

PTERIDOPHYTIC FLORA OF INDIA

(August 2020- March 2023)

**A. BENNIAMIN, B.S.KHOLIA,
V.K.RAWAT , BRIJESH KUMAR
D. JESUBALAN**



PTERIDOPHYTE DIVERSITY IN INDIA

- **TOTAL NO OF SPECIES : 1107 spp.**
- **NO OF FAMILIES : 34**
- **NO OF GENERA : 130**

(Fraser jenkins et al., 2016)



DR. A. BENNIAMIAN, WRC, PUNE

Sr.No	Name of the Family	Total No of species
1	Selaginellaceae	11 (New)
2	Marattiaceae	5
3	Osmundaceae	6
4	Plagiogyraceae	4
5	Dipteriaceae	1
6	Dryopteridaceae	204
7	Nephrolepidaceae	9
8	Oleandraceae	3
9	Lomariopsidaceae	28
10	Vittariaceae	6(New)
11	Blechnaceae	11
12	Azollaceae	3
13	Salviniaceae	3
14	Glechniaceae	7
15	Lygodiaceae	9
16	Schizaeaceae	3
17	Marsileaceae	3

DR. B.S. KHOLIA, NRC, DEHRADUN

Sr. No	Name of Family	Total No
1.	Lycopodiaceae	28
2.	Selaginellaceae	17
3.	Isoetaceae	4
4.	Equisetaceae	4
5.	Psilotaceae	2
6.	Cyatheaceae	11
7.	Lindsaeaceae	20
8.	Hymenophyllaceae	36
9.	Dennstaedtiaceae(with SC)	27
10.	Aspleniaceae	32
11.	Vittariaceae	10
13.	Thelypteridaceae	83
14.	Davalliaceae	19(New)
	Total	Ca.274spp

DR.V.K. RAWAT, APRC, ITANAGAR

	Name of Family	Total
1.	Selaginellaceae	19
2.	Pteridaceae (except Adiantum)	155
3.	Ophioglossaceae	20
4.	Polypodiaceae (except Lepisorus)	110
	Total	304spp.

DR. BRIJESH KUMAR, CRC, ALLAHABAD

	Name of Family/Genera	No of species
1.	Lepisorus (Polypodiaceae)	20
2.	Woodsiaceae	130
3.	Aspleniaceae	87
4.	Adiantum (Pteridaceae)	20
	Total	257spp.

YEAR WISE BREAK UP

NAME OF SCIENTIST	Total no of species	1 st year 2020-2021	2 nd year 2021-2022	3 rd year 2022-2023
Dr. A. BENNIAMIN	316spp.	110spp.	110spp.	106spp.
Dr. B.S.KHOLIA	274spp.	100spp.	100spp.	74spp.
Dr. V.K. RAWAT	304spp.	104spp.	100spp.	100spp.
Dr. BRIJESH KUMAR	257spp.	57spp.	100spp.	100spp.

THE FORMAT OF FLORA

Output Template

- Key to families
- Family description
- Key to Genera
- Genus description
- Key to species
- Species citation with basionym and synonymy
- Description
- Phenology
- Ecology
- Distribution
- Notes



Contribution from team members

Dr. A. BENNIAMIAN



Sr. No	Name of the Families	Total No of species
1.	Selaginellaceae	11 (New)
2.	Marattiaceae	5
3.	Osmundaceae	6
4.	Plagiogyraceae	4
5.	Dipteriaceae	1
6.	Dryopteridaceae	29
	TOTAL	56

Selaginellaceae (11spp)

Description prepared for the family Selaginellaceae of 11 species Selaginella cataractarum, Selaginella ciliaris, Selaginella coonooriana, Selaginella crassipes, Selaginella emodi, Selaginella fulcrata, Selaginella ganguliana, Selaginella intermedia, Selaginella microdendron, Selaginella miniatospora, Selaginella plana.





