



ENVIRONMENTAL SUSTAINABILITY: NEW PERSPECTIVES AND PARADIGMS

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Abstract

Medicinal values of Pteridophytes are known to man from more than 2000 years. They have healing and curing power and are used in Homeopathic, Ayurveda and Unani medicines. The medicinal applications of some Pteridophytes of those that grow in Western Ghats, West Bengal, Himachal Pradesh, Uttarakhand and Rajasthan are presented in this paper. Out of 70 families from different parts of the present Indian political boundary, selected species are considered under 12 families for the analysis. There are 219 species of Pteridophytes measured as „At risk“ in India. Of these, 160 are featured to designate that they fall into IUCN category of „Critically endangered“. Henceforth, for immediate and strict conservation of all these species, there is a need of an urgent and special study including locality-mapping by State Governments and creating public awareness. Pteridophytes are forest-dwelling species; they can be taken as good indicators of deforestation and habitat-destruction. Pteridophytes have substantial importance in traditional pharmacopoeias, scientific studies on pharmacology of this group are scanty.

Keywords: Critically endangered, IUCN, Medicinal values, Species and families.

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1. Introduction

Pteridophytes are second largest group of plants in India and represented by 33 families 130 genera and 1267 species. Pteridophytes with medicinal properties, have healing and curing power. They are used in homeopathic, ayurvedic and Unani medicines. Charaka, Sushruta, Theophrastus and Pedanius Dioscorides“s discoveries have referred to medicinal attributes of certain ferns.

There are 219 species of pteridophytes to be considered as „At risk“ in India. of these, 160 are starred to indicate that they come into IUCN category of „Critically endangered“. Presently, several conservation measures have been adopted for the angiosperms, however, Pteridophytes have not or only been partially given importance in this context [1-10]. Economic and medicinal values of higher plants have been investigated thoroughly and unfortunately Pteridophytes have been ignored, hence there is urgent need for documentation and conservation of pteridophytes.

The medicinal applications of some Pteridophytes of those that grow in Western Ghats, West Bengal, Himachal Pradesh, Uttarakhand, and Rajasthan are presented in this paper. In this paper, out of 70 families in India, 12 families are chosen.

2. Medicinal applications of pteridophytes

The following tables shows the medicinal application of some Pteridophytes of those that grow in Western Ghats, West Bengal, Himachal Pradesh, Uttarakhand, and Rajasthan.

Table 1: Medicinal Applications of Equisetaceae Family [2, 6, 7, 8, 9]

| Name of The Species | Common Name/ Local Name | Part Used | Medicinal Application |
|-------------------------------|-------------------------|--|--|
| <i>Equisetum Ramosissimum</i> | | Stem, Rhizome, Branches, Leaves, Plant | <p>Powdered stem dissolved in water is used forenema during stomach disorders in children.</p> <p>Barren women in South Africa, drink rhizome decoction to facilitate fertilization.</p> <p>Paste of branches with leaves is used as local application for treatment of fracture and bone dislocation.</p> <p>Plant has haemostatic, anti-fungal, anti-rheumatic, anti-viral properties.</p> |

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Table 2: Medicinal Applications of Marsileaceae Family [2, 6, 7, 8, 9]

| Name of The Species | Common Name/ Local Name | Part Used | Medicinal Application |
|------------------------|---|-------------|--|
| <i>Marsilea minuta</i> | Dwarf water clover, small water clover, Water clover. | Whole Plant | Plant is used to treat cough, spastic condition of leg, muscle, insomnia, diarrhoea, leprosy, skin diseases haemorrhoids, dyspepsia It is also used as sedative drug. Plant is sweet, astringent, diuretic, anodyne emollient, ophthalmic, expectorant, depurative, aphrodisiac and febrifuge. |

Table 3: Medicinal Applications of Psilotaceae Family [2, 6, 7, 8, 9]

| Name of The Species | Common Name/ Local Name | Part Used | Medicinal Application |
|-----------------------|-------------------------|-----------|---|
| <i>Psilotum nudum</i> | | Spores | Oily spores are given to infants to arrest diarrhoea. |

Table 4: Medicinal Applications of Salviniaceae Family [2, 6, 7, 8, 9]

| Name of The Species | Common Name/ Local Name | Part Used | Medicinal Application |
|-------------------------|-------------------------|-----------|-----------------------------|
| <i>Salvinia molesta</i> | | Plant | Plant is used as antifungal |

