Journal of Threatened Taxa

Building evidence for conservation globally

Open Access

10.11609/jott.2021.13.12.19675-19886
www.threatenedtaxa.org

26 October 2021 (Online & Print)
Vol. 13 | No. 12 | Pages: 19675–19886

ISSN 0974-7907 (Online)
ISSN 0974-7893 (Print)

ISSN 0974-7907 (Online); ISSN 0974-7893 (Print)

Publisher
Wildlife Information Liaison Development Society
www.wild.zooreach.org

Host
Zoo Outreach Organization
www.zooreach.org

No. 12, Thiruvannamalai Nagar, Saravanampatti - Kalapatti Road, Saravanampatti,
Coimbatore, Tamil Nadu 641035, India
Ph: +91 9385339863 | www.threatenedtaxa.org
Email: sanjay@threatenedtaxa.org

For Focus, Scope, Aims, and Policies, visit https://threatenedtaxa.org/index.php/JoTT/aims_scope
For Article Submission Guidelines, visit https://threatenedtaxa.org/index.php/JoTT/about/submissions
For Policies against Scientific Misconduct, visit https://threatenedtaxa.org/index.php/JoTT/policies_various

continued on the back inside cover

Caption: Stripe-backed Weasel *Mustela strigidorsa*. Medium—digital, Software—procreate, Device—iPad + Apple pencil © Dhanush Shetty.

Journal of Threatened Taxa | www.threatenedtaxa.org | 26 October 2021 | 13(12): 19781–19790
ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)
https://doi.org/10.11609/jott.7488.13.12.19781-19790
#7488 | Received 02 June 2021 | Final received 30 July 2021 | Finally accepted 20 August 2021

OPEN ACCESS

COMMUNICATION

On the pteridophytes of Bherjan-Borajan-Padumoni Wildlife Sanctuary, Assam, India

Pranjal Borah [1] & **Jayanta Barukial** [2]

[1] Department of Life Sciences, Dibrugarh University, Dibrugarh, Assam 786004, India.
[2] P.G. Department of Life Sciences, Debraj Roy College, Golaghat, Assam 785621, India.
[1] borahpranjal27@gmail.com (corresponding author), [2] barukialjayanta@gmail.com

Abstract: A preliminary survey on the pteridophytic flora of Bherjan-Borajan-Padumoni Wildlife Sanctuary of Assam, India revealed a total of 33 species belonging to 23 genera and 15 families. Most of the species belong to the family Pteridaceae followed by Polypodiaceae and Thelypteridaceae. A brief taxonomic description of each species is provided. *Stenochlaena palustris* (Burm.f.) Bedd., an edible fern, grows abundantly all over, especially in the openings and clearings.

Keywords: Fern, Polypodiaceae, Pteridophytic flora, Pteridaceae, *Stenochlaena,* taxonomic description, Thelypteridaceae.

Editor: Anonymity requested.

Date of publication: 26 October 2021 (online & print)

Citation: Borah, P. & J. Barukial (2021). On the pteridophytes of Bherjan-Borajan-Padumoni Wildlife Sanctuary, Assam, India. *Journal of Threatened Taxa* 13(12): 19781–19790. https://doi.org/10.11609/jott.7488.13.12.19781-19790

Funding: Self-funded.

Competing interests: The authors declare no competing interests.

Author details: Pranjal Borah is a PhD scholar at Dibrugarh University, Assam, pursuing research in the area of plant taxonomy. Dr. Jayanta Barukial is the Associate Professor and Head of the Department of Botany and PG Department of Life Sciences, Debraj Roy College, Assam and a recognized PhD supervisor of Dibrugarh University. His research interest is in the field of plant taxonomy, cytology, molecular taxonomy, environmental issues.

Author contributions: All authors equally contributed to the present study.

Acknowledgements: The authors are grateful to the principal chief conservator of forest (wildlife), Assam and the Assam State Biodiversity Board for giving the necessary permissions for field surveys. Also thankful to local forest officials for providing necessary help and guidance during the field trips. The authors are also grateful to Dr. Pankaj Chetia, asst. professor, Dept. of Life Sciences, Dibrugarh University, Assam and Mr. Nakul Neog, asst. professor, Sadiya College, Assam for their advice and help.

INTRODUCTION

Pteridophytes, also known as ferns and fern-allies, flowerless and seedless plants that once dominated the world vegetation 280–230 million years ago. The main plant body is sporophytic and the dominant phase in its life cycle. Chapman (2009) estimates that there are about 12,000 species of ferns and fern-allies across the world. According to Moran (2015), "worldwide, there are about 13,600 species of ferns and lycophytes". According to a survey, the pteridophytic flora of India comprises around 1,000 species belonging to 191 genera and 67 families including 47 endemic Indian ferns (Dixit 1984) and in another report, more than 1,100 species of pteridophytes belonging to 144 genera and 34 families with about 235 endemic species (Chandra 2000) from India. According to Fraser-Jenkins et al. (2017), "altogether there are about 1135 species including 42 exotics and 53 further subspecies", from the Indian subcontinent.

