May 2025 E-ISSN : 2348-7143

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RESEARCH JOURNEY

International E-Research Journal

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Issue - 364

Multidisciplinary Issue

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***Cover Design :** Maharani Ahilyadevi Holkar 300th Birth Anniversary (Source Picture) E-Sakal

 Price : Rs. 1000/-

'RESEARCH JOURNEY' International E- Research Journal
Issue 364 : Multidisciplinary Issue
Impact Factor : 6.625 (SJIF) Peer Reviewed Journal
E-ISSN : 2348-7143
May 2025

Habitat and Ecological Status of *Pteridophytes* from *Coastal Ecosystems* of Sindhudurg District of Maharashtra, India

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Abstract

The estuarine and coastal habitats of Sindhudurg district, Maharashtra, host a range of pteridophytic species adapted to complex environmental gradients. This study presents the ecological assessment of six pteridophytes *Acrostichum aureum* L. *Ceratopteris thalictroides* (L.) Brongn. *Marsilea minuta* L. *Lygodium flexuosum* (L.) Sw *Psilotum nudum* (L.) P. Beauv. *Draynaria quercifolia* (L.) J. Sm from selected microhabitats in the estuarine zones of Mithbaon, Achara, Kalavali, and Karli. Using randomly placed quadrats and standard soil analysis methods, key ecological variables including salinity, pH, tidal activity, and soil texture were recorded. Each species is discussed in terms of habitat preference, associated vegetation, and ecological tolerance. The findings suggest varied adaptability among species, with *Ceratopteris* and *Acrostichum* emerging as potential indicators of habitat quality in semi-disturbed estuarine wetlands.

Key Words: estuarine, pteridophytes, habitat, ecological status.

Introduction:

Pteridophytes form a critical yet underrepresented component of estuarine vegetation, especially in transition zones between terrestrial and aquatic ecosystems. Their sensitivity to microhabitat conditions such as salinity, soil composition, and moisture makes them valuable indicators of ecosystem change. Sindhudurg district along the Konkan coast presents a unique interface of mangrove ecosystems, tidal creeks, and encroached wetlands—ideal for studying ecological status of pteridophytes.

Pteridophytes, non-flowering vascular cryptogams, form an essential yet often overlooked component of wetland and coastal biodiversity. While their role in forest ecosystems has been extensively studied, their distribution and ecological functions in estuarine and coastal habitats—particularly in mangrove-associated environments—remain underdocumented. The Sindhudurg district, characterized by a mosaic of estuarine systems, mangroves, and seasonal wetlands, provides an ideal setting to study the habitat preferences and ecological of pteridophytes.

This study aims to evaluate the ecological status of pteridophyte species and their interactions with abiotic and biotic variables across different estuarine systems.

Materials and Methods:

Study Area:

The survey was conducted in the estuarine zones of Mithbaon, Achara, Kalavali, and Karli, (Maharashtra State of India) characterized by varying degrees of salinity, elevation, and anthropogenic influence.

Sampling Methodology:

- **Quadrat Method**: 1×1 m quadrats were randomly placed in micro-geographic units across different estuarine environments to record pteridophyte presence. Species were identified and confirmed by Dixit (1984).

Soil Analysis

- **Soil Texture (Sieve Method)**:
  Air-dried soil was sieved through a standard stack (2 mm to 0.075 mm). The retained fractions were weighed and used to estimate the sand composition (*Gee and Bauder,1986).*
- **Soil pH**:
  Measured by mixing 10 g of sieved soil with 25 mL of distilled water (1:2.5 ratio) and testing with a calibrated digital pH meter (*Thomas, 1996).*
- **Soil Salinity (Electrical Conductivity Method)**:
  Soil-to-water suspension (1:5 w/v) was prepared and electrical conductivity measured using an EC meter. Results were converted to salinity (ppt) (*Rhoades, 1999).*

Results and Discussion

The ecological assessment of six pteridophyte species across estuarine habitats of Sindhudurg reveals clear differences in habitat preferences, environmental tolerance, and species associations (Table 1)

