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BOTANY RESEARCH ARTICLE

Occurrence of *Helminthostachys zeylanica* (L.) Hook. (Polypodiopsida: Ophioglossaceae) from Cooch Behar District of West Bengal, India

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Abstract: *Helminthostachys zeylanica* (L.) Hook., belonging to the family Ophioglossaceae, is a rare and endangered fern species of significant botanical interest due to its unique morphology and ecological importance. This study documents its occurrence in the Cooch Behar District of West Bengal, India, for the first time, highlighting its habitat, morphology, ethnobotanical uses, and conservation challenges. Field surveys conducted from 2021 to 2023 revealed limited populations confined to specific microhabitats. Plants are found to grow in moist soil under full shades of teak (*Tectona grandis* L.f.) plants. Habitat loss due to anthropogenic activities and overexploitation are identified as major threats to its survival in its natural habitat which may lead to the extinction from the study area. This article emphasizes the need for targeted conservation strategies, including habitat protection and community awareness to ensure the survival of this unique fern species in the studied area.

Keywords: Pteridophytes, distribution, Sal Bagan, habitat, morphology, conservation, ethnobotany.

1. Introduction

Pteridophytes, the second largest group of vascular plants are distributed all over the world [1] and are an important component of the present-day vegetation [2]. Out of c. 13,000 species of pteridophytes that has been reported globally [3], around 1135 species are recorded from India and approximately 528 species are recorded from the state of West Bengal [4–6].

Helminthostachys zeylanica (L.) Hook., commonly known as Kamraj (King of Potency) is a monotypic genus belongs to the family Ophioglossaceae [7–9]. It is distributed in Asia (India, Bangladesh, Bhutan, Cambodia, China, Indonesia (Maluku), Japan, Laos, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Taiwan, Thailand, Vietnam) Australasia (Australia, New Guinea, New Caledonia) and Pacific Islands. In India, it is mostly found in Arunachal Pradesh, Assam State, Bihar, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh and West Bengal [4]. The species is reported from many districts of West Bengal including, Alipuduar [10], Jalpaiguri and Darjeeling [11], Uttar Dinajpur [12], Dakshin Dinajpur [13], Malda [14], Birbhum [15], Purulia [16], Hooghly [17], Jhargram [18], Purba and Paschim Medinipur [19], among others.

Cooch Behar district of West Bengal, India is considered a unique zone for pteridophytes [2]. A few studies [2, 20–23] have documented the pteridophytic flora of the Cooch Behar district,

shedding light on the diversity and distribution and ethnomedicinal uses. However, the presence of *H. zeylanica*, a rare and endangered pteridophyte, had not been documented in earlier studies. This omission highlights the need for continued exploration and more exhaustive surveys to uncover and record less conspicuous or overlooked species in the district's unique ecosystems. The present study aims to document, for the first time, the occurrence of the species in the district of Cooch Behar, which will be a major contribution to the floristic database of the State as well as of India.

2. Materials and methods

2.1. Study area

The investigated plant specimen has been recorded from the Sal Bagan (Figure 1), located at the outer part of Cooch Behar town (near Cooch Behar Airport) of Cooch Behar district, is recognized as a nature observation center. Geographically the area lies between 26°19′44″ to 26°20′17″ North Latitude and 89°27′29″ to 89°28′07″ East Longitude with an elevation of 14.5 m. Geographical location of the study area was recorded using the device GARMIN® eTrex® 22x. Though the studied area commonly referred to as Sal Bagan (forest of *Shorea robusta* Roth trees), it is predominantly characterized by the presence of teak trees (*Tectona grandis* L.f.).

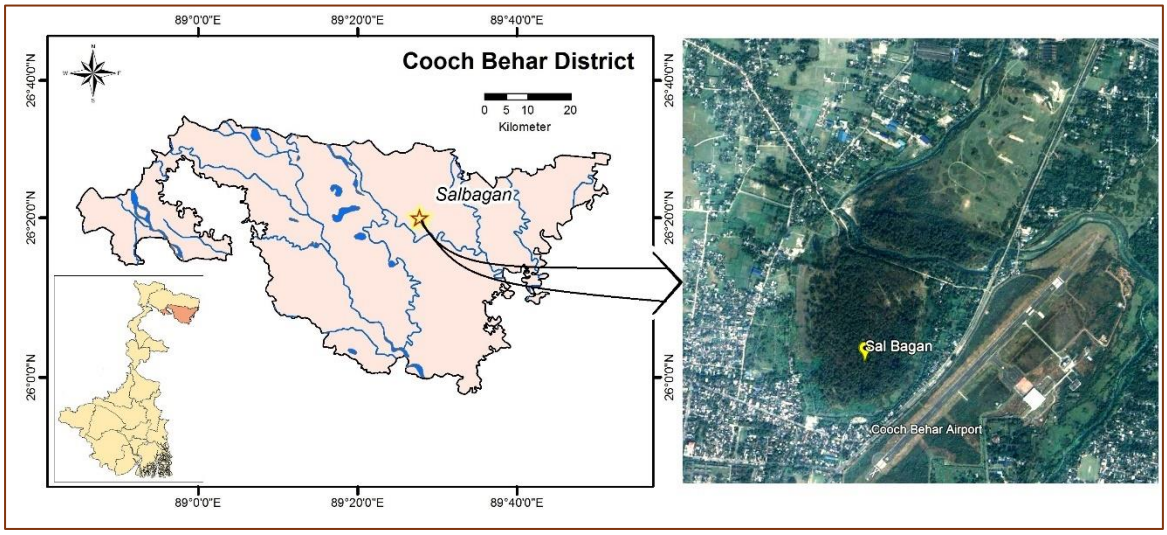

Figure 1: Map of Cooch Behar District showing sample collection site (Yellow pin) (Map prepared using an open source QGIS Desktop 3.22)