The Bherjan-Borajan-Padumoni is one of the smallest wildlife sanctuaries of Assam covering 7.22 km^2 of area spreading across three blocks located in Tinsukia district of the Upper Brahmaputra Valley of Assam, India which consists of three separate forests, namely Bherjan, Borajan, and Padumoni. The forest is the home for an endangered primate species, i.e., Western Hoolock Gibbon. Bherjan, Borajan, and Padumoni are tiny isolated pockets of lowland tropical forest covering an area of 105 ha, 493 ha, and 176 ha respectively and an ideal habitat for primate species like the Bengal Slow Loris, Assamese Macaque, Pig-tailed Macaque, Rhesus Macaque, Capped Langur, Stump-tailed Macaque, and Western Hoolock Gibbon. The three areas are disjoint and unconnected by tea gardens and human settlement. These are entirely on the flat plains of the Brahmaputra Valley. There are small, scattered marshes, with swamps, covered with dense growth of grass and *Alpinia* herb. The natural vegetation of all these areas is tropical wet evergreen 'rainforest' type. Bherjan is almost entirely covered with trees with a closed canopy. The original vegetation has been replaced by a fairly old mixed plantation dominated by the deciduous species *Lagerstroemia parviflora* and *Terminalia myriocarpa*. The Padumoni part is mostly in a degraded state due to large-scale felling. The canopy has been very badly broken up. Only a few mature trees of *Artocarpus, Bombax*, *Lagerstroemia*, and *Mesua* species can be seen. Borajan is a pocket of excellent rainforest, dominated by *Dipterocarpus macrocarpus*. Except for Teak, all the species as in the other two forest pockets are found. Bamboo species are found in all areas.

In Assam, a few systematic works on pteridophytes have been accomplished, like Kachroo (1953), Panigrahi (1960, 1968), Panigrahi & Chowdhury (1961, 1962), Dutta et al. (1980), Handigue & Konger (1986), Kachroo et al. (1989), Borthakur et al. (2001, 2018), Devi & Majumdar (2003), Sen & Ghosh (2011), and Kalita (2015).

METHODS

A number of field visits were undertaken to the study area in the year 2019–2020 (Figure 1). The different pteridophytes were collected from a range of habitat; however, those species which are Red Listed (IUCN) or used as food or shelter were left untouched. Under such circumstances, digital photographs of the concerned species were taken. The specimens were preserved and studied with standard literature like Baishya & Rao (1982), Jamir & Rao (1988), and Borthakur et al. (2001, 2018). The plants were collected from the field, cleaned, and pressed for the preparation of herbarium. Herbariums are prepared by following standard herbarium technique (Jain & Rao 1977) and deposited at the Botany Department, Debraj Roy College, Golaghat, Assam. Digital photographs of the specimens were also taken and some of them are displayed (Image 1).

The families are enumerated in text according to Fraser-Jenkins (2009). However, the genera and species within the families are listed alphabetically. The taxonomic citation is based on published literature and IPNI, Tropicos, and The Plant List.

RESULTS

A total of 33 species of pteridophytes belonging to 23 genera and 15 families are recorded. The plants are enumerated with a brief taxonomic description of each species.

Selaginellaceae

1. ***Selaginella monospora*** Spring; Collection No. DRC- 5005.

Terrestrial. Stem about 40 cm long, prostrate, ascending, branched. Leaves dimorphic, green, midrib prominent, lateral leaves ovate. Strobilus up to 8 mm long, terminal, simple, sporophylls spiral, spore green.

2. ***Selaginella semicordata*** (Wall. ex Hook. & Grev.) Spring; Collection No. DRC-5006.

Terrestrial. Stem slender, branched with related

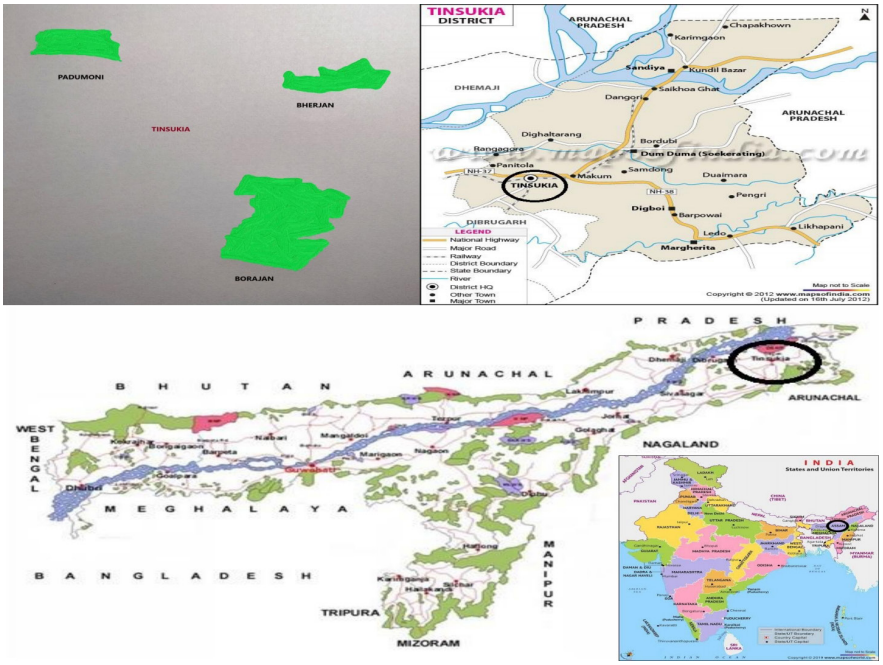

Figure 1. Study area – Bherjan-Borajan-Padumoni Wildlife Sanctuary.

dichotomy, rhizophore arises from forking. Leaves spirally arranged, lanceolate, entire, membranous. Strobilus up to 0.6 cm long, sporophyll lanceolate, ciliate at base; sporangia oval, orange in colour, spore oval, dark brown.

