INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print), 2222-5234 (Online)
http://www.innspub.net
Vol. 10, No. 3, p. 72-79, 2017

RESEARCH PAPER OPEN ACCESS

Taxonomic and ethnobotanic study of pteridophytes of miandam valley, district Swat, Khyber Pakhtunkhwa, Pakistan

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Key words: Pteridophytes, Description, Ethnomedicine, Maindam

http://dx.doi.org/10.12692/ijb/10.3.72-79 Article published on March 12, 2017

Abstract

The present work is based on an intensive and extensive study of Pteridophytes of Maindam valley, Swat and was carried out to collect, identify and preserve these plants and also to document its ethnobotanical uses. Frequent field visits were arranged and a total of 14Pteridophytes belonging to 10 genera and 8 families were collected. The dominant families were Dryopteridaceae and Pteridaceae represented by 2 genera with 3 species respectively. The Adiantaceae and Aspleniaceae were represented by 2 species respectively. The remaining families were represented by a single species each. The study revealed that these plants are used for the treatment of different health disorders. The plant inventory of Pteridophytes thus prepared may facilitate the workers of local District Government, the students and researchers of Ecology, Plant conservation, Biodiversity, Ethnobotany, Genetics, Pharmacology, etc.

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Introduction

Planttaxonomy, the naming and classification of plants, is a synthetic science that derives its data from other fields such as morphology, cytology, anatomy, molecular biology, genetics and chemistry. The correct identification of each plant is very important, because a plant's name is not only a key to its literature but also to what we know about it (Stuessy, 2008).

Pteridophytes are non-flowering, seedless and spore producing lower vascular plants. They are intermediate in position between the Bryophytes and Spermatophytes (Gymnosperms and Angiosperms). They are important economically due to their medicinal value, but unfortunately in Pakistan they have been neglected in this regard. They are threatened due to habitat loss in many areas of Pakistan especially in Swat, where species diversity is high. They are important for their food, medicinal and aesthetic values, thus can be used in Homoeopathic, Ayurvedic, Unani and Tribal medicine (Vasudeva, 1999; Das, 2003).

Maindam valley is located in District Swat of Khyber Pakhtunkhwa (KP). It lies in the Hindu Kush mountain range between 34° 34′ -35° 07′ N latitudes and 72° 36′ - 73° 35′ E longitudes. Its total area is about 36768 acres and elevation is 6800 feet from the sea level. Its mean annual precipitation ranges from 1000-1250 mm, while monthly temperature remains below 10 °C for about 6 months of the year. Its total population is about 30,000 and most of inhabitants are farmers.

The areas visited during the field study of maindam included Jishar, Kaldar, Kasoon, Kal, Swatoo kalay ada, Gojrano kalay (upper). Gojrano kalay (lower), Miangano cham, Sanay, Khair abad, Kalwara, Karin, Shatoot, Juktai, Dand, Shonga, Banray, Hawairay, Gohar abad and Noor abad. About 7000 people in the study area are earning 75 % of their total income from the sale of medicinal plants (PDMA, 2015).

Material and methods

Taxonomic data

A survey of Pteridophytes in Miandam valley was conducted during different seasons of the year 2015. During the field survey elaborate notes on the habitats, nature of rhizome, stipe, shape of frond, nature of scales and arrangement of sori were made in the field note book.

Ethnobotanical data

The questionnaire was designed for collection of ethnobotanical data from different age groups inhabitants of the study area. In addition, local herbal markets were also visited to collect information on these plants.

Collection and Identification

The plant specimens were collected in duplicate usually at their reproductive stage. They were properly pressed in the newspaper, dried and mounted on standard herbarium sheets using standard techniques (Lucas 1992). The plants were also photographed in the field using digital camera (Sony Cyber Shot -16 MP).

The detailed study of spores and sporangia was carried out with the help of light microscope. The plants were submitted to Dr. Sultan Ahmed Herbarium, GC University Lahore Pakistan as voucher specimens. Map and the Meteorological Data on the annual rain fall, humidity and temperature of the study area were collected from the Local Government of Swat District and the Pakistan Regional Meteorological Department, Peshawar.