Table 5: Medicinal Applications of Isoetaceae Family [2, 6, 7, 8, 9]

| Name of The Species | Common Name/ Local Name | Part Used | Medicinal Application |
|------------------------------|-------------------------|------------------------------|--|
| <i>Isoetes coromandelica</i> | | Whole Plant, Leaves, Rhizome | Plant is used as antiseptic, styptic, anthelmintic and also used to treat bronchitis. Dry leaves are used in tuberculosis. Rhizome is used to treat eye stroke of children below five years. |

| | | | |
|-------------------------------|--|-------------|---|
| <i>Isoetes rajasthanensis</i> | | Whole Plant | Whole plant extract is used for treatment of spleen and liver diseases. |
|-------------------------------|--|-------------|---|

Table 6: Medicinal Applications of Ophioglossaceae Family [2, 6, 7, 8, 9]

| Name of The Species | Common Name/ Local Name | Part Used | Medicinal Application |
|-----------------------------------|--|-------------------|---|
| <i>Ophioglossum reticulatum</i> | Adder's tongue fern, snake tongue fern/Ban palak | Leaves and fronds | Paste made of fresh leaf act as coolant on burns and it cures wounds and inflammation. Fronds are also found useful as tonic and styptic. |
| <i>Ophioglossum petiolatum</i> | Stalked adder's tongue | Rhizome | Hair fall control can be done through fresh rhizome Tuber paste |
| <i>Helminthostachys zeylanica</i> | | Fronds, Rhizome | Fronds are reported to anodyne, antiviral, antipyretic anti inflammatory intoxicant. Rhizome powder can increase memory Rhizome is used to treat sciatica, dysentery, catarrh, malaria and is used as tonic |
| <i>Botrychium lanuginosum</i> | | Plant | Plant is known to be antibacterial. |
| <i>Ophioglossum nudicaule</i> | | Plant | It is used as a cooling agent and in inflammations and wounds. |

Table 7: Medicinal Applications of Selaginellaceae Family [2, 6, 7, 8, 9]

| Name of The Species | Common Name/ Local Name | Part Used | Medicinal Application |
|-------------------------------|-------------------------------|------------------------|--|
| <i>Selaginella bryopteris</i> | Sanjeevini booti or Sanjeevni | Whole plant and leaves | It reduces toxicity. It is used to cure heat shock and jaundice. |

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|---------------------------------|--------|------------------|--|
| | | | <p>Fresh paste of young leaves along with sugar or honey is used to treat stomach ache and urinary tract inflammation for children.</p> <p>Women tribes of Chhattisgarh used dry powder of herb to treat gynaecological problems menstrual irregularities, leucorrhoea and to minimize</p> <p>It can prevent neuro-degeneration.</p> |
| <i>Selaginella radiata</i> | | Frond | Fronds are used as antibacterial agent. |
| <i>Selaginella involvens</i> | | Spore and Plant | <p>Ladies(in Western Ghats)use spore powder as substitute to vermilion powder.</p> <p>Plant helps to prevent cough, bleeding piles, amenorrhoea and acts as antibacterial agent.</p> |
| <i>Selaginella delicatula</i> | | Plant | As plant juice is antibacterial, it is used for healing wounds by the tribals at Nilambur. |
| <i>Selaginella chrysocaulos</i> | Kungoo | Spores and Plant | Powder of dried spores used as vermilion (kungu) powder. Plant is used in treating fever. |

Table 8: Medicinal Applications of Adiantaceae Family [2, 6, 7, 8, 9]