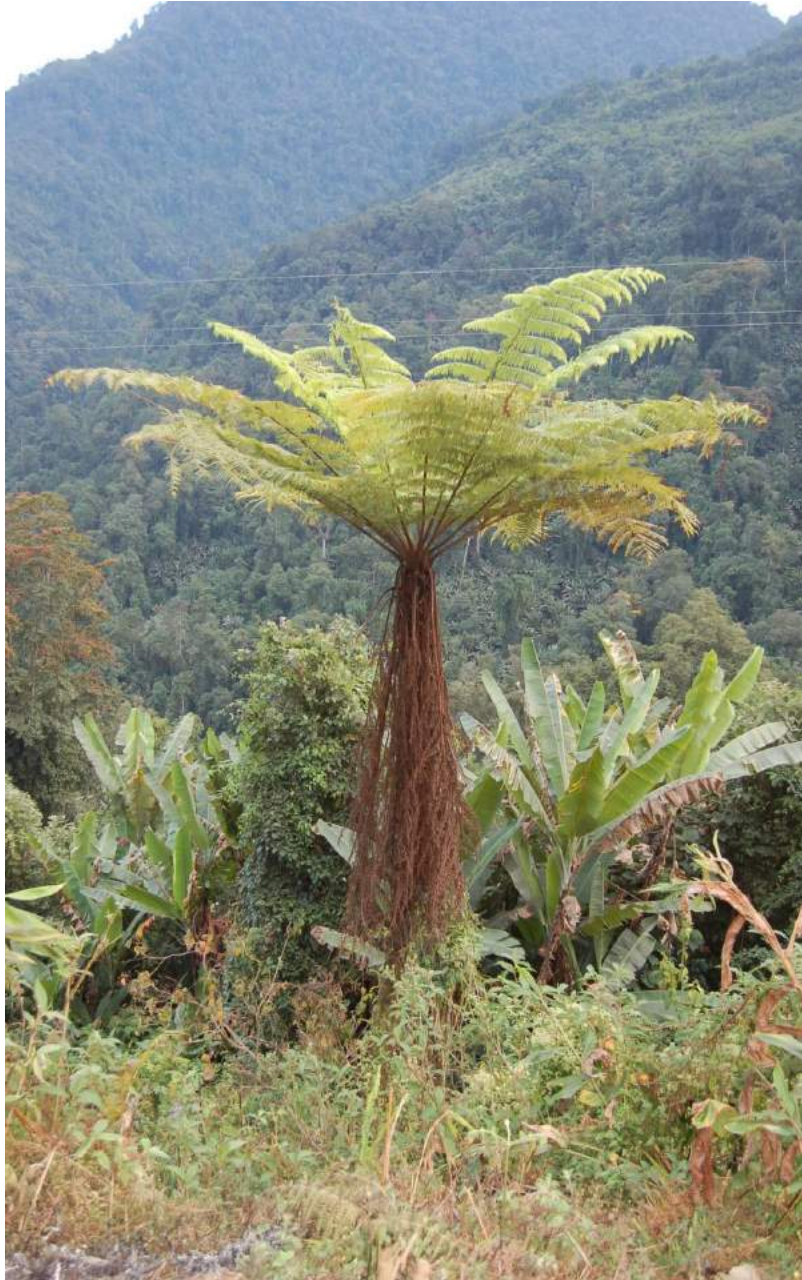
Osmundaceae (6spp)

Under Osmundaceae described 6 species and key also prepared for *Osmunda angustifolia*

***O. cinnamomea* L. subsp. *asiatica*,
O. claytoniana L. subsp. *vestita*,
O. hilsenbergii, *O. japonica*,
*O. javanica***



Dryopteridaceae (5 spp), Cyrtomium, (8 spp) Dryopsis)



Description prepared along with key of 5 species namely *Cyrtomium anomophyllum*, *C. caryotideum*, *C. fortune*, *C. macrophyllum*, *C. micropterum* and *Didymochlaena truncatula* has prepared.

Described of the genus *Dryopsis* comprising of 8 species namely *Dryopsis apiciflora*, *D. arunachalensis*, *D. clarkei*, *D. ferruginea*, *D. heterolaena*, *D. nidus*, *D. scabrosa*, *D. transmorrisonensis*



Kurungkumey District

Dryopteridaceae (13 spp) Arachniodes, Ctenitis2pp.)

Dryopteridaceae the genus key along with detailed description of the species namely *Arachniodes amabilis*, *Arachniodes assamica*, *Arachniodes carvifolia*, *Arachniodes chinensis*, *Arachniodes coniiifolia*, *Arachniodes cornucervi*, *Arachniodes henryi*, *Arachniodes miqueliana*, *Arachniodes palmipes*, *Arachniodes rhomboidea*, *Arachniodes simulans*, *Arachniodes sledge*, *Arachniodes spectabilis*, *Arachniodes superba*.

Described the species *Ctenitis manni*, *Ctenitis subglandulosa* along with keys.





