



MEDICINAL USES OF PTERIDOPHYTES FROM RAJASTHAN

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Abstract: Pteridophytes are a group of plants that represent important evolutionary advancements, such as the development of vascular tissues like xylem and phloem, in addition to a dominant sporophyte phase. Pteridophytes are used as ornamental plants due to their long foliage with specific patterns of branching and plant forms. They are also used as bioindicators of pollution, phytoremediators, and some are used as biofertilizers. During the invasion of land, pteridophytes developed several adaptations in morphology, anatomy, and reproductive strategies for successful habitation on land. In this process, they developed a number of secondary metabolites that help these plants thrive in harsh conditions. Some of these secondary metabolites have antimicrobial properties and are used as drugs against certain pathogens. The traditional system of medicines helps urban, rural, and tribal peoples in the treatment of many diseases without side effects. Pteridophytes (ferns and fern allies) hold immense value, although their economic and medicinal value is not well understood. Based on reports published within the last two decades, we have gathered information on medicinal ferns occurring in the Rajasthan state of India. The use of different plant parts of 11 species of ferns in Rajasthan by local peoples, especially tribes, for various ailments has been recorded. Commonly occurring species of the genus *Adiantum* are widely used in different parts of the state.

Keywords: Pteridophytes, fern, adaptation, seed, Rajasthan, medicinal, evolution.

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Introduction: Ten percent of all vascular plants are used as medicinal plants, estimated to be between 350,000 and almost half a million species. Since ancient times, plants have been used as medicine. Initially, a trial-and-error method was employed for disease treatment and general well-being, helping to identify beneficial plants as medicine (Kartik *et al.*, 2007). This knowledge of medicinal plants gradually evolved over generations, forming traditional medicines (Shaikh *et al.*, 2011). Traditional medicine encompasses the collective knowledge, skills, and practices based on theories, beliefs, and experiences indigenous to different cultures. It is used to maintain health, as well as for the prevention, diagnosis, improvement, or treatment of physical and mental illnesses (Kirtikar *et al.*, 1935). Until the 18th century, the therapeutic properties of many plants and their effects on the human body were known, but the active compounds remained unknown (Panda *et al.*, 2011). The emergence of modern sciences, particularly during the Renaissance, brought advancements such as chemical analysis and associated instrumentation, like the microscope, which made it possible to isolate active principles from plants. Since then, active principles have been synthetically obtained in laboratories to produce medicines. Although medicinal plants have been replaced by modern medicines, their safety and efficacy make them a preferred choice for primary healthcare (Banerjee and Sen, 1980).

Pteridophytes, often referred to as the reptiles of the plant kingdom, consist of non-flowering primitive vascular plants. They are found in humid and cold regions, with high diversity in the tropics. India alone is home to approximately 305 genera and 1,200 species of pteridophytes (Dixit, 1984; Manickam & Rajkumar, 1999; Manickam & Irudayaraj, 1992; Chandra, 2000). Pteridophytes possess an enormous variety of secondary metabolites and hold great potential in medical sciences. They play a significant role in traditional medicine systems. The medicinal importance of pteridophytes in India was initially explored by (Caius, 1935), and subsequent studies by (Chowdhary, 1973; Vyas and Sharma, 1998) (Padala, 1988) have exposed their ethnobotanical and medicinal uses. Various parts of the sporophytes, such as rhizomes, leaves, and spores, have been used to treat various diseases. Plant extracts from different pteridophytes have been employed for the treatment of many ailments. Theophrastus (327-287 BC) and Dioscorides (50 AD) described herbal formulations using several pteridophytes for the treatment of various disorders (Singh and Singh, 2013). Sushruta and Charaka also mentioned the use of certain ferns, such as

Marsilea minuta, *Adiantum capillus veneris*, *Selaginella bryopteris*, and *Lycopodium clavatum*, in homeopathic medicine. *Lycopodium clavatum* has been found to be beneficial for patients with fractured bones. *Helminthostachys zeylanica* (Kamraj) is used in herbal Ayurvedic formulations to enhance sexual efficiency and as a source of stimulants and aphrodisiacs. Marsilin, isolated from *Marsilea minuta*, is known to improve the immune system and is used in the treatment of psychopathy, diarrhea, cough, and skin diseases. *Pteris vittata* has demonstrated antimicrobial activity against several gastrointestinal bacterial strains. Thus, pteridophytes hold immense medicinal importance and find utility in various fields (Singh *et al.*, 2003).