2.2. Data collection

Field visits were made at different seasons between January 2021 and December 2023 for *H. zeylanica*. Only a leaflet was collected leaving rest of the plant intact in its natural habitat to ensure minimal disturbance to the plant and its ecosystem. The collected plant part was processed following a routine method of herbarium techniques [24]. Digital photographs were also taken and

a photograph of the plant was attached with the herbarium sheet along with the collected and processed leaflet. The specimen has been identified using standard literature [4, 25] and then confirmed by CRFJ from photographs sent. Correct nomenclature with standard name-authorities was maintained following IPNI [26]. Voucher specimen was deposited in the Department of Botany, A. B. N. Seal College, Cooch Behar for future reference.

3. Results and discussion

Helminthostachys zeylanica is popularly referred to as 'Sada Dhekia' and 'Ekbir' by the local people of the studied area. Plants are primarily found to germinate through rhizome due to poor germination rate of spores [9] however, Ravikumar and Ved [27] reported that new plants can germinate from powdery spores. New plants are begin to sprout in mid-April, while plants with fertile spikes are found to grow from May to July, aging and declining between late December and early January. From early February, all the plant disappears, until its next cycle of growth. Similar observations were also made by Dhawal *et al.* [9].

Figure 2: *Helminthostachys zeylanica*. (A-B) Young plants (C) Mature plant with young spike (D) Old-age plant with mature spike (E) Young spike (F) Mature spike. © Aninda Mandal

3.1. Habitat

Approximately 25 *Helminthostachys* plants were found to grow naturally in moist soil under the full shades of teak (*Tectona grandis* L.f.) trees in association with ferns like *Diplazium esculentum* (Retz.) Sw., *Thelypteris* (*Christella*) *dentata* (Forssk,) E.P.St.John and *Microlepia speluncae* (L.) T.Moore and some species of angiosperms such as *Oplismenus hirtellus* (L.) P.Beauv., *Clerodendrum infortunatum* L., among others. The plant specimen was reported to grow on damp shades along sub-marshy habitat [8–9, 28] with rich humus and decayed organic matter [29], even can withstand stagnant water [17]. Joshi [28] reported that the plant flourished well as undergrowth, chiefly in the forest of teak, among others.

3.2. Morphology of the aerial part of the plant

Plants (Figure 2) are perennial; terrestrial erect herb; young plants light green in color; mature plants 30–55 cm long above ground, phyllosporangiophore with a sterile laminal part (tropophore) and a fertile spike (sporophore), both trophophore and sporophore arise from a 25–40 cm common stalk; leaves ternately divided, whorled with 5–10 sub-sessile leaflets, lamina soft, palmately pinnate, dichotomously forked venation with distinct midrib; spike solitary, unbranched, green when young, turns yellowish brown on maturity, 10–15 cm long; sporangia arranged in several rows on the stem of fertile spike, green when young but turns yellowish brown when mature. The plant specimen was previously well-described by various researchers [8–9, 17, 28–30].

3.3. Ethnobotanical uses

The local ethnic community utilizes this plant for diverse ethnobotanical purposes, including cooking young leaves as a vegetable, using leaf extracts to treat colds and coughs, and relying on its extract for traditional contraceptive practices. Mitra and Mukherjee [31] also reported that an aqueous infusion, prepared by soaking freshly chopped rhizome in water overnight, given to the women as an contraceptive.

3.4. Conservation strategies

Collection of young fronds for vegetable is common practice in the studied area. Overexploitation and habitat loss due to anthropogenic activities may harm the concerned species and lead to extinction from the site. Hence, *in-situ* and *ex-situ* conservation strategy should be taken to protect the species. The author made aware the local residents near the study areas about the importance of the species, encouraging sustainable use practices and promoting their undisturbed growth in their natural habitats. The plant population has been declined over the years due to alteration of habitat, deforestation, climate change, overexploitation [7–9, 28–29, 31].

4. Conclusion

H. zeylanica, a rare and endangered plant species with a limited geographical distribution, has been documented for the first time from the district Cooch Behar, West Bengal, India, marking a significant contribution to the understanding of the region's rich botanical heritage. Poor spore germination, overexploitation, and ongoing habitat loss may lead to extinction of the ancient vascular land plant from the studied area. So, immediate necessary action should be taken to safeguard the species within its natural habitat.

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Competing interests

Funding source had no role in study design, data collection, interpretation of results and manuscript writing.

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