| Name of The Species | Common Name/ Local Name | Part Used | Medicinal Application |
|----------------------------------|--|---------------|--|
| <i>Adiantum edgeworthii</i> | Walking black maiden hair fern/Hansraj | Frond | Fronds are used in treating mouth blister. |
| <i>Adiantum venustum</i> | Evergreen maiden hair/Hansraj | Whole Plant | It is used to heal wounds, cough, tumours, fever, asthma and inflammatory disease of chest and shows anti-microbial activity |
| <i>Adiantum incisum</i> | Maiden hair fern/Mayrshika and Hansraj | Whole Plant | It is used as remedy to cure cough, diabetes, jaundice, fever, diarrhoea, skin wounds. |
| <i>Adiantum capillus-veneris</i> | Southern maiden hair fern | Plant | It is used as stimulant, febrifuge, purgative, demulcent, emollient tonic and hair tonic. It has hypoglycaemic, and antiviral properties. It is also used to treat menstrual irregularities. |
| <i>Adiantum caudatum</i> | Tailed maidenhair | Fronds | Frond extract is effective in wound healing. |
| <i>Adiantum lunulatum</i> | | Leaf and Root | Leaf and root decoction is used for treatment complaints in Malaya. |
| <i>Adiantum poiretii</i> | | Leaf | Leaves are used to cure coughs, fever, diabetes and skin disease in Philippines. |

Table 9: Medicinal Applications of Osmundaceae Family [2, 6, 7, 8, 9]

| Name of The Species | Common Name/ Local Name | Part Used | Medicinal Application |
|--------------------------|-------------------------|-----------|--|
| <i>Osmunda hugeliana</i> | | Fronds | Fronds are used as tonic, styptic and also for the treatment of rickets, rheumatism and for intestinal gripping. |

Table 10: Medicinal Applications of Dryopteridaceae Family [2, 6, 7, 8, 9]

| Name of The Species | Common Name/ Local Name | Part Used | Medicinal Application |
|-------------------------------|-------------------------|-----------|----------------------------------|
| <i>Dryopteris cardi hopei</i> | | Rhizome | Rhizome is used as anthelmintic. |

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|-------------------------------|-------------------------|-------------------------|---|
| <i>Dryopteris chrysocoma</i> | Cliff fern | Rhizome and Lamina | Extract of Rhizome can be applied to cuts and wounds. Crushed lamina works as anthelmintic. |
| <i>Dryopteris cochleata</i> | Wood fern, Buckler fern | Rhizome and whole plant | Rhizome is found useful for diarrhoea and vomiting and also acts as anthelmintic. |
| <i>Dryopteris juxtoposita</i> | | Fronds | Digestion is enhanced by fronds. |
| <i>Polystichum squarrosum</i> | Basket fern | Sporophyll and Rhizome | The extract of sporophyll is found to be antibacterial agent. Pyloric disease can be cured by rhizome decoction. |
| <i>Tectaria coadunata</i> | | Whole Plant | It is anti-bacterial and used to treat asthma, roncitis, stings of honeybee. Cooked tender portion is used for curing stomach problems. |
| <i>Hypodematum crematum</i> | | Rhizome and Leaves | Rhizome is used as an Antibacterial agent. Leaves are used to facilitate conception in women. |
| <i>Polystichum moluscens</i> | | Sporophyll | Sporophyll extract is used as an antibacterial agent. |
| <i>Tectaria wightii</i> | | Rhizome | Rhizome is used as anthelmintic. |

Table 11: Medicinal Applications of Polypodiaceae Family [2, 6, 7, 8, 9]

| Name of The Species | Common Name/ Local Name | Part Used | Medicinal Application |
|------------------------|-------------------------|-----------|---|
| <i>Drynaria mollis</i> | | Rhizome | Rhizome is used to treat tuberculosis and is also effective against cuts and burns. |

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|---------------------------------|----------------------------|-------------------|--|
| <i>Polypodium lachnopus</i> | | Rhizome | Rhizome is found laxative in nature. |
| <i>Microsorium membranaceum</i> | | Rhizome | Rhizome is useful to treat ulcer, swelling, sore boil, dysentery etc. |
| <i>Microsorum punctatum</i> | | Leaf | Leaf is ground into juice and applied over the affected area of wound, twice a day with hot water to heal it. |
| <i>Drynaria quercifolia</i> | Oakleaf fern/ Kankothari | Rhizome | Skin removed rhizome is made into a paste and boiled with pepper, cumin seeds, onion and water. This mixture is taken orally to get relief from body pain and joint pain. |
| <i>Pyrrisia lanceolata</i> | Lanceleaf Tongue Fern/Loti | Leaf | Leaf is made into paste with pepper and taken orally to treat sore throat and itching. |
| <i>Vittaria elongate</i> | Tape fern | Leaf | Leaf is ground into paste and applied over affected area to get relief from knee pain and therapeutic pain. |
| <i>Pyrrisia heterophylla</i> | | Plant | It is used as cooling agent for treatment of swellings, sprains etc and also used For relieving pain. |
| <i>Phlebodium aureum</i> | | Rhizome | Rhizome is used for cough, fever and reported to be sudorific in Mexico. |
| <i>Pleopeltis macrocarpa</i> | | FronD and Rhizome | Decoction of frond is used for cold, sore throat, and itches in South Africa. Rhizome is used as a febrifuge and for treatment of coughs in Mexico and Guatemala. |

