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STATUS OF PTERIDOPHYTIC GENERA REPRESENTED BY SINGULAR SPECIES IN INDIA AND THEIR CONSERVATION STRATEGIES

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ABSTRACT

Central National Herbarium (CAL) is of immense value in assessing the biodiversity and status of occurrence of particular species in Indian region by virtue of possessing the treasure of herbarium specimens, since the last two centuries. About 195 genera of Pteridophytes are known to occur in India, of which only 20 genera are being represented by singular species or monotypic. The status of such genera in India has been assessed on the basis of specimens housed in CAL with probable conservation strategies to be adopted.

INTRODUCTION

National herbaria may play vital role in assessing the biodiversity, status of occurrence of species from common to endangered or even extinct in particular region by virtue of the presence of documented herbarium specimens throughout the world. Central National Herbarium (CAL) is a National herbarium of India and houses specimens collected since the last two centuries as well as the recent ones collected by Scientists of Herbarium or received as duplicate specimens from the Regional Herbaria of the Survey and other Universities etc. Keeping in view of the treasure of herbarium specimens present in CAL, the efforts have been made to assess the status of monotypic pteridophytic genera or genera represented by singular species. The assessment of such genera in Indian distribution has been realised essential whether these are endemic or not in view of the fact by their representation of singular species, occurring usually in particular habitat or in limited area.

It is true that pteridophytes do not form the dominant vegetation anywhere in the world, today, but their conspicuous presence starting from sea level to high mountains can be easily recognised throughout the world. Due to their occurrence in different ecogeographical regions pteridophytes have been involved in evolutionary and phylogenetic relationships with higher plants since ages and thus drawing the attention of academicians and also of naturalists by virtue of presence of beautiful foliage. However, loss of vegetal cover especially in tropics is alarming as evidenced by destruction of *ca* 15 million hec., of forests per year, which is mainly due to human based necessities and also partly due to natural calamities. Thus, conservation of biological species is now a worldwide problem. Recently much of attention and work have been done on flowering plants, the vascular Cryptogams – pteridophytes, have also drawn the attention of conservationists by establishment of International Association of Pteridophytes (IAP) during 13th International Congress, Sydney, Australia in 1982. It was the beginning of positive chapter towards the necessity of conservation of pteridophytes and generated the worldwide awakening among pteridologists, naturalists and conservationists. According to Given and Jermy (1985) the Threatened Plant Committee (TPC) identified 15 regions in the world for taxonomic, ecologic and conservation status assessment for input to the IUCN computerised data base.

Several articles on rare, threatened and endangered pteridophytes have been published in India

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but not as per guidelines of IUCN (cf. Dixit, 1983, 1986, 1992 ; Dixit and Ghosh, 1985; Bharadwaja *et al.* 1987; Bir, 1987). In fact, Botanical Survey of India took lead and published 3 volumes of "Red Data Book" edited by Nayar and Shastry (1990) mainly dealing Phanerogams totalling 841 species as per IUCN pattern of which only 34 pteridophytes, mainly endemic species have been included.

About 70 families and 195 genera are estimated to occur in India (Dixit, 1984) of which 20 genera of pteridophytes represented by singular species occurring in India have been taken into account for conservation priority, since even a slight ecological disturbance may cause their total disappearance from the Indian region. The present paper provides details regarding 20 species of such genera of pteridophytes occurring in India. The species are enumerated alphabetically with current nomenclature, named of the family in bracket, diagnostic characters, specimens examined, ecology, distribution, status and their conservation measures proposed. All the specimens cited in text are housed in herb CAL if not mentioned otherwise.

1. **Ampelopteris prolifera** (Retz.) Copel. Gen. Fil. 144. 1947; Dixit, Cens. Ind. Pter. 102. 1984. *Hemionitis prolifera* Retz. Obs. Bot. 6 : 31. 1791. *Goneopteris prolifera* (Retz.) Presl. Tend. Pterid. 183. 1836; Bedd. Ferns South India t. 172. 1864; Handb., Ferns Brit. India 296. t. 153. 1883. (Thelypteridaceae).

Rhizome creeping, 0.7-1 cm diam., clothed with bunch of roots ; younger rhizome covered with scales; scales dark brown, ovate, apex acute to acuminate. Fronds green, lower surface pale-green paperaceous; sterile fronds with very long flagelliform tips. Fertile fronds bear terminal pinna; petiole and rachis shortly grooved on adaxial side, young petiole and rachis covered by multicellular glandular tipped and unicellular branched or acicular hairs. Lamina simple pinnate, elliptic; pinnae 4 - 10 × 1 - 2 cm, apex acute, base obliquely truncate, margin crenately lobed; venation reticulate; excurrent vein from base to sinus of the lobe except in the apical part of the lamina. Sori on the distal parts of the acroscopic and basiscopic vein.