Pteridophytic Flora of India

(a joint task)

B.S. Kholia, Scientist-E

October 2020- 2021



Name of Families	Total No of Species to be completed
Lycopodiaceae	28
Selaginellaceae	17
Isoetaceae	4
Equisetaceae	4
Psilotaceae	2
Cyatheaceae	11
Hymenophyllaceae	36
Dennstaedtiaceae	27
Aspleniaceae	32
Davalliaceae	19
Vittariaceae	10
Thelypteridaceae	83
Total	273spp





Family	Species
LYCOLODIACEAE	18
SELAGINELLACEAE	07
CYATHEACEAE	10
EQUISETACEAE	02
HYMENOPHYLLACEAE	02
DAVALLIACEAE	07
VITTARIACEAE	06
Total	52spp



LYCOPODIACEAE

- **Huperzia arunachalensis (D.D.Pant & P.S.Pandey) Fraser-Jenk., in Fraser-Jenkins, Kandel & Pariyar, Ferns Fern-Allies Nepal: 45. 2015 (12.4.2015), non Mazumdar & Mukhopadhyaya, Bionature 34(2): 33-35. 2016 ("2014").**
- *Lycopodium arunachalense* D.D.Pant & P.S.Pandey, Phyta Monogr. 3: 11-13, t. 3A, pl. 1A. 1985 (as "*arunachalensis*").
- *Lycopodium sahnii* D.D.Pant & P.S.Pandey, Phyta Monogr. 3: 16, t. 10A. 1985.
- *Huperzia mazumdariana* Chandan Das *IJARIE* 3 (3):3112. 2017.
- *Huperzia vorwerkii sensu* Mazumdar (Phytotaxa 226(1): 99-100. 2015 *non* (Nessel) Holub.
- Plants small up to 6 cm, stems erect, crowded at base; branches simple or dichotomously or pseudo-dichotomously branched, branches equal or unequal in length; leaves 3-4 x 1mm, narrowly elliptical to broad lanceolate, broadest at middle, tapering at both ends, spirally arranged, compact, stiff, exerted or deflexed, margins almost entire or rarely with few small teeth at apex, apex acute; sporangia generally arise at the apex of branches, sporophylls similar to microphylls.
- **Habitat:** Mesophyte or Lithophyte.
- **Specimens examined:** Photo of Type (*P.S. Pandey* 2101-2103, Arunachal Pradesh, Sewak Pass, Lohit Division, about 5700 ft.-6200 ft. a.s.l., 1978 !); BM H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki & P.R. Shukya 725178, 10.6.1972.
- **Distribution:** Arunachal Pradesh; Sikkim; Darjeeling; Meghalaya; Tripura and also in Nepal, China and Myanmar.
- **Note:** Some specimens of this species are identified as *H. selago* and *H. somae* in Indian herbaria.

Hyperzia cancellata (Spring) Trevis., Atti Soc. Ital. Sci. Nat. 17: 247. 1874.

Lycopodium cancellatum Spring, Mém. Acad. Roy. Sci. Belgique 24(2): 27. 1850.
Urostachys cancellata (Spring) Herter ex Nessel, Die Birklappgew. 140, 1-34. 1939.
Phlegmarium cancellatum (Spring) Ching, Act. Bot. Yunnan, 4(2): 122. 1982.
Chloanthus cancellatus Sze, Bot. Sinica, 4(2): 122. 1982.

Plants 40-80 cm tall, pendulous, robust, dichotomously or pseudo-dichotomously branched 3-5 times or more, branches or branchlets long, narrow, 3-5 mm in diameter, compact, floccid; leaves green, compact, very close together, scattered or imbricate, in a adpressed whorl of 6-8 microphylls, 4-6 x 2-3 mm, adnate, ovate- lanceolate, decurrent, firm, margins wavy and incurved, apex acuminate pointed; midrib faintly distinct; strobili slightly distinct or indistinct on terminal branches, sporophylls ovate, base cuneate, margin entire, apex acute; sporangia axial, small, covered by sporophylls. (Description based on type specimens at K, completed and checked)

Habitat: Epiphytic plant hanging on trees.
Specimen examined: Herb. (ASSAM & CAL. G. Bantwani, 49715. (Photo of Type at K)

Distribution: Arunachal Pradesh also in Bhutan, Myanmar, Tibet, China.

Note:

Hyperzia carinata (Desv. ex Poir.) Trevis., Atti Soc. Ital. Sci. Nat. 17: 247. 1874.

Lycopodium carinatum Desv. ex Poir., in Lamarck, Encycl. Méth. Bot., Suppl. 3(2): 555. 1814.
Urostachys carinata (Desv. ex Poir.) Herter ex Nessel, Die Birklappgew. 179. 1939.
Chloanthus carinatus (Desv. ex Poir.) Ching, Act. Bot. Yunnan, 20(4): 448. 1982.
Lycopodium laxum C.Presl, Reliq. Haenke, 1: 83. 1825.
Hyperzia laxa (C.Presl) Trevis., Atti Soc. Ital. Sci. Nat. 17: 247. 1874.
Hyperzia laxa (C.Presl) T.Sen & U.Sen, Fern Gaz. 11(6): 417.1978.
Lycopodium carinatum var. *minus* Jagawa, Act. Phytotax. Geobot. 14(3): 91. 1951.

