FERNS OF ASSAM

4.1 **Key to Families**

1a. Aquatic or marshy plants
  2a. Plants free-floating
    3a. Sporocarps in branches ; normal leaves above 0.8 x 0.5 cm ---------- **SALVINIACEAE**
    3b. Sporocarps in pairs ; normal leaves minute, below 1 x 0.8 mm, covered by simple trichomes ---------- **AZOLLACEAE**
  2b. Plants rooted in mud
    4a. Leaves distinctly 4-lobed ; sporangia in sporocarp at the base of the stipes ---------- **MARSILEACEAE**
    4b. Leaves not 4-lobed, pinnately compound ; sporangia on narrow leaflets with reflexed edges ---------- **PARKERIACEAE**
1b. Terrestrial or epiphytic plants
  5a. Sporangia borne on erect stalked spikes or panicles
    6a. Fertile segments paniculate, panicle borne terminaly above the base of the blade ---------- **OSMUNDACEAE**
    6b. Fertile segments a simple spike ; spike borne near the base of the blade
      7a. Blade simple ; veins anastomosing ---------- **OPHIOGLOSSACEAE**
      7b. Blade compound ; veins free ---------- **HELMINTHOSTACHYACEAE**
  5b. Sporangia borne on abaxial surface or edges of the fronds ; if on spike like outgrowths, these unstalked and at the apex of the fronds
    8a. Sporangia wall more than one cell in thickness ; annulus absent, dehisching by a slit into 2 valves ---------- **ANGIOPTERIDACEAE**
    8b. Sporangia wall one cell in thickness ; annulus well developed, dehiscence various.
      9a. Fronds twining, indefinite growth in length ---------- **LYGODIACEAE**
      9b. Fronds not twining, each usually of limited growth
        10a. Lamina one cell in thickness, filmy ----------**HYMENOPHYLLACEAE**
        10b. Lamina more than one cell thick, not filmy.
          11a. Tree ferns with a trunk-like stem ---------- **CYATHEACEAE**
          11b. Not distinctly tree ferns
            12a. Exindusiate
              13a. Sori acrostichoid, fronds dimorphic
                14a. Rhizome climber ---------- **STENOCHLAENACEAE**
                14b. Rhizome not climber
                  15a. Lamina ending with a vegetative bud at the tip ---------- **BOLBITIDACEAE**
                  15b. Lamina not ending with vegetative bud ---------- **PLAGIOGYRIACEAE**
              13b. Sori not acrostichoid ; if acrostichoid fronds not dimorphic
                16a. Sori linear, confluent
                  17a. Linear sori oblique to costa

18a. Lamina simple, obovate to oblanceolate ---------- **LOXOGRAMMACEAE**
18b. Lamina pinnate ; if simple, hastate or sagittate ---------- **HEMIONITIDACEAE**
17b. Linear sori marginal or parallel to margin
19a. Sori along the margin in grooves ; veins anastomosing only near the margin ---------- **VITTARIACEAE**
19b. Sori all along the veins ; veins copiously anastomosing throughout the surface ---------- **ANTROPHYACEAE**
16b. Sori round
20a. Fronds fan-shaped, deeply cleft into 2 halves, each part dichotomously lobed
21a. Epiphytes ; fronds dimorphic ; sori covered by stellate hairs ---------- **PLATYCERIACEAE**
21b. Terrestrials ; fronds monomorphic ; stellate hairs absent in sori ---------- **DIPTERIDACEAE**
20b. Fronds otherwise
22a. Lamina pseudodichotomously repeatedly forked with a dormant bud at the forking
23a. Rhizome clothed with multicellular hairs ; veins forked twice or more ---------- **DICRANOPTERIDACEAE**
23b. Rhizome not hairy ; veins forked only once ---------- **GLEICHENIACEAE**
22b. Lamina not dichotomously forked
24a. Predominently epiphytes, rarely terrestrials ; lamina simple, pinnatifid or rarely pinnate
25a. Humous collecting distinct, separate sterile fronds present ---------- **DRYNARIACEAE**
25b. Humous collecting fronds mostly absent, if present not separate, represented by leaf bases only ---------- **POLYPODIACEAE**
24b. Terrestrials ; lamina bipinnatifid to tripinnate ---------- **THELYPTERIDACEAE**
12b. Indusiate
26a. Rhizome hairy
27a. Sori continuous along the edge of leaflets ---------- **PTERIDIACEAE**
27b. Sori single at the ends of single vein
28a. Rhizome erect ; trunk massive ; indusia 2-lipped ---------- **DICKSONIACEAE**
28b. Rhizome creeping ; trunk not massive ; indusia not 2-lipped
29a. Indusia attached at base of sorus -------- **DENNSTAEDTIACEAE**
29b. Indusia consisting of small reflexed marginal flap ---------- **HYPOLEPIDACEAE**
26b. Rhizome scaly or scales mixed with hairs
30a. Sori linear
31a. Indusia formed by reflexed marginal flaps
32a. Marginal flaps meeting at the costa ---------- **CRYPTOGRAMMACEAE**
32b. Marginal flaps restricted to submarginal region

33a. Fronds with white powdery beneath ----------**CHEILANTHACEAE**
33b. Fronds without white powdery beneath
34a. Pinnules dimidiate ; stipes dark and polished ---------- **ADIANTACEAE**
34b. Pinnules not dimidiate ; stipes straw coloured ---------- **PTERIDACEAE**
31b. Indusia not formed by reflexed margin
35a. Sori linear on both sides of the costa ---------- **BLECHNACEAE**
35b. Sori otherwise
36a. Sori marginal, at the tip of veins ---------- **LINDSAEACEAE**
36b. Sori not marginal, along the veins
37a. Scales clathrate ; indusia single ---------- **ASPLENIACEAE**
37b. Scales never clathrate ; indusia usually double ----- **ATHYRIACEAE**
30b. Sori round or reniform
38a. Lamina simple ---------- **OLEANDRACEAE**
38b. Lamina variously compound
39a. Sori stalked ---------- **PERANEMATACEAE**
39b. Sori not stalked
40a. Stipes articulate on rhizome
41a. Lamina simple pinnate ; indusia round to reniform ---------- **NEPHROLEPIDACEAE**
41b. Lamina decompound ; indusia halfcup-shaped ----- **AVALLIACEAE**
40b. Stipes not articulate on rhizome
42a. Lamina covered by unicellular hairs ; veins of adjacent groups unite to form an excurrent vein --- **THELYPTERIDACEAE**
42b. Lamina glabrous or with multicellular hairs ; excurrent vein absent
43a. Rachis grooved on the upper surface and open to rachilla grooves ; ctenitis hairs absent -------- **DRYOPTERIDACEAE**
43b. Rachis not grooved or if grooved not open to rachilla grooves ; ctenitis hairs usually present along the dorsal surface of rachis, rachillae and costae ---------- **ASPIDIACEAE**

4.2 Enumeration of Species

Class : **OPHIOGLOSSOPSIDA**
Subclass : **OPHIOGLOSSIDAE**
Order : **OPHIOGLOSSALES**

HELMINTHOSTACHYACEAE Ching

Helminthostachys Kaulf.
Enum. Fil. 28. 1824.

A monotypic genus occuring in Sri Lanka, Malay Peninsula, China, Japan, Philippines, Solomon Islands, New Caledonia, New Guinea, Australia and India.

Helminthostachys zeylanica (L.) Hook. Gen. Fil. t. 47. 1840 ; Bedd. Handb. Ferns Brit. India, 467. t. 292. 1883 ; Suppl. 109. 1892 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 32.1982 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 55. t. 33. 1992. *Osmunda zeylanica* L. Sp. Pl. 2. 1063. 1753.

Rhizome creeping, *ca* 1 cm in diameter, fleshy, tuberous, glabrous. Stipe solitary, *ca* 30 - 45 x 0.6 cm, glabrous, pale brown at base, greenish above. Lamina palmately pinnate, *ca* 30 cm in diameter, ternately divided in three principal divisions which are stalked, and again forked or pinnate, the ultimate divisions *ca* 8 - 13 x 3 cm, oblong-lanceolate, apex acute or acuminate, base cuneate, glabrous, green, margin irregularly wavy, texture herbaceous, costa slightly raised and rounded below, grooved above ; veins distinct, forked once or twice, free, parallel, reaching the margin. Fertile branch solitary, arising from the base of the sterile lamina with stalk, *ca* 10 - 18 x 0.2 cm and stipe *ca* 7 - 15 x 0.9 cm. Sporangia borne superficially on the stipe, numerous. Spores globose, dark, exine reticulate (Pl. 6).

Fertile : July - Nov.

Distrib : (a) Sri Lanka, Malay Peninsula, China, Japan, Philippines, Solomon Islands, New Caledonia, New Guinea, Australia ; (b) Bengal plains, Himalayas, UttarPradesh, South India.

Occur : Very rare ; in moist, shady humous covered forest floor and on open moist roadside slopes. Deomornoi, Darrang dist. 327.

Uses : The young fronds and fleshy rhizomes are eaten in Gorakhpur, Garhwal, Assam ; the fronds are aperient, intoxicant, anodyne and used in sciatica ; young leaves are used as salad or cooked as vegetable in Philippines ; tender stalks eaten in Malaya ; rhizome used in dysentery, catarrah, sciatica, malaria and also as tonic and mild aperient (Chopra *et al* 1956, 1969 ; Dixit & Vohra 1984). Leaf juice relieves blisters on tongue and rhizome is used to treat impotency and jaundice (Ambasta 1986 ; Jain 1991 ; Asolkar *et al* 1992).

OPHIOGLOSSACEAE (R. Br.) Agardh

Six species, one subspecies, four varieties and three forma under two genera have been recorded from India (Dixit 1984). Four species of the genus *Ophioglossum* have been encountered in the present study.

Ophioglossum L.

Sp. Pl. 2. 1062. 1753.

Panigrahi & Dixit (1969b) have reported nine species and a variety under the genus from India, while Dixit (1984) has listed five species, one subspecies, four varieties and three forma. Dixit & Vohra (1984) have mentioned that fourteen species are occuring in India. In the present study only four species have been recorded.

Perennial, terrestrial herbs ; rhizome, erect, subterranean, short, fleshy or tuberous ; roots in cluster, slender, thick, proliferating. Fronds simple, linear to cordate-acuminate, entire, erect and not circinate ; venation reticulate. Fertile segments simple, springing from the sterile ones with a compact and stalked spike ; sporangia in two rows, without annulus and dehiscing transversly. Spores numerous per sporangium, trilete, circular.

KEY TO SPECIES

1a. Common stalk very short or absent ---------- --- --- --- --- --- --- --- ---- ---- ***costatum***
1b. Common stalk present and more than 3 cm long
  2a. Veins passing through the base of blade 15 - 20 ;
    blade typically oblong-ovate ---------- --- ***vulgatum***
  2b. Veins passing through the base of blade 6 - 10 ; blade other than oblong-ovate
    3a. Blade typically cordate ; exine of spores finely muricate --- --- ------ ***reticulatum***
    3b. Blade typically lance-ovate ; exine of spores minutely reticulate -- --- -- --- ***petiolatum***

Ophioglossum costatum R. Br. Prod. Fl. Nov. Holl. 163. 1810. *O. fibrosum* Schum, Beskr. Guind. Pl. 452. 1827 ; Bedd. Hnadb. Ferns Brit. India, 465. t. 289. 1883 ; Suppl. 109. 1892. *O. brevipes* Bedd. Ferns South. India, 23. t. 72. 1864. *O. bulbosum* Bedd. Ferns Brit. India Suppl. 28. 1876.

Rhizome short, erect, with a large, round, white bulb with numerous fibrous rootlets. Common stalk very short with the sterile blade close to its base ; blade *ca* 4 - 5 x 2 - 3 cm, lanceolate, apex acute or obtuse, base cuneate, margin entire ; texture thick and opaque ; midrib prominent or there are 2 - 3 strong central veins running parallel and close to each other, which fork more or less upwards and disappear well short of the apex of the lamina, veinlets free and forked in the areoles ; fertile stalk *ca* 10 - 12 cm long, 0.2 cm broad, glabrous. Spike *ca* 4 - 5 x 0.3 cm, linear lanceolate, apex acute ; sporangia 9 - 12 pairs. Spores trilete, circular (Pl. 7).

Fertile : Mar. - May.

Distrib : (a) Africa, Comores Archipelago, Madagascar, Sri Lanka, Sumatra to East Australia and New Zealand ; (b) North-West to Eastern Himalayas, Madhya Pradesh, West Bengal, Maharastra.

Occur : Rare ; on sandy habitats on exposed grasslands along rivulets. Kulsi, Kamrup dist.1774.

Ophioglossum petiolatum Hook. Exot. Fl. 1. t. 56. 1823 ; Nayar & Kaur, Comp. Bedd. Handb. 106.1974 ; Dhir, Ferns N. W. Himalayas, 26. 1980 ; Jamir & Rao. Ferns Nagaland, 38. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 52. t. 30. 1992.

Rhizome short, erect, *ca* 1 - 1.5 cm, cylindrical, bearing one or more fronds. Stipes *ca* 3 - 8 x 0.2 - 0.3 cm, grey-green, glabrous ; sterile blade *ca* 3 - 6 x 0.5 - 1.5 cm, sessile or shortly stalked, ovate-lanceolate slightly cuneate or subcordate at base, apex acute, margin slightly thickened, midrib not distinct, veins 6 - 10, passing up from the base of the blade, one or two median veins slightly distinct at the middle of the blade, areoles including one or more free veinlets. Fertile

portion stalked, *ca* 2 - 10 x 2 cm thick ; spike simple, *ca* 2 - 5.5 x 0.2 - 0.4 cm ; sporangia embedded in 2 rows on either side of the spike. Spores finely reticulate (Pl. 8).

Fertile : May - June.

Distrib : (a) Tropics and Temperate region of the world ; (b) Madhya Pradesh, Uttar Pradesh, South India.

Occur : Not common ; grows in moist exposed grassy areas during rainy season. Mangaldai, Darrang dist. 617.

Ophioglossum reticulatum L. Sp. Pl. 2. 1063. 1753 ; Bedd. Ferns South. India, 23. t. 70. 1864 ; Handb. Ferns Brit. India, 465. t. 291. 1883 ; Suppl. 109. 1892 ; Dhir, Ferns N.W. Himalayas, 26. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 33. 1982 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 51. t. 29. 1992.

Jibha (Ass.).

Rhizome short, erect, cylindrical, tuberous, *ca* 1 x 0.5 cm, elongated with many fibrous rootlets, bearing one or two fronds. Common stipe *ca* 7 - 10 x 0.2 cm, slender, dark-green, scaly at base, glabrous above ; sterile blade placed a little below the middle, simple, *ca* 2.5 - 5 x 2 - 4 cm, spathulate-cordate, apex blunt or acute, entire ; texture sub-membranous to coriaceous ; veins reticulate, midrib not well differentiated. Fertile segment arising from the base of the sterile blade, bearing *ca* 6 - 10 x 0.2 cm, slender stalk and *ca* 3 x 0.2 cm, oblong-lanceolate spike. Sporangia 15 - 40 in each row, globose. Spores oval to round, light yellow, exine finely muricate (Pl. 9).

Fertile : Oct. - Feb.

Distrib : (a) Malay Peninsula, Polynesia, Tropical America, Africa, Philippines, Sri Lanka ; (b) throughout India from the plains to the mountainous regions.

Occur : Frequent on moist coarse, sandy soil among grasses and sedges. Mangaldai, Darrang dist. 619 ; Jalukbari, Kamrup dist. 1938.

Uses : The fresh fronds are eaten as vegetable in curries (Dixit & Vohra 1984 ; Ambasta 1986 ; Jain 1991). *Ophioglossum* in general is used as a cooling agent and in the treatment of inflammations and wounds. Fronds are used as tonic and styptic used in contusions and haemorrhages. 'Green oil of Charity' is used in England as a vulnerary and remedy for wounds (Dixit 1959).

Ophioglossum vulgatum L. Sp. Pl. 2. 1062. 1753 ; Bedd. Handb. Ferns Brit. India, 464. 1883 ; Suppl. 109. 1892 ; Dhir, Ferns N.W. Himalayas, 26. 1980 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 49. t. 28. 1992.

Rhizome erect, short or elongated, cylindrical, producing 1 or 2 fronds annually. Common stalk slender, *ca* 12 x 0.3 cm, bearing a sterile blade and spike ; blade *ca* 3 - 7 x 1.5 x 3 cm, sessile or shortly stalked, ovate or oblong-ovate, slightly narrowing from the middle upward, apex rounded or obtuse, cuneate base, margin entire, midrib usually indistinct, 15 - 20 veins passing up through the stalk, some distinctly seen nearly upto the apex and connected by oblique veinlets, the rest forming polygonal areoles. Fertile stalk *ca* 7 - 11 x 0.2 cm, spike linear-oblong, *ca* 1.5 - 3.5 x 0.2 - 0.4 cm, slightly narrowing towards the apex. Spores with a coarsely reticulate exine (Pl. 10).

Fertile : May - July.

Distrib : (a) Temperate zones on the whole northern hemisphere ; (b) N.W. Himalayas, South India.

Occur : Common in grassy areas during rainy season. Mangaldai, Darrang dist.620 ; Bhairabkunda, Darrang dist. 1521.

Uses : The plant is held in Spain as a vulnerary of great repute. The plant yields a mucilaginous and astringent decoction which in used is angina in La Reunion. The fronds are considered tonic and styptic and are used in contusions, wounds and haemorrhages. A warm decoction of the rhizomes is used by the Sutos as lotion for boils(Manickam & Irudayaraj 1992). In Northeastern India rhizomes are used to treat boils and leaves to heal wounds (Ambasta 1986 ; Jain 1991).

Class : **MARATTIOPSIDA**
Subclass : **MARATTIIDAE**
Order : **MARATTIALES**

ANGIOPTERIDACEAE Fée ex Bonner

Angiopteris Hoffm. *nom. cons.*
Comm. Soc. Reg. Sci. Gotting 12. 29. 1793-94.

Dixit (1984) has listed fifteen species from India and Dixit & Vohra (1984) mentioned that twelve species are occuring in India. Some authors prefer to recognise only *Angiopteris evecta* as a highly variable species occuring in South-East Asia including India and used to list all other described species of *Angiopteris* within this species as varieties. Holttum (1978) made extensive observations on the problems of taxonomic delimitation in the genus *Angiopteris* and concluded that a large number of species of *Angiopteris* probably exist but that most existing herbarium material can not be used to describe them adequately. He listed several characters that one required to observe in the filed to distinguish between the species. Only one species is occuring in the area of present study.

Angiopteris evecta (Forst.) Hoffm. Comm. Soc. Reg. Gott. 12. 29. t. 5. 1793-94 ; Bedd. Ferns South. India, t. 78. 1864 ; Handb. Ferns Brit. India, 460. t. 285. 1883 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 34. 1982 ; Jamir & Rao, Ferns Nagaland, 39. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 56. t. 34. 1992. *Polypodium evectum* Forst. Prodr. 81. 1786.

Rhizome erect, cylindrical, broad, *ca* 24 cm in diameter, fleshy, pink inside. Stipes *ca* 166 x 5 cm, swollen at base, adaxially flattened, abaxially rounded, whitish linear streaks all over, with small brown scales and minute hairs. Lamina *ca* 1 - 3 m long, bipinnate ; pinnae *ca* 6.5 - 100 x 25 cm, subopposite, with *ca* 3 cm long swollen stalk, oblong-lanceolate, with a terminal pinnule similar to lateral ones ; pinnules *ca* 10 - 25 x 1 - 2.5 cm, subopposite, shortly stalked, oblong-lanceolate, acuminate, base subtruncate or cuneate, serrate, particularly towards apex ; texture herbaceous ; veins simple or forked twice, almost parallel, reaching the margin. Sori sub-marginal, ellipsoid ; sporangia upto six pairs in two rows, which is boat-shaped. Spores hyaline, tetrahedral, pale green (Pl. 11 ; Ph. 11).

Fertile : Feb. - Nov.

Distrib : (a) China, Japan, Tropical Australia, New Caledonia, Madagascar, Malaysia to Polynesia ; (b) throughout India.

Occur : Common in dense natural forest. Jorabat, Kamrup dist. 734 ; Jalukbari Kamrup dist. 552.

Uses : The massive stem is cooked and eaten by tribals of Assam ; an intoxicating drink called 'ruchshi' is also made out of it. The stem is widely used as a base for transporting orchids (Dixit & Vohra 1984). Base of the stipe is used in the treatment of leprosy and

the roots as a cure of ribs pain (Jain 1991). The plants yield an aromatic oil and is used for perfuming coconut oil in South Sea Islands (Manickam & Irudayaraj 1992).

Note : The present gatherings are highly variable in number of pairs of pinnae, number of pinnules on each pinna, size and shape of pinnules and colour of rhizomes. In some cases the rhizomes are pink inside, while in others the rhizomes are colourless. Further detail studies on the plants occuring in the area of present study is needed for clear taxonomic judgement as suggested by Holttum (1978).

Class : **FILICOPSIDA**
Subclass : **OSMUNDIDAE**
Order : **OSMUNADALES**

OSMUNDACEAE Berch. *et* Presl

Osmunda L.
Sp. Pl. 2.1063. 1753.

Dixit (1984) has listed four species and a variety from India. Dixit & Vohra (1984) mentioned that five species are occuring in India. Baishya (1993) reported the occurance of *Osmunda javanica* Bl. from Arunachal Pradesh. Only one species is recorded in the present study.

Osmunda regalis L. Sp. Pl. 2. 1063. 1753 ; Bedd. Ferns South. India. 26. t. 76. 1864 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 583. 1880 ; Bedd. Handb. Ferns Brit. India, 450. t. 276. 1883 ; Dhir, Ferns N.W. Himalayas, 27. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 36. 1982 ; Jamir & Rao, Ferns Nagaland, 41. 1988. *O. hugeliana* (Presl) Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 59. t. 36. 1992.

Royal Fern (Eng.).

Rhizome erect or sub-erect, *ca* 8 x 2 - 4 cm, scales absent. Stipes 15 - 30 x 0.3 cm, tufted, erect, glabrous, shinning, shallowly grooved above, rounded below, brown. Lamina *ca* 20 - 40 x 15 - 25 cm, bipinnate, distal one-fifth part of lamina bearing sporangia. Sterile pinnae *ca* 10 - 13 cm, opposite, spreading, short stalked, narrowly deltoid, upto 10 pairs ; pinnules *ca* 4 - 5 x 1.5 - 2 cm, oblong-lanceolate, apex obtuse or rounded, base broadly cuneate, sessile or shortly stalked, margin serrulate, texture coriaceous, costa and costules distinct, venation free, 1 - 2 forked ; pinnae pale-green to brown, glabrous. Fertile pinnules compressed, segments linear, 1 - 1.5 cm long ; sporangia attached all over the branches. Spores trilete, globose, with spinulose exine (Pl. 12).

Fertile : Feb. - Oct.

Distrib : (a) Throughout the World at 1000 to 5,3000 m altitude ; (b) Meghalaya, Nagaland, Uttar Pradesh, N. W. Himalayas, Madhya Pradesh, Tamil Nadu, Kerala, Maharastra, Karnataka.

Occur : Rare ; growing along the forest margin and on moist, shaded roadsides. Rowta forest, Darrang dist. 1362.

Uses : Fronds are used as tonic, styptic, and also for rickets, rheumatism and for intestinal gripping (Dixit 1959 ; Dixit & Vohra 1984). The rhizome is used as abortifacient (Jain 1991). Roots mucilaginous, tonic, stimulant and styptic. Aquous extract is given in intestinal gripe and also in rheumatism ; it is said to have antibacterial activity. Also given for dysentery, rickets and muscular debility. Fronds form a constituent of diuretic drinks given for swellings ; tender shoots used in balms and healing plasters (Ambasta 1986).

Subclass : **PLAGIOGYRIIDAE**
Order : **PLAGIOGYRIALES**

PLAGIOGYRIACEAE Bower

Plagiogyria (Kunze) Mett.
Abh. Senckneb. Naturf. Ges. 2. 265. 1858.

Terrestrial herbs. Rhizome erect, stout, short, not scaly. Stipe wide, flattened at base with a triangular or subquadrangular ridge, aerophores on each side of the ridge. Lamina simple pinate, lanceolate, dimorphic ; fertile ones longer than the sterile ones with much narrower pinnae ; veins free, dichotomously forked. Sori on whole length of the pinnae except the midrib, sporangia stalked ; annulus complete, oblique, dehiscing laterally. Spores round to triangular, trilete, exine granulose.

Sixteen species have been listed from India by Dixit (1984) and Dixit & Vohra (1984). Of these, only two species have been recorded from the area of present study.

KEY TO SPECIES

1a. Pinnae stalked throughout with truncate base ; lamina glaucous on lower surface, margin sharply serrate ---------- --- --- -------- --- --- --- --- ***glaucescens***

1b. Pinnae sessile, rarely a few basal pinnae very shortly stalked, cuneate at base ; lamina not glaucous, margin finely serrulate ------- --- --- --- --- ***euphlebia***

Plagiogyria euphlebia (Kunze) Mett. Fern. Plagiog. 10. 1857 ; Bedd. Ferns Brit. India, 1866 (*pro parte* excl. t. 165) ; Handb. Ferns Brit. India,129. 1883 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 48. 1982 ; Jamir & Rao, Ferns Nagaland, 44. 1988. *Lomaria euphlebia* Kunze in Bot. Zeit. 6. 521. 1848 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 473. 1880.

Rhizome erect, short, stout. Stipes *ca* 20 - 40 cm long, erect, tufted, with 2 - 3 aerophores on each side of the ridges at base, glabrous. Lamina dimorphic. Sterile lamina *ca* 30 - 60 x 15 x 25 cm, pinnate, ovate-lanceolate, lower pinnae sessile, the upper most adnate, and the terminal with one or more lobes at base ; pinnae 3 cm or more apart at base, *ca* 10 - 17 x 1.5 - 2.4 cm, lanceolate, acuminate apex, base cuneate, margin serrate ; rachis glabrous ; texture subcoriaceous ; veins prominent, simple or forked. Fertile pinnae similar to the sterile one, but the pinnae more distant and narrowly linear, *ca* 5 - 15 x 0.2 - 0.5 cm, cordate at base, distinctly petiolate. Sporangia acrostichoid, with septate, dark-brown hairs ; annulus 18 - 20 celled. Spores oval, often pyramidal, yellowish, papillate (Pl.13).

Fertile : Feb. - Oct.

Distrib : (a) China, Japan, Korea, Nepal, Myanmar, Philippines, Taiwan, Australia ; (b) Meghalaya, Nagaland.

Occur : Rare ; in moist and shady humous soil near stream in shaded areas in forest. Digheswari hills, Kamrup dist. 1185.

Plagiogyria glaucescens Ching, Acta Phytotax. Sin. 7. 150. t. 38. f. 2. 1958 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 48. 1982. *P. glauca sensu* auct. Bedd. Ferns Brit. India, t. 90. 1866 (descr. *pro parte*) ; Handb. Ferns Brit. India, 127. 1883 (descr. *pro parte*). *Lomaria glauca sensu* auct. Clarke, Trans. Linn. Soc. Lond.II. Bot. 1. 472. 1880. (*pro parte, non* Bl.1828).

Rhizome erect, stout, *ca* 6 cm thick. Stipe *ca* 20 - 30 x 0.4 cm, erect, fleshy, with one aerophore at the base on the right side of the ridge, trigonal, adaxial surface flattened, abaxial surface slightly concave. Lamina *ca* 40 - 60 x 12 - 16 cm, pinnate at base, pinnatifid at apex, broad lanceolate ; pinnae upto 20 - 40 pairs, sessile or lower ones shortly stalked, 1.5 cm apart ; largest pinnae *ca* 10 - 15 x 1 - 1.5 cm, lanceolate, apex acute or shortly acuminate, base rounded, margin crenate ; adaxial surface of rachis flattened and posses a median groove and a pair of lateral groove, abaxial surface rounded ; texture coriaceous ; midrib prominent on both surfaces, lateral veins closely placed, slightly oblique or perpendicular to the midrib, single or forked. Stipe of fertile frond longer than the sterile. Fertile lamina *ca* 30 - 35 x 10 - 15 cm, pinnate ; pinnae 20 - 30 pairs, subopposite, sessile or shortly stalked ; pinnae *ca* 6 - 8 x 0.3 cm, apex acute, upper ones gradually shorter and terminal one short and often pinnatifid. Sporangia with 15 - 17 celled annulus. Spores 3- lobed, light yellow, smooth (Pl. 14).

Fertile : Feb. - June.

Distrib : (a) China, Myanmar ; (b) Manipur and Meghalaya.

Occur : Rare ; on wet humous rich soil near streams and rivulets. Rowta forest, Darrang dist. 1370.

Notes : This species is very closely resemble *P. communis* Ching, but differ from the later in that the lower pinnae of the fertile frond are glaucous beneath, minutely serrate in lower half and suddenly truncate to a very short stalk.

Subclass : **GLEICHENIIDAE**
Order : **GLEICHENIALES**

GLEICHENIACEAE (R.Br.) Presl

Gleichenia J. Sm.
Mém. Acad. Sci. Turin. 5. 419. t. 9. f. 10. 1793. *nom. cons.*

Dixit (1984) has listed five species of *Gleichenia* from India and all are occuring in eastern India. Dixit & Vohra (1984) also mentioned the occurance of five species in India. In the present study only one species has been recorded from Assam.

Gleichenia volubilis Jungh, Resen durch Java 452. 1845 ; *et* Java 1. 592, 664. 1853 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 41. 1982 ; Jamir & Rao, Ferns Nagaland, 53. 1988.

Rhizome wide creeping, *ca* 0.6 cm thick, tough, covered by scales all over ; scales *ca* 0.3 - 0.8 x 0.2 - 0.4 cm, lanceolate, apex acuminate, ciliate, brown. Stipes *ca* 50 - 100 x 0.4 - 1 cm, erect, solid, scaly at base, glabrous above. Lamina with large and spreading branches ; primary branches *ca* 100 x 35 cm, deeply bipinnatifid ; secondary branches *ca* 10 - 20 x 1.5 - 3 cm, pinnatifid near to the costa, alternate or often opposite ; leaflets small, *ca* 1 x 0.2 cm, oblong, apex acute, each lobe separated by a narrow sinus ; rachis, costa and costules densely clothed by scales and hairs ; costa and costules raised on the ventral surface ; veins distinct, free and forked once ; texture subcoriaceous, lamina green ; sparsely covered by pale, stellate hairs ; apical dormant buds present on the main rachis, clefted, densely covered by cordate-lanceolate, dark-brown scales. Sori small, globose, submarginal, yellowish-brown. Spores hyaline, light yellow (Pl. 15).

Fertile : Feb. - Oct.

Distrib : (a) Indochina, Taiwan, Philippines, Malay Islands, New Guinea ; (b) Northeast India, Eastern Himalayas.

Occur : Not common, along roadside slopes, hill cuttings and open grasslands forming dense patches. Mornai, Goalpara dist.1081 ; Diphu, Karbi-Anglong dist. 1322.

DICRANOPTERIDACEAE Ching

Dicranopteris Bernh.
Schrad. Neu. Journ. Bot. 1(2). 38. 1805.

Dicranopteris linearis (Burm. f.) Underw. Bull. Torrey Bot. Club. 34. 250. 1907. var. ***altissima*** Holtt. Fl. Malaya, 2. 69. 1954 ; *et* Reinw. 4. 276. 1957 ; Dhir, Ferns N.W. Himalayas, 60. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 40. 1982 ; Jamir & Rao, Ferns Nagaland, 50. 1988.

Kap-dhekia (Ass.)

Rhizome long creeping, *ca* 0.4 cm thick, densely covered by hairs, scales absent ; hairs minute, multicellular, reddish-brown. Stipes *ca* 12 - 30 x 0.1 - 0.3 cm, slender, straggling, rigid and polished; apical bud covered by brown hairs and stipule like, small, *ca* 1 cm long, lobed bracts. Fronds *ca* 2 m long, pinnate or dichotomously branched ; ultimate branches *ca* 12 - 20 x 2 - 8 cm, lanceolate, apex acute or acuminate, deeply pinnatifid, nearly reaching to the costa ; segments *ca* 0.5 - 4 x 0.2 - 0.4 cm, narrowly linear or subulate, margin curved, deeply covered with brown hairs ; rachises repeatedly forked, covered with dark-brown hairs ; costae and costules sparsely hairy ; veins prominent, 2 - forked, free ; lamina light green ; texture hard. Sori small, globose, without paraphyses, in the two rows on both sides of the costa. Spores numerous, trilete, deeply grooved (Pl. 16 ; Ph. 7).

Fertile : July - Oct.

Distrib : (a) Malay Peninsula, Philippines, Moluccas, New Guinea, Solomon Islands ; (b) Northeast India, Madhya Pradesh, Tamilnadu.

Occur : Common, forming thickets in open areas and on hill slopes. Changsari, Kamrup dist. 433 ; Kurua , Darrang dist. 679.

Uses : Rhizomes are used as anthelmintic in Andaman Islands ; fronds are used for asthma in Madagaskar ; frond extract shows antibacterial properties ; stipes are used for preparing school pens (Chopra *et al* 1956 ; Dixit & Vohra 1984).Ribbon-like vascular bundles from the stalks of fronds are woven into mats, chair-seats, pauches, caps, fishing traps, baskets, belts, etc. (Ambasta 1986). Tender fronds are used to remove sterility in women, also used in poultice and in fever. Plant is reported to be antiasthmatic and have anticancer activity (Asolkar *et al* 1992).

Order : **POLYPODIALES**
Suborder : **POLYPODIINEAE**

The concept of Polypodiaceous ferns is very controversial, Ching (1940) had recognised 45 genera in Polypodiaceae (*sensu stricto*) and seven genera in Grammitaceae whereas Copeland (1947) included as many as 65 genera in the family including *Grammitis* Swartz and other allied genera like *Loxogramme* (Bl.) Presl. Crabbe *et al* (1975) assigned 57 genera to Polypodiaceae and 15 genera to Grammitidaceae (Grammitaceae of Ching and others). Ching (1978) on the other hand while proposing a systematic arrangement of Chinese fern families and genera, enumerated 26 genera under Polypodiaceae and recognised Drynariaceae (Three genera), Platyceriaceae (One genus), Grammitaceae (Six genera) and Loxogrammaceae (One genus) as separate families. Pichi-Sermolli (1977) distributed the Polypodiaceous genera into five families

as Grammitaceae (12 genera), Loxogrammaceae (Two genera), Polypodiaceae (63 genera), Cheiropleuriaceae (One genus) and Dipteridaceae (one genus).

Dixit (1984) has listed 150 species and seven varieties of Polypodiaceous ferns under 33 genera by considering Grammitaceae, Loxogrammaceae, Polypodiaceae, Platyceriaceae, Drynariaceae and Dipteridaceae separately. Satija & Bir (1985) have listed 130 species under 24 genera under four families viz. Grammitaceae, Loxogrammaceae, Polypodiaceae and Dipteridaceae. They did not recognise the families Platyceriaceae and Drynariaceae.

Panigrahi & Patnaik (1968a) mentioned that 99 species of Polypodiaceae (*sensu lato*) are occuring in eastern India. In the present investigation 50 species under 21 genera have been recorded. Of these, one genus and one species each under Loxogrammaceae, Platyceriaceae and Dipteridaceae, 17 genera and 44 species under Polypodiaceae, and one genus with three species under Drynariaceae have been encountered.

LOXOGRAMMACEAE Ching ex Pic. Ser.

Loxogramme (Bl.) Presl
Tent. Pterid. 214. t. 9. f. 8. 1836.

Dixit (1984) has listed seven species of *Loxogramme* for India, while Satija & Bir (1985) have reported eight species from India. Only one speices is encountered in the present study, which was first reported by Bhargavan & Joseph (1978) from Lohit district of Arunachal Pradesh and subsequently also known from Nagaland (Jamir & Rao 1988).

Loxogramme grammitoides (Bak.) C. Chr. Ind. Fl. Suppl. 2. 21. 1917 ; Jamir & Rao, Ferns Nagaland, 59. 1988. *Gymnogramme grammitoides* Bak. Journ. Bot. 27. 178. 1889.

Rhizome long creeping, *ca* 0.1 cm thick, slender, clothed with scales ; scales *ca* 2 x 0.5 mm, linear to ovate or lanceolate, apex acuminate, peltate, margin entire, dull-brown. Lamina dimorphic, fertile lamina longer than the sterile ones. Stipe of fertile lamina *ca* 2 - 3 x 0.1 cm, glabrous ; fertile fronds *ca* 2 - 4 x 0.3 - 0.6 cm, spathulate, apex rounded, base decurrent, margin entire ; sterile lamina shorter than the fertile ones, *ca* 1 - 2 x 0.2 - 0.7 cm, obovate to oblanceolate, apex rounded, gradually narrowed the short stipe ; costa upto middle or nearly to the tip of lamina ; veins not distinct, forming irregular areoles without included veinlets ; texture coriaceous ; lamina glabrous on both surfaces. Sori elongate, *ca* 0.8 cm long, oblique to the costa, immersed, 2 - 4 rows on both sides of the costa , exindusiate. Spores globular, pale-brown (Pl. 17).

Fertile : Sept. - Dec.

Distrib : (a) China, Malay, Japan, Loochoo Island ; (b) Arunachal Pradesh and Nagaland.

Occur : Rare ; on rocks in moist, shady places of forest forming green cushion. Nameri forest, Sonitpur dist. 988.

POLYPODIACEAE Bercht. *et* Presl

According to Ching (1978) the genus *Polypodium* L., which is the type genus of the family Polypodiaceae, is strictly a temperate northern Eurasian, northeastern Asian and north American genus with about 10 species. According to him the genus *Polypodium* (*sensu stricto*) has no true representatives in southeast Asia and in tropical and subtropical Asia the genus *Polypodium* is represented by members of *Polypodoides* Ching, *Polypodiastrum* Ching, *Schellolepis* J. Sm., *Metapolypodium* Ching and *Thylacopteris* Kunze. All these genera were previously included under *Polypodium* by different workers.

Predominantly epiphytes, rarely terrestrials or lithophytes. Rhizome generally creeping, rarely erect, densely scaly ; scales adpressed, usually peltate, rarely clathrate, hair-like or suppressed. Lamina simple, pinnate or pinnatifid, usually coriaceous. Veins reticulate, with free, included veinlets ending on hydathodes. Sori round to elongate, sometimes fused to form coenosori, exindusiate ; sporangia stalked, annulus incomplete, dehiscing by transverse slits ; spores bilateral, rarely tetrahedral, perispore absent.

KEY TO GENERA

1a. Epiphytes, with distinct humous collecting fronds --- -- -- ------- --- --- --- ***Pseudodrynaria***
1b. Epiphytes or terrestrial, without humous collecting fronds
2a. Fronds covered by stellate hairs throughout
3a. Sori acrostichoid, covering the surface of fertile lamina --- --- --- ***Pyrrosia***
3b. Sori marginal, linear-confluent ---------- --- --- ***Drymoglossum***
2b. Fronds glabrous or with simple gland like hairs
4a. Fronds dimorphic
5a. Sori biseriate, medial, forming linear coenosori covered with peltate scales ---------- --- --- ***Lemmaphyllum***
5b. Sori acrostichoid, peltate scales lacking
6a. Primary veins obscure ---------- --- --- ***Leptochilus***
6b. Primary veins conspicuous ---------- ----- --- ***Paraleptochilus***
4b. Fronds not dimorphic
7a. Sori acrostichoid on a constricted narrow apical part of frond - --- - --- ***Belvisia***
7b. Sori round to elongate throughout the surface of the lamina
8a. Veins inconspicuous
9a. Sori covered with peltate clathrate scales, atleast when young
10a. Epiphytes ; sori regularly biseriate - --- --- --- --- --- ***Lepisorus***
10b.Terrestrials ; sori irregularly biseriate --- --- --- ***Tricholepidium***
9b. Sori not covered with such scales - --- --- --- --- --- --- ***Microsorium***
8b. Veins prominent
11a. Sori linear, forming coenosori ------- - --- --- --- --- ***Colysis***
11b. Sori round or oval, not forming coenosori
12a. Fronds simple or pinnatifid
13a. Spores planoconvex ; sori large, more than 3 mm in diameter
14a. Rhizome tuberous, with acute, deltoid-ovate scales -- ------ ***Phymatosorus***
14b. Rhizome not tuberous, with acuminate,ovate-lanceolate scales --- --- --- ***Phymatopteris***
13b. Spores oval ; sori small, less than 3 mm in diameter
15a. Rhizome fleshy, 1 - 1.5 cm thick --- ***Goniophlebium***
15b. Rhizome wiry, less than 1 cm thick --- ***Polypodioides***
12b. Fronds pinnate
16a. Areoles copious, with free forked included veinlets - -- --- --- - ***Arthomeris***
16b. Areoles single row along the costa, with free simple included veinlets ---- --- --- --- ***Polypodiastrum***

Arthomeris (Moore) J. Sm.
Hist. Fil. 110. 1875.

Dixit (1984) has listed eight species and a variety for India, while Satija & Bir (1985) listed only six species. The genus is not represented from south India (Panigrahi & Patnaik 1968a) and only one species has been recorded from Assam.

Arthomeris wallichiana (Spr.) Ching, Contr. Inst. Bot. Natn. Acad. Peiping, 2. 92. 1933 ; Dhir, Ferns N.W. Himalayas, 129. 1980 ; Jamir & Rao, Ferns Nagaland, 105. 1988. *Polypodium wallichianum* Spreng. Syst. Veg. 4. 53. 1827 (Based on *P. juglandifolium* D. Don, 1825). *Pleopeltis juglandifolia* (D.Don) Moore, Ind. Fil. 78. 1857 ; Bedd. Handb. Ferns Brit. India, 368. t. 210. 1883.*Polypodium juglandifolium* D. Don, Prod. Fl. Nepal, 3. 1825 ; Clarke, Trans. Linn. Soc. Lond.II. Bot. 1.566. 1880. *Pleopeltis capitellata* (Mett.) Bedd. Ferns Brit. India, t. 12. 1866.

Lithophytes or epiphytes. Rhizome creeping, *ca* 1 cm thick, stout, densely scaly ; scales *ca* 1.5 x 0.4 cm, linear-lanceolate, apex acuminate, margin entire, reddish-brown, ferruginous. Stipe *ca* 10 - 35 x 0.5 cm, hard, glossy, glabrous, purplish-brown. Lamina *ca* 30 - 50 x 20 - 30 cm, simple pinnate, delto-ovate ; lateral pinnae 3 - 10 pairs, subopposite, loosely placed, sessile ; largest one *ca* 25 - 40 cm, oblanceolate, apex caudate-acuminate, attenuate at base, margin thick, wavy, rarely lobed ; main lateral veins prominent, areoles copious, hidden, with free included veinlets ; costa distinctly raised above and below ; texture subcoriaceous, lamina dark-green, glabrous. Sori large, globose, upto 0.5 cm wide, one between each main vein, forming a single row, close to the midrib, sometimes in two rows ; sporangia slender stalked. Spores oval, brownish, exine spinulose (Pl.18).

Fertile : July - Jan.

Distrib : (a) Myanmar, China, Thailand ; (b) Himalayas.

Occur : Common, on moist, shady tree trunks and on moss covered rocks in shaded areas. Basistha, Kamrup dist. 529.

Note : The plants from the area of present study show great variation in size of frond and in number of pinnae.

Belvisia Mirb.
in Lam. & Mirb. Hist. Nat. Vég. 3. 473. 1802.

Dixit (1984) and Satija & Bir (1985) listed three species for India. Only one species has been encountered from Assam in the present study.

Belvisia spicata (L. f.) Mirb. in Lam. & Mirb. Hist. Nat. Vég. 3. 473. 1802. *Acrostichum spicatum* L. Fil. Suppl. 444. 1781 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 582. 1880. *Gymnopteris spicata* Presl, Tent. Pterid. 244. t. 11. f. 7. 1836 ; Bedd. Handb. Ferns Brit. India, 432. t. 261. 1883 (*pro parte*). *Hymenolepis spicata* (L. f.) Presl, Epim. Bot. 159. 1894 ; Bedd. Ferns South. India, t. 46. 1864.

Epiphytes. Rhizome short creeping, *ca* 1 cm thick, densely scaly ; scales *ca* 0.5 x 0.2 mm, ovate-lanceolate, apex acuminate, base broad, margin entire, dark-brown. Stipes short, *ca* 1 - 2 x 0.4 cm, firm, powdery, glabrous, stramineous. Lamina *ca* 15 - 45 x 1 - 2.5 cm, simple, lanceolate, upper part for *ca* 7 - 15 cm suddenly contracted and fertile ; base decurrent, margin entire ; midrib slightly rasied above and distinctly raised below, grooved above and rounded below ; veins

indistinct, areoles uniform, hexagonal, with copious free, simple or forked veinlets ; texture subcoriaceous; lamina green, glabrous. Sori confined to narrow apex, mixed with sporangiasters; sporangia stalked (Pl.19).

Fertile : May - July.

Distrib : (a) Africa, Sri Lanka, Malay to Polynesia ; (b) Himalayas, Eastern India and South India.

Occur : Rare ; on moss and humous collections on tree trunks of forest. Nonai forest, Darrang dist. 1844.

Colysis Presl
Epim. Bot. 146. 1851.

According to Dixit (1984) and Dixit & Vohra (1984) the genus *Colysis* is represented by eight species in India. Satija & Bir (1985) have listed only four species. In the present investigation two species have been recorded from Assam.

Terrestrials. Rhizome creeping, scaly. Stipes scaly. Lamina simple or pinnately lobed, membranous, glabrous ; veins reticulate, forming series of areoles with included, free veinlets. Sori elongate or round, continuous or short, oblique to the costa, in one row between the lateral veins ; sporangia stalked, paraphyses absent. Spores numerous, bilateral.

KEY TO SPECIES

1a. Sterile lamina larger than the fertile ones ; sori continuous --- --- --- --- ***pedunculata***
1b. Sterile and fertile lamina similar ; sori not continuous --- --- --- --- ***hemionitidea***

Colysis hemionitidea (Wall. ex Mett.) Presl, Epim. Bot. 147. 1851 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 57. 1982 ; Jamir & Rao, Ferns Nagaland, 128. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 329 . t. 250. 1992. *Polypodium hemionitideum* Wall. ex Mett. Ann. Lugd . Bot. 4 (2). 215. 1866. *Pleopeltis hemionitidea* (Wall.) Bedd. Ferns South. India, t. 182. 1864 ; Handb. Ferns Brit. India, 358 t. 202. 1883. *Polypodium hemionitideum* (Wall.) Clarke, Trans. Linn. Soc . Lond. II. Bot. 1. 561. 1880.

Rhizome long creeping, *ca* 0.4 cm thick, clothed with scales ; scales *ca* 3 x 0.3 mm, linear - lanceolate, apex acuminate, base cuneate, margin dentate, pale - brown . Stipes *ca* 0.5 - 4 x 0.2 cm, grooved adaxially, sparsely scaly, pale - brown. Lamina *ca* 30 - 70 x 4 -10 cm, simple, elliptic - lanceolate, apex acuminate, base narrowly attenuate, decurrent, margin entire, wavy ; midrib slightly raised and grooved above, distinctly raised and rounded below ; veins slightly distinct, main lateral veins parallel, blackish-brown ; secondary veins connect the primary ones and form larger areoles ; tertiary veins connect the secondary veins to form smaller areoles which enclose branched veinlets with hydathodes ; texture herbaceous ; lamina pale-green, brownish when dry . Sori oblong-elongate or round, borne in one row between the lateral veins ; sporangia slender stalked. Spores minute (Pl. 20).

Fertile : May - Oct.

Distrib : (a) Nepal, Bhutan, Bangladesh, South China, Taiwan, Tonkin and Malay Islands ; (b) throughout India in mountainous regions.

Occur : Occasional, on moist shady forest along river bank and streams ; some times grows as epiphytes on moist tree trunks. Dirak forest, Tinsukia dist. 656.

Colysis pedunculata (Hook.*et* Grev.) Ching, Bull. Fan. Mem. Inst. Biol. 4. 321. 1933 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 57. 1982 ; Jamir & Rao, Ferns Nagaland, 128. 1988. *Ceterach pedunculata* Hook. *et* Grev. Icon. Fil. t. 5. 1827. *Gymnogramma hamiltoniana* Hook. Sp. Fil.5. 160. 1864 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 570. 1880. *Selliguea hamiltoniana* Bedd. Ferns Brit. India, t. 239. 1866 ; Handb. Ferns Brit. India, 390. t. 226. 1883.

Rhizome long creeping, *ca* 0.4 cm thick, woody, often climbing, clothed with scales ; scales *ca* 3 x 0.4 mm, linear-lanceolate, apex acuminate, hair tipped, clathrate at base, margin entire, dark - brown. Lamina dimorphic, simple ; stipe of sterile lamina *ca* 5 - 20 x 0.4 cm, and stipe of fertile lamina *ca* 20 - 35 x 0.5 cm, glabrous ; sterile lamina *ca* 15 - 30 x 6 - 10 cm, elliptic-oblong, apex short acuminate, base decurrent, margin entire, irregularly wavy ; midrib slightly raised above, distinctly raised below ; main lateral veins distinctly raised on both surfaces, very distinct to the edges, nearly parallel, with many intermediate areoles with free included veinlets ; texture thin, coriaceous ; lamina glabrous, green ; fertile lamina apparently smaller, *ca* 8 - 12 x 3 - 5 cm, narrowly ovate-lanceolate, apex linear-acuminate, base decurrent, margin entire ; lateral veins prominent, veinlets obscure. Sori linear, compact, in continuous rows, one between each main vein and parallel with them, throghout the surface of lamina ; sporangia oval, slender stalked, with hairs. Spores oval, hyaline, light- brown, exine with projections (Pl. 21).

Fertile : Feb. - April.

Distrib : (a) Bangladesh, Nepal, Malay Peninsula and South China ; (b) Himalayas, Nagaland, Arunachal Pradesh.

Occur : Rare ; on moist, humous covered rocky soils and bases of tree trunks. Simen forest, Dhemaji dist. 952.

Drymoglossum Presl

Tent. Pterid. 227. t. 10. f. 5 - 6. 1836. *nom. cons.*

Only two species of *Drymoglossum* are occuring in India (Dixit 1984 ; Dixit & Vohra 1984 ; Satija & Bir 1985). Both the species have been encountered in the present study.

Hovenkamp (1986) in his monogarphic work on the genus *Pyrrosia* Mirb. has treated members of *Drymoglossum* and also the members of *Saxiglossum* Ching under *Pyrrosia*. But in the present investigation *Drymoglossum* and *Pyrrosia* are considered as separate genera as followed by other Indian workers (Beddome 1863 ; Dixit 1984 ; Dixit & Vohra 1984 ; Satija & Bir 1985 ; Manickam 1986 ; Jamir & Rao 1988 ; Manickam & Irudayaraj 1992). Gametophytic features also not support the view that *Pyrrosia* and *Drymoglossum* are congeneric (Bhattacharyya & Sen 1986 ; Sen & Bhattacharyya 1989).

Epiphytes. Rhizome long creeping, slender, densely clothed with peltate scales. Lamina simple, fleshy, dimorphic, entire, sparsely hairy ; sterile lamina much shorter and broader than fertile ones ; veins indistinct, areoles irregularly reticulate with free, simple or forked veinlets. Sori marginal, linear ; confluent, continuous along the tip of lamina except the base ; sporangia oval, shortly stalked, with stellate paraphyses, dark-brown. Spores oval to elliptic.

KEY TO SPECIES

1a. Sterile lamina round or obovate --- --- --- --- --- --- --- --- --- --- --- --- ***piloselloides***

1b. Sterile lamina elliptic or ovate -- --- --- --- --- --- --- --- --- --- --- --- --- --- ***heterophyllum***

Drymoglossum heterophyllum (L.) Trimen, Journ. Linn. Soc. Bot. 24. 152. 1887 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 60. 1982 ; Jamir & Rao, Ferns Nagaland, 101. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 310. t. 237. 1992. *Acrostichum heterophyllum* L. Sp. Pl. 2. 1067. 1753. *Drymoglossum piloselloides* auct. non (Swartz) J. Sm. Bedd. Ferns South. India, 62. t. 186. 1864 (*pro parte*). *Drymoglossum beddomei* Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 575. 1880. (*nom. nud*). *Drymoglossum piloselloides* var. *beddomei* Bedd. Hand. Ferns Brit. India, 413. 1883 (*nom. invalid.*).

Epiphytes. Rhizome long creeping, wiry, *ca* 0.1 cm thick, densely covered by scales ; scales *ca* 2 x 0.25 mm, adpressed, peltate, ovate to round, apex acuminate, centre dark-brown, pale-brown in the rest, margin laciniate on both ends. Stipes of sterile fronds *ca* 0.3 x 0.1 cm and of fertile fronds *ca* 0.5 - 2 x 0.1 cm, about 2 cm apart, terete, articulate, covered with scales similar to rhizome. Lamina dimorphous, simple ; sterile lamina *ca* 3 x 1.5 cm, orbicular, ovate or elliptic, apex rounded, base cuneate, margin entire ; costa and veins indistinct, immersed, areoles with copious free veinlets ; texture thick, fleshy, more or less covered by stellate hairs when young, sparsely or rarely when matured, lamina pale or dark-green ; fertile lamina *ca* 3 - 10 x 0.5 - 0.8 cm, linear oblong, apex rounded, one-fifth to two-fifth of the basal part narrowed gradually, margin entire, texture and hairs similar to that of sterile lamina. Sori confluent along the tip of lamina, *ca* 0.2 cm wide, linear ; sporangia oval, short stalked, intermingled with stellate hairs, dark-brown. Spores oval to elliptic, hyaline, light-brown, exine spinulose (Pl. 22).

Fertile : Oct. - Feb.

Distrib : (a) Myanmar, Sri Lanka, Java, Philippines, Japan, China, Sumatra, New Guinea ; (b) Northeast India, South India, North India, West Bengal.

Occur : Very common forming large colonies on tree trunks and other habitats like rocks or even soil in expsosed places in lower elevation. Kachugaon, Kokrajhar dist. 1245 ; Paneri, Darrang dist. 419.

Uses : The plant is used in the treatment of eczema, itch and haemorrhage. The leaves are used to treat constipation, cough, gonorrhoea, headache and smallpox (Jain 1991).

Note : According to Hoven Kamp (1986) this species is occuring in South India, Sri Lanka and Seychelles. Dixit (1984) has mentioned South India and Tropical Asia as the areas of distribution. Satija & Bir (1985) have mentioned only Northeastern India as its area of distribution. Jamir & Rao (1988) on the other hand have mentioned Myanmar, Sri Lanka, Java, Philippines, Japan, China, Sumatra, New Guinea and India as areas of distribution of this species.

Likewise, the distribution of this species in India shown by different workers varies. Dixit (1984) has given South India as the area of distribution. Dixit & Vohra (1984) shown the area as Eastern Himalayas. Satija & Bir (1985) have given the area as Northeastern India and by Jamir & Rao as North India, Bengal Plains, Meghalaya and Nagaland.

Drymoglossum piloselloides (L.) Presl, Tent. Pterid. 227. 1836 ; Bedd. Ferns South. India, t. 55. 1864 ; Handb. Ferns Brit. India, 411. 1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 575. 1880 (*pro parte*). *Pteris piloselloides* L. Sp. Pl. ed. 2. 1530. 1763.

Rhizome long creeping, *ca* 0.2 cm thick, wiry, clothed with scales ; scales *ca* 1 x 0.5 cm, adpressed, diamond-shaped, acuminate, sometimes hair-pointed, peltate, laciniated ; lamina dimorphic, simple ; sterile lamina, *ca* 1.5 - 3 x 1 - 1.5 cm, sessile or shortly stalked, roundish or obovate, base cuneate, margin entire ; texture thick and fleshy ; when young covered by stellate hairs ; stipe

of fertile frond *ca* 1 - 1.5 x 0.2 cm, scaly at base, grooved adaxially, straw-coloured ; fertile lamina *ca* 5 - 10 x 0.5 - 0.8 cm, linear to oblong, apex round, base decurrent, margin entire ; veins indistinct, areoles copious, with free, froked or simple veinlets ; sori marginal, *ca* 0.2 cm wide, linear, continuous along the tip of lamina ; sporangia oval, short stalked, with a few stellate paraphyses, dark-brown. Spores oval to elliptic, light-brown (Pl. 23).

Fertile : Nov. - Mar.

Distrib : (a) Sri Lanka, Java, Myanmar, Philippines, China, Japan ; (b) Northeast India.

Occur : Common, on tree trunks in exposed places. Orangjuli, Darrang dist. 571 ; Dhaligaon, Bangaigaon dist. 1232.

Note : The distribution of this species in India is shown as throughout mountainous region by Dixit (1984), as South India by Dixit & Vohra (1984) and as Northeast India and Western Ghats by Satija & Bir (1985). But Manickam & Irudayaraj (1992) have not enlisted this species in their work on Western Ghats.

Goniophlebium Presl
Tent. Pterid. 185. t. 7. f.13 - 14 . 1836.

Dixit (1984) has listed two species under this genus for India, while Satija & Bir (1985) have listed three species for India. The taxonomic opinion seems to differ among the Indian workers in respect of the species included under this genus. Only one species has been recorded from Assam in the present study.

Goniophlebium amoenum (Wall. ex Mett.) J. Sm. in Hook. Gen, Fil. t. 51. 1840 ; Bedd. Ferns Brit. India, t. 5. 1866 ; Handb. Ferns Brit. India, 317. 1883. *Polypodium amoenum* Wall. ex Mett. Abh. Senckneb. Naturf. Ges. 2. 80. 1857 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 550. 1880 ; Dhir, Ferns N.W. Himalayas, 118. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 70. 1982 ; Jamir & Rao, Ferns Nagaland, 66. 1988.

Epiphytes. Rhizome long creeping, *ca* 1 cm thick, solid, fleshy, covered by scales ; scales *ca* 0.5 x 0.2 cm, lanceolate-subulate, apex acuminate, base broad, adpressed, grey-brown. Stipes *ca* 13 -35 x 0.5 cm, glabrous, shining, stramineous or brown. Lamina *ca* 15 - 60 x 10 - 20 cm, simple, deeply pinnatifid, ovate, terminating in a lanceolate, acuminate, subentire segment similar to lateral ones ; lateral segments numerous, alternate or opposite ; largest segment *ca* 12 x 2 cm, lanceolate, apex acuminate, base broad, margin entire or dentate-serrate, lowest pair deflexed ; costa slightly raised ; veins prominent, reticulate, forming one series of areoles with single included veinlets, sometimes forming two series ; marginal veins free. Sori large, *ca* 0.2 cm wide, round, terminal on included veinlets of the areoles. Spores oval to bean-shaped, hyaline, yellow (Pl. 24).

Fertile : May - Dec.

Distrib : (a) China to Taiwan, Indo-China and North Thailand ; (b) Himalayas, Northeast India.

Occur : Common, on tree trunks and humous rich shady slopes inside forest. Occasionally observed as lithophyte growing on moist rocks. Manas forest, Barpeta dist. 1203 ; Laokhowa forest, Nagaon dist. 518.

Uses : Rhizome diuretic, pectoral, astringent, used in urinary calculus and rheumatism ; decoction prescribed to stop haemorrhages (Ambasta 1986).

Note : Specimens of the present gatherings are highly variable with regard to shape of fronds. However, due to the presence of many variants in the same populations, a detail study is warranted for finer segregation into varietal level.

Lemmaphyllum Presl
Epim. Bot. 157. 1851.

According to Dixit (1984) there is only one species in India under *Lemmaphyllum*, while Satija & Bir (1985) have listed two species under this genus. One species has been recorded from Asam in the present study.

Lemmaphyllum carnosum (Wall.) Presl, Epim. Bot. 158. 1849 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 62. 1982 ; Jamir & Rao, Ferns Nagaland, 91. 1988. *Notholaena carnosa* Wall. Cat. 138. 1828 (*nom. nud*). *Drymoglossum carnosum* (Wall.) J. Sm. in Hook. Gen. Fil. t. 78 A. 1841 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 575. 1880 ; Bedd. Handb. Ferns Brit. India, 411. t. 243. 1883.

Rhizome long creeping, *ca* 1 mm thick, densely covered by scales ; scales *ca* 0.2 cm long, peltate, linear-lanceolate, basal region expanded, anterior region slender, margin ciliate, dark-brown. Stipes of sterile frond *ca* 2.5 x 0.1 cm, of fertile frond *ca* 3 x 2 cm, glabrous or sparsely scaly, glossy and green. Lamina dimorphic, simple ; sterile lamina *ca* 2 - 5 x 0.8 - 1.5 cm, usually oval-elliptical or orbicular or lanceolate, round or obtuse or acute apex, base cuneate or slightly tapering ; margin entire, texture fleshy, coriaceous when dry ; lamina light-green, glabrous and glossy ; venation completely hidden, reticulate ; midrib visible on the lower surface ; fertile lamina *ca* 4 - 6.5 x 0.2 - 0.4 cm, linear-lanceolate, apex rounded or obtuse ; texture similar to sterile ones ; lower surface of lamina scaly. Sori linear, adpressed, continuous, intermediate between the costa and the margin, *ca* 0.1 cm broad, sori not extending to the apex and base. Spores bilateral, gloden brown (Pl. 25).

Fertile : Oct. - Nov.

Distrib : (a) Nepal, Tonkin, N. Thailand, China ; (b) Central and Eastern Himalayas.

