animals from extreme cold acting as absorbent of urinal excreta (Singh & Khare 2011).

Distribution in the study area: Uttar Pradesh: Lakhimpur Kheri: Dudhwa National Park: On the way to Sathiyana, Lodaria compartment Belrayan range, Dudhwa; Bahraich: Katarniaghat Wildlife Sanctuary: Bicchia Beet.

13. *Ophioglossum reticulatum* L., Sp. Pl. 2: 1063, 1753. (Fig. 4 e).

Family: Ophioglossaceae; Common name: Jibhi, Jibra, Ekpatiya, Jibiya.

Sustainable utilization: Leaves used as delicious vegetable (Sen & Ghosh 2011), remedy against headache (Singh & Khare 2011). Fresh plant is used as tonic for treatment of worms and inflammation (Sen & Ghosh 2011). Fresh leaf along with rice is made into a cake and the boiled cake is taken orally in empty stomach for 15-20 days against menstrual disorders. Paste of fresh leaves and tubers are applied topically for treatment of boils, burns and as cooling agent (Rout et al. 2009).

Distribution in the study area: Uttar Pradesh: Lakhimpur Kheri: Dudhwa National Park: On the way to Gauriphanta, Dudhwa, Sonaripur, Mohraiya Belrayan, Belapersua, Sathiyana, Bankati; Kishanpur Wildlife Sanctuary: Kataiya Chauki, Jhaadi Taal, Taar Kothi; Bahraich: Katarniaghat Wildlife Sanctuary: Bicchia, Semar Chowk Nishangarha, Chaphria Chowk Nishangarha, Kakraha, Girijapuri Sadar Beet, Motipur.

14. *Pteris biaurita* L., Sp. Pl. 2: 1076. 1753. (Fig. 4 f).

Family: Pteridaceae.

Sustainable utilization: Entire plant is used as fodder. Dried plants are sprayed in the cattle shed as supplementary fodders and to protect the animals from extreme cold acting as absorbent of urinal excreta. Paste of the plants is applied on cuts and bruises (Rout et al. 2009).

Distribution in the study area: Uttar Pradesh: Lakhimpur Kheri: Dudhwa National

Park: Dudhwa, On the way to Sathiyana, On the way to Kila, Salukapur, Lodaria Compartment Belrayan, Bankati; Bahraich: Katarniaghat Wildlife Sanctuary: Sadar Beet, Murthia Dharampur.

Discussion

Tribal communities from various enthrals of the world depend on plant resources for their food, fodder, shelter and useful articles. India is considered one amongst twelve mega-biodiversity countries of the world having Himalayas and Western Ghats as two hot spots for biological species. Geographical expanse of Indian territories is rationally occupied by a number of tribal communities. Amongst plant kingdom the flowering plants are largely utilized in the livelihood of tribes, however non-flowering plants (algae, lichen, fungi, bryophytes and pteridophytes) are poorly known to be utilized by the tribal communities. There are few records that the species of pteridophytes like *Selaginella bryopteris* (Sanjeevani), *Helminthostachys zeylanica* (Kamraj), *Dryopteris cochleata* (Jatashankar) are potential taxa and in traditional use of many tribal communities (Singh and Khare 2011). Nevertheless, the role of pteridophytes in the livelihoods of tribal communities are less documented and known, as a result, the sustainable utilization of these plants are scantily known. As in above three species, the scattered documentation (Acharya & Acharya 2009, Bhattarai et al. 2009, Joseph et al. 2003, Khare & Kumar 2007, Kumar et al. 2006, Kumar et al. 2012, Kumar & Bharti 2014, Kumar et al. 2013, Singh et al. 2011, Verma 2011) on traditional knowledge about sustainable utilization of pteridophytes has provided potential data. Knowledge about the potentiality of pteridophytes has opened an opportunity to isolate new molecules for future applications. For the reason of proximity with foothills of Himalayas, the terai regions exhibit reasonably favourable climatic condition for growth and development of pteridophytes. As a consequence of favourable climate, the geographical areas of terai region harbour about 26 species of pteridophytes (Singh et al. 2014), which directly or indirectly are sustainably utilized by the people residing in the areas. Tharu tribes have long been utilizing pteridophytes for various purposes, but this information was never documented and

reported. Present study on pteridophytes and interactions with Tharus revealed that the pteridophytes were sustainably utilized for various purposes. Detailed study on the relationship of pteridophytes in the livelihood of Tharu tribes revealed that above 14 species belonging to 12 genera under 10 families were medicinally important. Many species were used in treatment of asthma, arthritis, improving memory, diarrhoea, fever, cuts, wounds, cold, cough, sprains and sexual disorders. The *Ampelopteris prolifera*, *Christella dentata*, *Christella parasitica*, *Diplazium esculentum*, *Lygodium flexuosum*, *Ophioglossum reticulatum* were used as food and vegetable. Some potential species like *Adiantum capillus-veneris*, *Ampelopteris prolifera*, *Ceratopteris thalictroides*, *Helminthostachys zeylanica*, *Lygodium flexuosum*, *Marsilea minuta* were used for treatment of diseases. Interaction with the Tharu tribes also revealed that the juvenile fronds, coiled leaves (crosiers), extract of rhizomes and entire frond of *Adiantum capillusveneris*, *Adiantum philippense*, *Ceratopteris thalictroides*, *Christella dentata*, *Christella parasitica*, *Diplazium esculentum*, *Helminthostachys zeylanica*, *Lygodium flexuosum*, *Ophioglossum reticulatum* and *Pteris biaurita* was used as vegetable and potential medicines. Study revealed that Tharu tribes solely depend on plant and sustainably utilize plant resources for their livelihoods (Fig. 1 a-f; Fig. 2 a-f). There were extreme pressure on the forests by the tribal people for food, fodder, shelter, household articles and wood (Fig. 1 a-f; Fig. 2 a-f). For these unavoidable needs, tribal people exploit plant resources in unsustainable manner. Such unsustainable utilization causes habitat fragmentation, deforestation and loss of valuable species. Few of the species viz. *Ophioglossum reticulatum*, *Helminthostachys zeylanica*, *Marsilea minuta*, *Dryopteris cochleata* are largely exploited by the Tharu tribes for their medicinal and food values. For the reason of overexploitation, a number of species are decreasing from their natural habitat. Such species requires special attention of conservation and mass multiplication. Study revealed that the knowledge about traditional uses of these plants is handed over from generation to generation. Tharu tribe uses a variety of pteridophytes in their traditional practices and this useful information is confined to



their community only. It is felt that if such valuable information is not documented well in time, there would remain a high risk for its loss. It is urgently required that this knowledge should be documented and validated with utmost priority. In this regard a few contributions (Acharya & Acharya 2009, Bhattarai *et al.* 2009, Joseph *et al.* 2003, Khare & Kumar 2007, Kumar *et al.* 2006, Kumar *et al.* 2012, Kumar & Bharti 2014, Kumar *et al.* 2013, Singh *et al.* 2011, Verma 2011) on useful aspects of plants by different tribes of India was also made. Nevertheless, no such documentation on sustainable utilization of pteridophytes in the livelihood of Tharu tribe is available. Above 14 species of

pteridophytes are largely used by Tharus tribes, therefore present study signify their large scale utilization and role in livelihoods amongst tribes of terrai regions.

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