Plants pendulous, 20-50 cm or more, rooting at base, dichotomously or pseudo-dichotomously branched 2-3 times or more, branches equal or unequal, thick, robust, up to 5 mm in diameter with leaves; leaves dense, 5-7 whorled, lax, opening outside, twisted, lanceolate, broadest at middle, margins entire, apex acute, base decurrent and adnate, midrib distinct on the lower surface; strobili or spikes 5-12 cm long, not distinct, continuous to terminal branches, slightly contracted; sporophylls compact, adpressed, ovate, slightly smaller than microphylls, base cuneate, margins entire, apex acute; sporangia completely covered by sporophylls, yellowish.

Habitat: ———
Specimen examined: PBL: NP Balakrishnan, 5856, 2778, 4029; NG Nair 7133.
Distribution: Andaman and Nicobar Islands also in S. E. Asian countries, China, and Pacific Islands.

Hyperzia cavei Fraser-Jenk. & B.S.Kholia, in Fraser-Jenkins, Kandel & Pariyar, Ferns Fern-Allies Nepal: 46-47. 2015.

Hyperzia lajouwensis Sze, Duxis, Jenkins et al. An. Inst. Bot. Univ. Acad. Indus. Biol. Ind. 13. 2017. 300 Ching (1981).
Hyperzia tibetica auct. Mazumdar & Mukhopadhyay, Sci. & Cult. 81 (1-2): 48. 2015.

Plants small 5 to 8 cm, terrestrial, in tufts, stem ascending or erect, compact, simple or 1-3 times dichotomously branched, densely covered by leaves, leaves less appressed at lower and mid parts, and often become horizontally subtended, leaves obovate, widest above middle, 3-4 x 1 mm, base truncate, smooth on both surfaces, mid rib indistinct, margin is smooth, often slightly reflexed, terminal or apical margins weakly or inconspicuously toothed, apex abruptly pointed, microphylls similar to microphylls, sporangia generally on terminal part of branches, reniform, distinct and visible, broader than sporophylls base, yellow.

Habitat: Mesophyte at open slopes or Lithophyte.

Specimen examined: Herb. G.H. Cave 188, 21, 7, 1906.

Distribution: Sikkim, also in Myanmar, Nepal and Tibet (China).

Note: While examining the types of *Hyperzia dictiana* P.Mondal & R.K.Ghosh Fraser- Jenkins reidentified the holotype as *Hyperzia selago* subsp. *appressa* and found paratypes different from holotype and proposed a new name *Hyperzia cavei* after its collector G.H. Cave, citing in preparation and published subsequently (Fraser-jenkins et al. 2015). In the mean time Mazumdar tried to pre-empt to publish it under H. avei based on determination of Fraser-Jenkins but this plagiarism was caught at reviewing stage and rejected by Journal authority. Subsequently, Mazumdar & Mukhopadhyay (2015), reported this species as *Hyperzia tibetica* (Ching) Ching which is distinct from present specimens. Later Fraser-Jenkins et al. (2017) thought it is *Hyperzia lajouwensis* or needs to be further study (2018). Recently, Shalimov et al. (2017) compared bit like species thoroughly and concluded that retained *H. cavei* as distinct from *Hyperzia lajouwensis*.

Hyperzia ceylanica (Spring) Trevis., Atti Soc. Ital. Sci. Nat. 17: 248. 1875.

Lycopodium ceylanicum Spring, Bull. Acad. Roy. Sci. Belg. 8: 514. 1842.
Urostachys ceylanica (Spring) Herter ex Nessel, Die Birklappgew. 52. 1939.
Lycopodium ceylanicum (Spring) Herter ex Nessel, Die Birklappgew. Syst. 43(1): 41. 1909.
Lycopodium delavayi (Christ & Hoster) Ching, Act. Bot. Yunnan, 3(3): 303. 1939.
Urostachys ceylanica Nessel, Folia Herbar. Spex. Nov. 36(12-15): 178. 1934.
Hyperzia virens (Nessel) Holub, Folia Geobot. 20(1): 78. 1985.
Hyperzia nanchuanense (Ching & Kung) Ghosh, Journ. Fl. East. Himal. 1: 50. 2004. (*Hyperzia nanchuanensis* (Ching & H.S.Kung) Ching & H.S.Kung.

