

An account of Thelypteroid ferns of Tripura state in India

Sumita Das¹ and Manabendra Dutta Choudhury

Ethnobotany and Medicinal Plants Research Laboratory, Department of Life Science & Bioinformatics,
Assam University, Silchar-788011, Assam, India

¹Corresponding author: E-mail: sumitads14@rediffmail.com

[Received 17.05.2014; Revised 24.12.2014; Accepted 26.12.2014; Published 31.12.2014]

Abstract

Thelypteridaceae, a fern family having diverse distribution and with about 1000 species, distributed nearly worldwide but are most diverse in the tropical regions. The family is represented in Tripura by 19 species from 9 genera. Keys to the identification of species, habitat, sporulation period, local distribution and description are provided.

Key words: Thelypteridaceae, Tripura, Morphology, Habitat, Sporulation.

INTRODUCTION

The fern family Thelypteridaceae is comprising about 1,000 species and as Vasudeva & Bir (1993) has mentioned, all those were kept under a single genus since its separation from the dryopteroid ferns about 60 years ago. Even today the classification of Thelypteridaceae cannot be considered as finally acceptable. Pteridologists are not of the similar opinion about the generic delimitation in the family. Some authors, like Morton (1963) treated Thelypteridaceae with a single genus *Thelypteris* Schmidel, while others (Christensen 1938; Copeland 1960; Ching 1963; Iwatsuki 1964 and Holttum 1971) segregated the Thelypteridaceae into two or more genera. Here, Thelypteridaceae is treated as it has been delimited by Pichi Sermolli (1977, 1982) with a little modification of Ching (1978) to make the system up to date, comprehensive and convenient. According to this system, Thelypteridaceae has been divided into 21 genera. A total number of 51 species and 9 genera of Thelypteroid ferns have been reported from Arunachal Pradesh by Singh & Panigrahi (2005) and about 12 genera comprising of 33 species of Thelypteroid ferns have been recorded from Assam by Borthakur *et al.* (1999). The only account of Thelypteroid ferns of Tripura state are given by Das & Sen (1991) and Das (1992, 2007) dealing with only with 11 species from 5 genera. D. B. Deb (1961) while working on Pteridophytes of Tripura, recorded only 2 genera comprising 2 species of Thelypteroid ferns.

Thelypteridaceae is of subcosmopolitan in distribution and of great species richness, with approximately 1000 species, most of which occur in tropical and subtropical regions (Ponce 1995; Smith & Cranfill 2002). Nearly all species are terrestrial, and most occur in moist or wet habitats. Leaf size and morphology are extremely variable, but the lamina is usually once or more pinnately compound. A characteristic feature of the family is the occurrence of small needle like hairs on the leaves; these hairs sometimes occur in clusters and appear to be branched. The structure of sori vary from rounded to linear, reniform, medial to supramedial or elongate along veins, and with membranous indusium. The spores are bean-shaped, bilateral, monolete or trilete.

Tripura is one of the hilly states in north-east region of India located between 22°56' N to 24°32' N, and 91°09' E to 92°20' E longitudes. It is bounded on the northwest, south and south-east by Bangladesh, whereas in the east it has common boundary with Assam and Mizoram. Administratively, it consists of 4 districts, namely North Tripura, Dhalai, West Tripura and South Tripura and capital city is Agartala. Total area of the state is 10496 sq km.

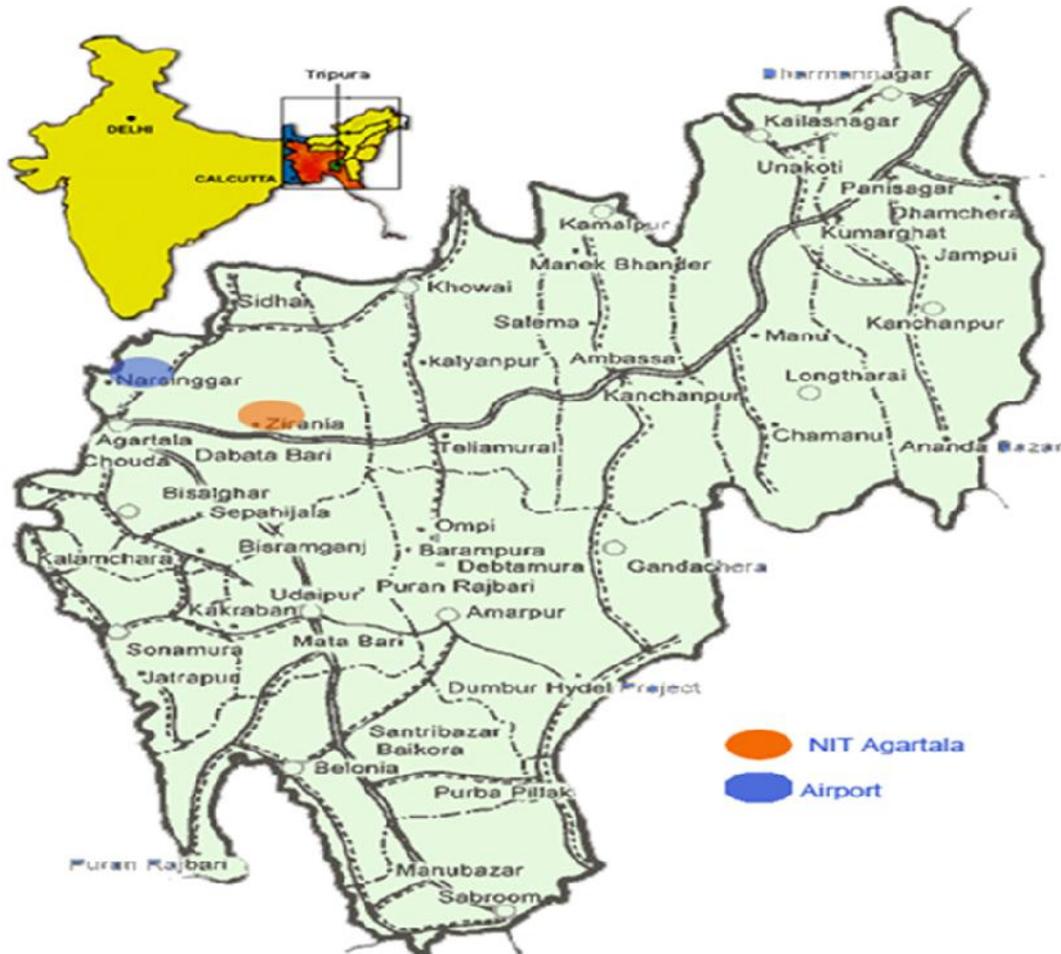


Fig. 1. Map of Tripura showing places of collection.

METHODOLOGY

Specimens of Thelypteroid ferns were collected round the year from their natural habitats during October 2009 to December 2012. During the survey, date of collection, habitats, and sporulation stage of each specimen has been recorded. Photographs of most of the plants were also taken in the field. The collected specimen have been dried, poisoned and mounted on standard herbarium sheets following conventional techniques (Jain & Rao 1977). Identification of specimens was finally confirmed by matching at CAL. The voucher specimens have been deposited at the Herbarium of the Assam University, Silchar [AUS3076 – AUS3089, AUS3091, AUS3093 – AUS3096].

ENUMERATION

For the present account the taxonomic delimitation at the generic level by Pichi Sermolli (1977, 1982) with a little modification of Ching (1978) has been followed. All the species has been enumerated below alphabetically for convenience of the work.

Christella Léveillé, Fl. Kouy-tscheou, 472. 1915, *emend* Holttum in Taxon 20: 533. 1971, *et* Blumea 19: 43. 1971, *et* Kew Bull. 31(2): 293. 1976.