Occur : Not common ; on moist, rather exposed tree trunks. Kulshi forest, Kamrup dist. 1775 ; Jatinga, North Cachar Hills dist. 1976.

Lepisorus (J. Sm.) Ching
Bull. Fan. Mem. Inst. Biol. Bot. 4. 47. 1933.

The genus *Lepisorus* has been treated sometimes with *Microsorium* Link. (Nayar 1961c), *Pleopeltis* Humb. et Bonpl. ex Willd. (Christensen 1938 ; Ching 1940 ; Copeland 1947 ; Holttum 1954 ; Pnaigrahi & Patnaik 1965), *Crypsinus* Presl and other Polypodioid genera. Dixit (1984) has listed 24 species of *Lepisorus* including *Pleopeltis macrocarpa* (Bory ex Willd.) Kaulf. and *Microsorium pteropus* (Bl.) Copel. under it. Satija & Bir (1985) have listed only 20 speices under the genus for India. It may be mentioned here that a greatly diversified views are advocated about the status and delimitation of such genera as *Polypodium*, *Pleopeltis*, *Lepisorus*, *Phymatopteris* and *Microsorium* of Polypodiaceae (*sensu stricto*) (Satija & Bir 1985). In the present investigation six species of *Lepisorus* have been encountered.

Epiphytes. Rhizome long or short creeping, covered with scales. Stipes short, articulate to rhizome, glabrous or scaly at the base. Lamina simple, linear, lanceolate to elliptic, glabrous or scaly ; texture coriaceous or membraneous, margin entire ; veins indistinct ; areoles with free, forked included veinlets ending in hydathodes. Sori large or small, globose to spherical in a single row on either side of the midrib ; annulus incomplete ; paraphyses peltate, clathrate. Spores bilateral.

KEY TO SPECIES

1a. Rhizome more than 0.5 cm across

2a. Veins distinct ; rhizome scales hair tipped --- --- --- --- --- --- --- -------- ***excavatus***

2b. Veins indistinct ; rhizome scales otherwise

3a. Lamina linear ; apex tapering ; spores tuberculate -- --- --- --- --- --- --- ***ussuriensis***

3b. Lamina lanceolate, apex obtuse ; spores smooth --------- --- --- ------ --- --- ***nudus***

1b. Rhizome less than 0.5 cm across

4a. Rhizome scales concolourous ; sparingly toothed ---------- --- --- --- --- --- ***sordidus***

4b. Rhizome scales bicolourous ; distinctly toothed

5a. Lamina 0.3 - 0.9 cm wide ; sori submedial, confluent towards the apex of lamina ---------- --- --- --- --- ----- --- --- ***subconfluens***

5b. Lamina 0.5 - 2 cm wide ; sori medial, not confluent -------- --- --- --- ***thunbergianus***

Lepisorus excavatus (Bory) Ching, Bull. Fan. Mem. Inst. Biol. Bot. 4. 68. 1933 ; Dhir, Ferns N.W. Himalayas, 121. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 64. 1982 ; Jamir & Rao, Ferns Nagaland, 77. 1988. *Polypodium excavatum* Bory in Willd. Sp. Pl. 5. 158. 1810. *Pleopeltis simplex* Bedd. Handb. Ferns Brit. India, 347.1883.

Epiphytes. Rhizome short creeping, *ca* 0.3 - 0.7 cm thick, stout, densely covered by scales ; scales *ca* 2 - 7 x 0.5 - 1 mm, linear-lanceolate, apex accuminate, hair tipped, margin slightly erose. Stipes *ca* 0.5 - 2.5 x 0.2 cm, grooved adaxially, glabrous, pale-brown to yellowish-green. Lamina *ca* 10 - 30 x 1.5 - 3 cm, elliptic-lanceolate, broadest below the middle, apex narrowly acute, base gradually decurrent, margin entire ; midrib slightly raised above and below ; veins prominent near the midrib, become obscure near margin, copiously anastomosing forming irregular areoles with included veinlets; texture thin, membranous ; lamina greenish, becomes pale-brown when dry, sparsely scaly at lower surface along the midrib. Sori globose, superficial, *ca* 0.2 - 0.5 cm in diameter, in a single row on either side of the midrib, closer to the midrib than the margin, on the upper half of lamina, light-brown ; sporangia slender stalked. Spores elliptical, light-brown, exine spinulose (Pl. 26).

Fertile : July - Oct.

Distrib : (a) Japan, Tropical Africa, Madagascar ; (b) Himalayas, Northeast India.

Occur : Rare ; on shady, moist tree trunks. Abhaipur forest, Sivasagar dist. 692.

Lepisorus nudus (Hook.) Ching, Bull. Fan. Mem. Inst. Biol. Bot. 4. 83.1933 ; Dhir, Ferns N.W. Himalayas, 124. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 65. 1982 ; Jamir & Rao, Ferns Nagaland, 81. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 332. t. 252. 1992. *Pleopeltis nuda* Hook. Exot. Fl. 1. t. 63. 1823. *P. wightiana* Bedd. Ferns South. India, 60. t. 180. 1864. *P. lineare* Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 558. 1880 (*pro parte*). *P. linearis* Bedd. Handb. Ferns Brit. India, 346.1883 (*pro parte*).

Epiphytes. Rhizome long creeping, *ca* 0.5 cm thick, stout, densely covered by scales ; scales *ca* 0.5 x 0.2 cm, ovate-lanceolate, apex acute, margin entire or subentire, pale brown. Stipes *ca* 1 -5 x 0.1 - 0.2 cm, adaxially grooved, abaxially rounded, scaly at the base, glabrous above, stramineous or grey-brown. Lamina *ca* 10 - 25 x 1 - 3 cm, simple, linear-lanceolate to linear- elliptic, broadest below the middle, gradually tapering towards both ends, apex acuminate, base decurrent, margin entire ; midrib slightly raised and flattened above and below ; veins indistinct, areoles irregular with forked, free veinlets ; texture coriaceous ; lamina dark-green above, pale green below, glabrous. Sori superficial, in two rows between the midrib and margin on distal half of the lamina. Spores oval to round, light-yellow, exine smooth (Pl. 27).

Fertile : Aug. - Oct.

Distrib : (a) Sri Lanka, Malay Peninsula, Malay Islands, China, Japan, Central and South Africa and its Islands ; (b) throughout India in mountainous regions.

Occur : Not common ; on shady, moist tree trunks. Sonai-Rupai forest, Sonitpur dist. 867.

Lepisorus sordidus (C. Chr.) Ching, Bull. Fan. Mem. Inst. Biol. Bot. 4. 79. 1933 ; Satija & Bir Polyp. Ferns India, 18. 1985 ; Jamir & Rao, Ferns Nagaland, 84. 1988. *Polypodium sordidum* C. Chr. Contr. U.S. Nat. Herb. 26. 320. 1931. *Pleopeltis sordidus* (C. Chr.) Panigr. *et* Patn. Curr. Sci. 34. 127. 1965.

Epiphytes. Rhizome creeping, *ca* 0.3 cm thick, apex covered by scales ; scales *ca* 3 x 0.5 mm, lanceolate, apex acuminate, base broad, margin sparingly toothed, rigid, concolourous, dark-brown. Stipes *ca* 3 - 10 x 0.4 cm, glabrous, pale-brown to stramineous. Lamina *ca* 15 - 40 x 1.5 - 4 cm, lanceolate, apex short-acuminate, broadest below the middle, cuneate at base, decurrent on stipe, margin entire ; midrib slightly raised and sparsely scaly ; veins obscure ; texture coriaceous ; lamina glabrous on both surfaces, greyish-green. Sori superficial, globose *ca* 0.4 cm in diameter, submarginal in a single row on each side of the midrib, usually on the upper half of the lamina ; sporangia shortly stalked, paraphyses black, stellate, filiform. Spores globose to elliptic, pale-yellow (Pl. 28).

Fertile : Oct. - Dec.

Distrib : (a) Myanmar, China ; (b) Eastern India.

Occur : Not common ; on moist shady tree trunks of evergreen forest. Rowta forest, Darrang dist. 1364.

Lepisorus subconfluens Ching, Bull. Fan. Mem. Inst. Biol. Bot. 4. 83. 1933 ; Jamir & Rao Ferns Nagaland, 85. 1988. *Pleopeltis subconfluens* (Ching) Panigr. *et* Patn. Curr. Sci. 34. 127. 1965.

Epiphytes. Rhizome long creeping, *ca* 0.2 cm thick, densely clothed with scales ; scales *ca* 1 - 3 x 2 mm, linear, apex acuminate, margin slightly hyaline and dentate, dark-brown. Stipes *ca* 0.5 - 1 x 0.3 cm, terete, glabrous. Lamina *ca* 7 - 20 x 0.3 - 0.9 cm, linear, apex acuminate, broadest at middle, gradually tapering towards base, margin entire ; midrib slightly raised above and below, glabrous ; veins indistinct ; texture coriaceous ; lamina light-green, become brownish when dry, glabrous above and below. Sori globose or oval, small, submedial, in a single row on either side of the midrib on upper half of the lamina, confluent towards the apex ; sporangia stalked shortly, annulus 10 - 15 thickened cells. Spores round to oval or elliptical, pale-yellow, exine granulose (Pl. 29).

Fertile : Oct. - Nov.

Distrib : (a) China, Thailand ; (b) Eastern India and Eastern Himalayas.

Occur : Not common ; on shady, moss covered tree trunks inside forest. Nonai forest, Darrang dist. 1846 ; Abhaipur forest, Sivasagar dist. 694.

Lepisorus thunbergianus (Kaulf.) Ching, Bull. Fan. Mem. Inst. Biol. Bot. 4. 88. 1933 ; *et* Icon. Fil. Sin. 2. 76. 1934 ; Dhir, Ferns N. W. Himalayas, 124. 1980 ; Jamir & Rao, Ferns Nagaland, 86. 1988. *Pleopeltis thunbergiana* Kaulf. Wessn. d. Frrankr. 113. 1827. *Pleopeltis linearis* Thunb. Fl. Jap. 335. 1784 ; Bedd. Handb. Ferns. Brit. India, 346. t. 194. 1883 (*pro parte*) ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 558. 1880 (*pro parte*).

Epiphytes. Rhizome *ca* 0.1 - 0.3 cm thick, wide creeping, covered with scales ; scales *ca* 2 x 0.5

mm, discolourous, broad-based, brown, peltate, clathrate, dark-brown to black, opaque, acuminate. Stipes *ca* 1 - 3.5 x 1 cm, slender, glabrous or rarely with few scales, articulate to rhizome ; lamina *ca* 15 - 30 x 0.5 - 1 cm, narrowly linear-elliptic, gradually tapering towards stipe, broadest in the middle with a narrow caudate acuminate apex, margin entire; midrib prominently raised above and below ; veins obscure ; areoles irregular with forked free veinlets ; texture coriaceous ; lamina green, but dark-brown when dry, both surfaces glabrous or nearly so. Sori round to oval, superficial or scarcely immersed, medial, forming a single row on half way between the costa and margin, paraphyses round, peltate, centre dark, margin pale (Pl. 30).

Fertile : March - Sept.

Distrib : (a) China, Korea, Indo-China, Taiwan, Philippines and Japan ; (b) Himalayas, Nagaland.

Occur : Common ; on moist, shady tree trunks. Bhalukpng, Sonitpur dist. 853 ; Bokajan, Karbi-Anglong dist. 1434.

Note : This species resemble very closely to *L. nudus* but differ from the later in having subulate-lanceolate, long-acuminate, ciliate-dentate and black rhizome scales.

Lepisorus ussuriensis (Regel *et* Mauck.) Ching, Bull. Fan. Mem. Inst. Biol. Bot. 4. 91. 1933 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 65. 1982 ; Jamir & Rao, Ferns Nagaland, 88. 1988. *Pleopeltis ussuriensis* Regel *et* Mauck. Mem. Acad. Sci. Petersel. 7. 44. 175. 1861.

Epiphytes. Rhizome creeping, *ca* 0.2 cm thick, wiry, scaly ; scales *ca* 2 x 0.5 mm, lanceolate, apex acuminate, base broad, margin entire, dark-brown. Stipes *ca* 1 x 0.2 cm, glabrous, dark-green. Fronds *ca* 5 - 15 x 0.3 - 0.8 cm, linear, broadest at middle, gradually tapering at both ends, apex acuminate, base decurrent, margin entire ; midrib distinct, slightly raised above and below ; veins indistinct ; texture coriaceous ; lamina pale-green when dry, glabrous above and below. Sori medial, small, depressed, usually on the upper half or 2/3 of the upper part of lamina ; sporangia light-brown, stalked. Spores oval or elliptic, yellow, exine tuberculate (Pl. 31).

Fertile : Oct. - Dec.

Distrib : (a) China, Korea, Japan and Eastern Siberia ; (b) Himalayas.

Occur : Rare ; on moist and shady tree trunks in forest. Bhairabkunda, Darrang dist. 1527.

Note : This species resemble *L. nudus* and can be distinguished in having tuberculate spores by *L. ussuriensis*.

Leptochilus Kaulf.
Enum. Fil. 147. 1824.

Dixit (1984) has listed three species of *Leptochilus* (*L. axillaris* (Cav.) Kaulf., *L. laciniatus* (Hook.) Ching, and *L. lanceolatus* Fée) for India. Satija & Bir (1985) have also listed three species, but *L. laciniatus* (Hook.) Ching has been excluded and *L. thwaitesianus* Fée has been included. In the present investigation only one species has been encountered.

Leptochilus axillaris (Cav.) Kaulf. Enum. Fil. 147. t. 1. f 10 1824 ; Jamir & Rao, Ferns Nagaland, 120. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 307. t. 233. 1992. *Acrostichum axillare* Cav. Ann. Hist. Nat. 1. 101. 1799 ; Clarke, Trans. Linn.Soc. Lond. II. Bot. 1. 579. 1880. *Gymnopteris variabilis* var. *axillaris* (Cav.) Bedd. Ferns Brit. India, t. 271. 1866 ; Handb. Ferns. Brit. India, 430. 1883.

Rhizome cilmber, slender, *ca* 0.5 cm in diameter, green at fresh, black when dry, apex clothed with scales ; scales *ca* 2 x 0.5 mm, conspicuously toothed along the margin, dark-brown. Fronds

dimorphic. Stipes *ca* 1 cm apart, stipes of sterile fronds *ca* 5 cm long and the stipes of fertile fronds *ca* 25 cm long, both glabrous. Sterile lamina lanceolate, *ca* 22 x 2.5 cm , apex acuminate, base gradually decurrent, entire, veins not so prominent ; fertile lamina *ca* 30 x 0.3 cm. Sori acrostichoid ; sporangia covering the fertile surface without paraphyses. Spores reniform, smooth (Pl. 32).

Fertile : Dec. - Feb.

Distrib : (a) Bangladesh, Myanmar, Malay, Indochina, Thailand ; (b) South India, West Bengal, Northeastern India.

Occur : A rare twinner on shady forest floor. Sipajhar, Darrang dist. 1209 ; Baharghat, Kamrup dist. 1299.

Microsorium Link
Hort. Reg.Bot. Berol. 2. 110. 1833.

According to Ching (1978) the original spelling *Microsorium* by Link is more correct. But according to Sledge (1960) the original publication by Link is as *Microsorum*. In the present investigation, however, the spelling *Microsorium* is followed.

Dixit (1984) has listed 16 species of *Microsorium* for India including *Microsorium pteropus* (Bl.) Copel. (also included under the genus *Lepisorus* (J. Sm.) Ching as *L. pteropus* (Bl.) Ching). Satija & Bir (1985) have listed only eight species of *Microsorium* for India. In the present investigation eight species of *Microsorium* have been recognised. It may be mentioned here that the generic position of many species of *Microsorium* recorded from India are in doubt as some species are referred to genera like *Kaulinia* Nayar, *Neocheiropteris* Chirst and *Neolepisorus* Ching. Out of the eight species recorded in the present investigation, *M. dilatatum* and *M. pteropus* are segregated into a new genus *Kaulinia* by Nayar (1964b). But *Microsorium* and *Kaulinia* can dependably be segregated only on the characters of gametophytes and therefore, a generic status to *Kaulinia* may not be considered. A detail discussion in this regard was provided by Bir & Trikha (1968a).

Epiphytic, terrestrials or lithophytes, rarely aquatic. Rhizome creeping, scaly ; scales ovate to lanceolate, entire or wavy or toothed, concolourous or bicolourous. Lamina simple or pinnate, glabrous ; veins copiously anastomosing, areoles with free, simple or forked veinlets ; texture herbaceous or coriaceous. Sori copious, globose, usually scattered, rarely arranged in two rows ; exindusiate ; annulus oblique ; spores bilateral, exine finely or coarsely granulose.

KEY TO SPECIES

1a. Lamina simple, lanceolate
  2a. Scales lanceolate ; sori in two irregular rows between the primary veins --- --- ---***zipelii***
  2b. Scales ovate or ovate-lanceolate ; sori irregularly scattered
    3a. Lamina membranous ; veins prominently raised --- --- -- -- --- ---***membranaceum***
    3b. Lamina coriaceous or subcoriaceous ; veins indistinct
      4a. Lamina slender stipitate ; sori superficial, throughout the surface --- ---***superficiale***
      4b. Lamina sessile ; sori scattered, more or less immersed along the upper half of the lamina --- --- --- --- --- --- --- --- --- ***punctatum***
1b. Lamina pinnate or pinnatifid
  5a. Stipes 6 - 10 cm long ; lamina 3 - lobed or sometimes simple --- --- ---***pteropus***
  5b. Stipes more than 20 cm long ; lamina pinnately divided into several pairs of pinnae
    6a. Rhizome scales acute and gland absent at the tip ; stipes trigonal. --- ----- ---***dilatatum***
    6b. Rhizome scales acuminate and terminated by gland ; stipes cylindrical

7a. Lamina elongate-oblong and margin of segments undulate ; stipes winged above ---------- --- --- --- --- -- --- --- ***rubidum***

7b. Lamina broadly ovate and margin of the segments not undulate ; stipes not winged ---------- --- --- --- --- --- --- --- ***alternifolium***

Microsorium alternifolium (Willd.) Copel. Gen. Fil. 197. 1947. *Polypodium alternifolium* Willd. in L. Sp. Pl. 5. 168. 1810. *Pleopeltis nigrescens* Bl. Enum. Fil. 127. 1828 ; Bedd. Handb. Ferns Brit. India, 367. t. 208. 1883. *P. longissima* Bedd. Ferns South. India, t. 176. 1864.

Rhizome wide creeping, *ca* 1 cm thick, green, scaly ; scales narrow, *ca* 0.5 - 0.7 cm long, ovate, apex acuminate, terminated by a gland, base rounded, margin dentate and with glandular hairs. Stipes *ca* 20 - 30 x 0.3 - 0.4 cm, erect, cylindrical, adaxial surface flattened, smooth, shining, brownish-green. Lamina *ca* 40 - 70 x 30 - 40 cm, broadly ovate, apex acuminate, base decurrent on the stipe and acute, pinnatifid into 10 -12 pairs of segments within 1 - 2 cm of the rachis. Segments *ca* 15 x 2 - 3 cm, shorter towards the apex, lanceolate, apex acuminate, suddenly decurrent, margin subentire ; terminal segment slightly larger than the others ; midrib and main lateral veins raised above and below ; main veins wavy, forming large primary areoles which extend two-third of the way to the margin and the rest of the segments are occupied by lesser irregular areoles including many free veinlets ; texture coriaceous and brittle ; lamina light-green, glabrous. Sori rather large, circular to oval, in one row on either side of the midrib of the leaf lobes at the middle of the primary areoles ; sporangia large, shortly stalked. Spores monolet, exine smooth (Pl. 33).

Fertile : May - Dec.

Distrib : (a) Sri Lanka, Malay, Polynesia, Australia ; (b) Western Ghats. Cultivated as an ornamental plant throughout India.

Occur : Rare ; on shaded rock surface in moist area near streams and occasionally on the basal portion of tree trunks. Digboi forest, Tinsukia dist. 652.

Note : This species is highly variable in the degree of lobing of fronds. There are plants with simply bilobed frond to regularly pinnatifid frond with up to 12 pairs of pinnae. Intermediate forms like trilobed frond or frond with varied number of pairs of pinnae are also found. A detail study is Warranted before any attempt to provide taxonomic status to these variations.

Microsorium dilatatum (Bedd.) Sledge, Bull. Brit. Mus. (N.H.) 2. 143. 1960. *Pleopeltis dilatata* Bedd. Ferns Brit. India, t.122. 1866 ; Handb. Ferns Brit. India, 367. t. 209. 1883. *Polypodium dilatatum* Wall. ex Hook. Sp. Fil. 5. 85. 1863 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 565. 1880. *Polypodium hancockii* Bak. Jour. Bot. 23. 116. 1886. *Microsorium hancockii* (Bak.) Ching, Bull. Fan. Mem. Inst. Biol. 4. 309. 1933 ; Satija & Bir. Polyp. Ferns India, 79. 1985. *Kaulinia hancockii* Nayar, Taxon 13. 67. 1964 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 62. 1982 ; Jamir & Rao, Ferns Nagaland, 117. 1988.

Lithophytes or semiepiphytes. Rhizome creeping, short, *ca* 1 cm thick, fleshy, green, apex scaly ; scales *ca* 0.8 x 0.2 cm long, narrow, ovate-lanceolate, apex acute, base broad, clathrate, entire, dark-brown. Stipes *ca* 20 - 35 cm long, erect, trigonal, abaxially ridged, adaxially flat or convex, stout, scaly at base. Lamina *ca* 20 - 45 x 15 - 30 cm, prominently decurrent towards the apex of the stipe, forming winges, simple pinnate, linear-oblong with an acuminate or slightly toothed terminal lobe ; lateral lobe 7 - 15 pairs, alternate, rather oblique and decurrent to rachis, base slightly broad, largest lobe *ca* 25 x 3 cm, oblong-lanceolate, apex acuminate, margin entire ; midrib prominent on both surfaces, main lateral veins raised on the lower surface, not reaching the margin, wavy, forming large primary areoles, which extend two third of the way to the margin, these and

the rest of the segments are occupied by lesser irregular areoles including many free veinlets, their branches moderately divaricating ; texture of the lamina thin, membranous ; light-green, glabrous. Sori copious, globose or oval, irregularly scattered throughout the lamina ; sporangia slender stalked. Spores oval, bilateral, greenish-yellow, exine smooth (Pl. 34).

Fertile : July - Aug.

Distrib : (a) South-West China, Sri Lanka, Malay, Myanmar, Malacca and Sqamos Islands ; (b) North and Northeast India.

Occur : Rare ; on deeply shaded, moist rocks on the banks of streams in hilly region or on forest floor, rarely on basal portion of tree trunks. Diphu, Karbi-Anglong dist. 1324.

Microsorium membranaceum (D. Don) Ching, Bull. Fan Mem. Inst. Biol. Bot. 4. 309. 1933 ; Dhir, Ferns N. W. Himalayas, 131. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 67. 1982 ; Jamir & Rao, Ferns Nagaland, 112. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 326. t. 248. 1992. *Polypodium membranaceum* D. Don, Prodr. Fl. Nepal, 2. 1825 ; Clarke, Trans. Linn. Soc. Lond.II. Bot. 1. 560. 1880 ; *Pleopeltis membranacea* Moore, Ind. Fil. 191. 1857 ; Bedd. Handb. Ferns Brit. India. 355. 1880 ; *Polypodium heterocarpum* Bedd. Ferns South. India, t. 177. 1864.

Terrestrial or epiphytic. Rhizome short creeping, *ca* 1 cm thick, sparsely covered by scales ; scales *ca* 0.5 x 0.3 cm, ovate or ovate-lanceolate, acuminate apex, rounded base, entire, blackish-brown. Stipes *ca* 5 - 15 x 0.3 - 0.5 cm, winged above, pale-brown. Fronds *ca* 40 - 62 x 6 - 12 cm, elliptic or oblong-lanceolate, apex acute or acuminate, base decurrent upon the stipes, margin entire, glabrous ; texture membranous, thin, pale-greenish or brownish when dry ; midrib distinctly raised below, flattened or shallowly grooved above ; veins distinct and slightly raised above and below, main veins horizontal, connected by transverse veins to form larger areoles enclosing many smaller areoles with one or more included veinlets. Sori *ca* 0.2 cm wide, numerous, round to globose, yellowish-brown, irregularly distributed all over the lower surface. Spores yellowish-green, exine granulose (Pl. 35).

Fertile : July - Oct.

Distrib : (a) Sri Lanka, Nepal, Myanmar, Indochina, Southwest China, Taiwan to Philippines and Celebes ; (b) throughout India in mountainous regions.

Occur : Common on moist, humous covered rocks along riverside. Sometimes grows as epiphyte. Dhaligaon, Bongaigaon dist. 1239 ; Orang forest, Darrang dist. 611.

Uses : Grown as ornamental plant (Satija & Bir 1985).

Microsorium pteropus (Bl.) Copel. Univ. Calif. Publ. Bot. 16. 112. 1929 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 329. t. 147. 1992. *Polypodium pteropus* Bl. Enum. Pl. Jav. ad. 3. 1828 ; Clarke, Trans. Linn Soc. Lond. II. Bot. 1. 562. 1880. *Polypodium tridactylon* Wall. ex. Hook. & Grev. Icon. Fil. 6. 209. 1831 ; Bedd. Ferns Brit. India, t. 11. 1866. *Pleopeltis pteropus* Moore, Ind. Fil. 78. 1867 ; Bedd. Handb. Ferns Brit. India, 359. t. 203. 1883. *Kaulinia pteropus* (Bl.) Nayar, Taxon 13. 67. 1964 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 62. 1982 ; Jamir & Rao, Ferns Nagaland, 119. 1988.

Aquatic. Rhizome creeping, *ca* 0.4 cm thick, fleshy, green, apex scaly ; scales *ca* 4 x 0.7 mm, lanceolate, long acuminate, entire, pale-brown. Stipes *ca* 2 - 10 cm long, winged upwards, sparsely covered by scales. Fronds *ca* 5 - 18 x 4 - 7 cm, simple, or 3 - lobate or 5 - lobate, lanceolate, acuminate, margin entire ; terminal lobe *ca* 20 - 2.5 cm, lateral ones *ca* 12 x 1.5 cm, linear-

lanceolate, acuminate apex, base long-tapering into a gradually decurrent wing upon the petiole ; all lobes scaly on the midrib beneath, glabrous above ; midrib raised and rounded below, flattened above ; veins distinct above and below, main veins rather wide apart, extending about two thirds of the way to the margin and then uniting to form large costal areoles, in addition a second series of smaller areoles is formed nearer the margin, the large areoles and rest of the frond filled up with a network of smaller irregular areoles, including free simple or forked veinlets which have clavate apices ; texture thin, firm, herbaceous ; lamina very dark, dirty green, often black when dry. Sori small, globose, scattered irregularly within the main areoles ; sporangia slender stalked, oval. Spores yellowish-green, exine smooth (Pl. 36 ; Ph. 5).

Fertile : Nov. - Jan.

Distrib : (a) Nepal, Bhutan, Bangladesh, Sri Lanka, Myanmar, Malay Peninsula, Malaysia, Taiwan ; (b) North India, South India, Nagaland, Meghalaya, Sikkim.

Occur : Rare ; on moist, shady rocks in beds or by the sides of streams and rivers. Paneri, Darrang dist. 412.

Note : The gatherings of the present study include plants with simple, trilobed and five-lobed fronds. The plants with trilobed and also the five-lobed fronds have been included under *M. pteropus* proper and the simple-leaved plants have been included under the forma *minor* (Bedd.) Ching by Satija & Bir (1985). Balakrishnan (1980) has, however, raised this forma to a varietal rank. But Satija & Bir (1985) observed that often the trilobed and simple fronds are present on the same rhizome (which is also observed by the present investigator in plants from Assam) and according to them it is for this reason that the forma *minor* can not be considered for a varietal rank.

Microsorium punctatum (L.) Copel. Orient. Gen. Polyp. in Univ. Calif. Publ. Bot.16.111. 1929 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 68. 1982 ; Jamir & Rao, Ferns Nagaland, 112. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 328. t.249.1992. *Acrostichum punctatum* L. Sp. Pl. ed. II. 2. 1524. 1763. *Pleopeltis punctata* (L.) Bedd. Ferns Brit. India. Suppl. 22. 1876 ; Handb. Ferns Brit. India, 357. t. 201. 1883. *Pleopeltis iridioides* Moore, Ind. Fil. 77. 1857 ; Bedd. Ferns South. India, t. 178.1864 (as '*irioides*').

Mirioni-mura (Ass.)

Epiphytes. Rhizome short creeping, *ca* 1cm thick, stout densely scaly ; scales *ca* 0.5 x 0.1cm, ovate or ovate-lanceolate, acuminate, margin toothed, thick, peltate, blackish-brown. Fronds without distinct stipe, *ca* 60 - 80 x 5 - 10 cm, simple, sessile, lanceolate or elliptic, apex blunt or acute, base decurrent, margin entire, midrib *ca* 0.6 cm across at the base, rounded below, grooved above ; veins visible but not prominent, areoles copious, including smaller areoles, in which are free simple or forked veinlets with clavate apices ; texture coriaceous ; pinnae glabrous above and below, dark-green when fresh, blackish when dry. Sori numerous, small, round, irregularly scattered on upper half of the frond ; sporangia oval, short-stalked. Spores yellowish green, exine finely granulose (Pl. 37 ; Ph. 1).

Fertile : May - Feb.

Distrib : (a) Warmer parts of Asia, Africa to Polynesia, Taiwan to S. China ; (b) throughout India.

Occur : Very common in moist shady places on tree trunks or on humous and moss covered rocks at low elevations. Kurua, Darrang dist. 755 ; Dhemaji, Dhemaji dist. 954.

Uses : Leaves and juice are used as purgative, diuratic and wound healer in Ivory Coast

(Boquet 1974). The plant is used as antidote to snake bite (Jain 1991). The plant is grown as ornamental plant (Satija & Bir 1985).

Note : A highly polymorphic species in respect of size and shape of the fronds.

Microsorium rubidum (Kunze) Copel. Gen. Fil. 197. 1947. *Polypodium rubidum* Kunze, Bot. Zeit. 117. 1848. *Pleopeltis longissima* Bl. Enum. Fil. 127. 1828 ; Bedd. Ferns Brit. India, Suppl. t. 388. 1876 ; Handb. Ferns Brit. India, 366. 1883.

Rhizome long creeping, *ca* 1 cm thick, densely clothed with scales at apex ; scales ovate, peltate, basal region broadly oval, adpressed, anterior region terminated by a glandular hair, margin dentate, with gladular hairs. Stipes *ca* 30 - 50 x 0.2 - 0.8 cm, cylindrical, hard,erect, apex winged by decurrent lamina, greenish-brown, glossy. Lamina *ca* 30 - 100 x 15 - 30 cm, narrowly elongate-oblong, deeply pinnatifid very nearly to the rachis, often leaving only the narrowest sign of a wing ; segments 3 - 20 pairs, *ca* 10 - 45 x 1.5 - 2.5 cm, linear-lanceolate, apex acuminate, margin subentire, wavy, base constricted ; midrib and main veins faintly violet coloured in some, main veins not very distinct, only faintly evident on the surface, areoles numerous, with free included simple or forked veinlets and slightly clavate apices ; texture membranous and papery. Sori *ca* 1.5 - 2.5 mm across, circular, in a single row on either side close to the midrib of the segments, deeply sunk and forming papillae on the upper surface ; sporangia narrow stalked. Spores bilateral and smooth walled (Pl. 38).

Fertile : June - Oct.

Distrib : (a) Bangladesh, Philippines, Taiwan, Malay Islands ; (b) only plains of Assam and cultivated in gardens throughout India.

Occur : Rare ; on moderately shaded moist rock surfaces, and on the base of moss covered tree trunks. Mandakata, Kamrup dist. 1164 ; Darrangiri, Goalpara dist. 1079.

Microsorium superficiale (Bl.) Ching, Bull. Fan Mem. Inst. Biol. Bot. 4. 308. 1933 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 68. 1982. Jamir & Rao, Ferns Nagaland, 115. 1988. *Polypodium superficiale* Bl. Enum. Pl. Jav. 130. t. 56. f. 1. 1828. Bedd. Ferns Brit. India, t. 75. 1866 ; Clarke, Trans.Lin. Soc. Lond. II. Bot. 1. 551. 1880 (excal. var.). *Pleopeltis superficialis* (Bl.) Bedd. Handb. Ferns Brit. India, 350. 1883.

Terrestrial or semiepiphytic. Rhizome long creeping, *ca* 0.5 cm thick, dorsiventrally flattened, greenish or brownish green, apex densely scaly, older region subglabrous ; scales *ca* 0.4 x 0.2 cm, ovate-lanceolate, acute at apex, base broad, clathrate, margin denticulate, dark-brown. Stipes *ca* 4 - 15 x 0.3 cm, scaly at base, slender, more or less flattened on the adaxial surface. Lamina *ca* 20 - 30 x 3 - 5 cm, simple, lanceolate, narrowed gradually at both ends, margin entire, glabrous ; midrib prominently raised on the upper surface and less prominent on lower surface ; veins obscure ; areoles numerous with simple or forked free veinlets ending in hydathodes ; texture subcoriaceous ; dark-green when dry. Sori *ca* 0.3 cm wide, copious, superficial, irregularly scattered throughout the lamina, yellowish when young ; sporangia small. Spores bilateral (Pl. 39).

Fertile : Dec. - Feb.

Distrib : (a) Myanmar, Nepal, Bhutan, China, Japan, Korea, Singapore, Java, Queensland ; (b) Eastern and South India.

Occur : Common, climbing on trees in deeply shaded forest. Longai forest, Karimganj dist.1396; Garampani forest, Golaghat dist. 1652.

Microsorium zippelii (Bl.) Ching, Bull. Fan Mem. Inst. Biol. Bot. 4. 308.1933 ; Dhir, Ferns N.W. Himalayas, 132. 1980 ; *Polypodium zippelii* Bl. Enum. Pl. Jav. 172. t. 80.1828 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 561. 1880. *Pleopeltis heterocarpa* Bedd. Ferns Brit. India, t. 319. 1866 (*non* Mett. or Bl.). *Pleopeltis zippelii* Moore, Ind. Fil. 348. 1862 ; Bedd. Handb. Ferns Brit. India, 357. 1883.

Epiphytic. Rhizome creeping, short, *ca* 0.5cm thick, slender, covered by scales ; scales *ca* 0.3 x 0.1cm, lanceolate, apex acuminate, base broad, clathrate, margin with glandular hairs, dark-brown. Stipe *ca* 1 - 5 x 0.2 - 0.3 cm, lamina decurrent almost to the base of the stipe, abaxially rounded, adaxially grooved, greenish. Lamina *ca* 30 - 60 x 3 - 8 cm, simple, lanceolate, apex acute, margin wavy ; midrib flattened, slightly raised on the upper surface and prominently raised on the lower surface ; main lateral veins prominent and near the margin ; areoles copious, with free included simple or forked veinlets ; texture subcoriaceous, light-green and glabrous. Sori rather large, *ca* 2 mm across, round, compital in two irregular rows between the primary veins and in about 4 rows between the costa and margin ; sporangia median sized, paraphyses filamentous. Spores bilateral (Pl. 40).

Fertile : Jan. - April.

Distrib : (a) Bhutan, Nepal, Java, Myanmar, China, Philippines, Malaysia, Indo-China ; (b) Northeast Himalayas.

Occur : Rare ; on shaded tree trunks or occasionally on moist rocks well inside the forest. Bhalukpung, Sonitpur dist. 856.

Paraleptochilus Copel.
Gen. Fil. 198. 1947.

It is a small genus with only two species and only the species *P. decurrens,* the type species of the genus, is known to occur in India (Dixit 1984 ; Dixit & Vohra 1984 ; Satija & Bir 1985), which is also recorded in the present study.

Paraleptochilus decurrens (Bl.) Copel. Gen. Fil. 198. 1947 ; Jamir & Rao, Ferns Nagaland, 122. 1988. *Leptochilus decurrens* Bl. Enum. Pl. Jav. 2. 206. 1828 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 307. t. 234, 1992. *Acrostichum variabile* Hook. Sp. Fil. 5. 277. 1864 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 578. 1880. *Gymnopteris variabilis* (Hook.) Bedd. Ferns Brit. India, t. 272. 1866 ; Handb. Ferns Brit. India, 429. t. 258. 1883.

Rhizome long creeping, *ca* 0.4 cm thick, densely covered by scales ; scales *ca* 4 x 1 mm, ovate-lanceolate, apex acuminate, hair-tipped, clathrate, pale-brown. Lamina dimorphic, simple ; stipes of sterile lamina *ca* 5 - 15 x 0.4 cm, winged nearly to the base, abaxially rounded, adaxially grooved, glabrous, grey-brown ; stipes of fertile lamina *ca* 15 - 25 x 0.3 cm, not distinctly winged, adaxially grooved, glabrous, grey-brown. Sterile lamina *ca* 20 - 50 x 5 - 10 cm, broadly ovate-lanceolate, shortly acuminate at apex, suddenly cuneate towards base, decurrent on the stipe, margin entire ; midrib distinctly raised below, slightly raised above, rounded above and below ; main lateral veins parallel, distinct on both surfaces, nearly reaching the margin, areoles copious with free included veinlets ; texture thin ; lamina dark-green, glabrous above and below; fertile lamina *ca* 20 - 50 x 0.5 - 1 cm, contracted and narrow, linear-oblong, covered entirely with sori at the lower surface . Sori exindusiate ; sporangia oval, slender stalked, with hairs. Spores oval to elliptical, light-brown, exine densely minutely warty (Pl. 41).

Fertile : May - June.

Distrib : (a) Myanmar, Polynesia, Malaysia, Indochina, S.W.China ; (b) Sikkim, Eastern India, South India.

Occur : Common, on moist shady places near rivers and streams ; sometimes grows as lithophytes. Katakhal forest, Hailakandi dist, 1403 ; Nameri forest, Sonitpur dist. 984.

Phymatopteris Pic. Ser.
Webbia 28. 460. 1973.

Dixit (1984) has listed 16 species of *Phymatopteris* for India while Satija & Bir (1985) have listed only 13 species for India. In the present study olny four species have been recorded.

Epiphytes or sometimes terrestrials. Rhizome creeping, densely covered with scales ; scales terminated by hair-like tips. Stipes more or less glabrous. Lamina simple or pinnatifid, entire, glabrous ; veins distinct, areoles with free branched veinlets ; sori large, globose ; sporangia with slender stalked, annulus oblique. Spores bilateral, spinulose.

KEY TO SPECIES

1a. Lamina simple.
  2a. Rhizome scales linear ; lamina dimorphic --- --- --- --- --- --- --- -- ***rhynchophylla***
  2b. Rhizome scales ovate-lanceolate ; lamina not dimorphic -- --- --- --- --- ***griffithiana***
1b. Lamina deeply pinnatifid nearly to the rachis
  3a. Lobes crenate; spores smooth - --- --- --- --- --- --- --- --- ***crenatopinnata***
  3b. Lobes entire or wavy ; spores spinulose or smooth --- --- ---- --- --- ***oxyloba***

Phymatopteris crenatopinnata (Clarke) Pic. Ser. Webbia 28. 461. 1973. *Polypodium crenatopinnatum* Clarke, Journ. Linn. Soc. Lond. 25. 99. t. 42. 1889. *Pleopeltis crenatopinnata* (Clarke) Bedd. Handb. Ferns Brit. India Suppl. 96. 1892. *Crypsinus crenato pinnatus* (Clarke) Copel. Gen. Fil. 206. 1947 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 58. 1982 ; Jamir & Rao, Ferns Nagaland. 107. 1988.

Epiphytes. Rhizome creeping, *ca* 0.2 cm thick, covered by hairs and scales ; scales *ca* 2 x 0.2 mm, linear-lanceolate, hair-tipped, peltate, margin toothed. Stipes *ca* 10 - 20 x .02 cm, abaxially rounded, adaxially grooved, glabrous, shining, purplish-brown. Lamina *ca* 9 - 15 x 5 - 10 cm, deeply pinnatifid nearly to the rachis, deltoid to ovate-lanceolate, cuneate at base, with an apical pinna which is linear, crenate ; lateral lobe 3 - 7 pairs ; lowest pair largest, *ca* 7 x 2 cm, oblanceolate, obtuse or round at apex, oblique at base, margin crenate ; costae and lateral veins distinct ; areoles with free veinlets, inconspicuos ; texture subcoriaceous ; lamina glabrous, green. Sori globose, *ca* 0.3 cm in diameter, biseriate, in between lateral main veins ; sporangia oval, dark-brown. Spores oval, light-yellow, exine smooth (Pl. 42).

Fertile : Oct. - Nov.

Distrib : (a) China ; (b) Northeast India.

Occur : Rare ; on shady tree trunks of forest. Sonai forest, Cachar dist. 1373.

Phymatopteris griffithiana (Hook.) Pic. Ser. Webbia 28. 462. 1973. *Polypodium griffithianum* Hook. Icon. Pl. 10. t. 951. 1854 ; Clarke, Trans. Linn. Soc. Lond. II . Bot. 1. 560. 1880. *Pleopeltis griffithiana* (Hook.) Bedd. Ferns Brit. India, t. 158. 1866 ; Handb. Ferns Brit. India, 354. t. 199.1883. *Crypsinus griffithiana* (Hook.) Copel. Gen Fil. 206. 1957 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 59. 1982 ; Jamir & Rao, Ferns Nagaland, 108. 1988.

Epiphyte. Rhizome long creeping, *ca* 0.2 - 0.4 cm thick, wiry, densely covered by scales ; scales

ca 0.7 x 0.2 cm, ovate-lanceolate, hair-tipped, base broad, margin entire, light-brown. Stipes *ca* 6 - 12 x 0.4 cm, firm, erect, adaxially grooved, abaxially rounded, glabrous. Lamina *ca* 15 - 30 x 2 - 6 cm, simple, lanceolate, apex acuminate, base cuneate, margin entire and with a strip of cartilaginous membrane, midrib slightly raised above and distinctly raised below ; main veins very distinct, not reaching the margin, areoles fine, hidden with copious free, simple or forked veinlets ; texture coriaceous ; lamina glabrous on both surfaces, green and become brownish when dry. Sori large, *ca* 0.4 cm in diameter, globose, one between each side of main vein in two rows, usually occupying upper half of lamina ; sporangia oval, dark-brown. Spores oval to elliptic, yellow, exine smooth (Pl. 43).

Fertile : May - June.

Distrib : (a) Bhutan, Myanmar,Borneo, South to west Malaysia, Southwest China to Japan ; (b) Northeast India, Sikkim.

Occur : Rare ; on moss covered tree trunks in shady forest. Rearely growing on humous covered soil as terrestrial and on rocks as lithophyte. Barnadi forest, Darrang dist. 1716 ; Darranga, Nalbari dist. 1297.

Phymatopteris oxyloba (Wall. ex Kunze) Pic. Ser. Webbia 28. 464. 1973. *Polypodium oxylobum* Wall. ex Kunze, Linn. 24. 255. 1851. *Polypodium hastatum* var. *oxyloba* Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 563. 1880 (*pro parte*). *Pleopeltis hastata sensu* Bedd. Handb. Ferns Brit. India, 362. 1883 (*pro parte*). *Phymatodes oxyloba* (Wall. ex Kunze) Presl, Tent. Pterid. 196. 1836 ; Dhir, Ferns N.W. Himalayas, 126. 1980. *Crypsinus oxylobus* (Wall. ex Kunze) Sledge, Bull. Brit.Mus. (Nat. Hist.) Bot. 2. 145. 1960 ; Jamir & Rao, Ferns Nagaland, 109. 1988.

Rhizome creeping, *ca* 0.5 cm thick, stout, densely scaly : scales *ca* 6 x 2 mm, ovate-lanceolate, apex acuminate, hair-tipped, margin entire, thin, ferruginous, dark-brown. Stipes *ca* 7 - 15 x 0.2cm, glabrous, abaxially rounded, adaxially grooved, shining, purplish-brown. Lamina *ca* 18 - 42 x 15 - 30 cm, deltoid to subcordate, deeply pinnatifid to within 1 cm of the rachis ; lateral pinnae 3 - 6 pairs with a terminal pinna similar to lateral ones ; largest pinna *ca* 6 - 17 x 2.5 - 4 cm, oblong lanceolate, apex short acuminate, base broad, margin entire , slightly thickened, midrib and costa prominently raised on both surfaces, hairy above, glabrous below ; main lateral veins often prominent beneath, slightly distinct above ; venation inconspicuous, main lateral veins united by transvers veins forming 3 - 4 series of primary areoles, filled by lesser ones including free veinlets ; texture subcoriaceous ; lamina yellowish green, glabrous. Sori globose, upto 3 mm wide, arranged in two rows one on either side of costae between the lateral veins which are nearer to the costa than the margin ; sporangia stalked, exindusiate. Spores elliptical, yellowish ; exine spinulose (Pl. 44).

Fertile : Oct. - Dec.

Distrib : (a) South West China, Northern Thailand ; (b) Himalayas.

Occur : Rare ; on moss covered rocks and moist tree trunks in forest. Bandardewa, Lakhimpur dist. 940.

Phymatopteris rhynchophylla (Hook.) Pic. Ser. Webbia 28. 464. 1973. *Polypodium rhynchophyllum* Hook. Icon Pl. 10. t. 954. 1854 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 560. 1880. *Pleopeltis rhynchophylla* (Hook.) Bedd. Ferns Brit. India, t. 9. 1866 ; Handb. Ferns Brit. India, 353. t. 198. 1883. *Crypsinus rhynchophyllus* (Hook.) Copel. Gen. Fil. 206. 1947 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 59. 1982.

Rhizome wide creeping, *ca* 0.2 - 0.3 cm thick, slender, wiry, clothed with scales ; scales *ca* 2 x 0.2 mm, linear, apex acuminate, reddish-brown. Lamina dimorphic, simple ; stipes of sterile lamina *ca*

2 - 5 x 0.2 cm, *ca* 5 - 9 x 0.2 cm of fertile lamina, slender, glabrous. Sterile lamina *ca* 2 - 5 x 1.5 - 2 cm, elliptical or subovate, obtuse at apex, margin slightly crenate ; fertile lamina *ca* 7 - 14 x 2.5 cm, lanceolate, apex acuminate, broadest below the middle, attenuate at base, margin slightly undulating, midrib distinctly raised above and below ; veins prominent ; costules connected by transverse veins forming areoles which enclose free, simple or forked veinlets ; texture firm, subcoriaceous ; lamina slightly thickened, glossy, green. Sori globose, in a single row on each side of midrib, mostly confined to the narrow acuminate apex, brown ; sporangia stalked, with 11 celled annulus. Spores minute, spherical, dark-brown (Pl. 45).

Fertile : Oct. - Dec.

Distrib : (a) Myanmar, Bhutan, North Thailand, Laos, Vietnam, China ; (b) Meghalaya.

Occur : Rare ; on rock surface along roadsides. Sonai Rupai forest, Sonitpur dist. 864.

Phymatosorus Pic. Ser.
Webbia 28. 457. 1973.

Dixit (1984) has listed four species of *Phymatosorus* for India and Satija & Bir (1985) on the other hand have reported five species under the genus for India. Only one species has been recorded in the present study.

Phymatosorus lucidus (Roxb. ex Griff.) Pic. Ser. Webbia 28. 459. 1973 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 316. t. 241. 1992. *Polypodium lucidum* Roxb. ex Griff. Calc. Journ. Nat. Hist. 4. 486. 1944. *Pleopeltis leiorhizum* Wall. Cat. n. 303. 1828 (*nom. nud.*) ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 567. 1880. *Pleopeltis leiorhiza* Moore, Ind. Fil. 346. 1862 ; Bedd. Ferns South. India, t. 174. 1864 ; Handb. Ferns Brit. India, 372. 1883.

Rhizome wide creeping, *ca* 1.5 cm thick, covered with ovate adpressed peltate, slaty-brown scales. Stipes *ca* 48 x 1 cm, pale or grey-brown, adaxially grooved, abaxially rounded, glabrous. Lamina pinnatifid, ovate, *ca* 60 x 40 cm, triforked at apex, base broadly cuneate, pinnae opposite or subopposite, basal one or two pairs sessile, others adnate, *ca* 30 x 2 cm, narrow lanceolate, acuminate at the apex, margin entire, both sides glabrous, dark-green, texture herbaceous. Rachis narrowly winged ; costa well rasied below, slightly rasied above ; main veins scarcely more prominent than the rest, areoles with copious free veinlets. Sori large, median between the margin of the pinna and costa, superficial, in two parallel rows on both sides of the costa. Spores planoconvex (Pl. 46).

Fertile : Jan. - May.

Distrib : (a) S.W. China and Tonkin ; (b) Himalayas, South India and Western Ghats.

Occur : Commonly growing as lithophytes, rarely as epiphytes in large colonies along fully shaded stream banks. Bhalukpung, Sonitpur dist. 868.

Polypodiastrum Ching
Acta Phytotax. Sin. 16(4). 28. 1978.

The genus *Polypodiastrum* is based on a very common fern of the Himalayas *Polypodium argutum* Wall. ex Hook. and is a segregate from *Polypodium* (*sensu lato*) by Ching (1978). According to Dixit (1984) only the type species of the genus is occuring in India. Satija & Bir (1985) mentioned that in addition to the type species two other species *P. prainii* (Bedd.) Ching and *P. molle* (Bedd.) Ching are also known from India. In the present study only the type species of the genus has been recorded.

Polypodiastrum argutum (Wall. ex Hook.) Ching, Acta Phytotax. Sin. 16(4). 28. 1978. *Polypodium argutum* Wall. ex Hook. Sp. Fil. 5. 32. 1863 ; Clarke, Trans. Linn. Soc. Lond II. Bot. 1. 551. 1880; Dhir, Ferns N.W. Himalayas, 121. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 71. 1982; Jamir & Rao, Ferns Nagaland, 67. 1988. *Goniophlebium argutum* (Wall. ex Hook.) J.Sm. in Hook. Gen. Fil. t. 52. 1840 ; Bedd. Ferns Brit. India, t. 6. 1866 ; Handb. Ferns Brit. India, 323. t. 174. 1883.

Epiphytes. Rhizome long creeping, *ca* 0.4 - 0.8 cm thick, stout, densely covered by scales ; scales *ca* 2 - 4 x 0.3 mm, linear-lanceolate, apex hair-tipped, acute, spreading, margin hooked, blackish or brown, glossy. Stipes *ca* 6 - 12 x 0.5 cm, erect, slender, hairy, pale-purplish, glossy ; lamina *ca* 10 - 30 x 8 cm, simple pinnate, deltoid to ovate-lanceolate, with a terminal pinna similar to lateral ones which sometimes bearing a short lobe at the base ; pinnae numerous, lower ones opposite, the rest alternate, lower pinnae sessile or shortly stalked, superior ones more or less adnate and decurrent, the lowest pair of pinnae reduced ; largest pinna *ca* 15 x 2 cm, oblanceolate, apex short acuminate, base subtruncate or cuneate or sometimes broad, margin obtusely serrated ; costa distinctly raised above and below ; veins prominent ; forming a costal series of large oblong areoles with included veinlets which bear sori ; marginal veins ending in a thickened apex within the margin and free ; texture firm, membranous ; lamina pale-greenish when dry. Sori globose, small, superficial, at the tip of the free veinlets in the costal areoles, light-brown ; sporangia short-stalked. Spores elliptical, with distinct loop like projects on both ends, greenish-yellow (Pl. 47).

Fertile : July - Oct.

Distrib : (a) China, Taiwan, Philippines, Tonkin, Indochina, Thailand ; (b) Himalayas from Kashmir to Bhutan, Meghalaya, Nagaland.

Occur : Common ; in moist, shady moss covered tree trunk and rocks in forest. Darranga, Nalbari dist. 1284 ; Haflong, North Cachar Hills dist. 1572.

Polypodioides Ching
Acta Phytotax. Sin. 16 (4). 26. 1978.

The genus is based on a classical Himalayan ferm *Polypodium amoenum* L. and according to Satija & Bir (1985) there are seven species of Polypodioides occuring in India. Dixit (1984), however, has listed only five species for India. In the present investigation only one species has been recorded.

Polypodioides lachnopus (Wall. ex Hook.) Ching, Acta Phytotax. Sin. 16 (4). 27. 1978. *Polypodium lachnopus* Wall. ex Hook. Icon. Pl. t. 952. 1854 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 551.1880; Dhir, Ferns N.W. Himalayas, 121. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 71. 1982; Jamir & Rao, Ferns Nagaland, 69. 1988. *Goniophlebium lachnopus* (Wall. ex Hook.) Bedd. Ferns Brit. India, t. 163. 1866 ; Handb. Ferns Brit. India, 319. 1883.

Epiphytes. Rhizome wide creeping, *ca* 0.5 cm thick, densely scaly all over ; scales *ca* 0.7 x 0.4 cm, spreading from small base, linear, hair-pointed long acuminate apex, margin hairy, blackish-brown. Stipes *ca* 5 - 15 x 0.4 - 0.7 cm, slender, erect, sparsely scaly at base, glabrous above, pale-brown ; lamina *ca* 20 - 45 x 5 - 10 cm, deeply pinnatifid, lanceolate with acuminate apex ; pinnae numerous, alternate ; lowest pair of pinnae cut down to the rachis ; largest pinna *ca* 5 - 7 x 1 - 1.5 cm, linear-lanceolate, base broad, gradually tapering to obtuse or acute apex, margin serrulate or crenate ; rachis sparsely scaly beneath and pubescent above ; costules broken on the lower half of the pinnae; areoles in a single series or rarely the veins are all free ; texture thin,

membranous ; lamina glabrous on both surfaces. Sori small, round, in a single series in the areoles or at the tip of the forked veinlets when there is no anastomosing ; sporangia slender stalked. Spores oval, yellowish-brown (Pl. 48).

Fertile : July - Oct.

Distrib : (a) & (b) Himalayas from Kashmir to Bhutan, Nagaland, Manipur, Meghalaya.

Occur : Common, on tree trunks and as well as humous floor of shady slopes. Bandardewa, Lakhimpur dist. 937 ; Kachugaon, Kokrajhar dist. 1243.

Pseudodrynaria C. Chr. ex Ching
Sunyat. 6. 10. 1941.

The monotypic genus *Pseudodrynaria* is represented by its type species *P. coronans* in India (Dixit 1985 ; Dixit & Vohra 1984 ; Satija & Bir 1985). Ching (1978) included the genus under the family Drynariaceae proposed by him alongwith the genera *Drynaria* (Bory) J. Sm., *Photinopteris* J. Sm., *Merinthosorus* Copel., *Holostachyum* (Copel.) Ching, *Aglaomorpha* Scott and *Drynariopsis* (Copel.) Ching.

Pseudodrynaria coronans (Wall. ex Mett.) Ching, Sunyat. 6. 10. 1941 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 73. 1982 ; Jamir & Rao, Ferns Nagaland. 130. 1988. *Polypodium coronans* Wall. ex Mett. Pol. 121. n. 242. t. 3. f. 40, 41. 1857 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 556. 1880. *Drynaria coronans* J.Sm. in Hook. Journ. Bot. 4. 61. 1841 ; Bedd. Ferns Brit. India, t. 13. 1866 ; Handb. Ferns Brit. India, 338. t. 187. 1883.

Bird-nest fern (Eng.)

Epiphytes or lithophytes. Rhizome creeping, 2 - 8 cm thick, soft, fleshy, dark-brown, densely scaly; scales *ca* 1 - 2 x 0.1 - 0.2 cm, narrowly lanceolate, apex long acuminate, hair-tipped, base broad, entire, golden-brown. Lamina *ca* 50 - 100 x 20 - 40 cm, sessile, basal portion broadly circular to cordate-ovate, basal margin shallowly lobed, lobes become more and more prominent upwards ; upper portion lanceolate, margin deeply lobed almost to the rachis ; largest lobe *ca* 12 - 25 x 2 - 5 cm, linear, lanceolate, apex acuminate, margin entire, wavy ; midrib strong, *ca* 1 cm thick, hard, brittle, raised on both surfaces, polished, rounded on lower surface, grooved on the upper surface, brownish-green ; venation prominent, main laleral veins alternate ; costules parallel, extending to the margin, costules are connected by transverse veins forming 5 - 6 soriferous areoles and then again generally two or three others which include free veinlets ; texture coriaceous ; lamina dark-green. Sori small, round or slightly elongated, in a irregular row usually one per primary areole along tertiary veins ; sporangia long stalked. Spores round, yellow (Pl. 49).

Fertile : July - Oct.

Distrib : (a) China, Taiwan, Nepal, Bhutan, Bangladesh, Malay, Taiwan ; (b) almost throughout Northern and Northeastern India.

Occur : Common, on tree trunks in forest ; sometimes grows on humous covered rocks. Dibru forest, Dibrugarh dist. 632 ; Kaupati, Darrang dist. 810 ; Baharghat, Kamrup dist. 1285.

Uses : Fronds are used for making umbrella and baskets (Dixit & Vohra 1984).

Pyrrosia Mirb.
Lam. *et* Mirb.Hist. Nat. Vég. 3 : 471. 5. 91. 1802.

The genus *Pyrrosia* includes about 100 species occuring mostly in Asia and a few in Australia, New Zealand and Africa (Shing 1983). Dixit has listed 27 species of *Pyrrosia*, including *Pleopeltis*

macrocarpa (Bory ex Willd.) Kaulf. for India. Satija & Bir (1985) have listed 25 species including two doubtful species for India. In the present study only 10 species have been encountered.

Epiphytes. Rhizome short or long creeping, more or less densely covered with scales. Stipes short. Lamina uniform or dimorphic, entire, fleshy, covered with stellate hairs ; texture coriaceous ; veins indistinct, irregularly anastomosing with free, included veinlets. Sori superficial, small, round to elongate, usually on included veinlets. Spores bilateral.

KEY TO SPECIES

1a. Lamina dimorphic
  2a. Sterile fronds linear-lanceolate, slightly different from fertile ones --- --- --- ***adnascens***
  2b. Sterile fronds circular or oval, much different from the fertile ones
    3a. Scales 3 - 4 mm long ; stipe of lamina 1 - 2 cm long ; sterile lamina obovate, rather thin and leathery --- --- --- --- --- --- --- --- --- ***obovata***
    3b. Scales 5 - 7 mm long ; stipe absent ; sterile lamina nearly circular, very thick and fleshy --- --- --- ----- --- --- --- --- --- --- --- --- --- ***numularifolia***
1b. Lamina uniform
  4a. Fronds more than 30 cm long
    5a. Stipes *ca* 3 cm long ; sori immersed --- --- --- --- --- --- -- --- --- --- ***beddomeana***
    5b. Stipes *ca* 10 - 15 cm long ; sori superficial --- --- --- --- --- --- -- --- --- ***subfurfuracea***
  4b. Fronds less than 30 cm long
    6a. Stipe of lamina more than 8 cm long ; sori throughout the lower surface
      7a. Lateral veins prominently raised ; margin of the scales hairy towards the apex - -- --- --- --- --- --- --- --- --- --- --- --- --- ***heteracta***
      7b. Lateral veins obscure ; margin of the scales entire or so --- --- -----***flocculosa***
    6b. Stipe absent or lamina shortly stalked ; sori on upper half of lower surface
      8a. Fronds are rather distantly placed ; the midrib forms a prominent median groove on the upper surface and raised on the lower surface
        9a. Lamina thick, 10 - 15 cm long ; 1.25 cm broad at the broadest part with an acute base ---- --- --- --- --- --- --- --- --- --- --- ***lanceolata***
        9b. Lamina thin, 15 - 30 cm long, 1.5 - 2 cm broad, with a narrowly or broadly cuneate base - --- --- --- --- --- --- --- --- --- --- ***varia***
      8b. Fronds are rather closely placed ; the midrib forms a very faint ridge on the upper surface and a shallow broad ridge on the lower.
        10a. Rhizome scales are conclourous --- --- --- --- --- --- --- --- --- ***mannii***
        10b. Rhizome scales are bicolourous --- --- --- --- --- --- --- --- --- ***mollis***

Pyrrosia adnascens (Sw.) Ching, Bull. Chin. Bot. Soc. 1. 69. 1935 ; Dhir, Ferns N.W. Himalayas, 118. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 74. 1982 ; Jamir & Rao, Ferns Nagaland, 93. 1988. *Polypodium adnascens* Sw. Syn. Fil. 25, 222. t. 2. f. 2. 1806. *Niphobolus adnascens* (Sw.) Kaulf. Enum. Fil. 124. 1824 ; Bedd. Handb. Ferns Brit. India, 325. 1883 (*pro parte*).

Son-chokolia (Ass.)

Epiphytes. Rhizome wide creeping, *ca* 0.2 cm, thick, profusely branched, densely covered with scales; scales *ca* 0.3 - 0.6 x 0.1 cm, lanceolate, apex acuminate, base ovate or oblong, margin fimbriate, centre dark-brown, pale-brown at periphery. Stipes *ca* 0.5 - 3 x 0.2 cm, adaxially grooved, scaly at base, glabrous above. Lamina dimorphic, simple, more or less regularly alternating with branches of rhizome, there is no clear distinction between sterile and fertile lamina, the

sterile leaves are shorter than the fertile ones ; sterile lamina *ca* 4 - 8 x 0.5 - 1.5 cm, obovate, shortly stalked, apex obtuse or acute, base cuneate, margin entire, upper surface clothed with scattered adpressed stellate hairs ; fertile lamina *ca* 7 - 15 x 0.3 - 0.5 cm, linear to lanceolate, apex obtuse or acute, base narrowly decurrent on stipe ; texture thickly fleshy ; upper surface is glossy green, lower surface covered with stellate hairs ; midrib prominently raised, veins obscure ; there are 6 rows of areoles enclosing 4 - 5 simple or branched tertiary veinlets. Sori small, round, depressed, covering from costa to margin on the 1/2 - 2/3 of fertile lamina ; sporangia oval, slender stalked. Spores round, bilobed, exine tuberculate, light golden-brown (Pl. 50).