Major pteridophytes of Rajasthan : *Adiantum capillus-veneris* L.: This species of fern is also known as the Maiden hair fern and Hansraj. It is found in alluvial soil deposited in rock crevices near waterfalls, under moist and shady places, and on humus-rich soil. The rhizome is slender, creeping to suberect, 10-30 cm long, bearing fronds and roots with narrow lanceolate needles. The fronds are bipinnate, and the stipe is slender. The sporangia are leptosporangiate with a tetrahedral wall of the spores (Bir and Verma, 1963).

Uses: The leaf and rhizome extract is used for bronchitis, as an aphrodisiac, for cough and fever. It is also used as a stimulant, purgative, and demulcent. It possesses anticancerous, hypoglycemic, aphrodisiac, antifungal, antibacterial, and antiviral properties (Dixit and Vohra, 1984).

Adiantum incisum Forsk.: The rhizome is small and vertical, covered with numerous fibrous roots and scales. The fronds are pinnate, 40 to 65 cm long, each having buds on the apical region, which serve for vegetative propagation. This fern is termed as the walking fern. The pinnae are opposite or alternate, and the stipe is dark brown. In the fertile fronds near the margin, each frond bears the marginal sori, with a large number of sporangia in each sorus (Sharma and Vyas, 1978; Kaushik, 1998).

Uses: The plant extract is used in cough, diabetes, and fever. In the region of Mount Abu, Bhil tribes use the extract of the leaves for skin diseases. In the tribal region, the leaf powder is used with butter to cure internal burning. The Garasia tribe uses a mixture of powder with tobacco to cure internal burning.

Adiantum lunulatum Burm.: The rhizome is ascending, small (9 to 23 mm in size), and densely covered with fibrous roots, scales, and leaf bases. The fronds are pinnate, 17 to 43 cm in length, and the stipe is shining dark brown in color. The pinnae are more or less lanceolate. In the fertile pinnae, the

outer margin is almost smooth and the inner margin is full of sporangia (sori) protected by the indusium. Each sorus possesses a large number of sporangia for reproduction.

Uses: In Ayurveda, the plant is pungent and used for indigestion. The decoction of the leaves is used for dysentery and ulcers (Vyas and sharma , 1988). The local and tribal peoples of the Aravalli region use the plant for cough, dysentery, asthma, leprosy, and hair fall treatment (Pairhar *et al.*, 2003).

Actinopteris radiata (J. Koenig ex Sw.) Link: The plants are 8 to 25 cm high and root in crevices of roots or between joints of brick walls in moist and shady places . The rhizome is horizontal, about 1.8 to 3 cm high, and densely covered with roots, leaf bases, and root hairs (Bhardwaj *et al.*, 1979). The young leaves show circinate vernation, but the lamina becomes flat at the early stages of development. The lamina is stiff and rough to the touch (Bohra *et al.*, 1980). The sporangia are submarginal to touch (Bohra *et al.*, 1980).

Uses: The paste of leaves is used as an anthelmintic. In Kumbhalgarh and Parsharuram Mahadev areas, the ash of the leaves is used with honey for fever and bronchitis. A paste of 5 to 6 leaves with cow milk is taken for irregular menstrual cycles. The paste of leaves is also given to females for birth control, and the decoction of leaves is used for tuberculosis .