Terrestrials. Rhizomes erect, suberect or creeping; scales narrow with or without superficial hairs. Lamina simple pinnatisect; lower few pinnae gradually reduced; basal 1 to 1½ pairs or rarely more pairs of veins anastomosing, others free; lower or both surfaces of pinnae usually covered with acicular or capitate hairs. Sori round, median or submedian on veins; indusium glabrous or hairy. Spores monolete, tuberculate or ridged. Chromosome number, x = 36 (Walker 1985).

Key to the species:

- 1a. Anastomosing vein one pair 2
- 1b. Anastomosing vein more than one pair 3
- 2b. Intervenal area with minute hairs above and below *C. dentata*
- 2a. Intervenal area without hairs *C. hispidula*
- 3a. Rhizome erect or suberect *C. evoluta*
- 3b. Rhizome short or long creeping 4
- 4b. Basal pinnae 2 to 3 pairs gradually reduced *C. malabariensis*
- 4b. Several pairs of basal pinnae gradually reduced *C. subpubescens*

Christella evoluta (C.B. Clarke & Baker) Holttum in Companion Bedd. Handb. Ferns Brit. India 208. 1974, *et* in Kew Bull. 31(2): 330. 1976; Kaur & Chandra in New Botanist 12: 88. 1985. *Nephrodium evolutum* (C.B. Clarke & Baker) Beddome, Handb. Ferns Brit. India Suppl. 76. 1892. *Dryopteris evoluta* (C.B. Clarke & Baker) C. Christensen, Ind. Fil. 263. 1905. *Cyclosorus evolutus* (C.B. Clarke & Baker) Ching, Bull. Fan. Mem. Inst. Biol., Bot. 8: 219. 1938. *Nephrodium amboinense* var. *evolutum* C.B. Clarke & Baker, J. Linn. Soc., Bot. 24: 417. 1888.

Terrestrial fern. Rhizomes short to long creeping, covered with dark brown lanceolate scales. Stipes dark stramineous. Lamina bases abruptly narrowed, apex caudate with a large apical pinna, papery, grayish green when dried, subglabrous or glabrous on both surfaces or rarely shortly hairy; lateral pinnae 8–14 pairs, proximal 1–3 pairs abruptly shortened, proximal pair triangular-auriculate, longer, reflexed; middle pinnae lanceolate, bases truncate to rounded-truncate, sessile or shortly stalked, pinnae lobes cut down 1/3 toward costae, lobes ovate or oblong, apex long acuminate or caudate. Midrib distinct on the lower surface of lamina, veinlets 5–7 pairs per segment, proximal few pairs anastomosing, rests running to sinus membrane. Sori orbicular, medial; indusia glabrous or shortly hairy, dark-brown. Sporangia bearing large reddish spherical glands on stalks. Spores monolete.

Fertile: October – January

Exsiccatae: Longtarai, *Sumita* 97, dated 18.05.2011.

Local distribution: Rupaicherra, Longtarai, Kanchanbari; occasional.

General distribution: India, Bangladesh, North Thailand

Note: Grows on wet places in dense forests.

Christella dentata (Forsskal) Brownsey & Jermy in Brit. Fern Gaz. 10(6): 338. 1973; Holttum in Kew Bull. 31(2): 314. 1976; Kaur & Chandra in New Botanist 12: 87. 1985. *Cyclosorus dentatus* (Forsskal) Ching, Bull. Fan Mem. Inst. Biol., Bot. 8: 206. 1938. *Polypodium dentatum* Forsskal, Fl. Aegypt.-Arab. 185. 1773. *Dryopteris dentata* (Forsskal) E.P. St. John in Amer. Fern J. 26: 44. 1936.

Terrestrial fern. Rhizomes suberect or shortly creeping, apices densely scaly. Scales light-brown linear-lanceolate, acuminate apex, margin entire. Fronds subclustered; stipe bases covered with scales, dark brown, stramineous distally; lamina simple pinnate, bases slightly narrowed, apices acuminate, brownish green when dried, shortly hairy adaxially, densely puberulent abaxially, sometimes with glandular hairs, texture herbaceous to papery; lateral pinnae 15–20 pairs, proximal 2 to 3 pairs progressively shortened; pinnae lanceolate to oblanceolate, sessile, subopposite, bases rounded-truncate, apices acuminate; pinnae lobes more than half way cut down to the costae, segments 15–25 pairs, oblong, slightly oblique, basal acroscopic one slightly longer, rounded-obtuse at apices, margin entire. Veinlets 6–8 pairs per segment, proximal pair anastomosing, next pair running to sinus membrane, intervenal area with several acicular hairs,. Sori orbicular, arranged in two rows on both side of the costule; indusia shortly hairy, brown. Spores monolete, irregularly cristate.

Fertile: July - December,

Exsiccatae: Salema (Kamalpur), *Sumita 109*, dated 18.05.2011.

Local Distribution: Throughout the state; very common

General distribution: Throughout tropics & subtropics of the world, America

Note: Grows on semi-open to open places.

Christella hispidula (Decaisne) Holttum in Kew Bull. 31(2): 312. 1976. *Aspidium hispidulum* Decaisne, Nouv. Ann. Mus. Hist. nat. Peris 3: 346, 1834. *Thelypteris hilsenbergii* (C. Presl) Panigrahi, Phytologia. 31: 369. 1975. *Christella quadrangularis* Holttum in Nayar & Kaur, Companion Bedd. Handb. Ferns Brit. India 207. 1974.

Terrestrial fern. Rhizome erect densely covered with scales. Scales pale-brown, narrow-lanceolate, apex acuminate. Fronds tufted, elliptic, bipinnatifid; stipes 10-15 cm long, grooved adaxially, rounded abaxially, hairy throughout, scaly at base; lamina unipinnate, pale-green when dried, texture herbaceous; pinnae upto 12-16 pairs, sessile, subopposite, lower 2-4 pairs of pinnae abruptly reduced, middle pinnae largest, widest at base, oblong-lanceolate, acroscopic base truncate, basisopic base cuneate; pinnae lobes cut down $\frac{1}{4}$ th way towards costae, lobes oblong, entire, margin hairy. Veins 6-8 pairs, anastomosing vein 1 pair, lowest pair from excurrent vein to the sinus, next pair extend to the margin of the sinus membrane, acicular hairs on both surfaces. Sori round, median; indusia bearing acicular hairs at the margin & on the surface. Sporangia bearing unicellular glandular hairs on stalks; spores bilateral, monolete, dark-brown.

Fertile: April – July

Exsiccatae: Churaibari Reserve Forest, *Sumita 61*, dated 18.10.2010.

Local Distribution: Churaibari Reserve Forest, Erarpar, Jeolcherra, Tepania; common

General distribution: Tropics of India, Africa, Asia, Tropical America, Sri Lanka, Malaysia

Note: Grows in exposed places or along with roadside drain.

Christella malabariensis (Fée) Holttum Kew Bull. 31 (2): 317. 1977. *Nephrodium malabariense* Fée 10 Mem. 43. 1865. *Christella meeboldii* Holttum in Companion Bedd. Handb. Ferns Brit. India 208. 1974; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 197. t. 148. 1992.

Terrestrial fern. Rhizome creeping, thick, covered with dense scale. Scales lanceolate, pale-brown, acuminate at apex, margin entire. Frond ovate, caudate acuminate; stipes tetragonal, 16 to 22 cm long, deeply grooved adaxially & laterally, glabrous. Lamina lanceolate, basal portion bipinnatifid with pinnatifid apices; lateral pinnae upto 16 pairs, oblong, sessile, subopposite or alternate, basal two to three pairs abruptly reduced and deflexed, longest in middle, basispic base broadly cuneate, acroscopic base truncate, apex acuminate; pinnae lobes cut down half towards costae. Costules and veins distinct. Veins 6 to 9 pairs, anastomosing vein 1 to 1½ pairs, next pairs form an excurrent vein end into the sinus membrane, other veins free, not reaching the margin. Sori round, suprmedian on veins, globose; indusia reniform, hairy. Sporangium stalked with unicellular glandular hairs; spores dark- brown, monoete.