Specimens examined : Only selective herbarium specimens from India have been cited. UTTAR PRADESH : Tehri Garhwal ; Aglar Valley, 915 m. 1878, *Mackinnon s.n.*, Acc. No. 20245 (CAL). MANIPUR : Kungpoki, 1978, *Dixit* 58970 (CAL). CONCAN : *Lav. s.n.* Acc. No. 20254. MADHYA PRADESH: Bastar, Darbha, 550 m., 1970, *Nair* 40385 (CAL).

Ecology : Terrestrial, trailing among grasses, several meter in length, near stream side, in open places in forest floor, several vegetative bud on rachis observed which detouch on maturity to give rise new plant, these vegetative propagation more frequent. One of the common species of forest hills climbing up to 70 m.

Distribution : India : All the States throughout; Nepal, Bhutan, Burma, North Australia, South Africa and its Islands, Philippines, New Caledonia, China.

Economic important : Young fronds are eaten as vegetable curry in India with choice in eastern India.

Status and Conservation measures proposed : Abundant. At present due to edible properties plants are exploited by the vegetative propagation in this species is prevalent and plucking of young fronds for vegetable curry may hamper vegetative propagation. However, *ex-situ* conservation has been recommended.

2. **Blechnidium melanopus** Hook. Sp. Fil. 3 : 64. t. 161. 1860 ; Bedd., Ferns Brit. India t. 50. 1865 ; Handb., Ferns Brit. India 133. t. 67. 1883. Dixit, Cens. Ind. Pter. 172. 1984. (Blechnaceae).

Stipes erect, blackish brown, 12 13 cm long, glabrous; fronds lanceolate, pinnate, glossy, sub-coriaceous; pinnae linear-oblong, falcate, acute at apex, slightly wide at base, margins narrowly revolute, uppermost ones gradually narrowed into a lanceolate elongated lobe, the lowest 2 3 pairs suddenly, small, obtuse, sub-auriculate at the



Fig. 1. *Ampelopteris prolifera* (Retz.) Copel-Habit
M.P. - Satna : Chitrakut, *Prasad* 31724 (BSA).



Fig. 2. *Dictyocline griffithii* Moore-Habit
Meghalaya - Jaintia hills, *Dixit* 32055 (BSA).

superior base. Veins reticulated anastomosing and forming larged arched areoles. Sori close to the costa, continuous but not reaching to the apex; lower surface and lower half of the rachis black.

Specimens examined : Specimens are not available in CAL herbarium.

Ecology : In moist situations along streams.

Distribution : India : Meghalaya ; Taiwan.

Status and Conservation measures proposed : Endangered to extinct. Intensive plant surveys should be undertaken in the known localities before declaring extinct in India. *Ex-situ* conservation of the plants recommended. The species is of academic interest.

3. Brainca insignis (Hook.) J. Sm. in Journ. Bot. 5 : 237. t. 2. 1856 ; Bedd., Ferns Brit. India t. 139. 1867 ; Handb., Ferns Brit. India 396. t. 230. 1883; Dixit, Cens. Ind. Pter. 173. 1984. *Bowringia insignis* Hook. in Journ. Bot. 5 : 237. t. 2. 1853. (Blechnaceae).

Rhizome 50 - 60 mm thick ; clothed by scales; scales brown, ferruginous, subulate to lanceolate, 7 10 mm long ; stipes reddish-brown, rigid, 70 100 mm long, basal partition scaly ; scales 10 20 mm long; fronds coriaceous, green, pinnate; pinnae numerous, linear-oblong, 70-100 mm long, 7 8 mm wide, apex acute, base wide, auricled, cordate, margins serrated. Sori linear, along veins, simple or branched.

Specimens examined : MEGHALAYA : Shillong, Barapani 1220 m, 1983, *Majumdar, s. n.*

Ecology : Growing in moist forest floor in between 915-1220 m elevation.

Distribution : India : Meghalaya ; Burma, Malaya Peninsula, Hong Kong.

Status and Conservation measures proposed : Rare. Introduction of the species in experimental gardens, where it could be successfully raised and *in situ* conservation is the only solution to conserve the species.

4. Cheilanthopsis straminea (Brause) Hieron. *ex* Copel Notizbl. Berlin 7 : 406. 1920 ; Dixit, Cens. Ind. Pter. 124. 1984. *Cheilanthes straminea* Brause, Hedw. 54 : 205. t. 4. H. 1914. (Woodsiaceae).