Araiostegia pseudocystopteris copel: The rhizome is terrestrial and creeping with scales. The stipe is glabrous and jointed to the rhizome. The fronds are tripinnate, and the pinnae are much dissected into small pieces. The sori are globose to sub globose, and the sporangia are long-stalked with oblique annulus and hyaline spores.

Uses: The tribal peoples in Mount Abu use the decoction of the leaves as a vermifuge .

Asplenium pumilum var *hymenophyllides* Fee: The rhizome is ascending, short, and the fronds are tufted. The sori are found in the fertile fronds on the margin.

Use: It is used as a depurative, sedative, antibacterial, and for ulcers (Bir and Verma, 1963).

Athyrium pectinatum T. Moore: The rhizome is large and creeping, branched, with brown scales. The stipes are fragile, and the lamina is variable, lanceolate to deltoid, with an acuminate apex. The pinnae are decompose, and the sori are minute with a thin indusium.

Uses: The rhizome is a strong antihelminthic and used by the Bhil people of the Mount Abu area as a medicinal plant (Parihar and Parihar, 2006).

Cheilanthes albomarginata Clarke: The rhizome is short, covered with hairs andramenta, and has brown lanceolate scales. The lamina is lanceolate and deltoid, with unipinnate to deeply pinnate

leaves. The sori are marginal and confluent, and the indusium is greenish brown. The sporangia are leptosporangiate with smooth exine (Parihar and Parihar,2006). The undersurface of the leaves is covered with white powder, distinguishing this fern from others.

Uses: The tribal people of Mount Abu, such as Bhil, Gharasia, and Sahaira, use the decoction of the plant as a general tonic for children. Some research reports suggest that the decoction of the plant is also useful for tuberculosis (Vyas and Sharma, 1988).

Cyclosorus dentatus (Forssk.) Ching: The rhizome is short and creeping. The stipes are variable in length and hairy, and the scales are lanceolate. The lamina can reach up to 100 cm in length, and the pinnae are 15 to 25 cm long. The sori are present on the fertile pinnae, located in the median position, with oblique indusium.

Uses: The Bhil and Garasia people of Mount Abu utilize the plant as a vegetable. Some studies have found that the rhizome paste and sporophyll paste have antibacterial properties in some species (Navr, 1958).

Dryopteris cochleata Don: The rhizome is woody, stout, and horizontal, covered with leaf bases. The fronds are dimorphic, with significant differences between fertile and vegetative fronds. During reproduction, a long series of sori can be seen, and the indusium is observed.

Uses: Young leaves are used as vegetables, and the paste of the leaves is used for eczema and as an anthelmintic.

Isoetes rajanthisis Gena & Bhardwaja: The plants are medium-sized, around 10 to 16 cm in height. The rhizomes are found in the form of rhizomorphs, and the roots are covered with small roots.

Uses: The extract of the whole plant is used in the treatment of liver and spleen disorders (Verma *et al.*, 1995).

Marsilea minuta Linn.: The plants are aquatic or amphibious. They are found in aquatic habitats as runners with nodes and internodes. From the nodes, roots, leaves, and sporocarps arise. The leaves have large petioles terminating in four leaflets with crenate margins. The sporocarps are stalked and bean-shaped (Dixit *et al.*, 1978).

Uses: The plants are used for cough and spastic conditions of leg muscles, as a sedative and for insomnia. The Garasia and Bhil tribes use the plants as vegetables, and the decoction of the leaves is used for treating cough with ginger (Nayr, 1959).

Conclusion: This review highlights the uses of pteridophytes in curing various diseases by tribal and rural communities in Rajasthan. These communities have a close relationship with nature and utilize plants for the treatment of various

disorders. Pteridophytes, although often overlooked, possess medicinal, ecological, and economic values. However, due to habitat destruction, this group of plants is at risk of extinction. Therefore, efforts for in-situ and ex-situ conservation are necessary to preserve this valuable natural resource.

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