Fertile : May - Feb.

Distrib : (a) Malay, China, Taiwan, Philippines, Polynesia, Fiji, Mascareen Islands, Sri Lanka ; (b) throughout India.

Occur : Abundant on tree trunks as epiphyte in open places ; sometimes completly enveloping the tree trunks, also grows as lithophyte and on old brick walls. Jirighat, Cachar dist. 1375 ; Marnai. Goalpara dist. 1077 ; Mangaldai, Darrang dist. 357 ; Jorhat, Jorhat dist. 1258.

Uses : Fronds are used medicinally to treat dysentery and burn injuries (Jain 1991).

Note : A highly polymorphic species.

Pyrrosia beddomeana (Gies.) Ching, Bull. Chin. Bot. Soc. 1. 68. 1935 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 74. 1982. *Niphobolus beddomeanus* Gies. Farngatt. *Niphobolus*. 101. 1901. *N. costatus* Bedd. Ferns Brit. India, t. 120. 1866. *Polypodium stigmosum* Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 553. 1880. *Niphobolus stigmosus* Bedd. Handb. Ferns Brit. India, 328. 1883 (*pro parte*).

Rhizome short creeping, *ca* 0.5 - 0.8 cm thick, stout, clothed with scales ; scales *ca* 0.6 - 1 x 0.1 cm, linear-lanceolate, apex hair like, entire, brown. Stipes aggregate, *ca* 3 x 0.4 cm, angled. Lamina *ca* 30 - 50 x 3 - 6 cm, oblanceolate, acuminate apex, gradually decurrent at base, sparsely clothed with stellate hairs, grey-brown tomentose beneath, texture coriaceous, green, entire ; veins prominent, lateral veins parallel, free at margin. Sori immersed, minute and numerous in close rows towards the apex of the lamina, light brown ; sporangia oval, short stalked. Spores cyndrical, hyaline, smooth walled, yellow (Pl. 51).

Fertile : Feb. - April.

Distrib : (a) China, Nepal, Java, New Guinea ; (b) Himalayas, Meghalaya.

Occur : Not common, on humous deposits over tree trunk or on rocks or stony wall as well as on forest floor. Silbari, Darrang dist. 837 ; Bhalukpung, Sonitpur dist 870.

Pyrrosia flocculosa (D. Don) Ching, Bull. Chin. Bot. Soc. 1. 66. 1935 ; Dhir, Ferns N.W. Himalayas, 117. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 75. 1982 ; Jamir & Rao, Ferns Nagaland, 94. 1988. *Polypodium flocculosum* D. Don, Prod. Fl. Nepal, 1. 1825 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 554. 1880. *Niphobolus flocculosus* (D. Don) Bedd. Ferns Brit. India, t. 162. 1866 ; Handb. Ferns Brit. India, 331. t. 180. 1883.

Epiphytes or lithophytes. Rhizome short creeping, *ca* 1 cm thick, soft, covered with scales ; scales *ca* 1 x 0.1 cm, linear, acuminate hair-pointed apex, base broad, brown. Stipes *ca* 10 - 20 x 0.3 cm, terete, scaly at base, above densely covered by stellate hairs. Lamina *ca* 10 - 30 x 3 - 8 cm, oblong-lanceolate to elongate-oblong, apex gradually narrowed-acute, base suddenly narrowed, sometimes broadly rounded to cuneate, often unequal sided, slightly attenuate or decurrent on

stipe, margin entire, wavy ; midrib prominently raised on both surfaces ; main lateral veins faintly rasied on the lower surface, 5 - 7 mm apart, straight, extending upto the margin ; areoles 10 - 15 on either side of the midrib with usually unbranched, parallel veinlets ; texture herbaceous ; lamina glabrous and blackish, puncate above when old, lower surface with stellate hairs. Sori copious, *ca* 1 - 1.5 mm across, nearly circular or very slightly spreading, depressed, arranged in regular rows between the costules ; sporangia short stalked, oval. Spores oval to kidney-shaped, light yellowish, exine finely grooved (Pl. 52).

Fertile : July - Oct.

Distrib : (a) Myanmar, Nepal, Bhutan, Annam, Tonkin, China ; (b) Himalayas and Northeast India.

Occur : Rare ; on mossy rock surface as well as on tree trunk in shady forest. Manas forest, Barpeta dist.1205 ; Lumding, Nagaon dist. 1559.

Pyrrosia heteracta (Mett. ex Kuhn) Ching, Bull. Chin. Bot. Soc. 1. 57. 1935. Baishya & Rao, Ferns & Fern-allies Meghalaya, 75. 1982 ; Jamir & Rao, Ferns Nagaland, 94. 1988. *Polypodium heteractis* Mett. ex Kuhn in Linnaea 36. 140. 1869 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 553. 1880. *Nephobolus heteractis* (Mett. ex Kuhn) Bedd. Handb. Ferns Brit. India, 327. 1883. *N. lingua sensu* Bedd. Ferns Brit. India Suppl. 22. t. 385. 1876 (*non* Spr. 1827).

Epiphytes or lithophytes. Rhizome wide creeping, *ca* 2 - 3 mm thick, branched and densely covered by scales. Scales *ca* 1 x 0.2 cm, thin, linear-lanceolate, apex acute, base forming an elongated lobe, margin profusely hairy towards the apex. Stipes *ca* 10 - 20 x 0.2 - 0.3 cm, terete, clothed with stellate hairs, thick and hard. Lamina *ca* 10 - 30 x 4 - 8 cm, elliptic or oblong, apex long acuminate, base broadly cuneate or rounded ; upper surface green, glossy, glabrous, lower surface of lamina covered by pale-brown stellate hairs ; midrib and main veins are grooved on the upper surface and protruded into blunt rounded ridges on the lower surface, texture coriaceous. Either the whole lamina or only the anterior half may be fertile. Sori large, globose, prominent, depressed ; sporangia oval, short stalked, mixed with hairs. Spores round, pale-brown (Pl. 53).

Fertile : July - Dec.

Distrib : (a) Bhutan, Myanmar, S. W. China, Sri Lanka ; (b) Sikkim Himalayas, Meghalaya, Nagaland.

Occur : Not common, on moist tree trunks and on moss covered rocks. Harisinga, Darrang dist. 858 ; Sonapur, Kamrup dist. 749.

Pyrrosia lanceolata (L.) Farewell. Amer. Midl. Nat. 12. 245. 1931 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 322. t. 245. *Acrostichum lanceolatum* L. Sp. Pl. 2. 1067. 1753. *Polypodium adnascens* Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 552. 1880. *Niphobolus adnascens* Bedd. Handb. Ferns Brit. India, 325. t. 176. 1883. (*non* Kaulf. 1824). *N. fissus sensu* Bedd. Ferns South. India, t. 184. 1864. (*non*. Bl. 1828).

Rhizome wide creeping, *ca* 2 mm thick, slender, clothed with scales ; scales lanceolate, *ca* 5 x 1 mm, apex acuminate, base rounded, margin profusely hairy, entire. Stipes distantly placed, upto 4 cm apart, *ca* 2.5 x 0.2 cm, flattened, winged along margin, grooved, pale-brown, covered by stellate hairs. Lamina simple, lanceolate, *ca* 10 - 15 x 1 - 1.25 cm, acute apex, base decurrent, entire or wavy, green and glossy above, brownish below, upper surface glabrous, lower surface densely covered by stellate hairs, texture coriaceous, midrib marked by a prominent median groove on the upper surface and raised on the lower ; veins immersed ; lamina wrinkle up on drying. Sori

irregularly distributed on the anterior half of lamina ; sporangia orbicular, *ca* 1 - 2 mm in diameter, dark-brown, naked. Spores greenish-yellow, reniform or planconvex, exine with tubercles (Pl. 54).

Fertile : June - Jan.

Distrib : (a) Sri Lanka, Bhutan, Polynesia, China, Thailand, Japan, Taiwan and Tonkin ; (b) throughout India.

Occur : Common, growing on tree trunks and also on the walls often forming extensive mats. Champagaon, Darrang dist. 760 ; Banshkandi, Cachar dist. 1377.

Uses : A decoction of the fern is used in South Africa for clods and sore throat. In Mexico, a tea prepared from the fronds is used for itch (Manickam & Irudayaraj 1992).

P*yrrosia mannii* (Gies.) Ching, Bull. Chin. Bot. Soc. 1. 55. 1935 ; Dhir, Ferns N. W. Himalayas, 116. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 75. 1982 ; Jamir & Rao, Ferns Nagaland, 97. 1988. *Niphobolus mannii* Gies. Farngatt. *Niphobolus*. 107. 1901. *N. porosus* Bedd. Ferns South. India, t. 183. 1864. *N. floccigerus* Bedd. Ferns Brit. India Suppl. t. 386. 1876. *N. fissus sensu* Bedd. Handb. Ferns Brit. India, 330. t. 179. 1883 (*pro parte* ; *non* Bl. 1828).

Epiphytes. Rhizome short creeping, stout, densely covered by scales ; scales *ca* 8 x 1 mm, lanceolate, apex long acuminate with glandular hair, base broad, margin entire, ferruginous brown. Fronds *ca* 5 - 15 x 1 - 3 cm, crowded, oblanceolate, stipes absent, apex acute or short acuminate, base gradually narrowed, margin entire ; upper surface glossy, provided with small pit-like hydathodes ; lower surface densely covered by reddish-brown, ferruginous, woolly stellate tomentum ; venation hidden ; midrib prominent on lower surface, indistinct on upper surface ; texture coriaceous. Sori copious, small, usually circular, arranged on upper half of the frond ; sporangia large, short stalked. Spores oval, yellow (Pl. 55).

Fertile : Aug. - Dec.

Distrib : (a) Sri Lanka, Malaysia, Madagascar ; (b) North-East to South India.

Occur : Not common, on open tree trunks. Bhairabkunda, Darrang dist. 1523.

Note : Panigrahi & Patnaik (1968a) mentioned this species as neo-endemic to Assam and Eastern Himalayas and with potentialities with wider distribution.

Pyrrosia mollis (Kunze) Ching, Bull. Chin. Bot. Soc. 1. 53. 1935 ; Dhir, Ferns N.W. Himalayas, 116. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 75. 1982 ; Jamir & Rao, Ferns Nagaland, 97. 1988. *Niphobolus mollis* Kunze Bot. Zeit. 6. 121. 1848. *N. fissus sensu* Bedd. Ferns Brit. India Corr. II. 1870 ; Handb. Ferns Brit. India, 330. 1883 (*pro parte* ; *non* Bl. 1828). *N. porosus sensu* Bedd. Ferns South. India, t. 183. 1864. *Polypodium fissum* Hook. et Bak. Syn. Fil. 351. 1874 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 554. 1880 (*non Niphobolus fissus* Bl. 1828).

Epiphytes. Rhizome short creeping, slender, *ca* 1.5 - 2 mm in diameter, densely covered by scales ; scales *ca* 0.6 - 0.1 cm, ovate-lanceolate, apex acute or blunt, brown, central region dark, margin profusely hairy. Stipes *ca* 0.3 cm long. Fronds *ca* 12 - 30 x 1 - 2.5 cm, oblanceolate, apex acute, base long attenuate, margin entire, upper surface with pitted hydathodes and sparsely adpressed stellate hairs, lower surface covered by dense, thick felt of reddish-brown dimorphous stellate hairs, texture herbaceous, veins hidden, soriferous in the upper half of lamina. Sori copious, small, round or oval, scattered from costa up to margin, dark-brown ; sporangia short-stalked. Spores oval, yellow (Pl. 56).

Fertile : July - Nov.

Distrib : (a) China, Philippines, Taiwan, Sri Lanka, Myanmar, Java and Tonkin ; (b) Himalayas, Meghalaya, Nagaland.

Occur : Not common, on moist tree trunks in forest. Kalikhola, Darrang dist. 731 ; Bagaribari, Dhubri dist. 392.

Pyrrosia nummulariaefolia (Sw.) Ching, Bull. China. Bot. Soc. 1. 47. 1935 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 76. 1982 ; Jamir & Rao, Ferns Nagaland, 99. 1988. *Acrostichum nummulariaefolium* Sw. Syn. Fil. 191. 418. t. 2. f. 1. 1806. *Polypodium nummulariaefolium* Mett. Farngatt. Poly. 123. t. 3.f. 9, 10. 1857 ; Clarke, Trans. Linn. Soç. Lond. II. Bot. 1. 553. 1880. *Niphobolus nummulariaefolius* J. Sm. Journ. Bot. 3. 396. 1841 ; Bedd. Ferns Brit. India. t. 320. 1866 ; Handb. Ferns Brit. India, 334. 1883.

Epiphytes. Rhizome wide creeping, *ca* 0.1 - 0.2 cm thick, very slender, branched profusely, densely covered by scales ; scales *ca* 5 - 7 x 0.7 mm, linear-lanceolate, apex acuminate hair-tipped, base ovate, margin with few long spreading hairs, pale-brown. Lamina dimorphic. Sterile lamina sub sessile or very shortly stalked, *ca* 1.5 - 4 x 1 - 1.5 cm, almost circular to broadly ovate or elliptical, margin smooth, entire ; midrib and venation completely hidden on either side ; veins forming 3 rows of areoles on either side of midrib with 1 or 2 free, simple veinlets, marginal veinlets free; texture carnose-coriaceous ; upper surface glossy and shining, the lower bears hairs ; fertile lamina *ca* 3 - 8 x 0.3 - 0.7 cm, with the stipe *ca* 1.5 - 2 cm long, narrowly oblong, apex bluntly obtuse or rounded, base gradually narrowed, margin entire ; venation similar to that of sterile lamina ; acicular hairs present on the lower surface. Sori close, rounded, scattered, sometimes covering the whole surface ; sporangia stalked. Spores round, golden-brown, exine with irregularly scattered long projections (Pl. 57).

Fertile : Oct. - Feb.

Distrib : (a) Bhutan, Bangladesh, Malay, Philippines, China ; (b) North India and Norheast India.

Occur : Common, on exposed tree trunks. Haflong, North Cachar Hills dist. 1574 ; Bilasipara, Dhubri dist. 398.

Pyrrosia obovata (Bl.) Ching, Bull. Chin. Bot. Soc. 1. 47. 1935 ; Nayar & Kaur, Comp. Bedd. Handb. 81. 1974. *Acrostichum obovatum* Bl. Enum. Pl. Jav. 102. 1828. *Polypodium nummulariaefolium* var. *obovatum* Clarke, Trans. Linn. Soc. Lont. II. Bot. 1. 554. 1880.

Epiphytes. Rhizome long creeping, *ca* 0.1 cm thick, slender, branched, densely clothed with scales ; scales *ca* 3 - 4 x 0.7 mm, narrowly lanceolate, apex acuminate hair tipped, base broad, margin with hairs, brown. Lamina dimorphic ; stipe of sterile lamina *ca* 8 x 0.7 mm ; sterile lamina *ca* 2.5 x 1.5 cm, ovate to oblong, apex broadly rounded, margin smooth, slightly recurved ; venation completely hidden, midrib slightly raised in the basal region; veins form 4 rows of areoles with two free ending veinlets which may be forked and branches occasionally form small areoles ; texture carnose papyraceous ; upper surface glossy at maturity, lower surface covered by stellate hairs ; fertile lamina with their stipe *ca* 2 - 2.5 x 0.1 cm and the lamina *ca* 7 x 0.7 cm, linear, apex rounded, base cuneate, margin smooth, slightly recurved ; midrib raised on the lower surface and grooved on the upper surface ; areoles narrow and contain 3 tertiary veinlets each ; lamina slightly thicker than the sterile ones. Sori crowded, circular, covering the whole surface ; sporangia long stalked. Spores golden-yellow, exine with spines (Pl. 58).

Fertile : Jan. - May

Distrib : (a) Java, Tonkin ; (b) Northeast India.

Occur : Common, on tree trunks of moist and shady places. Sonai Rupai forest, Sonitpur dist. 842 ; Darranga, Nalbari dist. 1287 ; Pabitara forest, Marigaon dist. 486.

Pyrrosia subfurfuracea (Hook.) Ching, Bull. Chin. Bot. Soc. 1. 68. 1935. *Polypodium subfurfuraceum* Hook. Sp. Fil. 5. 52. 1863 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 553. 1880. *Niphobolus subfurfuraceus* (Hook.) Bedd. Ferns Brit. India, t. 259. 1866 ; Handb. Ferns Brit. India, 329. 1883.

Epiphytes. Rhizome short creeping, *ca* 0.8 cm thick, fleshy, branched, scaly ; scales *ca* 1 x 0.1 cm, linear, apex acuminate, base broad, margin smooth, dark-brown. Stipes *ca* 10 - 15 x 0.3 cm, sub-cylindrical, adaxially grooved, stellate hairs present when young but glabrous at maturity. Lamina simple, *ca* 40 - 80 x 6 - 10 cm, elongate-lanceolate, gradually tapering to both ends, apex prolonged acuminate, base much attenuate upon the stipe, margin entire and slightly wavy ; midrib raised faintly on upper surface, prominently on the lower ; main lateral veins grooved on the upper surface, ridges on the lower ; venation indistinct, the areoles form 15 - 20 in a series between the costa and the margin, each with numerous included free or scarcely anastomosing soriferous veinlets ; texture thin, leathery ; upper surface of lamina green, glossy and bears minute pitted hydathodes, lower surface bears a thin covering of stellate hairs. Sori small, *ca* 0.4 mm across, compital, subglobose, forming as many arched series between the costules as there are areoles ; sporangia short stalked. Spores with thin, hyaline, smooth exine (Pl. 59).

Fertile : July - Oct.

Distrib : (a) Mayanmar, Bhutan, China ; (b) Northeast India.

Occur : Rare ; on tree trunks in shady forest. Lalabajar, Hailakandi dist. 1405 ; Kundarbil, Darrang dist. 1549.

Pyrrosia varia (Kaulf.) Farwell, Amer. Midl. Nat. 12. 302. 1931. *Niphobolus varians* Kaulf. Enum. Fil. 125. 1824. *N. adnascens sensu* Bedd. Handb. Ferns. Brit. India, 325. 1883 (*pro parte*).

Rhizome long creeping, *ca* 2-3mm thick, densely clothed with scales ; scales *ca* 7 x 1.5mm, linear, apex acute, with glandular hair, base broad, margin hairy, dark-brown at the middle, hyaline at the periphery. Stipe *ca* 1 - 4 x 0.2cm, abaxially rounded, adaxially grooved, scaly at base, glabrous above, stramineous. Lamina *ca* 10 - 20 x 1.5 - 2.5cm, lanceolate, broadest at middle, gradually narrowed to an acuminate apex, base broadly cuneate, margin entire and recurved towards the lower surface ; venation hidden, midrib prominent, grooved above, distinctly raised below ; texture coriaceous ; upper surface of lamina glossy, lamina green, become reddish-brown when mature. Sori large, circular, upto 1mm wide, on the anterior half of lamina ; sporangia with long stalk. Spores golden yellow (Pl. 60).

Fertile : Dec. - Feb.

Distrib : (a) Malaysia to Polynesia ; (b) Northeast India.

Occur : Common at certain places on trees in less exposed condition. Guwahati, Kamrup dist. 1306.

Tricholepidium Ching

Acta Phytotax. Geobot. 29. 41. 1978.

Tricholepidium is a small genus of 10 species mostly of subtropical and tropical regions of Asia. The genus is represented by its type species *T. normale* in India (Dixit 1984 ; Dixit & Vohra

1984 ; Satija & Bir 1985). Only the type species of the genus has been recorded in the present study.

Tricholepidum normale (D. Don) Ching, Acta Phytotax. Geobot. 29. 41. 1978. *Polypodium normale* D. Don, Prod. Fl. Nepal, 1. 1825 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 558. 1880. *Pleopeltis normalis* Moore, Ind. Fil. 347. 1848. Bedd. Ferns Brit. India, t. 10. 1866 ; Handb. Ferns Brit. India, 353. 1883. *Microsorium normale* (D. Don) Ching, Bull. Fan Mem. Inst. Biol. Bot. 4. 229. 1933 ; Nayar & Kaur, Comp. Bedd. Handb. 86. 1974. *Neolepisorus normalis* (D. Don) Ching, Bull. Fan. Inst. Biol. Bot. 10. 14. 1940. *Neocheiropteris normalis* (D. Don) Tagawa, J. Jap. Bot. 27. 217. 1952 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 68. 1982 ; Jamir & Rao, Ferns Nagaland, 72. 1988.

Rhizome long creeping, *ca* 0.5 - 0.7 cm thick, scandent, flattened, scaly ; scales small, adpressed, ovate-lanceolate, hair-pointed, margin entire, studded with erect tufts of linear, black-red, stiff bristles on their back. Stipes *ca* 2 - 6 x 0.2 - 0.4 cm, adaxially grooved, abaxially rounded, sparsely covered by scales, articulate to rhizome. Lamina *ca* 25 - 50 x 2 - 4 cm, simple, linear, broadest at middle, gradually narrowed at both ends, apex short acuminate, base decurrent ,margin entire, slightly wavy ; midrib distinctly raised below, slightly rasied above ; veins indistinct, but distinct in dried fronds, areoles irregular with free included veinlets ; texture thin, membranous ; lamina glabrous, greenish-brown when dry. Sori large, upto 0.3 cm wide, globose, superficial or a little immersed, in one or more irregular row on either side of the midrib ; sporangia oval, shortly stalked. Spores reniform, light yellow, exine verrucoid (Pl. 61).

Fertile : July - Dec.

Distrib : (a) Nepal, Bhutan, Myanmar, South West China ; (b) Himalayas.

Occur : Rare ; on tree trunks in evergreen forest. Nameri forest, Sonitpur dist. 885.

Note : This fern has long been subjected to nomenclatural changes several times. It was first placed under *Polypodium* by D. Don (*loc. cit.*) but later on placed in *Microsorium* and then to *Neolepisorus* by Ching (*loc. cit.*). Tagawa (*loc. cit.*) placed it under *Neocheiropteris*. Holttum (1954) has commented on it "Perhaps it is derived from *Lepisorus* and perhaps also some *Microsorium* species lacking paraphyses have the same origin" and keeping this in view, Ching (*loc. cit.*) proposed a new genus *Tricholepidium* for this and other related polypods from southeast Asia.

PLATYCERIACEAE (Nayar) Ching

Platycerium Desv.
Mém. Linn. Soc. Paris 6. 213. 1827.

The genus is represented in India by only one species in wild state (Dixit 1984 ; Dixit & Vohra 1984 ; Satija & Bir 1985), which is also recorded in the present study.

Platycerium alcicorne Desv. Mém. Linn. Soc. Paris, 6 : 213. 1827. *P. wallichii* Hook. Gard. Chron, 765. 1858 ; Bedd. Ferns Brit. India, t. 108. 1866 ; Handb. Ferns Brit. India, 445. t. 272. 1883 ; Suppl. 107. 1892.

Stag's horn fern (Eng.)

Large epiphytic fern. Rhizome short. Lamina dimorphic ; sterile lamina sessile, imbricated, irregularly sinuate-lobate, elongated above, dilated, much dichotomously pinnatifid, segments patent-inflexed, green at young, becoming dry and brown when mature ; fertile frond short stipitate, arranged in pairs, broadly flabellate-cuneate, dichotomusly froked, suddenly narrowed at base,

each primary segment bears sporangia ; the terminal segments beyond the soriferous disc are serveral times dichotomous and pendent ; veins dichotomous, parallel, elevated here and there, anastomosing to forming broad elongated areoles which are occupied by lesser ones with free branched included veinlets ; texture subcoriaceous ; young frond protected by stellate hairs. Sori only on part near apex in somewhat semi-circular disc areas, there are two sori each frond ; sporangia stalked, ovate to roundish (Pl. 62).

Fertile : Oct. - Nov.

Distrib : (a) Myanmar, Malay Peninsula ; (b) Eastern India and Andaman-Nicobar Islands.

Occur : Very Rare ; on tree trunks in dense forest. Upper Jiri forest, Cachar dist. 1407.

Uses : This fern is commonly called 'Stag's horn fern' and prized as a pot plant or as hanging from tree branches. Grown as ornamental plant in gardens for its gigantic ornamental foliage (Dixit & Vohra 1984 ; Satija & Bir 1985).

Note : According to Dixit (1984) and Dixit & Vohra (1984) this species is known to occur in wild state only in Manipur. Satija & Bir (1985) have shown its distribution also in Andaman-Nicobar Islands besides Manipur. However, they have mentioned that the plant is commonly cultivated in hilly regions of Karnataka and Maharastra. Kachroo (1975) has mentioned that this species is extremely restricted and collected only from Imphal. Panigrahi & Patnaik (1968a) are of opinion that restricted distribution of this species may be conseder as a relict species. In the present investigation this species has been located in several localities of Cachar district of Assam bordering Manipur and this adds to the distributional range of the species in India. Possibly the species may be occuring also in North Cachar Hills district bordering Manipur.

DRYNARIACEAE Ching

Drynaria (Bory) J. Smith

Hook. Journ. Bot. 4. 60. 1841. *nom. cons*

According to Dixit (1984) and Satija & Bir (1985) there are four species of *Drynaria* occuring in India. Dixit & Vohra (1984) have mentioned that only three species of this genus are occuring in India. Three species have been recorded in the present investigation.

Epiphytes, rarely terrestrials. Rhizome creeping, fleshy, stout,densely clothed by scales. Fronds dimorphic, articulate to the rhizome ; sterile frond much smaller than fertile ones, distant or overlapping each other on rhizome, broad, sessile, soon turning brown, venation anastomosing ; fertile frond large, deeply pinnatifid or pinnate, green ; veins copiously inarching forming large areoles, containing smaller ones and veinlets. Sori globose, exindusiate, borne on junction of veins, sporangia stalked ; annulus 10 - 15 celled. Spores bilateral.

KEY TO SPECIES

1a. Scales with hairy margin. Leaf margin subtruncate. Sori in one row on either side of the midrib of the leaf lobes --- --- --- --- --- --- --- --- ----- --- ---- ***propinqua***

1b. Scales with dentate margin. Leaf margin entire. Sori in many irregular rows on either side of the midrib of the leaf lobes

2a. Sterile lamina with oblong margin ; fertile lamina flaccid and apical portion slightly drooping ; sori in two regular rows on either side of the main lateral veins and devoid of paraphyses -------- - --- ---- --- --- ***quercifolia***

2b. Sterile lamina with wavy margin ; fertile leaves stiff and erect, never drooping ; sori irregularly scattered and with club-shaped paraphyses - ---- ***sparsisora***

Drynaria propinqua (Wall. ex Mett.) J. Sm. Journ. Bot. 4. 61. 1842 ; Bedd. Ferns Brit. India, t. 160. 1866 ; Handb. Ferns Brit. India, 339. t. 189. 1883 ; Dhir, Ferns N.W. Himalayas, 131. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 61. 1982 ; Jamir & Rao, Ferns Nagaland, 131. 1988. *Polypodium propinqum* Wall. ex Mett. in Abh. Senckneb. Naturf. Ges. 2. 120. t. 3. f. 50. 1857. *Pleopeltis parishii* Bedd. Ferns Brit. India, t. 135. 1866 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 556. 1880. *Drynaria parishii* (Bedd.) Bedd. Ferns Brit. India Suppl. 24. 1876.

Epiphytes. Rhizome creeping, *ca* 1 - 1.5 cm thick, branched, fleshy, densely scaly ; scales *ca* 0.8 x 0.1 cm, lanceolate, acuminate hair-pointed apex, base peltate, margin hairy, reddish-brown. Lamina dimorphic ; nest leaves sessile, *ca* 8 - 15 x 10 - 12 cm, obovate to cordate-ovate, deeply pinnatifid nearly reaching the costa ; lobes *ca* 6 x 1 cm, lanceolate, apex blunt, faintly constricted base, margin obscurely crenate ; veins finely reticulate ; texture coriaceous, thin, lamina glabrous, glossy ; pale-green when young, but soon turning dark-brown ; fertile lamina *ca* 20 - 50 x 15 - 35 cm, with the stipe *ca* 8 - 20 x 0.2 - 0.5 cm, thick, erect, glabrous, pale-brown ; lamina deltoid to obovate, deeply pinnatifid very near or quite to the rachis, base of lamina decurrent on either side as narrow wings at the stipe ; leaf lobes upto 10 - 15, alternate, *ca* 25 x 2 cm, linear-oblanceolate, apex acuminate or obtuse, margin shallowly crenate or entire ; terminal lobe similar to others ; veins prominently raised on ventral surface ; areoles copious with few free veinlets ; texture coriaceous ; greenish-brown. Sori *ca* 2 mm across in two rows one on either side close to the midrib of the lobes. Spores monolete, globose to oval, pale-brown, spinulose (Pl. 63).

Fertile : May - Oct.

Distrib : (a) Myanmar, China, Malay Peninsula, Malaysian Islands, Bhutan, Northern Thailand ; (b) Himalayas, Meghalaya, Nagaland.

Occur : Rare ; on moss covered tree trunks and shaded moist rock surfaces. Bhalukpung, Sonitpur dist. 869.

Drynaria quercifolia (L.) J. Sm. in Hook. Journ. Bot. 3. 398. 1841 ; Bedd. Ferns South. India, t. 186. 1864 ; Bedd. Handb. Ferns Brit. India, 341. t. 191. 1883 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 61. 1982 ; Jamir & Rao, Ferns Nagaland, 132. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 312. t. 238. 1992. *Polypodium quercifolium* L. Sp. Pl. 2. 1087. 1753 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 558. 1880.

Oak-leaved fern (Eng.) ; *Ashvakatri* (Sans.)

Epiphytes. Rhizome, long creeping, *ca* 2 cm thick, stout, densely scaly ; scales *ca* 1 - 1.5 x 0.2 cm, linear-lanceolate, apex acuminate hair tipped, base broad peltate, margin dentate-ciliate. Nest leaves *ca* 15 - 30 x 7 - 20 cm, sessile, crowded, ovate-cordate, dry, hard, pale-green when young, dull-brown at maturity, glossy, margin lobate-pinnatifid more or less half-way down to the costa ; lobes *ca* 4 x 2 cm, entire, glabrous ; the lobes towards the base less prominent ; midrib and primary veins distinctly raised above and below, secondary and tertiary veins slightly raised above and below ; veins interconnected ; fertile lamina *ca* 50 - 100 x 20 - 35 cm, with the stipe *ca* 22 x 0.7 cm, grey-brown, abaxially rounded, adaxially grooved, narrowly winged on either side, glabrous ; lamina ovate to oblanceolate, deeply pinnatifid nearly to the midrib, terminated by a pinnule similar to the lateral one, base decurrent ; lobes upto 15 pairs, alternate, largest lobe *ca* 20 - 40 x 5 cm, oblanceolate, acuminate or acute apex, base decurrent, margin entire, wavy ; venation distinct on both surfaces, interconnected by veinlets, areoles free from included

veinlets ; texture coriaceous ; pinnae pale-green, glabrous. Sori *ca* 2 mm across, seated at the juncture of the veins, more or less in a regular row on either side of the main lateral veins of the lobes, orbicular, exindusiate ; sporangia round, slender stalked. Spores oval, hyaline, light-brown, exine with minute blunt projections (Pl. 64 ; Ph. 2).

Fertile : Oct. - June.

Distrib : (a) China, Malay Peninsula, Fiji, Tropical Australia, Sri Lanka ; (b) throughout India in the plains and in hilly regions.

Occur : Very common, on shady as well as exposed tree trunks and branches forming bracket, sometimes grows on moist rock surfaces and on old brick walls. Lowkhoa, Nagaon dist. 516 ; Kalaigaon, Darrang dist. 1530. Also common in and around Guwahati.

Uses : Rhizome bitter, astringent ; fronds used in phthisis, hectic fever, dyspepsia, and cough and in Malayasia used as poultice on swellings ; the decoction of the plants is used in typhoid fever by Vaidyas ; the fluid extracted from the fronds show antibacterial properties (Chopra *et al* 1956 ; Dixit & Vohra 1984). The plant is used in the treatment of bodyache, rheumatism, skin diseases and as tonic, expectorant and anthelmintic ; fronds are antibacterial and used to treat swellings ; rhizome is used to treat bone fracture, cough, headache and typhoid fever (Jain 1991 ; Asolkar *et al* 1992).

Drynaria sparsisora (Desv.) Moore. Ind. Fil. 348. 1857. *Polypodium sparsisorum* Desv. Berl. Mag. 5 : 315. 1811. *Drynaria linnaei* (Bory) Bedd. Ferns Brit. India, t. 315. 1866 ; Handb. Ferns Brit. India, 343. 1883.

Epiphytes. Rhizome long creeping, *ca* 2 - 3.5 cm thick, stout, flattened dorsiventrally, covered by scales ; scales *ca* 0.5 - 0.8 cm long, basal region shield-like, tips uniseriate and bear glandular hairs, margin dentate, dark-brown. Nest leaves *ca* 10 - 15 x 6 - 9 cm, adpressed to the rhizome, ovate, sessile, apex blunt or acute, margin shallowly lobed or broadly wavy, ultimate margin entire, veins prominently raised, dull-brown. Fertile leaves erect, stiff. Stipes *ca* 12 - 18 x 0.3 - 0.4 cm, decurrent, forming narrow wings on the stipe, ovate-oblong, pinnatisect, incision sometimes reach the midrib, leaf lobes alternate, lanceolate, *ca* 15 - 20 x 2 - 3 cm, basal region faintly constricted, apex acuminate ; leaf lobes slightly bigger ; texture leathery, margin cartilagenous and irregularly undulate, venation prominent. Sori small, in two rows one on each side of the main lateral veins of the leaf, with a few irregularly scattered in some cases. Spores brownish, monolete (Pl. 65).

Fertile : April - July.

Distrib : (a) Sri Lanka, Malay Peninsula ; (b) Northeast India.

Occur : Not common ; growing on shaded rock surface and tree trunk, forming large colonies. Mandakata, Kamrup dist. 1162.

Suborder : **DIPTERIDINEAE**

DIPTERIDACEAE E. (Diels) Seward & Dale

Dipteris Reinw.
Syll. Pl. Nov. Ratisb. 2. 3. 1825 (Sero)-1826.

Dixit (1984) has listed only one species of *Dipteris* viz. *D. wallichii* for India. Satija & Bir (1985) have, however, listed one more species *D. conjugata* Reinw., about which they mentioned that according to several authors this species is grown in eastern India but this is primarily a Malayan species. In the present investigation only one species has been recorded.

Dipteris wallichii (R. Br.) Moore, Ind. Fil. 80. 1857 ; Bedd. Ferns Brit. India, t. 80. 1866 ; Handb. Ferns. Brit. India, 334. t. 184. 1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 184. 1880 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 60. 1982 ; Jamir & Rao, Ferns Nagaland, 134. 1988. *Polypodium wallichii* R. Br. in Hook. *et* Grev. Icon. Fil. t. 168-169. 1931.

Rhizome creeping, *ca* 1.5 cm thick, stout, densely scaly ; scales *ca* 2 - 3 x 0.1 mm, narrow, linear, hard, subulate-setaceous, margin shortly tubercled, black. Stipes *ca* 30 - 80 x 0.5 - 0.7 cm, erect, grooved above, hard, polished and smooth, glabrous. Lamina *ca* 30 - 60 cm long and much wider than long, fan-like, bipartite into two equal broad-cuneate portions which are palmately and dichotomously divided ; segments *ca* 10 - 35 x 4 - 8 cm, oblong, apex acuminate, margin entire ; costae prominently raised above and below, from the summit of the stipe dichotomously repeatedly branched veins pass through the frond with 2 main costae run through each segment which are united at the apex ; venation prominently raised below, reticulate ; all the costae are united by transverse flexuose costules, these by longitudinial flexuose vein through the middle into two series of costular areoles,which are again into lesser subquadriangular areoles ; free veinlets present in the areoles ; texture coriaceous ; lamina glossy-green above, coppery-green beneath, glabrous. Sori small, round, copious, superficial, scattered in the areoles ; sporangia oval, short stalked, light-brown. Spores oval, hyaline, pale-white, exine smooth (Pl. 66 ; Ph. 19).

Fertile : Mar. - Sept.

Distrib : (a) Bangladesh, China ; (b) Northeast India.

Occur : Very rare ; in slopes of hilly region in the shaded stream banks. Bhalukpung, Sonitpur dist. 865 ; Rani forest, Kamrup dist. 2167.

Note : Because of the failure to grow this species in the Experimental Garden of Botanical Survey of India at Shillong Panigrahi & Patnaik (1968a) have commented that *Dipteris wallichii* survives only in extremely specialised habitats. Present investigator has, however, successfully grown this species in the Botanical Garden of the Department of Botany, Gauhati University. The plant was introduced in the garden in 1992 and now it is observed that the plant is growing as its natural habitat and started proliferation.

Subclass : **SCHIZAEIDAE**
Order : **SCHIZAEALES**

LYGODIACEAE Presl

Lygodium Sw.
Schrad. Journ. Bot. 1800 (2). 7. 106. 1801. *nom. cons.*

Dixit (1984) has listed 10 species of *Lygodium* for India and out of these, only three species occur in Assam.

Terrestrial climbing ferns. Rhizome slender, short or long creeping, covered by stiff dark hairs. Stipe slender ; rachis twining, branched. Lamina tripinnate, dormant bud borne on the axis of the branches of common stalk ; pinnae variously compound ; pinnules cordate or oblong-lanceolate, entire or serrate ; veins forked, usually free, reaching the margin ; sporangia biseriate on marginal fingerlike outgrowths, each sporangia subtended by an indusium-like out growth ; annulus small, apical. Spores trilete, tetrahedral, minute, numerous.

KEY TO SPECIES

1a. Pinnules mostly lanceolate with cordate base in barren ;
fertile pinnules broadly ovate --- --- --- --- --- --- --- --- --- --- --- --- --- ***microphyllum***

1b. Pinnules linear oblong, margin acutely serrulate

2a. Sterile lateral pinnae bipinnate, secondary pinnae
pinnatifid at base ---------- --- --- --- --- --- --- ----- --- --- --- --- --- --- --- ***japonicum***

2b. Sterile lateral pinnae unipinnate, secondary pinnae
often trilobed or tripartite at base --- --- --- --- --- --- --- --- --- --- --- --- --- ***flexuosum***

Lygodium flexuosum (L.) Sw. Schrad. Journ. 1800 (2). 7. 106. 1801 ; Bedd. Ferns South India, t. 63. t. 1864 ; Handb. Ferns Brit. India, 457. f. 283. 1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 584. 1880 ; Dhir, Ferns N.W. Himalayas, 28. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 37. 1982 ; Jamir & Rao, Ferns Nagaland, 136. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 61. t. 38. 1992. *Ophioglossum flexuosum* L. Sp. Pl. 2. 1063. 1753.

Kapau-dhekia, Chepti-dhekia (Ass.)

Rhizome creeping, short, *ca* 0.5 cm thick, covered by dark-brown, multicellular, uniseriate hairs. Stipes *ca* 40 x 0.3 cm, glabrous, abaxially rounded, adaxially flattened, dark-brown. Fronds wide-spreading, tripinnate, glabrous ; primary pinnae alternate, 15 cm apart, with *ca* 3 mm long common stalk forked once and bearing a dormant bud on the forking axis, each forked branch *ca* 12 - 40 x 10 - 30 cm, bears two to three pinnules alternately ; pinnules *ca* 6-10 x 2.5 cm, oblong-lanceolate, simple or terminal leaflets forked, basal leaflets often large, separate or lobed with 2 - 3 leaflets, apex acute or acuminate, base cuneate in simple pinnules, forked or lobed pinnules subtruncate or cordate, stalks *ca* 0.2 - 0.7 cm long ; sterile leaflets finely toothed ; texture firm ; rachis and costa densely or sparsely pubescent all over ; veins distinct, 1 - 3 forked, free, reaching the margin ; fertile leaflets a little narrower than the sterile ones. Sporangia arranged adaxially on *ca* 3 x 1.5 mm spikes, protruding from the margin ; sporangia large, short stalked, about 5 pairs, arranged in 2 rows, alternate. Spores small, trilete, yellowish-green (Pl. 67 ; Ph. 14).

Fertile : Feb. - Dec.

Distrib : (a) Sri Lanka, Malay Peninsula, Malaysian Islands, China, Northern Australia, Tropical Africa ; (b) throughout India from plains to mountainous regions.

Occur : Common both in shady and open areas, often twining on bushes. Tangla, Darrang dist. 1704 ; Biswanath Chariali, Sonitpur dist. 1042.

Uses : Young shoots are used as leafy vegetables ; plants are used as expectorant ; rhizome boiled with mustard oil and locally applied to carbuncles and in rheumatism, sprains, scabies, ulcers, eczema and cuts (Chopra *et al* 1956, 1969 ; Dixit & Vohra 1984 ; Ambasta 1986). The aquous extracts of the rhizome cure gonorrhoea. The paste of the rhizome is applied on piles and rhizome is also tied on the waist (Singh *et al* 1989). Rhizome is used as abortifacient and as appetizer ; it is also used in the treatment of abdominal pain, cholera, cuts, eczema, indigestion, jaundice, scabies and ulcer. The plant is used to pleuricy (Jain 1991). Stems are used as cordage in construction work (Jain 1991). The leaves are used to prepare rice-beer cake by the Deoris and several other tribes of Assam.

Note : This species is very variable with regard to the disection of fronds and pinnules, size and shape of pinnules. The margin of the pinnules also varies from entire or subentire to serrulate state.

Lygodium japonicum (Thunb.) Sw. Schrad. Journ. Bot. 1800 (2). 7. 106. 1801 ; Bedd. Ferns South India, t. 64. 1864 ; Handb. Ferns Brit. India, 452. 1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot.1. 584. 1880 ; Dhir, Ferns N.W. Himalayas, 28. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 37. 1982 ; Jamir & Rao, Ferns Nagaland, 137. 1988. *Ophioglossum japonicum* Thunb. Fl. Jap. 328. 1784.

Rhizome long creeping, covered with black hairs. Stipes *ca* 30 x 0.2 cm, scaly at base, glabrous above, abaxially flattened ; scales *ca* 2 x 0.5 mm, linear-lanceolate, apex acuminate, black. Fronds wide-spreading, tripinnate ; primary pinnae *ca* 7 - 10 cm apart, with 2 mm long common stalk forked once ; primary branches clothed with pale-brown hairs ; secondary branches *ca* 5 - 12 cm long, opposite ; pinnae ending in a linear, elongated pinnules ; pinnules 3 - 5 lobed, central lobe much elongated, *ca* 1.5 - 4 x 0.5 - 1 cm, pubescent at base ; fertile pinnae much contracted giving an appearance of dissected lamina ; margin of pinnules crenate ; texture herbaceous ; primary rachis scabrous ; secondary rachis ridged ; veins distinct, 1 - 3 forked, free, reaching the margin. Sori on *ca* 0.5 cm long, finger like, marginal projections which are greenish when young and dark-brown at maturity ; sporangia short stalked, arranged in 2 rows, alternate. Spores small, numerous, tetrahedral, exine rugolose (Pl. 68).

Fertile : July - Nov.

Distrib : (a) Japan, Sri Lanka, Korea, Thailand, Indo-China, China, Malaysian Islands, Philippines, Australia ; (b) Northeast India and Western Himalayas.

Occur : Common in moist open places, often twining on the bushes. Jalukbari, Guwahati, Kamrup dist. 554 ; Mangaldai, Darrang dist. 1359.

Uses : The plant is used as an expectorant ; decoction of vegetative parts and spores is used as diuretic or cathartic ; stem is used as a substitute for ordinary ropes for some domestic purposes (Chopra *et al* 1956, 1969 ; Islam, 1983 ; Ambasta 1986). Fronds are used for preparing local drinks and roots are used as veterinary medicine to treat wound (Jain 1991).

Lygodium microphyllum (Cav.) R. Br. Prod. Fl. Nov. Holl. 162. 1810 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 583. 1880 ; Bedd. Handb. Ferns Brit. India, 455. t. 282. 1883 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 62. t. 39. 1992. *Ugenia microphyllum* Cav. Icon. Descr. Pl. 6. 76. t. 595. 1801. *Lygodium scandens* Bedd. Ferns South. India, t. 61. 1864. *Ophioglossum filiforme* Roxb. ex Griff. Calc. Journ. Nat. Hist. 4. 476. t. 26. f. 3. 1844.

Twining fern. Rhizome long creeping, *ca* 0.5 cm thick, densely covered by hairs. Stipes *ca* 2 mm thick, abaxially rounded, adaxially flattened, brown ; rachis twining, similar to stipe. Fronds *ca* 200 - 300 x 20 cm ; primary branches *ca* 5 x 1 m, upto 10 cm apart, alternate, bearing a dormant apex which covered by hairs ; a pair of secondary branches borne subapically from primary branches ; secondary branches *ca* 7 x 3 cm, pinnate, oblong, with an apical pinna similar to lateral ones which is more or less lobed ; lateral pinnules *ca* 2 x 1.5 cm, stalked, alternate, ovate-oblong, apex rounded, cordate at base, margin crenate ; veins distinct, flabellately branched, free, reaching the margin ; texture herbaceous, pinnules glabrous, pale-green. Sori finger like, *ca* 0.5 cm long, round the margin of the pinnules except the base ; sporangia short stalked, upto six pairs in two rows. Spores trilete, exine densely verrucate (Pl. 69).

Fertile : July - Sept.

Distrib : (a) Malay Peninsula, Malaysian Islands, Sri Lanka, Africa, Polynesia and Australia ; (b) Sikkim, Madhya Pradesh, South India, Andaman & Nicobar Islands.

Occur : Rare ; on open, moist places. Garampani forest, Golaghat dist. 1658.

Uses : Young leaves eaten ; their decoction used in dysentery ; poultice of leaves applied to skin diseases. Old stems are used for basket making and plaiting (Ambasta 1986). The plant is used medicinally to treat dysentery (Jain 1991).

Order : **PTERIDALES**
Suborder : **PTERIDINEAE**

CHEILANTHACEAE Nayar

Cheilanthes Sw.
Syn. Fil. 5. 126. 1806. *nom. cons.*

The genus *Cheilanthes* with about 180 species occurs in all tropical and warm temperate regions of the world in dry places (Copeland 1947). The genus includes 26 species in India (Dixit 1984 ; Dixit & Vohra 1984). Only 4 species have been recorded in the present study.

Terrestrials or lithophytes. Rhizome short creeping to erect, densely clothed with fibrous roots and scales. Stipes slender, dark, polished or sparsely hairy. Lamina small, unipinnate to tripinnate, hairy or scaly, herbaceous to subcoriaceous, usually with glabrous surface, veins free. Sori marginal, terminal on veins, confluent, with a false indusium formed by modified reflexed margin of the lamina, paraphyses absent, spores tritele.

KEY TO SPECIES

1a. Under surface of lamina without silvery crest --- --- --- --- --- --- --- --- --- --- ***tenuifolia***
1b. Under surface of lamina with silvery crest
  2a. Stipe and rachis dark-purplish brown ; lamina oblong-lanceolate --- --- --- --- --- ***belangiri***
  2b. Stipe and rachis otherwise ; lamina ovate to delto-lanceolate
    3a. Scales on rhizome with translucent margin ; indusium with flabellate margin bearing small glandular hairs --- --- --- --- ***albomarginata***
    3b. Scales on rhizome without translucent margin ; margin of indusia nearly smooth or serrate --- --- --- --- --- --- --- --- --- --- --- --- --- ***farinosa***

Chilanthes albomarginata Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 456. t. 52. 1880 ; Bedd. Handb. Ferns Brit. India, 94. 1883 ; Dhir, Ferns N.W. Himalayas, 36. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 143. 1982 ; Jamir & Rao, Ferns Nagaland, 139. 1988. *Cheilanthes farinosa* var. *albomarginata* Bedd. Handb. Ferns. Brit. India. Suppl. 22. 1892.

Rhizome short erect, *ca* 1 cm thick, clothed with scales ; scales *ca* 0.6 cm long, lanceolate, hair pointed, acuminate apex, blackish-brown, margin translucent. Stipes *ca* 8 - 20 x 0.1 cm, cylindrical, slender, shining, reddish-brown, sparsely covered with lanceolate, hair like scales. Lamina *ca* 5 - 15 x 3 - 10 cm, bipinnatifid, ovate-lanceolate to deltoid-lanceolate, acute apex ; pinnae upto 8 - 12 pairs, subopposite ; elongate-ovate, apex blunt, deeply pinnatifid ; lowest pair of pinna slightly enlarged on the basiscopic side ; segments of pinnae narrowly oblong with blunt apices and lobed into rounded or slightly elongated blunt lobes ; rachis similar to the stipe ; texture rough and coriaceous ; upper surface of lamina glossy ; lower surface bears scales as well as acicular hairs and is covered by a white silvery crust ; costa scaly ; veins free, forked once, reaching the margin. Sori marginal, confluent, indusium brown, margin lacerate ; sporangia large, short stalked. Spores globose, blackish (Pl. 70).

Fertile : Oct. - Feb.

Distrib : (a) Nepal, Bhutan, China ; (b) throughout India in hilly regions.

Occur : Common on roadsides cut slopes and among rocks crevices. Barnadi forest, Darrang dist. 1706 ; Darranga, Nalbari dist. 1290.

Note : This species is variable with regard to the size and shape of fronds. Small mature fronds are profusely covered with scales and thick farina and the sori obliterate the whole under surface of pinnules. The larger fronds have less scales and usually farina is absent and sori are restricted to the margin only.

Cheilanthes belangiri (Bory) C. Chr. Ind. Fil. 172. 1905 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 144. 1982. *Pteris belangiri* Bory, Bel. Voy. Bot. 2. 44. 1833. *C. varians* Wall. ex Hook. Sp. Fil. 2. 89. t. 103A. 1852 ; Bedd. Ferns South. India, t. 189. 1864 ; Handb. Ferns Brit. India, 91. t. 47. 1883.

Rhizome short, semierect, clothed with scales ; scales *ca* 0.4 x 0.1 cm, narrow, lanceolate, apex hair-like, costaneous brown. Stipes *ca* 10 -15 x 0.1 - 0.2 cm, slender, scaly at base, glabrous above, ebeneous-glossy, plane and margined on the upper side, dark-purplish brown. Lamina *ca* 40 x 8 cm, oblong-lanceolate, apex pinnatifid, acuminate, pinnated above, bipinnate below ; largest pinnae *ca* 4 x 1.5 cm, opposite or subopposite, distant, spreading or a little curved upwards, sessile or shortly stalked ; upper ones lanceolate, apex acuminate or acute, pinnatifid at their base ; lower ones deltoid, acuminate or acute, pinnate at their base, pinnatifid acuminated in the upper half, pinnules lanceolate, acuminate or acute, pinnatifid below ; the lowest pinnae longest ; rachis glabrous, dark-purplish brown ; lamina light brownish-green ; texture submembranaceous, glabrous ; costa slightly raised below, indistinct above ; veins free, forked once or more, reaching the margin. Sori confluent along the margin of lobes, leaving no sterile region except the apex ; indusia lacerate at margin (Pl. 71).

Fertile : July - Nov.

Distrib : (a) Myanmar, China, Luzon ; (b) Bengal plains, Meghalaya.

Occur : Rare ; in open roadside slopes. Gauripur, Dhubri dist. 397.

Cheilanthes farinosa (Forsk.) Kaulf. Enum. Fil. 212. 1824 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 457. 1880 ; Bedd. Ferns South. India, t. 191. 1864 ; Handb. Ferns Brit. India, 92. 1883 ; Dhir, Ferns N.W. Himalayas, 37. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 144. 1982 ; Jamir & Rao, Ferns Nagaland, 141. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats- S. India, 87. t. 63. *Pteris farinosa* Forsk. Fl. Aegypt. Arab. 187. 1775.

Rhizome short, erect, *ca* 2 cm thick, densely scaly ; scales *ca* 0.5 - 0.8 x 0.1 cm, lanceolate, apex acuminate, margin entire, blackish-brown. Stipes *ca* 4 - 22 x 0.2 - 0.4 cm, scaly at base, glabrous above, glossy, polished, tufted, terete, chestnut brown. Lamina *ca* 5 - 20 x 4 - 12 cm, ovate-lanceolate, apex acuminate, base cordate, bipinnate at base, pinnatifid at apex ; pinnae about 10 pairs, slightly ascending, sessile, opposite ; largest pinna *ca* 7 x 3 cm, pinnatifid, lanceolate, acroscopic base truncate, basiscopic base broadly cuneate ; pinnules *ca* 3 x 0.8 cm, oblong, apex rounded, margin crenate, alternate ; costae and costules distinct above and below ; veins distinct below, indistinct above, free, forked once or more, reaching the margin ; rachis glabrous, grooved above ; texture thin, subcoriaceous ; lamina dark-green, ventral surface covered with whitish or yellowish waxy powdery substance, glabrous above. Sori submarginal, rounded, sometimes confluent, *ca* 1 mm wide, indusia false, pale-brown ; sporangia large, short stalked. Spores globose, dark-brown, exine with dense reticulate, raised thickenings (Pl. 72).

Fertile : July - Feb.

Distrib : (a) Sri Lanka, Myanmar, Tropical America, Java, Philippines, East Africa and its Islands and Arabia ; (b) throughout India.

Occur : Common along roadsides and also among rock crevices. Bandardewa, Lakhimpur dist. 936 ; Agiathuri, Kamrup dist.1790 ; Bhairabkunda, Darrang dist. 262, 1524.

Uses : Roots are used to treat eczema and stomachache ; fronds are used to treat menstural disorders (Jain 1991).

Cheilanthes tenuifolia (Burn. f.) Sw. Syn. Fil. 129. 332. 1806 ; Bedd. Ferns South. India, t. 188. 1864 ; Handb. Ferns Brit. India, 92. 1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 455. 1880 ; Baishya & Rao, Ferns and Fern-allies Meghalaya, 144. 1982 ; Jamir & Rao, Ferns Nagaland, 142. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 90. t. 66. 1992. *Trichomanes tenuifolia* Burm. f. Fl. Ind. 237. 1768.

Rhizome small, short creeping or suberect, *ca* 1 cm thick, apex scaly ; scales *ca* 2 x 0.25 mm, lanceolate, acuminate,entire, brownish. Stipes *ca* 7 - 25 x 0.2 cm, scaly at base, glabrous above, glossy, rounded below, above grooved, erect, dark-purplish. Lamina *ca* 5 - 25 x 3 - 10 cm, ovate-lanceolate, tripinnate below, bipinnate middle and unipinnate above, apex acuminate ; primary pinnae *ca* 8 x 5 cm, about 6 pairs, subopposite, stalked, ovate-lanceolate ; the lowest pinnae rather distantly spaced ; secondary pinnae larger on the basiscopic side, *ca* 2 x 1 cm, ovate-lanceolate, about 6 pairs, subopposite or alternate ; ultimate pinnules *ca* 1 x 0.4 cm, lobed to the midrib ; lobes ovate, subacute, entire ; rachis similar to the stipe ; lamina green, glabrous ; texture herbaceous ; veins of upper surface not visible but slightly distinct below, forked once or twice, free. Sori marginal on each ultimate lobes, protected by reflexed margin of the lamina, indusia very short, undulate. Spores dark-brown, tetrahedral (Pl. 73).

Fertile : July - Oct.

Distrib : (a) China, Sri Lanka, Taiwan, Philippines, Taiwan, Malay Islands, Australia, New Zealand, Polynesia, Bangladesh ; (b) throughout India.

Occur : Abundant in foothills and plains along the river sides. Jorabat, Kamrup dist. 737 ; Jatinga, North Cachar Hills dist. 1576.

Uses : A preparation from the roots is prescribed by the Santhals for sickness due to witchcraft or evil eyes. Rhizome and roots are used by tribals as a general tonic (Chopra *et al* 1956 ; Dixit & Vohra 1984). The plant is used as hair tonic (Jain 1991).

CRYPTOGRAMMACEAE Pic. Ser.

Onychium Kaulf.
Berlin Iahrb. Pharm. 21. 45. 1820.

There are eight species of *Onychium* occuring in India (Dixit 1984 ; Dixit & Vohra 1984) and of these only two species have been recorded in the present investigation.

Terrestrials. Rhizome creeping or semierect, scaly. Stipes long, not articulate to rhizome, scaly at base, glabrous above. Lamina tripinnate to more compound with numerous small pinnules, glabrous, herbaceous to subcoriaceous, veins free. Sori elongate, along the margin, protected by a scarious introrse marginal or submarginal indusium, paraphyses absent, sporangia long stalked, annulus of about 20 thickened cells, spores tetrahedral.

KEY TO SPECIES

1a. Rhizome creeping, scales hair tipped ; sporangia pale-brown --- --- ---***japonicum***
1b. Rhizome semierect, scales not hair tipped ; sporangia bright yellow --- --- -- ***siliculosum***

Onychium japonicum (Thunb.) Kunze, Bot. Zeit. 6. 507. 1848 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 459. 1880 ; Bedd. Handb. Ferns Brit. India, 96. 1883 ; Dhir, Ferns N.W. Himalayas, 34. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 154. 1982 ; Jamir & Rao, Ferns Nagaland, 143. 1988. *Trichomanes japonicum* Thunb. Fl. Japan, 340. 1784. *Onychium lucidum sensu* Bedd. Ferns Brit. India, t. 21.1866. (*non* Spr. 1827).

Rhizome creeping, short, *ca* 1 cm thick, densely covered by scales ; scales *ca* 1.3 x 0.2 cm, lanceolate, apex acuminate, base broad, margin entire, brown. Stipes *ca* 15 - 50 x 1.5 - 4 cm, tufted, stout, erect, scaly at base, glabrous above, straw-coloured or pale-brown. Lamina *ca* 15 - 50 x 10 - 30 cm, quadripinnate, ovate, lanceolate, apex acuminate, lowest pinnae largest lanceolate-deltoid ; pinnules and segments numerous ; ultimate segments *ca* 1 - 1.5 x 0.2 - 0.3 cm, obovate-oblong, apex acuminate ; veins free ; texture subcoriaceous, glabrous and shining on both surfaces ; rachis nacked and similar with the stipe. Sori elongate and submarginal on broad fertile pinnules ; indusia membranaceous, elliptic, margin entire, opening inwardly, grey-brown ; ripe capsules deep brown, projecting upwards. Spores pale-brown ; exine papilate (Pl. 74).

Fertile : July - Oct.

Distrib : (a) China, Pakistan, Myanmar, Korea, Japan, Taiwan, Taiwan, Philippines, Java ; (b) Himalayas from Panjub to Assam.

Occur : Common, in dry places along roadsides and in open forest. Khalingduar, Darrang dist. 1843 ; Jalukbari, Kamrup dist. 563.

Uses : Juice of crushed leaves prevent falling of hairs (Dixit & Vohra 1984 ; Jain 1991). The plant yield kaempferol and rhamnose (Ambasta 1986).

Onychium siliculosum (Desv.) C. Chr. Ind. Fil. 468. 1934 ; Dhir, Ferns N.W. Himalayas, 33. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 146. 1982 ; Jamir & Rao, Ferns Nagaland, 143. 1988. *Pteris siliculosa* Desv. Berlin Mag. 5. 324. 1811. *Onychium auratum* Kaulf. Enum. Fil. 144. 1824 ; Bedd. Ferns South. India, t. 30. 1864 ; Handb. Ferns Brit. India, 96. 1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot.1. 458. 1880.

Rhizome short, semierect, densely clothed with scales ; scales *ca* 0.7 cm long, narrow, lanceolate, acuminate, hair tipped apex, brown. Stipes *ca* 8 - 30 x 0.1 - 0.4 cm, stout, erect, glabrous, cylindrical, straw coloured or pale-brown. Lamina *ca* 20 - 30 x 7 - 20 cm, quadripinnate, ovate, apex acuminate ; pinnae alternate or subopposite, about 8 pairs or more ; lower pinnae subdeltoid, ascending, stalked ; pinnules and segments numerous ; ultimate segments *ca* 1 x 0.2 cm, obovate, apex acute, cuneate at base, margin entire ; fertile segments *ca* 0.4 - 2.5 cm, terminal pinnules much longer, pod like, apex usually trifid ; veins free ; rachis glabrous, brownish ; texture subcoriaceous, both surfaces nacked, shining on upper surface. Sori submarginal, continuous along both margins, connected with veinlets, bright golden yellow ; indusia membranous, margin fimbricate ; sporangia golden-brown. Spores small, tetrahedral (Pl. 75).

Fertile : Jan. - Oct.

Distrib : (a) Myanmar, Indo-China, Malay Peninsula, China, Taiwan, Philippines, Malay Islands, New Guinea, Polynesia ; (b) Himalayas from Nepal to Assam.

Occur : Very common in open dry places. Bhairabkunda, Darrang dist. 1525 ; Singimari, Sonitpur dist. 1053.

Uses : Fronds are used to treat baldness and dysentery (Jain 1991).

PTERIDACEAE Ching

Pteris L.
Sp. Pl. 2. 1073. 1753.

Dixit (1984) has listed 48 species and a variety for India. In the present investigation 15 species of *Pteris* have been encountered.