Fertile: November - January,

Exsiccatae: Zion Hill (Baramura), *Sumita 142*, dated 19.06.2011.

Local Distribution: Balanalcherra Forest Village, Zion Hill (Baramura); occasional

General distribution: India, China, Sri Lanka

Note: Grows on damp areas.

Christella subpubescens (Blume) Holttum in Kew Bull. 31 (2): 323. 1976; Kaur & Chandra in New Botanist 12. 91. 1985. *Aspidium subpubescens* Blume, Enum. Pl. Javae. 149. 1828. *Dryopteris subpubescens* (Blume) Ching in Bull. Fan. Mem. Inst. Biol. Bot. 8: 211. 1938, p.p. *Cyclosorus subpubescens* (Blume) Ching in Bull. Fan Mem. Inst. Biol. Bot. 8: 211. 1938, *non sensu* Ching.

Terrestrial fern. Rhizome erect to short creeping, clothed with dense scales. Scales ovate-lanceolate, base broad, acuminate at apex, acicular hairs on surface and edges, pale-brown, concolorous. Fronds tufted, elliptic, bipinnatifid; stipes 12 to 18 cm long, abaxially rounded, adaxially grooved, covered with acicular hairs throughout; lamina simple pinnate, lanceolate; pinnae upto 15 pairs, subopposite or alternate, sessile, oblong, lower few pairs gradually shortened & deflexed, largest in middle of lamina, acroscopic base truncate and slightly auricled, basispic base wide cuneate; pinnae lobes cut down half towards costae, lobes slightly oblique, oblong, entire. Midvein hairy throughout, veins 6-8 pairs, anastomosing vein 1½ to 2 pairs, others free, costae, costules & veins hairy on both surfaces. Sori round, median; indusium reniform, surface hairy, subentire; sporangium bearing unicellular glandular hairs on stalk; spores monoete, brown, irregular tuberculated.

Fertile: July – December

Exsiccatae: Teliamura, *Sumita 110*, dated 19.06.2011.

Local Distribution: Throughout the state; frequent

General distribution: India, China, Myanmar, Thailand, Vietnam, Malaysia, Queensland, New Herbrides, Fiji, Samoa, New Guinea, Philippines

Note: Grows on shady hill forests.

Cyclosorus Link, Hort. Reg. Bot. Berol. 2: 128. 1833; Smith in Kramer & Green, Fam. Gen. Vasc. Pl. 1: 271. 1990; Panigrahi in Abstr. & Souv. Nation. Symp. Curr. Trends Pterid. 4-6 Oct, 1991: 12-13.

Terrestrials, rarely epiphytic. Rhizomes creeping or erect. Fronds pinnate-pinnatifid; lamina lacking aerophores or bears only a small darkened protuberance where aerophores would be located; proximal pinnae reduced or not; lateral pinnae alternate or subopposite, sessile or shortly stalked; pinnae-lobes deeply cut down about one third way to costae; indument consists of unicellular, acicular hairs and sometimes capitate glands on the costae and veins; sori round, usually large, persistent, hairy indusia; sporangia having or not hairs or glands on the stalk; spores bilateral, dark-brown, with an often broadly winged perispore; chromosome number, $x = 36$ (Walker 1985).

Key to the species:

- 1a. Basal pinnae gradually reduced 2
- 1b. Basal pinnae hardly or not reduced 5
- 2a. Rhizome erect or short creeping 3
- 2b. Rhizome long creeping 4
- 3a. Basal few pairs of pinnae auricled, small aerophores present *C. crinipes*
- 3b. Basal pinnae not auricled, aerophores absent *C.holttumii*
- 4a. Lower surface of costae, veins sparsely clothed with short hairs; hairs absent in between veins *C. appendiculatus*
- 4b. Lower surface of costae and veins clothed with dense short hairs; intervenal area with long acicular hairs *C. interruptus*
- 5a. Lamina broadly ovate, deltoid or cordate; multicellular glandular hairs absent
.....*C. parasiticus*
- 5b. Lamina simple pinnate, deltoid to deltoid lanceolate; glandular hairs present between veins of lower surface *C. cylindrothrix*

Cyclosorus appendiculatus (C. Presl) K.H. Shing in Fl. Reipubl. Popularis Sin. 4(1): 199. 1999. *Christella appendiculata* (C. Presl) Holttum in Kew Bull. 31(2): 311 – 312. 1976. *Nephrodium appendiculatum* C. Presl, Epim. Bot. 47. 1851. *Nephrodium extensum* var. *microsorium* Clarke in Trans. Linn. Soc. ser. 2(Bot.) 1: 530. 1880. *Nephrodium microsorium* (Clarke) Bedd. Handb. Ferns Brit. India 270. 1883. *Thelypteris molliuscula* (Beddome) K. Iwatsuki in Hara, Fl. East. Himal. 484. 1966.

Terrestrial. Rhizome long creeping, thick, covered with scales. Scales linear-lanceolate, hairy, reddish brown. Stipe slender, sparsely hairy, scaly at base; Lamina simple pinnate; pinnae upto 14 pairs, distantly placed, sessile, basal pair of pinnae conspicuously reduced, basal auricle crenate, longest pinna lanceolate, base truncate, acuminate at apex; pinnae lobes deeply cut down to the rachis, oblique, linear-oblong, margin entire, apex rounded. Veins 10-14 pairs, basal pair anastomosing with short excurrent veinlets to sinus; sparsely hairs on lower surface of rachis, costae, costules & veins, none between veins; hairs on upper surface of costae & costules thick, short acicular hairs between veins. Sori medial, arranged in two rows on both side of the costules; indusia small with hairs. Spores monolete.

Fertile: January – May

Exsiccatae: Halahali (Kamalpur), *Sumita 264*, dated 16.04.2012

Local distribution: Halahali, Ampura, Kalyanpur, Kanchanpur; frequent

General distribution: India, China.

Note: grows along edge of forests in shady & slightly moist places.

Cyclosorus crinipes (Hooker) Ching, Bull. Fan Mem. Inst. Biol., Bot. 8(4): 179-180. 1938. *Christella crinipes* (Hooker) Holttum in Companion Bedd. Handb. Ferns Brit. India 208. 1974; et Kew Bull. 31 (2): 326. 1976. *Nephrodium crinipes* Hooker, Sp. Fil. 4: 71. 1862; *Dryopteris crinipes* (Hooker) Kuntze, Rev. Gen. Pl. 2: 812. 1891. *Thelypteris crinipes* (Hooker) K. Iwatsuki in J. Jap. Bot. 38: 315. 1963.

Terrestrial. Rhizomes creeping, apices with dense dark brown scales. Scales linear-lanceolate, base broad, acuminate at apex, margin entire. Fronds clustered; stipes 10-20 cm, dark stramineous, with dense scales from bases to rachises, adaxially grooved, abaxially rounded, glabrous above; lamina lanceolate, apices acuminate, grayish green when dried; texture papery; pinnae 15-20 pairs, proximal 3-5 pairs abruptly shortened, sessile, basal pinnae auricled on both sides, oblong-lanceolate, bases truncate or broadly cuneate, apices long acuminate; pinnae lobes cut down half towards costae, segments upto 20 pairs, oblong, entire, apices obtuse. Veinlets 7-9 pairs, proximal 1 to 1½ pairs anastomosing, next pair running to sinus membrane, veins forked in auricled lobes, dense acicular hairs along veins adaxially, short acicular hairs along costae and veins abaxially, midvein hairy on both surfaces. Sori round, suprmedian; indusia reniform, shortly hairy. Sporangia bearing glandular hairs on stalks. Spores dark brown, monolete, tuberculate.