The available taxonomic literature on Pteridophytes was consulted to get the plant specimens correctly identified. Some of the literature included Moore (1859), Hooker and Baker (1874), Beddome (1892), Rodin (1960), Nasir and Ali (1971- 91) Stewart(1972), Nakaike and Malik (1993),Smith (1993), Devol and Shieh (1994), Hoshizaki and Moran (2001), Fraser-Jenkins (2008),etc.

Results and discussion

A total of 14 Pteridophytes species belonging to 10 genera and 8 families were reported during the field survey of Miandam valley. The dominant families were Dryopteridaceae and Pteridaceae. The Dryopteridaceae was represented by 2 genera with 3 species (*Hypodermatum crenatum*, *Polystichum lonchitus*, *Polystichum setiferum*) and the Pteridaceae was also represented by 2 genera with three species (*Onychium contiguum*, *Pteris cretica*, *Pteris stenophylla*).

The Adiantaceae and Aspleniaceae were represented by2 species of one genus each viz., *Adiantum capillus-veneris*, *Adiantum incisum* and*Asplenium adiantum-nigrum*, *Asplenium trichomane*re spectively.

The Athyriaceae, Equisetaceae, Polypodiaceae and Selaginellaceae were represented by one species of one genus each viz., *Athyrium mackinnonii*, *Equisetum pratense*, *Pleopeltis macrocarpa* and *Selaginella sanguinolenta*re spectively (Table 1).

Table 1. Medicinally important Pteridophytes of Miadam Valley, Swat, Khyber Pakhtunkhwa, Pakistan.

S. No	Family	Botanical Name	Voucher No	Part Used	Collected From	Local Medicinal uses
1	Adiantaceae	*Adiantum capillus-veneris* L.	GC. Herb. Bot. 2991	Rhizome, frond, Whole Plant	Swatoo kalay ada	Diabetes, cough, measles, diuretic, emetic, expectorant, scorpion bite, washing the eye, tooth ache and good health.
		Adiantum incisum Forsk.	GC. Herb. Bot. 2992	Frond	Khair abad	Internal burning of stomach, fever, cough, diabetes, and skin diseases.
2	Aspleniaceae	*Asplenium adiantum-nigrum* L.	GC. Herb. Bot. 2993	Frond	Gojrano kalay (lower)	Diarrhea
		Asplenium trichomane L.	GC. Herb. Bot. 2994	Frond	Shatoot, Shonga	Laxative, expectorant, cough, liver ailment, breast diseases and for cold in head and chest.
3	Athyriaceae	*Athyrium mackinnonii* (C.Hope) C.Chr.	GC. Herb. Bot. 2995	Shoot, Rhizome	Gojrano kalay (upper)	Vegetable, general body pain and to induce milk flow in caked breast.
4	Dryopteridaceae	*Hypodermatum crenatum* (Forssk.) Kuhn	GC. Herb. Bot. 2996	Frond, Whole plant	Noor abad	To reduce swelling, to get relief from insect bite and also used by the women for conception.
		Polystichum lonchitus (L.) Roth	GC. Herb. Bot. 2997	Frond, Rhizome	Hawairay, Jishar	Diarrhea, Tuberculosis
		Polystichum setiferum (Forsk.) Woynar	GC. Herb. Bot. 2998	Rhizome	Karin, Kaldar	Dysentery in children
5	Equisetaceae	*Equisetum pratense* Ehrh.	GC. Herb. Bot. 2999	Rhizome	Gohar abad	Vegetable
6	Pteridaceae	*Onychium contiguum* C.Hope	GC. Herb. Bot. 3000	Whole plant	Miangano cham	Urine complication
		Pteris cretica L.	GC. Herb. Bot. 3001	Fronds	Kalwara, Kasoon	Healing of wounds and as antibacterial.
		Pteris stenophylla L.	GC. Herb. Bot. 3002	Fronds	Gohar abad, Kal	Healing of wounds and as antibacterial.
7	Polypodiaceae	*Pleopeltis macrocarpa* (Bory ex Willd.) Kaulf.	GC. Herb. Bot. 3003	Fronds, Rhizome	Juktai, Sanay	Sore throat, cold, itches, cough, febrifuge and for abortion.
8	Selaginellaceae	*Selaginella sanguinolenta* (L.)	GC. Herb. Bot. 3004	Whole plant	Dand, Banray	Eye wash

The detailed description of each species comprising of their taxonomic notes, ethnobotanical uses and figures were recorded as below:

Family: Adiantaceae

Adiantum capillus-veneris L.

