

# Aquatic Pteridophytes of District Hamirpur, Himachal Pradesh, India

Babita Suman<sup>1</sup> and Sheesh Pal Singh<sup>2</sup>

<sup>1,2</sup>*Department of Botany, Janta Vedic College, Baraut, CCS, University, Meerut, UP, India*

(Received 30 June, 2023; Accepted 23 August, 2023)

## ABSTRACT

Pteridophytes are lower vascular plants. They include true ferns and fern allies. This group of plants constitute second major component of forest wealth after angiosperms. They occupy intermediate position between bryophytes and seed plants. Pteridophytes have aesthetic, economic and ecological importance. There is dearth of documentation of aquatic pteridophytes of district Hamirpur. Hence, the present study was undertaken with the objective to determine the diversity and distribution of aquatic pteridophytes of district Hamirpur, Himachal Pradesh, India. This study was carried out between January 2019 to June 2023 in this area. During present exploration four species of aquatic pteridophytes belonging to four genera and three families were reported.

**Key words:** *Pteridophytes, Aquatic, Documentation, Diversity, Himachal Pradesh*

## Introduction

Pteridophytes, the seedless vascular plants have flourished in past by dominating the vegetation on the earth by 400 million years ago (Mehra, 1967; Bir, 1976a, Khare, 1996). They include fern and fern allies. At present about 12000 species of pteridophytes occur throughout the world. In India pteridophytes are represented by about 1107 species (Fraser-Jenkins *et al.*, 2017). Majority of them are mainly distributed on Himalayan Hill ranges and Western Ghats. Pteridophytes form connecting link between lower plants and vascular seed plants. This group of plants prefer shady and moist habitat with moderate temperature but they have diverse range of habitats. Pteridophytes have aesthetic, economic and ecological values. Many species are facing various natural and anthropogenic threats. So far no attempt has been made for documentation of aquatic pteridophytes in reference to Hamirpur district of

Himachal Pradesh. Hence, the present study was undertaken with the objective to determine the diversity and distribution of aquatic pteridophytic flora.

## Materials and Methods

The present study was conducted between January 2019 to June 2023. It was based on the field survey, collection of pteridophytes with a critical study in different seasons from various parts of district Hamirpur, H.P., India. In majority of pteridophytic plants new fronds start from June to July and start bearing sori from late August. Therefore, collection was made from mid of September onwards. During collection in the field importance was given to record the characters of rhizomes, scales, hairs, branching system of fronds, structure of sori and photography along with abundant field data such as characters of taxonomic values. The collected speci-

(<sup>1</sup>Research Scholar, <sup>2</sup>Associate Professor)

mens were dried and preserved in the herbarium sheets according to the recommended procedures of Jain and Rao (1976). The specimens were identified with the help of standard literature and various published works (Khullar, 2000; Ghosh *et al.*, 2004 and Singh and Panigrahi, 2005).

## Results and Discussion

In the present study four species of four genera representing three families have been documented. Keys of documented taxa, taxonomic details and photographs are provided for their easy identification.

### Key to the Families

- 1a. Plants free floating; fronds/leaves sessile.....Salviniaceae  
 1b. Plants rooted; fronds/leaves with distinct stipe.....2  
 2a. Leaflet 4, palmate; sporangia in specialized, minute sporocarps..... Marsileaceae  
 2b. Leaves simple, deeply pinnatsect, sporangia in large fertile fronds.....Parkeriaceae  
**Salviniaceae** Saguier, Fl. Veron. 3: 52.1754

### Key to the Genera

- 1a. Sporocarps in pair; leave minute, imbricate; roots present, simple..... *Azolla*  
 1b. Sporocarps in cluster; leaves diamorphic, floating entire; submerged leaves much dissected, root like.....  
*Salvinia*

*Azolla* Lamarck, Encycl. Meth. 1: 343. 1783.

**Etymology:** The term was introduced by Lamarck in 1783 and it has Greek origin. It is combination of two words, azo means dry and ollyo (olluo) means to kill, meaning "killed by drought". It reflects that these plants are sensitive to water deficit and are killed when the water dry up.

*Azolla pinnata* R. Br., Prodr. Fl. N. Holl. 167. 1810. Ghosh *et al.*, Pterid. Fl. East Ind.1: 184. 2004 (Plate I; Fig. 1).

**Etymology:** The species name *pinnata* is derived from Latin and refers to the pinnate branches of the stem.

**Synonyms:** *Azolla imbricata* (Roxb.) Nakai, Bot. Mag. Tokyo. 39. 185. 1925. *Salvinia imbricata*

Roxb., Calc. J. 4. 470. 1844. *Azolla pinnata* R. Br.

var. *imbricata* Sweet and Hill, Amer. Fern J. 61. 1-13. 1971.