Fertile: August – December

Exsiccatae: Baramura Reserve Forest, *Sumita 137*, dated 19.06.2011.

Local Distribution: Throughout the state; very common

General distribution: India, Bhutan, China, Myanmar, North Thailand, Hainan

Note: Grows on wet forest margins & shady places near roadsides.

Cyclosorus cylindrothrix (Rosenstock) R.C. Ching, Bull. Fan Mem. Inst. Biol., Bot. 8(4): 199-200. 1938. *Christella cylindrothrix* (Rosenstock) Holttum in Companion Bedd. Handb. Ferns Brit. India 208. 1974, et Kew Bull. 31(2): 308. 1976; Kour & Chandra in New Botanist 12: 87. 1985. *Dryopteris cylindrothrix* Rosenstock, Repert. Spec. Nov. Regni Veg. 12: 246. 1913. *Cyclosorus parasiticus sensu* Deb & Dutta in J. Bomb. Nat. Hist. Soc. 68 (3): 584. 1972, p.p. (non Linnaeus) Farwell 1920.

Terrestrial fern. Rhizomes short to long creeping, stout, covered with dense scales. Scales linear-lanceolate, light-brown. Fronds usually distant, monomorphic; stipes 20-30 cm long, stramineous or reddish, proximal part with linear-lanceolate scales; lamina simple pinnate, deltoid-lanceolate, bases not narrowed, apices acuminate, grayish green when dried, abaxially with short acicular hairs and many golden thin clavate glands throughout, texture herbaceous to papery; lateral pinnae 12-20 pairs, sessile, alternate; proximal pinnae slightly reflexed, slightly shortened or not, proximal several pinnae narrowed toward their bases; middle pinnae linear-lanceolate, slightly auriculate on acroscopic bases, bases truncate, pinnae lobes more than half way cut down to the costae, apices long acuminate; segments upto 25 pairs, obtuse at apices. Veinlets 8-10 pairs, proximal pair anastomosing with a short excurrent veinlet running to sinus membrane, short acicular hairs along costae and veins and between veins adaxially. Sori orbicular, medial or suprmedian on the vein; indusia with sparse short hairs and golden clavate glands. Sporangia bearing similar glands on stalks. Spores with wings, monolete.

Fertile: November - January,

Exsiccatae: Manikbhandar (Kamalpur), *Sumita 103*, dated 18.05.2011.

Local Distribution: Mohanpur, Manikbhandar, Damburnagar; common

General distribution: India, Bhutan, Myanmar, Thailand

Note: Grows on moist forest & hill-slopes.

Cyclosorus holttumii Sarnam Singh & Panigrahi, Ferns Fern-Allies Arunachal Pradesh 2: 682. 2005.

Terrestrial fern. Rhizomes creeping to erect, clothed with scales at apex. Scales pale-brown, ovate-lanceolate, apex acuminate. Stipe 12-18 cm long, densely scaly throughout. Fronds tuft, oblong, clustered, bipinnatifid; lamina simple pinnate, monomorphic, bases slightly or not narrowed, apices acuminate, texture subcoriaceous; pinnae 10-15 pairs, proximal 2-3 pairs gradually shortened, middle pinnae longest, acroscopic bases rounded-truncate, basiscopic base widely cuneate and both are not auricled; pinnae lobes cut down half or less than half toward costae, aerophores not found; segments 15-20 pairs, slightly oblique, oblong, entire, margins usually covered with acicular hairs. Midvein hairy on both surfaces; veinlets 5-7 pairs, proximal 1 to 2 pairs anastomosing, next pair running to sinus membrane. Sori round, median on veins; indusia minutely hairy, reniform. Sporangia bearing light yellow glandular hairs on stalk. Spores dark brown, monolete.

Fertile: April – July

Exsiccatae: Atharamura, *Sumita* 238, dated 15.06.2012.

Local Distribution: Restricted to Atharamura; rare

General distribution: Arunachal Pradesh and Tripura; endemic

Note: Grows on highly moist places in forests.

Cyclosorus interruptus (Willdenow) H. Ito, Bot. Mag. (Tokyo), 51(608): 714. 1937; Manickam & Irudayaraj, Pterid. Fl. West. Ghats S. India, 187. t. 142. 1992. *Pteris interrupta* Willdenow, Phytographia, 13. t. 10. f. 1. 1794. *Nephrodium propinquum* R. Brown, Prod. Fl. Nov. Holl. 148. 1810; Beddome, Ferns South. India, t. 89. 1864. *Nephrodium unitum sensu* Beddome, Handb. Ferns Brit. India, 268. 1883.

Terrestrial ferns. Rhizomes long creeping, black, clothed with sparse scales. Scales ovate-lanceolate, apex acuminate, margin entire. Stipe slender, adaxially grooved, abaxially flattened, bases black & sparsely scaly, distally stramineous, glabrous. Fronds distant; lamina bases not narrowed, apex caudate with apical pinna similar to lateral ones; lateral pinnae 10-15 pairs, linear-lanceolate, shortly stalked, bases rounded-truncate, apices acuminate, reddish when dried, subglabrous adaxially, abaxially with acicular hairs; texture somewhat leathery; pinnae lobes cut down half or less toward costae, segments upto 20 pairs, triangular, apices pointed. Veinlets 6-8 pairs, proximal 1 or 1½ pair anastomosing, others free, running to sinus membrane, lower surface of vein bears reddish orange, sessile, spherical glands and several membranous broadly ovate scales along costae. Sori orbicular, median to submarginal on the veins arranged in 2 rows, proximal 1 or 2 pairs of veins sterile; indusia sparsely hairy. Sporangia with spherical reddish orange glands on stalks. Spores monolete, sparsely minutely echinulate, pale-brown.

Fertile: October – February

Exsiccatae: Jeolcherra (Ambasa), *Sumita* 170, dated 20.07.2011.

Local Distribution: Bagafa, Gezacherra, Jeolcherra, Khowai; common

General distribution: Tropics & subtropics of the world

Note: Grows on wetlands or water-logged paddy fields.

Cyclosorus parasiticus (Linnaeus) Farwell, Amer. Midl. Naturalist 12(8): 259. 1931. *Christella parasitica* (Linnaeus) H. Léveillé, Fl. Kouy-tscheou. 475. 1915; Deb & Dutta in

Journ. Bombay Nat. Hist. Soc. 68(3): 584. 1972, p.p.; Holttum in Kew Bull. 31 (2): 309. 1976; *Polypodium parasiticum* Linnaeus, Sp. Pl. 2: 1090. 1753; *Aspidium parasiticum* (Linnaeus) Swartz in Schrad. J. Bot. 1800 (2): 35. 1801.

Terrestrial fern. Rhizomes short to long creeping, clothed with dense scales. Scales dark brown, linear-lanceolate, margin covered with short hairs, acuminate at apex. Fronds approximate to distant; stipes stramineous, densely hairy at apex; lamina broadly ovate, simple pinnate, bases not narrowed, apices caudate-acuminate; bases broadly cuneate or truncate, brownish green or yellowish green when dried, with thin acicular hairs throughout on both surfaces, and reddish orange glands throughout abaxially; texture herbaceous; lateral pinnae 11–15 pairs, proximal 1 or 2 pairs reflexed, middle pinnae lanceolate, bases truncate, apices long acuminate, pinnae lobes at least half way or more cut down to the costae; segments 15–20 pairs, oblique, basal acroscopic one longer, obtuse to subacute at apices. Veinlets 5–7 pairs, simple, proximal pair anastomosing, sometimes next vein running to sinus membrane. Sori orbicular, medial or submarginal on the vein; indusia densely hairy. Sporangia bearing reddish glands on stalks. Spores with wings, bean-shaped, monolete.