Rhizome short, thin, creeping, branched, wiry in texture, covered with small, slender, brown scales; stipe black, polished, 2-7 inches long, scaly at the basal part; frond tufted, up to 16 inches long and 8 inches wide, delicate, drooping; leaf blade 4-15 inches long, commonly twice compound, each blade consisting 5-12 alternate pinnae per side, each pinna consists of about 6 pinnules, pinnules stalked, obovate, apical margin usually deeply lobed, lower edge V-shaped; veins branched dichotomously; sori 1-10, clustered on the lower pinnule surface, covered with lobes tip, half-moon shaped; insdusia cresent-shaped, translucent, yellowish brown, spores trilete, 46 µm in diameter.(Voucher No: GC. Herb. Bot. 2991, Plate 1- A).

Ethnobotanical Uses: Juice of the fresh plant is used for curing diabetes, cough, given to the children for good health and is also diuretic, emetic and expectorant.

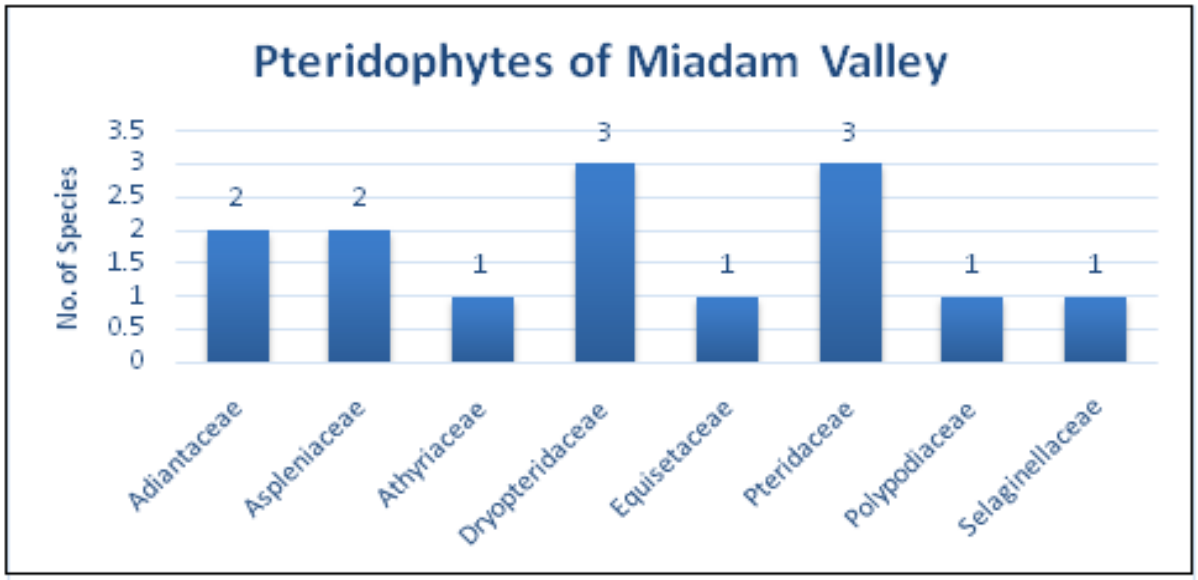

Fig. 1. Family wise distribution of Pteridophytes's species at Miandam Valley, Swat.

The plant is kept under the bed to prevent children from chicken pox. The fronds are also used for curing scorpion bite.

The whole plant is boiled in water, the cooled water is then used for cough, washing the eyes and tooth ache problems. Sugar is added and the plant is eaten with carrot for curing measles.