Terrestrials. Rhizome erect or short creeping, scaly as well as hairy. Stipes tufted, adaxially grooved, scaly at base, glabrous above. Lamina simple pinnate to bipinnate or tripartite ; basal pair of pinnae or sometimes others often with one or two branches near the base on the basiscopic side ; veins usually forked once, all free or anastomosing without included veinlets ; rachis and costae grooved ; costae, costules and veins often bear spinules ; pinnae glabrous, texture herbaceous to coriaceous. Sori linear, continuous along the margin except the apex and base of the pinnae and pinnules ; indusia false, formed by reflexed margins of pinnae or pinnules ; paraphyses usually present ; annulus of 12 - 14 thickened cells ; spores tetrahedral, often bilateral, surface rugose or papillose.

KEY TO SPECIES

1a. Lamina dimorphic
- 2a. Basal pair of pinnae bipartite, pinnae uniform
  - 3a. Pinnae shortly stipitate, linear-lanceolate, finely serrated, terminal pinna decurrent on rachis ; veins prominent --- --- --- --- --- --- --- --- --- ***cretica***
  - 3b. Pinnae sessile, alternate at base, margin deeply lobed, lobes serrated, terminal pinna not deccurent on rachis, veins obscure --- --- --- --- --- -- ***grevilleana***
- 2b. Basal pair of pinnae not bipartite, pinnae not uniform --- --- --- -- --- --- --- ***ensiformis***

1b. Lamina monomorphic
- 4a. Rachis trichotomously branched at base --- --- --- --- --- --- --- --- --- ***wallichiana***
- 4b. Rachis not trichotomously branched
  - 5a. Lamina simple pinnate
    - 6a. Pinnae subentire on the upper margin and the lower margin pinnately divided --- --- --- --- --- --- --- --- --- --- --- ***semipinnata***
    - 6b. Pinnae undivided on both the margins
      - 7a. About 5 pairs of basal pinnae progressively reduced --- -- --- --- ***vittata***
      - 7b. Basal pinnae not reduced
        - 8a. Lamina submembranaceous ; pinnae oblong-lanceolate, less than 1cm wide --- --- --- --- --- --- --- --- -- --- --- --- ***multiaurita***
        - 8b. Lamina subcoriaceous ; pinnae elliptic or linear-lanceolate, more than 1cm wide
          - 9a. Basal pair of pinnae not bipartite ; exine of spores verrucate ---***pellucida***
          - 9b. Basal pair of pinnae bipartite at the base ; exine of spores not verrucate ----- --- --- --- --- -- --- ***scabripes***
  - 5b. Lamina bipinnatifid or bipinnate
    - 10a. Pinnae usually 3, basal pair of pinnae hardly larger than the segments of the terminal pinna --- --- --- --- --- --- --- ----- --- ---- ***subindivisa***

10b. Pinnae numerous, lateral pinnae much larger
11a. Basal veins anastomosing to form series of costal areoles --- --- --- ***biaurita***
11b. Basal veins not anastomosing
12a. Lowest pair of pinnae bipartite
13a. Spinules present both on costa and costules -- ---- ***quadriaurita***
13b. Spinules present on costa only -- ---------- -- --- --- --- ***linearis***
12b. Basal pair of pinnae not bipartite
14a. Stipes and rachis bright chestnut coloured ---------- ***excelsa***
14b. Stipes and rachis bright green or stramineous --------- ***longipinnula***

Pteris biaurita L. Sp. Pl. 2. 1076. 1753 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 469. 1880 ; Dhir, Ferns N.W. Himalayas, 49.1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 110. 1982 ; Jamir & Rao, Ferns Nagaland, 146. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 73. t. 49. 1992. *Campteria biaurita* (L.) Hook. Gen. Fil. t. 65A. 1841 ; Bedd. Ferns South. India, t. 44. 1864 ; Handb. Ferns Brit. India, 115. 1883.

Rhizome erect, short, *ca* 3 mm thick, scaly at the apex ; scales *ca* 3 x 0.7 mm, linear-lanceolate, apex acuminate, margin hairy, dark-brown. Stipes *ca* 25 - 65 x 0.3 - 0.7 cm, glabrous except at base, adaxially grooved, stramineous. Lamina *ca* 30 - 70 x 20 - 35 cm, bipinnatifid, glabrous ; pinnae upto 12 pairs, with longest basal pinna forked once or twice on the basal basiscopic side, subopposite, lanceolate, sessile or shortly stalked, apex acuminate, base cuneate ; margin lobed within 3 mm from the costa ; lobes *ca* 4 x 0.7 cm, oblong, slightly falcate, apex rounded, margin entire ; pinnae pale green ; texture thin ; veins distinct, basal veins of adjacent costules forming an arc along costa with five to seven excurrent veins passing to the sinus base, other veins forked once. Sori confluent along the margin of the sinus but not reaching the apex of the lobes. Spores tetrahedral, dark-brown, not translucent (Pl. 76 ; Ph. 4).

Fertile : July - Oct.

Distrib : (a) Throughout the tropics of the World ; (b) Western Ghats, Himalayas, Northeast India.

Occur : Common, along the roadsides and slopes of hills in shady places. Mandakata, Kamrup dist. 1187 ; Bhutiachang, Darrang dist. 1851.

Uses : Rhizomes are used to treat wounds (Jain 1991).

Note : This species is highly variable in size of pinna lobe and sinus, and in the pattern of anastomosing of veins.

Pteris cretica L. Mant. 130. 1767 ; Bedd. Ferns South. India, t. 39. 1864 ; Handb. Ferns Brit. India, 106. 1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 452. 1880 ; Dhir, Ferns N.W. Himalayas, 47. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 110. 1982 ; Jamir & Rao, Ferns Nagaland, 147. 1988 ; Manickam & Irudayaraj, Pterid Fl. West. Ghats-S. India, 70. t. 45. 1992.

Rhizome erect, *ca* 2 mm thick, scaly at the apex ; scales *ca* 5 x 3 mm, ovate-lanceolate, acuminate, entire, dark-brown, concolourous. Stipes *ca* 10 - 40 x 0.2 - 0.4 cm, slender, stramineous, glabrous, glossy, abaxially rounded, adaxially grooved, pale-brown. Frond dimorphic, sterile lamina *ca* 20 - 40 x 10 - 20 cm, simple pinnate, pinnae upto 7 pairs, opposite or subopposite, one or two pairs of basal pinnae forked at their base, shortly stalked, others sessile and simple, largest pinna *ca* 20 x 2 cm, lanceolate, acuminate, base broadly cuneate ; margin sharply spinulose, serrate. Fertile lamina much longer than sterile ones ; pinnae similar to those of sterile ones but somewhat narrower and margin entire ; rachis glabrous ; texture coriaceous ; pinnae dark green ; veins

parallel, simple or forked once, free. Sori linear all along the margin except at base and apex. Spores dark-brown, exine with reticulate thickenings (Pl. 77).

Fertile : July - Oct.

Distrib : (a) Widely distributed in tropics and temperate regions of the World ; (b) South India, West Bengal, Meghalaya, Nagaland.

Occur : Common in open places along roadsides and in the dry floors of forestry plantation. Haflong, North Cachar Hills dist. 1572 ; Nambar forest, Golaghat dist. 1653 ; Harmati, Lakhimpur dist. 932.

Pteris ensiformis Burm. f. Fl. Ind. : 230. 1768 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 463. 1880 ; Bedd. Handb. Ferns Brit. India, 107. 1883 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 110. 1982 ; Jamir & Rao, Ferns Nagaland, 147. 1988. *P. crenata* Sw. Schrad. Journ. Bot. 1800 (2). 65. 1801 ; Bedd. Ferns South. India, t. 35. 1864.

Rhizome erect, short, scaly ; scales linear-lanceolate, acuminate, entire, shining, dark-brown. Stipes *ca* 7 - 30 x 0.1 - 0.3 cm, glabrous, polished, slender, abaxially rounded, adaxially grooved. Fronds dimorphous, but sometimes some fronds partly fertile and partly sterile ; sterile lamina ca 10 - 20 x 6 - 12 cm, pinnate, much shorter than fertile ones ; apical part of lamina simple or with 2 - 3 pairs of lobes ; lateral pinnae about 2 - 5 pairs, *ca* 3 - 12 x 1 - 1.5 cm, deltoid with 1 - 5 pairs of pinnule or lobes and much elongated apex, lobes more in basiscopic sides, the lowest basiscopic pinnule again often lobed ; pinnules oblong or elliptic, apex rounded, serrate. Fertile lamina *ca* 15 - 40 cm long, bipinnate, glabrous ; terminal pinna *ca* 10 - 20 x 0.4 - 1 cm, bifid ; lateral pinnae about 2 - 5 pairs which are simple, forked, trifid or even more compound, shortly stalked, the segments very narrow and elongated, entire ; lamina pale-green ; texture thin but firm ; rachis glabrous, grooved above, pale-brown ; veins distinct on both surfaces, simple or forked, free, oblique. Sori confluent, marginal, developing basipetally. Spores dark-brown, tetrahedral, covered with papillae (Pl. 78).

Fertile : July - Nov.

Distrib : (a) Sri Lanka, Myanmar, Malay Peninsula, China, Taiwan, Philippines, Malay Islands Tropical Australia, Polynesia, Micronesia ; (b) throughout India.

Occur : Frequent in moist and humous rich forest floor and rock crevices. Hajo, Kamrup dist. 1781 ; Kurua, Darrang dist. 673.

Uses : Young fronds are eaten in Philippines ; frond decoction used for dysentery ; leaf juice astringent ; root juice used for glandular swelling of neck in Malay (Dixit & Vohra 1984 ; Jain 1991). Tender fronds eaten as flavouring (Ambasta 1986).

Pteris excelsa Gaud. Frey. Voy. Bot. 388. 1829 ; Bedd. Ferns Brit. India, t. 218. 1866 ; Handb. Ferns Brit. India, 114. 1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 467. 1880 ; Dhir, Ferns N.W. Himalayas, 49. 1980 ;

Rhizome short, erect, covered by scales ; scales linear-lanceolate, hair pointed, dark-brown. Stipes *ca* 25 - 45 x 0.5 - 0.8 cm, erect, stout and flexuose. Lamina *ca* 30 - 50 x 20 - 35 cm, bipinnatifid ; pinnae alternate or subopposite, *ca* 15 - 30 x 3 - 6 cm, remote, numerous, ovate-lanceolate, acute or acuminate apex, caudate base, sessile, lower ones petiolate ; lowest pinnae simple or sometimes bipartite at the basal basiscopic side ; pinnae deeply pinnatifid nearly to the costa ; segments *ca* 5 - 10 x 0.4 - 0.8 cm, linear-lanceolate, obtuse, base broad, margin serrated, subfalcate, lower base decurrent ; pinnae, light-green ; texture submembranaceous ; rachis glabrous,

bright castaneous glossy ; costae ridged, veins free, forked once at or near the middle or 3 - 4 branched, very rarely a few veinlets anastomose. Sori marginal, continuous except at the apex ; indusia continuous from the base almost to the apex, rather broad (Pl. 79).

Fertile : July - Dec.

Distrib : (a) Sandwich Islands ; (b) Northern and Northeast India.

Occur : Rare ; in shady and moist areas of secondary forest. Bandarguri, Darrnag dist. 913 ; Jatinga, North Cachar Hills dist. 1580.

Pteris grevilleana Wall. ex Agardh, Rec. Sp. Gen. Pteridis. 23. 1839 ; Clarke, Trans. Linn. Soc. Lond.II. Bot. 1. 466. t. 56. 1880 ; Bedd. Handb. Ferns Brit. India, 112. 1883 ; Suppl. 24. 1892.

Rhizome erect, *ca* 3cm thick, scaly at apex ; scales *ca* 0.3 x 0.1cm, linear-lanceolate, apex acuminate, brown. Lamina dimorphic ; stipe of sterile lamina shorter than the fertile ones, *ca* 12 x 0.3 cm, abaxially rounded, adaxially grooved, scaly at base, glabrous above, slightly winged towards the apex, stramineous. Sterile lamina *ca* 12 x 10 cm, pedately 5-fid, apical pinna largest, *ca* 10 x 3 cm, sessile, ovate-lanceolate, apex obtuse or rounded, alternate at base, margin deeply lobed nearly to the costae ; lobes *ca* 0.4 cm wide, overlaping, oblong, obtuse at apex, margin serrated ; stipe of fertile lamina similar to the sterile one but slender and longer, *ca* 25 cm long ; fertile lamina *ca* 15 x 10 cm, bipinnatifid with 5 pinnae, lateral two pairs and a single apical one, lower pair bipartite, lateral pinnae similar to sterile ones, but lobes somewhat distant, linear-oblong, falcate ; veins obscure, free, forked once. Sori linear, along the margin, except at apex and base ; indusia linear ; sporangia slender stalked (Pl. 80).

Fertile : Aug. - Dec.

Distrib : (a) Malay Peninsula, Borneo, Bangladesh, Myanmar, Singapore ; (b) Eastern India.

Occur : Rare ; occuring amongst dry rock boulders. Harmati, Lakhimpur dist. 938.

Pteris linearis Poir in Encycl. 5. 723. 1804 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghat-S. India, 80. t. 56. 1992.

Rhizome erect, upto 5 cm thick, densely clothed with scales ; scales *ca* 8 x 1 mm, linear-lanceolate, apex long acuminate, margin ciliated, pale-brown at the periphery and dark-brown at the centre. Stipes *ca* 9 x 0.8 cm, scaly at base, glabrous above, polished, abaxially rounded, adaxially grooved, chestnut brown at the base, stramineous above. Lamina *ca* 40 - 75 x 22 - 32 cm, ovate, bipinnate, pinnae upto 10 pairs, opposite or subopposite, shortly stalked or sessile ; largest pinna *ca* 30 x 4 cm, oblong-lanceolate, apex long acuminate, base broadly cuneate, unequal, margin pinnatifid upto 2 - 3 mm to the costa ; basal pair of pinnae bear an accessory branch on the basal basiscopic side ; lobes up to 25 pairs, *ca* 2 x 0.5 cm, oblong, slightly ascending, apex rounded, margin entire, basiscopic lobes are slightly longer than acroscopic ones ; pinnae and rachis glabrous above and below ; rachis polished, grooved ; texture coriaceous ; pinnae pale-green ; costa, costules and veins raised above and below ; veins up to 20 pairs, all veins except a few pairs in distal part of the pinnae lobes forked once, free, basal basiscopic veins arising from the costa while basal acrscopic ones arising from the axis of costa and costule, basal most pair of veinlets of adjacent lobes reaching the base of sinus independently ; spinules present at the junction of costae and costule. Sori continuous all along the margin except at the apex of the lobes ; indusia, rigid, pale-brown. Spores yellowish-green (Pl. 81).

Fertile : Feb. - July.

Distrib : (a) Australia, Tropical Africa, Asia, Polynesia ; (b) South India, Eastern Himalayas.

Occur : Rare ; in moist and shady places near stream banks. Khanapara, Guwahati, Kamrup dist. 742.

Pteris longipinnula Wall ex Agardh, Rec. Sp. Gen. Pteridis. 19. 1839 ; Bedd. Ferns South. India, t. 43. 1964 ; Handb. Ferns. Brit. India, 112. 1883; Clarke, Trans. Linn. Soc. Lond. II . Bot. 1. 467. 1880 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 110. 1982 ; Jamir & Rao, Ferns Nagaland, 150. 1988.

Rhizome erect, densely clothed with scales ; scales linear, margin densely ciliate, reddish-brown. Stipes *ca* 30 - 60 cm long, erect, slender, abaxially rounded, adaxially grooved, scaly at base, glabrous above, green in fresh, pale-dark to purplish when dry ; Lamina *ca* 70 x 40 cm, bipinnatifid, with 3 - 8 pairs of lateral pinnae and an apical pinna ; the lowest pair undivided or rarely bi-partite near the base on the basiscopic side ; pinnae *ca* 20 - 35 x 4 - 7 cm, opposite or subopposite, deeply pinnatifid, lanceolate, apex caudate, base cuneate ; largest lobes *ca* 2 - 3 x 0.5 - 1 cm, entire, blunt, falcate, not distant ; lobes gradually reduced towards apex, basal pair of lobes reduced on costae, often auricled ; rachis and surface of pinnae nacked ; texture subcoriaceous ; costae and costules glabrous, spinules present on upper surface ; veins free, forked once. Sori marginal, continuous nearly to the apex of the lobes. Spores triangular to 'T'-shaped, dark-brown (Pl. 82).

Fertile : Oct. - Feb.

Distrib : (a) Malaya, Bangladesh ; (b) Sikkim, Northeast India.

Occur : Not common, in moist shady roadside ditches. Changsari, Kamrup dist. 437 ; Chariduar, Sonitpur dist. 871.

Pteris multiaurita Agardh, Rec. Sp. Gen. Pteridis. 12. 1839 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 69. t. 43. 1992.

Rhizome short creeping, *ca* 1 cm thick, clothed with scales at the apex ; scales *ca* 3 x 0.5 mm, lanceolate, apex acuminate, pale-brown, dark at the centre, light at periphery. Stipes *ca* 15 - 25 x 0.2 cm, abaxially rounded, adaxially grooved, scaly at base, stramineous with few long, soft, slender, white hairs, dark-brown. Lamina *ca* 25 x 20 cm, simple pinnate, ovate, glabrous ; pinnae upto 10 pairs, subopposite, shortly stalked or sessile, 2 - 4 cm apart, spreading or slightly ascending, some of the pinnae bipartite at the base ; largest pinna *ca* 12 x 0.8 cm, oblong-lanceolate, apex acute or acuminate, base cuneate ; margin entire in the basal part, serrate in the distal part ; texture submembranaceous ; rachis grooved adaxially, glabrous ; costa slightly raised above and below ; veins forked once or twice, free. Sori all along the margin except at base and apex. Spores 35 x 30 μm (Pl. 83).

Fertile : July - Oct.

Distrib : South India.

Occur : Rare ; on the forest floor along wayside. Kurua hills, Darrang dist. 674.

Note : The distribution of this species has been shown only in South India by Dixit (1984). Present investigator has recorded it from Assam during the present study.

Pteris pellucida Presl, Rel. Haenk. 1. 55. 1825 ; Bedd. Ferns South. India, t. 38. 1864 ; Handb. Ferns Brit. India, 106. 1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 462 ; Jamir & Rao, Ferns Nagaland, 150. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 69. t. 44. 1992.

Rhizome erect, short, scaly at the apex ; scales *ca* 3 x 0.5 mm, lanceolate, gland tipped, dark-brown, margin with fingerlike, multicellular out-growths. Stipes *ca* 20 - 40 x 0.3 cm, erect, glabrous,

glossy, abaxially rounded, adaxially grooved. Lamina *ca* 20 - 35 x 10 - 25 cm, broadly ovate, pinnate with ternate apex ; pinnae 3 - 13 pairs or 1 only, simple or the lowest pair 2 - fid, the basal basiscopic side of the terminal pair usually adnate with the rachis ; largest pinna *ca* 25 x 3.5 cm, elliptic or lanceolate, progressively narrowing towards the apex, abruptly decurrent at the base ; margin entire or nearly serrated at acuminate apex, undulate ; rachis nacked, texture coriaceous ; surfaces bright green, often glossy ; costa slightly raised and deeply grooved above, distinctly raised and rounded below ; veins free, close, simple or forked at right angle from the midrib. Sori usually all along the margin except at base and apex or along the margin of the one-third to half of the distal or median part of the pinna, *ca* 2 mm wide ; indusia entire, glabrous, dark-brown, membranous. Spores trilete, tetraherdral, yellowing brown (Pl. 84).

Fertile : July - Oct.

Distrib : (a) Malay Islands, Guinea Coast, Myanmar ; (b) throughout India.

Occur : Frequent ; both in open and shady places. Madankamdeva, Kamrup dist. 1183 ; Rowta forest, Darrang dist. 1361 ; Jatinga, North Cachar Hills dist. 1578.

Pteris quadriaurita Retz. Obs. Bot. 6. 38.1791 ; Bedd. Ferns South. India, t. 31.1864 ; Handb. Ferns Brit. India, 110.1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 465. 1880 (*pro parte*) ; Dhir, Ferns N.W. Himalayas, 48. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 111. 1982 ; Jamir & Rao, Ferns Nagaland, 152. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 79. t. 55. 1992.

Rhizome erect or suberect, short, *ca* 2.5 cm thick, scaly at the apex ; scales *ca* 4 x 0.5 mm, linear-lanceolate, apex acuminate, membranaceous at periphery, thick at the centre, dark-brown, margin hairy. Stipes *ca* 30 - 50 x 0.7 cm, glabrous, glossy above, erect, ridged, green in living, pale-dark, to purplish when dry. Lamina *ca* 75 x 30 cm, deltoid or broadly ovate, bipinnatifid, with an apical pinna, basal pinnae simple or forked once at the base ; pinnae *ca* 20 - 35 x 4 - 7 cm, opposite or subopposite, lanceolate, with caudate, acuminate apex, base broadly cuneate ; margin entire ; texture subcoriaceous, pinnae dark-green ; upper surface of costae and costules with spinules ; veins distinct below, forked once, free. Sori blackish-brown, generally partial on the margins of the segments, rarely upto the apex. Spores with verrucate exine (Pl. 85).

Fertile : July - Dec.

Distrib : (a) Throughout the tropics of the World ; (b) throughout India.

Occur : Very common, in shady and waste places. Pabha forest, Lakhimpur dist. 943 ; Mangaldai, Darrang dist., 1351 ; Darranga, Nalbari dist. 1288.

Note : According to Sledge (1982), this species is confined to Sri Lanka and South India. But the present investigator observed that this species is not only occuring in Assam but also one of the common species of *Pteris*.

Pteris scabripes Wall. ex Agardh, Rec. Sp. Gen. Pterid. 11. 1839 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 71. t. 46. 1992 ; Holtt. Rev. Fl. Mal. 2. 399. 1954 ; Tagawa & Iwastsuki, Southeast As. St. 5. 82. 1967 ; Acta. Phytotax. Geobot. 23. 55. f. 20. 4. 1968.

Rhizome erect, *ca* 2 x 3 cm, scaly at apex ; scales *ca* 6 x 0.5 mm, ovate-lanceolate, apex long acuminate, gland tipped, margin entire with multicellular glandular hairs, dark-brown. Stipes *ca* 15 - 50 x 0.3 - 0.5 cm, tufted, abaxially rounded, adaxially grooved, scaly at base, glabrous above, base pale-brown, stramineous above. Lamina *ca* 17 - 35 x 15 - 30 cm, obovate, simple pinnate ; pinnae upto 6 pairs, basalmost pair may bear an accessory pinna on the basal basiscopic side, shortly stalked or sessile, opposite, upto 4 cm apart ; largest pinna *ca* 10 - 25 x 1.5 - 2.5 cm, linear

lanceolate, apex acuminate or acute, base narrowly cuneate, margin serrate at apex, entire in the rest ; basal acroscopic side of the basalmost pinnae excised ; costae distinctly raised above and below, grooved above, rounded below ; veins distinct, free, simple or forked once, reaching the margin ; rachis similar to stipe ; texture subcoriaceous, pinnae pale-green, glabrous. Sori along the margin except the base and apex ; indusia thin, membranous. Spore densely verrucate, brown, exine winged (Pl. 86).

Fertile : Oct. - Feb.

Distrib : (a) and (b) South India.

Occur : Rare ; in open shady places. Changsari, Kamrup dist. 439.

Note : *Pteris scabripes* known to occur only in South India and the present study recorded it from Assam also.

Pteris semipinnata L. Sp. Pl. 2. 1076. 1753 ; Bedd. Ferns South. India, t. 34. 1864 ; Handb. Ferns Brit. India, 109. t. 58. 1883 ; Clarke, Trans Linn. Soc. Lond. II. Bot. 1. 464. 1880 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 111. 1982 ; Jamir & Rao, Ferns Nagaland, 155. 1990.

Rhizome short-creeping, densely scaly ; scales *ca* 0.5 x 0.1 cm, linear lanceolate, entire, shining, dark-brown. Stipes *ca* 20 - 50 x 0.2 - 0.4 cm, erect, tufted, slender, glabrous, abaxially rounded, adaxially grooved, dark-brown at base, pale-brown above. Lamina *ca* 25 - 50 x 10 - 30 cm, pinnate, ovate-lanceolate, glabrous ; upper part of lamina cut down nearly to the rachis into numerous close entire linear lobes, the largest of which *ca* 4 - 7 x 0.4 - 0.8 cm ; bases more or less dilated, tapering gradually to acute apex ; the lower two-third with 4 - 8 pairs of opposite or subopposite, distantly placed pinnae ; pinnae nearly sessile, pinnatifid at lower margin, upper margin subentire, finely serrate, basal pinnule larger in size and gradually decreases towards apical region ; sterile pinnae finely toothed or serrate at margin ; texrure subcoriaceous ; rachis castaneous, glabrous, shining, grooved above, pale-brown below ; costae and costules minutely grooved on the upper surface ; veins free, fine, forked once, oblique, slightly raised on both surfaces. Sori linear, continuous along the margins of lobes except quite near the bases and apices ; indusia reaching the sinus. Spores triangular to oval, pale-brown (Pl. 87).

Fertile : Feb. - Oct.

Distrib : (a) China, Malay Islands, Japan, Taiwan, Philippines, Borneo, S.E. Asia, Bangladesh, Myanmar ; (b) throughout India in hilly regions.

Occur : Frequent, mostly grows on humous covered soil in secondary forest and also common in fallow lands. Dibru, Dibrugarh dist. 634 ; Gopeswar, Kamrup dist. 445 ; Baman, Darrang dist. 676.

Pteris subindivisa Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 467. t. 56. f. 1. 1880 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 111. 1982. *P. quadriaurita* var. *subindivisa* (Clarke) Bedd. Handb. Ferns Brit. India, 112. 1883.

Rhizome short, erect, *ca* 1 cm thick, densely scaly ; scales *ca* 0.4 x 0.1 cm, linear, apex acuminate, hair-tipped, margin densely ciliated. Stipes *ca* 2 - 20 x 0.2 cm, abaxially rounded, adaxially grooved, glabrous, stramineous. Lamina *ca* 10 - 20 x 2.5 - 5 cm, bipinnatifid, only with 3 pinnae, terminal pinna *ca* 11 - 15 x 2.5 - 4 cm, lanceolate, apex acuminate, deeply pinnatifid, pinnules numerous, subopposite or alternate, *ca* 2 x 0.5 cm, linear, apex acute, margin entire, basal pair of pinnae opposite, hardly longer than the segments of the terminal pinna, *ca* 5 x 2 cm, oblong, apex acute, pinnules 3 - 8 with a terminal pinna similar to lateral ones but somewhat larger, pinnules of acroscopic side smaller than the basiscopic side ; veins free, forked ; costae distinctly raised

above and below, spinules present on the upper surface of costae ; sori continuous along the margin except the apex and base of pinnules ; indusia linear, entire. Spores triangular, dark-brown, exine smooth (Pl. 88).

Fertile : Oct. - Jan.

Distrib : (a) Bhutan ; (b) Eastern Himalayas.

Occur : Rare ; on moist, shady rock crevices. Barnadi forest, Darrang dist. 1718.

Pteris vittata L. Sp. Pl. 2. 1074. 1753 ; Dhir, Ferns N.W. Himalayas, 46. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 111. 1982 ; Jamir & Rao, Ferns Nagaland, 154. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 68. t. 42. 1992. ***Pteris longifolia auct. quoad.*** Pl. Asiat. Rar. Bedd. Ferns South. India, t. 33. 1864 ; Handb. Ferns Brit. India, 106. t. 55. 1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 461. 1880.

Rhizome suberect, short, *ca* 4 cm thick, densely covered by scales at apex, scales *ca* 6 x 7 mm, ovate-lanceolate, thin, membranaceous, entire, pale-brown. Stipes *ca* 5 - 40 x 0.8 cm, stout, abaxially rounded, adaxially grooved, pale-brown, clothed with linear, silky, pale-brown scales. Lamina *ca* 20 - 90 x 10 - 30 cm, simple pinnate with a single, elongate, linear, terminal pinna like the lateral ones ; pinnae numerous, opposite or subopposite, 1-3 cm apart, middle one largest, upper ones slightly reduced, basal ones gradualy reduced, up to 6 - 10 pairs of basal pinnae reduced to deflexed auricles, largest pinnae *ca* 5 - 20 x 0.5 - 1 cm ; all pinnae sessile, linear lanceolate, acuminate at apex, base broadly cuneate ; margin serrate in the distal non-soral part, entire in the rest ; texture thin, herbaceous, both surfaces nacked ; rachis nacked or slightly scaly ; costae grooved ; veins simple or forked once, free, distinct on both surfaces. Sori all along the margin, except at base and apex ; indusia membranaceous. Spores round, yellowish-green. (Pl. 89 ; Ph. 15).

Fertile : July - Feb.

Distrib : (a) Tropics and Subtropics of the World ; (b) South India, Meghalaya, Nagaland.

Occur : Common along road cuttings and rock crevices. Guwahati, Kamrup dist. 524 ; Jagiroad, Morigaon dist. 491 ; Tangla, Darrang dist. 417.

Uses : Used by Kacharies as tonic after boiling in water (Islam 1983). Roots are used as demulcent (Jain 1991).

Pteris wallichiana Agardh Rec. Sp. Gen. Pteridis. 69. 1839 ; Clarke, Trans Linn. Soc. Lond. II. Bot. 1. 469. 1880 ; Dhir, Ferns N.W. Himalayas, 49. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 111. 1982 : Jamir & Rao, Ferns Nagaland, 157. 1988. *Campteria wallachiana* Moore, Ind. Fil. 221. 1861 ; Bedd. Ferns Brit. India, t. 25 & 217. 1866 ; Handb. Ferns Brit. India, 118. 1883.

Rhizome suberect, short, glabrous. Stipes *ca* 50 - 90 x 1 - 2 cm, erect, slender, glabrous, glossy, purple. Lamina *ca* 100 x 50 cm, irregularly trichtomous, erect, tri- or quadripinnatifid, broad, pedate ; rachis trichotomously forked at base (3-partite), bearing two lateral pinnae and one terminal pinna ; lateral pinnae *ca* 20 - 60 x 10 - 20 cm, bi- or tripartite at their basiscopic side ; terminal pinna *ca* 30 - 70 x 15 - 30 cm, not forked, glabrous above, hairy beneath ; largest pinna *ca* 10 - 25 x 2 - 5 cm, sessile, linear-lanceolate, apex acuminate, deeply pinnatifid ; segments *ca* 1 - 2 x 0.3 - 0.5 cm, linear-lanceolate, apex acuminate, deeply pinnatifid ; segments *ca* 1 - 2 x 0.3 - 0.5 cm, linear-lanceolate, apex obtuse ; margin serrulate ; rachis pale-purple, very smooth, glossy, glabruos ; texture subcoriaceous ; veins free, forked, rarely a single areole at the base of the

costule, acroscopic one pair anastomosing above the sinus. Sori confluent, marginal, confined to basal region of pinnules, along the sinuses. Spores light-brown (Pl. 90).

Fertile : July - Dec.

Distrib : (a) Nepal, Bhutan, Philippines, Java, Samoa ; (b) Himalayas, Meghalaya, Nagaland.

Occur : Rare ; in moist places and along shady places near rivers and streams at higher elevations. Jatinga, North Cachar Hills dist. 1593.

Uses : Leaves are used medicinally in cuts and wounds (Jain 1991).

ADIANTACEAE (Presl) Ching

Adiantum L.
Sp. Pl. 2.1094. 1753.

Twenty five species and two varieties of *Adiantum* have been listed for India by Dixit (1984). Of these, five species are cultivated as ornamental plant. In the present investigation nine species have been recorded from Assam including *Adiantum aethiopicum* L., which is so far known to occur only in Tamilnadu and in Western Ghats.

Terrestrials or lithophytes. Rhizome erect, long or short creeping, covered by narrow, blackish scales. Stipes slender, dark, glabrous or hairy, polished ; rachis grooved on the upper surface. Lamina simple pinnate to quadripinnate ; leaflets fan shaped, margin entire, more or less deeply lobed ; veins free, rarely anastomosing, simple or forked ; texture herbaceous. Sori marginal, covered with a marginal reflexed indusium ; indusia usually reniform to linear ; sporangia large, stalked, borne on veins of reflexed margin ; annulus of 10-15 thickened cells, incomplete ; spores tetrahedral.

KEY TO SPECIES

1a. Lamina simple pinnate
  2a. Sori transversely elongated, forming a partially interrupted or uninterrupted line ; pinnae glabrous --- --- --- --- --- --- --- --- --- ***philippense***
  2b. Sori small, not forming a continuous line ; pinnae densely hairy all over
    3a. Lamina upto 20 cm long ; texture herbaceous --- ----- --- --- --- --- --- ***caudatum***
    3b. Lamina upto 50 cm long ; texture papyraceous --- --- ---- --- -- ---***assamicum***
1b. Lamina bi to quadripinnate
  4a. Rhizome erect ; rachis dichotomously branched
    5a. The two branches of dichotomies are equal ; texture of pinnae herbaceous ; rachis and its branches glabrous --- - ---------- ---- ---- ***pedatum***
    5b. The two branches of dichotomies are not equal ; texture of pinnae leathery ; upper region of rachis and its branches covered by a felt of hairs --- --- --- ----- --------***flabellulatum***
  4b. Rhizome creeping ; rachis not dichotomously branched
    6a. Scales are narrow, lanceolate ; rachis zigzag
      7a. Pinnules are subdimidiate to cuneate and longer than broad ; rhizome scales entire --- --- --- --- --- --- --- --- ------ --- ----- ***capillus-veneris***
      7b. Pinnules are semicircular to subreniform and broader than long ; margin of scales hairy --- --- --- --- --- --- --- ---------- ----- ***aethiopicum***
    6b. Scales are ovate-lanceolate ; rachis otherwise
      8a. Margin of scales smooth ; pinnules small, obcuneate ---- --- --- ----- ***venustum***
      8b. Margin of scales dentate ; pinnules large, subtrapeziform --- --- --- ***peruvianum***

Adiantum aethiopicum L. Syst. Nat.ed. X. 2.1329. 1759 ; Bedd. Ferns South. India, t.5. 1864 ; Handb. Ferns Brit. India, 84. 1883 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 191. t.77. 1992.

Rhizome wiry, long creeping, *ca* 0.5 cm thick, scaly. Scales dark-brown, glossy, *ca* 5 x 0.5 mm , apex acuminate, base ovate, bearing spreading hairs at the edges. Stipes dark- brown to black, *ca* 15 - 25 cm long and *ca* 1.5 -2 mm thick, polished, scaly at base and nacked upward. Lamina 3 or 4 - pinnate, ovate - deltoid, *ca* 20 - 30 x 15 - 25 cm ; basal primary pinnae upto 4 cm apart, *ca* 13 x 8 cm, basal secondary pinnae upto 1.5 cm apart, *ca* 4 x 3 cm, tertiary pinnae with two to four pinnules, all pinnae terminated by a pinnule larger than the lateral ones ; pinnules suborbicular, fan-shaped, lobed half way to the base, largest 2 cm across, basė cuneate or rounded, entire, texture pellucid- herbaceous ; rachis strong, zigzag, bearing alternatig secondary and tertiary rachis which are also zigzag, nacked ; veins dichotomously branched, free. Sori in several roundish or transversly oblong patches in rounded hollows of the outer edges ; sporangia rather large, annulus 16-17 cells long. Spores smooth walled, trilete and with simple leasurae (Pl. 91).

Fertile : April - June.

Distrib : (a) Sri Lanka, Australia, New Zealand, America, Africa, East African Islands ; (b) Western Ghats, Tamilnadu.

Occur : Not common ; forming small, clustered colonies in well shaded damp areas. Tezpur, Sonitpur dist.1059.

Uses : The decoction of the fern is used in South Africa as abortifacient. The fern also possesses emetic and astringent properties (Ambasta 1986).

Adiantum assamicum (Nayar) Nayar, Bull Nat. Bot. Gard. Lucknow, 54. 1. 1964. *A. caudatum* var. *assamicum* Nayar, Bull. Nat. Bot. Gard. Lucknow, 52. 10. 1961.

Rhizome erect, *ca* 0.5 cm thick, unbranched, covered by hairs and scale ; scales *ca* 0.7 x .1 cm, linear-lanceolate, apex acuminate, base broad, bicolourous, centre dark-brown, pale-brown at periphery, margin entire. Stipes *ca* 12 - 15 x 0.2 cm, slender, densely villous, blackish-brown. Lamina *ca* 20 - 35 x 3 - 4 cm, narrowly lanceolate, simple pinnate, often with the rachis much prolonged into a whip-like region bearing a vegetative bud at the apex ; lateral pinnae numerous, alternate, closely placed, largest one *ca* 1.5- 2 x 0.5 - 0.7 cm, dimidiate, sessile, base pointed, nearly trapeziform, gradually narrowed towards rounded apex, lower margin slightly concave and entire, upper margin deeply cut into narrow, closely placed primary lobes ; the primary lobes again dissected into secondary and tertiary lobe ; veins distinct above, free, forked once or twice; texture papyraceous ; lamina pale-green, densely villous above and below. Sori restricted to the tips of secondary or tertiary lobes. Spores tetrahedral, exine granulose, brownish (Pl. 92).

Fertile : Aug. - Dec.

Distrib : Eastern India.

Occur : Common in foot hills and also along roadsides of open places. Chandrapur, Kamrup dist. 1603 ; Kurua, Darrang dist. 1353.

Adiantum capillus-veneris L. Sp. Pl. 1096. 1753 ; Bedd. Ferns South. India, t. 4. 1864 ; Handb. Ferns Brit. India, 84. 1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1, 453. 1880 ; Dhir, Ferns N.W. Himalayas, 30. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 141. 1982 ; Jamir & Rao, Ferns Nagaland, 159. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 103. 1992.

Hansaraj (Hind.) ; *Southern maidenhair fern, Venus's-hair fern* (Eng.)

Rhizome short creeping, *ca* 3 mm thick, densely clothed with brown, narrow, lanceolate, acuminate, entire scales ; scales *ca* 4 x 1 mm. Stipes slender, *ca* 5 - 25 x 0.1 - 0.2 cm, scaly at base, glabrous and dark glossy above. Lamina bipinnate, lanceolate, cuneate at base, glabrous, *ca* 12 - 25 x 5 - 15 cm, pinnae stalked, parallelogram like, flabellate, obtriangular, obovate, *ca* 1.5 - 0.7 cm, lower margin straight or concave and entire, outer margin rounded, deeply 4 - 5 lobed, lobes crenate, sterile lobes with more or less rounded, finely toothed edges ; rachis nacked ; veins dichotomously branched. Sori elliptic or linear, placed in roundish sinuses of the crenations ; sporangia globose, small and short stalked. Spores smooth walled (Pl. 93).

Fertile : May - June.

Distrib : (a) Europe, Africa , America, Australia, Malay, Taiwan, China, Philippines ; (b) South India, Northeast India and North India.

Occur : Not common, in moist areas near streams and along road cuttings. Sonai Rupai forest, Sonitpur dist. 844 ; Jalukbari , Guwahati, Kamrup dist. 556.

Uses : Fronds used as a pectoral demulscent, expectorant, diuretic, emmenagogue, tonic, febrifuge ; whole plant steamed for small pox cure in California (Chopra *et al* 1956). Used in cold imposthumes of uterus, hard swelling and tumours of spleen ; fronds are used in clod fever, sores and catarrhal affection (Ambasta 1986 ; Asolkar *et al* 1992). Fronds are used to treat bronchitis, cold, cough, fever and menstural irregularities (Jain 1991).

Adiantum caudatum L. Mant. 308. 1771 ; Bedd. Ferns South. India, t. 2. 1864 ; Handb. Ferns Brit. India, 83. t. 44. 1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 453. 1880 (*pro parte*) ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 142. 1982 ; Jamir & Rao, Ferns Nagaland, 162. 1988 ; *Adiantum incisum* Forssk. Fl. Aeg. 187. 1775 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 96. t. 71. 1992.

Mayurshikha (Sans.)

Rhizome short, erect, *ca* 0.5 cm thick, densely covered by scales ; scales *ca* 3 x 0.2 mm, lanceolate, apex acuminate, base broad, entire, dark-brown at the centre, gradually become pale towards the margin. Stipes *ca* 4 - 15 x 0.1 cm, rounded below, grooved above, densely covered by long, multicellular pale-brown hairs all over, dark-brown. Lamina *ca* 15 - 20 x 2 - 3 cm, simple pinnate with a terminal pinna or with the rachis much prolonged and bearing an apical vegetative bud, oblong-lanceolate or linear-oblong-lanceolate ; pinnae numerous, alternate, sessile or sub-sessile, upper pinnae gradually smaller, largest pinnae in the middle portion of the lamina , *ca* 1.5 - 0.5 cm, dimidiate, lower margin straight or slightly concave, upper margin rounded and lobed repeatedly half way or more to the lower margin, acroscopic base truncate, apex subacute or rounded ; lamina pale-green, both surfaces hairy ; texture herbaceous ; rachis densely covered by long and short hairs ; venation distinct on the upper surface, dichotomously branched, reaching the margin. Sori on the apices of the lobes, roundish-oblong, about 1 mm in diameter ; indusia cordate, round, entire ; sporangia are small. Spores deep-brown, granulated. (Pl. 94 ; Ph. 9).

Fertile : Aug. - Dec.

Distrib : (a) China, Sri Lanka, Malay Peninsula, Malaysian Islands, Africa, Mauritius, Cape Verde Islands ; (b) throughout India from plains to lower hills.

Occur : Common along road cuttings in moist areas and also in slopes of hills ; often gregarious.

Kurua hills, Darrang dist. 680 ; Kulsi, Kamrup dist. 1778.

Uses : Used in skin diseases, diabetes, cough and fever (Chopra *et al* 1956 ; Dixit & Vohra 1984 ; Ambasta 1986 ; Jain 1991 ; Asolkar *et al* 1992).

Adiantum flabellulatum L. Sp. Pl. 2. 1905. 1753 ; Bedd. Ferns South. India, t. 218. 1864 ; Handb. Ferns Brit. India, 88. 1883.

Rhizome short ; branched, semi-erect, *ca* 0.5 cm across and scaly, scales *ca* 0.5 cm long, less than 1 mm broad, linear and dark-brown. Stipes *ca* 30 - 45 x 0.2 cm, scaly towards base, glabrous above. Lamina flabellate, bipartite, pedately divided, tripinnate or quadripinnate, ovate-cordate in shape, *ca* 15 - 25 x 20 cm. Pinnae alternate but sometimes solitary on the ultimate branches when they alternate with the tertiary branches ; basal pinnae stalked and upper ones subsessile, pinnule glabrous, subcoriaceous, obliquely cuneate or semiorbicular-cuneate, *ca* 1 - 1.2 x 0.7 - 0.9 cm ; lower margin almost straight or slightly concave ; base straight or concave, smooth ; outer margin convex, 2 - 4 lobed, with the lobes subserrate ; apex rounded ; rachis and its branches covered by a felt of hairs. Sori transversely oblong, crowded all over the outer margin, *ca* 2 mm broad and 5 mm long. Sporangia large and the annulus 14 - 17 cells long (Pl. 95).

Fertile : May - June.

Distrib : (a) Nepal, Bangladesh, Malay Peninsula, Malaysian Islands, China and Japan ; (b) Eastern India.

Occur : Not common, in moist areas near streams and along road cuttings. Katakhal, Hailakandi dist. 1408 ; Khanapara, Guwahati, Kamrup dist. 744.

Uses : Rhizomes used for cough and as an anthelmintic ; also used against gripe (Ambasta 1986).

Adiantum pedatum L. Sp. Pl. 2. 1095. 1753 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 453. 1880 ; Bedd. Ferns Brit. India, t. 167. 1866 ; Bedd. Handb. Ferns Brit. India, 86. 1883 ; Dhir, Ferns N.W. Himalayas, 32. 1980.

Rhizome erect, short, stout, *ca* 1 - 2 cm thick, scaly ; scales *ca* 10 x 2 - 2.5 mm, ovate-lanceolate, apex acuminate, margin smooth, base broad ; stipes strong, black, polished, often with a white powdery crust when young, *ca* 20 - 30 cm long and *ca* 2 - 3 mm thick ; leaves clustered, tri-compound, reniform to subreniform in outline, *ca* 25 - 30 x 35 - 40 cm ; rachis dichotomises at the apex, each branch forming an arch with its tip pointing almost downwards, on the convex side are 5 - 8 secondary branches,; pinnule, specially the lower ones petiolated, *ca* 1.5 cm broad, dimidiate-falcate, with a broad base and narrowed towards the apex ; lower margin almost in line with petiole ; the base of pinnule entire, straight and forming an angle of 45 - 90° with the lower margin ; upper margin convex, gradually converging towards the lower to end in a blunt apex and cut up into 5 - 7 primary segments. Sori one per primary segment, transversly elongated and slightly depressed from the general outline. Sporangia large and annulus *ca* 17 cells long (Pl. 96).

Fertile : Oct. - Feb.

Distrib : (a) Japan, North America ; (b) North-West Himalayas to Sikkim.

Occur : Rare ; grows as lithophyte on shady slopes of hills. Manas, Barpeta dist. 1218.

Note : This species has been collected only along the Indo-Bhutan border.

Adiantum peruvianum KL. Linnea, 18. 555. 1844 ; Dixit, Cens. Ind. Pterid. 75. 1984.

Rhizome short creeping, *ca* 1 - 2 cm thick, scaly ; scales *ca* 0.7 x 0.2 cm, lanceolate with a cordate

base, dentate margin and acute apex ; stipes *ca* 30 - 50 cm long and 1 cm thick, black, polished, densely scaly at the base, erect when young and later becoming obliquely vertical ; Leaves large and 3 - 4 pinnate ; lamina obliquely horizontal with the upper part spreading, broadly ovate-deltoid in outline, *ca* 60 - 100 cm long and *ca* 40 - 80 cm broad ; rachis resembles the stipe ; pinnules petiolate and loosely placed, *ca* 5 - 8 x 3 - 6 cm, lower margin of pinnules straight or slightly concave and smooth ; base of the pinnules smooth, convex ; upper margin smoothly curved towards the base, becoming slightly concave and almost parallel to lower margin to a distance equal to the length of latter and then curved to an acute or blunt point from where it sharply turned backwards, running in a straight line to join the lower margin ; venation not evident. Sori occur all over the upper margin except the extreme tip. Sporangia are long stalked, with an annulus *ca* 17 cells long (Pl. 97).

Fertile : Aug. - Nov.

Distrib : Widely cultivated in the garden as pot plant.

Occur : Cultivated widely as pot plant. Guwahati, Kamrup dist. 1610.

Uses : Rhizomes used as stimulant, expectorant, demulcent and emmenagogue (Ambasta 1986).

Adiantum philippense L. Sp. Pl. 2. 1094. 1753 ; Jamir and Rao, Ferns Nagaland, 162. 1988. *A. lunulatum* Burm. f. Fl. Ind. 235. 1768 ; Bedd. Ferns South. India, t. 1. 1864 ; Handb. Ferns Brit. India, 82. 1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 452. 1880 ; Dhir, Ferns N. W. Himalayas, 31. 1980 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 98. t. 73. 1992.

Kalijhant (Hind.) ; *Walking maidenhair fern* (Eng.)

Rhizome short, erect or suberect, *ca* 2.5 cm thick, scaly ; scales *ca* 3 x 0.5 mm, ovate - lanceolate, acuminate at apex, entire, brown with deep brown central region, Stipes *ca* 10 - 15 x 0.7 cm, nacked and polished, scaly at base, deep brown to black. Lamina *ca* 20 x 5 - 6 cm, simple pinnate, either terminated by an apical pinna or apex of rachis prolonged bearing a vegetative bud ; pinnae 10 - 17 pairs, alternate, *ca* 3 x 1.5 cm, distinctly stalked, stalk of lower pinnae are longer than those of the upper ones ; pinnae lunulate, lower margin straight or slightly concave, entire, upper margin rounded, lobed shallowly into 4 - 8, broad lobes, each lobe may be further lobed ; pinnae pale-green, glabrous ; texture-herbaceous ; rachis similar to the stipe ; veins distinct above and below, dichotomously branched, free, reaching the margin. Sori continuous along the margin of the lobe which is slightly depressed from the general outline, crescent - shaped, upto 2 mm wide ; indusia coriaceous, entire, brownish ; sporangia stalked. Spore triangular, smooth (Pl. 98).

Fertile : Aug. - Dec.

Distrib : (a) Tropics and Subtropics of the world ; (b) throughout India.

Occur : Common along the banks of rivers and streams and in moist shady places as terrestrial in forests and rarely as lithophyte. Jorhat, Jorhat dist. 1252 ; Kurua hills, Darrang dist. 672 .

Uses : Used in fever, blood diseases, epilepitic fits, rabies (Chopra *et al* 1956 ; Dixit & Vohra 1984 ; Ambasta 1986). Roots are used in dysentery, ulcers and muscular pain (Jain 1991 ; Asolkar *et al* 1992).

Adiantum venustum D. Don, Prod. Fl. Nepal, 17. 1825 ; Bedd. Ferns Brit. India, t. 20. 1866 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 453. 1880 ; Bedd. Handb. Ferns Brit. India, 86. t. 45. 1883 ; Dhir, Ferns N.W. Himalayas, 32. 1980.

Hansapadi (Sans.) ; *Sunraj* (Hind.)

Rhizome long creeping, branched, *ca* 0.3 cm thick, scaly. Scales pale-brown, large *ca* 7 x 2.5 mm, ovate - lanceolate, base non cordate, margin smooth, apex acute. Stipe deep - brown, *ca* 20 - 25 x 0.1 - 0.2 cm, erect and scaly at base but glabrous and glossy above. Lamina tri- to quadripinnate, deltoid in outline, *ca* 30 x 20 cm ; pinnule small, *ca* 0.5 - 0.75 cm across, shortly petiolate ; petiole thin, wiry, *ca* 0.5 cm long ; pinnae firm, membranaceous-chartaceous, glabrous and slightly glaucous beneath, ovate-cuneate, rarely subrhomboid-acuminate, outer margin smoothly curved, in some cases shallowly lobed into 2 or 3 rounded, prominently dentate segments ; rachis glossy, glabrous and the secondary rachises are usually spreading ; venation prominent and evident on both surfaces. Sori 1 - 3 per pinnule, restricted to the outer margin ; involucres reniform-cordate, submembranaceous. Sporangia rather large, and the annulus is 17 - 22 cells long (Pl. 99).

Fertile : April - July.

Distrib : (a) Afghanistan ; (b) Northeast Himalayas.

Occur : Not Common, growing in clumps as lithophyte in semi-shaded localities in hilly areas. Hahim, Kamrup dist. 1792 ; Rowta forest, Darrang dist. 1365.

Uses : Used as tonic, resolvent, expectorant, diuretic, emmenagogue, astringent, emetic and in scorpion sting (Ambasta 1986 ; Jain 1991 ; Asolkar *et al* 1992).

HEMIONITIDACEAE Pic. Ser.

Terrestrials. Rhizome creeping, covered with scales. Stipes erect or suberect, glabrous, scaly at base, polished, dark brown, black. Lamina simple or pinnate, pinnules entire or serrulate ; texture herbaceous to coriaceous, glabrous or scaly ; veins free, forked once or twice or anastomosing, without included veinlets. Sori elongate, along the veins, exindusiate ; paraphyses absent or small ; annulus of 13 -24 thickened cells. Spores tetrahedral or bilateral, exine reticulate, spinulose.

KEY TO GENERA

1a. Lamina simple, dimorphic ---------- --- --- ***Hemionitis***
1b. Lamina pinnate, monomorphic
2a. Lower surface of lamina covered by white or yellow crust --- --- --- ***Pityrogramma***
2b. Lower surface of lamina not covered by such crust ---------- --- --- ***Coniogramme***

Coniogramme Fée

Gen. Fil. 167. 1852. *nom. cons.*

Dixit (1984) has listed 12 species and a variety of *Conniogramme* for India and all the species are occuring in the Himalayas. Only two species have been recorded in the present investigation.

Terrestrials. Rhizome creeping, scaly ; scales narrow, brown. Stipes errect, glabrous or scaly at base. Lamina simple pinnate to bipinnate ; pinnae entire or serrulate, glabrous ; texture herbaceous or coriaceous ; veins free, forked once or twice. Sori elongate, confluent along the veins, exindusiate, paraphyses small ; annulus of 13 -22 thickened cells. Spores tetrahedral, rarely bilateral, exine smooth.

KEY TO SPECIES

1a. Pinnules serrate or serrulate ; lamina bipinnate throughout ---------- --- --- --- ***procera***
1b. Pinnules entire ; only lower most pinnae pinnate ---------- --- --- ***fraxinea***

Coniogramme fraxinea (D.Don) Fée ex Diels in Engl. & Prantl, Nat. Pfl. 1(4). 262. 1899 ; Dhir. Ferns. N.W. Himalayas, 43. 1980 ; Baishya & Rao, Ferns & Fern - allies Meghalaya, 145. 1982

; Jamir & Rao, Ferns Nagaland, 167. 1988. *Diplazium fraxineum* D.Don, Prod. Fl. Nepal, 12. 1825. *Gymnogramme fraxinea* (D.Don) Bedd. Ferns Brit. India. Suppl. 24. 1876 ; *sensu* Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 569. 1880 (*pro parte*). *Syngramme fraxinea* (D.Don) Bedd. Handb. Ferns Brit. India, 386. 1883 (*pro parte*) ; Suppl. 100 . 1892.

Rhizome long creeping , *ca* 0.8 cm thick, stout, densely clothed with scales ; scales *ca* 6 x 0.2 mm, lanceolate, apex hair pointed, brown. Stipes *ca* 60 x 1.5 cm, erect, adaxially grooved, abaxially rounded, glabrous, light-brown. Lamina *ca* 75 x 40 cm, bipinnate at the base, simple pinnate at apex, ovate to oblong-ovate ; pinnae upto 3 -8 pairs, subopposite, shortly stalked ; largest pinna *ca* 30 x 6 cm, narrowly elliptical, apex cuspidate, base cuneate, margin entire ; secondary pinnae at the base smaller than the others, oblique at base ; costae raised above and bellow ; veins parallel, forked, free, ending in hydathodes ; rachis grooved on upper surface, glabrous, pale-brown ; texture subcoriaceous ; lamina glabrous. Sori along the veins and run to half the distance from costal region to the margin. Spores trilete, exine granulose (Pl. 100).

Fertile : May - Oct.

Distrib : (a) China, Malay Peninsula, Indo-China, Malaysia, Taiwan, Philippines ; (b) through out mountainous regions in India.

Occur : Rather common, on moist, shady forest floor near rivers and streams. Bokajan, Karbi-Anglong dist. 1432 ; Upper Dihing forest, Tinsukia dist. 669.

Coniogramme procera Wall. ex Fée, 10 me Mém. 22. 1865 ; Jamir & Rao, Ferns Nagaland, 168. 1988. *Grammitis procera* Wall. Cat. No. 3. 1828 (*nom. nud.*). *Gymnogramma javanica* (Bl.) Bedd. Ferns South. India, t. 232. 1864 ; Ferns Brit. India, t. 57 .1866. *Syngramme fraxinea* (D.Don) Bedd. Handb. Ferns Brit. India, 386. t. 222. 1883 (*pro parte*).

Rhizome creeping, *ca* 0.8 -1 cm thick, densely clothed with scales ; scales *ca* 7 x 2 mm, linear, apex acuminate, entire, dark brown. Stipes *ca* 25 - 50 x 1 - 2 cm, erect sparsely scaly at base, glabrous above, adaxially grooved, abaxially rounded, stramineous. Lamina *ca* 25 - 60 x 30 - 45 cm, bipinnate or rarely tripinnatifid at base, simple pinnate at apex ; lower pinnae *ca* 10 - 40 x 5 - 15 cm, ovate, comprising of 6 - 15 pairs of lateral pinnules ; alternate or subopposite, sessile or subsessile, *ca* 3 - 9 x 1 - 2 cm, ovate-lanceolate, cuspidate at apex, cuneate at base, margin crenate or serrulate, pinnae of the upper portion is larger than the secondary basal pinnae ; costae raised above and below ; veins prominent, very close, forked from the base near the midrib, one or both branches often again forked, ending in hydathodes near the marginal serrations ; texture thin, herbaceous ; lamina glabrous or a little pilose beneath. Sori linear, running along all the veins but stopping far short from the margin ; sporangia shortly stalked. Spores deep-yellow (Pl. 101).

Fertile : Oct. - Nov.

Distrib : (a) North Thailand, China, Taiwan ; (b) Himalayas and Northeast India.

Occur : Rare ; in shady places near the water sources. Nambar forest (Part), Karbi-Anglong dist.1689.

Hemionitis L.

Sp. Pl. 2. 1077. 1753.

The genus *Hemionitis* is represented by single species in India (Dixit 1984 ; Dixit & Vohra 1984). The distribution of *H. arifolia,* the lone species occuring in India, has however been shown as South India by the above workers. Chowdhury & Phukan (1974) reported its occurance in Assam also.

Hemionitis arifolia (Burm.) Moore, Ind. Fil. 114. 1859 ; Bedd. Handb. Ferns Brit. India, 413. t. 245. 1883 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 93. t. 68. 1992. *Asplenium arifolium* Burm. Fl. Ind. 231. 1768. *Hemionitis cordifolia* Roxb. ex Bedd. Ferns South. India, t. 53. 1864.

Rabit ear fern (Eng.)

Rhizome suberect, short, hard, *ca* 5 - 10 x 0.5 cm, covered by scales ; scales *ca* 3.5 x 5 mm, ovate-lanceolate, acuminate at apex, entire but sparsely toothed towards base , light-brown. Stipes *ca* 25 cm long in fertile fronds, *ca* 22 cm in sterile ones, shining, terete, scaly, black to dark-brown. Lamina dimorphic, simple *ca* 8 - 12 x 4 - 8 cm, ovate-cordate, tending to be hastate or sagittate, apex acute or rounded, margin entire ; texture coriaceous ; lamina pale-green, upper surface glossy and the lower surface covered by multicellular hairs and small, soft, pale-brown scales ; costa raised below, grooved above ; venation reticulate with small elongated areoles devoid of included veinlets ; fertile lamina similar to sterile ones but slightly smaller than the sterile. Sori continuous along the veins forming reticulate pattern on the lower surface ; sporangia small, long stalked ; spores spherical, trilete, exine with incomplete reticulation (Pl. 102 ; Ph. 20).

Fertile : Sept. - Jan.

Distrib : (a) Bangladesh, Sri Lanka, Myanmar, Philippines ; (b) South India, Plains of Northeast India.

Occur : Rare ; on shaded earth cuttings on steep slopes. Bashistha, Kamrup dist. 527.

Uses : The fronds are used in the treatment of aches and as vermifuge. In Philippines crushed juice from the fronds is used for burns (Dixit & Vohra 1984 ; Ambasta 1986 ; Jain 1991 ; Asolkar *et al* 1992 ; Manickam & Irudayaraj, 1992).

Pityrogramma Link.
Handb. Erken. Gew. 3. 19. 1833.

Dixit (1984) has listed three species of *Pityrogramma* for India including *P. chrysophylla* (Sw.) Link., which is now regarded as a variety of *P. calomelanos* (L.) Link. (i.e. *P. Calomelanos* var. *aureoflava* (Hook.) Wealth. ex Bailey) by many workers in India. Only one species has been recorded under this genus in the present investigation.

Golden fern (Eng.)

Pityrogramma calomelanos (L.) Link. Handb. Erken. Gew. 3. 20. 1833 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 146. 1982 ; Jamir & Rao, Ferns Nagaland, 171. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 94. t. 69. 1992. *Acrostichum calomelanos* L. Sp. Pl. 2. 1072. 1753. *Pteris calomelanos* (L.) Bedd. Ferns Brit. India, t. 22. 1866. *Pallaea calomelanos* (L.) Bedd. Handb. Ferns Brit. India, 104. 1883.

Rhizome short, erect to ascending, clothed with scales ; scales *ca* 0.6 cm long, narrow, thin, entire, dark-brown. Stipes *ca* 10 - 35 x 0.2 - 0.5 cm, tufted, scaly at base, glossy above, black. Lamina *ca* 20 - 40 x 5 - 18 cm, oblong-triangular, subcoriaceous, bipinnate, pinnae in the lower half of the lamina more or less equal ; gradually shortened towards apex, lower surface covered with white waxy powdery substance, pinnae *ca* 20 x 7 cm at base, shortly petiolate, deeply lobed, acuminate, cordate ; largest pinnules *ca* 2 cm long, oblique, narrowly deltoid, lobed at based, apex acute ; lobes oblique, elliptic, toothed ; rachis black-ebenous, glossy ; veins dichotomously radiated, free. Sori continuous throughout the lower surface. Spores tetrahedral (Pl. 103 ; Ph. 21).

Fertile : Oct. - Nov.

Distrib : (a) Maxico, West Indies, Argentina, Tropical America, Malay, Africa ; (b) throughout India.

Occur : Common in open dry places along road cuttings ; usually terrestrial, rarely lithophyte. Khairabari, Darrang dist. 358 ; Changsari, Kamrup dist. 434 ; Pabha forest, Lakhimpur dist. 934.

Uses : Plant decoction is used for kidney trouble in Philippines ; tea prepared out of the frond is used as a cure for flu, hypertension, fever and cough in Trinidad (Dixit & Vohra 1984 ; Manickam & Irudayaraj 1992).

ANTROPHYACEAE (Link.) Ching

Antrophyum Kaulf.
Enum. Fil. 197, 282. 1824.

Dixit (1984) has listed seven species under this genus from India. Only two species have been encountered in the present investigation.