Table 12: Medicinal Applications of Pteridaceae Family [2, 6, 7, 8, 9]

| Name of The Species | Common Name/ Local Name | Part Used | Medicinal Application |
|----------------------------------|---|--------------------|--|
| <i>Pteris aspercularis</i> | Ribbon fern | Fronde and Rhizome | Extract of Frond is applied on cuts and Bruises. Brew of Rhizome and frond is given to treat chronic disorder. |
| <i>Pteris cretica</i> | Ribbon fern, Table fern etc | Whole Plants | Paste of fronds helps in healing of wounds and properties. It is also found useful in treating leprosy. |
| <i>Pteris vittata</i> | Ladder Brake fern | Plant | It is used to treat sores on tongue, in burns etc. It has antiviral and antibacterial properties. It also serves as tonic. |
| <i>Pteris quadriaurita</i> | | Rhizome | Rhizome paste is applied to take out The pus and hasten the healing of Boils. |
| <i>Onychium contiguum</i> | | Fronde | Fronde are used to treat urinary tract diseases. |
| <i>Onychium japonicum</i> | Carrot fern | Plants | It is used to treat skin diseases, fever, and headache. |
| <i>Cheilanthes bicolor</i> | Silver fern/ Kali sankha | Rhizome | Rhizome used in fever and as tonic. |
| <i>Cheilanthes albomarginata</i> | Lip fern | Rhizome | Rhizome is used in stomach ulcer, Stomach disorders, diseases, cuts and wounds. |
| <i>Adiantum philippens</i> | Walking maiden hair fern, black maiden hair/ Hamsapadi, Hanswati, Kaante Ghar | Whole Plant | It is used as diuretic, it is used to treat dysentery, asthma, indigestion, diarrhoea and hair fall. |

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|----------------------------|---|--------------------|--|
| <i>Adiantum lunulatum</i> | | Whole plant | It is used to treat, cough, indigestion, dysentery, ulcers, leprosy, asthma, fever, hair fall, urinary tract problems and nose bleeding. |
| <i>Acrostichum aureum</i> | Leather fern, Paku fern, Mangrove fern, etc | Rhizome and Fronds | Rhizome paste is applied to heal wounds and boils. It is also used as anthelmintic, vulnerary and bladder complaints. Fertile Frond is used for syphilitic ulcers in Borneo. They are also used as Antifungal agents |
| <i>Pteridium aquilinum</i> | Eagle fern | Rhizome | The Rhizome of this plant is astringent, anthelmintic and it is useful to treat diarrhoea. It is also useful in treating gastric and intestinal mucus problems. |

Medicinal value of pteridophytes is known to man from more than 2000 years. Theophrastus and Pedanius Dioscorides have referred to medicinal attributes of certain pteridophytes long back. Although North American studies of Pteridophytes are still quite limited, much research is being done in Asia to understand their medicinal uses to humans. For example, a study from China identified the Pteridophytes families of Pteridaceae, Polypodiaceae and Adiantaceae as having significant medicinal activity. In addition, an ethnobotanical paper from Bangladesh describes 16 Pteridophyte species linked to human consumption as food, medicine or both.

Pteridophytes are also used by physicians in Unani system of medicine. In the traditional Chinese system of medicine, several medicinal Pteridophytes are recommended by native doctors. They are used to heal wounds, cuts, burns, blisters, ulcers, dermal problems, boils, headaches, sores, bruise, body pain, knee pain, joint pain, therapeutic pain, etc.