Stem up to 2.5 cm long, thin, 0.02 cm in diameter, main axis pseudodichotomously branched; roots hanging downwards. Leaves free floating, bilobed, imbricate, sporocarps on submerged ventral lobes; microsporocarps many with micropores; megasporangia few with one megaspore.

**Fertile Season:** January - February

**Localities of Collection:** BS 15, December 2020, Kunah stream, BS 40, January 2021, Maan stream, BS 50, February 2022, Gasoti stream

**Distribution in Himachal Pradesh:** Chamba; Dalhousie; Banikhet; Bakarota. Kangra: Dharamshala. Mandi: Sunder Nagar. Kullu: Nagar; Manali. Shimla Hills: below Matiana; Fagu; Glen; Chadwick Fall; Chail; Jubbal. Solan: Mt. Karol (Khullar, 2000).

**Uses:** It is used as green manure in horticulture and paddy fields. Also utilized as duck and fish feed.

*Salvinia* Seguiet, Fl. Veron. 3. 352. 1754.

**Etymology:** The genus name is after the name of Antonia Maria Salvini, an Italian professor of Greek who helped Micheli with his botanical work.

*Salvinia adnata* Desvauz, Mem. Soc. Linn. Paris 6: 177. 1827 [Plate I; Fig. 2].

**Etymology:** The specific epithet name is derived from Latin word *adnatus* meaning adnate or joined together which refers to jointed fronds.

**Synonyms:** *Salvinia molesta* Mitchel, Brit. Fern Gaz. 10: 251. 1972.

Floating, rhizome 0.5 - 2.0 mm in diameter, hairy, brown and acicular. Fronds: compressed, oval, folded, spongy. Sporocarps: globose, densely hairy, short stalked. Megasporocarps 2-3 and microsporocarps pubescent, sessile or subsessile, containing mostly empty microsporangia.

**Fertile Season:** November - March

**Localities of Collections:** BS 20, January 2021, Kunah Stream near Kehdru

**Distribution in Himachal Pradesh:** Dalhousie, Khajjiar lake, Manali (Khullar, 2000).

**Uses:** Green manure

**Marsileaceae** Mirbel in Lamarck and Mirbel, Hist. Nat. Veg. 5. 126. 1802, 1803.

*Marsilea* L., Sp. Pl. 2: 1099. 1753

**Etymology:** The genus is somewhat incorrectly named after Lugi Ferdinando Marsigli of Bologna, a naturalist and patron of Botany. It is commonly known as the "4-leaved clover" or "water clover" or "clover fern".

*Marsilea minuta* L., Mant: 308. 1771. [Plate I; Fig. 3].

**Etymology:** The specific epithet in Latin means "small" in allusion to the small size of the pinnae.

**Synonyms:** *Marsilea crenulata* Desv. Mem.Soc.Linn. Paris 6: 179. 1827.

Rhizome; creeping, long, thin, diameter 0.1-0.2 cm, glabrous but hairy apex. Roots borne on the nodes. Stipe; scattered, usually green. Leaflets; 4, sessile, margin entire or crenate, arranged cross wise. Sporocarps; borne at the nodes near the base of stipe, bean shaped, bilaterally compressed.

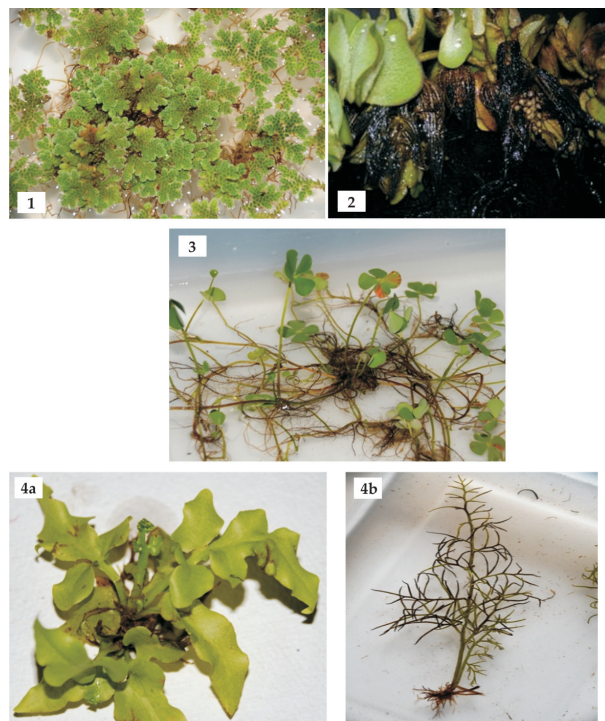
**Fertile Season:** December - March

**Localities of Collection:** BS 18, December 2020, Kunah stream, BS 42, January 2021, Maan stream, BS 48, February 2022, Gasoti stream

**Distribution in Himachal Pradesh:** Kangra: Dharamshala, Dari, Guptganga; Sirmaur: in fields along Nahan and Paonta Sahib road.