Rhizome small, erect, cloth with scales ; scales ferruginous, linear lanceolate, broader at base, about 2 cm. long margins wavy; fronds tufted petiole shiny stramineous with the scaly base like rhizomes, glabrescent, 6 10 cm long; lamina linear-lanceolate, acuminate, herbaceous, hairy above, hairs articulate, lower surface glandulose; 35 37 × 3.5-5 cm., pinnate to pinnatifid; pinnae 30 36 pairs, apex pinnatifid, pinnae linear-lanceolate; 1-1.3 cm long, upper ones adnate, margins insised, segments sessile about 9 pairs, crowded at base, about 5 mm wide, confrient, sub-quadrangular, apex obtuse, margins crenate; rachis and costa shining stramineous above furrowed with dense, long articulate hairs, lower surface sparsely hairy, terete; veins simple to furcate. Sori indusiate, 1 3 per pinnae.

Specimens examined : The specimens are not available in the herbarium CAL. The report is given here based on published literature.

Ecology : Plants rooting in rock crevices in open sunny situations in stream sides.

Distribution : India : North-east Himalayas; China (Unan).

Status and Conservation measures proposed : Extremely rare to endangered. Introduction trials into the botanic/experimental gardens should be made.

5. Christensenia aesculifolia (Blume) Maxon in Proc. Biol. Soc. Washington 18 : 240. 1905; Dixit & Panig. in Bull. Bot. Surv. India 11 : 370. f. 14- 16. 1972; Pal in Bull. Bot. Surv. India 24 : 180 182. pl. 1, t. 1-4, 1982. *Aspidium aesculifolium* Blume, Enum. Pl. Jav. 2 : 143. 1828. *Kaulfussia aesculifolia* (Blume) Blume, Enum. Pl. Jav. 2 : 260. 1828; Bedd., Handb., Ferns Brit. Ind. 462. t. 287. 1883; *K. assamica* Griff. in Asiat. Res. 19 : 108. t. 18. 1836. (Christenseniaceae).

Rhizome horizontally creeping, fleshy, 2-5 cm thick, upper surface covered by successive sockets with fleshy auricles, where stipes arises, bristly,

green; lower surface purplish, rhizoids present; rhizoid whitish; stipe 14-50 cm long, 0.3-1.3 cm thick, fleshy, olive-green; stipe base slightly curved and wide, notched at the curving point; scales minute, green; rusty waxy throughout, except flattened part of stipe; frond simple or lobed, old frond palmately compound, leaflets 3 to 5, subsessile to shortly stalked; middle leaflets largest, 13 21 × 7- 11 cm., obovate-oblong to elliptic, cuneate at base, acuminate to sub-acuminate at apex, entire to sub-repand or broadly crenate or dentate, leathery, dark-green above, whitish-green beneath, glabrous; mid-vein prominent; lateral leaflets smaller, 11-15 × 5-6 cm., obliquely oblong or elliptic, main lateral vein curved; venation reticulate with free veinlets. Sorus at vein junctions in two rows in between transverse veins.

Specimens examined : ARUNACHAL PRADESH : Itanagar, 500 m., Subansiri District, 1985, *Ghosh* 59687. ASSAM : Lower Jiri, 150 m., Cachar, 1985; *Ghosh* 59260.

Ecology .: It is a lithophytic fern growing in cool shaded, amidst areas of secondary hill forest and by the side of river.

Distribution : India : Assam, Arunachal Pradesh; Bangladesh, Malaya Islands, Philippines.

Status and Conservation measures proposed : Extremely rare; the species is of academic interest and attractive due to large foliage. *In situ* conservation is recommended. *Ex-situ* conservation in Botanical garden of similar habitats may also tried.

6. **Diacalpe aspidioides** Bl., Enum. Pl. Jav. 241. 1828; Bedd., Ferns South India t. 257. 1865; Handb. Ferns Brit. India 18, t. 7. 1883; Dixit, Cens. Ind. Pter. 146. 1984. *Peranema aspidioides* Bl., Enum. Pl. Jav. 241. 1828. (Peranemaceae).

Large fern. Rhizome erect; stipe scaly at base, reddish brown, fronds tripinnate, membraneous; rachis scaly; pinnae alternate, 10-25 mm long, 7-10 mm wide; pinnules deeply lobed; lobes near to the costa, decurrent at base, apex acute, obtuse or obliquely 2 lobed, glabrous, veinlets not reaching the margin, 2-4 mm long, 1-1.2 mm wide. Sori medial on the anterior lower veinlets, globose, indurate.

Specimens examined : MANIPUR : Makuikhong forest, 1600 m., 1984, *Ghosh* 16526.