Fertile: October – December

Exsiccatae: Pecharthal, *Sumita 12*, dated 11.10.2009.

Local Distribution: Throughout the state; very common

General distribution: Wetter parts of tropics & subtropics of Asia, Malaysia, Australia, Hawaii, Kenya, Uganda

Note: Occurs in semi-open places in thickets & roadsides.

Pronephrium C. Presl, Epim. Bot. 258. 1851; Holttum in Blumea 19: 34. 1971, *et* Blumea 20: 105. 1972; Pichi Sermolli in Webbia 31(2): 337. 1977.

Terrestrials. Rhizome long creeping or erect, covered with scales. Scales ovate-lanceolate, hairy. Stipe tufted, dark brown, scaly at base. Fronds lacking reduced basal pinnae; lamina trifoliate to simple pinnate, pinnae oblong-lanceolate, margin crenate to entire, base equal or not. Midrib distinct, usually with several pairs of anastomosing veins, lower surface of intervenal area often pustular when dry, spherical glands sometimes present on the lower surfaces of pinnae or on sporangia. Sori indusiate or exindusiate, circular or elongated, occur at the end of veins and secondary veins; indusia hairy or glandular. Sporangia bearing glandular hairs on stalk; spores monolete, ellipsoidal or rarely trilete, exine with spinulose outgrowths. Chromosome number, $x = 36$ (Smith 1990).

Key to the species:

- 1a. Rhizome erect; fronds clustered *P. articulatum*
- 1b. Rhizome long creeping, fronds distant *P. triphyllum*

Pronephrium articulatum (Houlston *et* T. Moore) Holttum in Blumea 20(1): 116. 1972; Khullar *et al.* in Noba Hedwigia 38: 643. 1983; Kour & Chandra in New Botanist 12: 98. 1985. *Nephrodium articulatum* Houlston *et* T. Moore in Gard. Mag. Bot. 293. 1851. *Thelypteris articulata* (Houlston *et* T. Moore) Panigrahi in Phytologia 31 (5): 371. 1975. *Cyclosorus articulatus* (Houlston *et* T. Moore) Panigrahi in Res. J. Pl. Environment 9: 66. 1993.

Terrestrial fern. Rhizomes erect, sparsely scaly at the apex. Scales basifixed, ovate, acuminate, base broad, margin glandular hairy, pale brown, concolorous. Fronds tufted, simple pinnate;

stipes scaly at base above glabrous, acicular hairy; lamina lanceolate, glabrous above, hairy below, dark green, with a terminal pinna similar to lateral ones; texture sub coriaceous; pinnae upto 12 pairs, sub opposite or alternate, sessile or sub sessile, margin shallowly lobed, apex acuminate, acroscopic base broad cuneate to truncate, basiscopic base cuneate, lower 2-3 pairs of pinnae slightly deflexed; pinnae lobes cut down one fourth way to the costa, segments 15-20 pairs, acute, slightly ascending. Veins distinct, anastomosing, upper 2-3 pairs free, lower surface sparsely hairy. Sori round, small, median on veins, arranged in two rows; indusia glabrous; sporangia bearing club shaped glandular hairs on stalk; spores monolete, pale brown.

Fertile: July – October

Exsiccatae: Damcherra, *Sumita* 27, dated 28.10.2009.

Local Distribution: Damcherra, Sangita JFMC (Manu), Tirthamukh; occasional

General distribution: India, Bangladesh, Sri Lanka, China, Myanmar, North Thailand.

Note: Grows on deeply shady & moist places.

Pronephrium triphyllum (Swartz) Holttum in *Blumea* 20(1): 122. 1972; Kaur & Chandra in *New Botanist* 2: 101. 1985; Baishya & Rao, *Ferns & Fern Allies*, Meghalaya, 86.1982; Jamir & Rao, *Ferns Nagaland*, 2: 61. 1988; Manickam & Irudayaraj, *Pterid, Fl. West. Ghats S. India*, 185. t. 140. 1992 *Meniscium triphyllum* Swartz in *Schrader, J. Bot.* 1800(2):16. 1801; Beddome, *Ferns South. India*, t. 56. 1864. *Thelypteris triphylla* (Swartz) K. Iwatsuki in *Mem. Coll. Sci. Kyoto Imp. Univ., Ser. B, Biol.* 31(3). 190. 1965.

Terrestrial fern. Rhizomes long creeping, blackish brown, with dense short hairs and scales. Scales brown, linear-lanceolate, apex acuminate, hair whitish, hooked. Fronds monomorphic or slightly dimorphic; fertile fronds slightly taller than sterile ones, stipes longer, pinnae narrower. Stipes dark stramineous, sparsely scaly at base and dense curved short hairs throughout; lamina trifoliate, ovate, rounded at bases, long acuminate at apices, adaxially glabrous except costal grooves, abaxially hooked hairs; texture subcoriaceous; lateral pinnae 1 or rarely 2 pairs, oblique distally, opposite, oblong-lanceolate, bases rounded or rounded-cuneate, shortly stalked, margins entire, apices shortly acuminate; apical pinna longer than the lateral ones, lanceolate, bases rounded or rounded-cuneate, stalk longer, margins entire or undulate, apices acuminate. Veins distinct abaxially & adaxially, veinlets 8 or 9 pairs, oblique or spreading, veinlet pairs joining by their ends and forming triangular areoles, an excurrent veinlet arising from connecting point joining with veinlets of others forming subsquare areoles, lower surface of costae, veinlets and intercostal areas covered with scattered hooked hairs. Sori arranged on whole length of veinlets, orbicular when young, becoming narrowly ovate and confluent, exindusiate; sporangial setae hooked; spores monolete, reniform, dark-brown.

Fertile: February – May

Exsiccatae: Jatanbari, *Sumita* 190, dated 21.08.2011.

Local Distribution: Throughout the state; common

General distribution: India, Sri Lanka, China, Myanmar, Thailand, Japan, Malaysia, Queensland

Note: Grows on moist hill-slopes.

Thelypteris Schmidel, *Icon. Pl.*, ed. Keller, 3, 45. 1763, nom. cons.,

Terrestrial small to medium sized plant. Rhizomes long creeping, black, glabrous, sparsely scaly at apex. Lamina oblong-lanceolate, pinnate-pinnatifid, apex acuminate, bases slightly tapering; lamina thickly herbaceous, both surfaces with few acicular hairs when young,

glabrescent when old. Pinnae sessile or shortly stalked, basal pinnae not or little reduced. Veins prominent, free, veinlets forked or simple, reaching margins. Sori orbicular, supramedial, arranged in a row on each side of costules; indusia membranous, reniform, spores monolete, bilateral.

Thelypteris nudata (Roxburgh) C.V. Morton in *Contr. U.S. Natl. Herb.* 38(7): 352 1974. *Pronephrium nudatum* (Roxburgh) Holttum in *Blumea* 20(1): 111. 1972; Chandra in *Bull. Bot. Surv. India*, 13. 274. 1971; Kaur & Chandra in *New Botanist* 12. 99. 1985; Baishya & Rao, *Ferns & Fern allies, Meghalaya*, 85. 1982; Jamir & Rao, *Fern Nagaland*, 258. 1988; *Polypodium nudatum* Roxburgh in *Calcutta J. Nat. Hist.* 4: 491. 1844; *Phegopteris multilinea* (Wallich ex Hooker) Beddome, *Ferns Brit. India*, t. 231. 1867. *Abacopteris multilinea* (Wallich ex Hooker) Ching in *Bull. Fan. Mem. Inst.* 8. 253. 1938.