Table 1 Species inventory with habitat preferences and ecological status

Species	Habitat Type	Ecological Status	Salinity	pH	Soil Texture	Elevation	Tidal Influence
Acrostichum aureum L.	Encroached & undisturbed land	Locally common	High	Slightly alkaline	Gravelly	Low	High
Ceratopteris thalictroides (L.) Brongn.	Semi-disturbed, water-logged zones	Occasional	Moderate	Alkaline	Gravelly	Low	High
Marsilea minuta L.	Encroached land, seasonal marshes	Locally occasional	Moderate	Slightly acidic	Sandy	Slightly high	Moderate
Lygodium flexuosum (L.) Sw	Elevated, shaded creekside slopes	Rare	—	Slightly acidic	Gravelly	High	Very low
Psilotum nudum (L.) P. Beauv.	Epiphytic on coconut roots	Rare	Low	Slightly acidic	—	High	Spring tide only
Draynaria quercifolia (L.) J. Sm.	Epiphytic on mangrove trunks	Rare	—	—	—	—	—

Distribution Patterns and Habitat Preferences:

Among the species studied, *Acrostichum aureum* and *Ceratopteris thalictroides* were the most widespread, both occurring frequently in low-lying, high tidal influence zones with gravelly

soils and alkaline pH. Their ability to thrive under saline or brackish conditions suggests a high degree of environmental plasticity. *Acrostichum aureum*, a mangrove associate, is known for its salt tolerance and colonization of disturbed mangrove margins (Beddome, 1883). It was locally common across multiple sites, showing strong association with halophytic mangrove species such as *Rhizophora mucronata* and *Avicennia officinalis*.

Ceratopteris thalictroides, in contrast, preferred zones of moderate salinity and stagnant water conditions. Though less frequent than *Acrostichum*, its presence in both disturbed and semi-natural sites aligns with previous studies highlighting its facultative aquatic nature and use as a bioindicator in wetland systems (Cook, 1996).

Marsilea spp. were sparsely distributed and restricted to slightly elevated, seasonally moist areas with sandy and slightly acidic soils. Their presence alongside sedges, grasses, and insectivorous species like *Drosera indica* suggests preference for ephemeral wetlands with minimal tidal influence. This matches findings from earlier work that describe *Marsilea* as moderately desiccation-tolerant and typical of seasonally inundated wetlands (Fraser-Jenkins, 2008).

Lygodium spp. were recorded only along high elevation banks with negligible tidal action and slightly acidic gravelly soils. Its rarity and association with less disturbed riparian vegetation (*Heritiera*, *Aegiceras*) imply a narrow ecological amplitude and potential vulnerability to habitat modification.

The epiphytic species *Psilotum spp.* and *Dranaria spp.* were both rare and restricted to encroached areas and mangrove tree trunks, respectively. *Psilotum* was found growing on coconut roots in moist microclimates, while *Dranaria* occurred on shaded, bark-rich mangrove substrates. These species are not soil-bound, and their distribution reflects microhabitat specialization rather than broad edaphic or tidal tolerance. Their occurrence in stable, shaded, and humid environments underlines the need to conserve such micro-niches, especially as they are sensitive to climatic and anthropogenic disturbances.Environmental parameters and species response is recorded in Table 2.

Table 2. Environmental Parameters and Species Response

Parameter	Common Ranges	Species Most Tolerant
Salinity	0.5–7 ppt	*Acrostichum aureum*, *Ceratopteris thalictroides*
Soil Texture	Gravelly to sandy	*Acrostichum*, *Lygodium*, *Marsilea*
pH	Slightly acidic to alkaline (6.0–8.5)	*Acrostichum* (alkaline), *Marsilea* (acidic)
Elevation	Low to high	Epiphytes at high elevation (*Psilotum*, *Dranaria*)
Tidal Influence	Low to high	*Acrostichum*, *Ceratopteris* (high); *Lygodium*, *Psilotum* (low)

5. Conclusion:

This ecological investigation reveals diverse habitat preferences and adaptive strategies among pteridophytes in the coastal wetlands of Sindhudurg. *Acrostichum aureum* and *Ceratopteris thalictroides* demonstrate ecological versatility and may be employed as indicator species for ecosystem monitoring. Other species such as *Psilotum* and *Dranaria* highlight the importance of preserving epiphytic niches in mangrove ecosystems. Conservation strategies must

integrate microhabitat protection and regulate anthropogenic pressures to safeguard this often-overlooked plant group.

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