Adiantum incisum Forsk.

Rhizome short, erect, 4-5 mm in length, 0.2 mm in width, linear scales at the basal part; stipe 6-12 cm in lenght, dark, tomentose, tufted at the basal part; fronds 10-40 cm long, pinnate, pinnae 12-18 mm long, 6 mm wide, alternate, triangular, become smaller at the top, more or less cut at the distal end; sori on the edge of the lobe, 1-3 mm long, circular to oblong.. (Voucher No: GC. Herb. Bot. 2992, Plate 1- B).

Ethnobotanical Uses: The frond is powdered, mixed with butter and are used to control the internal burning of the stomach. It is also used in fever, cough, diabetes and skin diseases.

Family: Aspleniaceae

Asplenium adiantum-nigrum L.

Rhizome short, creeping, scaly; scales dark, 4mm long, clathrate, triangular; fronds evergreen, 10 – 38 cm long, 3-10 cm broad, monomorphic, lanceolate; stipe tufed, 5-26 cm long, dark red and broad at the base, narrow and light green at the apex; blade bipannate, thick, glossy, triangular, broad at the base, narrow at the apex, dark green, scaly below; scales minute, dark, scattered; pinnae 4-12 pairs, opposite to alternate, largest at the base, margins incised, apex acute; veins forking, free; pinnules 4-8 per pinna, densely covered with brown sori at the late stage; indusium white. (Voucher No: GC. Herb. Bot. 2993, Plate 1-C).

Ethnobotanical Uses: The decoction of the young frond is used to treat diarrhea.

Asplenium trichomane L.

Rhizome short, creeping to vertical, branched, scales clathrate, lanceolate, black, covered the stipe bases, clumps of frond arise from the upper rhizome; frond 20 cm long; stipes densely clustered, 1-6 cm long, dark brown to black; rachis thick; blade 1-pinnate, 2 - 8 cm long, 0.7 - 1.2 cm wide, middle part widest, tapering at both ends, pinnae 15-35 pairs, oval, opposite to sup opposite, oblong, round at the apex, sessile, edge crenate, sub-coriaceous in texture; veins evident, free; sori 1.6 mm long, 2 to 5 pairs per pinna; sporangia dark brown; indusium translucent, hidden by the sporangia at maturity. (Voucher No: GC. Herb. Bot. 2994, Plate 1-D).