Ecology : Abundant in the forest floor in between 1524-1829 m altitude.

Distribution : India : Himalayas, Manipur; Nepal, Bhutan, Burma, China, Malaya Islands, Philippines, New Guinea, Sri Lanka.

Status and Conservation measures proposed : Rare. Introduction trails into the botanic gardens should be made.

7. **Dictyocline griffithii** Moore, Gard. Chron. 854. 1855 ; Bedd., Ferns Brit. India t. 155. 1867. Dixit, Cens. Ind. Pter. 108. 1984. *Hemionitis griffithii* Hook. et Thomson in Hook. Sp. Fil. 5. 193. 1864; Bedd. Handb., Ferns Brit. India 415. t. 246. 1883. (Thelypteridaceae).

Rhizome creeping; stipes 16 22 cm long, hirsute, paleaceous; fronds sub-deltoid, pinnatifid or pinnate, 2 4 pairs when pinnate, 80 90 mm long, 20 25 mm wide, apex acuminate, margins entire or crenate, rachis and venation hairy on both surfaces, veinlets reticulated, areoles all soriferous.

Specimens examined : MEGHALAYA : Jaintia hills Jowai Jorain forest, 1982, *Dixit* 32055, 32087 (BSA, CAL).

Ecology : Growing in rock crevices along flowing stream.

Distribution : India : Meghalaya, Eastern Himalayas; Tonikin, Formosa, China, Japan, Malaya.

Status and Conservation measures proposed : Abundant. Efforts should be made to conserve the species by *ex-situ* measures.

8. **Didymochlaena truncatula** (Sw.) J. Sm. in Journ. Bot. 4 : 196. 1841 ; Dixit, Cens. Ind. Pter. 140. 1984. *Aspidium truncatulum* Sw., Schrad. Journ. Bot. 1800(2) : 36. 1801 ; *Didymochlaena lunulata sensu* Bedd., Ferns

.Brit. India t. 15. 1865; Handb., Ferns Brit. India 199. t. 99. 1883; Suppl. 42. 1892. (Aspidiaceae).

Rhizome erect, sub-arborescent; stipe reddish-brown, scaly throughout, densely covered at base, scales 7-25 mm long, 1-3 mm wide, linear-oblong, acute; fronds densely tufted, auriculate with the rachis, 1.5-1.8 m long, bipinnate; pinnules subquatrangular, dimidiate, slightly sinuate; veinlets forked. Sori elliptical, 2-6 to a pinnule intramarginal and terminal on a veinlet, 2-3 mm long; indusium elliptical.

Specimens examined : MANIPUR : Tamenlong, 1200 m., 1984, *Ghosh* 16492 A & B.

Ecology : Along stream sides in the forest floor in open places.

Distribution : India : It is mainly confined to the Eastern India ; Burma, Malaya Peninsula, Tropical America, East African Islands, Malay Islands, Fiji.

Status and Conservation measures proposed : Abundant. The introduction of the species in botanic gardens should be undertaken.

9. Gymnogrammites dareiformis (Hook.) Ching, ex Tard. et Christ, Notul Syst. Paris 6 : 2. 1937; Dixit, Cens. Ind. Pter. 172. 1984. *Polypodium dareiformis* Hook., 2nd Cent. Ferns t. 24. 1860; Bedd., Handb., Ferns Brit. India 316. t. 169. 1883. *Acrophorus hookeri sensu* Bedd. Ferns Brit. India t. 95. 1865. (Gymnogrammittidaceae).

Rhizome creeping, stout, densely covered by filiform golden scales; stipes 80-100 mm long, glossy, glabrous; fronds 160-180 mm long, 70-85 mm wide, 3-4 pinnate; pinnae lanceolate-deltoid, 20-35 mm wide; secondary pinnae 4-6 mm long; tertiary pinnae 1-1.5 mm long, forked; ultimate segments filiform, blunt; rachis glossy; veins one to each ultimate segments, not reaching the margin, thickened at the apex. Sori extending beyond the margins of the segments, exindusiate.

Specimens examined : SIKKIM : Sikkim Himalayas, 1883, *King's Coll. s.n.*, Acc. No. 3788.

Ecology : Among rock boulders along stream side at the elevation of 1220-1524 ft.

Distribution : India : Himalayas, Meghalaya. Endemic to India.

Status and Conservation measures proposed : Endangered. Protection of habitat and introduction in botanic gardens should be taken on priority to same this ornamental species.

