



BIODIVERSITY AND CONSERVATION OF PTERIDOPHYTES IN MIRZAPUR DISTRICT, UTTAR PRADESH

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ABSTRACT

The Mirzapur district, nestled within the Vindhyan plateau of Uttar Pradesh, represents a unique ecological transition zone characterized by rocky terrains, seasonal waterfalls, and moist deciduous forest patches. While Angiospermic flora has been extensively documented in this region, the Pteridophytes (fern and fern allies) remain comparatively understudied despite their significant role as ecological indicators. This study aims to provide a comprehensive assessment of the pteridophytic diversity, distribution patterns, and conservation requirements within the district. The research identifies critical threats to this diversity, primarily driven by anthropogenic pressures such as illegal sandstone mining, habitat fragmentation, and the alteration of natural water bodies. Furthermore, it provides a baseline for future taxonomic studies and highlights the urgent necessity of preserving the non – flowering vascular plant wealth of the Vindhya region.

KEYWORDS: Mirzapur, Biodiversity, Vindhya region, Conservation, Pteridophytes

Mirzapur district, covering 4,521 square kilometres in southeastern Uttar Pradesh, is situated between latitudes 23 °52'N to 25 °32'N and longitudes 82 °7'E to 83 °33'E. It blends fertile alluvial plains with the rugged Vindhya Range (Survey of India, 2022). The authors examine its boundaries, elevation profile, groundwater dynamics, and cultural landmarks, highlighting their interplay in shaping local ecology and heritage. The district's terrain rises from Ganges floodplains to Vindhyan hills. Mirzapur district's pedological diversity underpins its agrarian economy, reflecting Vindhyan geology and Gangetic fluvial dynamics (National Bureau of soil survey and Land use Planning [NBSS&LUP], 2022). Spanning black, sandy loam, and red lateritic soils, these types cover 99% of the 4,521 km² area. Pteridophytes, as the earliest vascular land plants, predominantly occupy terrestrial niches but demonstrate remarkable ecological versatility, thriving in mesic, xerophytic, epiphytic, and aquatic habitats (Raven *et al.*, 2020). Their distribution reflects evolutionary adaptations to microclimatic gradients, particularly reliance on moisture for gametophyte viability and spore dispersal. The majority of pteridophytes are terrestrial, favouring humid, shaded understories in temperate and tropical forests. The pteridophytic flora of district Mirzapur is distinctly categorized by habitat – specific adaptations across rugged Vindhya landscape. Lithophytic species thrive within sandstone crevices and near the district's numerous waterfalls like Tanda fall and Wyndom fall featuring drought – tolerant taxa like *Actiniopteris radiata* (Pteridaceae), and the famous “resurrection” plant *Selaginella bryopteris*

(Selaginellaceae). The region hosts various members of the Pteridaceae family, including *Adiantum caudatum*, a specialized lithophytic species found on rocky outcrops, and *Adiantum lunulatum* (also known as *A. Philippense*), which exhibits a terrestrial to semi – lithophytic growth habit along moist earthen embankments. In the region's aquatic ecosystems, including marshes and reservoir margins like Sirsi, semi – aquatic and floating taxa such as *Marsilea minuta* (Marsileaceae) and *Azolla pinnata* (Salvinaceae) are prevalent. While epiphytic growth is restricted by the dry deciduous climate, climbing varieties such as *Lygodium flexuosum* (Lygodiaceae) frequently scramble over vegetation in humid ravines, illustrating the complex botanical tapestry formed by the unique topographic and hydrological features of this Uttar Pradesh region. This ecological richness, which includes aquatic taxa like *Marsilea minuta* and *Azolla pinnata* found in regional reservoirs like Sirsi Dam, is currently facing a significant decline due to anthropogenic pressures such as intensive sandstone mining, habitat fragmentation, and the alternation of natural hydrology near waterfalls like Lakhaniya Dari. Of particular concern is the status of the locally endemic *Isoetes mirzapurensis*, which faces potential extirpation alongside other vulnerable species like *Ophioglossum reticulatum* due to degradation of specific micro – refugia. Consequently, the conservation status of Mirzapur pteridophytes has shifted from the robust populations documented in historical floras (Duthie, 1903) to a state requiring urgent in – situ protection and systematic monitoring (Singh *et al.*, 2020) to preserve the unique evolutionary lineage of the Vindhya highlands. (Figure 1a, 1b and 2)

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Figure 1a: Map of India indicating U.P, Map of U.P indicating Mirzapur District.