Epiphytes. Rhizome creeping, scaly. Stipes absent or very short. Lamina simple, pendulous, lanceolate or falcate-elliptic, narrowly decurrent at base, apex acute or obtuse, margin entire ; midrib absent or slightly distinct at the base ; veins distinct above and below, reticulate, areoles long, narrow, without included veinlets ; texture coriaceous to subcoriaceous ; lamina dark-green, glabrous. Sori linear, born along the reticulate veins, immersed, confluent ; sporangia round, stalked, paraphyses club-shaped or taeniform. Spores oval, tetrahedral, exine smooth.

KEY TO SPECIES

1a. Lamina linear lanceolate ; paraphyses taeniform ---------- --- --- ***reticulatum***
1b. Lamina lanceolate or falcate-eliptic ; paraphyses club-shaped ---------- --- --- ***plantagineum***

Antrophyum plantagineum (Cav.) Kaulf. Enum. 197, 282. 1824 ; Bedd. Handb. Ferns Brit. India, 403. t. 236 1883 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 147. 1982 ; Jamir & Rao, Ferns Nagaland, 177. 1988 ; Manickam & Irudayaraj , Pterid. Fl. West. Ghats-S. India, 107. t. 85. 1992. *Hemionitis plantaginea* Cav. Descr. 260. 1802. *Antrophyum reticulatum sensu* Bedd. Ferns South. India, t. 52. 1864..

Rhizome short creeping, *ca* 4 mm thick, fleshy, densely scaly ; scales *ca* 2 - 7 x 0.3 mm, lanceolate, apex hair-tipped, base broad, margin toothed, dark-brown. Stipes short, *ca* 6 x 0.2 cm, flattened, scaly at base. Lamina *ca* 10 - 30 x 4 cm, simple, lanceolate or falcate-elliptic, usually widened towards the apex, then suddenly narrowed into an acute or obtuse apex, narrowly decurrent at base, margin entire ; midrib absent or slightly distinct at the base ; veins distinct above and below, reticulate ; areoles long, narrow, without any included veinlets ; texture subcoriaceous ; lamina dark-green, glabrous above and below. Sori linear, born along the reticulate veins, *ca* 1.5 mm wide, immersed, often confluent, soral grooves raised on the upper surface of the lamina ; sporangia round, stalk slender, paraphyses club-shaped on branched stalk. Spores oval, trilete, tetrahedral, light-brown, exine smooth (Pl. 104).

Fertile : July - Nov.

Distrib : (a) Sri Lanka, Malay Penninsula, Malaysian Islands. Philippines, Polynesian Islands ; (b) Meghalaya, Nagaland, Tamilnadu, Kerala, Western Ghats.

Occur : Occasional, on tree trunks in evergreen forests. Bhalukpung, Sonitpur dist. 843.

Antrophyum reticulatum (Forst.) Kaulf. Enum. 198. 1824 ; Bedd. Ferns South. India, t. 231. 1864 ; Handb. Ferns Brit. India, Suppl. 102. 1892. *Hemionitis reticulata* Forst. Prod. 79. 1876. *Antrophyum reticulatum sensu* Bedd. Handb. Ferns Brit. India, 401. t. 235. 1883 (*pro parte*).

Rhizome creeping, *ca* 0.3 cm thick, densely clothed with scales ; scales *ca* 3 x 0.2 mm, apex acuminate, base broad, margin toothed, blackish-brown. Stipes absent or very short. Lamina simple, *ca* 12 - 40 x 2 - 3 cm, apex acuminate, broadest above the middle, very gradually narrowed downwards, base decurrent, margin entire ; midrib absent or sometimes present towards the base of the lamina ; veins distinct above and below, copiously anastomosing, areoles very long, narrow and distinctly raised on the upper surface, without any included veinlets ; texture coriaceous ; lamina dark-green, glabrous. Sori born along the reticulate veins, immersed, confluent ; sporangia round, stalked, paraphyses taeniform. Spores oval, tetrahedral (Pl. 105).

Fertile : Feb. - July.

Distrib : (a) Sri Lanka, Malay Peninsula, Polynesia, Queensland ; (b) Meghalaya, West Bengal, Sikkim, Manipur, Kerala, Tamilnadu.

Occur : Rare ; on tree trunks in dense evergreen forest. Bhalukpung, Sonitpur dist. 847.

VITTARIACEAE (Presl) Ching

Vittaria J. Sm.
Mém. Acad. Sci. Turin. 5. 413. t.9(5). 1793.

Dixit (1984) has listed 16 species of *Vittaria* for India. Only three species of the genus have been encountered in the present investigation.

Epiphytes or lithophytes. Rhizome short creeping, scaly ; scales lanceolate, hair pointed. Stipes articulate to rhizome. Lamina simple, linear-lanceolate, margin entire ; veins slightly distinct above and below ; glabrous, dark-green ; texture coriaceous to subcoriaceous. Sori linear, along submarginal veins or born in an apparently marginal groove ; sporangia stalked, paraphyses copious. Spores yellowish green to bright yellow.

KEY TO SPECIES

1a. Midribconspicuously raised below, grooved above ---------- --- --- ---***flexuosa***
1b. Midrib not conspicuously raised below, not grooved above
  2a. Lamina *ca* 15 - 50 cm long, linear-oblong lanceolate ; apex acuminate --- --- ---***elongata***
  2b. Lamina *ca* 7 - 10 cm long, linear-lanceolate ; apex subobtuse --- --- --- ***sikkimensis***

Vittaria elongata Sw. Syn. Fil. 109, 302. 1806 ; Bedd. Ferns South. India, t. 21. 1864 ; Handb. Ferns Brit. India, 404. t. 238. 1883 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 147. 1982 ; Jamir & Rao, Ferns Nagaland, 174. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 107. t. 84. 1992. *Pteris graminifolia* Roxb. ex Griff. Calc. Journ. Sci. 4 : 502. t. 33. 1844.

Rhizome short creeping, *ca* 0.3 cm thick, slender, branched, densely scaly ; scales *ca* 5 x 0.3 mm, lanceolate, apex acuminate, hair-tipped, margin sparsely dentate, blackish. Stipes *ca* 1 - 1.5 x 0.3 cm, flattened. Lamina *ca* 15 - 50 x 0.5 - 1 cm, simple, linear-oblong lanceolate, gradually tapering towards both ends, apex acuminate, margin entire ; midrib distinct, slightly raised below ; veins slightly distinct above and below, simple, immersed, parallel, oblique to costa ; texture coriaceous ; lamina dark-green, glabrous. Sori sunk in extrose marginal groove, *ca* 1 mm wide, linear, confluent ; sporangia short stalked, paraphyses copious. Spores monolete, ellipsoid, pale yellowish-green (Pl. 106)

Fertile : Feb. - Dec.

Distrib : (a) Sri Lanka, Bangladesh, Myanmar, Vietnam, Laos, Malay, Taiwan, Philippines, China, Polynesia, Australia, Africa ; (b) throughout India in mountainous regions.

Occur : Common, on moss covered tree trunks and as well as on rock surfaces. Pabhoi, Sonitpur dist. 1732 ; Khalingduar, Darrang dist. 1701.

Uses : Fronds are used to treat rheumatism (Jain 1991).

Vittaria flexuosa Fée, 3 Mém. Fam. Foug. 16. 1851-1852 ; Clarke Trans. Linn. Soc. Lond. II. Bot. 1. 575. 1880 ; Dhir, Ferns N.W. Himalayas, 32. 1980 ; Jamir & Rao, Ferns Nagaland, 174. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 105. t. 81. 1992. *V. lineata sensu* Bak. in Hook. Syn. Fil. 396. 1874 ; Bedd. Handb. Ferns Brit. India, 407.1883. *Taeniopteris lineata* Bedd. Ferns South. India, t. 54. 1864.

Rhizome short creeping, *ca* 4 mm wide, covered by scales ; scales *ca* 1.3 x 0.3 cm, lanceolate, subulate, hair-pointed, slightly denticulate, dark-brown. Frond simple, tufted, sessile without distinct stipe, *ca* 15 - 40 x 0.4 - 1 cm, linear, gradually tapering at both ends, apex acute, margin entire, midrib conspicuously raised below, marked by distinct groove above ; veins simple, immersed, frond glabrous, green, coriaceous. Sori along submarginal grooves, covered by inrolled margins, paraphyses with terminal cell as long as wide, sporangia short stalked. Spores pale, translucent, oval, verrucoid (Pl. 107).

Fertile : Feb. - Dec.

Distrib : (a) Sri Lanka, Nepal, Bhutan, Thailand ; (b) Arunachal Pradesh, Nagaland, West Bengal, Uttar Pradesh, South India.

Occur : Rare ; on the moss covered tree trunks in forest. Mayang, Marigaon dist. 1620.

Vittaria sikkimensis Kuhn. Linnaea 36. 66. 1869 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 574. t. 84.f. 3. 1880 ; Bedd. Handb. Ferns Brit. India, 406. t. 239. 1883. *V. minor* Bedd. Ferns Brit. India, t. 56. 1866 (*non* Fée 1851 - 52).

Rhizome very shortly creeping, slender, *ca* 0.2 cm thick, scaly ; scales *ca* 2 x 0.3 mm, linear-lanceolate, small, hair-pointed, reddish-brown. Stipes *ca* 7 x 0.3 cm, densely tufted, grooved adaxially, glabrous. Lamina *ca* 7 - 10 x 0.5 - 1 cm, linear-lanceolate, apex subobtuse, base decurrent on stipe ; midrib obscure or slightly depressed beneath ; veins indistinct ; texture subcoriaceous ; sori marginal, outer lip indistinguishable from the margin of the lamina, when young, deeply sunk in a large extrose marginal groove ; sporangia few, club-shaped, stalked. Spores ovoid (Pl. 108).

Fertile : May - Aug.

Distrib : (a) China ; (b) Arunachal Pradesh, Darjeeling and Sikkim Himalyas.

Occur : Rare ; on shaddy, moss covered rocks and as well as tree trunks. Bhairabkunda R. F., Darrang dist. 1529.

Suborder : **PARKERIINEAE**

PARKERIACEAE Hook.

Ceratopteris Ad. Brongn.
Bull. Sci. Soc. Philom. Paris 1821. 186. 1822.

Dixit (1984) has listed three species of *Ceratopteris* for India. Of the three species, only *C.*

thalictroides (L.) Brongn. has been encountered in the present study. Dixit (1984), however, mentioned that *C. cornuta* (P. Beauv.) Le Prieur is also occuring only in Assam. But, the present investigator has not encountered this species in the present study.

Ceratopteris thalictroides (L.) Ad. Brongn. Bull. Sci. Soc. Philom. Paris 1821. 186. 1822 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 471. 1880 ; Bedd. Ferns South. India, t. 75. 1864 ; Handb. Ferns Brit. India, 123. t. 63. 1883 ; Dhir, Ferns N.W. Himalayas, 45. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 148. 1882 ; Jamir & Rao, Ferns Nagaland, 179. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India; 91. t. 67. 1992. *Acrostichum thalictroides* L. Sp. Pl. 2. 1070. 1753.

Rhizome short, erect or suberect, fleshy, bearing fibrous roots, apex scaly ; scales *ca* 2 x 4 mm, soft, ovate, apex acute, margin entire, pale-brown. Stipes *ca* 2 x 1.5 cm, terete, fleshy, ridged, pale-green, with few scattered scales. Lamina dimorphic ; sterile lamina *ca* 30 x 18 cm, bipinnate, mostly oblong, apex acute, base cuneate ; primary pinnae *ca* 10 x 6 cm, about 5 pairs alternate, stalked, upto 6 cm apart ; secondary pinnae *ca* 4 x 4 cm, about four pairs, alternate, stalked, broadly deltoid or ovate, lobed upto 2-3 mm to the costa ; lobes linear, *ca* 1.5 x 0.7 cm, oblong, acute, margin entire ; lamina glabrous, pale-green ; texture soft herbaceous ; veins slightly distinct above and below, copiously anastomosing ; fertile lamina much taller than sterile ones and much dissected, bipinnatifid or tripinnatifid, *ca* 10 - 35 x 12 - 16 cm, pinnae alternate ; ultimate segments needle like, *ca* 6 x 0.2 cm, apex acute, margin reflexed and completely covering the lower surface on which two rows of sporangia are born ; sporangia globose, shortly stalked. Spores large, ribbed, tetrahedral (Pl. 109).

Fertile : July - Oct.

Distrib : (a) Tropics and Subtropics of the world ; (b) throughout India.

Occur : Common, in lowlands particularly in paddy fields and in stagnant shallow water bodies. Kamalpur, Kamrup dist. 1303 ; Mangaldai, Darrang dist. 831.

Uses : Fronds are used as poultice in skin complaints and in China as tonic and styptic ; fresh leaves eaten as vegetable curries. It is ploughed in as part of the green manure in rice fields (Chopra *et al* 1956 ; Dixit & Vohra 1984 ; Ambasta 1986 ; Jain 1991).

Note : In many localities this species grows gregariously. It is also observed that the species also adapted to grow terrestrially in moist soil saturated with water. When adapted to terretrial habitat, the plants become comparatively smaller in size than the plants growing in water bodies.

Subclass : **MARSILEIDAE**
Order : **MARSILEALES**

MARSILEACEAE Mirb.

Marsilea L.
Sp. Pl. 2. 1099. 1753.

There are 14 species of *Marsilea* in India (Dixit 1984 ; Dixit & Vohra 1984). Except *M. minuta* L., which is widely occuring in India, all other species are restricted to particular geographical limits or political boundaries. Only the common species *M. minuta* has been recorded in the present investigation.

Marsilea minuta L. Mant. 308. 1771 ; Dhir, Ferns N.W. Himalayas, 29. 1980 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 342. t. 259. 1992.

Aquatic. Rhizome long creeping, branched, subterranean, *ca* 1 mm thick, with nodes and inter-nodes, submarged in water or partly out of water, green or pale-brown, covered by hairs all over ; hairs *ca* 5 x 0.2 mm, soft slender, whitish. Stipes *ca* 15 x 0.2 cm, terete, glabrous or with few hairs, green or pale-brown. Leaves 4, sessile, arranged at the tip of the stipe in clover leaf model, *ca* 2.5 x 2 cm, obovate or wedge-shaped, apex rounded, base cuneate, margin entire ; veins distinct, above and below, branched, occasionally connected by lateral veins ; texture thin, herbaceous ; leaves green, glabrous. Sporocarps born in clusters at the nodes alternately, 5 per clust-ers ; sporocarps *ca* 5 x 4mm, oval to bean-shaped, with stalk, *ca* 7 x 1mm, densely hairy when young, sparsely when mature, ridged verticaly, black to dark-brown ; heterosporous with both mega and micro sporangia in the same sporocarp. Microspores globose, yellowish-brown, with distinct exine and intine ; megaspores ovate, yellowish-brown (Pl. 110 ; Ph. 17).

Fertile : Nov. - Feb.

Distrib : (a) Java and Philippines ; (b) throughout India.

Occur : Common in lowlands along paddy fields as well as in shallow, stagnant water bodies. Mangaldai, Darrang dist. 352 ; Baghbar, Barpeta dist. 1211 ; Rani, Kamrup dist. 569.

Uses : Plants are used in cough, spastic condition of leg muscles, etc. and also in sedatum and insomnia ; the leaves and sprouts are used as vegetables for which also sold in the market (Chopra *et al* 1969 ; Dixit and Vohra 1984 ; Ambasta 1986 ; Jain 1991).

Subclass : **HYMENOPHYLLIDAE**

Order : **HYMENOPHYLLALES**

HYMENOPHYLLACEAE Link

Hymenophyllaceae has about 800 species, which are mostly distributed in the tropics and in the southern hemisphere. The generic delimitation in the family has long been subjected to difference of opinion among the Pteridologists. Copeland (1938) proposed a system of classification of the family by recognising many genera, while some others recognised only two genera *Trichomanes* L. and *Hymenophyllum* J. Sm. Ito (1949), Iwatsuki (1958), Nakaike (1981), Pichi-Sermolli (1977) and most of the Indian Pteridologists (Dixit 1984 ; Dhir 1980) accepted Copeland's (1938) system. Holttum (1954) and Sledge (1968) on the other hand favour the bigeneric system. Morton (1968), however, has recognised two larger genera in addition to four monotypic genera. In the present work the multigeneric system is followed.

Terrestrials, epiphytes or lithophytes. Rhizome slender, usually wide creeping, rarely short erect, covered with brown rhizoids and ramenta. Stipes not articulate to rhizome. Lamina small, delicate, filmy, one cell in thickness except for the veins, simple to variously compound ; veins free, forked, covered by hairs. Sori marginal or submarginal ; sporangia born on more or less elongated receptacles formed by extention of veinlets ; indusia tubular or 2- lipped to orbiculate, terminal on segments, annulus complete, oblong to nearly transverse. Spores tetrahedral, smooth or slightly granulose to spinulose.

KEY TO GENERA

1a. Rhizome filamentous ; indusia 2-lipped ; receptacle not exserted, included ---------- ***Mecodium***

1b. Rhizome slender ; indusia otherwise ; receptacle exserted ---------- ***Vandenboschia***

Mecodium Presl ex Copel.

Philip. Journ. Sci. 67. 17. 1938

Dixit (1984) has listed seven species and two varieties of *Mecodium* for India. In the present investigation only two species have been recorded.

Terrestrial. Rhizome filamentous, wiry, creeping ; rhizoids with dense, brown ramenta. Stipe covered by brown hairs. Lamina delicate, pinnate, filmy ; pinnae variously lobed, margin entire ; veins prominent, forked, free, covered by hairs ; rachis flat, winged or not. Tip of pinnules bearing cup-shaped, 2-lipped indusia ; receptacles cylindrical or capitate, shorter than indusia.

KEY TO SPECIES

1a. Stipe winged, glabrous ---------- ***javanicum***

1b. Stipe not winged, hairy ---------- ***exsertum***

Mecodium exsertum (Wall. ex Hook.) Copel. Philip. Journ. Sci. 67. 23. 1938 ; Dhir, Ferns N.W. HiMalays, 50. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 44. 1982 ; Jamir & Rao, Ferns Nagaland, 184. 1988. *Hymenophyllum excertum* Wall. ex Hook. Sp. Fil. 1. 109. t. 38A. 1844 ; Bedd. Ferns South. India, t. 9. 1864 ; Handb. Ferns Brit. India, 30. t. 16. 1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 436. 1880. *H. gardnerii* v. d. B. Ned. Kruid. Arch. 4. 417. 1859 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 145. t. 111. 1992.

Rhizome long creeping, *ca* 0.3 mm thick, wiry, sparsely hairy. Stipes *ca* 1 - 5 x 0.3 cm, terete, not winged, densely hairy, dark-brown. Lamina *ca* 5 - 10 x 2 - 4 cm, ovate-lanceolate to oblong lanceolate, bipinnatifid ; lateral pinnae numerous, alternate, very close, often overlapping, with a terminal pinna similar to lateral ones ; lowest pair of pinnae sometimes reduced ; largest pinna *ca* 3 x 0.7 cm, oblanceolate, apex subacute or rounded, base broadly cuneate, margin deeply lobed ; ultimate lobes *ca* 3 x 2 mm, linear, subacute, entire, close, shallowly bilobed ; costa and veins distinct and slightly raised above and below, not reaching the margin ; rachis winged above or often throughout, more or less densely clothed with deciduous, ferruginous hairs ; lamina pale-green, hairy beneath, glabrous above, Sori on about four basal acroscopic lobes at the end of the veins ; indusia cleft near the base, lips ovate with entire margin, rarely toothed towards apex (Pl. 111).

Fertile : May - Oct.

Distrib : (a) Myanmar, Sri Lanka ; (b) throughout India in mountainous regions.

Occur : Occasional, on moist and shady moss covered rocks and tree trunks. Rowta forest, Darrang dist. 1367.

Mecodium javanicum (Spr.) Copel. Philip. Journ. Sci. 67. 20. 1938 ; Dhir, Ferns N.W. Himalayas, 50. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 44. 1982 ; Jamir & Rao, Ferns Nagaland, 186. 1988. *Hymenophyllum javanicum* Spr. Syst. Vég. 4. 132. 1827 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 437. 1880 ; Bedd. Handb. Ferns Brit. India, 32. 1883 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 146. t. 112. 1992. *H. crispatum* Wall. ex Hook. *et* Grev. Icon. Fil. t. 77. 1827 ; Bedd. Ferns South. India, t. 207. 1864.

Rhizome long-creeping, *ca* 0.5 mm, wiry, glabrous. Stipes *ca* 2 - 5 x 0.2 cm, erect, slender, wingless at the base, narrowly winged above, glabrous, wing upto 0.2 cm wide, entire or crisped. Lamina *ca* 3 - 12 x 3 - 5 cm, bipinnatifid, oblong-lanceolate ; lateral pinnae close, not overlapping, oblique ; largest pinna *ca* 4 x 1.5 cm, triangular rhomboidal, with about 5 pairs of pinnules ; pinnules *ca* 1 - 0.5 cm, flat, entire or crisped, lobed ; lobes *ca* 5 x 2 mm, oblong, apex round or obtuse, entire ; rachis and costa broadly winged, entire, undulate ; veins distinct, not reaching the

margin ; lamina dark-green, glabrous. Sori terminal on the upper pinnae, *ca* 2 x 1 mm, elliptic to ovate; indusia, 2-lipped, lip orbicular to oblong, acute, entire, glabrous (Pl.112).

Fertile : May - June.

Distrib : (a) Sri Lanka, Myanmar, Malay Peninsula, Australia, New Zealand, Mauritius, Philippines, Bourbon ; (b) throughout India in mountainous regions.

Occur : Occasional, on moist and shaddy moss covered rocks and tree trunks. Darranga, Nalbari dist. 1289 ; Silveta, Karbi-Anglong dist. 2767.

Uses : The dried fern mixed with garlic and onions is sometimes smoked by the South Indian people to cure headache (Manickam & Irudayaraj 1992).

Vandenboschia Copel.
Philip. Journ. Sci. 67. 51. 1938.

Vandenboschia auriculata (Bl.) Copel. Philip. Journ.Sci. 67. 55. 1938 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 45. 1982. *Trichomanes auriculatum* Bl. Enum. Pl. Jav. 225. 1828 ; Clarke, Trans. Linn. Soc. Lond. II . Bot. 1. 441. 1880 ; Bedd. Handb. Ferns Brit. India, 44. 1883. *T. dissectum* J. Sm. ex Hook. Sp. Fil. 1. 140. 1844 ; Bedd. Ferns Brit. India, t. 182. 1866.

Rhizome long creeping, *ca* 1.5 mm thick, slender, wiry, apex covered by hairs. Stipes *ca* 0.2 - 1 cm, adaxially grooved, densely hairy. Lamina *ca*10 - 25 x 2.5 - 5 cm, simple pinnate to bipinnate or rarely tripinnatifid ; pinnae numerous, *ca* 10 x 3 cm, alternate or subopposite, shortly stalked or sessile, ovate-rhomboildal, apex clefted, obliquely cuneate at the base, margin irregularly cut down nearly half or more to the costae into segments or pinnules ; pinnules *ca* 2 x 1 cm, sessile, obovate, margin lobed, lobes *ca* 0.3 cm wide, oblong, margin entire ; basal pinnae sterile ; fertile pinnae towards the apex, fertile pinnules reduced to a single vein appearing a serrated pinna ; rachis winged, grooved, hairy ; texture subcoriaceous. Sori arranged on slender receptacle, 2 - 12 to a pinna, receptacle slightly curved, protruding outward upto a length of 5 mm ; indusia scarcely wider than the length, narrowed and winged at base, mouth truncate (Pl. 113).

Fertile : Dec. - Jan.

Distrib : (a) Japan, Taiwan, Philippines, Java, Guiana ; (b) Himalayas, Meghalaya.

Occur : Rare ; on moist, shady, moss covered rocks in dense forest. Mahur, North Cachar Hills dist. 1598.

Order : **DICKSONIALES**
Suborder : **DICKSONIINEAE**

DICKSONIACEAE Hook. ex Bower

Cibotium Kaulf.
Berlin Jahrb. Pharm. 21. 53. 1820.

Out of the two species of *Cibotium* listed for India by Dixit (1984) only one species has been recorded in the present investigation.

Cibotium barometz (L.) J. Sm. Lond. Journ. Bot. 1. 437. 1842 ; Bedd. Handb. Ferns Brit. India, 24. t. 13. 1883 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 48. 1982. *Polypodium barometz* L. Sp. Pl. 2. 1092. 1753. *C. glaucum* Bedd. Ferns Brit . India, t. 83. 1966. *Dicksonia baromtetz* Hook. et Bak. Syn. Fil. 49. 1867 ; Clarke, Trans . Linn. Soc. Lond . II. Bot. 1. 435. 1880 .

Arborescent fern. Rhizome short creeping or erect, stout, densely covered with hairs. Stipes *ca* 25 - 100 x 0.5 - 1.5 cm, basal portion scaly, upper portion hairy, greenish or brownish ; scales *ca* 1.5 cm long, narrowly linear, shining, brown ; lamina *ca* 1 - 2.5 m long, tripinnatifid, covered by whitish powdery substance on the dorsal and ventral side ; lower pinnae *ca* 30 - 60 x 15 - 30 cm, ovate-lanceolate, acuminate at apex, stalked ; pinnules *ca* 10 - 13 x 1 - 2 cm, numerous, subopposite, shortly stalked, lanceolate, apex acuminate, margin deeply lobed nearly to costae, lobes *ca* 0.8 x 0.4 cm, numerous, linear-oblong, apex acute, subfalcate ; rachis covered with small, flaccid hairs ; veins free ; fertile veins simple ; sterile veins forked ; texture subcoriaceous ; lamina glabrous on upper surface, shining ; lower surface glaucous. Sori globose, 2 - 12 to a lobe, terminal on the veins, covered by 2 indusial lobes, outer lobe larger, lobes coriaceous, concave ; sporangia gradate, annulus complete. Spores ridged (Pl. 114).

Fertile : July - Nov.

Distrib : (a) Myanmar, Malay Islands, China, Australia, Malaysia ; (b) Eastern India.

Occur : Common in certain localities on forest cleared areas. Haflong, N.C. Hills dist. 1575.

Uses : Rhizome used as tonic and given for lumbago in China and used as vermifuge ; stems are used as tonic and styptic (Dixit & Vohra 1984 ; Ambasta *et al* 1986 ; Asolkar 1992).

Suborder : **CYATHEINEAE**

CYATHEACEAE Kaulf.

Cyathea Sm.
Mém. Acad. Sci. Turin 5. 416. 1793.

Holttum (1964) recognised 191 speceis of *Cyathea* from Malaysia and only 25 species of the genus from the whole of Asia excluding Malaysia (Holttum 1965). He has divided the genus into many subgenera and sections. Dixit (1984) has listed 11 species of *Cyathea* for India and out of these, five species have been recorded in the present investigation.

Tree ferns, with tall, massive, stout trunk. Stem usually unbranched, with persistent leaf bases ; the trunk and bases of stipes more or less densely covered by scales ; hairs present or absent. Lamina large, bipinnate to tripinnatifid, spirally arranged at the apex of the stem ; veins free, forked once or more ; texture coriaceous. Sori superficial, globose ; indusia either complete, globose, at first covering the sorus, finally splitting into lobes, or vestigial or absent ; sporangia small, shortly stalked, paraphyses present or not, annulus complete, oblique, with definite stomium. Spores tetrahedral, with perispore.

KEY TO SPECIES

1a. Stipes distinctly spinulose ; sori indusiate ---------- ***spinulosa***
1b. Stipes smooth or tuberculate ; sori exindusiate
  2a. Sori not forming inverted 'V' shape ; basal basiscopic vein always form costule ---------- ***khasyana***
  2b. Sori forming inverted 'V' shape
    3a. Lamina densely hairy ; scales ovate-lanceolate ---------- ***andersonii***
    3b. Lamina glabrous or sparsely hairy ; scales linear-lanceolate
      4a. Basal basiscopic vein arising from costae and costules ; basal pair of pinnules reduced ---------- ***henryi***
      4b. Basal basiscopic vein arising from costae ; basal pair of pinnules not reduced ---------- ***gigantea***

Cyathea andersonii (Scott ex Bedd.) Copel. Journ. Sci. ser. C. (Bot.) 4. 56. 1909 ; Jamir & Rao, Ferns Nagaland, 196. 1988. *Alsophila andersonii* Scott ex Bedd. Ferns Brit. India, t. 310. 1866; Clarke, Trans Linn. Soc. Lond. II. Bot. 1. 453. 1880 ; Bedd. Handb. Ferns Brit. India, 12. 1883.

Trunk massive, erect, *ca* 4 - 5 m tall. Stipes muricate and rough, black to dark-brown, clothed with scales ; scales *ca* 2 x 0.5 cm, ovate-lanceolate, subulate, deciduous, hair-tipped. Lamina *ca* 2.5 m long, ovate-lanceolate, pilose, bipinnate ; primary pinnae *ca* 60 x 25 cm, oblong-lanceolate, apex acuminate ; secondary pinnae 20 - 25 pairs, alternate or subopposite, *ca* 15 x 2.5 cm, linear- oblong, apex acuminate, base cordate to deltoid, lobed nearly to the costae, lobes oblong, slightly falcate, apex obtuse or rounded, finely serrate or crenate ; texture herbaceous-membranaceous ; rachis dark-brown, tawny villous below, scabrous above ; costae, costules, veins clothed with long, whitish hairs beneath, sparsely above ; veins 10 - 12 pairs in each lobe, simple or forked once. Sori globose, closer to margin, mixed with long paraphyses, exindusiate (Pl. 115).

Fertile : Oct. - Jan.

Distrib : (a) Bhutan, China ; (b) Meghalaya, Nagaland, Darjeeling and Sikkim.

Occur : Frequent, on slopes of hills in moist, dense forest. Bhalukpung, Sonitpur dist. 874.

Cyathea gigantea (Wall. ex Hook.) Holtt. Gard. Bull. Str. Settl. 8. 318. 1935 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 50. 1982 ; Jamir & Rao, Ferns Nagaland, 199.1988; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 162. t. 126. 1992. *Alsophila gigantea* Wall ex Hook. Sp. Fil. 1. 53. 1844. *A. glabra sensu* Bedd. Ferns South. India, t. 60. 1864 ; Handb. Ferns Brit. India, 14. 1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 432. 1880.

Trunk massive, erect, *ca* 2 - 4 m tall, bearing crown of fronds at the apex, densely covered by scales ; scales *ca* 1.5 x 0.2 cm, mixture of narrow, oblong and linear-lanceolate, dark-brown, apex acuminate, margin toothed. Stipes *ca* 75 x 2 cm, tufted, glossy, scaly at base, glabrous above, abaxially rounded, adaxially grooved, dark-purple. Lamina bipinnate, *ca* 150 - 200 x 103 cm, deltoid, dark- green when fresh, brownish when dry ; primary pinnate upto 12 pairs, *ca* 50 - 80 x 20 - 30 cm, oblong-lanceolate, alternate, shortly stalked, about 20 cm apart, acuminate at apex, base truncate ; secondary pinnae up to 20 pairs, *ca* 10 x 1.5 cm, oblong-lanceolate, alternate, shortly stalked, about 2 cm apart, apex acuminate, base subtruncate or truncate, margin lobed half way to the costae, lobes oblong or broadly deltoid, *ca* 0.3 x 0.4 cm, rounded apex, margin crenate ; texture of lamina herbaceous ; rachis slightly dark-brown, shining, glabrous or subglabrous, a few adpressed hairy above ; costae and costules well distinct ; vein of adjacent lobes reaching the side of sinus independently. Sori median on the veins, spherical, 1 mm in diameter, forming an inverted 'V' shape, exindusiate ; sporangia numerous, compact (Pl. 116).

Fertile : Dec. - Feb.

Distrib : (a) Nepal, China, Myanmar, Thailand, Laos, Vietnam, Sri Lanka, Bangladesh ; (b) throughout India in hilly regions.

Occur : Frequent on hill slopes. Garampani forest, Golaghat dist. 1655 ; Bhairabkunda R.F., Darrang dist. 1533.

Uses : Aerial parts antiinflammatory (Asolkar *et al* 1992) ; stem edible (Jain 1991).

Cyathea henryi (Bak.) Copel. Philip. Journ. Sci. ser. C. (Bot.) 4. 38. 1909 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 50. 1982 ; Jamir & Rao, Ferns Nagaland, 199. 1988. *Alsophila henryi* Bak. Kew Bull. 229. 1898.

Trunk massive, erect, *ca* 3 m or more tall. Stipes dark-purple, scaly at base ; scales *ca* 2 x 0.2 cm,

linear-lanceolate, hair-tipped, dark-brown ; stipes *ca* 50 - 75 x 2 cm, abaxially rounded, adaxially grooved. Lamina *ca* 150 - 200 x 90 - 100 cm, bipinnate, ovate-lanceolate, primary pinnae *ca* 50 x 20 cm, lanceolate, apex acute or acuminate, base truncate, green ; secondary pinnae *ca* 11 - 15 x 2.3 - 2.7 cm, alternate or opposite, shortly stalked, ovate-lanceolate, apex acute or acuminate, base truncate, lobed nearly to the costae, lobes oblong or broadly deltoid, apex rounded, margin of lobes serrate, secondary rachis setose beneath ; rachis dark-purple, glabrous ; texture of lamina subcoriaceous ; costae setose beneath, scaly above ; scales calthrate, terminating into dark setae, abundant ; basal pair of pinnae reduced ; veins 8 - 10 pairs, simple, basiscopic basal vein arising from costae and costules. Sori oblique to the costule, globose, forming an inverted 'V' shape, exindusiate ; sporangia small, shortly stalked, with paraphyses (Pl. 117).

Fertile : Oct. - Feb.

Distrib : (a) China ; (b) Sikkim, Meghalaya, Nagaland.

Occur : Rare ; gegarious in shady forest. Jalukbari, Kamrup dist. 559 ; Jorabat, Kamrup dist. 746.

Cyathea khasyana (Moore ex Kuhn) Domin, Acta Bot. Bohem. 362. 1930 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 51. 1982 ; Jamir & Rao, Ferns Nagaland, 200. 1988. *Alsophila khasyana* Moore ex Kuhn, Linnaea, 36. 154. 1869. *A. ornata* Scott ex Bedd. Ferns Brit. India, t. 342. 1870 ; Handb. Ferns Brit. India, 12. 1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 432. 1880. *A. oldhami* Bedd. Ferns Brit. India, t. 343. 1866 ; Handb. Ferns Brit. India, 13. 1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot.1. 433. 1880.

Trunk massive, *ca* 4.5 m tall. Stipes *ca* 1 - 1.5 cm thick, scaly at base, dark-purple ; scales *ca* 2 x 0.2 cm, linear-lanceolate, apex hair-tipped, broadly ovate at base, dark-brown, shining. Lamina *ca* 3 m long, bipinnate, primary pinnae *ca* 60 x 18 cm, oblong, apex acuminate ; secondary pinnae upto 20 pairs, alternate or subopposite, sessile or shortly stalked, basal pair shortened ; largest one *ca* 8 - 12 x 1.5 - 2 cm, linear-oblong, apex acuminate, base truncate, margin cut down 2/3 way to the costa, lobes *ca* 0.5 cm wide, slightly oblique, linear-oblong, blunt-toothed ; veins 5 - 9 pairs, basal basiscopic vein always from costules, simple or forked once ; primary rachis scaly at base, dark-brown, secondary rachis sparsely scaly, brown ; costae and costules setose beneath, scaly towards base ; texture herbaceous ; lamina pale-green. Sori globose, in two rows below the middle of veinlets, exindusiate ; sporangia dark-brown, stalked. Spores light-brown (Pl. 118).

Fertile : Oct. - Dec.

Distrib : (a) Myanmar ; (b) Eastern India, Eastern Himalayas.

Occur : Rare ; in moist and shady forest in hilly areas. Jorabat, Kamrup dist. 739.

Cyathea spinulosa Wall. ex Hook. Sp. Fil. 1. 25. t. 12. 1844 ; Bedd. Ferns South. India, t. 57. 1864 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 430. 1880 ; Bedd. Handb. Ferns Brit. India, 6. 1883 ; Suppl. 2. 1892 ; Dhir, Ferns N.W. Himalayas, 61. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 51. 1982 ; Jamir & Rao, Ferns Nagaland, 202. 1988. *Alsophila decipiens* Scott ex Bedd. Ferns Brit. India, t. 311. 1866. *Hemitelia decipiens* (Scott) Scott, Trans. Linn. Soc. 30. 33. t. 14. 1874 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 430. 1880. *Amphicosmia decipiens* (Scott) Bedd. Ferns Brit. India, Suppl. 1. 1876 ; Handb. Ferns Brit. India, 10. 1883 ; Suppl. 2. 1892. *Hemitelia beddomei* Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 429. 1880.

Trunk arborescent, erect, massive, upto 3 m or more tall. Stipes and rachis strongly aculeate or spiny, scaly at base, dark-purple ; scales linear-lanceolate, long hair-pointed, coriaceous, black.

Lamina bipinnate, *ca* 2 - 2.5 m long ; primary pinnae *ca* 60 x 25 cm, oblong-lanceolate, short stalked ; secondary pinnae upto 25 pairs or more, shortly stalked or sessile, alternate, lowest pair reduced, largest pinnae *ca* 15 x 3 cm, linear-oblong, apex acuminate, base truncate or subtruncate ; margin deeply cut down almost quite near to the costa into lobes ; lobes *ca* 1.5 x 0.5 cm, oblique, apex round or obtuse, margin crenate or serrate ; rachis of pinnules and main veins of lobes scaly below, but the latter glabrous above ; lamina coriaceous ; veins usually forked once, free. Sori large, round, copious near the costules or main veins, indusium completely covering the sorus when young, soon breaking irregularly. Spores irregular in shape ; pale-brown, hyaline (Pl. 119 ; Ph. 10).

Fertile : Oct. - Dec.

Distrib : (a) Nepal, Bhutan, China, Myanmar, Thailand, Taiwan and Japan ; (b) throughout India in hilly regions.

Occur : Common in moist shady forest near foothills. Harmati, Lakhimpur dist. 945 ; Rowta forest, Darrang dist. 1358.

Uses : Leaves are used medicinally for sores and wounds ; pith of the stem edible (Jain 1991).

Order : **DENNSTAEDTIALES**
Suborder : **DENNSTAEDTIINEAE**

DENNSTAEDTIACEAE Pic. Ser.

Terrestrials. Rhizome creeping, slender, hairy, scales absent. Stipes stout, erect, adaxially grooved, hairy or scabrous, not articulate to rhizome. Lamina variously pinnate, much dissected ; veins free, forked. Sori marginal, on the vein tips ; indusia half cup-shaped or 2 - lipped, lower lip sometimes lacking ; sporangia with slender, elongated stalks ; paraphyses usually absent ; annulus oblique or rarely vertical. Spores tetrahedral or rarely bilateral, exine granulose or verrucose.

KEY TO GENERA

1a. Sori marginal ; indusia attached to half of the length of sides, half open ---------- --- --- --- ***Dennstaedtia***

1b. Sori intramarginal ; indusia attached by base and sides, opening outwards -- --- ***Microlepia***

Dennstaedtia Bernh.
Schrad. Journ. Bot. 1880 (2). 124. t.1(3). 1801

The single species listed by Dixit (1984 ; Dixit & Vohra 1984) for India has been recorded in the present study.

Dennstaedtia scabra (Wall. ex Hook.) Moore, Ind. Fil. 307. 1961 ; Bedd. Handb. Ferns Brit. India, 24. t. 12. 1883 ; Dhir, Ferns N.W. Himalayas, 52. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 88. 1982 ; Jamir & Rao, Ferns Nagaland, 205. 1988. *Dicksonia scabra* Wall. ex. Hook. Sp. Fil. 1, 80. t. 28B. 1844 ; Clarke, Trans . Linn. Soc. Lond. II. Bit. 1, 436. 1880. *Dennstaedtia deltoidea* Bedd. Ferns South. India, t. 258. 1864.

Rhizome long creeping, *ca* 0.8 cm thick, stout, covered with hairs. Stipes *ca* 15 - 45 x 0.2 - 0.5 cm, scabrous, redish-brown. Lamina *ca* 20 - 50 x 10 - 20 cm, tripinnate, deltoid to ovate ; pinnae numerous, alternate, basal pinnae large, *ca* 15 - 20 x 4 - 7 cm, distant on rachis, lanceolate, apex acute ; largest pinnules *ca* 7 x 3 cm, slightly oblique, deltoid-lanceolate, apex acute, margin deeply cut down almost to the costules into lobes ; lobes *ca* 1 x 0.5 cm, oblong-deltoid, apex obtuse, decurrent at base, margin

crenate ; rachis scabrous ; veins free, forked ; texture herbaceous ; ventral surface of lamina covered with shining hairs. Sori 2-8 in each lower segments, marginal ; indusia cup-shaped, subglobose, outer lip attached half the length by its side, half open outwards, lower lip rudimentary. Spores pale-brown, exine smooth (Pl. 120).

Fertile : July - Dec.

Distrib : (a) Sri Lanka, Myanmar, Indo-China, China, Korea, Taiwan, Japan, Philippines, Malay Peninsula, Borneo, Celebes ; (b) Punjab to Assam.

Occur : Common, on shady roadsides slopes of forest. Diphu, Karbi-Anglong dist. 1326.

Microlepia Presl
Tent. Pterid. 124. t.4(21-23). 1836.

Of the 12 species of *Microlepia* listed by Dixit (1984) for India four species have been recorded in the present investigation. In addition to these, two more species *M. hookeriana* and *M. puberula* have also been recorded.

Terrestrials. Rhizome creeping, densely covered by ferruginous hairs. Stipes erect, stout, glabrous or hairy. Lamina bipinnate to tripinnate, ovate-deltoid, ultimate leaflets always unequal at base, usually crenate or lobed, glabrous or hairy ; veins free, forked ; texture herbaceous to papyraceous. Sori submarginal, terminal on veins ; indusia membranous, cup-shaped, attached by base and sides, apex truncate, hairy. Spores tetrahedral, exine smooth or little sculptured.

KEY TO SPECIES

1a. Posterior side of the pinna base auricled ; lamina simple pinnate --- --- --- ***hookeriana***
1b. Posterior side of the pinna base not auricled ; lamina bipinnate to tripinnate
2a. Lamina bipinnate-tripinnatifid ---------- --- --- ***pilosula***
2b. Lamina tripinnate-quadripinnatifid
3a. Indusia margin lobed and hairy
4a. Lamina densely hairy on both surfaces ; sori submarginal --- --- --- ***speluncae***
4b. Lamina densely hairy below, sparsely or glabrous above ; sori marginal ---------- --- --- ***puberula***
3b. Indusia margin entire and naked
5a. Lamina tripinnate ; stipes dark-brown ---------- --- --- --- ***todayensis***
5b. Lamina quadripinnatifid ; stipes yellowish green ---------- --- ***haflongensis***

Microlepia haflongensis Nayar *et* Kaur, Bull. Nation. Bot. Gard. Lucknow, 94. 8. f. 2 - 3.1964 ; Dixit, Cens. Ind. Pterid. 96. 1984.

Rhizome creeping, branched, *ca* 1.5 cm thick, sparsely hairy ; hairs acicular, stiff, dark-brown. Stipes *ca* 50 - 100 x 1 cm, erect, cylindrical, adaxially grooved, glabrous,yellowish green. Lamina *ca* 60 - 125 x 40 - 50 cm, tripinnate-quadripinnatifid, broadly ovate-lenceolate, apex acuminate ; primary pinnae numerous, loosly placed, alternate or subopposite, largest primary pinnae *ca* 30 - 35 x 12 - 14 cm, deltoid-lanceolate, apex gradually acuminate ; secondary pinnae up to 20 or more pairs, alternate or subopposite, *ca* 6 - 8 x 2- 2.5 cm, lanceolate, acuminate, serrate apex, basal basiscopic secondary pinnae of each primary pinna larger than the others ; tertiary pinnae upto 10 pairs, alternate, *ca* 1 x 0.3 - 0.5 cm, sessile, ovate-oblong, apex blunt, acroscopic side broader than the basiscopic one, the basal acroscopic tertiary pinnae larger than the others, margin lobed ; the ultimate lobes *ca* 2 - 4 x 1 - 3 mm, rhomboidal, margin crenate ; veins free, simple or forked, reaching the margin ; rachises, costae, veins bear stiff acicular hairs ; texture

herbaceous ; lamina green. Sori small, submarginal, near the base of the sinuses of the tertiary pinnae on the acroscopic basal veinlets of the lobes ; indusia halfcup-shaped, broader, hairy, margin entire, naked (Pl. 121).

Fertile : Sept. - Dec.

Distrib : Assam.

Occur : Rare ; in deeply shaded forest beds. Jatinga, North Cachar Hills dist. 1586.

Note : Although Dixit (1984) shown the distribution as Eastern India, yet no record of occurance of this species in other parts of Eastern India is available.

Microlepia hookeriana (Wall. ex Hook.) Presl. Epim. Bot. 95. 1849 ; Bedd. Ferns Brit. India, t. 101. 1866 ; Handb. Ferns Brit. India, 62. t. 32. 1883 ; Jamir & Rao, Ferns Nagaland, 209. 1988. *Davallia hookeriana* Wall. ex Hook. Sp. Fil. 1. 172. 1846.

Rhizome creeping, stout, *ca* 1 cm thick, densely hairy ; hairs pale-brown. Stipes *ca* 20 - 35 x 0.5 - 0.8 cm, erect, densely hairy at base, glabrous or sparsely hairy above, dark-brown. Lamina *ca* 35 - 50 x 15 - 20 cm, simple pinnate, lanceolate, with a simple, elongate, *ca* 10 cm long apical pinna ; lateral pinnae upto 28 pairs, alternate or subopposite, subsessile ; basal pinnae gradually shortened ; lowest one *ca* 4 x 1 cm ; largest pinnae *ca* 10 x 1.5 cm. lanceolate, apex acuminate, base broad-hastate, margin crenate ; veins parallel, free, forked dichotomously ; rachis pale-brown, pubescent ; costae and veins sparsely hairy beneath ; texture submembranous ; lamina green. Sori approximate, forming a continued line at the base of the crenatures of the margin ; indusia halfcup-shaped ; sporangia stalked. Spores globose, pale-brown (Pl. 122).

Fertile : Sept. - Nov.

Distrib : (a) Bangladesh, Hongkong ; (b) Northeast India.

Occur : Not common, in moist shady forest as well as on rock crevices. Upper Dihing,Tinsukia dist. 667.

Microlepia pilosula (Wall.) Presl, Tent. Pterid. 125.1836 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 91. 1982 ; Jamir & Rao, Ferns Nagaland, 211. 1988. *Davallia pilosula* Wall. Cat. No. 263. 1828 (*nom. nud*). *D. polypodioides* var. *pilosula* Clarke, Trans. Linn. Soc. Lond. II . Bot. 1. 448. 1880.

Rhizome semierect, short, *ca* 0.5 cm, thick stout, apex covered by hairs ; hairs small, pale-brown. Stipes *ca* 25 - 40 x 0.3 cm, abaxially rounded, adaxially grooved, densely wooly tomentose, dark-brown at base, pale-brown above. Lamina *ca* 30 - 60 x 20 - 30 cm, tripinnatifid, deltoid, apex acuminate ; lateral pinnae upto 15 pairs, alternate, shortly stalked ; largest pinnae *ca* 15 x 5 cm, oblong, apex short acuminate or acute ; pinnules *ca* 3 x 1.5 cm, sessile, alternate, oblique, delto-lanceolate, apex rounded or subacute, margin deeply cut down to midrib at base, pinnatifid at apex ; lobes *ca* 0.7 x 0.3 cm, oblong, apex rounded, entire or slightly crenate ; veins free, forked ; rachis, costae, costules and veins covered with hairs on both surfaces ; texture coriaceous ; lamina pale-green. Sori superficial on veinlets, 1-2 sori on each acroscopic submargin of the lobes ; indusia halfcup-shaped, surface sparsely hairy, margin undulating ; sporangia oval, slender stalked. Spores elliptical to triangular, hyaline, light yellow, exine smooth (Pl. 123).

Fertile : Oct. - Dec.

Distrib : (a) Tropics of Asia ; (b) Northeast India.

Occur : Common, in shady and open forest. Gahpur, Sonitpur dist. 1735.

Microlepia puberula v.A.v.R. Bull. Jard. Bot. Buit. 2. 11. 17. 1913 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 92. 1982 ; Jamir & Rao, Ferns Nagaland, 212. 1988. *Davallia flaccida* R. Br. Fl. N. Holl. 157. 1810 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 448. 1880 (*pro parte*).

Rhizome creeping, stout, densely covered by hairs ; hairs dark-brown, shining. Stipes *ca* 40 - 75 x 0.4 - 0.7 cm, stout, finely rugose. Lamina *ca* 40 - 100 x 20 - 40 cm, tripinnate at base, tripinnatifid towards the apex, broadly lanceolate, apex acuminate ; pinnae numerous, alternate, shortly petiolate, lowest pinnae reduced ; largest pinna *ca* 25 x 10 cm, deltoid-lanceolate, apex acuminate, pinnules *ca* 9 x 3 cm, shortly stalked, lanceolate, apex acuminate or blunt, base unequal, deeply lobed ; lobes *ca* 2 x 1 cm, oblique to the costules, basal one of the acroscopic side larger than the others, elliptic or oblong, apex rounded, margin crenate or lobed on acroscopic side ; veins free, forked ; rachis, costae and veins puberulous throughout ; texture herbaceous, thin ; lamina dark-green ; lower surface densely covered by short hairs, upper surface sparsely hairy. Sori superficial, marginal, on the tip of veinlets, single in each lobe on acroscopic edge ; indusia elliptical, margin lobed, densely hairy ; sporangia oval, peltate paraphyeses, hairy. Spores triangular, yellow, exine smooth (Pl. 124).

Fertile : Oct. - Dec.

Distrib : (a) Malay ; (b) Northeast India.

Occur : Common, along moist and shady places. Basistha, Kamrup dist. 539.

Microlepia speluncae (L.) Moore, Ind. Fil. 93. 1857 ; Bedd. Handb. Ferns Brit. India, 67. 1883 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 92. 1982 : Jamir & Rao, Ferns Nagaland, 213. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 119. t. 93, 94. 1992. *Polypodium speluncae* L. Sp. Pl. 2. 1093. 1753.

Rhizome long creeping, stout, *ca* 2 cm thick, hairy ; hairs *ca* 3 mm long, pale-brown. Stipes *ca* 35 - 75 x 0.4 - 1 cm, rounded below, grooved above, short hairy, purplish green. Lamina *ca* 50 - 90 x 30 - 45 cm, tripinnate or quadripinnate, deltoid-ovate ; pinnae about eight pairs, alternate, petiolate ; largest pinna *ca* 15 - 50 x 6 - 20 cm, ovate-lanceolate, apex acuminate, acroscopic base truncate, basiscopic base cuneate ; largest pinnule *ca* 7 x 2.5 cm, narrowly deltoid, subopposite or alternate, shortly stalked, basal acroscopic leaflet much larger than the rest ; ultimate pinnules *ca* 1 x 0.6 cm, sessile, alternate, apex subacute, acroscopic base truncate, basiscopic base cuneate, margin lobed up to the costule, basal acroscopic lobe largest one, margin subentire or crenate ; texture thin, soft ; costae and costules hairy ; veins slightly distinct, forked once, free, not reaching the margin. Sori submarginal, near the base of the sinuses between the lobes, *ca* 1.5 mm wide, indusia cup-shaped, hairy ; sporangia copious. Spores yellowish-brown, exine smooth (Pl. 125 ; Ph. 22).

Fertile : Oct. - Nov.

Distrib : (a) Bangladesh, Sri Lanka, Malay Peninsula, Polynesia, Tropical America ; (b) Himalayas, South India, Meghalaya, Nagaland.

Occur : Frequent in moist, shady places. Palashbari, Kamrup dist. 562 ; Deomarnai, Darrang dist. 1013.

Uses : Fornds are used medicinally to treat fever (Jain 1991).

Note : This species varies greatly in cutting of pinnae and in pubescence. Although Sledge (1957) has divided the species into three varieties viz., var. *speluncae*, *pubera* (Cl.) Sledge and var. *pubescens* (Cl.) Sledge on the basis of nature of surface of lamina, yet he himself admited that these three varients are somewhat arbitary (*cf.* Manickam &

Irudayaraj 1992). Dixit (1984) did not mention any variety for this species. Manickam (1986) and Manickam & Irudayaraj (1992), however, recognised the above varieties and all the varieties were recorded from Pilni hills and Western Ghats by them. The gathering of the present investigation also confirmed the polymorphic nature of this species but these varients have not been considered for providing varietal status.

Microlepia todayensis Christ, Philip. Journ. Sci. 3. 272. 1908 ; Dixit. Cens. Ind. Pterid. 97. 1984.

Rhizome creeping, *ca* 1 cm thick, profusely branched, hairy. Stipes scattered, *ca* 30 - 60 x 0.5 - 0.8 cm, abaxially rounded, adaxially grooved, glabrous, dark-brown. Lamina *ca* 90 - 120 x 35 - 50 cm, oblong-lanceolate, tripinnate, apex acuminate ; primary pinnae numerous, stalked, alternate, loosely placed ; largest one *ca* 25 - 40 x 5 - 10 cm, oblong-lanceolate, apex acuminate ; secondary pinnae numerous, shortly stalked or sessile, alternate, upto 1 cm apart, basal secondary pinnae on the acroscopic side larger than the basiscopic side ; largest one *ca* 4 - 8 x 2 cm, lanceolate or oblong-lanceolate, apex blunt or acute ; tertiary pinnae upto 12 pairs, sessile or adnate, alternate, acroscopic tertiary pinnae at the base are larger than the basiscopic ones ; largest tertiary pinnae *ca* 1 - 1.5 x 0.5 - 0.7 cm, rhomoidal, apex blunt, margin crenate or nearly entire ; veins free, forked once or twice ; rachis, costae and costules densely hairy above, sparsely below ; veins sparsely hairy above and below ; texture herbaceous, lamina light-green. Sori small, submarginal, below the marginal sinuses, generally on the acroscopic margin of the lobes, but on both the margins of large tertiary pinnae ; indusia half cup-shaped, entire, hairy. Spores triaspidate ; exine thin (Pl. 126).

Fertile : Oct. - Jan.

Distrib : (a) Minadano ; (b) Himalayas.

Occur : Rare ; on open places of scrub jungles. Kumarikata, Nalbari dist. 1291.

HYPOLEPIDACEAE Pic. Ser.

Hypolepis Bernh.
Schrad. Neu. Journ. Bot.1 (2). 34. 1805.

The genus is represented by lone species *Hypolepis punctata* (Thunb.) Mett. ex Kuhn in India (Dixit 1984 ; Dixit & Vohra 1984).

Hypolepis punctata (Thunb.) Mett. ex Kuhn, Fil. Afr. 120. 1868 (*non* Bedd.1892) ; Bedd. Handb. Ferns Brit. India Suppl. 19. 1892 ; Dhir, Ferns N.W. Himalayas, 55. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 89. 1982 ; Jamir & Rao, Ferns Nagaland, 221. 1988. *Polypodium punctata* Thunb. Fl. Jap. 337. 1784. *Hypolepis glanduligera* Brown. et Chinn. J. Adaide Bot. Gard. 10 (1). 16. t. 2, 8. 1987 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 113. t. 88. 1992.

Rhizome long creeping, *ca* 1 cm thick, slender, subterranean, densely hairy ; hairs long, septate, dark-brown. Stipes *ca* 20 - 75 x 1 cm, abaxially rounded, grooved adaxially, densely short hairy, pale-brown. Lamina *ca* 25 - 80 x 100 cm, deltoid, abruptly narrowed towards acuminate apex, subtruncate at base, quadripinnate towards base, bipinnate at apex ; lower primary pinnae subopposite, upper ones alternate, pinnae upto 8 pairs, spreading, largest primary pinna *ca* 15 - 50 x 30 cm, deltoid, acuminate, subtruncate ; secondary pinnae upto 15 pairs, subopposite, shortly stalked, *ca* 22 x 6 cm, narrowly deltoid, acuminate, truncate ; tertiary pinnae upto 20 pairs, alternate, subsessile, *ca* 4 x 1 cm, oblong-lanceolate, acute, truncate, pinnules upto 8 pairs, subopposite, 0.5 - 1 x 0.3 cm, oblong, margin crenate or lobed, apex obtuse or rounded, base winged ; rachis similar to stipe ; costae, costules, veins densely covered by hairs ; veins slightly distinct below, forked once, free, reaching the

margin ; texture herbaceous ; lamina pale-green, almost glabrous. Sori subterminal on the acroscopic veinlets of lobes, round, indusia consisting of a small reflexed marginal flap. Spores elliptic to bean-shaped, hyaline, yellowish green, exine smooth or tubercullate (Pl. 127).

Fertile : Aug. - Nov.

Distrib : (a) Sri Lanka, Japan, Malay Peninsula ; (b) throughout India.

Occur : Common, in open dry places along roadsides and on forest edges. Tezpur, Sonitpur dist. 1046 ; Haflong, North Cachar Hills dist. 1582.

Uses : The frouds are used for poulticing boils in Malaysia (Ambasta 1986 ; Manickam & Irudayaraj 1992).

PTERIDIACEAE Ching

Pteridium Gled. ex Scop.
Fl. Carn. 169. 1760. *nom. cons.*

Dixit (1984) has listed two species and two varieties of *Pteridium* for India. The most common species *P. aquilinum* (L.) Kuhn has been recorded in the present study.

Pteridium aquilinum (L.) Kuhn v. Deck. Reis. 3 (3). 11. 1879 ; Dhir, Ferns N. W. Himalayas, 54. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 107. 1982 ; Jamir & Rao, Ferns Nagaland, 223. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 109. t. 86. 1992. *Pteris aquilina* L. Sp. Pl. 1075. 1753 ; Bedd. Handb. Ferns Brit. India. Suppl. 115. 1892.

Barcken, Brake (Eng.)

Rhizome wide creeping, subterranean, *ca* 1 - 2 cm thick, densely clothed with hairs ; hairs *ca* 5 mm long, fine, multicellular, deciduous, pale-brown ; scales absent. Stipes *ca* 20 - 65 x 1 cm, hairy at the base, glabrous above, solid, stout, dark-brown to black. Lamina *ca* 60 - 140 x 90 cm, deltoid-ovate, acute, broadly cuneate, bipinnate or tripinnate, herbaceous or subcoriaceous, glabrous or sparsely hairy ; lower primary pinnae large, opposite or subopposite, with *ca* 5 cm long petiole ; upper primary pinnae smaller, alternate ; largest primary *ca* 20 - 60 x 10 - 30 cm, ovate-lanceolate, apex acuminate, base truncate ; secondary pinnae subopposite at base, alternate above, *ca* 30 x 6 cm, shortly stalked, oblong-lanceolate, acuminate apex, base truncate ; pinnules *ca* 3.5 x 1 cm, sessile, acute or acuminate, truncate or subtruncate, margin lobed 1 - 2 mm to costule, lobes *ca* 5 x 3 mm, deltoid, oblique, acute, entire ; rachis hairy, but almost glabrous beneath ; costae and costules grooved above ; costules, veins, veinlets slightly raised below ; costae, costules and veins hairy beneath ; veins forked, free. Sori linear submarginal ; indusia inconspicuous ; sporangia slender stalked. Spores tetrahedral, pale-brown (Pl. 128).

Fertile : July - Nov.

Distrib : (a) China, Japan, Sri Lanka, Taiwan, North America, Philippines, Nepal ; (b) N. W. Himalayaaa, Meghalaya, Nagaland, South India.

Occur : Not common ; growing in slopes of open areas and along roadsides. Hahim, Kamrup dist. 1492.

Uses : Rhizomes are eaten roasted or boiled or made into flour, mixed with malt, the rhizomes are used for brewing a kind of beer ; also employed as feed for stock, especially pigs. Tender fronds are used as vegetable, also employed in soups. Green fronds used as fodder ; dried ones as packing material (Ambasta 1986 ; Manickam & Irudayaraj 1992).

Rhizome is astringent, anthelmintic and is useful in diarrhoea and inflammation of the gastric and intestinal mucous membranes. Decoction of rhizome and fronds is given in chronic disorders of viscera and spleen (Ambasta 1986 ; Jain 1991 ; Manickam & Irudayaraj 1992).

Suborder : **LINDSAEINEAE**

LINDSAEACEAE Pic. Ser.

Terrestrials. Rhizome creeping, slender, bearing narrow scales or hairs. Stipes not articulate to rhizome. Lamina simple to variously compound, veins free or anastomosing without included veinlets ; texture herbaceous ; lamina glabrous ; rachis deeply grooved adaxially ; basiscopic margin of the pinnae decurrent on the edges of the rachis. Sori marginal, single or forming coenosori at the end of veinlets ; indusia attached at base ; sporangia stalked having 2 - 3 rows of cells ; annulus 12 - 18 thickened cells, incomplete, vertical. Spores tetrahedral, exine smooth or granulose or spinulose.

KEY TO GENERA

1a. Lamina simple pinnate ; sori numerous or more or less confluent ; indusia marginal ---------- --- --- ***Lindsaea***

1b. Lamaina tripinnate or quadripinnatifid ; sori single at the apices of lobes ; indusia submarginal ---------- --- --- ***Sphenomeris***

Lindsaea Dryand.ex Smith.
Mém. Acad. Sci. Turin. 5. 413. t.9(4). 1793.

Dixit (1984) has listed 21 species and two varieties under *Lindsaea* for India. Of these, three species have been recorded in the present study.