Terrestrial fern. Rhizomes long creeping, dark brown, with sparse broadly lanceolate scales. Fronds remote, oblong-elliptic, simple pinnate; stipe bases with brown scales, distally glabrous, dorsally & dorso-laterally grooved throughout; lamina broadly ovate-oblong, imparipinnate, dark-green, upper surface glabrous & shining, lower surface with obscure hairs; texture thin, herbaceous; lateral pinnae 6–10 pairs, obliquely spreading, alternate, subsessile, bases somewhat rounded or cuneate, margins regularly shortly and sharply serrate, apices long acuminate; distal pinnae slightly shortened; apical pinna of similar shape as middle ones, slightly shorter, bases with both sides not symmetrical. Veins distinctly visible, veinlets raised on both sides, obliquely spreading or parallel to each other, abaxially raised and forming triangular areoles between veinlets, distally forming juxtaposed rhomboid areoles. Sori small, orbicular, attached on middle of veinlets, arranged in 2 rows between costules; indusia small, reniform, shortly hairy adaxially. Sporangia glabrous; spores dark-brown, monolete.

Fertile: July – October

Exsiccatae: Churaibari Reserve Forest, *Sumita* 75, dated 18.10.2010.

Local Distribution: Throughout the state; common

General distribution: India, China, Myanmar, Thailand, Tonkin, Malay Peninsula.

Note: Grows on shady places and hill-slopes.

Macrothelypteris (H. Itô) Ching in *Acta Phytotax. Sin.* 8: 308. 1963; Holttum in *Blumea* 17: 25. 1969, *et* *Blumea* 19: 27. 1971; Pichi-Sermolli in *Webbia* 31(2): 335. 1977, *p.p.* Kaur & Chandra in *New Botanist* 12. 94. 1985.

Terrestrial. Rhizomes thick and short, erect, ascending or decumbent, covered with brown lanceolate long scales. Lamina ovate or ovate-lanceolate, triipinnate to tripinnatifid. Veins indistinct, free or biforked, not reaching the margin. Fronds herbaceous or subpapyraceous, yellowish-green when dried. Sori small, round, median on basal acroscopic veinlets, indusium minute or exindusiate; sporangium bearing capitate hairs near annulus, hairs unicellular. Spores monolete, bilateral, elliptical, reniform; perispores transparent and corrugate; exines with fine reticulate ornamentations on surfaces. Chromosome number, $x = 31$ (Tindale & Roy, 2002).

Macrothelypteris ornata Ching, *Acta Phytotax. Sin.*, 8(4): 309. 1963; Holttum in *Blumea* 17: 30. 1969; Kaur & Chandra in *New Botanist* 12: 94. 1985; Manickam & Irudayaraj, *Pterid, Fl. West. Ghats S. India*, 171. t. 130. 1992. *Polypodium ornatum* Wallich ex Beddome, *Ferns S. India*, 56. t. 171. 1864. *Dryopteris ornata* (Wallich ex Beddome) C. Christensen, *Ind. Fil.*, 281. 1905. *Thelypteris ornata* (Wallich ex Beddome) Ching in *Bull. Fan Mem. Inst. Biol. Bot.* 6: 276. 1936.

Terrestrial fern. Rhizomes erect, cylindrical, clothed with dense scales; scales brownish, linear-lanceolate, ciliate along margins, apex acuminate. Fronds clustered; stipes thick, stramineous, polished, bases swollen with similar scales as on rhizomes, distally sparsely scaly; lamina large, triangular-ovate, tripinnate, not tapering to bases, acuminate and pinnatifid at apices, when dry yellowish green; texture herbaceous; lateral pinnae 8-10 pairs, subopposite, spreading, sessile, oblong-lanceolate; secondary pinnae alternate, spreading, sessile, lanceolate, bases truncate, symmetrical, pinnate-pinnatifid, apices acuminate; tertiary pinnae subopposite, spreading, sessile, lanceolate, slightly falcate, bases decurrent, connected to each other by narrow wing along costae; pinnule lobes 1/2 or more way cut down to costules, segments upto 10 pairs, crenate like or triangular, oblique distally, entire. Veins obscure, veinlets 2 or 3 pairs per segment, free, 2 to 3 forked, abaxial sides of costules and main veins with multicellular acicular hairs, costae with sparse linear-lanceolate scales abaxially, short acicular hairs adaxially, scales inflated at bases, persistent. Sori small, round, median, attached near top of basal acroscopic veinlets; indusia not developed. Spores monoletate, reniform.

Fertile: July – February

Exsiccatae: Tirthamukh(Dambur), *Sumita 184*, dated 21.08.2011.

Local Distribution: Dambur, Jampui, Baganbazar, Amarpur; common

General distribution: India [North-west Himalayas and North-eastern part of India], Nepal, Bhutan, Bangladesh, Myanmar, Malaysia, Vietnam, Taiwan, Australia, Polynesia.

Note: Grows on partially shady forest areas.

Amblovenatum J.P. Roux, *Strelitzia 23: 200-201. 2009.*

Terrestrial. Rhizomes short creeping or erect, densely scaly. Stipes hairy at grooves, scaly at base. Lamina simple pinnate, lower pinnae slightly reduced or not, appears orange glandular hairs at the edges of ultimate segments; pinnae lobes cut down half way or nearly to the costae. Veins free, lowest pair anastomosing with excurrent veinlets passing to the sinus. Sori median, indusium reniform, sporangia stalked with glandular hairs. Spores monoletate, exine tuberculate. Chromosome number, $x = 36$ (Walker 1985).

Amblovenatum opulentum J.P. Roux, *Strelitzia 23: 201.2009.* *Amphineuron opulentum* (Kaulfuss) Holttum in *Blumea 23(2): 212.1977*; Baishya & Rao, *Ferns & Fern Allies Meghalaya*, 79. 1982; Jamir & Rao, *Fern Nagaland*, 252. 1988; *Aspidium opulentum* Kaulfuss, *Enum. Fl. 238. 1824.* *Nephrodium extensum* T. Moore, *Ind. Fil. 91. 1858*; Beddome, *Handb. Ferns Brit. India*, 269. 1883. *Nephrodium punctatum* Parish *ex* Beddome, *Ferns Brit. India*, t. 131. 1866.

Terrestrial fern. Rhizomes shortly creeping, covered with dense scales. Scales linear-lanceolate, dark brown. Fronds approximate; stipes scaly at apices and bases, slender, brownish; lamina simple pinnate, bases not narrowed or slightly so, apices caudate, yellowish green when dried; texture herbaceous; pinnae upto 12 pairs, almost sessile, alternate; proximal pair of pinnae slightly shortened; middle pinnae linear-lanceolate, bases rounded-truncate, apices long acuminate; pinnae lobes cut down $\frac{1}{2}$ to $\frac{2}{3}$ toward costae, segments 10-15 pairs, lobes subfalcate, slightly oblique, entire, subacute to obtuse at apices, small yellowish glandular hairs at the edges. Veins prominent, pinnate, veinlets 8-10 pairs, proximal single pair anastomosing or only connivent, sometimes next vein running to sinus membrane, minute hairs and many minute yellow spherical glands on lower surface of veins and minute hairs on intervenal areas. Sori small, round, submarginal, usually sterile on proximal 1 or 2 pairs of veins; indusia thin, glabrous or glandular along margins. Sporangia with golden spherical glands on stalks. Spores monoletate, cristate.

Fertile: July – December

Exsiccatae: Churaibari Reserve Forest, *Sumita 180*, dated 20.08.2011.

Local Distribution: Restricted to Churaibari; rare

General distribution: India, Sri Lanka, East Africa, Myanmar, Thailand, Malaysia, Tropical America.

Note: Grows on edges of hill-slopes & forests.

Pneumatopteris Nakai in Bot. Mag. Tokyo 47. 179. 1933 *emend*; Holttum in Blumea 19. 42. 1971, *p.p. excl. Pseudocyclosorus, et* Blumea 21. 293. 1973, *et* Gard. Bull. Singapore 33: 15. 1980.