10. Helminthostachys zeylanica (Linn.) Hook., Gen. Fl. t. 47. 1840; Bedd., Handb., Ferns Brit. India 467. t. 292. 1883; Suppl. 109. 1892; Dixit, Cens. Ind. Pter. 21. 1984. *Osmunda zeylanica* Linn. Sp. Pl. 2 : 1063. 1753. (Helminthostachyaceae).

Rhizome creeping, fleshy; stipes 24-30 cm long, barren segments palmately pinnate (forked two limes), ultimate lobes linear-oblong, 70-80 mm long, 10-15 mm wide, apex acuminate, margins entire to slightly undulate-dentate. Fertile spike solitary from the base of the sterile segments, 60-80 mm long, 10-12 mm wide.

Specimens examined : WEST BENGAL : Malda, Bhaluka Road, 1966, *Dutta* 506. GREAT NICOBAR : Pulobha, 1984, *Sanjappa* 17877.

Ecology : Growing on the forest floor of swampy places.

Distribution : India : Uttar Pradesh, West Bengal, Assam, South India, Nicobar Islands; Sri Lanka, Malaya Peninsula, China, Japan, Philippines, Soloman Islands, New Caledonia, New Guinea, Australia.

Status and Conservation measures proposed : Rare to endangered. Habitat should be preserved as a part of *in-situ* conservation measures. Rhizome is used by Adivasis in Uttar Pradesh as tonic.

11. Idiogramma microphylla (Hook.) Ghosh in J. Econ. Tax. Bot. 4(3) : 982. 1983; Dixit, Cens. Ind. Pter. 79. 1984. *Gymnogramme microphylla* Hook., Icon. Pl. 10 : t. 916. 1854; Bedd., Handb., Ferns Brit. India 384. t. 221. 1883. *Anogramma microphylla* Diels, Nat. Pflanz. 1(4) : 259. 1899; Clarke in Trans. Linn.



Fig. 3. *Helminthostachys zeylanica* (Linn.) Hook

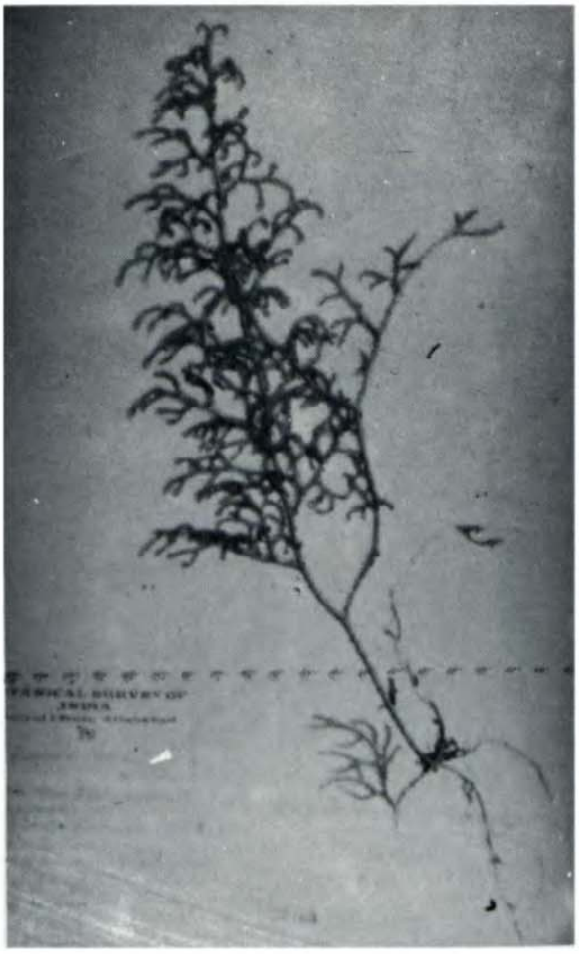


Fig. 4 *Palhinhaea cernua* (Linn.) Franco. + Vasc.
Arunachal Pradesh : Senkie view, *Dixit* 32103 (BSA)

Soc. Lond. II. Bot. 1 : 569. 1880. *Grammitis microphylla* Bedd., Ferns Brit. India t. 148. 1866. (Hemionitidaceae).

Rhizome shortly creeping; stipes densely tufted, shining dark brown, slender, fragile; fronds 25-60 mm long, deltoid, quadripinnatifid; pinnae close; pinnules deltoid 1-3 mm long, 0.8-1 mm wide, pellucid-herbaceous; veins and sori one to each ultimate segments.

Specimens examined : SIKKIM : 1100 m., 1882, *King's Coll. s.n.*

Ecology : Growing in 1524 to 3049 m altitude in the forest floor.

Distribution : India : Eastern part, Eastern Himalayas; China.