Marattiaceae

3. ***Angiopteris evecta*** (G.Forst.) Hoffm.; Collection No. DRC- 5015**.**

Terrestrial. Tree like fern. Rhizome erect, cylindrical, broad. Stipes swollen at base, adaxially flattened, abaxially rounded, whitish linear streaks all over, with small brown scales and minute hairs. Lamina bipinnate; pinnae subopposite, with long swollen stalk, oblong-lanceolate, veins simple or forked twice, almost parallel, reaching the margin. Sori sub-marginal, ellipsoid; sporangia up to six pairs in two rows, which is boat-shaped. Spores hyaline, tetrahedral, pale green.

Gleicheniaceae

4. ***Dicranopteris linearis*** (Burm.f.) Underw.; Collection No. DRC- 5016**.**

Terrestrial. Rhizome long creeping, densely covered by hairs, scales absent; hairs minute, multicellular, reddish-brown. Stipes slender, straggling, rigid and polished; apical bud covered by brown hairs. Fronds pinnate or dichotomously branched; margin curved, deeply covered with brown hairs; rachises repeatedly forked, covered with dark-brown hairs; veins prominent, 2-forked, free; lamina light green; texture hard. Sori small, globose, without paraphyses, in the two rows on both sides of the costa. Spores numerous, trilete, deeply grooved.

Polypodiaceae

5. ***Microsorum pteropus*** (Bl.) Copel.; Collection No. DRC- 5021**.** Aquatic. Rhizome creeping, fleshy, green, apex scaly; lanceolate. Fronds simple or 3/5 - lobate, lanceolate, veins distinct above and below, main veins rather wide apart, lamina very dark, dirty green, often black when dry. Sori small, globose, scattered irregularly within the main areoles; sporangia slender stalked, oval. Spores yellowish-green.

6. ***Microsorum punctatum*** (L.) Copel.; Collection No. DRC- 5025**.**

Epiphyte. Rhizome short creeping. Fronds without distinct stipe, simple, sessile, lanceolate or elliptic, base decurrent, margin entire, midrib across at the base, veins visible but not prominent; pinnae glabrous above and below, dark green when fresh, blackish when dry. Sori numerous, small, round, irregularly scattered on upper half of the frond; sporangia oval, short-stalked. Spores yellowish-green.

7. ***Pyrrosia lanceolata*** (L.) Farewell.; Collection No. DRC- 5029.

Epiphyte. Rhizome wide creeping, slender, clothed with scales; base rounded, margin profusely hairy, entire. Lamina simple, lanceolate acute apex, base decurrent, entire or wavy, green and glossy above, brownish below,

upper surface glabrous, lower surface densely covered by stellate hairs, veins immersed; lamina wrinkle up on drying. Sori irregularly distributed on the anterior half of lamina; sporangia dark-brown, naked. Spores greenish-yellow.

8. ***Pyrrosia piloselloides*** (L.) M.G.Price; Collection No.:- DRC-5032.

Epiphyte. Rhizome long creeping, clothed with scales; lamina dimorphic, simple; sterile lamina sessile or shortly stalked, roundish or obovate, base cuneate, margin entire; stipe of fertile frond scaly at base, grooved adaxially, straw-coloured; fertile lamina linear to oblong, apex round, base decurrent, margin entire; veins indistinct. Sori marginal, linear, continuous along the tip of lamina; sporangia oval, short stalked dark-brown. Spores oval to elliptic, light-brown.

Lygodiaceae

9. ***Lygodium flexuosum*** (L.) Sw.; Collection No. DRC-5037.

Climber. Rhizome creeping, short, covered by dark-brown, multicellular, uniseriate hairs. Stipes glabrous, abaxially rounded, adaxiaily flattened, dark-brown. Fronds widespreading, tripinnate, glabrous; primary pinnae alternate, bears two to three pinnules alternately; pinnules oblong-lanceolate, simple or terminal leaflets forked, basal leaflets often large, separate or lobed with 2–3 leaflets, sterile leaflets finely toothed; texture firm; rachis and costa densely or sparsely pubescent all over; veins distinct, free, reaching the margin; fertile leaflets a little narrower than the sterile ones. Sporangia arranged adaxially protruding from the margin; sporangia large, short stalked, about five pairs, arranged in two rows, alternate.

10. ***Lygodium japonicum*** (Thunb.) Sw.; Collection No. DRC- 5038.

Climber. Rhizome long creeping, covered with black hairs. Stipes scaly at base. Fronds wide-spreading, tripinnate; primary pinnae forked, opposite; fertile pinnae much contracted giving an appearance of dissected lamina; texture herbaceous; primary rachis scabrous; secondary rachis ridged; veins distinct, free, reaching the margin. Sori finger like, marginal projections which are greenish when young and dark brown at maturity; sporangia short stalked, arranged in two rows, alternate. Spores small, numerous.

Pteridaceae

11. ***Acrostichum heterophyllum*** L.; Collection No. DRC- 5040.