Terrestrial. Rhizomes erect or shortly creeping, scaly. Stipes scaly at base, grooved and hairy dorsally. Lamina simple pinnate, basal few pairs of pinnae suddenly reduced into small auricles, pinnae glabrous and punctuate with pinnae lobes distinctly truncate and crenate; usually one to three pairs anastomosing forming an excurrent vein to the base of sinus membrane. Sori round, median on veins; indusia reniform; sporangia stalked with club-shaped glandular hairs. Spores monolete, exine tuberculate. Chromosome number, $x = 36$ (Roux 2001).

Pneumatopteris truncata (Poiret) Holttum in Blumea 21(2): 314. 1973; Kaur & Chandra in New Botanist 12: 98. 1985; Jamir & Rao, Fern Nagaland, 269.1988; Manickam & Irudayaraj, Pterid, Fl. West. Ghats S. India, 202. t. 152. 1992 *Polypodium truncatum* Poiret, Encycl. Meth. 5: 534. 1804. *Nephrodium truncatum* (Poiret) C. Presl, Tent. Pterid. 81. 1836; Clarke in Trans. Linn. Soc. Lond. ser. II. Bot. 1: 534. 1880; Beddome, Handb. Ferns Brit. India, 280. f. 143. 1883.

Terrestrial fern. Rhizomes erect, covered with scales. Scales peltate, surfaces almost non hairy, apex acute, margin entire, pale brown, concolorous. Stipes scaly at base, grooved above, small, pointed, whitish hairs dorsally, stramineous when dried. Fronds 20–35 cm long, bipinnatifid, elliptic, with aerophores at base of pinnae; lamina bases slightly narrowed; lateral pinnae 10-14 pairs, pinnae sessile, oblong-lanceolate, opposite or subopposite, acuminate at apex, obtuse at base, the terminal pinna similar to lateral ones, lower 2 to 3 pairs of pinnae gradually reduced and 3 to 4 pairs suddenly shortened to small auricles, middle pinna longest, pinnae lobes shortly cut down $\frac{1}{3}$ to $\frac{1}{2}$ way to costae; lobes oblong-rectangular, truncate to slightly toothed, margin cartilaginous. Veins 6-8 pairs, proximal 2 pairs of veinlets anastomosing forming an excurrent vein to the base of the sinus membrane, next pair reaching just above the sinus, veins glabrous adaxially, rachis and costae sparsely hairy on the lower surface. Sori circular, median, arranged in 2 rows either side of midvein of pinna lobes; indusium small, reniform. Sporangia bearing glandular hairs on stalks; spores monolete, dark-brown, spinulose.

Fertile: July – December

Exsiccatae: Kashba, *Sumita 298*, dated 28.11.2012.

Local Distribution: Kashba, Kanchanpur, Pilak; occasional

General distribution: India, Sri Lanka, China, Malaysia, Philippines.

Note: Grows on damp areas and nearby water-logged areas.

Parathelypteris (H. Itô) Ching in Acta Phytotax. Sin. 8: 300.1963, *p.p. excl. Sect. Melanostipes* Ching; Holttum in Blumea 19: 32. 1971; Pic.-Serm. in Webbia 31(2): 366. 1977; Kaur & Chandra in New Botanist 12: 97. 1985.

Terrestrial. Rhizomes long or short creeping or erect, scaly or rusty-yellow hairy. Fronds tufted, pinnate to pinnatifid; stipes stramineous, scaly at base, acicular hairy at the grooves. Lamina simple pinnate, pinnae numerous, basal 3 to 4 pairs gradually narrowed and then abruptly shortened to the small auricles. Veins pinnate, free, lateral veins single and all reached to margins, glands present between the veins. Sori round, median, dorsifixed at middles or near edges of lateral veins; indusial hairy and glandular; sporangium bearing shortly stalked with glandular hairs. Spores monolete, exine with narrow wings. Chromosome number, $x = 27$ (Weng & Qiu 1988).

Parathelypteris glanduligera (Kunze) Ching, Acta Phytotax. Sin. 8(4): 303. 1963; Baishya & Rao, Ferns & Fern allies, Meghalaya, 84. 1982; Kaur & Chandra in New Botanist 12: 97. 1985; Jamir & Rao, Fern Nagaland, 249. 1988 *Aspidium glanduligera* Kunze, Anal. Pterid. 44. 1837. *Lastrea gracilescens* var. *glanduligera* Beddome, Handb. Ferns Brit. India, Suppl., 51. 1892.

Terrestrial fern. Rhizomes long creeping, glabrous, sparse lanceolate scales at apex. Fronds approximate; stipes 15–20 cm long, stramineous, with short hairs or sometimes glabrous; lamina lanceolate or broadly lanceolate, bases not reduced, pinnate-pinnatifid, acuminate and pinnatifid at apices, grass-green when dry; lamina herbaceous; pinnae 8–13 pairs, flat or obliquely spreading, alternate or subopposite proximally, sessile, lanceolate or linear-lanceolate, apices acuminate, bases symmetrical and slightly wide, or proximal pair slightly tapering to bases, truncate, glabrous or shortly pubescent abaxially, adaxially with dense acicular hairs, pinna-lobes deeply cut down to costae; segments upto 15 pairs, spreading, oblong-lanceolate, entire, apex rounded-obtuse or obtuse-pointed. Veins prominent, 5–7 pairs per segment, lateral veins simple, free, proximal pair arising from above base of costules, costae and veins occasionally with few short acicular hairs, rachises grayish pubescent. Sori small, orbicular, submarginal, 4 or 5 pairs per segment, dorsifixed near ends of lateral veins; indusia orbicular-reniform, glandular and hairy, brown. Sporangia shortly stalked; spores bilateral, monolete, finely reticulate.

Fertile: May – October

Exsiccatae: Tepania (Udaipur), *Sumita 165*, dated 20.07.2011.

Local Distribution: Udaipur, Sidongcherra, Teliamura; occasional

General distribution: India, Nepal, South China, Korea, Taiwan, Japan, Thailand, North Malaysia

Note: Grows on moist and shady places.

Sphaerostephanos J. Smith in Hooker, Gen. Fil. t. 24. 1836; Holtt. in Kew Bull. 34(2): 221. 1979.

Terrestrial. Rhizome long or short creeping or erect, covered with small narrow scales. Stipes hairy above base and scaly at base. Lamina simple pinnate, lanceolate, basal few pairs of pinnae suddenly shortened. Veins free, basal one to two pairs anastomosing to form an excurrent vein reaching the base of sinus membrane; orange coloured glands distributed on the lower surface of costules, veins and intervenal areas. Sori small, round, median; indusia glabrous. Spores monolete, dark-brown, exine spinulose. Chromosome number, $x = 36$ (Holttum 1982).

Sphaerostephanos unitus (Linnaeus) Holttum, J. S. Afr. Bot. 40(2): 165–166. 1974; Baishya & Rao, Ferns & Fern allies, Meghalaya, 87. 1982; Jamir & Rao, Fern Nagaland, 271. 1988; Manickam & Irudayaraj, Pterid. Fl. West. Ghats S. India, 191. t. 144. 1992 *Polypodium unitum* Linnaeus, Sys. Nat. (ed. 10) 2: 1326. 1759. *Nephrodium cucullatum* (Blume) Baker in Hooker, Syn. Fil. 290. 1867; Beddome, Handb. Ferns Brit. India, 270. t. 138. 1883.