Plants 10-15 cm or more tall, often clustered, terrestrial, erect or suberect on rocks, rooting at base, 1-2 times isodichotomously or pseudo-dichotomously forked, densely covered by microphylls; microphylls glossy, green, crowded in a whorl of 5-8, linear or linear lanceolate, 4-6 x 1-2mm, spreading, cuneate at base, broadest at above middle, margins entire or shortly toothed at apex, apex acute; midrib slightly distinct, strobili not distinct, sporangia on intercalary or terminal on braches, sterile and fertile zones not differentiated, in the axis of sporophylls, sporophylls similar to microphylls, sporangia reniform, broader than sporophylls base and visible. (Description based on type from P)

Habitat: Lithophyte or rarely base epiphyte.
Specimen examined: Herb. (Collector, Coll. No.; Collector Coll. No.; Collector Coll. No.;)

* Proposed AAP 2021-2022

Q1.

Identification, Label writing and incorporation of unidentified Pteridophyte herbarium at BSD
Study Review of literature on Indian fern taxonomy
Consultation of DD herbarium as and when required.
Data collection, compilation & preparation draft Mss(20 spp.).

Q2.

Identification, Label writing and incorporation of unidentified Pteridophyte herbarium at BSD
Study Review of literature on Indian fern taxonomy
Consultation of DD herbarium as and when required.
Data collection, compilation & preparation draft Mss(20 spp.).
One filed tour to Uttarakhand Himalayas (subject to the Pandemic situation).

Q3.

Identification, Label writing and incorporation of unidentified Pteridophyte herbarium at BSD
Study Review of literature on Indian fern taxonomy
Consultation of DD herbarium as and when required.
Data collection, compilation & preparation draft Mss(20 spp.).
One herbarium cum filed tour to NE India (BSHC, ASSAM, ARUN) (subject to the Pandemic situation)

Q4.

Identification, Label writing and incorporation of unidentified Pteridophyte herbarium at BSD
Study Review of literature on Indian fern taxonomy
Consultation of DD herbarium as and when required.
Data collection, compilation & preparation draft Mss(20 spp.).

(Pteridophytic flora of India)
(August 2020 to March 2021)
Dr Vineet K. Rawat



Name of Families	Total No of Species to be completed
Acrostichum	01
Actiniopteris	01
Adiantum	26
Aleuritopteris	19
Annogramma	2
Ceratopteris.	02
Cerosora	01
Coniogramme	05
Cryptogramm a.	01
Doryopteris	01
Mickelopteris	01
Notholaena	04

Name of Families	Total No of Species to be completed
Oeosporangium	05
Onychium	07
Pallaea	04
Pityrogramma L	01
Pteris	69
Syngamma	01
Taenitis	02
Total.	19 Genera/151sp p.

PTERIDOPHYTIC FLORA OF INDIA

(2020-21)

Brijesh Kumar

Targets for 2020 – 2021	Achievements	Remarks Reason for shortfall, if any
<p>Data collection, compilation & preparation draft Mss. (75 spp.)</p> <p>Q1.-(15 spp.) Q2. -(15 spp.) Q3.-(23 spp.) Q4. -(22 spp.)</p> <p>[Action plan received in Nov. 2021]</p>	<p>Species Described: 50</p> <p><i>Botrychium daucifolium</i> Wall. ex Hook. & Grev., <i>B. lanuginosum</i> Wall. ex Hook. & Grev., <i>B. lunaria</i> (L.) Sw., <i>B. multifidum</i> (S.G.Gmel.) Rupr., <i>B. multifidum</i> subsp. <i>robustum</i> (Rupr. ex Milde) Clausen, <i>B. simplex</i> E.Hitchc., <i>B. ternatum</i> (Thunb.) Sw., <i>B. virginianum</i> (L.) Sw., <i>H. zeylanica</i> (L.) Hook., <i>Ophioglossum costatum</i> R.Br., <i>O. eliminatum</i> Khand. & Goswami, <i>O. gramineum</i> Willd., <i>O. lancifolium</i> C.Presl, <i>O.lusitanicum</i> L., <i>O. oleosum</i> Khand., <i>O. parvifolium</i> Grev. & Hook., <i>O. pendulum</i> L., <i>O. petiolatum</i> Hook., <i>O. polyphyllum</i> A.Braun ex Seub., <i>O. reticulatum</i> L., <i>O. rubellum</i> Welw. ex A.Braun [Family-Ophioglossaceae]; <i>Lepisorus amaurolepidus</i> (Sledge) B.K.Nayar & S.Kaur, <i>L. nudus</i> Ching, <i>L. clathratus</i> Ching, <i>L. jakonensis</i> (Blanf.) Ching, <i>L. loriformis</i> Ching, <i>L. macrosphaerus</i> Ching, <i>L. mehrae</i> Fraser-Jenk., <i>L. scolopendrium</i> (Buch.-Ham. ex D.Don) Mehra & Bir, <i>L. sublinearis</i> Ching [Family-Polypodiaceae]. <i>Woodsia alpina</i> (Bilton) Gray, <i>W.andersonii</i> (Bedd.) Christ, <i>W. cycloloba</i> Hand.-Mazz., <i>W. elongata</i> Hook., <i>W. glabella</i> R.Br. ex Richardson, <i>W. hancockii</i> Baker, <i>W. lanosa</i> Hook., <i>W. rosthorniana</i> Diels., <i>Athyrium anisopterum</i> Christ, <i>A. atkinsonii</i> Bedd., <i>A. attenuatum</i> (C.B. Clarke) Tagawa , <i>A. cuspidatum</i> (Bedd.) M kato, <i>A. distans</i> (D.Don) T. Moore, <i>A. drepanopterum</i> (Kunze) A. Braun ex Milde , <i>A. falcatum</i> Bedd., <i>A. fimbriatum</i> T. Moore, <i>A. flabellulatum</i> (C. B. Clarke) Tradieu, <i>A. foliolosum</i> T. Moore ex R. Sim, <i>A. himalaicum</i> Ching ex Mehra & Bir [Family- Woodsiaceae]</p>	<p>Work remaining-25 spp</p> <p>(This will be completed by May 2021)</p>