Epiphytes. Rhizome long creeping, densely covered by scales; apex acuminate, centre dark brown, pale-brown in the rest. Stipes of sterile fronds covered with scales similar to rhizome. Lamina dimorphous, simple or elliptic, apex rounded, margin entire; costa and veins indistinct, immersed; texture thick, fleshy, more or less covered by stellate hairs when young, sparsely or rarely when matured, lamina pale or dark-green; linear oblong, apex rounded. Sori confluent along the tip of lamina, sporangia oval, short stalked, intermingled with stellate hairs, dark-brown. Spores oval to elliptic, hyaline, light-brown.

12. ***Adiantum capillus-veneris*** L.; Collection No. DRC-5055.

Terrestrial. Rhizome short creeping, densely clothed with brown, narrow, lanceolate, acuminate, entire scales; Stipes slender scaly at base, glabrous and dark glossy above. Lamina bipinnate, lanceolate, cuneate at base, lower margin straight or concave and entire, outer margin rounded, lobed, lobes crenate, sterile lobes with more or less rounded, finely toothed edges; rachis uncovered; veins dichotomously branched. Sori elliptic or linear; sporangia globose, small and short stalked. Spores smooth walled.

13. ***Pityrogramma calomelanos*** (L.) Link.; Collection No. DRC- 5057.

Terrestrial. Rhizome short, erect, glossy above, black. Lamina oblong-triangular, subcoriaceous, bipinnate, pinnae in the lower half of the lamina more or less equal; gradually shortened towards apex, lower surface covered with white waxy powdery substance, lobes oblique, elliptic, toothed; rachis black-ebeneous, glossy; veins dichotomously radiated, free. Sori continuous throughout the lower surface. Spores tetrahedral.

14. ***Pteris biaurita*** L.; Collection No. DRC- 5045.

Terrestrial. Rhizome erect, short, scaly at the apex; linear-lanceolate, margin hairy, dark brown. Stipes glabrous except at base, adaxially grooved. Lamina bipinnatifid, glabrous; pinnae up to 12 pairs, sub-opposite, lanceolate, sessile or shortly stalked, margin lobed, apex rounded, margin entire; pinnae pale green; veins distinct, other veins forked once. Sori confluent along the margin of the sinus but not reaching the apex of the lobes. Spores tetrahedral, dark brown.

15. ***Pteris ensiformis*** Burm.f.; Collection No. DRC-5046.

Terrestrial. Rhizome erect, short, scaly; scales linear-lanceolate, entire, shining, dark-brown. Stipes glabrous, polished, slender, abaxially rounded, adaxially grooved. Fronds dimorphous, but sometimes some fronds partly fertile and partly sterile; Fertile lamina bi-pinnate, glabrous; the segments very narrow and

Image 1. I—*Pyrrosia lanceolata* (L.) Farw. | II—*Acrostichum heterophyllum* L. | III—*Lygodium flexuosum* (L.) Sw. | IV—*Lygodium japonicum* (Thunb.) Sw. | V—*Microsorum punctatum* (L.) Copel. | VI—*Microsorum pteropus* (Bl.) Copel. | VII—*Angiopteris evecta* (G.Forst.) Hoffm. | VIII—*Blechnum orientale* L. | IX—*Cyathea gigantea* (Wall. ex Hook.) Holtt. | X—*Stenochlaena palustris* (Burm.) Bedd. | XI—*Dicranopteris linearis* (Burm.f.) Underw. | XII—*Vittaria elongata* Sw. © Pranjal Borah

elongated, entire; lamina pale-green; rachis glabrous, grooved above, pale-brown; veins distinct on both surfaces, simple or forked, free. Sori confluent, marginal, developing basipetally. Spores dark brown, tetrahedral.

16. ***Pteris longipinnula*** Wall. ex J. Agardh.; Collection No. DRC- 5047.

Terrestrial. Rhizome erect, densely clothed with scales; scales linear, reddish-brown. Stipes erect, slender, abaxially rounded, adaxially grooved, scaly at base. Lamina bipinnatifid, with 3 - 8 pairs of lateral pinnae and an apical pinnae, apex caudate; lobes gradually reduced towards apex, often auricled; rachis and surface of the pinnae uncovered; spinules present on upper surface; veins free, forked once. Sori marginal, continuous nearly to the apex of the lobes. Spores triangular to 'T'-shaped, dark brown.

17. ***Pteris semipinnata*** L.; Collection No. DRC- 5048.

Terrestrial. Rhizome short-creeping, densely scaly; dark brown. Stipes erect, tufted, slender, glabrous, dark brown at base, pale brown above. Lamina pinnate, ovate-lanceolate, glabrous; upper part of lamina cut down nearly to the rachis into numerous close entire

linear lobes; costae and costules minutely grooved on the upper surface; veins free, fine, forked once. Sori linear, continuous along the margins of lobes except quite near reaching the sinus. Spores triangular to oval, pale brown.

18. ***Pteris vittata*** L.; Collection No. DRC- 5049.

Terrestrial. Rhizome suberect, short, densely covered by scales at apex, membranaceous, entire, pale-brown. Stipes pale-brown, clothed with linear, silky, pale-brown scales. Lamina simple pinnate with a single, elongate, linear, terminal pinnae like the lateral ones; pinnae numerous, opposite or subopposite, reduced to deflexed auricles, all pinnae sessile, linear-lanceolate, acuminate at apex; veins simple or forked once, free, distinct on both surfaces. Sori all along the margin, except at base and apex; indusia membranaceous. Spores round, yellowish-green.