Status and Conservation measures proposed : Rare. Habitat should be preserved as a part of *in-situ* conservation measures. *Ex-situ* conservation is also recommended.

12. Kuniwatsukia cuspidata (Bedd.) Pic. Ser., Webbia 28 : 454. 1973. Dixit, Cens. Ind. Pter. 136. 1984. *Lasterea cuspidata* Bedd., Ferns Brit. India 2 : III, IV et correct. 348. 1870; Handb., Ferns Brit. India 232. t. 119. 1883. *Polypodium elongatum* Wall. ex Hook., Sp. Fil. 4 : 234. 1862; Bedd. Ferns Brit. India t. 118. 1865. *Microchlaena cuspidata* (Bedd.) Ching, Acta Phytotax. Sin. 9 : 99. 1964. (Athyriaceae).

Rhizome erect; stipes 25-27 cm long, scaly at base, reddish-brown; fronds 30-75 cm long; pinnae numerous, linear-lanceolate, 8.0-12.0 cm long, 1-1.3 cm wide, cuspidate at base, margins serrated, apex gradually narrowed; veins pinnate with 3-4 veinlets on each side. Sori towards the base of the veinlets; indusium reniform, fugacious.

Specimens examined : MANIPUR : Tamenlong, 1100 m, 1983, *Ghosh,* 59417.

Ecology : In the forest floor along flowing stream rooting in rock crevices.

Distribution : India : North-east Himalayas, Manipur; Nepal, Burma, S.W.China.

Status and Conservation measures proposed : Rare. Efforts should be made to conserve the species by preserving the natural habitat; trials of *ex-situ* conservation in botanical gardens should be made.

13. Leptogramma totta (Willd.) J. Sm. in Journ. Bot. 4 : 52. 1841, Bedd., Handb. Ferns Brit. India 377. t. 215. 1883; Dixit, Cens. Ind. Pter. 161. 1984. *Gymnogramma tottum* Schlecht., Adumb. 13. t. 6. 1825. *Grammitis totta* Presl., Tent. Pterid. 209. t. 9. f. 4. 1836; Bedd., Ferns South India .t. 49. 1863. *Thelypteris totta* (Schlecht.) Nayar & Kaur, Comp. to Bedd. Handb. 90. 1974. (Lomariopsidaceae).

Rhizome short, creeping; stipes sub-tufted, 12-15 cm long, pilose, scaly at base; fronds 25-38 cm long, 12-18 cm wide, pinnate, pilose; pinnae lanceolate, 0.7-3 cm wide, pinnatifid half-way to the midrib, lobes obtuse, entire or sub-entire, 3-5 cm wide, herbaceous in texture; veinlets simple. Sori linear-oblong, medial on veinlets.

Specimens examined : The species is abundant in distribution. However, the bundles of herbarium specimens seem to be misplaced.

Ecology : Grown in the hilly forest in between 915 to 1524 m elevation.

Distribution : India : All the States throughout in mountainous regions; Nepal, Bhutan, Sri Lanka, China, Japan, Malesia.

Status and Conservation measures proposed : Abundant. Efforts should be made for its introduction in botanic gardens, and further collection from the wild source should be prevented.

14. Lithostegia foeniculacea (Hook.) Ching, Sinensia 4 : 2. 1933; Dixit, Cens. Ind. Pter. 146. 1984. *Aspidium foeniculaceam* Hook. Sp. Fil. 4 : 36. t. 237. 1862. *Diacalpe foeniculacea* (Hook.) Clarke in Trans. Linn. Soc. Lond. II Bot. 1. 434. 1880; Bedd., Handb. Ferns Brit. India 18. 1883. *Lastrea foeniculacea* Bedd., Ferns Brit. India t. 36. 1865. (Lomariopsidaceae).

Rhizome long creeping ; stipes tufted. lower surface covered by scales; scales lanceolate, reddish-brown; fronds deltoid-lanceolate 30-61

cm long, 23-30 cm wide, 4-5 pinnatifid; lower pinnule 120-150 mm long, 60-90 mm wide; pinnules sub-deltoid, 40-50 mm long; secondary pinnules cut down to the rachis, lower lobes again pinnatifid; segments linear, acute, sub-coriaceous, glossy, hairy beneath. Sori globose; indusium leathery, spherical, dark purple.

Specimens examined : WEST BENGAL : Nerua valley, 2 km away from Pankhasari, 2600 m, 1984, *Ghosh* 58564.

Ecology : Growing in between 2134-3049 m altitude.

Distribution : India : Eastern Himalayas ; Burma, China.

Status and Conservation measures proposed : Rare. Its habitat should be protected. *Ex-situ* and *in-situ* conservation is recommended.