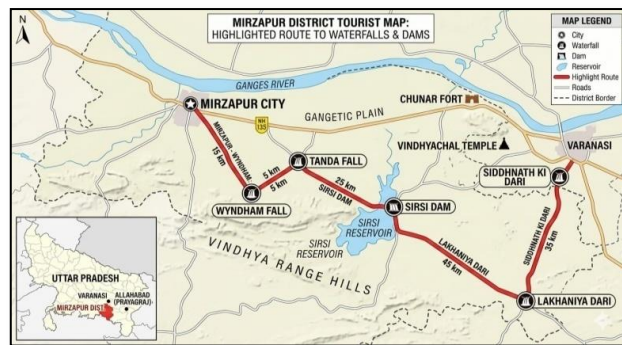


Figure 1b: Collection sites in the study area.



Figure 2: Tourist places in the study area : (A) Lakhaniya Dari, (B) Wyndham fall, (C) Sirsi Dam (D) Tanda fall

MATERIALS AND METHODS

Study Area and Field Survey

The study was conducted by authors in district Mirzapur, located in south – eastern Uttar Pradesh, India. Its varied landscape, including the Vindhyan plateau, plains, and southern hilly areas, provides diverse habitats that support pteridophyte growth. Because of this variation in topography and vegetation, the district is well suited for examining pteridophyte diversity and identifying habitats that require conservation. Seasonal field survey were carried out by authors across forest patches, moist slopes, shaded valleys, rocky crevices, stream banks, village fringes, and both disturbed and undisturbed sites to document pteridophytes. (Table 1)

Table 1 : Summary of the study area

Zone type	Key locations
Waterfall zones	Wyndham Falls, Tanda Falls, Lakhaniya Dari, Sirsi Fall
Dam & Reservoir peripheries	Sirsi Dam
Roadside Rocks & Escarpments	Vindhyachal Ranges, Chunar Hills, Road cuts on NH-7
Deep Gorges & Forest Floor	Devrikala Forest
	Kotwa – Patewar Range

Field Collection and Observation

Field surveys were conducted by authors during different seasons in different regions of district Mirzapur. Specimens like *Adiantum caudatum*, *Adiantum philippense*, *selaginella bryopteris* and *Pteris vittata* were collected due care, ensuring the inclusion of frond morphology, venation pattern, sori placement, rhizome structure wherever available. For each specimen, relevant field data such as locality, co-ordinates, or site description, substrate, and habitat conditions were recorded. The collected materials were then pressed, dried, and mounted according to standard herbarium techniques. Identification under taken by compairing the morphological characters of the specimens with relevant floristic literatures. (Figure 3)