19. ***Vittaria elongata*** Sw.; Collection No. DRC- 5053.

Epiphyte. Rhizome short creeping, thick, slender branched, densely scaly. Stipes flattened. Lamina simple, linear-oblong lanceolate, gradually tapering towards both ends, apex acuminate, margin entire, midrib distinct; veins slightly distinct above and below, simple, immersed, parallel; lamina dark green. Sori linear, confluent; sporangia short stalk. Spore pale yellowish-green.

Cyatheaceae

20. ***Cyathea gigantea*** (Wall. ex Hook.) Holtt.

Terrestrial. Tree like fern. Trunk massive, erect, densely covered by scales dark brown. Stipes tufted, glossy, scaly at base, glabrous above, abaxially rounded, adaxially grooved, dark purple. Lamina bipinnate, deltoid, dark- green when fresh, brownish when dry; oblong-lanceolate, alternate, shortly stalked, about 20 cm apart, acuminate at apex about 2 cm apart, apex acuminate, margin lobed half way to the costae, rounded apex, margin crenate; texture of lamina herbaceous; rachis slightly dark brown. Sori median on the veins, spherical and inverted 'V' shape, exindusiate; sporangia numerous, compact.

21. ***Cyathea spinulosa*** Wall. ex Hook.

Terrestrial. Tree like fern. Trunk erect, up to 3 m or more tall. Stipes and rachis strongly aculeate or spiny, scales linear-lanceolate, long hair-pointed, black. Lamina bipinnate, short stalked; rachis of pinnules and main veins of lobes scaly below, but the latter glabrous above; lamina coriaceous; veins usually forked once, free. Sori large, round, indusium completely covering the sorus when young, soon breaking irregularly.

Dennstaedtiaceae

22. ***Microlepia speluncae*** (L.) Moore; Collection No. DRC- 5063.

Terrestrial. Rhizome long creeping, stout, hairy; pale-brown. Stipes rounded below, grooved above, short hairy, purplish-green. Lamina tripinnate or quadripinnate; pinnae about eight pairs, alternate, petiolate; ovate-lanceolate, apex acuminate, largest pinnule narrowly deltoid, subopposite or alternate, shortly stalked, basal acroscopic leaflet much larger than the rest; ultimate pinnules, veins slightly distinct, forked once, free, not reaching the margin. Sori submarginal, near the base of the sinuses between the lobes, indusia cup-shaped, hairy; sporangia copious. Spores yellowish-brown.

Lindsaeaceae

23. ***Sphenomeris chinensis*** (L.) Maxon; Collection No. DRC- 5067.

Terrestrial. Rhizome short creeping, stout, covered by scales; scales hair-like, stiff, dark-brown. Lamina tripinnate or quadripinnatifid, distal part bipinnatifid, lanceolate, apex acuminate, acroscopic base truncate, basiscopic base cuneate; secondary pinnae about eight pairs, alternate, shortly stalked, acute; tertiary pinnae about three pairs, alternate, shortly stalked, obovate, apex rounded, base cuneate. Sori marginal or submarginal at the end of veins; indusial attached basally. Spores bilateral and brown.

Thelypteridaceae

24. ***Amblovenatum opulentum*** (Kaulf.) J.P.Roux.; Collection No. DRC- 5069.

Terrestrial. Rhizome creeping, densely scaly; scales narrow, linear brown. Stipes erect, slender, grooved, hairy at grooves, scaly at base. Lamina simple pinnate, lanceolate, apex acuminate; pinnae about 20–30 pairs, alternate or subopposite, sessile; apex obtuse or rounded, margin wavy, clothed with small yellowish glandular hairs; lamina dark green. Sori mostly confined to lobes, globose, often much immersed and visible as punch form dots on the upper surface; indusia thin, sporangia slender stalked. Spores dark in colour.

25. ***Christella parasitica*** (L.) H.Lev.; Collection No. DRC- 5072.

Terrestrial. Rhizome creeping, densely scaly; linear-lanceolate, apex acuminate, margin more or less clothed with short, soft hairs. Simple pinnate, pinnae numerous, alternate or subopposite, sessile, margin lobed two-third to the costa, lobes up to 20 pairs, oblique, basal acroscopic lobe slightly larger than the others; rachis copiously covered by long and short hairs; costa, eostules

Image 1. XIII—*Christella parasitica* (L.) H.Lev. | XIV—*Adiantum capillus-veneris* L. | XV—*Amblovenatum opulentumI* (Kaulf.) J.P.Roux. | XVI—*Araiostegia divaricata* (Bl.) M.Kato. | XVII—*Sphenomeris chinensis* (L.) Maxon | XVIII—*Pityrogramma calomelanos* (L.) Link. | XIX—*Diplazium esculentum* (Retz.) Sw. | XX—*Diplazium dilatatum* Bl. | XXI—*Microlepia speluncae* (L.) Moore | XXII—*Pteris biaurita* L. | XXIII—*Pteris semipinnata* L. | XIV—*Pteris vittata* L. © Pranjal Borah

and veins covered by short acicular or glandular hairs; veins up to 10 pairs, upper surface covered with thick, acicular hairs. Sori medial or submarginal on the veins up to five pairs.