Terrestrials. Rhizome short creeping, slender, clothed with hair like scales. Stipes slender, grooved adaxially. Lamina simple pinnate to bipinnate ; pinnules variously shaped ; veins flabellate or pinnate, free or anastomosing, without distinct rib. Sori marginal on veins, linear, continuous or discontinuous ; connected with two or more veinlets ; indusia marginal, formed by the splitting of marginal lobes into two flaps, delicate, broad, attached along base of the receptacle ; annulus of 9 - 17 thickened cells. Spores tetrahedral, sometimes bilateral, exine smooth or minutely warty.

KEY TO SPECIES

1a. Lamina broadly ovate ; pinnae elongate, about 10 - 15 cm long, not dimidiate ; veins anastomosing ---------- --- --- ***ensifolia***

1b. Lamina oblong-linear ; pinnae small, about 1 - 3 cm long, dimidiate ; veins free.

2a. Upper margin of pinnae entire or 1 - 2 lobed ; basal pinnae not reduced --- ------ ***himalaica***

2b. Upper margin of pinnae 3 - 7 lobed ; few pairs of basal pinnae slightly reduced ---------- -- ---------- ---------- --- --- ***odorata***

Lindsaea ensifolia Sw. Schrad. J. Bot. 1800 (2). 77. 1801 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 452. 1880 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 97. 1982 ; Jamir & Rao, Ferns Nagaland, 229. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 125. t. 98. 1992. *Schizoloma ensifolia* (Sw.) J. Sm. in Hook. Journ. Bot. 3. 414. 1841 ; Bedd. Ferns South. India, t. 25. 1864 ; Handb. Ferns Brit. India, 80. t. 41. 1883.

Rhizome short creeping, *ca* 3 mm thick, branched, densely scaly ; scales *ca* 2 x 0.7 mm, ovate-lanceolate, apex acuminate, margin entire, brown. Stipes *ca* 10 - 30 x 0.1 - 0.2 cm, quadriangular, ridged, stramineous above, glossy and glabrous all over. Lamina *ca* 10 - 25 x 8 - 20 cm, obovate, simple pinnate with a terminal pinna similar to lateral ones or terminal pinna may forked ; lateral

pinnae one to six pairs, alternate or subopposite, *ca* 20 x 2 cm, shortly stalked, ovate or lanceolate, apex acuminate, base cuneate, margin toothed on sterile pinnae ; costa flattened above, rounded below, veins slightly distinct, copiously anastomosing to form a series of narrow areoles ; texture herbaceous ; lamina dark-green, glabrous. Sori linear, continuous along both margins except at the tip ; indusia thin, membranous, pale-brown, glabrous. Spores globose, dark-brown (Pl. 129).

Fertile : Feb. - July.

Distrib : (a) Bangladesh, Myanmar, Sri Lanka, China, Malay Peninsula, Malaysian Islands, New Guinea, Australia, Africa, New Caledonia, Hawaii ; (b) throughout India.

Occur : Common on roadsides in open places. Chandrapur, Kamrup dist. 1605.

Note : This species shows variation in shape of pinnae, which may be ovate-lanceolate or oblong-lanceolate. In addition to simple pinnae lobed pinnae have also been observed.

Lindsaea himalaica Kran. Gard. Bull. Singapore, 26 (1). 43. f. 3. 1972 ; Jamir & Rao, Ferns Nagaland, 229. 1988. *L. cultrata* (Willd.) Sw. var. *assamica* Hook. Sp. Fil. 1. 204. 1846.

Rhizome short creeping, *ca* 3 mm thick, wiry, densely scaly all over ; scales *ca* 0.1 cm long, narrow, linear, apex acuminate, hair tipped, margin entire. Stipes *ca* 2 - 5 x 0.2 cm, tough, scaly at base, glabrous above, dark-brown. Lamina *ca* 8 x 2 cm, simply pinnate, slender, oblong, apex acuminate ; lateral pinnae upto 15 pairs, alternate, lower pinnae shortly stalked, upper pinnae sessile ; largest pinnae *ca* 1.2 x 0.7 cm, linear-lanceolate, base cuneate, apex acute, lower margin entire, upper margin upto 3 shallowly lobed ; veins obscure on both surfaces ; rachis similar to stipe ; texture herbaceous, lamina green but become dark-greenish when dry, glabrous on both surfaces. Sori terminal, one on each lobe ; indusia firm, entire, arranged at the upper margin of lamina, margin toothed, greenish-brown. Spores globose (Pl. 130).

Fertile : Jan. - Mar.

Distrib : Northeast India.

Occur : Rare ; on humous and moss covered rocks along water courses. Rowta forest, Darrang dist. 1354.

Lindsaea odorata Roxb. ex Griff. Calc. Journ. Nat. Hist. 4. 511. 1844 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 125. t. 97. 1992. *Lindsaea cultrata* (Willd.) Sw. Syn. Fil. 119. 1806 ; Bedd. Ferns South. India, 7. t. 23. 1864 ; Handb. Ferns Brit. India, 72. t. 36. 1883 ; Jamir & Rao, Ferns Nagaland, 228. 1988. *Lindsaea lobbiana* Hook. Sp. Fil. 1. 205. t. 62. 1864 ; Bedd. Ferns Brit. India, t. 28. 1866.

Rhizome short creeeping, *ca* 3 mm thick, densely scaly ; scales *ca* 2 x 0.2 mm, hair-like, lanceolate, narrow, dark-brown. Stipes *ca* 20 x 0.2 cm, rounded below, grooved above, glossy, glabrous, pale-brown or nearly black. Lamina *ca* 5 - 30 x 1 - 3.5 cm, simple pinnate, linear-lanceolate ; pinnae about 35 pairs, alternate, few pairs of basal pinnae slightly reduced, pinnae in the apical portion also gradually reduced to acuminate apex ; largest pinnae *ca* 2 x 1 cm, shortly stalked, narrowly triangular, acute at apex, base truncate, lower margin straight, entire, upper margin shallowly lobed into 3 - 7, rounded or truncate segments ; veins obscure, forked once or twice, free ; texture herbaceous ; pinnae pale-green, glabrous. Sori along the margin of each lobe ; indusia firm, entire. Spores globose, kidney shaped, pale-green (Pl. 131).

Fertile : July - Nov.

Distrib : (a) Myanmar, Bangladesh, Sri Lanka, Malay Peninsula, Malaysian Islands, New Guinea, Moluccas, Philippines ; (b) Eastern India and Southern India.

Occur : Common, along partially shaded stream banks as well as on roadsides. Guwahati, Kamrup dist. 1319.

Sphenomeris Maxon

Journ. Wash. Acad. Sci. 3. 144. 1913. *nom. cons.*

The only species *Sphenomeris chinensis* listed under the genus for India (Dixit 1984; Dixit & Vohra 1984) has been recorded in the present study.

Sphenomeris chinensis (L.) Maxon, Journ. Wash. Acad. Sci. 3. 144. 1913 ; Dhir, Ferns N.W. Himalayas, 56. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 97. 1982 ; Jamir & Rao, Ferns Nagaland, 226. 1988. *Trichomanes chinensis* L. Sp. Pl. 2. 1099. 1753. *Davallia chinensis* Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 449. 1880. *D. tenuifolia* Sw. Schrad. Journ. Bot. 1800 (2). 88. 1801 ; Bedd. Ferns South. India, t. 16. 1964. *Stenoloma chinensis* (L.) Bedd. Handb. Ferns Brit. India, 70. t. 34. 1883. *Odontosoria chinensis* (L.) Smith, Bot. Voy. Herald, 430. 1857 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 121. t. 95. 1992.

Rhizome short creeping, *ca* 0.5 cm thick, stout, covered by scales ; scales hair-like, *ca* 0.3 cm long, stiff, dark-brown. Stipes *ca* 50 x 0.4 cm, terete or shallowly grooved above, scaly at base, glabrous above, polished, grey-brown or stramineous. Lamina *ca* 15 - 45 x 6 - 20 cm, tripinnate or quadripinnatifid, distal part bipinnatifid, lanceolate, apex acuminate, base cuneate ; primary pinnae upto 10 pairs, ascending, subopposite or alternate, *ca* 6 cm apart, stalked, largest pinna *ca* 8 - 15 x 5 - 8 cm, ovate-lanceolate, apex acuminate, acroscopic base truncate, basiscopic base cuneate ; secondary pinnae about 8 pairs, alternate, shortly stalked, *ca* 3 - 5 x 1 cm, ovate, apex acute ; tertiary pinnae about 3 pairs, alternate, shortly stalked, *ca* 1 x 0.5 cm, obovate, apex rounded, base cuneate, deeply segmented into 2 - 4 lobes to the rachis ; lobes *ca* 5 x 2 mm, obconical, apex truncate, margin entire ; veins obscure, 2 - 3 in each lobe, forked, free ; texture herbaceous, lamina pale-green but become brownish when dry, glabrous. Sori marginal or submarginal at the end of veins ; indusia attached basally. Spores bilateral, hyaline, brown, exine smooth (Pl. 132).

Fertile : July - Dec.

Distrib : (a) Sri Lanka, Malay Peninsula, China, Japan, Polynesia, East African Islands ; (b) throughout India from the plains to the hilly regions.

Occur : Common in forest cleared areas along roadsides. Khanapara, Guwahati, Kamrup dist. 722 ; Kurua hills, Darrang dist. 817.

Uses : Used internally for chronic enteritis in Mauritius. It is also used to produce red dye. (Foseberg 1942 ; Dixit & Vohra 1984 ; Jain 1991).

Note : This species has been proved as a small species complex with few morphotypes (Kramer 1967, 1971). Morphovarients of this species complex have been grouped under 3 vari eties, viz. *chinensis*, var. *rheophila* Kramer and var. *divaricata* (Christ.) Kramer by Kramer (1971). In India, the first and the last varieties occur (Kramer 1971 ; Dixit 1984). Kramer (1971), however, stated that there are no sharp distinction between var. *chinensis* and var. *divaricata* as intermediates between these two varieties also occur.

The gatherings of the present study also have plants with much variation in size and shape of the ultimate segments of the lamina.

Order : **ASPIDIALES**

Suborder : **THELYPTERIDINEAE**

THELYPTERIDACEAE (Presl) Pic. Ser.

Terrestrials or lithophytes. Rhizome creeping, semierect to erect, scaly ; scales rigid, margin often bearing glandular or setose hairs. Stipes not articulate to rhizome ; rachis and costae more or less covered with setose or glandular hairs, midrib grooved. Lamina variously pinnate ; veins pinnate, veinlets simple or forked, free or variously anastomosing. Sori dorsal, superficial, round to elongate, medial or subapical on veins ; indusia renifrom or vestigial or absent. Sporangia long stalked, usually with glandular hairs and spherical, sessile glands, often with acicular hairs. Spores bilateral, rarely trilete, with perispores.

KEY TO GENERA

1a. Rachis with proliferating vegetative buds and forked unicellular hairs --- --- --- ***Ampelopteris***
1b. Rachis without proliferating vegetative buds and forked hairs
2a. Costae not grooved on dorsal surface ; veins not reaching the margin
3a. Lamia simple pinnate, ovate-lanceolate ; basal pinnae slightly reduced ---------- ***Metathelypteris***
3b. Lamina tripinnate, broadly ovate or deltoid ; basal pinnae not reduced ---------- ***Macrothelypteris***
2b. Costae grooved on dorsal surface ; veins reaching the margin.
4a. Veins free
5a. Few pairs of basal pinnae abruptly reduced to tubercles --- --- ***Pseudocyclosorus***
5b. Basal pinnae not or slightly progressively reduced
6a. Rhizome erect ; spores trilete ---------- ***Trigonospora***
6b. Rhizome creeping ; spores monolete ---------- ***Parathelypteris***
4b. Veins anastomosing
7a. Anastomosed basal veins more than 3 pairs ; pinnae lobed one-fourth way to the costa --- --- ----- ***Pronephrium***
7b. Anastomosed basal veins less than 3 pairs ; pinnae lobed one- third to half way to costa
8a. Lower surface of rachis and costa bears scales ----- --- --- ***Cyclosorus***
8b. Lower surface of rachis and costa without scales
9a. Pinnae with sessile orange glands on the lower surface
10a. Sori and glands confined to the pinna lobes - --- --- ***Amphineuron***
10b. Sori and glands distributed both on lobed and unlobed portion of pinnae ---------- --- ***Sphaerostephanos***
9b. Pinnae without glands on the lower surface
11a. Basal few pairs of pinnae abruptly reduced to small auricles ; pinnae pustular when dry --- --- ***Pneumatopteris***
11b. Basal pinnae progressively reduced or not ; pinnae not pustular when dry ---------- --- ---***Christella***

Ampelopteris Kunze
Bot. Zeit. 6. 114. 1848

The only species of *Amelopteris* listed for India. viz. *A. prolifera* by Dixit (1984 ; Dixit & Vohra 1984) has been recorded in the present study.

Ampelopteris prolifera (Retz.) Copel. Gen. Fil. 144. 1947 ; Dhir, Ferns N.W. Himalayas, 105. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 78. 1982 ; Jamir & Rao, Ferns Nagaland, 234. 1988. *Hemionitis prolifera* Retz. Obs.Bot. 6. 31. 1791. *Goniopteris prolifera* (Retz.) Presl. Tent. Pterid. 183. 1836 ; Bedd. Ferns South. India, t. 172. 1864 ; Handb. Ferns Brit. India, 296. t. 153. 1883.

Rhizome wide creeping, *ca* 1 cm thick, stout, apex densely scaly ; scales *ca* 4 x 2 mm, ovate-lanceolate, acuminate, dark-brown. Stipes *ca* 15-35 x 0.3 cm, adaxially grooved, glabrous, green. Lamina *ca* 30 - 120 x 7 - 10 cm, simple pinnate, slightly dimorphic ; sterile lamina often flagelliform and much elongated as the tips appear to be of indefinite growth ; fertile lamina developing a terminal pinna similar to lateral ones ; pinnae numerous, alternate or subopposite, sessile or subsessile ; largest pinna *ca* 4 - 20 x 1 - 2 cm, linear-lanceolate, apex blunt or acute, base truncate or cordate, margin bluntly lobed or crenated ; midrib prominent, veins 6 - 10 on a side, anastomosing with adjacent opposite costules forming excurrent, closed veinlets ; excurrent veins rarely free and only a few veins run to the contiguous margin ; rachis adaxially grooved, hairy ; texture herbaceous or subcoriaceous ; lamina usually glabrous, green, dark-brown when dry. Sori elongate-oblong or even linear and often confluent in age, superficial ; indusia absent ; sporangia short stalked. Spores bilateral, monolete, ovate, exine thick, smooth, spinulose (Pl. 133 ; Ph. 16).

Fertile : July - Feb.

Distrib : (a) Nepal, Bhutan, Myanmar, North Australia, South Africa, Philippines, New Caledonia, China ; (b) throughout India in lower elevation.

Occur : Very common, on wet grounds in low lands ; sometimes it forms large pure populations. Sipajhar, Darrang dist. 2207 ; Kaziranga, Golaghat dist. 1116 ; Mayang, Marigaon dist. 2129.

Uses : The fresh tender fronds are eaten cooked as vegetables in Darjeeling (Dixit & Vohra 1984). Fronds aperient, alterative (Ambasta 1986 ; Asolkar *et al* 1992).

Amphineuron Holtt.
Blumea 19. 45. f. 19, 19a. 1971.

Of the three species of *Amphineuron* listed by Dixit (1984) two species have been recorded in the present study.

Rhizome creeping, scaly ; scales narrow, linear-lanceolate. Stipes erect, scaly at base, above glabrous or slightly pubescent ; adaxially grooved, hairy at groove. Lamina simple pinnate, lanceolate, ovate-oblong or oblong, apex acuminate ; pinnae numerous, alternate or subopposite, sessile, lanceolate, apex acuminate, glandular beneath ; veins pinnate, lowest pair anastomosing with excurrent veinlets passing to the sinus, others free ; texture herbaceous or coriaceous. Sori confined to pinnae lobes, globose, indusiate ; indusia thin, hairy. Sporangia slender stalked ; spores dark, exine tuberculate.

KEY TO SPECIES

1a. Pinnae lobed to 1 mm from costa or more deeply ; basal veins quite free or uniting to form a very short excurrent vein ---------- --- --- ***immersum***

1b. Pinnae lobes less deep ; basal veins anastomosing with a distinct excurrent vein on most parts of the frond ---------- --- --- ***opulentum***

Amphineuron immersum (Bl.) Holtt. in Nayar & Kaur, Comp. to Bedd. Handb. 203. 1974. *Aspidium immersum* Bl. Enum. Pl. Jav. 156. 1828. *Lastrea immersa* (Bl.) Moore, Ind. Fil. 139.

1857 ; Bedd. Ferns Brit. India, t. 252. 1866 ; Handb. Ferns Brit. India, 234. 1883.

Rhizome short creeping, *ca* 1 cm thick, covered with scales all over ; scales *ca* 1 - 2 x 0.2 mm, narrow, linear-lanceolate, apex acuminate, base broad, dark-brown. Stipes *ca* 20 - 90 x 0.6 cm, erect, grooved adaxially, scaly at base, above glabrous or slightly pubescent. Lamina *ca* 70 x 25 cm, simple pinnate, ovate-oblong, apex acuminate ; pinnae numerous, alternate or subopposite, 1 - 2 pairs of basal pinnae sometimes small ; largest pinnae *ca* 12 - 20 x 2.5 cm, lanceolate, apex acuminate, margin cut down nearly to the costae into lobes ; lobes *ca* 3.5 mm, linear, oblique, apex rounded, margin serrate ; rachis strigose and with minute yellow glandular dots ; veins 12 - 14 on each side of the costa, simple, with a few distant inconspicuous hairs, costules and veins bearing small yellow glands ; texture coriaceous ; lamina green, glabrous or with short erect acicular and capitate hairs below. Sori medial, one to each vein, immersed ; indusia large, persistant, hairy, reniform, but appearing orbicular from the overlapping at the sinus ; sporangia stalked ; stalk hairy. Spores dark, exine tuberculate (Pl. 134).

Fertile : Aug. - Dec.

Distrib : (a) Hainan, Thailand, Malaysia, Queensland, New Herbrides, New Caledonia ; (b) Assam.

Occur : Rare ; on hills slopes and along roadsides. Bhairabkunda R.F., Darrang dist. 1543.

Amphineuron opulentum (Kaulf.) Holtt. Blumea, 23 (2). 212. 1977 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 79. 1982 ; Jamir & Rao, Ferns Nagaland, 252. 1988. *Aspidium opulentum* Kaulf. Enum. Fl. 238. 1824. *Nephrodium extensum* Moore, Ind. Fil. 91. 1858 ; Bedd. Handb. Ferns Brit. India, 269. 1883. *N. punctatum* Parish ex Bedd. Ferns Brit. India, t. 131. 1866. *N. parasitcium* var. *multijugum* Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 533. 1880.

Bih-dhekia, Bihlangani (Ass.)

Rhizome creeping, *ca* 1cm thick, densely scaly ; scales *ca* 3 x 0.2 mm, narrow, linear, setiferous, brown. Stipes *ca* 30 - 60 x 0. 7 cm, erect, slender, grooved, hairy at grooves, scaly at base. Lamina *ca* 80 x 30 cm, simple pinnate, lanceolate, apex acuminate ; pinnae about 20 - 30 pairs, alternate or subopposite, sessile ; largest pinnae *ca* 20 - 25 x 2 - 2.5 cm, lanceolate, apex acuminate, margin cut down ¾ towards the costa into lobes ; lobes *ca* 1 x 0.4 cm, slightly oblique and falcate, apex obtuse or rounded, margin wavy, clothed with small yellowish glandular hairs ; lower surface of rachis, costae and costules covered by acicular hairs, upper surface nacked or with a few distant hairs, veins pinnate, 10 - 12 pairs in each lobe, the lowest pair anastomosing with a free excurrent veinlet or meeting just at the sinus without excurrent veinlets, the other pairs always free ; texture herbaceous ; lamina dark-green. Sori mostly confined to lobes, globose, supramedial, often much immersed and visible as punctiform dots on the upper surface ; indusia thin, margin with glandular hairs ; sporangia slender stalked, stalks glandular hairy. Spores dark, exine irregularly tuberculate (Pl. 135).

Fertile : July - Feb.

Distrib : (a) Sri Lanka, East Africa, Seychelles, Myanmar, Thailand, Malaysia, Tropical America ; (b) South India, Northeast India.

Occur : Common, along forest edges. Mandakata, Kamrup dist. 1153 ; Hailakandi, Hailakandi dist. 1419.

Uses : Fronds are used as substitute of tea and also used as an ingredient for fermenting local drinks (Jain 1991).

Christella Léveillié
Fl. Kouy - Tchéou. 472. 1915.

Dixit (1984) has listed 23 species of *Christella* for India. Of these, 13 species have been recorded in the present investigation.

Terrestrials. Rhizome erect, suberect or creeping ; scales narrow with or without superficial hairs. Stipes adaxially grooved. Lamina simple pinnate with more or less lobed pinnae ; generally in almost all cases 1 - 5 pairs or rarely more pairs of lower pinnae gradually reduced and in almost all cases auricled on the acroscopic base ; aerophores at the base of reduced pinnae not swollen ; veins pinnate, one to one and half pairs or rarely more pairs of basal veins anastomosing, others free, simple or forked ; lower or both surfaces of pinnae usally covered by acicular or capitate hairs ; orange coloured sessile glands very rarely present on lower surface of pinnae. Sori round, median or submedian on veins ; indusia glabrous or hairy. Spores monolete, dark, tuberculate or ridged.

KEY TO SPECIES

1a. Basal pinnae not or hardly reduced
  2a. Stipes densely scaly ; glandular hairs present between veins on lower surface ---------- --- --- ***cylindrothrix***
  2b. Stipes not scaly ; glandular hairs absent on lower surface --- --- --- --- -------***parasitica***
1b. Basal pinnae reduced
  3a. Pinnae with only basal pair of veins anastomosing, next pair both to edge above the base of sinus
    4a. Rhizome long creeping ; hairs on lower surface of costae, costules and veins spares, intervenal area glabrous --- --- --- --- --- --- --- ***---appendiculata***
    4b. Rhizome short creeping ; hairs on lower surface usually dense, intervenal area more or less hairy -- --- --- --- --- --- --- --- --- --- --- ***--- hsipidula***
  3b. Pinnae with atleast the second acroscopic vein passing to side of sinus membrane ; more than one pair of veins anastomosing
    5a. Second acrospic vein running to the base of sinus membrane, not anastomosed
      6a. Basal one or two pairs of pinnae slightly reduced ; pinnae lobed less than half way to costae --- --- --- --- --- --- --- --- --- --- --- ***namburensis***
      6b. Basal two or more than two pairs of pinnae distinctly gradually reduced ; pinnae lobed more than half way to costae
        7a. Basal acrospic lobe dentate or again lobed --- --- --- --- --- --- -- ***dentata***
        7b. Basal acroscopic lobe entire not dentate or lobed --- --- --- ***crinipes***
    5b. Second acroscopic vein anastomosing
      8a. Rhizome erect ; fronds tufted
        9a. Basal acroscopic lobe strongly auricled ; one and half pairs of vein anastomosing --- ------ --- --- --- --- --- --- --- ----- --- --- -- ***papilio***
        9b. Basal acroscopic lobe not auricled ; two and half or three pairs of veins anastomosed -- --- --- --- --- ------ --- ----- ***evoluta***
      8b. Rhizome creeping, fronds distant
        10a. Pinnae lobed distinctly less than half way to costa ; texture coriaceous
          11a. Largest fertile pinnae 25 - 30 x 2 - 2.5 cm ; veins upto 14 pairs --- --- --- --- --- -- --- --- --- --- --- --- ----***papyracea***
          11b. Largest fertile pinnae rarely over 15 cm long and 2 cm wide ; veins fewer --- --- --- --- --- --- --- --- --- --- --- --- ***arida***
        10b. Pinnae lobed half or more than half way to costae ; texture subcoriaceous

12a. Lateral pinnae widely placed ; lower 2 - 3 pairs of pinnae gradually reduced --- --- --- --- --- -- --- --- --- ***malabariensis***

12b. Lateral pinnae closely placed ; several pairs of lower pinnae gradually reduced --- -- --- --- --- --- --- --- --- ***subpubescens***

Christella appendiculata (Presl) Holtt. Kew Bull. 31 (2). 311. 1977 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 80. 1982 ; Jamir & Rao, Ferns Nagaland, 264. 1988. *Nephrodium appendiculatum* Presl, Epim. Bot. 47. 1851. *N. extensum* var. *microsorium* Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 530. 1880. *N. extensum* var. *late-repens* Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 530. 1880. *N. microsorum* (Clarke) Bedd. Handb. Ferns Brit. India, 270. 1883 (*non* Hook. 1862). *N. molliusculum* Bedd. Handb. Ferns. Brit. India, Suppl. 68. 1892 (*nom. nov. superfl*).

Rhizome wide creeping, *ca* 0.5 cm thick, scaly ; scales *ca* 1 x 0.2 cm, linear-lanceolate, hair-tipped, reddish brown. Stipes *ca* 30 - 50 x 0.5 cm, slender, angled, scaly at base, hairy at the upper part. Lamina *ca* 30 - 65 x 15 - 30 cm, simple pinnate ; pinnae numerous, distantly placed, sessile, basal pair of the pinnae conspicuously reduced to crenate auricle on the rachis, the second pair slightly reduced ; largest pinna *ca* 9 - 20 x 1.5 - 2.5 cm, lanceolate, apex acuminate, base truncate, margin deeply cutdown almost to the rachis ; lobes *ca* 1 x 0.4 cm , oblique, linear-oblong, obtuse or rounded at apex, margin entire, basal lobes elongate : rachis densely hairy ; lower surface of costae, veins sparsely clothed with short hairs, hairs absent in between veins ; hairs on upper surface thick ; veins 8 - 13 pairs on each lobe, the lowest pair anastomosing at an acute angle very near the costa with an excurrent vein and the other pair always free, texture herbaceous, thin. Sori minute, medial, in two rows on either side of the costules, sometimes only near the costa, brown ; indusia small, hairy, pale-brown (Pl. 136).

Fertile : Jan. - May.

Distrib : (a) China ; (b)Himalayan foothills, Northeast India.

Occur : Common, along roadsides as well as in shady places of the forest. Mariani, Jorhat dist. 1256 ; Mangaldai, Darrang dist. 974 ; Goalpara, Goalpara dist. 1084.

Christella arida (D. Don) Holtt. in Nayar & Kaur, Comp. to Bedd. Handb. 206. 1974. *Aspidium aridus* D. Don, Prod. Fl. Nepal. 4. 1825. *Nephrodium aridus* (D. Don) J. Sm. Hook. Journ. Bot. 4. 1841 ; Bedd. Ferns Brit. India, t. 297. 1866 ; Handb. Ferns Brit. India, 272. 1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 531. 1880. *Cyclosorus aridus* (D. Don) Tagawa, Acta Phytotax. Geobot. 7. 78. 1938 ; Dhir, Ferns N. W. Himalayas, 104. 1980.

Rhizome long creeping, *ca* 0.5 - 1 cm thick, scaly ; scales *ca* 0.8 x 0.1 cm, linear-lanceolate, apex acuminate. Stipes *ca* 15 - 30 x 0.5 - 1 cm, adaxially and abaxially grooved, glabrous, stramineous. Lamina *ca* 150 x 30 cm, oblong-lanceolate, apex acuminate, slimple pinnate, lateral pinnae numerous, rather distant, sessile, subopposite or alternate, lower 3 - 5 or more pairs subabruptly reduced and more widely placed, not or hardly auricled, lowest pair commonly 5 - 10 mm long ; apex of lamina pinna like ; largest pinna *ca* 16 x 1.8 cm, oblong, width above somewhat dilated base, apex acuminate, margin cut about one-fourth of the way down into subtriangular sharp pointed lobes ; veins prominent beneath, upto 10 pairs, 1½ pairs anastomosing, next 3 pairs passing to sinus membrane, costules 3 - 4 mm apart, slightly oblique, costae distinctly raised above and below, grooved above, rounded below ; lower surface of costae bearing stiff erect hairs and narrow scales sparsely, upper surface of costae covered with short antrose hairs ; lower surface of costules and veins with short acicular hairs and with thick yellow glandular hairs ; rachis grooved and hairy above, glabrous and rounded below ; texture coriaceous, lamina light brown when dry, glabrous above, hairy below. Sori medial globose, small, lower ones divergent ; indusia glabrous or with some glandular and short acicular

hairs ; sporangia stalked (Pl. 137 ; Ph. 23).

Fertile : Oct. - Jan.

Distrib : (a) South China, Thailand, Vietnam, Malaysia, North Queensland, New Herbrides, New Caledonia, Fiji, Samoa ; (b) Northeast India.

Occur : Rare ; on shady moist forest. Rowta forest. Darrang dist. 1870 ; Haflong, North Cachar Hills dist. 1981.

Uses : Roots are used in veterinary medicine and fronds are used as vegetable (Jain 1991).

Christella crinipes (Hook.) Holtt. in Nayar & Kaur, Comp. to Bedd. Handb. 208. 1974. *Nephrodium crinipes* Hook. Sp. Fil. 4. 71. 1862 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 533. 1880 ; Bedd. Ferns Brit. India, t. 263. 1866 ; Handb. Ferns Brit. India, 279. 1883.

Rhizome creeping, *ca* 0.5 cm thick, scaly ; scales *ca* 0.3 x 0.1 cm, linear-lanceolate, apex short acuminate, base broad, margin entire. Stipes *ca* 25 - 50 x 0.2 - 0.5 cm, abaxially rounded, adaxially grooved, scaly and pale brown at base, glossy, glabrous and dark-brown above. Lamina *ca* 45 - 90 x 15 -25 cm, bipinnatifid, lanceolate, apex acuminate ; pinnae numerous, alternate or subopposite, sessile upto 5 pairs of basal pinnae gradually reduced ; largest one *ca* 10 - 18 x 1.5 - 2.5 cm, oblong-lanceolate, base truncate, apex long-acuminate, margin cut down nearly to costae into lobes ; lobes *ca* 1.5 x 0.4 cm, falcate, apex acute, basal acroscopic lobe somewhat enlarged ; veins 8 - 12 pairs, basal pair anastomosing next pair to the sides of short sinus membrane, others free, simple ; long acicular hairs distributed densely on the upper surface of rachis, costae, sparsely on costules and veins ; lower surface of lamina short hairy throughout ; texture herbaceous ; lamina blackish-green when dry. Sori medial, but little nearer the margin than the costules, globose, on all the veins except the upper 1 or 2 pairs ; indusia reniform, persistent, glabrous, dark- brown (Pl. 138).

Fertile : Aug. - Dec.

Distrib : (a) Myanmar, China, North Thailand, Hainan ; (b) Meghalaya, Darjeeling and Sikkim Himalayas.

Occur : Not common, on moist shady places of forest. Hajo, Kamrup dist. 2297 ; Kurua, Darrang dist. 814 ; Naharbari, Darrang dist. 2172.

Chrislella cylindrothrix (Rosenst.) Holtt. in Nayar & Kaur, Comp. to Bedd. Handb. 208. 1974 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 80. 1982 ; Jamir & Rao, Ferns Nagaland, 265. 1988. *Dryopteris cylindrothrix* Rosenst. in Fedde. Report. 12. 1913. *Nephrodium parasiticum* var. *aureum* Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 533. 1880. *N. molle* var. *aureum* (Clarke) Bedd. Handb. Ferns Brit. India, 279. 1883. *N. procurrens sensu* Bedd. Handb. Ferns Brit. India Suppl. 67. 1892 (*pro parte*).

Rhizome creeping, *ca* 0.4 cm thick, stout, scaly ; scales *ca* 1 x 0.2 cm, linear-lanceolate, golden-brown. Stipes *ca* 25 - 50 x 0.5 cm, slender, densely scaly at base, sparsely above, pale-brown to reddish. Lamina *ca* 30 - 50 x 15 - 30 cm, simple pinnate, deltoid to deltoid-lanceolate ; pinnae about 15 - 27 pairs, close, sessile, alternate, basal pair slightly reduced or not ; largest pinna *ca* 9 - 20 x 1.5 - 2.5 cm, linear-lanceolate, apex caudate-acuminate, truncate at base, margin deeply cut down nearly to the costae into lobes ; lobes *ca* 1 x 0.4 cm, oblique, oblong, rounded or obtuse at apex, margin entire or slightly crenate ; rachis shortly scaly or hairy ; costae, costules, veins clothed with hairs on upper surface ; veins 8 - 12 pairs, simple, lowest pair anastomosing with excurrent veins to sinus ; texture thin but firm, lower surface of lamina more or less densely covered by short, acicular hairs and also many

thick glandular hairs on or between veins. Sori medial on the veins in two rows on either side of the costules ; indusia hairy (Pl. 139).

Fertile : Nov.- Jan.

Distrib : (a) Bhutan, Myanmar, Thailand ; (b) Sikkim, Northeast India.

Occur : Rare ; on shady, moist forest along hill slopes. Barnadi forest, Darrang dist. 1709.

Christella dentata (Forssk.) Brownsey *et* Jermy, Brit. Fern Gaz. 10. 338. 1973 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 81. 1982 ; Jamir & Rao, Ferns Nagaland, 266. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 198. t. 149. 1992. *Polypodium dentatum* Forssk. Fl. Aegypt. Arab. 185. 1773. *Cyclosorus dentatus* (Forssk.) Ching, Bull. Fan. Mém. Inst. Biol. Bot. 8. 206. 1938 ; Dhir, Ferns N.W. Himalayas, 103. 1980.

Rhizome short creeping, *ca* 1 cm thick, apex sparsely scaly ; scales *ca* 1 x 0.1 cm, linear-lanceolate, apex acuminate, margin entire, hairy, pale-brown. Stipes *ca* 15 - 45 x 0.4 cm, scaly at base, glabrous above or pubscent, pale-brown to dark-brown. Lamina *ca* 75 x 25 cm, oblanceolate, simple pinnate ; pinnae about 15 - 25 pairs, subopposite or alternate, sessile, upto 3 - 5 pairs of basal pinnae progressively reduced and deflexed ; reduced pinnae *ca* 3 - 5 cm long, auricled at acroscopic base ; auricle again lobed ; largest pinna *ca* 15 x 2 cm, lanceolate, apex acuminate, base broadly cuneate, margin lobed more than half way towards the costae ; lobes 0.4 cm wide, slightly oblique, apex rounded, entire ; lower surface of costae and costules with dense short hairs ; rachis and costae densely covered by long acicular hairs on upper surface, sparsely on costules and veins ; veins 6 - 9 pairs, basal one pair anastomosing to form an excurrent vein reaching the base of sinus, acroscopic vein to the side of sinus membrane, others free ; texture thin but firm ; intervenal area with few minute hairs above and below. Sori median on veins, arranged in two rows, one on either side of the costule ; indusia large entire, hairy, brown. Spores planoconvex or reniform (Pl. 140).

Fertile : July - Dec.

Distrib : (a) Throughout the Tropics and Subtropics of the World ; (b) throughout India.

Occur : Common, along shady roadsides slopes, forest clearings and stream banks. Bangaigaon, Bangaigaon dist. 1236 ; Bihpuria, Lakhimpur dist. 1920 ; Mangaldai, Darrang dist. 2479.

Note : *Christella dentata* is one of the very variable species of *Christella* with regard to the number of reduced basal pinnae, distribution of hairs, lobing of pinnae, size of the plant and nature of the rhizome.

Christella evoluta (Bedd.) Holtt. in Nayar & Kaur, Comp. to Bedd. Handb. 208. 1974 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 81. 1982. *Nephrodium amboiense* var. *evolutum* Clarke *et* Bak. Journ. Linn. Soc. Bot. 24. 417. 1888. *N. evolutum* Bedd. Handb. Ferns Brit. India Suppl. 76. 1892.

Rhizome erect or suberrect, *ca* 1 cm thick, scaly ; scales *ca* 0.7 x 0.1 cm, linear, apex acuminate. Stipes *ca* 20 x 0.5 cm, abaxially rounded, adaxially grooved, hairy in grooves, otherwise glabrous, dark-brown. Lamina *ca* 60 - 70 x 20 - 30 cm, simple pinnate, oblong-lanceolate, lateral pinnae upto 15 pairs, sessile or shortly stalked, alternate or subopposite, 2 - 3 lower ones very distant, suddenly reduced, strongly auricled ; largest pinna *ca* 16 - 20 x 3 - 4 cm, oblong, apex short-acuminate, base not auricled, margin lobed about ¼ way towards costae ; lobes slightly falcate, rounded but sometimes apiculate ; veins prominent, 8 - 11 pairs, lowest 3 pairs anastomosing ;

rachis and costae hairy on both surfaces ; costules and veins hairy on lower surface only ; texture papyraceous ; lamina pale-green, upper surface glabrous, lower surface hairy. Sori medial, lower ones divergent, globose, indusia hairy, dark-brown. Sporangia stalked (Pl. 141).

Fertile : Oct. - Jan.

Distrib : (a) North Thailand ; (b) Eastern India.

Occur : Rare ; on moist, shady places in dense forest. Nambar forest, Golaghat dist. 1643 ; Rowta forest, Darrang dist. 1878.

Christella hispidula (Decne) Holtt. Kew Bull. 31. 312. 1976 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 199. t. 150. 1992. *Aspidium hispidulum* Decne, Nouv. Ann. Mus. Hist. Nat. Paris, 3. 346. 1834.

Rhizome short creeping, *ca* 0.5 cm thick, sparsely scaly ; scales *ca* 7 x 2 mm, narrow-lanceolate. Stipes *ca* 20 - 30 x 0.7 cm, abaxially rounded, adaxially grooved, hairy, grey-brown at base, stramineous above. Lamina *ca* 30 - 50 x 25 cm, ovate-lanceolate, simple pinnate ; lateral pinnae 20 - 25 pairs, sessile, subopposite, basal 2 - 4 pairs gradually reduced with dentate acroscopic auricles, largest pinnae *ca* 8 - 12 x 1.2 - 1.5 cm, oblong-lanceolate, acuminate at apex, base truncate, margin lobed four-fifth way to the costae ; lobes about 30 pairs, *ca* 10 x 4 mm, oblong, slightly oblique ; veins slightly distinct below, upto 10 pairs, lowest pair spreading at a broad angle to costule, anastomosing with short excurrent vein to sinus, next vein both to edge ; lower surface of rachis bearing slender spreading pale hairs ; long, slender acicular hairs densely distributed on upper surface of costa, sparsely on upper surface of veins and costules, upper intervenal area glabrous or sometimes with short capitate hairs, lower surface of pinnae, costae, costules and veins with slightly shorter and often with capitate hairs. Sori medial or sometimes a little supramedial, round, 0.7 mm wide ; indusia reniform, small, hairy (Pl. 142).

Fertile : April - July.

Distrib : (a) Tropical America, Africa, Sri Lanka, Malay, Malaysia ; (b) South India and Northeast India.

Occur : Common, on open places. Gauripur, Dhubri dist. 372 ; Mangaldai, Darrang dist. 2075 ; Biswanath Chariali, Sonitpur dist. 1749.

Christella malabariensis (Fée) Holtt. Kew Bull. 31(2). 317.1977. *Nephrodium malabariense* Fée 10 Mém. 43. 1865. *Christella meeboldii* (Rosenst.) Holtt. in Nayar & Kaur. Comp. to Bedd. Handb. 208. 1974 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 197. t. 148. 1992.

Rhizome creeping, *ca* 1 cm thick, scaly ; scales *ca* 0.5 x 0.1 cm, lanceolate, apex acuminate, margin entire, brown. Stipes *ca* 28 x 0.5 cm, tetragonal, above deeply grooved, lateral sides shallowly grooved, distinctly grooved below, glabrous. Lamina *ca* 70 x 28 cm , lanceolate, bipinnatifid below, apex pinnatifid ; lateral pinnae upto 20 pairs, sessile, subopposite at the basal part, alternate above, basal two pairs slightly reduced and deflexed ; about two pairs at the distal part abruptly reduced, apical pinna pinnatifid and acute ; largest lateral pinna *ca* 14 x 1.8 cm, oblong-lanceolate, acuminate at apex, cuneate at base, margin lobed half way to the costae ; lobes *ca* 0.7 x 0.4 cm, apex subacute or rounded ; rachis adaxially grooved, abaxially rounded, densely hairy all over ; costae slightly raised above, distinctly raised below, sparsely hairy at lower side, densely hairy at upper side ; costules and veins distinct, veins upto nine pairs, basal one to one and half pairs anastomosing to form an excurrent vein, ending well below the sinus, other veins free, not reaching the margin, long acicular hairs present sparsely on the upper side of costules and veins ; texture subcoriaceous ; lamina

light-green, hairy. Sori median on veins except the distal one to three pairs, *ca* 1 mm in diameter, globose, indusia round. Spores dark-brown (Pl. 143).

Fertile : Nov. - Jan.

Distrib : (a) China, Sri Lanka ; (b) Northeast and South India.

Occur : Rare ; on fully shaded stream banks. Changsari, Kamrup dist. 2327.

Christella namburensis (Bedd.) Holtt. in Nayar & Kaur, Comp. to Bedd. Handb. 206. 1974. *Nephrodium namburense* Bedd. Handb. Ferns Brit. India Suppl. 69. 1892.

Rhizome long creeping, *ca* 4 - 5 mm thick, wiry, scaly ; scales *ca* 6 x 1 mm, narrow-lanceolate, acuminate. Stipes *ca* 20 - 30 x 0.4 cm, distant, scaly at base, glabrous above, reddish. Lamina *ca* 25 - 40 x 20 cm, subdeltoid, apex acuminate ; lateral pinnae 8 - 10 pairs, subopposite or alternate, sessile, generally no reduction of basal pinnae in smaller fronds, but in larger fronds 1 or 2 lower pairs distant and reduced, somewhat auricled ; largest pinnae *ca* 10 x 2 cm, lanceolate from a square base, widest about middle, narrowly acuminate, margin lobed one third or half way to the costa, lobes *ca* 4 mm wide, oblong, falcate, acute ; veins 9 - 12 pairs, 1 pair anastomosing and 1 pair to sinus membrane ; rachis densely strigose ; very short hairs on lower surface of costae and costules, sparsely on veins and intervenal areas ; glabrous above except the costae and near the edges of lobes. Sori medial, round ; indusia, reniform, short hairy, pale-brown (Pl. 144).

Fertile : May - July.

Distrib : (a) Thailand ; (b) Assam.

Occur : Not common, open dry places under bamboo grooves. Garampani forest, Golaghat dist. 1645 ; Bokajan, Karbi-Anglong dist. 1429 ; Kurua, Darrang dist. 829.

Christella papilio (Hope) Holtt. in Nayar & Kaur, Comp. to Bedd. Handb. 208. 1974 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 200. t. 151. *Nephrodium papilio* Hope, Journ. Bomb. Nat. Hist. Soc. 12. 625. t. 12. 1899. *N. molle* var. *major* Bedd. Handb. Ferns Brit. India Suppl. 76. 1892 (*pro parte*) ; *Cyclosorus papilio* (Hope) Ching, Bull. Fan. Mém. Inst. Biol. 8. 214. 1938 ; Dhir, Ferns N. W. Himalayas, 103. 1980.

Rhizome erect, *ca* 3 cm thick, scaly ; scales *ca* 6 x 2 mm, lanceolate, apex acuminate, margin hairy, pale-brown. Stipes *ca* 10 - 30 x 0.5 cm, tufted, scaly at base, glabrous above, grey-green. Lamina *ca* 90 x 24 cm, simple pinnate, lanceolate ; lateral pinnae numerous, alternate or subopposite, many pairs of basal pinnae progressively reduced, few pairs of basal most pinnae reduced to tubercles, strongly auricled on acroscopic base, largest pinna *ca* 22 x 2.5 cm, oblong-lanceolate, acuminate at apex, base broadly cuneate, margin lobed less than half way to costa ; lobes 30 pairs, *ca* 5 mm wide ; veins upto 8 pairs, one and half pairs anastomosing, one to one and half pairs to sinus membrane ; lower surface minutely hairy throughout, long hairs on upper surface of costae, minute hairs sometimes present between veins. Sori median, lower ones sometimes divergent ; indusia thin, short hairy ; exine irregularly spinulose (Pl. 145).

Fertile : May - June.

Distrib : (a) Sri Lanka, Thailand, Malaysia to Northern Malay ; (b) Northeast to South India.

Occur : Occasional, on shady as well as on open places. Tangla, Darrang dist. 1546 ; Jiadhal, Dhemaji dist. 958.

Christella papyracea (Bedd.) Holtt. in Nayar & Kaur, Comp. to Bedd. Handb. 206. 1974. *Nephrodium papyraceum* Bedd. Handb. Ferns Brit. India Suppl. 69. 1892.

Rhizome long creeping, *ca* 5 mm thick. Stipes *ca* 50 x 0.5 cm, distant, minutely hairy, tetragonal, stramineous. Lamina *ca* 100 x 30 cm , simple pinnate, apex pinna like, lateral pinnae 20 pairs or more, sessile, subopposite or alternate, several pairs of basal pinnae gradually reduced and widely placed, lowest 5 mm long, upper ones not auricled ; largest pinna *ca* 24 - 30 x 2 - 2.5 cm, oblong-lanceolate, apex acuminate, margin lobed to a depth of 3 mm from edge ; lobes oblong, rounded at the apex but with a sudden mucro ; veins upto 12 pairs, 2 - 2½ pairs of basal veins anastomosing, 3 - 4 pairs to long sinus membrane, distinctly prominent below, slightly prominent above ; lower surface of costae, costules and veins with sparse short stiff hairs, many thick orange glandular hairs on veins ; upper surface hairy on costae only ; texture papyraceous or papyraceo-coriaceous, lamina brilliant green, glabrous and shining above. Sori small, medial on supramedial, basal ones often meeting ; indusia small, glabrous (Pl. 146).

Fertile : May - Aug.

Distrib : (a) Myanmar, Nepal ; (b) Assam.

Occur : Occasional ; on shady, moist places. Balipara, Sonitpur dist. 1753 ; Darranga, Nalbari dist. 1279.

Christella parasitica (L.) Lev. Fl. Kouy-Tchéou 475. 1951 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 81. 1982 ; Jamir & Rao, Ferns Nagaland, 267. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 195. t. 147. 1992. *Polypodium parasiticum* L. Sp. Pl. 2. 1090. 1753. *Nephrodium parasiticum* (L.) Desv. Mém. Soc. Linn. Paris. 6. 260. 1827 ; Clarke, Trans Linn. Soc. Lond. II. Bot. 1. 533. 1880 (*pro parte*). *N. didymosorum* Parish ex Bedd. Ferns Brit. India, t. 200. 1866. *N. procurrens* (Mett.) Bak. Syn. Fil. 290. 1867 ; Bedd. Handb. Ferns Brit. India Suppl. 67. 1892. *N. molle* var. *didymosorum* Bedd. Handb. Ferns Brit. India, 279. 1883. *N. tectum* Bedd. Handb. Ferns Brit. India Suppl. 79. 1892. *Cyclosorus didymosorum* (Parish ex Bedd.) Nayar & Kaur, Comp. to Bedd. Handb. 208. 1974.

Rhizome creeping, *ca* 1 cm thick, densely scaly ; scales *ca* 10 x 1.5 mm, linear-lanceolate, apex acuminate, margin more or less clothed with short, soft hairs. Stipes *ca* 20 - 45 x 4 cm, hairy at apex, grey-green. Lamina *ca* 25 - 50 x 15 - 22 cm, broadly ovate, deltoid or cordate, simple pinnate, pinnae numerous, alternate or subopposite, sessile, basal pair usually deflexed, not or slightly reduced ; largest pinna *ca* 13 x 2 cm, linear-lanceolate, apex short acuminate, base truncate or very broadly cuneate, margin lobed two-third to the costa, lobes upto 20 pairs, oblique, basal acroscopic lobe slightly larger than the others ; rachis copiously covered by long and short hairs ; costa, costules and veins covered by short acicular or glandular hairs ; veins upto 10 pairs, lowest pair of opposite lobes joining to form an excurrent vein passing to the base of sinus, next veins running to edge or sometimes the acroscopic one to side of sinus-membrane ; texture subcoriaceous ; lamina pale-green, lower surface covered with pale, soft spreading hairs, upper surface covered with thick, acicular hairs. Sori medial or submarginal on the veins upto five pairs, sometimes only the lowermost vein bearing sori ; sori 1 mm wide ; indusia hairy. Spores bean-shaped, exine irregularly granulose (Pl. 147).

Fertile : Oct. - Dec.

Distrib : (a) Wetter parts of Tropics and Subtropics of Asia, Malaysia, Queensland, Pacific to Tahiti and Hawaii, E. Africa, St. Helena ; (b) Northeastern and Southern India.

Occur : Common in a variety of habitats, such as around permanent source of trickling water, on forest floor and man made clearings in exposed places. Mangaldai, Darrang dist. 2249 ; Kaziranga, Golaghat dist. 1136 ; Silchar, Cachar dist. 1386.

Uses : Fronds are used medicinally to treat gout and rheumatism (Jain 1991).

Christella subpubescens (Bl.) Holtt. Webbia. 30. 193. 1976 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 82. 1982 ; Jamir & Rao, Ferns Nagaland, 268 . 1988. *Aspidium subpubescens* Bl. Enum. Pl. Jav. 149. 1828. *Nephrodium molle* var. *major* Bedd. Handb. Ferns Brit. India Suppl. 76. 1892. *N. molle* var. *amboinense* Bedd. Handb. Ferns Brit. India, 278. 1883 (*pro parte*).

Rhizome short creeping, *ca* 0.5 thick scaly ; scales *ca* 1 x 0.3 cm, lanceolate, base broad, acuminate. Stipes *ca* 10 - 25 x 0.3 cm, abaxially rounded, adaxially grooved, glabrous or sparsely hairy, dark-brown and scaly at base, pale-brown above. Lamina *ca* 50 - 100 x 10 - 25 cm, simple pinnate, lanceolate, apex acuminate ; pinnae numerous, alternate or subopposite, sessile, lower 2 - 8 pairs gradually reduced to butterfly like and deflexed, broadest at middle, apex gradually tapering, ending in a deeply lobed pinna ; lowest pair *ca* 3 x 1.5 cm, basal acroscopic lobe much enlarged with crenate margin ; largest pinnae *ca* 15 x 2.5 cm, base truncate, gradually tapering to a lanceolate acuminate apex, margin lobed to half way to the costa ; lobes *ca* 0.6 cm wide, falcate, apex rounded, margin entire ; veins 5 - 9 pairs, the lower 1½ - 2 pairs anastomosing, others free, simple ; upper surface of rachis, costae, costules, veins clothed with long acicular hairs ; lower surface of pinnae hairy throughout ; texture subcoriaceous, lamina dark-green. Sori medial on all the veins except the 2 - 3 apical ones ; indusia large, minutely hairy (Pl. 148).

Fertile : July - Dec.

Distrib : (a) South West China, Myanmar, Thailand, Vietnam, Malaysia, North Queensland, New Herbrides, Fiji, Samoa ; (b) Northeast India.

Occur : Common, along the shady places of forest. Kaziranga, Golaghat dist. 1148 ; Haflong, North Cachar Hills dist. 1985 ; Pabha forest, Lakhimpur dist. 1916.

Cyclosorus Link
Hort. Reg. Bot. Berol. 2. 128. 1833.

Both the species of *Cyclosorus* listed for India by Dixit (1984) have been recorded in the present study.

Terrestrials. Rhizome long creeping, apex clothed with scales ; scales ovate or linear-lanceolate. Stipes scaly at base, glabrous, adaxially grooved. Lamina simple pinnate, elliptic-lanceolate or broadly ovate-lanceolate, with a terminal pinna similar to lateral ones except for its broader base ; lateral pinnae alternate or subopposite, sessile or shortrly stalked, apex acuminate, margin cut down about one-third way to the costae ; rachis glabrous or hairy ; lower surface of costae, costules hairy or not, scaly, upper surface glabrous ; veins upto 10 pairs, basal one or one and half pairs anastomosing, others free, reaching the margin ; texture coriaceous ; sori medial ; indusia reniform, hairy ; spores monolete.

KEY TO SPECIES

1a. Rhizome scales linear-lanceolate ; stipes *ca* 45 cm long ; basal pair of pinnae somewhat shortened ; base of pinnae truncate or cuneate --- --- --- ***gongylodes***

1b. Rhizome scales ovate ; stipes *ca* 70 cm ; basal pinnae not reduced ; base of pinnae broadly cuneate --- --- --- --- --- --- --- --- --- --- --- --- --- --- ***interruptus***

Cyclosorus gongylodes (Schkuhr) Link. Hort. Reg. Bot. Berol. 2. 128. 1833 ; Jamir & Rao, Ferns Nagaland, 240. 1988. *Aspidium gongylodes* Schkuhr, Kr. Gew. 1. 193. t. 33c. 1809.

Rhizome long creeping, *ca* 0.6 cm thick, slender, apex clothed with scales ; scales 2 x 0.4 mm, narrow, linear-lanceolate, light-brown. Stipes *ca* 25 - 45 x 0.6 cm, scaly at base, rest glabrous, adaxially grooved, pale-brown. Lamina *ca* 45 x 18 cm, simple pinnate, broadly ovate-lanceolate

with a terminal pinna similar to lateral ones except for its broader base, lateral pinnae upto 25 pairs, oblique or spreading, alternate or subopposite, sessile or may be shortly stalked ; the lowest pair of pinnae somewhat shorter ; largest pinnae *ca* 12 x 1 cm, linear-lanceolate, apex short acuminate, base truncate or cuneate, margin cut down about one-third into lobes ; lobes *ca* 0.3 cm broad, slightly oblique, apex rounded or acute, margin entire ; rachis glabrous or sparsely hairy on lower surface ; lower surface of costae with or without spreading hairs and clothed with scales ; costules and veins glabrous below or with hairs like the costae, usually with round orange glands ; veins 8 - 10 pairs, the lowest anastomosing with corresponding veins of adjascent groups forming a long excurrent vein running to the sinus base, the next acroscopic vein joining the same excurrent vein and the corresponding basiscopic vein joining the short, hyaline, sinus membrane and remaining veins running to the margins ; texture chartaceous ; lamina pale-green, lower surface hairy, upper glabrous. Sori medial, globose, in a close, continuous row ; indusia reinform, hairy ; sporangia short stalked. Spores bilateral, monolete, exine spinulose (Pl. 149 ; Ph. 12).

Fertile : Nov. - Feb.

Distrib : (a) Taiwan, Malay ; (b) throughout India in lowlands.

Occur : Common, in swampy places and by the side of ponds. Jalukbari, Kamrup dist.2334 ; Nalbari, Nalbari dist. 1273 ; Bardaulguri, Darrang dist. 2186.

Cyclosorus interruptus (Willd.) H. Itô, Bot. Mag. Tokyo, 51. 714. 1937 (*nomen tantum*) ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 187. t. 142. 1992. *Pteris interrupta* Willd. Phytographia, 13. t. 10. f. 1. 1794. *Nephrodium propinqum* R. Br. Prod. Fl. Nov. Holl. 148. 1810 ; Bedd. Ferns South. India, t. 89. 1864. *N. pteroides* Hook. *et* Bak. Syn. Fil. 289. 1867 ; Bedd. Handb. Ferns Brit. India, 269. 1883. *N. unitum sensu* Bedd. Handb. Ferns Brit. India, 268. 1883.

Rhizome long creeping, *ca* 0.5 cm thick, clothed with scales at the apex ; scales *ca* 3 x 1.5 mm, ovate, acuminate at apex, margin entire. Stipes *ca* 70 x 0.5 cm, slender, sparsely scaly and black at the base, glabrous and brown above, adaxially grooved, abaxially flattened. Lamina *ca* 90 x 22 cm, elliptic-lanceolate, simple pinnate with an apical pinna similar to lateral ones but the base somewhat broad ; lateral pinnae numerous, subopposite, sessile or very shortly stalked, basal pinnae not reduced, few pairs of the distal part of pinnae rather abruptly reduced ; largest pinna *ca* 18 x 1.5 cm, oblong-linear-lanceolate, apex acuminate, base broadly cuneate, margin lobed one-third way to the costae ; lobes *ca* 4 x 3 mm, deltoid, apex rounded with a short acumen ; rachis grooved above and below, hairy ; costae slightly raised and grooved above, distinctly raised and flattend below ; costules distinct below, indistinct above ; veins slightly distinct below, upto 10 pairs simple, basal one or one and half pair anastomosing to form an excurrent vein reaching the base of sinus, others free, reaching the margin ; lower surface of costae, costules, veins and intervenal areas densely covered by long, soft acicular hairs, upper surface glabrous ; broad, thin, pale-brown ciliated scales present on the lower surface of costae ; texture coriaceous ; lamina pale-green ; sori medial on the veins, in two rows, arranged in V-shaped ; indusia reniform, hairy ; sporangial stalk bearing capitate hairs. Spores monolete, pale-brown, exine finely spinulose (Pl. 150).

Fertile : Oct. - Feb.

Distrib : (a) Tropics and Subtropics of the world ; (b) South India.

Occur : Common, as large colonies in open, marshy places, lakes and border of paddy fields. Changsari, Kamrup dist. 429 ; Kaziranga, Golaghat dist. 1128.

Macrothelypteris (H. Itô.) Ching
Acta. Phytotax. Sin. 8. 308. 1963.

Of the nine species of *Macrothelypteris* in the world only two species *M. ornata* (Wall. ex Bedd.) Ching and *M. torresiana* (Gaud.) Ching have been recorded for India (Dixit 1984). Both these species have also been recorded in the present study.

Terrestrials. Rhizome erect or short creeping, densely scaly ; scales linear-lanceolate, apex acuminate, margin hairy. Stipes stout, tufted, adaxially grooved, abaxially rounded, verrucose or smooth, scaly at base. Lamina ovate or ovate-lanceolate, tripinnate or tripinnatifid ; primary pinnae 10 - 15 pairs, alternate or subopposite, sessile or shortly stalked ; secondary pinnae numerous, sessile to adnate, oblong-lanceolate, apex acute or acuminate, tertiary pinnae numerous. Veins indistinct, free, froked, not reaching the margin ; texture herbaceous ; lamina dark or pale-green. Sori round, medial on basal acroscopic veinlets, indusia very minute or exindusiate. Spores round or reniform.

KEY TO SPECIES

1a. Stipe and rachis smooth ; rhizome scales gland tipped --- --- --- --- -- --- --- --- ***torresiana***
1b. Stipe and rachis verrucose ; rhizome scales not gland tipped --- --- --- --- --- --- --- ***ornata***

Macrothelypteris ornata (Wall. ex Bedd.) Ching, Acta phytotax. Sin. 8. 309. 1963 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 171. t. 130. 1992. *Polypodium ornatum* Wall. ex Bedd. Ferns South. India, t. 171. 1864 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 545. 1880. *Phegopteris ornata* J. Sm. Hist. Fil. 233. 1875 ; Bedd. Handb. Ferns Brit. India, 294. 1883.

Rhizome erect, *ca* 4 cm thick, densely scaly ; scales *ca* 2 x 0.2 cm, linear-lanceolate, apex acuminate, margin hairy, dark-brown. Stipes *ca* 90 x 1 cm, tufted, swollen at base, abaxially rounded, adaxially grooved, densely scaly when young, become verrucose by their persistent bases when mature, purple brown. Lamina *ca* 150 x 130 cm, ovate, tripinnate, apex acuminate ; lateral primary pinnae upto 10 pairs, distantly placed, subopposite, or alternate, sessile, largest one *ca* 60 x 20 cm, lanceolate ; secondary pinnae numerous, alternate, sessile ; largest one *ca* 10 x 4 cm, oblong-lanceolate, apex acute or short acuminate, base truncate ; tertiary pinnae upto 20 pairs, opposite, subopposite or alternate ; largest one *ca* 2 x 0.8 cm, linear oblong, apex acute, base sessile, square, margin lobed half way to the costule, lobes *ca* 2 x 1 mm, oblong, oblique, apex subacute or rounded ; veins obscure, free, forked twice or thrice ; abaxial side of primary and secondary rachis verrucose, densely strigose above ; costae sparsely scaly below ; long, stiff acicular or capitate hairs densely distributed on costules and veins above and below ; texture herbaceous ; lamina dark-green. Sori medial, borne on basal acroscopic vein ; basal most pair of lobes bears sori on both basal acroscopic and basiscopic veins. Spores planoconvex or reniform (Pl. 151).

Fertile : July - Feb.

Distrib : (a) Myanmar ; (b) Northeast and South India.

Occur : Common, on fully or partially exposed roadsides at forest edges. Lumding, Nagaon dist. 1567 ; Sonari, Sivsagar dist. 697 ; Mangaldai, Darrang dist. 2094.

Macrothelypteris torresiana (Gaud.) Ching, Acta Phytotax. Sin. 8. 310. 1963 ; Jamir & Rao, Ferns Nagaland, 238. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 172. t. 131. 1992. *Polystichum torresianum* Gaud. in Freyc. Voy. Bot. 333. 1824. *Nephrodium tenericaule* Hook. Sp. Fil. 4. 142. 1862. (excl. t. 269) ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 528. 1880. *Lastrea tenericaulis* Moore, Ind. Fil. 99. 1858 ; Bedd. Handb. Ferns Brit. India, 266. 1883.