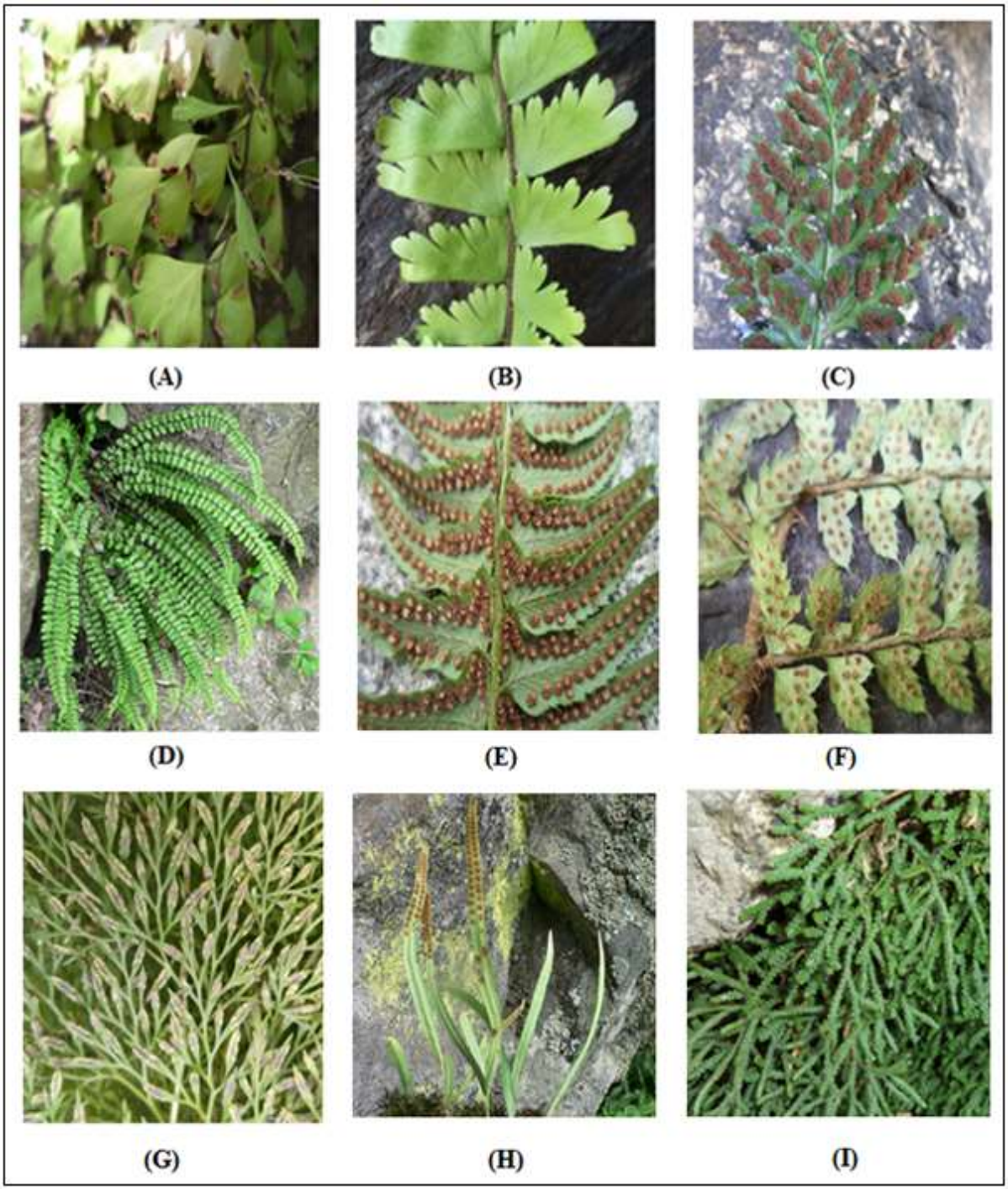

Fig. 2. (A) *Adiantum capillus-veneris* L. (B) *Adiantum incisum* Forsk. (C) *Asplenium adiantum-nigrum* L. (D) *Asplenium trichomane* L. (E) *Polystichum lonchitus* (L.) Roth (F) *Polystichum setiferum* (Forsk.) Woynar (G) *Onychium contiguum* C. Hope (H) *Pleopeltis macrocarpa* (Bory ex Willd.) Kaulf. (I) *Selaginella sanguinolenta* (L.).

Ethnobotanical uses

The leaf of the plant is Lexative, expectorant, used in cough, liver and breast diseases; leaf when smoked is used for colds in head and chest.

Family: Athyriaceae

Athyrium mackinnonii (C. Hope) C. Chr.

Rhizome erect, few fronds at the apex, densely scaled; scales dark brown, narrow, entire, 0.8-6 mm long, apex long-tailed; stipe 10 to 25 cm in length, dark brown, stramineous, scaly at the basal part;

lamina 20-30 cm, broadly oblong, acute at the apex, bipinnate to tripinnatifid; pinnae 8 up to 14 pairs, lower pinnae stalked, 8-12 cm in length, 3-5 cm in width, upper pinnae becoming smaller; pinnuless hortly stalked, distinctly toothed, oblique, cuneate at the base, apex acute-rounded, anterior part truncate-auricled, posterior bases cuneate; sori moon shaped, on either side of the midrib, 8-12 in each pinuule; indusial oblong.(Voucher No: GC. Herb. Bot. 2995).

Ethnobotanical Uses: Young shoots are used as vegetables. A special type of tea is prepared from the boiled rhizome for the treatment of general body pain and also to induce milk flow in caked breast.