26. ***Cyclosorus interruptus*** (Willd.) H. Ito.; Collection no. 5065.

Terestrial. Rhizome long creeping, clothed with scales at the apex; scales ovate, acuminate at apex, margin entire. Stipes slender, sparsely scaly and black at the base, glabrous and brown above, adaxially grooved, abaxially flattened. Lamina elliptic-lanceolate, simple pinnate with an apical pinnae; lateral pinnae numerous, sessile or very shortly stalked, basal pinnae not reduced, rachis grooved and hairy; veins slightly distinct below and densely covered by long, soft acicular hairs, upper surface glabrous; lamina pale green; sori medial on the veins, in two rows, arranged in V-shaped; indusia reniform, hairy. Spores pale brown.

Aspleniaceae

27. ***Asplenium nidus*** L.; Collection No. DRC- 5076

Epiphyte. Rhizome erect, short, stout, apex clothed

with scales. Stipes dark to pale brown, glabrous above, scaly at base; lamina simple, lanceolate, gradually narrowed at both ends, glabrous; midrib strongly raised on the upper surface, veins nearly simple or 2-forked; almost parallel. Sori linear, borne along each veinlet on upper half of the lamina, nearly reaching margin from the midrib; indusia linear, narrow, superficially attached at base, slightly curved, greenish-grey. Spores light brown.

Athyriaceae

28. ***Diplazium dilatatum*** Bl.

Terrestrial. Rhizome erect, stout, apex densely clothed with scales; apex acuminate, margin with many teeth, thin, dark brown. Stipes scaly at base, glabrous above, abaxially rounded, adaxially grooved. Lamina ovate, bipinnate or tripinnatifid; primary pinnae seven pairs, alternate, shortly stalked or sessile, slightly ascending, pinnae up to 12 pairs, subopposite to alternate shortly stalked, simple or forked once, reaching the margin, texture herbaceous; lamina dark green above, pale green below, glabrous. Sori linear, confluent, indusia linear, entire, pale brown; sporangia slender stalked. Spores oval, pale brown.

29. ***Diplazium esculentum*** (Retz.) Sw.

Terrestrial. Rhizome erect, apex densely covered by scales, linear, lanceolate, apex long acuminate, dark-brown. Stipes stout, erect, sparsely scaly at base, dark-brown at base, pale-brown above. Lamina bipinnate at base, simple pinnate at apex, rarely simply pinnate, deltoid, apex acuminate, base truncate, basal pair of pinnae slightly reduced; pinnae up to seven pairs, basal one or two opposite or sub-opposite, others alternate; petiolate, narrowly deltoid, with a deeply lobed terminal pinnae, apex acuminate, lamina pale-green, hairs densely distributed all over the lamina. Sori in two rows near the margin, dark brown. Spores reniform, pale-brown.

Dryopteridaceae

30. ***Bolbitis heteroclita*** (Presl.) Ching; Collection No. DRC- 5082.

Terrestrial. Rhizome long creeping, soft, brittle, apex clothed with ovate-lanceolate, darkbrown scales; Stipes green, sparsely covered by scales. Fronds usually in two or three alternate rows; they vary from simple to pinnate and loosely placed; pinnae usually trifoliate, simple leaves and terminal pinnae of pinnate leaves similar, veins prominent, lateral veins raised, secondary veins anatomising without included veinlets, marginal veins free. Fertile lamina simple or pinnate; apical pinnae lateral, fertile lanceolate with acute apex, margin smooth and shortly stalked. Sori covering the whole lower surface and brown.

Davalliaceae

31. ***Araiostegia divaricata*** (Bl.) M.Kato.; Collection No. DRC- 5085.

Epiphyte. Rhizome creeping, densely scaly all over; scales, apex long acuminate, base broad, thin, transparent, brown. Stipes firm, erect, scaly at base, glabrous above, chestnut brown, tripinnatifid, deltoid-lanceolate, apex acute or acuminate; apex acuminate, base cuneate; secondary pinnae up to 12 pairs, alternate, sessile or shortly stalked, margin deeply cut down to lobe nearly to the costules; margin sharply toothed or crenate; veins not conspicuous, uniform, free, not reaching the margin; lamina dark reddish-brown when dry, glabrous. Sori half cup-shaped, obliquely placed as regards the central veins in the tooth, submarginal, brownish; indusia tubular or half cup-shaped, as long as broad.

Blechnaceae

32. ***Blechnum orientale*** L.; Collection No. DRC- 5087.

Terrestrial. Rhizome creel, densely scaly, massive, linear-lanceolate, apex acuminate, shining, dark brown. Stipes tufted, erect, scaly at base, glabrous above, reddish-brown at the base, grey brown above. Lamina ovate to linear-lanceolate, apex acute, simple pinnate; costa grooved above, rounded below; veins slightly distinct, simple or forked once or two times, free; lamina pale green, glabrous above and below, glossy. Sori linear along either side of the costa, continuous nearly to the apex, dark brown; indusia narrow, firm with entire margin. Spores round to oval, translucent, yellowish-brown.

33. ***Stenochlaena palustris*** (Burm.f.) Bedd.; Collection No. DRC- 5090.