Ex-situ Conservation (Fern House)

Renovation of Fern House

Introduced Three (03) species of pteridophytes viz.,
Selaginella bryopteris (L.) Baker, *Thelypteris dentata*
(Forssk.) E.P.St.John and *Nephrolepis auriculata* (L.)
Trimen. in BSI, CRC, Fern House



DRYOPTERIDACEAE

Dryopteridaceae Ching in Acta Phytotax. Sin. 10: 1. 1965.

Type genus: *Dryopteris* Adanson

Plant terrestrial, rhizome dictyostelic, covered with persistent leaf bases, usually short, erect sometimes long creeping; stipe with a ring of several vascular bundles, usually tufted or distant, scaly at base, scales opaque, very diverse in size, shape, texture and colour, venation free or anastomosing, rachis deeply grooved on upper side and usually open to receive rachillae groove; sori round, dorsal or terminal on veins; indusia round, peltate, centrally attached or attached by a deep sinus, rarely absent.

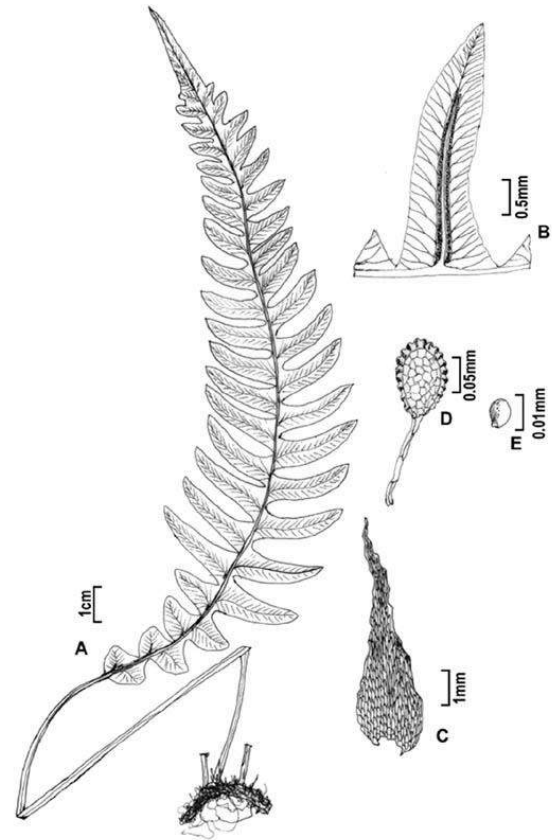
About 13 genera, 7 in India and in this region also 7 genera.