15. Luerssenia kehdingiana Kuhn in Bot. Centralbl. II : 77. 1882; C. Chr., Ind. Fil. 411. 1905. *Aspidium kehdingianum* Luerss. in msc. No. 9834 (*nom. nud.*) ex Christ, Farnkr. 235. 1897. (Aspidiaceae).

Rhizome thick, clothed with dark-brown scales, ovate-lanceolate, 2-5 × 1-20 mm, few scales persistent on stipes; fronds simple, sub-dimorphic, margins entire; sterile fronds on short stipes, 10-17 cm long, lamina broadest above the middle, elliptic lanceolate, 35-40 × 5-6.5 cm, gradually tapering on both the sides but long narrowly decurrent on the lower side, apex acute, texture thin and much fragile on drying; venation reticulate with free included vienlets. Fertile frond on much longer stalk, 40-50 cm long, lamina much narrow, 30-40 × 1.8-2.0 cm, oblong-lanceolate, long decurrent at the base. Sori indusiate, terminal on veinlets, elongated one in each areole, 1-6, in longitudinal rows.

Specimens examined : SOUTH NICOBARS : Great Nicobars, Campbell Bay, 20 m, 1978, *Nair* 7113 (PBL, CAL); East-side hills, 25 m, 1984, *Sanjappa & Chatterjee* 18044 (CAL).

Ecology : Growing in forest floor along stream sides.

Distribution : India : South Nicobar ; Western Sumatra (Lankat).

Status and Conservation measures proposed : Rare. Introduction trails into the botanic gardens should be made.

16. Lycopodiastrum casuarinoides (Spring) Holub ex Dixit, Journ. Bomb. Nat. Hist. Soc. 77(3) : 541. 1981. Dixit, Cens. Ind. Pter. 10. 1984. *Lycopodium causuarinoides* Spring, Mem. Acad. Sci. Belg. 15(1) : 92. 1843; 24(2) : 45. 1850. (Lycopodiaceae).

Stems scandent, stiff, dark straminaceous to red, branches remote, copiously compound, ultimate branchlets 10-25 cm long, pendulous. Leaves variable, scattered, decurrent and peltate at base, green to reddish green; branchlets more variable, decurrent with only a minute, persistent, free blade possing a long, subulate, hyaline, deciduous or persistent entire apex, sometimes with long aristate, free blade up to 3.0 mm long. Spikes 2.5-7.5 cm × 0.3-0.4 cm, cylindrical, panicled on the special branchlets; sporophylls ovate, ascending, margins scarious, cuspidate-acuminate.

Specimens examined : ASSAM : Jawapunji, 1500 m, Sept. 1892, *s. l.* 29476. MEGHALAYA : Khasi hills, Aug. 1890, *Collet* 48.

Ecology : In open forest floor between 1500 to 5000 m altitude.

Distribution : India : Eastern India; Bhutan, Burma, China, Malaya Peninsula, Malaya Islands, Philippine Islands, Japan.

Status and Conservation measures proposed : Endangered. Collection of plant material should be stopped and *ex-situ* conservation is recommended.

17. Palhinhaea cernua (Linn.) Franco. & Vasc. in Vasc. & Franco. in Bot. Soc. Broter. Ser. 2. 41 : 25. 1967; Dixit, Cens. Ind. Pter. 10. 1984. *Lycopodium cernuum* Linn., Sp. Pl. 2 : 1103. 1753; Clarke in Trans. Linn. Soc. Lond. II. Bot. 1 : 591. 1880. (Lycopodiaceae).

Rhizome subterranean, producing arborescent lateral stems, 0.4-2.0 m long with solitary, sessile,

pendulous, strobiloids in the ends of the branchlets; leaves linear-lanceolate, 3.0-5.0 cm long, glaucous-green to brownish-green at maturity, margins strongly revolute, sparsely ciliate at base, arcuate-ascending, sporophylls laciniate or dentate in the margins ; sporangia transversely ellipsoidal-globose, opening on the abaxial side by a fissure with laciniate margins, valves unequal.

Specimens examined : BIHAR : Singhbhum : Tholkobad, 18.3. 1964, *Gupta s. n.* WEST BENGAL : Darjeeling - Mungpoo, 1220 m, 14.1. 1909, *Kari* 51. SIKKIM : Gangtok, 1707 m, 20.10. 1952, *Biswas* 9779. ORISSA : Koraput, 1000 m., 18.9. 1970, *Nair* 40655. MADHYA PRADESH : Jaspur division, 4.5. 1964, *Arora* 5842. ASSAM : Umsaw, 2.1. 1960, *Ghatak* 31. MANIPUR : Irang, 1220 m, May, 1882, *Watt* 6908. MEGHALAYA : Khasia, *Oldham s. n.* TAMIL NADU : Salem Shevaroy hills, 1405 m., 18.3. 1962; *Ghatak* 13. KARNATAKA : Mysore Agalhatti, 1067 m, Feb. 1908, *Meebold* 8330. ANDAMAN ISLANDS : *Parkinson* 958.