Climber. Rhizome scandant, long creeping, thick, sparsely scaly, often climbing on trees; scales ovate, apex acuminate, margin ciliated, dark-brown at the centre, pale-brown at the periphery. Lamina dimorphic; stramineous, glabrous, adaxially grooved, abaxially rounded; simple pinnate; pinnae 8–15 pairs, lanceolate, apex acuminate, hard, rachis similar to stipe; veins distinct, simple or rarely once forked, reaching the margin; lamina green, glabrous on both surfaces, shining. Fertile lamina borne at the distal part of the plant, more or less same size and shape with the sterile one, but pinnae much contracted. Sori densely covering the lower surface except midrib and the extreme apex;

sporangia large, stalked, crowded. Spores monoiete, pale-green, spinulose.

DISCUSSION

The vegetation of the study area is mostly dominated by the angiosperms. Out of the 33 species of pteridophytes, two species belong to fern-allies and 31 species belong to true ferns. The two species of fern-allies belong to the family Selaginellaceae. Considering the habitat, 25 plants are terrestrial, seven plants epiphytic, and one aquatic (Figure 2). Among them, three species are trees, three species are climbers and remaining 27 species are either herbs or shrubs (Figure 3). Three species namely *Angiopteris evecta* (G.Forst.) Hoffm., *Cyathea spinulosa* Wall. ex Hook. and *Cyathea gigantea* (Wall. ex Hook.) Holtt. are tree ferns. *Microsorum pteropus* (Bl.) Copel. is the only aquatic fern found there. *Lygodium flexuosum* (L.) Sw., *Lygodium japonicum* (Thunb.) Sw., and *Stenochlaena palustris* (Burm. f.) Bedd. are climbers. *Cyclosorus interruptus* (Willd.) H. Ito is grown abundantly in swamp areas. *Pityrogramma calomelanos* (L.) Link. is commonly called as silver fern due to its silver colour spores and found to be growing in the forest and also grow on stored bricks or nearby brick making industries. Epiphytic ferns *Microsorum punctatum* (L.) Copel. and *Asplenium nidus* L. are seen to be growing plentifully in tree trunks not only in the forest but also adjoining areas. *Diplazium esculentum* (Retz.) Sw. is widely used as vegetables in the nearby area. The fern species like *Cyathea gigantea* (Wall ex Hook.) Holtt. and *Diplazium esculantum* (Retz.) Sw. were observed to be taken as food by *Trachypithecus geei* during their study in Kakoijana reserve forest, Assam. However, no record traced the existence of this endangered primate species in the present study area. Due to the subsistence of other primate species including the endangered Hoolock Gibbons, these two fern species were kept unscathed and only digital photograph were taken.

The family Pteridaceae has the greatest number of genera, i.e. 5; among them, the genus *Pteris* has highest number of species. In India, the family Thelypteridaceae is represented by 80 species and 16 hybrids (Fraser-

Table 1. Number of pteridophyte taxa in genera and families.

Family	Genus	Number of taxa
Selaginellaceae	*Selaginella*	2
Marrattiaceae	*Angiopteris*	1
Gleicheniaceae	*Dicranopteris*	1
Polypodiaceae	*Microsorum*	2
	Pyrrosia	2
Lygodiaceae	*Lygodium*	2
Pteridaceae	*Acrostichum*	1
	Pteris	5
	Adiantum	1
	Pityrogramma	1
	Vittaria	1
Cyatheaceae	*Cyathea*	2
Dennstaedtiaceae	*Microlepia*	1
Lindsaeaceae	*Sphenomeris*	1
Thelypteridaceae	*Amblovenatum*	1
	Christella	1
	Cyclosorus	1
Aspleniaceae	*Asplenium*	1
Athyriaceae	*Diplazium*	2
Dryopteridaceae	*Bolbitis*	1
Davalliaceae	*Araiostegia*	1
Blechnaceae	*Blechnum*	1
	Stenochlaena	1

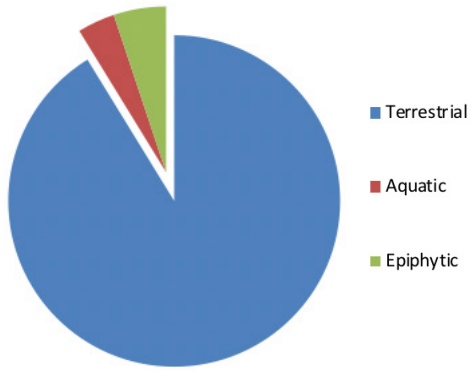

Figure 2. Habitats of pteridophytes.

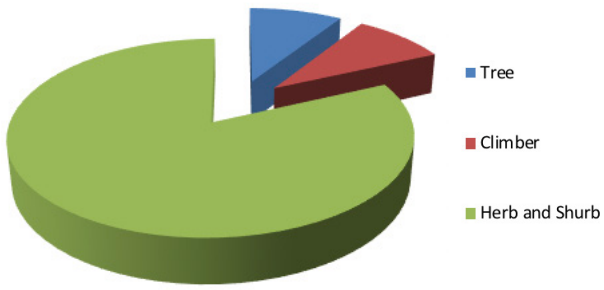

Figure 3. Different habits of pteridophytes.

Jenkins et al. 2017) while only three species are recorded from the present study area. Most of the families and genera have a single number of species (Table 1).