Rhizome short creeping, *ca* 5 cm thick, stout, densely scaly ; scales *ca* 1 x 0.2 cm, linear-lanceolate, apex acuminate, gland tipped, margin with long acicular hairs, pale-brown. Stipes *ca* 50 - 65 x 1 cm, stout, adaxially grooved, abaxially rounded, scaly and dark-brown at the base, pale-brown above and with minute dark-brown spots of persistent scale bases. Lamina *ca* 85 x 50 cm or more, ovate-lanceolate, tripinnatifid ; primary pinnae upto 15 pairs, subopposite or alternate, sessile or shortly stlaked, largest one *ca* 25 - 45 x 8 - 16 cm, delto-lanceolate, apex acuminate ; secondary pinnae numerous, subopposite, sessile to adnate, 2 cm apart, largest one *ca* 8 x 2 cm, oblanceolate, apex acuminate ; tertiary pinnae upto 18 pairs, alternate to subopposite, oblong, apex subacute, margin lobed half way to the costa ; costa slightly raised above and below ; costules distinct ; veins indistinct, free, forked, not reaching the margin ; rachis glabrous, pale-yellowish brown ; lower surface of costa, costules and veins sparsely covered by long, acicular, septate hairs, upper surface of secondary rachis and costa densely covered by slender, acicular hairs, sparsely on costules ; texture herbaceous ; lamina pale-green. Sori round, on the basal acroscopic veinlets of each lobe just above the forking point ; indusia inconspicuous, fugaceous ; sporangia shortly stalked, with 2 - 4 capitate hairs. Spores reniform, round, exine soinulose (Pl. 152).

Fertile : July - Feb.

Distrib : (a) Mascareen Islands, warmer parts of mainland of Asia and Japan, Malaysia, North-east Australia, Polynesia, Hawaii, Malay ; (b) South India, Himalayas.

Occur : Common, on forest cleared areas and along roadsides on hills. Mangaldai, Darrang dist. 1018 ; Subansiri R.F., North Lakhimpur dist. 1905.

Metathelypteris (H. Itô) Ching.
Acta Phytotax. Sin. 8. 305. 1963.

Of the four species of *Metathelypteris* listed for India (Dixit 1984) only one species has been recorded in the present investigation.

Metathelypteris decipiens (Clarke) Ching, Acta Phytotax. Sin. 8. 306. 1963 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 84. 1982. *Nephrodium gracilescens* var. *decipiens* Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 514. t. 65. f. 2. 1880. *Lastrea gracilescens* Bedd. Handb. Ferns Brit. India, 234. 1883 (*pro parte*). *L. gracilescens* var. *decipiens* (Clarke) Bedd. Handb. Ferns Brit. India Suppl. 51. 1892.

Rhizome short creeping, *ca* 0.8 cm thick, scaly ; scales *ca* 6 x 1 mm, linear-lanceolate, apex acuminate, margin bears short hairs. Stipes *ca* 15 - 25 x 0.4 cm, tufted, scaly at base, thin, soft hairs distributed all over, stramineous. Lamina *ca* 25 x 18 cm, deltoid-lanceolate, simple pinnate, apex short acuminate ; lateral pinnae upto 12 pairs, subopposite or alternate, sessile, basal pinnae slightly reduced or not, often narrowed at basiscopic base ; largest pinnae *ca* 6 - 10 x 2 - 2.5 cm, oblong-lanceolate, short acuminate with curved tip, margin lobed nearly to costa, lobes oblique, basal acroscopic lobe larger, crenate or entire ; veins upto 7 pairs, free, simple or forked, not reaching the margin ; rachis, costae, costules and veins bearing short hairs and linear brown scales on lower side ; costae densely hairy above, sparsely on costules and veins ; texture subcoriaceous, lamina glabrous. Sori medial, round, indusia pale-brown, small, hairy (Pl. 153).

Fertile : July - Oct.

Distrib : Eastern India.

Occur : Rare ; along shady places near streams. Sivasagar, Sivasagar dist. 682.

Parathelypteris (H. Itô) Ching
Acta Phytotax. Sin. 8. 300. 1963.

Of the two species of the genus listed for India (Dixit 1984) only one species has been recorded in the present study.

Parathelypteris glanduligera (Kunze) Ching, Acta Phytotax. Sin. 8. 303. 1963 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 84. 1982 ; Jamir & Rao, Ferns Nagaland, 249. 1988. *Aspidium glanduligerum* Kunze, Anal Pterid. 44. 1837. *Lastrea gracilescens* var. *glanduligera* Bedd. Handb. Ferns Brit. India Suppl. 51. 1892.

Rhizome wide creeping, *ca* 0.6 cm thick, slender, wiry, scaly ; scales narrow with capitate hairs on surface. Stipes *ca* 15 - 30 x 0.4 cm, slender, scaly, stramineous. Lamina *ca* 15 - 35 x 5 - 14 cm, delto-lanceolate, apex acuminate, bipinnatifid, pinnae about 15 - 20 pairs, subopposite or alternate, sessile, distinct ; basal pinnae rather longest or slightly reduced, and basal side of basal pinnae narrowed gradually ; largest pinnae *ca* 6 - 9 x 1 - 2 cm, lanceolate, apex acute, margin lobed almost to the costa ; basal acroscopic lobe sometimes enlarged and dentate ; lobes *ca* 0.8 x 0.3 cm, obtuse at apex, margin entire ; costae slightly raised above and below ; costae and rachis hairy on upper and lower surface ; veins 4 - 8 pairs, simple, free, reaching the margin ; glands present between the veins. Sori submarginal, small, near the apices of veins ; indusia hairy and glandular ; sporangia short-stalked. Spores hyaline, monolete, often opaque, exine with narrow wings (Pl. 154).

Fertile : May - Oct.

Distrib : (a) Nepal, South China, Korea, Taiwan, Japan, Thailand, North Malaysia ; (b) Eastern India and Eastern Himalayas.

Occur : Rare ; in moist and shady forest floor. Garbhanga, Kamrup dist. 1612.

Pneumatopteris Nakai
Bot. Mag. Tokyo, 47. 179. 1933.

Dixit (1984) has listed one species and a variety of *Pneumatopteris* for India and of these, only one species has been recorded from Assam in the present study.

Pneumatopteris truncata (Poir.) Holtt. Blumea. 21 (2). 314. 1973 ; Jamir & Rao, Ferns Nagaland 269. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 202. t. 152. *Polypodium truncatum* Poir. Encycl. Méth. 5. 534. 1804. *Nephrodium trunctatum sensu* Bedd. Handb. Ferns Brit. India, 280. 1883.

Rhizome short, erect, *ca* 4 cm thick, scaly ; scales *ca* 5 x 3 mm, ovate, apex acuminate, margin entire, pale-brown. Stipes *ca* 25 - 60 x 1 cm, adaxially grooved, abaxially rounded, scaly at base, hairy at the grooves, striminous. Lamina *ca* 50 - 110 x 24 - 40 cm, nearly triangular, simple pinnate ; pinnae numerous, opposite at base, subopposite or alternate above, sessile, basal four to nine pairs of pinnae abruptly reduced to small auricles which are widely spaced ; largest pinna *ca* 25 x 3 cm, linear-lanceolate, apex acuminate, base broadly cuneate or truncate, margin lobed half way to the costae ; lobes *ca* 0.5 cm wide, oblong, apex rounded or bluntly toothed ; costa distinctly raised, grooved above, rounded below ; veins upto 10 pairs, 1 - 2 pairs anastomosing forming an excurrent vein to the base of the sinus membrane, next pair to the sides of the sinus membrane ; texture subcoriaceous ; rachis and costae sparsely clothed with short hairs beneath, upper surface of lamina glabrous, lower surface with small pustules when dry. Sori median on veins, upto six pairs, arranged in two rows on either side of costules, lower ones not divergent, *ca* 1 mm in diameter, indusia glabrous ;

sporangia minute, stalk with glandular hairs ; exine spinulose (Pl. 155).

Fertile : May - Dec.

Distrib : (a) Sri Lanka, China, Malaysia, Philippines ; (b) South India and Northeast India.

Occur : Not common, in fully shaded places near streams and river banks. Nambar forest (Part), Karbi-Anglong dist. 1648 ; Khalingduar, Darrang dist. 1855.

Pronephrium Presl
Epim. Bot. 258. 1851.

Eight species of *Pronephrium* have been listed for India (Dixit 1984). Of these, six species have been recorded in the present investigation.

Terrestrials. Rhizome long creeping, erect, densely scaly ; scales ovate-lanceolate, hairy. Stipes tufted or scattered, scaly at base, hairy or glabrous above. Lamina trifoliate to simple pinnate with several pairs of pinnae ; basal pinnae not reduced ; pinnae oblong-lanceolate, base equal or unequal, margin crenate to entire or rarely very shallowly lobed ; veins several pairs, usually all anastomosing, united excurrent veins sometimes free, usually joining to form zigzag composite veins alternating with costules ; costa densely hairy ; texture herbaceous to chartaceous, surface hairy. Sori round or elliptic or crescent shaped ; indusiate or exindusiate ; indusia hairy or glandular ; sporangia with few acicular hairs. Spores monolete, exine with spinulose outgrowths.

KEY TO SPECIES

1a. Lamina trifoliate --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ***triphyllum***
1b. Lamina simple pinnate
  2a. Sori exindusiate
    3a. Stipes minutely hairy ; pinnae 2 - 8 pairs --- --- --- --- --- --- - --- --- --- ***parishii***
    3b. Stipes glabrous ; pinnae more than 8 pairs
      4a. Pinnae serrate, lower surface hairy ; texture herbaceous --- --- --- ***stenopodum***
      4b. Pinnae entire, lower surface glabrous ; texture subcoriaceous- --- ***lakhimpurensis***
  2b. Sori indusiate
    5a. Rhizome erect ; pinnae lobed one-fourth way to the costae --- --- --- ***articulatum***
    5b. Rhizome creeping ; pinnae sharply crenate --- --- --- --- ----- --- --- --- ***nudatum***

Pronephrium articulatum (Houlst. *et* Moore) Holtt. Blumea, 21 (1). 116. 1972 ; Nayar & Kaur, Comp. Bedd. Handb. 207. 1974 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 186. t. 141. 1992. *Nephrodium articulatum* Houlst. *et* Moore, Gard. Mag. Bot. 293. 1851. *N. glandulosum* var. *late-strigosum* Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 532. t. 74. f. 2. 1880.

Rhizome erect, *ca* 5 cm thick, sparsely scaly ; scales *ca* 5 x 4 mm, ovate, apex acuminate, base broad, margin entire, pale-brown. Stipes *ca* 30 - 65 x 0.5 cm, muricate at base, above glabrous, grey-green. Lamina *ca* 50 - 100 x 20 - 45 cm, lanceolate, simple pinnate, with an apical pinna similar to lateral ones, pinnae numerous, subopposite or alternate, sessile or subsessile, upto 4 cm apart, basal pinnae slightly deflexed ; largest pinnae *ca* 25 - 4 cm, lanceolate, acuminate at apex, base truncate to broadly cuneate, margin shallowly lobed one-fourth way to the costa ; lobes acute, slightly ascending ; rachis grooved, sparsely hairy, stramineous ; costa slightly raised above and below, grooved and hairy above and below ; veins distinct, upto 13 pairs, basal veins anastomosing, upper 2 - 4 pairs free, veins sparsely hairy on lower surface ; texture subcoriaceous, lamina green, glabrous above, hairy below. Sori median on veins, upto 10 pairs in two rows, small, indusia glabrous. Spores monolete, brown, exine spinulose (Pl. 156).

Fertile : May - Oct.

Distrib : (a) Bangladesh, Sri Lanka, Myanmar, North Thailand, China ; (b) South and North India.

Occur : Rare ; on fully shaded stream banks. Bhalukpung, Sonitpur dist. 882.

Pronephrium lakhimpurensis (Rosenst.) Holtt. Blumea, 21 (1). 110. 1972 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 85. 1982 ; Jamir & Rao, Ferns Nagaland, 256. 1988. *Dryopteris lakhimpurensis* Rosenst. Meded. Rijksherb. 31. 7. 1917. *Meniscium cuspidatum* var. *longifrons* Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 572. 1880.

Rhizome long creeping, *ca* 2 cm thick, scaly ; scales *ca* 2 x 0.5 mm, lanceolate, acuminate. Stipes *ca* 40 - 90 x 0.5 - 1 cm, adaxially grooved, abaxially rounded, glabrous, pale-brown. Lamina *ca* 50 - 150 x 25 - 60 cm, simple pinnate, lanceolate, with a long acuminate apical pinna similar to lateral ones ; apical pinna larger than the distant lateral pinnae ; lateral pinnae 9 - 12 pairs or more, alternate, sessile or slightly petiolate, largest pinnae *ca* 20 x 4 cm, lanceolate, apex tapering and suddenly long acuminate, base caudate, margin entire or slightly undulate ; rachis similar to stipe ; midrib distinctly raised below and rounded ; costae slightly raised below, veins distinct, upto 20 pairs, all anastomosing, excurrent veins often free ; texture subcoriaceous ; lamina glabrous above and below, pale-green when fresh ; become reddish-brown when dry. Sori small, superficial along veins, exindusiate ; sporangia lacking setae, spinulose (Pl. 157).

Fertile : July - Oct.

Distrib : (a) China, Tonkin, Thailand ; (b) Himalayas and Northeast India.

Occur : Not common, inside shady forest floor. Harmati, Lakhimpur dist. 1818 ; Bhalukpung, Sonitpur dist. 841.

Pronephrium nudatum (Roxb. ex Griff.) Holtt. Blumea, 21(1). 111. 1972 ; Dhir, Ferns N.W. Himalayas, 105. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 85. 1982 ; Jamir & Rao, Ferns Nagaland, 258. 1988. *Polypodium nudatum* Roxb. ex Griff. Calc. Journ. Nat. Hist. 4. 491. 1844. *Goniopteris multilineata* Bedd. Ferns Brit. India, t. 231. 1866. *Nephrodium moulumeinese* Bedd. Ferns Brit. India, Suppl. t. 18. 1876 ; Handb. Ferns Brit. India : 275. 1883.

Rhizome long creeping, *ca* 2 cm thick, stout. Stipes *ca* 60 x 1 cm, firm, erect, abaxially rounded, adaxially grooved, sparsely scaly at base, scales membranous, dark-brown, glabrous above, pale-brown. Lamina *ca* 100 x 70 cm, simple pinnate ; pinnae numerous, alternate or subopposite, sessile, with a terminal pinna similar to lateral ones ; largest pinnae *ca* 18 - 45 x 2.5 - 5 cm, narrow oblong, apex long acuminate, base broadly cuneate, margin sharply crenate, shortly cartilaginous or slightly toothed ; rachis similar to the stipe ; costa distinctly raised above and below, grooved on upper surface, rounded at lower surface ; costules and veins very prominent, veins upto 20 pairs, all but the upper 2 - 3 pairs anastomosing with a zigzag excurrent veinlet united throughout ; texture thin, coriaceous ; lamina pale-green, upper surface generally quite glabrous and shining, under surface with obscure hairs on the costae and veins. Sori small, round, median on veins in a single row on each side of the costules ; indusia small, reniform, sporangia glabrous. Spores dark, exine short spinulose (Pl. 158 ; Ph. 6).

Fertile : July - Oct.

Distrib : (a) Myanmar, Thailand, Tonkin, China, Malay Peninsula ; (b) North West Himalayas and Northeast India.

Occur : Common, on moist, shady places near streamlets and rivers. Kachugaon, Kokrajhar

dist. 1241 ; Mangaldai, Darrang dist. 1006 ; Mandakata, Kamrup dist. 1150.

Pronephrium parishii (Bedd.) Holtt. Blumea, 20 (1). 123. 1972. *Meniscium parishii* Bedd. Ferns Brit. India, t. 184. 1866. *Meniscium tryphyllum* var. *parishii* Bedd. Handb. Ferns Brit. India, 399. 1883. *Pronephrium triphyllum* var. *parishii* (Bedd.) Kuo, Fl. Taiwan 1. 431. (ed. 2). 1980 ; Jamir & Rao, Ferns Nagaland, 261. 1988.

Rhizome long creeping, *ca* 0.5 cm thick, furnished with numerous thick wiry roots, scaly ; scales *ca* 9.5 x 0.2 mm, lanceolate, acuminate, dark-brown. Stipes *ca* 15 - 40 x 0.4 cm, slender, adaxially grooved, abaxially flattened, hairy, dark-brown at base, stramineous above. Lamina *ca* 20 - 40 x 10 - 15 cm, simple pinnate, ovate-lanceolate, with an apical pinna similar to lateral ones except slightly enlarged, sometimes the base of terminal pinna auricled ; lateral pinnae 2 - 9 pairs, alternate or subopposite, sessile or lower ones shortly petiolate ; largest pinna *ca* 16 x 4 cm, oblanceolate, broadest at middle, suddenly narrowed to an acuminate apex, oblique or alternate at base, sinuate at margin ; rachis similar to the stipe, hairy ; costa distinctly raised above and below, hairy on both surfaces ; veins distinct and hairy on lower surface, areoles 10 - 13 pairs, excurrent venlets free or united to the next pair of veins above ; texture, subcoriaceous ; lamina glabrous above, green when fresh, yellowish-brown when dry. Sori small exindusiate along the veins ; sporangial setae hooked at the tip (Pl. 159).

Fertile : Feb. - May.

Distrib : (a) Sri Lanka, Malay, Tonkin ; (b) Andaman & Nicobar Islands, Northeast India.

Occur : Rare ; on moist humous covered soils. Rowta forest. Darrang dist. 1347.

Pronephrium stenopodum Chandra, Kew Bull. 26. 81. 1971 ; Dixit, Cens. Indian Pterid. 111.1984.

Rhizome long creeping, *ca* 1 cm thick, covered with scales ; scales *ca* 5 x 3 mm, ovate-lanceolate, apex acuminate, margin bearing unicellular, acicular, glandular hairs. Stipes *ca* 70 x 1 cm, abaxially rounded, adaxially grooved, scaly at base, glabrous above. Lamina *ca* 90 x 55 cm, oblong, simple pinnate, with an apical pinna similar to lateral ones ; lateral pinnae 14 - 16 pairs, subopposite to alternate, shortly stalked ; largest one *ca* 26 x 5 cm, oblong-lanceolate, apex long acuminate, base narrowly cuneate, margin serrate, undulate ; veins 12 - 14 pairs, all but the upper 2 - 4 pairs anastomosing ; costa grooved and hairy above ; unicellular, acicular, short hairs present on the lower surface of costae and costules ; texture herbaceous ; intervenal areas of lower surface of pinnae with nonglandular hairs. Sori towards the apex of veins, elongate, confluent, exindusiate, annulus with 14 - 16 thickened cells, sporangial setae hooked. Spores bilateral, granulose (Pl. 160).

Fertile : Feb. - April.

Distrib : (a) & (b) Assam.

Occur : Rare ; on moist, shady places of forest. Haflong, North Cachar Hills dist. 1989.

Pronephrium triphyllum (Sw.) Holtt. Blumea, 20(1). 122. 1972 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 86. 1982 ; Jamir & Rao, Ferns Nagaland, 261. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 185. t. 140. 1988. *Meniscium triphyllum* Sw. Schrad. Journ. Bot. 1800. (2). 16. 1801 ; Bedd. Ferns South. India, t. 56. 1864 ; Handb. Ferns Brit. India, 367. t. 231. 1883.

Rhizome long creeping, *ca* 0.5 cm thick, slender, scaly ; scales *ca* 6 x 2 mm, linear-lanceolate, apex acuminate, margin entire, hairy, dark-brown. Stipes *ca* 7 - 40 x 0.3 cm, slightly longer in fertile lamina, slender, flattened below, grooved above, sparsely scaly at the base, covered by

hairs all over, dark-brown at the base, grey-green above. Lamina *ca* 10 - 25 x 7 - 15 cm, trifoliate, ovate in outline ; lateral pair of pinnae *ca* 5 - 13 x 1.5 - 2.5 cm, lanceolate to oblanceolate, opposite, distinctly petiolate, apex acuminate, attenuate at base, margin entire or irregularly undulating ; terminal pinna larger than the lateral ones, *ca* 15 x 4 cm, apex acuminate, base attenuate or auricled to cuneate, margin entire or undulating ; costules and veins distinct above and below ; veins about eight pairs, all veins of adjacent costules meet at the centre to form an excurrent vein which usually dose not connect to the next pair ; texture subcoriaceous ; lamina dark-green, upper surface sparsely hairy, but costae more densely hairy ; lower surface of costules and lateral veins densely hairy. Sori along almost the whole length of veins, oblong or elliptic, exindusiate ; sporangial setae hooked. Spores reniform or planoconvex, exine spinulose (Pl. 161).

Fertile : Feb.

Distrib : (a) Sri Lanka, Myanmar, Thailand, China, Japan, Malyasia, Queensland ; (b) South India and Northeast India.

Occur : Rare ; in open forest near streams and rivers. Bhairabkunda R.F., Darrang dist. 1516.

Pseudocyclosorus Ching
Acta Phytotax. Sin. 8. 324. 1963.

Dixit (1984) has listed 8 species of *Pseudocyclosorus* for India and of these, only the type species of the genus has been recorded for Assam in the present investigation.

Pseudocyclosorus tylodes (Kunze) Ching, Acta Phytotax. Sin. 8. 324. 1963. Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 175. t. 133.1992. *Aspidium tylodes* Kunze, Linnaea, 24. 244. 283.1851. *Lastrea tylodes* (Kunze) Moore, Ind. Fil. 107. 1858 ; Bedd. Ferns South. India, t. 107.1864. *Lastrea ochthodes* var. *tylodes* Bedd. Handb. Ferns Brit. India, 240.1883. *Thelypteris tylodes* (Kunze) Ching, Bull. Fan. Mém. Inst. 6. 296. 1935 ; Jamir & Rao, Ferns Nagaland, 245. 1988 (as '*xylodes*').

Rhizome erect or semierect, stout, *ca* 5 cm thick, covered by scales at apex ; scales *ca* 5 x 2.5 mm, lanceolate, acute at apex, glabrous, margin bearing finger like outgrowths at distal part, dark-brown at the centre, pale-brown at periphery. Stipes *ca* 90 x 1 cm, stout, glabrous above, scaly at the base, straminaceous, adaxially grooved, abaxially rounded, grey-brown. Lamina *ca* 100 x 45 cm, oblong-lanceolate, pinnate, dark-green ; pinnae upto 40 pairs, alternate or subopposite, sessile, with a prominent gland at the base beneath ; some of the lower pinnae abruptly reduced to tuberculate glands ; largest pinna *ca* 25 x 2 cm, linear oblong-lanceolate, apex long acuminate, base truncate or subtruncate, margin lobed *ca* 1 - 2.5 mm to the costa ; lobes about 40 pairs, *ca* 1.5 x 0.4 cm, oblong, falcate, obtuse or shortly acuminate, entire ; texture subcoriaceous ; rachis, costa hairy on the adaxial side, rarely on the abaxial side of the costa and the margin of the lobes ; veins 8 - 15 pairs on each lobe, simple, free, prominent, the lowest opposite pair running into sinus. Sori rather large, at the base of the veins, very close to the costules, flesh red when young, dark-brown when mature, indusia glabrous ; sporangia shortly stalked. Spores bilateral, dark-brown, exine spinulose (Pl. 162).

Fertile : July - Sept.

Distrib : (a) Sri Lanka, Myanmar, China, Japan, Malay, Philippines ; (b) South India, Nilgiri Hills, Northeastern Himalayas, Nagaland.

Occur : Rare ; in moist shady places in forest areas. Sonapur, Kamrup dist. 715 ; Bokajan, Karbi-Anglong dist. 1437.

Sphaerostephanos J. Sm.
in Hook. Gen. Fil. t. 24. 1836.

Only one species out of the four species of *Sphaerostephanos* listed by Dixit (1984) for India has been recorded from Assam in the present investigation. In addition to the above, *S. subtruncatus,* a species not listed by Dixit (1984), has also been encountered in the present study.

Terrestrials. Rhizome erect or wide creeping ; scales narrow, margin hairy or glabrous. Stipes scaly at base, hairy above. Lamina simple pinnate, varied number of basal pinnae progressively or abruptly reduced ; acrophores swollen or elongate ; pinnae lobed one third to half way to the costae ; one to one and a half pairs of basal veins anastomosing ; costa grooved above ; upper and or lower surface of pinnae with sessile orange glands and acicular hairs. Sori round, median ; indusia small, hairy or glabrous. Spores monolete, light-brown, exine spinulose.

KEY TO SPECIES

1a. Rhizome erect ; texture herbaceous ---------- --- --- --- ***subtruncatus***
1b. Rhizome long creeping ; texture coriaceous ---------- --- --- --- ***unitus***

Sphaerostephanos subtruncatus (Bory) Holtt. in Kew Bull. 26. 80. 1971 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 193. t. 146. 1992. *Polypodium subtruncatum* Bory in Belanger Voy. Bot. 2. 32. 1833.

Rhizome erect, *ca* 1 cm thick, covered by scales at the apex ; scales *ca* 5 x 2 mm, ovate-lanceolate, apex acuminate, margin entire, pale-brown. Stipes *ca* 30 x 0.8 cm, tertragonal, above deeply grooved, lateral side shallowly grooved, flattend below, sparsely scaly at the base, hairy and grooved above. Lamina *ca* 100 x 30 cm, oblong-lanceolate, simple pinnate, pinnae numerous, subopposite or alternate, sessile ; pinnae in the distal part rather abruptly reduced and terminate with lobed pinna smaller than the lateral ones, about 8 pairs of basal pinnae abruptly reduced, reduced pinnae spaced 8 cm, ovate-lanceolate or oblong, auricled on the acroscopic base, margin crenate ; veins forked, free or anastomosing ; unreduced largest pinna *ca* 15 x 2 cm, linear-lanceolate, acuminate at apex, base broadly cuneate, acroscopic base auricled, margin lobed one-fourth way to the costae, lobes, *ca* 5 x 4 mm, oblong, apex subacute or rounded ; costa distinctly raised and rounded below, grooved and slightly raised above ; costules and veins slightly distinct, veins upto 10 pairs, one to one and half pairs of basal veins of adjacent lobes anastomosing to form an excurrent vein reaching the base of thick sinus membrane, next pair reaching the side of the sinus membrane ; upper surface of costa densely hairy and lower surface sparsely hairy ; costules and veins rarely hairy ; texture firm, herbaceous ; lamina dark-green, lower surface sparsely covered by small, spherical, yellow glands. Sori median on veins, round, *ca* 1 mm in dimeter; indusia glabrous. Spores monolete, exine spinulose (Pl. 163).

Fertile : May - Aug.

Distrib : (a) & (b) Southwest India.

Occur : Very Rare ; along partially exposed stream banks. Changsari, Kamrup dist. 2339.

Note : Manickam & Irudayaraj (1992) stated that this species is restricted to Southwest India, Sri Lanka and Seychelles, where it is rare in occurance. Their observations were based on specimens cited by Holttum (Holttum & Chandra 1971) and by Sledge (1981). Holttum (*loc. cit.*) cited four collections from India, one each from Dindigul mountain collected (type locality) by Belanger, Tirunelveli Ghats collected by Beddome, Goa collected by Chandra and Duars, Bengal collected by Gamble. The only report of this

collected by Chandra and Duars, Bengal collected by Gamble. The only report of this species from India after Holttum & Chandra (*loc. cit.*) is that of Manickam & Irudayaraj (*loc. cit.*) who have collected this rare species from Tirunelveli hills, Annamalais and Kerala Ghats.

Sphaerostephanos unitus (L.) Holtt. Journ. South Afr. Bot. 40. 165. 1974 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 87. 1982 ; Jamir & Rao, Ferns Nagaland, 271. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 191. t. 144. 1992. *Polypodium unitum* L. Syst. Nat. (ed. 10.) 2. 1326. 1759. *Nephrodium cucculatum* Bak. in Hook. Syn. Fil. 290. 1867 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 530. 1880 ; Bedd. Handb. Ferns. Brit. India, 270. t. 138. 1883.

Rhizome long creeping, *ca* 1 cm, thick, apex covered with scales ; scales *ca* 6 x 1.3 mm, lanceolate, apex acuminate, margin entire, hairy, pale-brown. Stipes *ca* 25 - 75 x 7 cm, grooved above and below, slender, densely clothed with short, adpressed hairs, glabrous above when matured, glossy. Lamina *ca* 40 - 60 x 20 - 30 cm, simple pinnate, lanceolate ; pinnae numerous, ascending, subopposite or alternate, sessile, the lowest 3 - 6 pairs reduced to tubercles, auricled at base of acroscopic side ; largest pinna *ca* 25 x 25 cm, linear-oblanceolate, acuminate apex, cuneate at base, margin cut down one-third way towards the costae ; lobes rounded, oblique, deltoid, apex acute, margin entire ; rachis hairy beneath ; veins prominently raised beneath, the basal lower two pairs anastomosing to form an excurrent vein reaching the base of sinus membrane, next two pairs above meeting the side of the hyaline membrane ; texture coriaceous ; pinnae dark-green above, pale-green below, pale-brown hairs distributed on lower surface of lamina and upper surface of costa ; spherical, sessile, orange coloured glands distributed on the lower surface of costules, veins and intervenal areas. Sori small, medial, almost to the apices of veins, horse-shoe shaped, indusia small, brown, glabrous. Spores reniform, brown (Pl. 164).

Fertile : July - Oct.

Distrib : (a) Myanmar, Sri Lanka, Thailand, Malaysia, Malay, Queensland ; (b) throughout India in mountainous regions.

Occur : Common ; in moist, exposed places in forest. Khalingduar, Darrang dist. 1859 ; Pabha forest, Lakhimpur dist. 1910.

Trigonospora Holtt.
Blumea, 19 (1). 29. f. 4, 4a. 1971.

Of the three species of *Trigonospora* listed for India (Dixit 1984) only one species has been recorded from Assam in the present study.

Trigonospora ciliata (Wall. ex Benth.) Holtt. Blumea, 19(1). 29. f. 4, 4a. 1971. Baishya & Rao, Ferns & Fern-allies Meghalaya, 87. 1982 ; Jamir & Rao, Ferns Nagaland, 248. 1988. Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 183. t. 139. 1992. *Aspidium ciliatum* Wall. (*nom. nud.*) ex Benth. Fl. Hong Kong, 455. 1861.

Rhizome short, erect, *ca* 2.5 cm thick, scaly at apex ; scales *ca* 2 x 1 mm, ovate, apex acute, margin entire, hairy, brown. Stipes *ca* 15 x 0.3 cm in sterile lamina, *ca* 25 x 0.3 cm in fertile ones, more or less densely clothed with soft acicular hairs, grey-brown when dry. Lamina *ca* 30 x 15 cm, bipinnatifid, ovate-lanceolate, apex caudate ; pinnae 15 - 25 pairs, alternate, sessile, *ca* 2 cm apart, basal one to three pairs slightly reduced, basal pair deflexed ; largest pinna *ca* 10 x 2 cm, oblanceolate, apex acute or acuminate, base unequal, broadly cuneate to truncate on acroscopic side, rounded at basiscopic side, margin lobed two-third way to the costae ; lobes *ca* 6 x 3 mm, subfalcate, slightly oblique, apex subacute or rounded, margin entire, basal acroscopic lobe larger than the normal ones, the basal acroscopic lobe of the basal most pair of pinnae more or less free from the next adjacent lobe ; rachis

densely clothed by hairs above and below, grooved adaxially, abaxially rounded, costae slightly raised, flattened above, rounded below ; costules sparsely hairy on lower surface ; veins and costules slightly distinct ; veins free, simple and reaching the margin, upto 7 pairs, basal acroscopic vein reaching the base of sinus and basal basiscopic vein reaching the side of the sinus well above the base ; texture herbaceous ; lamina pale-green. Sori median on veins, round, light-violet when young, brown at mature ; indusia hairy, small. Spores tetrahedral (Pl. 165).

Fertile : Nov.- Feb.

Distrib : (a) Myanmar, Sri Lanka ; (b) South India and Northeast India.

Occur : Rare ; attached on rocks near streams and rivers. Bhairabkunda R. F., Darrang dist.1519.

Suborder : **ASPLENIINEAE**

ASPLENIACEAE Mett. ex Frank

Asplenium L.
Sp. Pl. 2. 1078. 1753.

The Asplenioid ferns are represented in India by *Asplenium* L., *Neottopteris* J. Sm., *Asplenidictyum* J. Sm., *Ceterachopsis* (J. Sm.) Ching and *Ceterach* Willd. Although the latter four genera have been merged with *Asplenium* (Copeland 1947) yet in many of the Indian works these have been treated as subgenera (Mehra & Bir 1964 ; Singh & Bir 1989).

Dixit (1984) has listed 50 species and 14 varieties of *Asplenium* for India while Singh & Bir (1989) have reported the occurance of 65 species, which account for nearly 10 - 12 percent of the total fern flora of India. In the present investigation seven species have been recorded for Assam.

Terrestrials or epiphytes. Rhizome erect or short creeping, scaly ; scales clathrate, usually hairs present. Stipes tufted, not articulate to rhizome, usually glabrous, rarely covered by scales. Lamina simple to variously compound, dimidiate or not ; veins usually free, forked, rarely anastomosing without included veinlets ; texture membranaceous to coriaceous. Sori linear, along one side of the veinlets ; indusia linear, glabrous, entire or fimbriate ; sporangia long stalked, annulus incomplete, vertical. Spores monolete, planoconvex or reniform, perispore present.

KEY TO SPECIES

1a. Lamina simple
  2a. Spores smooth ; fronds 8 - 15 cm wide ---------- --- --- ***nidus***
  2b. Spores spinulose ; fronds 4 - 6 cm wide ---------- --- --- ***phyllitides***
1b. Lamina pinnately compound
  3a. Fronds simple pinnate
    4a. Lateral pinnae 2 - 5 pairs, margin entire ---------- --- ---***finlaysonianum***
    4b. Lateral pinnae more than 5 pairs, margin otherwise
      5a. Rhizome long creeping ; stipes scattered ---------- --- --- ***unilaterale***
      5b. Rhizome erect ; stipes tufted
        6a. Scales bicolourous, margin sparsely hairy ; pinnae subacute or rounded ---------- ------ --- --- ***normale***
        6b. Scale uniform coloured, margin entire ; pinnae acuminate ----------***falcatum***
  3b. Fronds bipinnate ---------- --- --- --- ***nitidum***

Asplenium falcatum Lam. Encycl. 2. 306. 1786 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 479. 1880 ; Bedd. Handb. Ferns Brit. India, 150. 1883. *A. caudatum sensu* Bedd. Ferns South. India, t.

143. 1865. *A. polyodon* G. Forster, Prod. 80. 1786 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 218. t. 166. 1992.

Rhizome erect, *ca* 2 cm thick, densely covered by scales at apex ; scales *ca* 1 x 0.2 cm, lanceolate, apex acuminate, caudate at base, margin entire, dark-brown. Stipes *ca* 20 x 0.4 cm, tufted, erect, adaxially grooved, abaxially rounded, scaly at base, glabrous or sparsely scaly at above, greyish. Lamina *ca* 40 x 15 cm, lanceolate, simple pinnate, with an apical pinna similar to lateral ones, apex acuminate, base broadly cuneate ; pinnae upto 13 pairs, stalked, alternate or subopposite ; largest pinna *ca* 3 x 1 cm, lanceolate, often caudate, acuminate at apex, cuneate at base, usually base unequal by the slight excision of the basiscopic base, acroscopic base slightly auricled, margin irregularly biserrate ; rachis glabrous or fibrillose, grooved adaxially, brown ; vein distinct, very oblique, parallel, forked upto 5 times, reaching the margin ; texture coriaceous ; lamina pale-green, glabrous. Sori linear, on veins, more or less uniformly distributed ; indusia pale-brown, narrow, entire. Spores reniform, dark-brown (Pl. 166).

Fertile : May - July.

Distrib : (a) Sri Lanka, Bangladesh, Malay Peninsula, Australia, Africa, Polynesia ; (b) South India, Sikkim.

Occur : Rare ; on moist, shady forest floor. North Lakhimpur, Lakhimpur dist. 1803.

Uses : The plant is used for spleen enlargement, jaundice and malaria ; also for incontinence of urine (Ambasta 1986). Rhizome is used as anthelmintic (Jain 1991).

Asplenium finlaysonium Wall. ex. Hook. Icon. Pl. t. 937. 1854 ; Jamir & Rao, Ferns Nagaland, 281. 1988. *Hemidictyum finlaysonium* (Wall. ex Hook.) Moore, Index. Fil. 50. 1857 ; Bedd. Ferns Brit. India, t. 72. 1866 ; Handb. Ferns Brit. India, 195. t. 96. 1883.

Rhizome erect, stout, *ca* 0.5 cm thick, densely covered by scales ; scales *ca* 0.7 x 0.2 cm, linear-lanceolate, hair-tipped, entire, dark-brown. Stipes *ca* 10 - 25 x 0.6 cm, tufted, compressed, abaxially rounded, adaxially grooved, scaly at base, glabrous above. Lamina *ca* 10 - 25 x 7 - 12 cm, simple pinnate oblong, apex acuminate ; lateral pinnae 2 - 5 pairs with a single terminal pinna similar to lateral ones, opposite or subopposite, shortly stalked, largest pinnae *ca* 12 x 5 cm, ovate-lanceolate, broadest somewhat above the base, suddenly narrowed to an acuminate-caudate apex, gradually narrowed towards the base, margin entire or irregularly lobed ; veins subfalcate, diverging from an indistinct costa, dichotomous, free below, anastomosing towards the margin into very elongated subhexagonal areoles, terminal veinlets free or sometimes combined in arch near the margin, forming an intramarginal line ; rachis usually glabrous, green ; texture coriaceous, pinnae brownish-green when dry, glabrous. Sori linear, oblique, upto 2.5 cm long, originating at the centre but never extending to the margin ; indusia linear, narrow, margin entire. Spores oval or reniform (Pl. 167).

Fertile : Dec. - Feb.

Distrib : (a) Bangladesh, Malay Peninsula ; (b) Eastern Himalayas and Eastern India.

Occur : Rare ; on shady, moist rocks near streams in dense forest. North Lakhimpur, Lakhimpur dist. 1813.

Asplenium nidus L. Sp. Pl. 2. 1079. 1753 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 457. 1880 ; Dhir, Ferns N.W. Himalayas, 113. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 115. 1982 ; Jamir & Rao, Ferns Nagaland, 284. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S.India, 206 . t. 153. 1992. *Thamnopteris nidus* Presl, Epim. Bot. 68. 1849 ; Bedd. Ferns Brit. India, t. 197. 1866 ; Handb. Ferns Brit. India, 137. 1883.

Bird's nest fern (Eng.)

Epiphytes. Rhizome erect, short, stout, apex clothed with scales ; scales *ca* 1 x 0.4 cm, thin, clathrate, broad-acuminate, black, margin bearing numerous hair-like appendages. Stipes *ca* 5 x 0.7 cm, stout, dark to pale-brown, glabrous above, scaly at base ; lamina *ca* 70 - 150 x 8 - 15 cm, simple, lanceolate, gradually narrowed at both ends, glabrous ; midrib strongly raised on the upper surface, shining, dark-brown, texture coriaceous, veins nearly simple or 2 - forked ; almost parallel. Sori linear, borne along each veinlet on upper half of the lamina, nearly reaching margin from the midrib ; indusia linear, narrow, superficially attached at base, slightly curved, greenish-grey. Spores light-brown, translucent when fresh, opaque when old (Pl. 168 ; Ph.3).

Fertile : July - Oct.

Distrib : (a) China, Japan ; (b) throughout India in hilly regions.

Occur : Common in moist, dense forest. Sometimes grows on humous covered soil and on moss covered rock. Rowta forest, Darrang dist. 1880 ; Rani, Kamrup dist. 2163.

Uses : Used as depurative and sedative in Philippines (Dixit & Vohra 1984). The plant is used medicinally to cure sore and ulcer ; also eaten as vegetable (Jain 1991).

Note : The plant is highly variable in size of the frond. In the present gatherings a wide range in size of the fronds of plants has been observed. Holttum (1974a) has enumerated five varieties under the species *A. nidus* L. Dixit (1984) has listed two varieties *A. nidus* L. var. *acutifolium* Bir and *A. nidus* L. var. *phyllitides* (D. Don) Bir from India. Although no attempt has been made to recognise varieties in the present work, yet it appears from the variation observed in plants of the present gatherings that in addition to typical *nidus* other two varieties var. *acutifolium* and var. *phyllitides* are also occuring in Assam. The last variety has, however, been recognised as a species in the present account.

Asplenium nitidum Sw. Syn. Fil. 84. 280. 1806 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 483. 1880 ; Bedd. Handb. Ferns Brit. India, 157. 1883 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 227. t. 175. 1992. *A. nitidum* var. *obtusum* Bedd. Ferns South. India, t. 149. 1864.

Rhizome short creeping, *ca* 0.5 cm, clothed with scales ; scales ovate-lanceolate, *ca* 2.5 x 0.5 mm, dark-brown, acuminate, entire. Stipes *ca* 15 x 0.3 cm, firm, erect, dark-brown, rounded below, above grooved, glabrous. Lamina oblong-lanceolate *ca* 20 x 5 cm, acuminate, base cuneate, bipinnate ; pinnae numerous, lanceolate-deltoid, shortly stalked, opposite or alternate, *ca* 5 x 3 cm, pinnules upto 4 pairs, adnate, alternate, *ca* 1.5 x 0.8 cm, obovate, apex subacute or rounded, base cuneate, margin crenate, pale-green, glabrous ; rachis firm, grey, glabrous ; veins slightly raised above, slightly distinct below, flabellate, free. Sori median along the veins, short, not reaching the margin ; indusia pale-brown, entire. Spores elliptical, dark brown, perispore narrowly winged, exine smooth (Pl. 169).

Fertile : April - June.

Distrib : (a) Sri Lanka, Malay Peninsula, Malay Islands, S. Africa ; (b) Himalayas from Nepal to Assam, South India.

Occur : Not common, growing on shady marshy places. Haflong, North Cachar Hills dist. 1591 ; Nameri forest, Sonitpur dist. 1734.

Asplenium normale D. Don, Prod. Fl. Nepal, 7. 1825 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 477. 1880 ; Bedd. Handb. Ferns Brit. India, 144. 1883 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 115. 1982 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 217. t. 165. 1992.

Rhizome erect, *ca* 1.5 cm thick, apex covered with scales ; scales *ca* 8 x 0.5 mm, ovate-lanceolate, apex acuminate, glandular hair-tipped, margin sparsely hairy. Stipes *ca* 8 - 17 x 0.2 cm, tufted, abaxially rounded, adaxially grooved, glabrous, polished, dark-purple. Lamina *ca* 17 - 35 x 4 cm, simple pinnate, oblong-lanceolate, acute at apex ; base truncate or cordate ; lateral pinnae numerous, closely placed, subopposite, sessile, basal pair not reduced ; largest pinna *ca* 2 x 1 cm, oblong, apex rounded, basiscopic base slightly excised, acroscopic base truncate, sometimes slightly auricled, margin incised-crenate ; veins slightly distinct, free, forked once or twice, not reaching the margin ; texture subcoriaceous ; lamina dark-green, glabrous above and below. Sori 5 - 8 in each pinna, elliptic, in two rows, very various in directions ; indusia elliptic, attached along the veins at base, entire, pale-brown. Spores reniform (Pl. 170).

Fertile : Oct. - Dec.

Distrib : (a) Nepal, Bhutan, Sri Lanka ; (b) South India, Himalayas.

Occur : Common, on fully shaded forest floor. Nilachal hill, Guwahati, Kamrup dist. 1923 ; Barnadi forest, Darrang dist. 1711.

Asplenium phyllitides. D. Don, Prod. Fl. Nepal. 7. 1825 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 115. 1982 ; Jamir & Rao, Ferns Nagaland, 288.1988. *Thamnopteris phyllitides* (D.Don) Bedd. Ferns South. India, t. 123.1964. *T. nidus* var. *phyllitides* (D. Don) Bedd. Handb. Ferns Brit. India, 139. 1883. *A. nidus* var. *phyllitides* (D. Don) Bir, J. Indian Bot. Soc. 43. 567. 1964.

Epiphytes.Rhizome erect or semierect, apex densely scaly ; scales *ca* 1 x 0.4 cm, broad, acuminate at apex, thin, clathrate, margin hairy, dark-purplish. Stipes *ca* 3 x 0.4 cm, stout, scaly at base, glabrous above, dark-brown. Lamina *ca* 30 - 90 x 4 - 6 cm, simple, lanceolate, gradually narrowed towards both ends, apex acuminate or subacuminate, base decurrent, margin entire, veins indistinct above, slightly distinct below, simple or forked once, nearly parallel, connected by intramarginal vein cotinuously ; midrib prominently raised on upper surface, shining, pale-greenish ; texture coriaceous, glabrous. Sori linear, borne along each veinlets on upper half of the lamina, stretching above from the midrib, nearly reaching the margin ; indusia linear, narrow, entire, pale-brown. Spores translucent, light-brown, exine with long and slender spine-like protuberances (Pl. 171).

Fertile : Sept. - Oct.

Distrib : (a) Malay, Myanmar and Tropics of the World ; (b) Northeastern Himalayas, Andaman & Nicobar Islands.

Occur : Rare ; on tree trunks of moist forests. Jorabat, Kamrup dist. 724.

Note : This species is very similar to *Asplenium nidus* L. except for the size of the frond. Dixit (1984) has listed this species as a variety of *A. nidus* L. viz. var. *phyllitides* (D. Don) Bir.

Asplenium unilaterale Lam. Encycl. 2. 305. 1786 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 481. 1880 ; Bedd. Handb. Ferns Brit. India, 152. 1883 ; Dhir, Ferns N.W. Himalayas, 109. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 116. 1982 ; Jamir & Rao, Ferns Nagaland, 292. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 212. t. 160. 1992. *A. resectum* J. Sm. Ic. Pl. 3. t. 72. 1791 ; Bedd. Ferns South. India, t. 132. 1864.

Rhizome wide creeping, *ca* 0.5 cm thick, slender, clothed with scales ; scales *ca* 0.3 x 0.1 cm, narrow lanceolate, apex acuminate, hair-tipped, margin entire, thin, dark-brown. Stipes scattered, *ca* 12 - 28 x 0.1 - 0.3 cm, abaxially rounded, adaxially grooved, scaly at base, glossy and glabrous above, brown. Lamina *ca* 15 - 40 x 4 - 7 cm, oblong-lanceolate, simple pinnate, apex acuminate,

base truncate ; pinnae numerous, shortly stalked, alternate to subopposite, upto 1 - 2 cm apart, basal two to four pairs of pinnae slightly reduced, usually somewhat deflexed ; largest pinnae *ca* 2 - 4 x 1 - 1.5 cm, trapezoid, acroscopic base broady cuneate or subtruncate, two- third part of the basiscopic base excised, apex obtuse or rounded, upper margin and distal part of the lower margin incised, creanate or dentate ; veins distinct on the both surfaces, free, forked once or twice, rarely simple ; rachis similar to stipe ; texture herbaceous ; lamina green, glabrous. Sori upto 0.5 cm long, linear, median, close to costule ; indusia thin, entire, pale-brown ; sporangia stalked. Spores spherical, dark, winged (Pl. 172).

Fertile : May- Dec.

Distrib : Sri Lanka, Myanmar, Indo-China, Malay Peninsula, China, Taiwan, Japan, Philippines, Malay Islands, Polynesia, Hawaii, East Africa ; (b) Himalayas.

Occur : Common at certain places on moist, moss covered floor inside dense forest. Garampani forest, Golaghat dist. 1672.

Suborder : **ASPIDIINEAE**
ATHYRIACEAE Ching

Terrestrials, rarely epiphytes. Rhizome short, erect or rarely creeping, scaly ; scales never clathrate. Stipes stout, flattened at base, sometimes ridges. Lamina simple to variously compound, thin ; veins free, forked, rarely anastomosing without included veinlets ; rachis and costae grooved above, interrupted and enlarged at the joints with their meeting place. Sori oblong to linear, single or double, more or less curved and flat or circular with indusia of similar shape ; sporangia globose ; annulus of 10 - 20 thickened cells. Spores bilateral, exine smooth or granulose to rugolose.

KEY TO GENERA

1a. Sori globose ; indusia small
  2a. Stipe scaly at base but glabrous above ; sori at the vein forking --- --- --- ***Dryoathyrium***
  2b. Stipe sparsely covered by scales and multicellular hairs all over ; sori not at the forking ---------- --- --- --- ***Acystopteris***
1b. Sori elongate ; indusia conspicuous
  3a. Rachis groove hairy ; spine like appendages present on the upper surface at the base of costae and costules
    4a. Indusia linear, margin fimbriate ---------- --- --- ***Athyriopsis***
    4b. Indusia reniform, U-shaped, J-shaped, margin not fimbriate --- ---- --- --- ---***Athyrium***
  3b. Rachis groove glabrous ; spine like appendages absent on costae and costules ---------- --- --- ***Diplazium***

Acystopteris Nakai
Bot. Mag. Tokyo, 47. 180.1933

The lone species *Acystopteris tenuisecta* listed by Dixit (1984 ; Dixit & Vohra 1984) under the genus for India has been recorded in the present study.

Acystopteris tenuisecta (Bl.) Tagawa, Acta Phytotax.Geobot. 7. 73. 1938. *Aspidium tenuisectum* Bl. Enum. Pl. Jav. 170. 1828. *Cystopteris setosa* (Bedd.) Bedd. Ferns Brit. India, t. 312. 1866 ; Handb. Ferns Brit. India, 71.1883. *Lastrea setosa* Bedd. Ferns Brit. India, t. 262. 1866 (*non* Presl. 1848, *non* Moore 1858).

Rhizome erect, *ca* 1 cm thick, stout, densely scaly ; scales *ca* 2 x 0.4 mm, narrow, flaccid, subulate, light-brown. Stipes *ca* 30 x 1 cm, sparsely covered with scales and hairs, grooved above, base light-brown, greenish above. Lamina *ca* 50 - 75 x 30 - 45 cm, quadripinnatifid at base, bipinnate at apex,

ovate, ovato-oblong or deltoid, apex acuminate ; primary pinnae numerous, opposite or subopposite, largest pinna *ca* 15 - 22 x 6 - 15 cm, linear-lanceolate to oblong, apex acuminate, lowest pair of primary pinnae as long as the central ones and gradually decreasing in size towards the apex ; secondary pinnae upto 18 pairs, alternate or subopposite, sessile, basal pair sometimes slightly reduced, largest secondary pinna *ca* 3 - 7 x 1.5 - 2.5 cm, linear-lanceolate or oblong, apex acute ; pinnules *ca* 1 - 1.5 x 0.5 cm, sessile,opposite, elliptic or ovate, apex round, base decurrent, margin deeply lobed nearly to the rachis ; lobes *ca* 5 x 2 mm, ovate, apex obtuse or rounded, base broad, margin variously toothed ; rachises and costae scaly on both sides ; costules and veins hairy ; veins distinct, forked and simple, reaching the margin ; texture membranous ; lamina dark-green ; furnished on both sides sparingly with long, weak, shining hairs or nearly glabrous. Sori circular, one or more on each segment and medial on vein ; indusia membranous, small, scale like, ovate or oblong, glabrous ; sporangia shortly stalked (Pl. 173).

Fertile : Mar. - Dec.

Distrib : (a) China, Japan, Indo-China, Java ; (b) Sikkim.

Occur : Rarely occur in moist and shady places. Kurua, Darrang dist. 835 ; Mandakata, Kamrup dist. 1190.

Athyriopsis Ching
Acta Phytotax. Sin. 9. 63. 1964.

The lone species *Athyriopsis japonica* listed under the genus *Athyriopsis* by Dixit (1984 ; Dixit & Vohra 1984) for India has been recorded in the present investigation.

Athyriopsis japonica (Thunb.) Ching, Acta Phytotax. Sin. 9. 63. 1964 ; Jamir & Rao, Ferns Nagaland, 304. 1988. *Asplenium japonicum* Thunb. Fl. Jap. 334. 1784. *Diplazium japonicum* (Thunb.) Bedd. Ferns Brit. India Suppl. 12. 1876 ; Handb. Ferns Brit. India,180. 1883. *D. decussatum* Bedd. Ferns Brit. India, t. 292. 1866. *Athyrium japonicum* (Thunb.) Copel. Philip. Journ. Sc. 3C. 290. 1908 ; Dhir, Ferns N.W. Himalayas, 91. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 138. 1982. *Deparia petersonii* (Kunze) M. Kato, Bot. Mag. Tokyo, 96. 1977 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats- S. India, 239. t. 186. 1992.

Rhizome creeping, *ca* 0.5 cm thick, densely scaly ; scales *ca* 1 x 0.2 cm, linear-lanceolate, apex acuminate, margin entire, thin, dark-brown. Stipes *ca* 10 - 30 x 0.3 cm, abaxially rounded, adaxially grooved, scaly at base, pubescent or glabrous above, dark-brown at base, pale-brown above. Lamina *ca* 15 - 40 x 10 - 20 cm, simple pinnate, lanceolate, apex caudate, lateral pinnae upto 15 pairs, alternate or subopposite, sessile or shortly petiolate, slightly ascending, basal pair not reduced, largest one *ca* 15 x 5 cm, lanceolate, apex acuminate, base broadly cuneate, margin deeply cut down almost to the costa ; lobes *ca* 2.5 x 0.6 cm, oblong, slightly oblique, apex subacute or rounded, margin serrate at the apex, entire in the rest ; veins slightly distinct, free, simple or forked once, reaching the margin, costa slightly raised above and below ; rachis, costa and veins with crisped hairy ; texture herbaceous ; lamina pale-green. Sori median on veins, linear, upto 0.4 cm long, single or double, 3 - 5 pairs in each lobe ; indusia linear, margin fimbriate, brownish. Spores globose to oval, pale-brown, exine spinulose (Pl. 174).

Fertile : July - Dec.

Distrib : (a) Sri Lanka, China, Japan, Polynesia, Malay Peninsula ; (b) throughout India in mountainous regions.

Occur : Common, along shady places of forest and along roadsides. Haflong, North Cachar Hills dist. 1584 ; Diphu, Karbi-Anglong dist. 1331.

Note : The generic and specific position of this taxon is not unanimous and it has been included under different genera like *Athyrium, Diplazium, Lunathyrium* and *Deparia* by different workers.

Athyrium Roth.
Tent. Fil. Germ. 3. 31,58. 1799.

Dixit (1984) has listed 36 species and three varieties of *Athyrium* for India and out of these, only one species has been recorded in the present investigation.

Athyrium puncticaule (Bl.) Moore, Ind. Fil. 186. 1860 ; Dhir, Ferns N.W. Himalayas, 88. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 139. 1982 ; Jamir & Rao, Ferns Nagaland, 300. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 234. t. 180. 1992. *Aspidium puncticaule* Bl. Enum. Pl. Jav. 159. 1828. *Athyrium macrocarpum* (Bl.) Bedd. Ferns South. India, t. 152, 153. 1864 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 488. 1880.

Rhizome erect, *ca* 2.5 cm thick, scaly at apex ; scales *ca* 4 x 0.5 mm. linear-lanceolate, thin membranceous, apex acuminate, entire, light-brown. Stipes *ca* 10 - 20 x 0.2 - 0.4 cm, tufted, rounded below, grooved above, scaly at base, glabrous above, stramineous. Lamina *ca* 20 - 40 x 7 - 18 cm, bipinnatifid at base, pinnatifid apex, oblanceolate, apex acuminate ; lateral pinnae upto 20 pairs, alternate, stalked, few pairs of basal pinnae somewhat reduced, largest one *ca* 5 x 2 cm, oblong-lanceolate, apex acute, base broadly cuneate, auricled at the base on acroscopic side, margin deeply lobed nearly to the costa ; lobes slightly oblique, oblong, apex acute, margin entire or finely serrate ; veins distinct below, free, forked once or twice ; rachises and costae bear few scales and hairs below ; texture herbaceous, lamina dark-green, glabrous. Sori medial on veins, reniform ; indusia thin, membranous, reniform, margin wavy, pale-brown ; sporangia shortly stalked. Spores oval, reniform or planoconvex, yellowish green ; exine tuberculate (Pl. 175).

Fertile : July - Oct.

Distrib : (a) Sri Lanka, Tonkin, Java ; (b) Northeast India and South India.

Occur : Rare ; in open and shady places of forest. Darranga, Nalbari dist. 1293.

Diplazium Sw.
Schrad. Journ. Bot. 1800 (2). 4, 61. 1801.

In India 29 species and two varieties under the genus *Diplazium* have been listed (Dixit 1984). Of these, seven species have been recorded in the present investigation in addition to *D. bentamense* Bl., which is not listed by Dixit (1984).

Terrestrials. Rhizome usually short, erect or sometimes creeping, scaly ; scales linear to ovate, entire or toothed. Stipes scaly at base, smooth or muricate above. Lamina simple to variously pinnate ; veins usually free, forked, rarely anastomosing without included veinlets, rachis and costae grooved above ; texture herbaceous to subcoriaceous, glabrous. Sori linear along the veins, oblique to the costae, the lowest acroscopic sorus usually diplazoid and occasionally other sori also double ; indusia linear, entire or crenate. Spores bilateral.

KEY TO SPECIES

1a. Veins anastomosing ---------- --- --- ***esculentum***
1b. Veins free
  2a. Lamina simple pinnate
    3a. Pinnae more or less shallowly lobed ---------- --- --- ***lobulosum***

3b. Pinnae entire or serrate
4a. Apical pinna simple, margin of the pinnae entire --- --- --- ***bentamense***
4b. Apical pinna pinnatifid, margin of the pinnae sharply serrate ---------- --- --- ***pinnatifido-pinnatum***
2b. Lamina more than once pinnate
5a. Rhizome erect
6a. Indusia entire ; stipes glabrous ---------- --- --- ***dilatatum***
6b. Indusia fimbriate ; stipes muricate ---------- --- --- ***polypodioides***
5b. Rhizome creeping
7a. Costa scaly beneath ; texture subcoriaceous ---------- --- --- ***muricatum***
7b. Costa glabrous ; texture herbaceous ---------- --- --- --- ***spectabile***

Diplazium bentamense Bl. Enum. Pl. Jav. 191. 1828 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 497. 1880 ; Bedd. Handb. Ferns Brit. India, 177. t. 86. 1883 ; Jamir & Rao, Ferns Nagaland, 308. 1988. *Athyrium bentamense* (Bl.) Milde, Bot. Zeit. 353. 1870 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 138. 1982.

Rhizome short creeping, forming suberect large caudex, scaly ; scales *ca* 1 x 0.2 cm, linear-lanceolate, apex long acuminate, margin hooked, dark-brown. Stipes *ca* 20 - 50 x 0.3 - 0.6 cm, scaly and blackish-brown at base, glabrous and pale-brown above, abaxially rounded, adaxially grooved. Lamina *ca* 25 - 60 x 15 - 25 cm simple pinnate, with a single apical pinna similar to lateral ones ; lateral pinnae 3 - 7 pairs, subopposite, or alternate, shortly stalked, lowest pair somewhat reduced ; largest one *ca* 15 - 22 x 3 - 5 cm, lanceolate, apex acuminate or caudate, base narrow, slightly unequal on the lower side, rounded, margin entire ; veins distinct on both surfaces, free, forked near or at the costa ; rachis glabrous, brownish, costae distinctly raised above and below, grooved above, rounded below ; texture coriaceous ; lamina greenish, glabrous. Sori linear, confluent, irregular, starting from near the costa, extending nearly to the margin or only half way ; indusia linear, margin entire, persistent. Spores brown, hyaline (Pl. 176).

Fertile : July - Feb.

Distrib : Malay, China ; (b) Northeast India.

Occur : Rare ; on moist, shady forest floor near streams. Digboi, Tinsukia dist. 659 ; Garampani forest, Golaghat dist. 1675.

Diplazium dilatatum Bl. Enum. Pl. Jav. 194. 1828 ; Bedd. Ferns South. India, t. 162. 1864 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 248. t. 193. 1992. *Athyrium latifolium* D. Don, Prodr. Fl. Nepal, 8. 1825 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1, 502. 1880 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 138. 1982 ; Jamir & Rao, Ferns Nagaland, 299. 1988. *Diplazium latifolium* (D. Don) Moore, Ind. Fil. 144. 1859 ; Bedd. Handb. Ferns Brit. India, 187. 1883 (*pro parte*) ; Dhir, Ferns N.W. Himalayas, 95. 1980.

Rhizome erect, *ca* 4 cm thick, stout, apex densely clothed with scales ; scales *ca* 0.7 x 0.2 cm, linear-oblanceolate, apex acuminate, margin with many teeth, thin, dark-brown. Stipes *ca* 30 - 60 x 1 cm, tufted, scaly at base, glabrous above, abaxially rounded, adaxially grooved, dark-brown at the base, greyish brown in the rest. Lamina *ca* 40 - 70 x 10 - 30 cm, ovate, bipinnate or tripinnatifid ; primary pinnae 7 pairs, alternate, upto 7 cm apart, shortly stalked or sessile, slightly ascending, largest one *ca* 25 - 50 x 8 - 20 cm, deltoid-lanceolate, apex acuminate ; secondary pinnae upto 12 pairs, subopposite to alternate, upto 3 cm apart, shortly stalked, largest one *ca* 10 x 3 cm, oblong-lanceolate, apex acuminate, base truncate, margin more or less cut down to the costae ; lobes *ca* 1.5 x 1 cm, oblong, apex rounded, margin finely crenate or serrate ; veins pinnate,

simple or forked once, reaching the margin, their number depending on the size of the segments ; costae slightly raised above, and below ; texture herbaceous ; lamina dark-green above, pale-green below, glabrous. Sori linear, confluent, upto 0.7 cm long, basal acroscopic diplazoid ; indusia linear, entire, pale-brown ; sporangia slender stalked. Spores oval, pale-brown, exine smooth (Pl. 177).