Family: Dryopteridaceae

Hypodermatum crenatum (Forssk.) Kuhn

Rhizome short, creeping, densely clothed with scales, bearing close fronds; scales brown, oblong-lanceolate, 20 mm in length, 2.5 mm in width, concolorous, entire; frond 15- 40 cm long; stipe 8- 15 cm long, light green, grooved; blade oblong-subdeltoid, 12-30 cm in length, 10- 30 cm in width, widest at the base, basal pinnae quadripinnatifid; pinnae subtriangular, upper pinnae gradually becoming smaller, ultimate segments oblong, adnate at base, subtruncate at the apex, lobed; sori brown, 4-8 pairs, on either side of the midrib; indusia horse shoe shaped, 1 mm broad, white to slightly greyish. (Voucher No: GC. Herb. Bot. 2996).

Ethnobotanical Uses:

The paste of the leaf is used to reduce swelling and also to get relief from insect bite. The paste of the plant is used by the women for conception.

Polystichum lonchitus (L.) Roth

Rhizome stout, vertical, about 8-10 cm in length, 0.4 to 0.8 cm in width and densely covered with roots; scales pale brown in colour, ovate to lanceolate in shape, gradually narrowing towards the apex; stipe short, densely covered with scales and both the stipe and rachis are deeply grooved; fronds are leathery, stiff, evergreen up to 25- 34 cm long; the blades lanced shaped, widest at the middle and narrowing towards the base and apex;

Pinnae are 20 to 42 pairs in number, oblong to lancolate, bending at the apex, each pinna terminate into a sharp bristly spine; Sori are present only on the upper blade, arranged in two rows between midvien and margins, about 20-40 sori in each pinna; indusium peltate, grayish white; sporangia dark brown to black, spores spiky. (Voucher No: GC. Herb. Bot. 2997& Plate 1-E).

Ethnobotanical Uses:

The paste of the frond is given to the children for the treatment of diarrhea. The decoction of the rhizome is also used for the treatment of tuberculosis.

Polystichum setiferum (Forsk.) Woynar

Rhizome short, stout; fronds, 4-10 in number, 30-120 cm long, up to10-15 wide, drooping downwards, soft texture, monomorphic, evergreen; stipe grooved, up to 1/6 of the frond size, scaly, scales golden brown; blade bi-pinnate, widest at the middle, lanceolate, rachis golden brown scaled; pinnae 20-40 pairs, pinna 2 to 8 cm in lenght, 1-2 cm in width; pinnules 8- 24 pairs, basal pinnules pointing upward with small outgrowth, margins serrate; sori round, in two rows on either side of the midrib; indusium peltate, golden brown; sporangia dark brown. (Voucher No: GC. Herb. Bot. 2998 & Plate 1-F).

Ethnobotanical Uses:

During the period of milk teeth development in children, rhizome is tied around the neck for the cure of dysentery.

Family: Equisetaceae

Equisetum pratense Ehrh.

Rhizome dull, black, horizontal; stem whitish green, erect, hollow, rough, dimorphic, 20 to 50 cm in lengh , 1-2 mm thick, intennodes 4-16 grooved, whorls of drooping branches at the nodes, main stem sheaths 3-8 mm long, 4-16 toothed, persistent, with a blackish rib; primary branches internodes solid, 3-4 grooved, sheaths 3-4 toothed; strobilus 1-2.5 cm long. (Voucher No: GC. Herb. Bot. 2999).

Ethnobotanical Uses: Rhizome is eaten both raw and cooked.

Family: Pteridaceae

Onychium contiguum C.Hope

Rhizome creeping, densely scaly, bearing close-set of stipes; scales 2-5 long, deep brown, thin, firm, entire; stipes 20-30 cm long, basal portion dark, grooved, scaly at the base, glabrous upwards; blade 20 to 40 cm in length, 8 to 15 cm in width, oblong-subdeltoid, quadripinnate, pinnae largest at the base, gradually becoming smaller towards the tip, basal acroscopic pinnule largest, 4th division in larger pinnae, 2-5 lobed, spathulate, ultimate lobes lanceolate, apex acuminate, entire, 2 mm in length, 0.6 mm in width, papyraceous, glabrous, green, fertile pinnule 2-4 mm in length; sporangia dense on lower surface, protected by marginal flaps. (Voucher No: GC. Herb. Bot. 3000, Plate 1- G).