Figure 3: Tools for plant collection in the study field



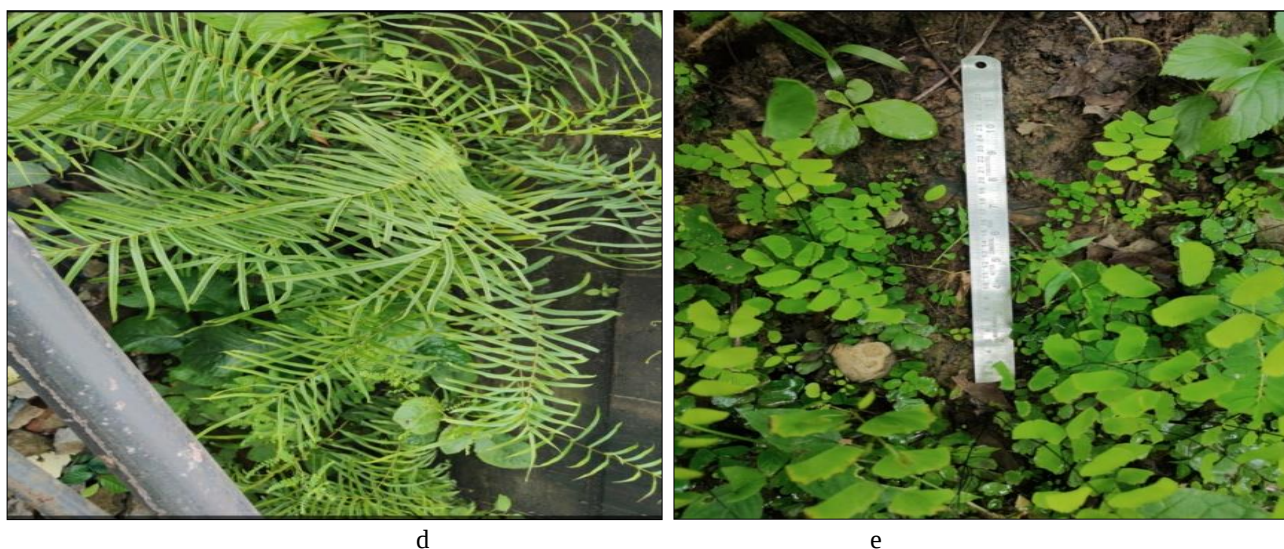


Figure 4: Plant specimens were Collected from the study area as follows : a) a leaf of *Adiantum caudatum* bearing sori , b) *Selaginella bryopteris* growing on rocks at Lakhaniya Dari, c) *Adiantum caudatum* growing on roadside rocks along NH-35 at Barkachha , d) *Pteris vittata*, e) *Adiantum Philippense*



Figure 5: Dried and pressed specimens of the collected specimen

CONSERVATION STATUS

Threats to conservation in Mirzapur mirror those documented in various other parts of India: forest loss, growth of infrastructure, farming encroachment, climate fluctuations, drying of habitats, and disruption of wetland ecosystems. Infrastructure development and agriculture expansion have fragmented the tropical dry deciduous forests, eliminating the “micro-regugia” (Humid, shaded pockets) essential for fern reproduction (Saini *et al.*, 2010). The construction of dams and the alternation of seasonal water flow from falls like Wyndham Fall and Lakhaniya Dari have reduced the ambient humidity, causing moisture-sensitive species to vanish. The rapid spread of invasive plants like *Lantana camara* outcompetes native ground-dwelling ferns for space and nutrients (Wildlife of Mirzapur, 2021). Since numerous

pteridophytes are diminutive, nich-dependent, and readily overlooked, they could consistent monitoring efforts. This holds particular significance in the Vindhyan landscape, where specialized microhabitats vanish rapidly from land transformation and resource mining .Conservation efforts in Mirzapur ought to adopt an integrated approach. Firstly, key fern habitats must be pinpointed and safeguarded in their natural setting, particularly shaded gullies, woodland areas, and moist stream channels. Secondly, off-site preservation via botanical gardens, herbarium records, and spore storage can secure endangered species. Thirdly, community education initiatives should engage students, forestry personnel, and rural residents to highlight pteridophytes as essential components of biodiversity, not mere trivial ground cover. (Table 2, 3 and Figure 4, 5)

Table 2: Diversity summary of pteridophytic flora in Mirzapur

Family	Common species in Mirzapur	Habitat type
Pteridaceae	<i>Adiantum caudatum</i> , <i>Adiantum phillipines</i> , <i>Pteris vittata</i>	Lithophytic /Terrestrial
Selaginellaceae	<i>Selaginella bryopteris</i>	Lithophytic (Resurrection habit)
Salviniaceae	<i>Azolla pinnata</i>	Aquatic
Ophioglossaceae	<i>Ophioglossum reticulatum</i>	Terrestrial, damp, and seasonally wet environments.
Lygodiaceae	<i>Lygodium flexuosum</i>	Moist, stream banks, swamps, and disturbed areas like roadside

Several specimens reported by the author indicate, based on preliminary field observations in that

the species has a restricted local distribution in Mirzapur and is associated with specific habitat types.

Table 3: Summary of observations from the study area

Species Name	Previous era status	Current status in Mirzapur
<i>Pteris vittata</i>	Documented historically as an “interesting pteridophytes” in the Vindhyan plateau, and plains.	Appears to have maintained a stable presence in district Mirzapur.
<i>Selaginella bryopteris</i>	Previously Abundant across the Vindhyan hills	Facing depleted wild populations due to over-harvesting for its medicinal (Sanjeevani) and ornamental value..
<i>Ophioglossum reticulatum</i>	Once common in moist grasslands.	Experiencing a sharp decline caused by urbanization and soil compaction from cattle grazing.
<i>Adiantum philippense</i>	Frequent near almost all permanent waterfalls.	At present, their numbers are stable, but there is a possibility of a decline in their population due to human interference.”

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