KEY TO THE GENERA

- Swollen base of stipe bearing glossy scales; axes of frond bearing short unicellular hairs only ---
-----*Hypodematum*
- 1a. Base of stipe not swollen. scales usually on other parts also hairs on axes of fronds mostly not unicellular – -----2
- Rhizome usually creeping, frond approximate ----- *Arachniodes*
- 2a. Rhizome erect, short suberect, frond tufted -----3
- Costae and costules densely scaly in abaxial surface ----- *Ctenitis*
- 3a. Costae and costules bearing few scattered scales on the abaxial surfaces --4
- Veins anastomising -----*Tectaria*
- 4a. Veins free -----5
- First pinnule of all pinnae except the lowest anadromous, rachis usually more or less zig zag-----
----- *Acrorumohra*
- 5a. First pinnule of all pinnae except the lowest catadromous -----6
- Lamina margin with a tooth in each sinus, the teeth elevated on adaxial surface --*Pleocnemia*



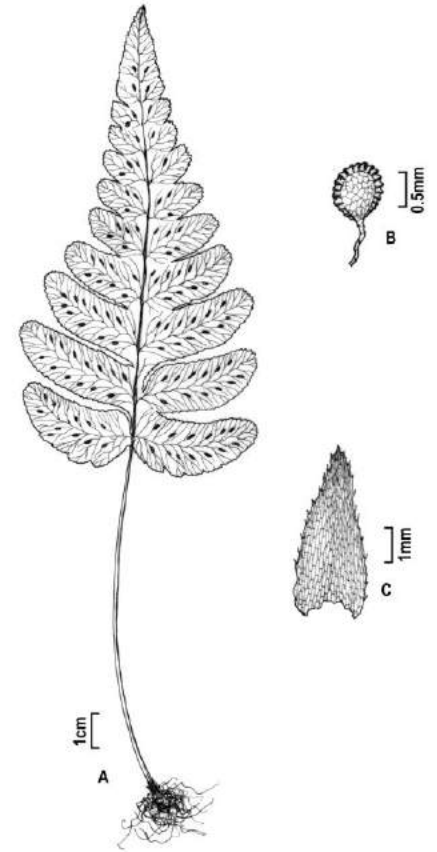
Fig.1 : *Anogramma leptophylla* (L.) Link a. Plant; b. & c. Part of pinna showing venation and sori; d. Rhizome hairs; e. Sporangium; f. Spore.



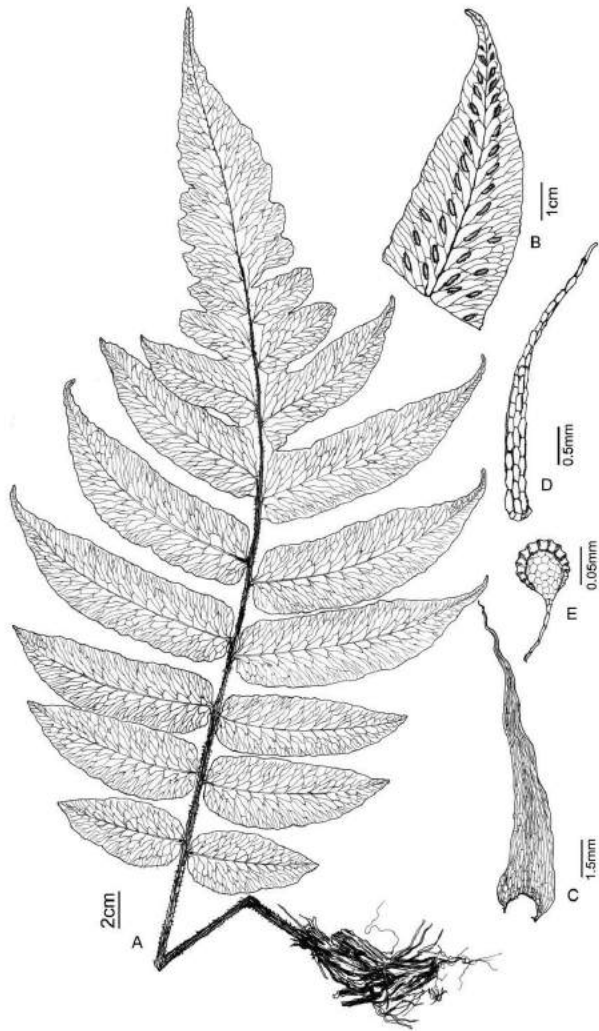
A. Habit; B. Portion of enlarged Pinnae; C. Rhizome scale; D. Sporangium; E. Spore