Terrestrial fern. Rhizome long creeping, covered with small narrow scales. Scales lanceolate, light-brown, acuminate at apex, margin entire. Fronds distant; stipes 12- 16 cm long, hairy above base and scaly at base, slender, glabrous above; Lamina simple pinnate, lanceolate, deep-green when mature, hairy abaxially; texture coriaceous; pinnae 10-15 pairs, linear-lanceolate, sessile, alternate or subopposite, basal 4-5 pairs of pinnae suddenly shortened to triangular auricles, apex acuminate, base truncate, margin shortly cut down towards costae; segments 20-25 pairs, lobes oblong, slightly oblique, acute at apex, base rounded, margin entire. Veins free, 5-7 per segment, proximal one to two pairs anastomosing forming an excurrent vein reaching the base of sinus membrane; lower surface of costules, veins and interveinal areas clothed with orange coloured glands. Sori small, round, median, arranged in 2 rows on either side of the vein; indusia glabrous. sporangia shortly stalked; spores monoletate, dark-brown, exine spinulose.

Fertile: July – October

Exsiccatae: Chakmaghat, *Sumita 135*, dated 19.06.2011.

Local Distribution: Chakmaghat, Churaibari, Geolcherra, Salema; Common

General distribution: India, Sri Lanka, Myanmar, Thailand, Malaysia, Malay, Queensland

Note: Grows on marshy areas or moist low-lands.

DISCUSSION

The present study on thelypteroid ferns of Tripura state reveals a total number of 19 species under 9 genera. Among the studied 9 genera, *Cyclosorus* emerged as the largest genus carrying 6 species. The second most abundant genus is *Christella* containing 5 species. The genus *Pronephrium* contains 2 species and the remaining other (*Macrothelypteris*, *Parathelypteris*, *Amblovenatum*, *Pneumatopteris*, *Thelypteris* and *Sphaerostephanos*) are represented by single species in each. In this taxonomic study it has been found that 13 species are common, 4 species are occasional and 2 species viz. *Amblovenatum opulentum* and *Cyclosorus holtumii* are rare in nature. Comparative study with the previous workers namely Das (1992, 2007) reveals that there are 8 species belonging to 4 genera are identical. However, 11 species and 5 genera under Thelypteridaceae were newly recorded from the state of Tripura in this paper. Again in comparative study with Deb's (1961) findings there is only single genus and species such as *Sphaerostephanos unitus* was found to be identical. It has also been observed during the survey that 3 species, *Ampelopteris prolifera*, *Macrothelypteris torresiana*, & *Christella papyracea* and single genus *Ampelopteris* were recorded by Das (1992, 2007) and only single genus and species, *Thelypteris ciliata*, was reported by Deb (1961) were presently not available. The reason may be deforestation through excessive jhum cultivation by ethnic people as a traditional means of agriculture.

CONCLUSION

The present report has been prepared on the basis of periodical field survey giving emphasis on forest areas, botanical garden, hill slopes and most remote areas. It is a taxonomical study on the basis of morphological characters to know the diversity of the Thelypteroid ferns of this state. The outcome of the study shows certain new genera and species but at the same time there is unavailability of certain species from the previous work which may be because of deforestation. So, the urgent need of the hour is to preserve this precious biodiversity for future prospect.

Acknowledgements

Authors express their sincere thanks to all the staff members of Forest Department, Botanical Gardens and the common people of Tripura for extending their support and knowledge to explore the Thelypteroid fern diversity. They also wish to convey their thanks to the staff of CAL and ASSAM herbaria for their assistance in identification works. Authors are also thankful to the Department of Life Science & Bioinformatics of Assam University, Silchar for providing all the facilities to carry out the research work.

LITERATURE CITED

- Borthakur, S.K.; Deka, P. & Nath, K.K. 1999. *Illustrated manual of Ferns of Assam*. Bishen Singh Mahendra Pal Singh, Dehradun.
- Ching, R.C. 1978. The Chinese fern families and genera: systematic arrangement and historical origin. *Acta Phytotax. Sin.* 16(3): 1–19; 16(4): 16–37.
- Christensen, C. 1938. Filicinae. In *Manual of Pteridology*, ed. F. Verdoorn. The Hague: Martinus Nijhoff, pp. 522–550.
- Copeland, E.B. 1947. *Genera Filicum*. Waltham, Mass.: Chronica Botanica.
- Das, N.C. 1992. Taxonomic study in Thelypteroid ferns of Tripura state, Eastern India, *Indian Fern Journal*. 9: 233 - 239.
- Das, N.C. 2007. *Ferns and Fern Allies of Tripura: North East India*, International Book Distributors, Dehradun. India.
- Das, N.C. & Sen, U. 1991. *Fern flora of Tripura state, Aspects of plant science, vol.-13, Perspective in Pteridology; present and future*, pp. 69-73. Today and Tomorrow Printers and Publishers, New Delhi.
- Deb, D. B. 1961. *Preliminary study on the pteridophyta of Tripura territory*, Presidings 48 Indian Science Congress, Part-III abstract, Section IV, Bot. No. 62; 271- 272.
- Deb, D.B. 1968. Medicinal plants of Tripura State. *Indian For.* 94(10): 53 - 765.
- Holttum, R.E. 1971. Studies in the family Thelypteridaceae. III. A new system of genera in the Old World. *Blumea* 19: 17 – 52.
- Holttum, R.E. 1982. Thelypteridaceae. In: C.G.G.J. van Steenis & R.E. Holttum, eds. 1959-1982. *Flora Malesiana, Being an Illustrated Systematic Account of the Malesian Flora*. Series II. Pteridophyta. M. Nijhoff. The Hague, Boston & London. Vol. I, pt. 5.
- Jain, S.K. & Rao, R.R. 1977. *A Handbook of Field and Herbarium Methods*. Today & Tomorrow's Printers and Publishers, New Delhi.
- Pichi Sermolli, R.E.G. 1977. Tentamen pteridophytorum genera in taxonomicum ordinem redigendi. *Webbia* 31: 313 – 512.
- Pichi Sermolli, R.E.G. 1982. A further contribution to the nomenclature of the families of Pteridophyta. *Webbia* 35: 223 – 237.
- Ponce, M.M. 1995. Las especies austrobrasileñas de *Thelypteris* subgen. *Amauropelta* (Thelypteridaceae, Pteridophyta). *Darwiniana* 33: 257 - 283.
- Roux, J.P. 2001. *Conspectus of Southern African Pteridophyta*. Southern African Botanical Diversity Network Report No. 13. pp.118. Sabonet, Pretoria.
- Singh, S. & Panigrathi, G. 2005. *Ferns and Fern allies of Arunachal Pradesh*, Vol I-II, Bishen Singh Mahendra Pal Singh Publications, Dehra Dun.

- Smith, A.R. 1990. Thelypteridaceae. pp. 263 – 272 in: Kramer, K.U. & Green, P.S. (eds.), *The families and genera of vascular plants*, vol. 1. Berlin: Springer.
- Smith, A.R. & Cranfill, R.B. 2002. Intrafamilial relationships of the Thelypteroid ferns (Thelypteridaceae). *Am. Fern J.* 92(2): 131 - 149.
- Tindale, M.D. & Roy, S.K. 2002. A cytotaxonomic survey of the Pteridophyta of Australia. *Austr. Syst. Bot.* 15: 839 – 937.
- Vasudeva, S.M. & Bir, S.S. 1993. Pteridophytic Flora of Pachmarhi Hills, Central India-IV (Fern Families: Thelypteridaceae–Marsileaceae, *Indian Fern J.* 10: 172 - 205.
- Walker, T.G. 1985. Cytotaxonomic studies of the ferns of Trinidad 2. The cytological and taxonomic implications. *Bull. Brit. Mus. (Nat. Hist.), Bot.* 13: 149 – 249.
- Weng, R.F. & Qiu, S.P. 1988. Chromosome counts of some ferns from Zhejiang. *Invest. Stud. Nat.* 8: 43 – 52.