Ethnobotanical Uses: It is used in combination with other plants in folk medicine for urine complication.

Pteris cretica L.

Rhizome short, underground, creeping or ascending, produces clumps of fronds, scaly at the apex; scales dark brown, up to 5 mm long, margin entire, apex acuminate; stipe hairy at the base, stramineous to castaneous or deep purple, up to 15 cm in length; frond up to 30 cm in length and 20 cm in width, light to medium green, frond blade has up to four pairs of pinnae, and a single terminal pinna; lowest pair of pinnae forked at the base, each pinna is up to 10 cm in length and 2 cm in width, apex taper; sori marginal; indusia firm and brown. (Voucher No: GC. Herb. Bot. 3001).

Ethnobotanical Uses:

The decoction of the leaves is used for the healing of external wounds and as antibacterial.

Pteris stenophylla L.

Rhizome thin, short, 3-4 mm long, creeping, scaly; scales lanceolate, dark-brown; fronds clustered, dimorphic; stipe 20-30 cm in length, 1-2 mm in width, stramineous, scaly at the basal part, glabrescent upward; blade pinnate, 12-16 cm long, 10-12 cm wide, subcoriaceous in texture, glabrous; pinnae 3-5, clustered at stipe apex, 8-12 cm long, 1-2 cm broad, margins sub-entire, serrate, apex long acuminate, dimorphic, fertile pinnae longer and narrower than sterile; veins forked or simple, mid-vein straw colored; sori marginal, indusia continuous, spores brown.(Voucher No: GC. Herb. Bot. 3002).

Ethnobotanical Uses: The decoction of the leaves is used for the healing of external wounds and as antibacterial.

Family: Polypodiaceae

Pleopeltis macrocarpa (Bory ex Willd.) Kaulf.

Rhizome long, creeping, branched, up to 2 mm in diameter, attached to the substratum by long fibrous roots, densely scaled; scales 3 mm long, brown, clathrate; phyllopodia 0.5-1 cm apart, 2 mm long, densely scaled; stipe 52 mm in length, diameter up to 1.2mm, articulated to the phyllopodia; fronds monomorphic, erect, 6-20 cm long; blade simple, herbaceous, entire, 3-17 cm long, 0.5 cm in width; sori oval, 2 to 4 mm in length, brown, in a line on both side of the midrib, only on the upper half of the blade. (Voucher No: GC. Herb. Bot. 3003, Plate 1- H).

Ethnobotanical Uses: Decoction of fronds is used for sore throat, cold and itches. Rhizome is also used for the treatment of cough and as a febrifuge. Women also take decoction of the entire plant for abortion.

Family: Selaginellaceae

Selaginella sanguinolenta (L.)

Plants xerophytic, creeping, seasonally green, 5-30 cm long or more in some cases, well branched; rhizophore on ventral side, in axil of creeping stem and branches; main stem 0.25-0.75 mm in diameter, terete, glabrous; primary branches 3 to 6 cm apart on the main stem, 3 or 4 times pinnately branched, ultimate branches including leaves 0.7-1.9 mm wide; axillary leaves larger than those on brancges, oblong, obtuse, base peltate, symmetrical, 0.8-2 mm long, 0.4 to 0.8 mm wide, margins lacerate to ciliolate, dorsal leaves slightly larger on the main stems than those on the branches; on branches darsal leaves 0.6 to1.6 mm in length, 0.2 to 0.8 mm in width, imbricate, rhomboid-ovate; ventral leaves larger on main stem and slightly smaller on branches; strobili terminal,

tetragonal, compact, 6-40 cm long, 1to1.5 mm wide; sporophyll monomorphic, ovate, apex acute and lacerate at the margins. (Voucher No: GC. Herb. Bot. 3004, Plate 1- I).

Ethnobotanical Uses: The plant is boiled in water. The water is then cooled and thus the strained liquid obtained is used as medicinal eye wash.

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