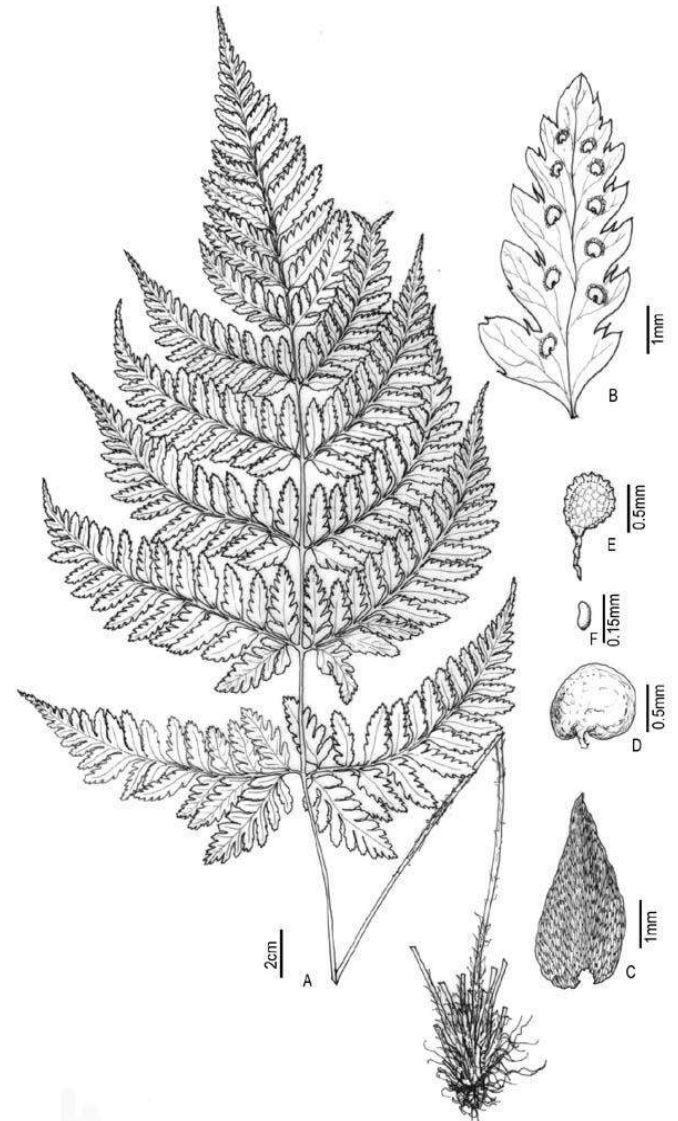
Fig. 4: A. Habit; B. Portion of enlarged Pinnae; C. Stem scale; D&E. Rizhome scale; F. Stipe scale; G. Sporangium



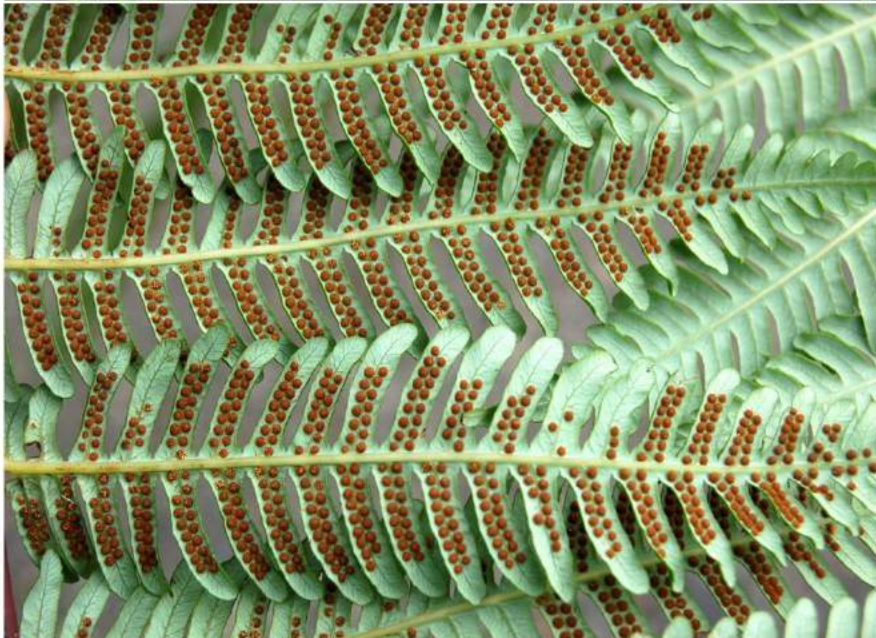
A. Habit; B. Sporangium; C. Rizhome scale



A. Habit; B. Portion of Pinnae; C. Rizhome scale; D. Pinnae scale; E. Sporangium



A. Habit; B. Portion of enlarged Pinnae; C. Rizhome scale; D. Stipe scale; E. Sporangium; F. Spore



Cyathea brunoniana (Wall. ex Hook.) C.B. Clarke & Baker.

Fig 11. *Ctenitis subglandulosa* (Hance) Ching



Fig 12. *Cyrtomium anomophyllum* (Zenker)Fras.-jenk.



CONCLUSION

- **Total no of Species : 211 spp.**
- TARGETS : 350 to be described **(2021-22)**

Pteris argyrea Moore

THANKS . . .