REFERENCES

Baishya, A.K. & R.R. Rao (1982). *Ferns and Fern-allies of Meghalaya State*, India. Scientific Publisher, Jodhpur, 162 pp.

Borthakur, S.K., P. Deka & K. Nath (2001). *Illustrated Mannual of Ferns of Assam.* Bishen Singh Mahendra Pal Singh, Dehra Dun, 468 pp.

Borthakur, S.K., D. Baro, A. Bawri & A. Baro (2018). *Flora of BTAD (Bodoland Territorial Area Districts, Assam), Pteridophytes and Gymnosperms*. Eastern Book House Publisher, India, Vol.1, 152 pp.

Chandra, S. (2000). *The Ferns of India* (*Enumeration, Synonyms & Distribution*). International Book Distributors, Dehradun, India.

Chapman, A.D. (2009). Numbers of Living Species in Australia and the World Report for the Australian Biological Resources Study Canberra, Australia, September 2009. http://wwwenvi ronmentgovau/ biodiversity/abrs/publications/other/species/numbers/indexhtml.

Devi, J. & H.C. Majumdar (2003). A study on Pteridophytic flora Byrnihat and Umtru area of Meghalaya State. *Plant Archives* 3(2): 207–213.

Dixit, R.D. (1984). *A Census of the Indian Pteridophytes*. Botanical Survey of India, Howrah.

Dutta, A.K., T.K. Dutta & K.K. Gupta (1980). A tentative accounting of the forest flora of North Cachar Hills and Barail range-II: Enumeration of spores of Pteridophytes. *Indian Forester* 106: 34–40.

Fraser-Jenkins, C.R. (2009). A brief comparison of modern pteridophyte classifications (families and genera in India). *Indian Fern Journal* 26: 107–126.

Fraser-Jenkins, C.R., K.N. Gandhi, B.S. Kholia & A. Benniamin (2017). *An annonated checklist of Indian pteridophytes part-1.* Bishen Singh Mahendra Pal Singh, Dehradun, India, 562 pp.

Handique, P.J. & G. Konger (1986). A list of Ferns and Fern allies of greater Guwahati (Assam) with their ecological adaptation. *Mendel* 3(2): 130–135.

Jain, S.K. & R.R. Rao (1977). *A Handbook of Field and Herbarium Methods.* Today & Tomorrow's Printers and Publishers, New Delhi, 157 pp.

Jamir, N.S. & R.R. Rao (1988). *The Ferns of Nagaland*. Bishen Singh Mahendra Pal Singh, Dehra Dun, India, 426 pp.

Kachroo, P. (1953). Ferns of Assam. *Journal of Asiatic Society, Bengal.* 29: 161–174.

Kachroo, P., S.S. Bir & S.M. Vasudeva (1989). Pteridophytic flora of North-Eastern India-II (families: Cryptogramaceae-Thelypteridaceae. *Indian Fern Journal* 6: 78–99.

Kalita, P.C. (2015). Survey for pteridophytic diversity in Madan Kamdev Hill region of Assam, India. *Pleione* 9(2): 376–400.

Moran, R.C. (2015). An overview of ferns and lycophytes Opening Symposium Abstract (p5) In 'Next Generation Pteridology' [An International Conference on Lycophyte and Fern Research], Smithsonian Institution and US Botanic Garden, Washington DC; June 1–5, 2015 *Book of Program and Abstracts,* Pp 74

Panigrahi, G. (1960). Pteridophytes of eastern India-1 Enumeration of the species collected and their nomenclature. *Bulletin of Botanical Survey of India* 2: 309–314.

Panigrahi, G. (1968). Studies in the Polypodiaceae in eastern India: distribution and ecology. *Journal of Indian Botanical Society* 47: 1–6.

Panigrahi, G. & S. Choudhury (1961). Taxonomic studies on the Aspidiaceae of Eastern India. *Proceeding of Indian Science Congress* 48: 272.

Panigrahi, G. & S. Choudhury (1962). Enumeration and distribution of fern allies in Eastern India. *Proceeding of Indian Science Congress* 49: 255–256.

Sen, A. & P.D. Ghosh (2011). A note of the ethnobotanical studies of some pteridophytes in Assam. *Indian Journal of Traditional Knowledge* 10(2): 292–295.

Journal of Threatened Taxa is indexed/abstracted in Bibliography of Systematic Mycology, Biological Abstracts, BIOSIS Previews, CAB Abstracts, EBSCO, Google Scholar, Index Copernicus, Index Fungorum, JournalSeek, National Academy of Agricultural Sciences, NewJour, OCLC WorldCat, SCOPUS, Stanford University Libraries, Virtual Library of Biology, Zoological Records.

NAAS rating (India) 5.64

Print copies of the Journal are available at cost. Write to:
The Managing Editor, JoTT,
c/o Wildlife Information Liaison Development Society,
No. 12, Thiruvannamalai Nagar, Saravanampatti - Kalapatti Road,
Saravanampatti, Coimbatore, Tamil Nadu 641035, India
ravi@threatenedtaxa.org

Journal of Threatened Taxa

www.threatenedtaxa.org

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

October 2021 | Vol. 13 | No. 12 | Pages: 19675–19886
Date of Publication: 26 October 2021 (Online & Print)
DOI: 10.11609/jott.2021.13.12.19675-19886

Publisher & Host

WILD ZOOREACH
Threatened Taxa