In [11] it is revealed that out of 414 species of Pteridophytes, 219 at risk, of which 160 critically endangered, 82 near-threatened and 113 rare species. Pteridophytes of political India, are threatened or rare there. According to [12] between one third and a half of

Indian Pteridophyte-species appear to be under threat or rare. It therefore appears that a considerable decline has occurred since that time, the main cause of which is undoubtedly the ever-increasing level of deforestation throughout the region. Approximately 15% (16-17%) or one sixth of Indian Pteridophyte species are critically endangered and thus very rare species which are very seldom seen.

Recent efforts to improve the representation of plant species included on the IUCN Red List of Threatened Species through the IUCN Sampled Red List Index (SRLI) for Plants have led to the assessment of almost 1000 additional species of Pteridophytes under IUCN Red List criteria [12].

3. Current context of pteridophytes in India

Threat Analysis: Numbers and percentages of species of Pteridophytes assessed as threatened for the IUCN Sampled Red List Index (SRLI) for Plants.

| Threat | Number of species threatened | % of species threatened |
|-------------------|------------------------------|-------------------------|
| Agriculture | 97 | 62 |
| Logging | 30 | 19 |
| Livestock | 26 | 17 |
| Development | 17 | 11 |
| Plantations | 9 | 6 |
| Mining | 8 | 5 |
| Disturbance | 7 | 4 |
| Invasive species | 6 | 4 |
| Natural disasters | 6 | 4 |
| Species dynamics | 6 | 4 |
| Intrinsic biology | 3 | 2 |
| Harvesting | 1 | 1 |
| Pollution | 1 | 1 |

The following tables gives an overview of Current status of the different species of Pteridophytes in India.

| Species | Location | Current Status |
|-----------------------------------|--|----------------|
| <i>Arthromeris notholaenoides</i> | Andrapradesh | At Risk |
| <i>Asplenium exiguum</i> | Tamilnadu :Nilgiri | At Risk |
| <i>Asplenium khasianum</i> | EastAP; Meghalaya:Khasi hills | At Risk |
| <i>Asplenium rivulare</i> | Deccan Peninsula | Very Rare |
| <i>Athyrium kumaonicum</i> | Uttarakhand:Nainital,Pithoragarh | Very Rare |
| <i>Athyrium parasnathense</i> | Rajasthan:Aravali Ranges; Deccan Peninsula: Central Highlands | |
| <i>Bolbitis presliana</i> | Kerala:Malabar; Goa: Dudhsagar;Karnataka: CastleRock,Shimoga,Coorg | Very Rare |
| <i>Bolbitis semicordata</i> | Kerala:Malabar; TN:Anamalais; Kerala: Munnar | Very Rare |

| | | |
|---------------------------------|---|------------|
| <i>Bolbitis subcrenatooides</i> | Kerala:Malabar; Karnataka:Chikmagalur | |
| <i>Cyathea albosetacea</i> | Nicobar Islands: Camorta, Kutchall | Vulnerable |
| <i>Cyathea gamblei</i> | Sikkim;Assam | |
| <i>Cyathea nicobarica</i> | Nicobar Islands | |
| <i>Cyathea nilgirensis</i> | Karnataka:Coorg,Hassan, Kodagu; TN:Nilgiri, Anamalais,Palni,Shevroy hills; Kerala:Munnar,Travancor ehills; MP | Endangered |
| <i>Dryopsis scabrosa</i> | TN:Anamalais,Palnihills, Nilgiri | |
| <i>Dryopteris austroindica</i> | TN:Shevaroyhills(probably extinct), Nilgiri | Very Rare |
| <i>Dryopteris khullarii</i> | Uttarakhand: | |
| <i>Dryopteris odontoloma</i> | Anamalais, Nilgiri | Very Rare |

4. Conclusions

Based on field-observations of different authors, data from herbarium-collections, and published literature an appraisal of rare and threatened pteridophytes of political India, classifying species into different categories, has been made. Observations from literature survey reveal that populations of 13 species have been decreased to a critical level and they are at a very high risk. Slight disturbance in their habitat can lead to their total extinction. Eight species are thought to be „very rare“ and are liable to be in peril if contiguous steps are not taken to stop the devastation of their habitats. In India more than 1000 species of pteridophytes have been reported, which comprise 67 families and 191 genera. Out of those 414 species are listed as threatened plants. So it is suggested that a comprehensive analysis is still required to be undertaken to re-evaluate the taxonomy and status of endemic pteridophytes.

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