Ecology : Growing on rocks in moist situations.

Distribution : Throughout the tropics of the world.

Status and Conservation measures proposed : Abundant but polymorphic species, collections from the wild condition should be stopped.

18. Pseudodrynaria coronans (Wall. ex Mett.) Ching, Sunyat. 6 : 10. 1941 ; Dixit, Cens. Ind. Pter. 52. 1984. *Polypodium coronans* Wall. Mett., Pol. 121. n. 242. t. 3f. 40, 41. 1857. *Drynaria coronans* J. Sm. in Journ. Bot. 4 : 61. 1841; Bedd., Ferns Brit. India t. 13. 1865; Handb., Ferns Brit. India 338. t. 187. 1883. (Hemionitidaceae).

Rhizome wide-creeping, thick, branched, clothed with golden scales; fronds large, arranged in a circle in young condition, firm coriaceous, translucent 15-50 cm long, base sessile, cordate, lobate-pinnatifid, then suddenly constricted, lanceolate, almost pinnatifid, lobes 12-20 cm long, 4-5 cm wide, oblong-lanceolate, acuminate, lower ones gradually shortened, more or less entire, margins incrassated; costules parallel, connected by transverse veins forming 5-6 soriferous areoles. Sori oval, solitary in primary areoles.

Specimens examined : ASSAM : Garo hills 1903, *Marten s. n.*

Ecology : Epiphytes, commonly found in between 152-915 m altitude.

Distribution : India : All the States throughout ; Nepal, Burma, Bangladesh, Malaya Peninsula, Hong Kong, Formosa.

Status and Conservation measures proposed : Abundant. Its habitat should be protected.

19. Quercifiliz zeylanica (Houtt.) Copel. in Philip. Journ. Sci. 37 : 408. 1928; Dixit, Cens. Ind. Pter. 142. 1984. *Ophioglossum zeylanicum* Houtt., Nat. Hist. 14 : 43. 1783. (Lomariopsidaceae).

Rhizome creeping, stout, scaly, stipes 2-5 cm long, clothed with soft spreading reddish brown hair; barren fronds oblong, 7-10 cm long, 5-6 cm wide, terminal pinnae ovate, obtuse, lobes sometimes 1/4 to costa, basal pair with small, sessile round to ovate auricled segments, apex obtuse, truncate or sub-cordate at base, herbaceous; main veins distinct to the edge, hairy beneath, areoles copious. Fertile fronds truncate on long slender stipes; stipes 15-20 cm long, naked, hairy at base; terminal segments linear, 2-5 cm long, 2-2.5 cm wide, entire, lateral segments erecto-patent, similar but smaller.

Specimens examined : Specimens are not available in the herbarium CAL. All the reports are given here based on literature.

Ecology : Lithophytes; plants rooting in rock crevices along streams.

Distribution : India : Southern India; Sri Lanka, Malesia to Polynesia, China.

Status and Conservation measures proposed : Rare. Its habitat should be protected. Efforts should be made to locate the species in other adjoining areas and introduced in botanic gardens.

20. Sinephropteris delavayi (Franch.) Mick. Britt. 28(3) : 327. f. 1-2, 1976; Dixit, Cens.

Ind. Pter. 123. 1984. *Scolopendrium delavayi* Franch. in Bull. Soc. Bot. Fr. 32 : 28. 1885; Bedd., Handb., Ferns Brit. India Suppl. 41. 1892. (Aspleniaceae).

Rhizome oblique, stout, clothed with thick lanceolate, subulate scales; stipes 60-90 cm long, deep brown, shining, glabrous; fronds pellucid, thin, entire, orbicular to sub-orbicular, 0.7-3 cm in diam., cordate at base, sinus opened or closed, margin hyaline, midrib absent, veins repeatedly forked. Sori elongate, not reaching at the apex, indusiate.

Specimens examined : Specimens are not traceable in the herbarium CAL.

Ecology : Plants rooting in rock crevices near flowing stream.

Distribution : India : Sikkim, Manipur ; Tibet, China.

Status and Conservation measures proposed : Rare and endangered. Introduction of live plants into botanic gardens for *ex-situ* conservation. *In situ* conservation is also recommended.

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