**Uses:** Young fronds are eaten as vegetables, also used in cough, bronchitis, skin diseases, haemorrhoids, fever, insomnia and mental problems.

**Parkeriaceae** Hook., Exotic Fl. 2: 147. 1825.



**Plate 1.** Aquatic Pteridophytes of Hamirpur District, Himachal Pradesh, India. Fig.1. *Azolla pinnata* R. Br; 2. *Salvinia adnata* Desvaux; 3. *Marsilea minuta* L.; 4. *Ceratopteris thalictroides* (L.) Brongn. 4a. Young frond 4 b.Fertile frond.

*Ceratopteris* Ad. Brongn., Bull. Sci. Soc. Philom. Paris Ser.3, 8: 186. 1821.

**Etymology:** The genus name is derived from Greek word *Cerato* means horn or antler and *pteris* means fern in reference to antler like fertile fronds of this fern. Also called "Antler Fern".

*Ceratopteris thalictroides* (L.) Brongn., Bull. Sci. Soc. Philom. Paris Ser. 3, 8: 186. 1821. [Plate I; Fig. 4a & 4b).

**Synonyms:** *Acrostichum thalictroides* L., Sp. Pl. 2: 1970. 1753. *Pteris thalictroides* (L.) Sw., J. Bot. 1800: 65. 1801.

Rhizome: short, erect. Fronds: diamorphic, fertile fronds erect, sterile fronds short and drooping. Sterile fronds: succulent, inflated, glabrous, lamina up to 3 pinnate, pinnae lanceolate or ovate or dentate, margins variously lobed. Fertile fronds: up to 4-pinnate lower part, bipinnate in the upper part, lanceolate; pinnae up to 10 pairs, alternate, petiolate, lanceolate or deltate; ultimate lobes linear or deltate, apex acute, margins recurved to enclose the sporangia. Sori: in 1-3 rows.

**Etymology:** The specific epithet *thalictroides* means resembling *Thalictrum* L., "meadow-rue"- an angiosperm genus of family Ranunculaceae.

**Fertile Season:** May - November

**Localities of Collection:** BS 45, June 2021 and BS 70 November 2022, Choru brook.

**Distribution in Himachal Pradesh:** Kangra: Palampur, Dharamshala; Chamba: Rajpur, Dalhousie; Mandi; Sirmaur.

**Uses:** Whole plant is used as green manure in rice fields, fronds are used as poultice for skin problems and styptic to stop bleeding.

The present study revealed 4 aquatic pteridophytes belonging to 4 genera and 3 families. *Azolla pinnata* and *Marsilea minuta* are very common aquatic pteridophytes where as *Salvinia adnata* and *Ceratopteris thalictroides* are less common. *Ceratopteris thalictroides* has been reported first time from district Hamirpur, Himachal Pradesh. The present exploration may be utilized for bioprospecting.

### Acknowledgement

We are thankful to Mr. Sunil Pathak, Assistant Professor of Botany, Govt. College, Barsar, Himachal Pradesh who has helped in collection of data and identification.

**Conflict of Interests**

There is no conflict of interests regarding research, authorship and publication of this research paper.

**References**

- Bir, S.S. 1976a. Taxonomy of Indian Pteridopytes. In : P. Kachroo (Ed.) *Recent Advances in Botany*. Bishen Singh Mahendra Pal Singh, Deharadun. pp. 70-115.
- Fraser Jenkins, C.R. 2008. Taxonomic Revision of three hundred Indian Subcontinental Pteridophytes with a Revision Census List. Bishen Singh Mahendra Pal Singh, Dehradun.
- Fraser Jenkins, C.R., Gandhi, K.N., Kholia, B.S. and Benniamin, A. 2017. An Annotated Checklist of Indian Pteridophytes Part -I, II (Lycopodiaceae to Polypodiaceae), Bishen Singh Mahendra Pal Singh, Dehradun.
- Ghosh, S.R., Ghosh, A., Bishwas, A. and Ghosh, R. K. 2004. The Pteridophytic Flora of Eastern India I. Flora of India Series 4. *Botanical Survey of India*, Kolkata.
- Jain, S.K. and Rao, R.R. 1976. *A Handbook of Field and Herbarium Methods*. Today and Tomorrow's Printers and Publishers, New Delhi.
- Khare, P.B. 1996. Ferns and fern allies, their significance and fantasies. *Allied Botany (Abs.)* 16: 50-61.
- Khullar, S. P. 2000. *An Illustrated Fern Flora of West Himalaya* Vol. II. International Book Distributers, Dehradun.
- Mehra, P. N. 1967. Conquest of land evolutionary patterns in early land plants. 15th Seward memorial lecture delivered at Birbal Sahni Institute of Palaeobotany, Lucknow. 14: 1-27.
- Singh, S. and Panigrahi, G. 2005. *Ferns and Fern Allies of Arunachal Pradesh*, Vols I & II. Bishen Singh Mahendra Pal Singh, Dehradun.