Fertile : Feb. - Dec.

Distrib : (a) China, Indo-China, Myanmar, Malay, Philippines, N. Australia ; (b) South and Northeast India.

Occur : Rare ; in moist, shady places of dense forest. Rowta forest, Darrang dist. 1872 ; Balipara, Sonitpur dist. 876.

Diplazium esculentum (Retz.) Sw. Schrad. Journ. Bot. 1801(1). 312. 1803 ; Dhir, Ferns N.W. Himalayas, 95. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 140. 1982 ; Jamir & Rao, Ferns Nagaland, 311. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 241.t.187. 1992. *Hemionitis esculenta* Retz. Obs. Bot. 6. 38. 1791. *Anisogonium esculentum* (Retz.) Presl Tent. Pterid. 116. 1836 ; Bedd. Handb. Ferns Brit. India, 192. 1883. *Callipteris esculenta* (Retz.) J. Sm. *apud* Houlst & Moore in Gard. Mag. Bot. 3. 265. 1851 ; Bedd. Ferns South. India, t. 164. 1864.

Rhizome erect, *ca* 4 cm thick, apex densely covered by scales ; scales *ca* 1 x 0.1 cm, linear-lanceolate, apex long acuminate, margin finely toothed, dark-brown. Stipes *ca* 30 - 60 x 0.5 - 1 cm, stout, erect, sparsely scaly at base, glabrous above, purplish glands scattered throughout the stipe and rachis, dark-brown at base, pale-brown above. Lamina *ca* 100 x 50 cm, bipinnate at base, simple pinnate at apex, rarely simply pinnate, deltoid, apex acuminate, base truncate, basal pair of pinnae slightly reduced ; pinnae upto seven pairs, basal one or two opposite or subopposite, others alternate ; largest pinnae *ca* 20 - 45 x 10 - 25 cm, petiolate, narrowly deltoid, with a deeply lobed terminal pinna, apex acuminate, truncate at base ; pinnules upto 15 pairs, alternate, *ca* 6 - 15 x 1.5 - 3 cm, varying in size and lobation, lowest one stalked shortly, others sessile, oblong-lanceolate, apex acuminate, base truncate and usually auricled either one or both sides at the base, margin serrate at apex, shallowly lobed or crenate in the rest ; lobes broadly deltoid, apex blunt, margin serrate ; rachis and costa glabrous or pubescent beneath with numerous hairs and scales ; costa slightly raised above and below, grooved above, flattened below ; veins fine, forked, copiously branched with distinct costules, veins in the unlobed part of the adjacent groups joining to form an irregular excurrent vein reaching the base of sinus ; texture herbaceous ; lamina dark-green, glabrous. Sori upto 8 mm long, linear, continuous along veins on both sides ; indusia linear, margin entire, pale-brown. Spores oval, dark, hyaline, exine finely granulose (Pl. 178).

Fertile : July - Feb.

Distrib : (a) China, Taiwan, Malaysia, Philippines, New Guniea, Samoa ; (b) throughout India.

Occur : Very common in moist, open places forming thickets. Kokrajhar, Kokrajhar dist. 1248 ; Kaziranga, Golaghat dist. 1103 ; Tangla, Darrang dist. 414.

Uses : Tender fronds are used as vegetable. Decoction prepared from rhizome and young leaves used for haemophyts and cough in Philippines (Ambasta 1986 ; Jain 1991 ; Manickam & Irudayaraj 1992). In Assam tender fronds are also sold in markets as vegetable (Ph. 24).

Note : In the same populations plants with simple pinnate and bipinnate fronds occur very

commonly. Likewise, the degree of the dissection of the fronds are also vary. Sledge (1962) has stated that such variations are due to age and also due to the influence of habitat.

Diplazium lobulosum (Wall. ex Mett.) Presl, Tent. Pterid. 114. 1836. Dhir, Ferns N.W. Himalayas, 93. 1980 ; *Asplenium lobulosum* Wall. ex Mett. Aspl. 163. n. 170. 1859. *Diplazium longifolium* (D. Don) Moore, Ind. Fil. 141. 332. 1859 ; Bedd. Ferns. Brit. India, t. 247. 1866 ; Handb. Ferns Brit. India, 179. t. 87. 1883. *Asplenium longifolium* D. Don, Prod. Fl. Nepal, 7. 1825 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 478. 1880.

Rhizome erect to suberect, *ca* 0.5 cm thick, densely scaly ; scales *ca* 0.5 x 0.1 cm, linear, apex acuminate, hair-tipped, margin entire, thin, membraneous, pale-brown. Stipes tufted, *ca* 8 - 15 x 0.3 cm, scaly at base, glabrous above, abaxially flattened, adaxially grooved, stramineous. Lamina *ca* 12 x 30 - 5 x 10 cm, broad lanceolate, pinnate with pinnatifid, acuminate apex, lateral pinnae upto 12 pairs, subopposite to alternate, upto 3 cm apart, shortly stalked or sessile, largest one *ca* 3 - 7 x 1 - 2.5 cm, broad lanceolate, apex acute or sharply acuminate, truncate and auricled at the acroscopic base, basiscopic base excised, margin more or less lobed ; veins pinnate, simple, free ; costae slender, flexuose, vein-like ; rachis hairy ; texture membranaceous ; lamina pale-green, glabrous. Sori linear, asplenoid, usually on the lowest acroscopic veins, neither attaining costa nor the margin ; indusia linear, entire ; sporangia stalked (Pl. 179).

Fertile : Nov. - Feb.

Distrib : (a) Nepal ; (b) North West Himalayas.

Occur : Rare ; in shady, moist places of forest on moss covered rocks. Upper Haflong, North Cachar Hills dist. 1589.

Diplazium muricatum (Mett.) v.A.v. R. Malayn Ferns, 829. 1909 ; Jamir & Rao, Ferns Nagaland, 313. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S.India, 244. t.190. 1992. *Asplenium muricatum* Mett. Ann. Mus. Bot. Lugd. Bot. 2, 239. 1866. *Asplenium procerum* (Hook. *et* Bak.) Wall. ex Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 495. 1880. (*non A. procerum* Bernh. 1802). *Diplazium umbrosum* var. *australe* Bedd. Handb. Ferns Brit. India, 189. 1883. (*pro parte, non Allantodia australis* R. Br.). *D. umbrosum* var. *procerum* (Hook. *et* Bak.) Bedd. Handb. Ferns Brit. India, 189. 1883.

Rhizome short creeping, *ca* 1 cm thick, stout, scaly at base ; scales *ca* 4 x 1 mm, linear-lanceolate, acuminate at apex, margin toothed, dark-brown to blackish. Stipes *ca* 50 x 0.6 cm, erect or semierect, muricate, black at base, grey-brown above. Lamina *ca* 60 x 40 cm, bipinnate to tripinnatifid at base, apex simple pinnate, ovate, lateral primary pinnae upto 8 pairs, alternate or subopposite, petiolate, lowest pair largest, *ca* 30 x 15 cm, ovate, apex pinnatifid, acuminate, base truncate ; secondary pinnae upto 12 pairs, shortly stalked or sessile or decurrent, alternate, largest *ca* 10 x 3 cm, oblong-lanceolate, apex acuminate, truncate at base, margin serrate at apex, deeply lobed almost quite to the costule in the rest ; lobes *ca* 1.5 x 0.8 cm, oblong, slightly oblique, apex round with a tooth, margin crenate or toothed ; rachis similar to stipe, costa slightly raised, bearing soft, pale-brown scales beneath ; costules and veins slightly distinct ; veins upto 4 pairs, simple or forked once, reaching the margin ; texture subcoriaceous ; lamina dark-green. Sori upto 0.3 cm long, oblong, brown ; indusia thin, pale-brown, attached to the vein. Spores reniform (Pl. 180).

Fertile : Oct. - Dec.

Distrib : (a) Bhutan, Nepal, Myanmar, Thailand, Taiwan, Java ; (b)Himalayan region, Nagaland, South India.

Occur : Common in moist as well as in open sunny places. Dhaligaon, Bangaigaon dist. 1234 ; Pabitara forest, Marigaon dist. 483.

Diplazium pinnatifido-pinnatum (Hook.) Moore, Ind. Fil. 334.1861 ; Bedd. Ferns Brit. India, t. 244. 1866 ; Handb. Ferns Brit. India, 178.1883. *Asplenium pinnatifido-pinnatum* Hook. Sp. Fil. 3. 238.1860.

Rhizome erect, *ca* 3 cm thick, scaly ; scales *ca* 0.5 x 0.1 cm, linear-lanceolate, apex acuminate, base broad, margin toothed, dark-brown. Stipes *ca* 25 - 45 x 0.4 - 0.7 cm, scaly at base, glabrous above, abaxially rounded, adaxially grooved, pale-brown. Lamina *ca* 20 - 30 x 15 - 20 cm, simple pinnate with pinnatifid apex, broadly ovate, apex short acuminate ; lateral pinnae 3 - 4 pairs, opposite to subopposite, upto 5 cm apart, shortly stalked or sessile or adnate ; largest one *ca* 15 x 3 cm, lanceolate, apex acute or short acuminate, base cuneate, margin sharply serrate, veins indistinct above, distinct below, free, pinnate, costae distinctly raised below, not above ; texture coriaceous, lamina glabrous, dull blackish when dry. Sori linear, confluent, along the veins, begining from the costae, not reaching the margin, indusia linear, persistent pale-brown (Pl. 181).

Fertile : Nov. - Feb.

Distrib : (a) & (b) Throughout India.

Occur : Rare ; in dense shady forest. Nambar forest, Golaghat dist. 1641.

Diplazium polypodioides Bl. Enum. Pl. Jav. 194. 1828 ; Bedd. Ferns South. India, t. 163. 1864 ; Ferns Brit. India, t. 293. 1866 ; Handb. Ferns Brit. India, 184. t. 89. 1883 ; Dhir, Ferns N. W. Himalayas, 94. 1980 ; Jamir & Rao, Ferns Nagaland, 313. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 250. t. 195. 1992.

Rhizome erect, *ca* 1 cm thick, subarborescent, stout, densely scaly at the apex ; scales *ca* 1.5 x 0.2 cm, linear-lanceolate, apex acuminate, hair-tipped, fibrillose, dark-brown. Stipes *ca* 35 - 100 x 2 cm, tufted, stout, sparsely scaly at the base, muricate all over the surface,dark-brown to blackish at base, grey-brown above. Lamina *ca* 125 x 75 cm, broadly lanceolate, tripinnatifid ; primary pinnae upto 10 pairs, alternate, shortly stalked, largest one *ca* 30 x 15 cm, oblong-lanceolate, apex acuminate, base truncate, secondary pinnae upto 25 pairs, subopposite to alternate, sessile or shortly stalked, largest one *ca* 9 x 4 cm, delto-oblong, apex acuminate, base truncate, margin deeply lobed, almost reaching to the costae, lobes *ca* 8 x 4 mm, oblong, apex rounded, margin deeply toothed or serrate ; constules and veins slightly distinct, veins upto 8 pairs, generally forked, sometimes simple, reaching the margin ; costa slightly raised below, lower surface of costae and costules sparsely scaly ; texture thin, herbaceous ; lamina dark-green, glabrous. Sori upto 0.5 cm long, linear, oblique, in two rows on each lobe ; indusia thin, membranaceous, margin fimbriate brown, exine smooth (Pl. 182).

Fertile : July - Jan.

Distrib : (a) Sri Lanka, East Indies, Philippines ; (b) Northwest India, Northeast India and South India.

Occur : Not common, along fully and partially shaded stream banks of forest. Pabha forest, Lakhimpur dist. 1912 ; Sonai Rupai forest, Sonitpur dist. 879.

Uses : Fronds are edible and also used medicinally in piles (Jain 1991).

Diplazium spectabile (Wall. ex Mett.) Ching, Lingnan Sci. Journ. 15. 278. 1936 ; Dhir, Ferns N.W. Himalayas, 94. 1980 ; Jamir & Rao, Ferns Nagaland. 315. 1988. *Asplenium spectabile* Wall. ex Mett. Aspl. 196. no. 240. 1859. *Diplazium jerdoni* Bedd. Ferns Brit. India, t. 327. 1866.

Diplazium griffithii (Bak.) Bedd. Ferns Brit. India, t. 328. 1866. *Asplenium multicaudatum* Wall. ex Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 502. 1880. *Diplazium umbrosum* var. *multicaudatum* (Wall. ex Clarke) Bedd. Handb. Ferns Brit. India, 190. t. 1883.

Rhizome creeping, *ca* 1 cm thick, stout, densely scaly at the apex ; scales *ca* 0.6 x 0.1 cm, linear-lanceolate, apex acuminate, dark-brown. Stipes *ca* 50 x 1.5 cm, stout, abaxially rounded, adaxially grooved, scaly at base, muricate above, dark-brown. Lamina *ca* 50 - 100 x 25 - 60 cm, tripinnate, delto-lanceolate, apex acuminate ; primary pinnae *ca* 45 x 25 cm, deltoid to ovate-lanceolate, alternate, shortly stalked, apex acuminate, base truncate ; secondary pinnae numerous, alternate, subsessile, largest one *ca* 15 x 6 cm, oblong-lanceolate, apex acuminate, base truncate, pinnules numerous, opposite or subopposite, sessile, largest one *ca* 3 x 1.5 cm, oblong, obtuse or rounded at apex, margin deeply serrate ; veins slightly distinct, free, simple or forked once, reaching the margin ; rachis and costae pale-brown, glabrous ; costae distinctly raised above and below ; texture thin, herbaceous ; lamina pale-greenish, glabrous. Sori oblong or subquadrate, slightly oblique ; indusia pale-brown ; sporangia stalked (Pl. 183).

Fertile : Dec. - Feb.

Distrib : (a) Bangladesh, Nepal, Bhutan ; (b) Himalayas.

Occur : Rare ; on moist, shady places of dense forest. Harmati, Lakhimpur dist. 1805 ; Barnadi forest, Darrang dist. 1714.

Dryoathyrium Ching
Bull. Fan. Mém. Inst. Biol. Bot. 11. 79. 1941.

Only *Dryoathyrium boryanum* (Willd.) Ching, the type species of the genus, listed for India by Dixit (1984 ; Dixit & Vohra 1984) has been recorded from Assam in the present investigation.

The genus *Dryoathyrium* has been merged with the genus *Deparia* Hook. *et* Grev. along with *Lunathyrium* Koidz. and *Athyriopsis* Ching by Kato (1977).

Dryoathyrium boryanum (Willd.) Ching, Bull. Fan. Mém. Inst. Biol. Bot. 11. 81. 1941 ; Dhir, Ferns N.W. Himalayas, 92. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 140. 1982 ; Jamir & Rao, Ferns Nagaland, 303. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 230. t. 177. 1992. *Aspidium boryanum* Willd. in Linn. Sp. Pl. 5. 285. 1810. *Lastrea divisa* (Hook.) Bedd. Ferns South. India, t. 97. 1864. *Polypodium subtripinnatum* Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 545. 1880. *Lastrea boryana* (Willd.) Bedd. Handb. Ferns Brit. India, 266. 1883. *Phegopteris kingii* Bedd. Handb. Ferns Brit. India Suppl. 84. 1892.

Rhizome suberect, short, *ca* 5 cm thick, scaly at the apex ; scales *ca* 1.5 x 0.1 cm, lanceolate, hair pointed, entire, dark-brown. Stipes *ca* 50 - 90 x 0.5 - 1.5 cm, tufted, abaxially rounded, adaxially grooved, scaly at base, glabrous above, green, pale-brown when dry. Lamina *ca* 100 x 65 cm, deltoid, tripinnatifid ; primary pinnae numerous, subopposite to alternate, petiolate, lowest pair somewhat reduced, largest one *ca* 45 x 15 cm, broad-lanceolate, apex acuminate, base truncate ; pinnules upto 10 pairs, alternate ; largest pinnule *ca* 12 x 3 cm, sessile or subsessile, lanceolate, apex acuminate, base decurrent, margin deeply cut-down to the costa into lobes ; lobes *ca* 1.5 x 0.5 cm, oblong, margin serrate ; veins slightly distinct below, indistinct above, upto 6 pairs, forked once or twice, free, not reaching the margin ; rachis, costa and costules densely clothed with multicellular hairs ; texture herbaceous ; lamina dark-green. Sori round, born at the vein forking ; indusia thin, small, fugaceous, roundish to reniform, brown. Spores dark, exine papillate (Pl. 184).

Fertile : July - Feb.

Distrib : (a) East Africa to Tropical Asia ; (b) Himalayas, South India.

Occur : Rare ; grows in moist, shady places near rivers and streams. Haflong, North Cachar Hills dist. 1595.

ASPIDIACEAE Mett. ex Frank.

Terrestrials. Rhizome erect or short creeping, scaly. Stipes tufted, not articulate to rhizome, scaly. Lamina simple pinnate to tripinnate, multicellular hairs present on lamina ; veins free or variously anastomosing with or without included veinlets ; stipes and rachis grooved, costae and costules raised, but not grooved ; texture herbaceous to coriaceous. Sori round, superficial or terminal on veinlets ; indusia round to reniform, rarely exindusiate ; spores bilateral, with perispore.

KEY TO GENERA

1a. Sinus of each lobe of pinnae with an elevated tooth on the dorsal surface ---------- ***Pleocnemia***

1b. Sinus tooth absent

2a. Veins anastomosing ; areoles with included veinlets ---------- ***Tectaria***

2b. Veins usually free ; if anastomosing, areoles without included veinlets ---------- ***Ctenitopsis***

Ctenitopsis Ching ex Tard. *et* C. Chr.
Notul. Syst. Paris, 7. 86. 1938.

The genus *Ctenitopsis* has been erected by Ching (1938) to include species of *Tectaria* Cav. with free veins. Holttum (1983, 1985) and others rejected the genus *Ctenitopsis*. Pichi-Sermolli (1977) also recognised the genus following Ching (*loc. cit.*). Dixit (1984) has followed Ching and listed four species under the genus for India. In the present investigation only one species has been recorded in Assam.

Ctenitopsis fuscipes (Wall. ex Bedd.) Ching, Bull. Fan. Mém. Inst. Biol. Bot. 8. 313. 1938 ; Jamir & Rao, Ferns Nagaland, 357. 1988. *Aspidium fuscipes* Wall. Cat. No. 361. (*ex-parte*), 1827. (*nom. nud.*) ex. Bedd. Ferns Brit. India Suppl. 15. t. 366. 1876. *Lastrea fuscipes* Moore, Ind. Fil. 82. 1858 ; Bedd. Handb. Ferns Brit. India, 243. 1883. (*pro prarte*). *Nephrodium membranifolium* Hook. Sp. Fil. 131. t. 261. 1862 (*pro parte*) ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 534 t. 75A. 1880. *Aspidium membranifolium* Bedd. Handb. Ferns Brit. India, 225. 1883. Suppl. 48. 1892 (excl. *syn.*). *Tectaria paradoxa* (Fée) Sledge in Kew Bull. 27. 413. 1973 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 135. 1982.

Rhizome erect, short, stout. Stipes *ca* 30 - 60 cm long, tufted, stramineous, dark-brown, covered with scales ; scales *ca* 1 x 0.2 cm, linear-lanceolate, apex acuminate, black. Lamina *ca* 30 - 45 x 15 - 25 cm, bipinnate at base, pinnatifid at apex, deltoid-ovate, lateral pinnae 10 - 15 pairs, opposite to subopposite, sessile or shortly petiolate, margin of pinnae deeply lobed near to the costae ; lowest basal pair of pinnae much larger, *ca* 10 - 30 x 7 - 15 cm, broadly deltoid-ovate, the first basiscopic lobe enlarged, apical part of the lamina deeply pinnatifid with a decurrent base, the segnents *ca* 1 cm wide, obtuse or round at apex, margin entire or bluntly lobed ; texture herbaceous, upper surface of lamina hairy ; fertile lamina more contracted ; rachis, costae densely short hairy, brownish ; veins free or forked, often forming a few areoles without included veinlets ; each basiscopic veinlets arising from the costa. Sori irregularly scattered throughout the segments, generally terminating on the free veinlets ; indusia reniform, suborbicular, margin undulating, glabrous, attached above at base ; sporangia stalked (Pl. 185).

Fertile : Oct. - Nov.

Distrib : (a) Sri Lanka, Myanmar, Vietnam, China, Taiwan ; (b) Sikkim, Meghalaya, Nagaland.

Occur : Common in moist, shady forest. Bhairabkunda RF, Darrang dist. 1536 ; Haflong hills, North Cachar Hills dist. 1600 ; Sonapur, Kamrup dist. 732.

Pleocnemia Presl
Tent. Pterid. 183. t.7(12). 1836.

The lone species under *Pleocnemia* listed for India by Dixit (1984 ; Dixit & Vohra 1984) has been recorded in the present study in Assam.

Pleocnemia winitii Holtt. Reinw. 1. 1951. *P. leuzeana sensu* Bedd. Ferns Brit. India, t. 134. 1866 ; Handb. Ferns Brit. India, 228. 1883 (descr. *pro parte*, excl. t. 117).

Rhizome large, subarborescent, apex densely scaly ; scales *ca* 2.5 x 0.2 cm, lanceolate, apex acuminate, shining, deep brown. Stipes *ca* 50 - 90 x 0.5 - 0.8 cm, stout, abaxially rounded, adaxially grooved, shortly hirsute without scales, upper surface stramineous, below dark-brown. Lamina *ca* 120 x 90 cm, bi- or tripinnate, subdeltoid, apex acuminate ; primary pinnae upto 15 pairs, alternate to subopposite, stalked, basalmost pair largest with one or two accessory branches on the basal basiscopic side, largest primary pinna *ca* 30 - 45 x 15 - 22 cm, oblong-lanceolate, apex acuminate, secondary pinnae upto 20 pairs, alternate, shortly stalked, largest one *ca* 8 - 10 x 1 - 2.5 cm, oblanceolate, apex acuminate, base truncate, margin cut down half way or more to the costules into lobes ; lobes *ca* 0.6 cm wide, oblong, slightly oblique, apex acute or rounded, margin denticulate, sinuses with one or a few teeth ; lower veins anastomosing in costal arches near the costa of the pinnules and along the midrib of the segments, other veins free and excurrent ; rachis similar to stipe ; costa distinctly hairy above, sparsely below ; costules and veins bearing yellowish glandular hair beneath ; texture subcoriaceous ; lamina brown olivaceous, glabrous. Sori medial on veins, usually in single row on each side of the costules of the lobes, mixed with yellow glandular hairs ; sporangia stalked. Spores globose (Pl. 186).

Fertile : Dec. - Feb.

Distrib : (a) Thailand, Annam, China ; (b) Assam.

Occur : Rare ; on shady, moist dense forest. Garampani forest, Golaghat dist. 1677.

Tectaria Cav.
Anal. Hist. Nat. 1(2). 115. 1799.

Dixit (1984) has listed 21 species and a variety of *Tectaria* for India. Of these, six species and *T. devexa*, not listed by Dixit (1984), have been recorded for Assam in the present study.

Terrestrials. Rhizome erect or short creeping, stout ; scales narrow, dark-brown, margin usually fimbriate.Stipes tufted or clustered , not articulate to rhizome, adaxially grooved, scaly at base. Lamina simple pinnate to bipinnate, basal pinnae larger ; veins irregularly anastomosing with included veinlets. Usually stipe, rachis and costae covered with ctenitis hairs on upper side, texture thin, herbaceous to coriaceous. Sori round, oval to elongate, borne on veinlets, irregularly scattered all over the ventral surface of lamina ; indusiate or exindusiate, indusia reniform. Spores bilateral, with perispore.

KEY TO SPECIES

1a. Stipes broadly winged ---------- --- ***vasta***

1b. Stipes not winged

2a. Lamina simple pinnate, pinnae broad entire

3a. Basal pair of pinnae biforked at lower base ; fertile pinnae not contracted ---------- --- ***polymorpha***

3b. Basal pair of pinnae not biforked ; fertile pinnae contracted --- ---- --- --- ***wightii***

2b. Lamina bipinnate or bipinntifid ; pinnae apparently small, margin deeply cut

4a. Veins anastomosing in central and costular areoles ---------- ***devexa***

4b. Veins copiously anastomosing

5a. Lamina densely hairy on both surfaces ---------- ----- --- ***coadunata***

5b. Lamina sparsely hairy on upper surface, glabrous below

6a. Costal and costular areoles with included free veinlts --- --- --- ***variolosa***

6b. Costal and costular areoles devoid of free veinlets --- --- ---***macrodonta***

Tectaria coadunata (Wall. ex Hook. *et* Grev.) C. Chr. in Contr. U.S. Nat. Herb. 26. 331. 1931 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 260. t. 200. 1992. *Aspidium coadunatum* Wall. ex Hook. *et* Grev. Icon. Fil. 2. 202. 1831 (*non* Kaulf. 1824). *Sagenia gigantea* Bedd. Ferns South. India, 28. t. 80. 1864. *S. coadunata sensu* Bedd. Ferns South India, 28 t. 81. 1864. *S. variolosa* Bedd. Ferns Brit. India, t. 170. 1866. *Nephrodium cicutarium* Hook. *et* Bak. Syn. Fil. 299. 1874 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 539. 1880. *N. cicutarium* var. *coadunatum* Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 540. 1880.

Rhizome short creeping, *ca* 1 cm thick, stout, apex covered by scales ; scales *ca* 8 x 2 mm, ovate-lanceolate, acuminate at apex, margin ciliated, brown. Stipes *ca* 50 x 0.5 cm, adaxially grooved, abaxially rounded, glossy, glabrous, greyish-brown. Lamina *ca* 30 x 40 cm, broadly ovate, apex acute, cordate at base, bipinnate or bipinnatifid, distinct primary pinnae three to five pairs, one-third distal part of lamina with three to five adnate pinnae ; primary pinnae opposite or subopposite, basalmost pair largest, *ca* 25 x 17 cm, ovate, apex acuminate, base broadly cuneate, shortly stalked ; secondary pinnae upto 5 pairs, alternate, adnate and decurrent, basal basiscopic pinna of basalmost pair is the largest one, *ca* 8 x 3.5 cm, oblong-lanceolate, apex acute, margin crenate at the distal pairs ; basal pairs lobed three-fifth way to the costae ; lobes oblong, 1.5 x 1 cm, apex rounded, margin entire or subcrenate, costa distinct above and below ; veins distinct below, copiously anastomosing to form a series of elongated areoles with free, simple or forked veinlets, areoles along the main costa do not extend from one costule to other ; texture soft, herbaceous ; lamina pale-green, hairs densely distributed all over the lamina. Sori in two rows near the margin, terminal on vein within long areole, orbicular, *ca* 1.5 mm in diameter ; indusia glabrous, dark-brown. Spores reniform, pale-brown. (Pl. 187).

Fertile : May - Dec.

Distrib : (a) Sri Lanka, Myanmar, Malay ; (b) South India and Eastern India.

Occur : Rare ; along fully or partially shaded roadsides inside forest. Rowta forest, Darrang dist. 1886 ; North Lakhimpur, Lakhimpur dist. 1811.

Uses : The young fronds are eaten as vegetable curry or as salad ; extract from fresh rhizomes used for preventing diarrhoea of children in Darjeeling dist. (Dixit & Vohra 1984 ; Jain 1991).

Tectaria devexa (Kunze) Copel. Philip. J. Sci. 20. 415. 1907 ; Jamir & Rao, Ferns Nagaland, 358. 1988. *Aspidium devexum* Kunze, Bot. Zeit. 259. 1848. *Sagenia gigantea* var. *minor* Bedd. Ferns South. India, t. 243. 1864. *Pleocnemia membranacea* Bedd. Ferns Brit. India Suppl. 15. 1876 ; Handb. Ferns Brit. India, 225. 1883.

Rhizome erect, or semierect, *ca* 1 cm thick, densely clothed with scales ; scales *ca* 0.8 x 0.2 cm,

linear-lanceolate, hair-tipped, glossy, dark-brown. Stipes *ca* 10 - 30 x 0.5 cm, tufted, abaxially rounded, adaxially grooved, densely covered by scales at base, sparsely above, dark to pale-brown. Lamina *ca* 20 - 35 x 10 - 20 cm, deltoid, bipinnatifid at base, pinnatifid above ; lower pinnae 2 - 5 pairs, alternate or subopposite, petiolate, upper ones sessile to adnate, basal basiscopic pinnae of the basalmost pair of the primary pinnae is the larget one, largest pinnae *ca* 15 x 7 cm, deltoid, apex short acuminate, base truncate, margin lobed $^2/_3$ way to the costae ; lobes *ca* 1 cm wide, slightly oblique, margin shallowly crenate ; lower veins forming a regular row of costal areoles, other veins free, forked or simple ; rachis and costae densely covered by ctenitis hairs on the upper surface, more sparsely beneath ; texture membranaceous ; lamina brownish-green when dry ; upper surface somewhat hairy towards the margin ; fertile lamina similar to sterile one, but more or less contracted. Sori at the apex of free vein, globose, rather large, upto 0.2 cm wide, medial or submarginal ; indusia orbicular or reniform, margin ciliate ; sporangia with slender stalk. Spores brown (Pl. 188).

Fertile : May - Dec.

Distrb : (a) Sri Lanka, Java, Malay, Philippines, Polynesia, Thailand, Taiwan ; (b) Northeast India.

Occur : Common, in moist shady places inside forest. Harmati, Lakhimpur dist. 1807 ; Laokhowa, Nagaon dist. 514.

Tectaria macrodonta (Fée) C. Chr. Ind. Fil. Suppl. III. 181. 1934 ; Dhir, Ferns N.W. Himalayas, 75. 1980 ; Jamir & Rao, Ferns Nagaland, 362. 1988. *Sagenia macrodonta* Fée, Gen. Fil. 313. t. 24.A.f. 1. 1852. *Aspidium cicutarium* (L.) Sw. Schard. Journ. Bot. 1880. (2). 36. 1801 ; Bedd. Handb. Ferns Brit. India, 220. 1883.

Rhizome erect to suberect, short, *ca* 1 cm thick, densely scaly ; scales *ca* 0.8 x 0.2 cm, linear-lanceolate, apex acuminate, hair-tipped, dark-brown. Stipes tufted, *ca* 15 - 70 x 0.5 - 0.8 cm, abaxially rounded, adaxially grooved, scaly at base, glabrous above, brown. Lamina *ca* 20 - 65 x 15 - 40 cm, cordate to deltoid, bipinnate to tripinnate, apex pinnatifid, lateral pinnae 2 - 6 pairs, opposite or subopposite, basal 1 - 3 pairs shortly salked, others sessile or adnate ; basalmost pinnae largest, *ca* 10 - 40 x 8 - 2.5 cm, deltoid to oblong ; secondary pinnae *ca* 6 - 25 x 5 - 10 cm, shortly stalked or sessile ; opposite or subopposite, linear-oblong, apex bluntly acuminate, base truncate ; tertiary pinnae *ca* 8 x 3 cm, sessile or adnate, subopposite or alternate, oblong, apex blunt or rounded, margin entire to shallowly lobed ; main lateral veins conspicuous, others various and copiously netted with free included veinlets ; rachis similar to stipe, costae and costules puberulous or shortly hairy beneath ; texture thin, herbaceous, sparsely hairy or glabrous above, lamina dark-green. Sori rather large, globose, upto 0.2 cm wide, arranged in two rows between the main veins on the netted veins or at the tip of free veinlets ; indusia reniform, brown ; sporangia stalked (Pl. 189).

Fertile : May - July.

Distrib : (a)Tropics of the World ; (b) throughout India.

Occur : Common ; on moist, shady places. Haflong, North Cachar Hills dist. 1962 ; Mariani, Jorhat dist. 1269.

Uses : Fronds are used medicinally to treat asthma, bronchitis and strings of honey-bee (Jain 1991).

Tectaria polymorpha (Wall. ex Hook.) Copel. Philip. Journ. Sci. 2, C. 413. 1907 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 136. 1982 ; Jamir & Rao, Ferns Nagaland, 364. 1988. *Aspidium ploymorpha* Wall. ex Hook. Sp. Fil. 4, 54. 1862 ; Bedd. Ferns South. India, t. 116.

1864 ; Handb. Ferns Brit. India, 218. 1883. *Nephrodium polymorphum* Bak. in Hook. Syn. Fil. 297. 1867 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 537. 1880 (excl. vars.).

Rhizome suberect, densely covered by scales ; scales *ca* 1 x 0.2 cm, broad-lanceolate, acuminate, stiff, dark-brown. Stipes *ca* 70 x 0.5 cm, tufted, slender, scaly at base, glabrous above, grooved adaxially, abaxially rounded, yellowish or brown. Lamina *ca* 70 - 40 cm, deltoid-lanceolate, simple pinnate ; lateral pinnae upto 6 pairs, opposite or subopposite, sessile or shortly stalked, with an apical pinna similar to lateral ones but slightly larger ; basal pair of pinnae petiolate and usually biforked at basal basiscopic side ; largest lateral pinna *ca* 25 x 5 cm, oblong or elliptic, broadest at middle, gradually tapering both ends, suddenly acuminate at apex, unequal or slightly toothed ; fertile lamina slightly contracted or not ; rachis similar to stipes ; costae distinctly raised and rounded above and below, costules distinctly raised below, slightly raised above ; veins distinct, irregularly anastomosing with free, simple or forked veinlets ; texture firm, herbaceous ; lamina green, glabrous. Sori small, on the netted veins, round, scattered, usually in two irregular rows between the main veins ; indusia reniform, firm, persistent, entire, brownish ; sporangia long stalked. Spores oval, hyaline, yellow, exine smooth (Pl. 190).

Fertile : May - Dec.

Distrib : (a) Bangladesh, Myanmar, Sri Lanka, Malay Islands, Philippines ; (b) South, North west and Northeast India.

Occur : Common ; in moist, shady forest floor. Haflong hills, North Cachar Hills dist. 1996 ; Manas forest, Barpeta dist. 1229.

Uses : Plants are considered as anthelmintic (Dixit & Vohra 1984).

Tectaria variolosa (Wall. ex Hook.) C. Chr. in Contr. U.S. Nat. Herb. 26. 289. 1931 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 136. 1982 ; Jamir & Rao, Ferns Nagaland, 365. 1988. *Aspidium variolosum* Wall. ex Hook. Sp. Fil. 4. 51. 1862. Bedd. Ferns Brit. India Suppl. t. 365. 1876 ; Handb. Ferns Brit. India, 216. t. 111. 1883 ; Suppl. 45. 1892. *Aspidium zollingerianum* Bedd. Ferns Brit. India, t. 251. 1866.

Rhizome creeping to suberect, short, stout, covered with scales ; scales *ca* 0.7 x 0.1 cm, narrowly lanceolate, entire, shining, black. Stipe *ca* 25 - 45 cm long, tufted, slender, densely clothed with scales and hairs at base, above glabrous. Lamina *ca* 20 - 35 x 8 - 15 cm, bipinnate at base, pinnatifid at apex, deltoid, deeply lobed, more or less decurrent ; lateral pinnae 1 - 4 pairs, opposite or subopposite, petiolate ; basal pinnae *ca* 15 x 6 cm, obliquely deltoid-ovate, with basal basiscopic pinnule largest, pinnatifid upwards ; basal basiscopic pinnules *ca* 6 x 2 cm, lanceolate, base rounded, apex acuminate, margin deeply lobed ; lobes oblong, apex acute, crenulate, texture firm, herbaceous ; rachis, costae and costules covered with brown, septate hairs ; veins forked, free or occasionally united with acroscopic veinlet from adjacent costule. Fertile fronds usually narrower than sterile ones. Sori biseriate, large, rounded, marginal along the pinnule lobes, terminal on veinlets, often on the netted veins ; indusia reniform, round, attached at the base, persistent, peltate ; sporangia stalked (Pl. 191).

Fertile : May - July.

Distrib : (a) Myanmar, Malay Peninsula, Taiwan ; (b) Sikkim, West Bengal, Meghalaya, Nagaland.

Occur : Common, on moist shady forest. Sonapur, Kamrup dist. 726 ; Bhairabkunda R.F., Darrang dist. 1538 ; Silchar, Cachar dist. 1382.

Tectaria vasta (Bl.) Copel. Philip. Journ. Sci. 2 C. 411. 1907 ; Jamir & Rao, Ferns Nagaland, 366. 1988. *Aspidium vastum* Bl. Enum. Pl. Jav. 142. 1828 ; Bedd. Ferns Brit. India Suppl. 15. 1876 ; Handb. Ferns Brit. India, 212. t. 108. 1883. *Nephrodium vastum* Hook. *et* Bak. Syn. Fil. 296. 1874; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 536. 1880. *Sagenia alata* Bedd. Ferns Brit. India, t. 169. 1866.

Rhizome short creeping, *ca* 0.5 cm thick, massive, apex covered by scales ; scales *ca* 0.7 x 0.3 cm, broad lanceolate, apex acuminate, brown. Stipes *ca* 30 - 50 x 0.5 cm, stout, abaxially rounded, adaxially grooved, narrowly winged nearly to the base, wings *ca* 1 cm wide, scaly. Lamina *ca* 85 x 40 cm, cut down to a broadly winged rachis consisting of 3 - 6 pairs of lateral pinnae ; largest pinnae *ca* 40 x 8 cm, oblong-lanceolate, apex acuminate, base decurrent, margin usally entire, slightly undulate ; main veins prominent, nearly reaching the margin, connected by numerous cross veins forming 6 - 8 areoles between the costa and margin with free or netted included veinlets ; rachis grooved above, rounded and scaly below, dark-brown ; costae distinctly raised above and below, sparsely scaly beneath ; texture subcoriaceous ; lamina glabrous. Sori scattered on netted veins, round, large, *ca* 0.2 cm wide ; indusia reniform, persistent, brown ; sporangia long stalked (Pl. 192).

Fertile : Oct. - Feb.

Distrib : (a) Bangladesh, Malay Peninsula, Malay Islands ; (b) Eastern India.

Occur : Occasional, along stream banks of dense forest. Nambar forest, Golaghat dist. 1660.

Tectaria wightii (Clarke) Ching, Sin. 2. 28. 1931 ; Manickam & Irudayaraj, Pterid Fl. West. Ghats-S. India, 258. t. 199. 1992. *Nephrodium wightii* Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 538. 1880. *Aspidium polymorphum* var. *macrocarpum* Bedd. Ferns South. India, t. 117. 1864.

Rhizome creeping, *ca* 1.5 cm thick, densely clothed with scales ; scales *ca* 0.4 x 0.1 cm, lanceolate, apex acuminate, margin serrate. Stipes *ca* 50 x 0.5 cm, tufted, densely scaly at base, sparsely above, dark-brown at the base, stramineous above. Lamina *ca* 45 x 22 cm, ovate-lanceolate, simple pinnate with an apical pinna similar to lateral ones ; lateral pinnae upto 6 pairs, opposite or subopposite, sessile or shortly stalked, ascending largest one *ca* 16 x 6 cm, ovate-lanceolate, apex abruptly narrowed, acuminate, base cuneate, margin entire ; veins distinct, slightly raised below, copiously anastomosing forming areoles with simple or forked included veinlets ; costae slightly raised and rounded below, grooved above ; fertile lamina distinctly contracted than sterile ones, otherwise similar ; texture herbaceous ; lamina pale-green, glabrous. Sori numerous upto 2 mm wide, on the netted veins in two irregular rows on each side of the costule ; exindusiate ; sporangia shortly stalked. Spores ellipsoid to reniform, pale-brown, exine spinulose (Pl. 193).

Fertile : June - Dec.

Distrib : (a) Bhutan ; (b) South India.

Occur : Rare ; on moist, shady places of forest. Nambar forest, Golahgat dist. 1679.

PERANEMATACEAE (Presl) Ching

Peranema D. Don
Prod. Fl. Nepal, 12. 1825.

Of the two species listed under *Peranema* for India by Dixit (1984) only the type species, *P. cyatheoides* of the genus, has been recorded from Assam in the present study.

Peranema cyatheoides D. Don Prod. Fl. Nepal. 12. 1825 ; Bedd. Ferns South. India, t. 73. 1864 ; Handb. Ferns Brit. India, 22. 1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 433. 1880 ;

Dhir, Ferns N.W. Himalayas, 63. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 129. 1982; Jamir & Rao, Ferns Nagaland, 320. 1988.

Rhizome erect, large, *ca* 15 cm thick, densely covered by scales at the apex ; scales *ca* 3 x 0.5 cm, lanceolate, apex acuminate, base broad, margin entire, dark-brown. Stipes *ca* 30 - 60 x 0.5 - 1 cm, abaxially rounded, adaxially grooved, densely scaly, pale-brown. Lamina *ca* 40 - 90 x 30 - 60 cm, deltoid-ovate, tripinnate ; primary pinnae loosely placed, about 10 cm apart, alternate or subopposite, stalked, largest one *ca* 50 x 15 cm, ovate-lanceolate, apex acuminate, broadest at little above the base ; secondary pinnae *ca* 15 - 20 x 4 - 7 cm, deltoid-lanceolate, acuminate at apex, basiscopic side of secondary pinnae larger than those of acroscopic side ; tertiary pinnae *ca* 4 x 1.5 cm, oblong-ovate, sessile, obtuse at apex, decurrent at base, margin lobed nearly to the costules ; lobes *ca* 1 x 0.5 cm, oblong, apex obtuse, margin entire ; veins free, forked, rachis similar to stipe ; costae and costules hairy ; texture herbaceous ; lamina dark-green, both subfaces hairy. Sori globose, upto 1.5 mm wide, superficial on veinlets, shortly stalked, indusia globose, entire. Spores oval, brown, exine smooth (Pl. 194).

Fertile : Sept. - Nov.

Distrib : (a) Nepal, Bhutan, Taiwan ; (b) Himalayas.

Occur : Rare ; on shady, moist places near streams of dense forest. Bashistha, Kamrup dist. 537 ; Kumarikata, Nalbari dist. 1295.

DRYOPTERIDACEAE (Ching) Ching

Terrestrials. Rhizome erect to creeping, scaly. Stipe not articulate to rhizome, scaly and sometimes with hairs. Lamina variously compound ; veins free, simple or forked ; rachis grooved adaxially, rachis and costae scaly or glabrous ; texture herbaceous to coriaceous. Sori dorsal, superficial on veins ; indusia peltate to reniform , attached at base, sometimes absent ; sporangia stalked. Spores bilateral, perispore present.

KEY TO GENERA

1a. Indusia peltate, rarely absent ---------- --- --- ***Polystichum***
1b. Indusia orbicular-reniform
  2a. Rhizome suberect to erect ; lamina glabrous or hairy ---------- ***Dryopteris***
  2b. Rhizome creeping, lamina scaly ; rarely hairy ---------- --- ***Arachniodes***

Arachniodes Bl.

Enum. Pl. Jav. 2. 241. 1828.

Dixit(1984) has listed 10 species for India. Of these, only two species have been encounted in the present investigation.

Terrestrials. Rhizome creeping, covered with scales. Stipes scattered, stout, densely scaly at base, sparsely above. Lamina bipinnate to quadripinnatifid, anadromous ; lateral pinnae subopposite to alternate, petiolate ; lowest pair of pinnae largest ; pinnules usually rhomoid and aristate ; veins free, forked ; texture subcoriaceous. Sori dorsal, subterminal on veins ; indusia reniform or orbicular. Spores bilateral.

KEY TO SPECIES

1a. Lamina deltoid, tripinnate at base, bipinnate or bipinnatifid above --------- --- --- ---***aristata***
1b. Lamina ovate-lanceolate, bipinnate at base, pinnatifid at apex ---------- --- --- ***assamica***

Arachniodes aristata (Forst. f.) Tindale, Contr. N.S. Wales Nation. Herb. 3. 89. 1961 ; Dhir, Ferns N.W. Himalayas, 77.1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 124. 1982 ; Jamir & Rao, Ferns Nagaland, 336. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 274. t.211. 1992. *Polypodium aristatum* Forst. f. Prod. 82. 1786. *Lastrea aristata* Moore, Ind. Fil. 85. 1858 ; Bedd. Ferns South. India, t. 101. 1864 ; Handb. Ferns Brit. India, 229. 1883. *Aspidium aristatum* (Forst. f.) Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 511. 1880.

Rhizome long creeping, *ca* 1 cm thick, densely scaly ; scales *ca* 1 x 0.1 cm, linear-lanceolate, apex acuminate, base broad, margin entire, reddish-brown. Stipes *ca* 50 x 0.5 cm, scattered, rather stout, flattened and densely scaly below, sparsely above, pale-brown. Lamina *ca* 40 - 60 x 25 - 35 cm, deltoid, tripinnate at base, bipinnate or bipinnatifid above, apex acuminate, base broadly cuneate ; primary pinnae 5 - 8 pairs, alternate, stalked, lowest basal pair largest, *ca* 30 x 20 cm, ovate-lanceolate, apex acuminate, base truncate, secondary pinnae upto 15 pairs, alternate, shortly stalked, largest one *ca* 10 x 4 cm, ovate-lanceolate, apex acute, acroscopic base cuneate or truncate, basiscopic base cuneate ; pinnules *ca* 3 x 1 cm, oblong-ovate, sessile or adnate, base unequally cuneate, margin more or less lobed, apices of pinnules and lobes bearing long stiff spinules ; veins indistinct, free, forked ; main and secondary rachises more or less densely clothed with dark-brown scales above and below ; texture subcoriaceous ; lamina dark-green, glabrous. Sori apical on veinlets and well with the margin, rather large, reniform ; indusia reniform, fugacious, dark-brown ; sporangia long, slender stalked. Spores oval, dark-brown, exine papillate (Pl.195).

Fertile : July - Feb.

Distrib : (a) Myanmar, Sri Lanka, China, East Australia, Polynesia ; (b) South and Northeast India

Occur : Common, on fully shaded stream banks of forest. Haflong hills, North Cachar Hills dist. 1964 ; Nameri forest, Sonitpur dist. 1738.

Arachniodes assamica (Kuhn) Ohwi, Journ. Jap. Bot. 37. 76. 1962 ; Jamir & Rao, Ferns Nagaland, 337. 1988. *Aspidium assamicum* Kuhn, Linnaea, 36. 108. 1869. *A. aristatum* var. *assamica* (Kuhn) Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 511. 1880.

Rhizome short creeping, *ca* 0.6 cm thick, stout, apex densely scaly ; scales *ca* 0.8 x 0.2 cm, linear-lanceolate, apex acuminate, hair-tipped, brown. Stipes *ca* 50 x 0.5 cm, densely scaly at base, sparsely or glabrous above, abaxially grooved, stout, pale-brown. Lamina *ca* 25 - 50 x 15 - 30 cm, ovate-lanceolate, bipinnate at base, pinnatifid at apex ; lateral pinnae 4 - 8 pairs, subopposite to alternate, stalked, lowest pair of pinnae largest, *ca* 15 - 30 x 5 - 10 cm, obovate to delto-lanceolate, apex acuminate ; secondary pinnae upto 14 pairs, alternate, lowest pair shortly stalked, others sessile ; largest one *ca* 8 x 3 cm, ovate-lanceolate, slightly falcate, apex acute, base unequally cuneate, margin more or less cut down to lobes, the lowest acroscopic lobe largest, *ca* 1 cm wide, margin entire or sparsely but sharply toothed, apex acute with long stiff spinules ; veins pinnate, simple ; rachis and costae sparsely covered by scales and hairs above and below ; texture subcoriaceous ; lamina light-green, glabrous on both surfaces. Sori globose, terminal on veinlets, large ; indusia reniform to orbicular, brown (Pl. 196).

Fertile : July - Jan.

Distrib : (a) Myanmar, China, Japan, Tonkin, Thailad ; (b) Northeast India.

Occur : Not common ; in moist, shady places in forest. Nambar forest, Golaghat dist. 1662.

Dryopteris Adanson

Fam. Pl. 2. 20. 551. 1763. *nom. cons.*

Dixit (1984) has listed 52 species of *Dryopteris* for India. Only four species have been recorded in the present study for Assam.

Terrestrials. Rhizome suberect to erect, short, thick, stout, densely scaly. Stipes tufted, elongate, scaly at base, glabrous or sparsely scaly above. Lamina bipinnate to tripinnate, broadly ovate to oblong-lanceolate ; monomorphic or dimorphic ; lateral pinnae numerous, shortly stalked or sessile, lowest pair of basal pinnae sometimes bear an accessory on the basal basiscopic side ; pinna lobes entire, crenate or serrate ; veins free forked ; texture herbaceous or subcoriaceous. Lamina glabrous. Sori large, globose or reniform ; indusia reniform. Spores bilateral.

KEY TO SPECIES

1a. Lamina dimorphic ---------- --- --- --- ***cochleata***

1b. Lamina monomorphic

2a. First basiscopic pinnule of the lowest pinna much larger than the next pinnule ; sharp tooth present at the sinus ---------- --- --- --- --- ***sparsa***

2b. First basiscopic pinnule of the lowest pinna not larger than the next pinnule ; tooth absent at the sinus

3a. Sori terminal on veinlets ; lamina deltoid ; rachis and costae clothed with numerous narrow black scales -- ---------- ***pulvinulifera***

3b. Sori medial on veinlets ; lamina ovate or ovate-lanceolate ; rachis and costae usually glabrous, sometimes sparsely scaly ---------- --- --- --- ***marginata***

Dryopteris cochleata (Buch. -Ham. ex D. Don) C. Chr. Ind. Fil. 258. 1905 ; Dhir, Ferns N.W. Himalayas, 68. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 126. 1982 ; Jamir & Rao, Ferns Nagaland, 326. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 279. t. 215. 1992. *Nephrodium cochleatum* Buch. -Ham. ex D. Don, Prod. Fl. Nepal, 6. 1825 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 521. 1880. *Lastrea cochleata* (Buch. -Ham. ex D. Don) Bedd. Ferns South India, t. 115. 1864. *Lastrea filix-mas* var. *cochleata* (Buch. -Ham. ex D. Don) Bedd. Handb. Ferns Brit. India, 250. 1883.

Rhizome semierect, *ca* 3 cm thick, stout, densely scaly ; scales *ca* 1.5 x 0.3 cm , lanceolate, apex acuminate, margin entire and with glandular hair, thin, membranaceous, transparent, pale-brown. Stipes *ca* 50 x 0.5 cm tufted, scaly below, glabrous and glossy above, grey-brown when dry. Lamina dimorphic, bipinnate ; sterile lamina *ca* 60 x 25 cm, lanceolate, apex acuminate ; lateral pinnae numerous, subopposite, shortly stalked, slightly ascending, largest one *ca* 15 x 6 cm, oblong-lanceolate, acute at apex, base truncate ; pinnules numerous, alternate, adnate, largest one *ca* 4 x 1.5 cm, oblong, round or obtuse at apex, basiscopic base decurrent, margin lobed one fourth way to the costules ; lobes *ca* 4 x 3 mm, oblong, apex rounded, margin serrate or crenate ; veins slightly distinct below, free, forked once or twice, not reaching the margin, costae slightly raised, rounded and stramineous below, flattened and brown above ; texture subcoriaceous ; lamina pale-green, glabrous ; fertile lamina much contracted, *ca* 30 x 12 cm. Sori globose or reniform, large, upto 2.5 mm wide, usually completely covering the under surface of fertile pinnules ; indusia reniform. Spores oval or round, dark-brown (Pl. 197).

Fertile : March - Oct.

Distrib : (a) Myanmar, Malay Peninsula, China, Tonkin, Nepal ; (b) Himalayas.

Occur : Rare ; along fully exposed roadsides and forest clearings. Nameri forest, Sonitpur dist. 1742.

Uses : Rhizome is used medicinally in cholera (Jain 1991).

Dryopteris marginata (Wall. ex Christ.) Christ. Philip. Journ. Sci. 2. 212. 1907 ; Dhir, Ferns N.W. Himalayas, 69. 1980 ; Jamir & Rao, Ferns Nagaland, 330. 1988. *Aspidium marginatum* Wall. Cat. No. 391. 1828 (*pro parte*) ex Christ. Bull. Soc. Bot. France, 52. Mém. 1. 39. 1905. *Lastrea filix-mas* var. *elongata* Bedd. Ferns South. India, t. 112. 1864 ; Handb. Ferns Brit India, 250. 1883 ; Suppl. 56. 1892 ; *Nephrodium filix-mas* var. *marginata* Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 521.t.71. 1880.

Rhizome erect, *ca* 4 cm thick, apex clothed with scales ; scales *ca* 1 x 0.4 cm, broad-lanceolate, apex acuminate, hair-pointed, light-brown. Stipes *ca* 20 - 40 x 0.8 cm, scaly at base, glabrous or sparsely scaly above, pale-brown. Lamina *ca* 25 - 45 x 15 - 25 cm, bipinnate, to tripinnate, ovate or ovate-lanceolate, apex acute, base broadly cunate ; primary pinnae numerous, ascending, suboppisite or alternate, shortly stalked, basal one largest, *ca* 20 x 7 cm , oblong-lanceolate, apex caudate acuminate, acroscopic base truncate, basiscopic base broadly cuneate ; secondary pinnae numerous, alternate, sessile or decurrent, largest one *ca* 5 x 1.8 cm, oblong-lanceolate, apex bluntly obtuse or slightly acute, margin more or less deeply lobed almost to the costae ; lobes *ca* 1 cm wide, oblong, apex obtuse, margin finely serrate or crenate ; veins slighly distinct, free, forked ; rachises and costules usually glabrous, sometimes sparsely scaly, pale-brown ; texture subcoriaceous ; lamina pale-green, glabrous above, often fibrillose below. Sori rather large, medial *ca* 0.2 cm wide, in pairs on each pinnule or lobe, reniform ; indusia glabrous, reniform, pale-brown. Spores oval (Pl. 198).

Fertile : July - Oct.

Distrib : (a) Sri Lanka, Malay Peninsula, Taiwan, China ; (b) Eastern Himalayas and Eastern India.

Occur : Rare ; in moist deciduous forest. Upper Dihing, Tinsukia dist. 665.

Uses : Rhizome anthelmintic (Ambasta 1986).

Dryopteris pulvinulifera (Bedd.) O. Ktze. Rev. Gen. Pl. 2 : 213. 1891 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 127. 1982. *Lastrea pulvinulifera* Bedd. Ferns Brit. India, t. 333. 1866 ; Handb. Ferns Brit. India, 255. 1883. *Lastrea pulvinulifera* var. *zeylanica* Bedd. Ferns Brit. India Suppl. 17. 1876. *Nephrodium pulvinuliferum* Hook. *et* Bak. Syn. Fil. 500. 1874 (*pro parte*) ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 525. 1880 (*pro parte*). *N. sparsum* var. *squamilosa* Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 524. 1880 (*pro parte*). *Lastrea sparsa* var. *zeylanica* Bedd. Handb. Ferns Brit. India, 254. 1883.

Rhizome semierect, *ca* 0.3 cm thick, densely clothed with scales ; scales *ca* 1 x 0.2 cm, linear, apex acuminate, margin entire, golden-brown, stipes *ca* 60 x 0.5 cm, base flattened and densely scaly, glabrous or sparsely scaly above. Lamina *ca* 15 - 60 x 12 - 40 cm, deltoid, tripinnate, apex acuminate ; lateral pinnae upto 12 pairs, lower pair opposite, others subopposite or alternate, stalked, basal one largest, *ca* 25 x 15 cm, oblong-lanceolate, apex acuminate ; secondary pinnae numerous, subopposite or alternate, sessile, largest one *ca* 8 x 4 cm, delto-lanceolate, apex blunt or acute, base cuneate ; tertiary pinnae or pinnules *ca* 2.5 x 1.5 cm, alternate, adnate, ovate, apex obtusely rounded, margin entire or lobed, occasionaly dentate or crenate ; veins inconspicuous, pinnate, free, not reaching the margin ; rachises and costae clothed with numerous, narrow, black scales, which are more copious at the axils of the pinnae, costules and veins sometimes furnished with stiff hairs on the upper surface ; texture subcoriaceous ; lamina glabrous. Sori terminal on the lower veinlets, globose, submarginal ; indusia reniform, glabrous ; sporangia light-brown. Spores round to oval-elliptical, dark-brown, exine tuberculate (Pl. 199).

Fertile : Sept. - Dec.

Distrib : Sri Lanka ; (b) Northeast Himalayas.

Occur : Not common, on rock crevices and shady places of forest. Jorabat, Kamrup dist. 729 ; Harmati, Lakhimpur dist. 815.

Dryopteris sparsa (Buch. -Ham. ex D. Don) O. Ktze. Rev. Gen. Pl. 2. 813. 1891 ; Dhir, Ferns N. W. Himalayas, 70. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 128. 1982 ; Jamir & Rao, Ferns Nagaland, 334. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 281. t. 216. 1992. *Nephrodium sparsum* Buch. -Ham. ex D. Don, Prod, Fl. Nepal, 6. 1825 ; Clarke, Trans. Linn. Soc Lond. II. Bot. 1. 523. 1880. *Lastrea sparsa* (Buch. -Ham. ex D. Don) Moore, Ind. Fil. 87. 1858 ; Bedd. Ferns South. India, t. 103. 1864 ; Handb. Ferns Brit. India, 252. 1883.

Rhizome suberect, short, *ca* 5 cm thick, densely covered by scales ; scales *ca* 1 x 0.5 cm, ovate-lanceolate, apex acute, entire, thin, membranous, pale-brown or stramineous. Stipes *ca* 12 - 40 x 0.2 - 0.4 cm, densely scaly at base, sparsely above, abaxially rounded, adaxially grooved, shining, tufted, dark-purplish at base, pale-brown above. Lamina *ca* 18- 50 x 10 - 30 cm, ovate-lanceolate, bipinnate, primary pinnae numerous, opposite or subopposite, petiolate, upto 5 cm apart, largest pinnae *ca* 20 x 5 cm, ovate-lanceolate, apex acute or short acuminate, base cuneate, lowest pair of basal pinnae largest, sometimes bear an accessory branch on the basal basiscopic side ; secondary pinnae upto 2 pairs, subopposite or alternate, sessile or subsessile, largest one *ca* 4.5 x 2.5 cm, ovate-lanceolate, apex acute, decurrent on the basal basiscopic side, basiscopic base broadly cuneate, acroscopic base truncate or cuneate, margin more or less shallowly lobed or serrate with a short, sharp tooth in between the lobes ; veins slightly distinct below, indistinct above, upto five pairs, free, forked, terminating near the margin ; rachis and costa bear small scattered scales ; texture herbaceous ; lamina pale-green or brownish when dry, glabrous. Sori median on the veinlets, upto 0.2 cm wide, globose, usually one per lobe ; indusia large, reniform, entire, pale-brown ; sporangia stalked. Spores oval, dark-brown, exine smooth (Pl. 200).

Fertile : Feb. - Nov.

Distrib : (a) Sri Lanka, Myanmar, Malay Peninsula, New Guinea, Tibet, China, Taiwan, Japan, Philippines ; (b) throughout India.

Occur : Usually grows in moist and shady roadside slopes and open forest. Haflong, North Cachar Hills dist. 1998 ; Nambar forest, Golaghat dist. 1664.

Uses : Plant is used as anthelmintic (Jain 1991).

Polystichum Roth.

Tent. Fl. Germ. 3. 31. 69. 269. 1799. (*nom. cons.*)

Dixit (1984) has listed 36 species and four varieties of *Polystichum* for India. According to Fraser-Jenkins (1991) there are 15 species in the Indian subcontinent. Only one species has been recorded in the present investigation.

Polystichum biaristatum (Bl.) Moore, Ind. Fil. 86. 1856 ; Dhir, Ferns N.W. Himalayas, 75. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 132. 1982 ; Jamir & Rao, Ferns Nagaland, 343. 1988. *Aspidium biaristatum.* Bl. Enum. Pl. Jav. 164. 1828. *A. aculeatum* var. *biaristatum* Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 510. 1880. *Polystichum aculeatum* var. *biaristatum* (Cl.) Bedd. Handb. Ferns Brit. India, 209. 1883.

Rhizome suberect, stout, *ca* 0.7 cm thick, scaly ; scales *ca* 2.5 x 0.5 cm, broad-lanceolate, apex acuminate, centrally thick and blackish, margin thin, pale-brown, conduplicately curved. Stipes

ca 20 - 50 x 0.4 cm, abaxially rounded, adaxially grooved, tufted, base densely scaly, small scars of scale bases sparsely distributed above, pale-brown. Lamina *ca* 30 - 70 x 15 - 30 cm, bipinnate, lanceolate or delto-lanceolate ; lateral pinnae numerous, subopposite or alternate, sessile or shortly stalked, basalmost pair reduced ; largest one *ca* 10 - 20 x 2.5 - 6 cm, oblong-lanceolate, apex acuminate, base truncate ; pinnules *ca* 1.5 - 3 x 0.5 - 1.5 cm, subopposite or alternate, oblong, falcate, auricled at the upper base, lower base slightly cuneate, margin serrate, apex acute ; veins indistinct, free, forked ; rachis and costae more or less densely covered by dark-brown scales ; texture coriaceous ; lamina pale-brown when dry. Sori rather large, terminal on veinlets, generally around the margin, dark-brown, receptacles of sori protruberant ; indusia peltate, entire, light-brown. Spores round, yellowish ; exine smooth (Pl. 201).

Fertile : Feb. - Oct.

Distrib : (a) Sri Lanka, Malay Peninsula, China, Myanmar, Thailand, Java, Celebes, Taiwan ; (b) Northeast India.

Occur : Rare ; in moist, shady places of forest. Bhalukpung. Sonitpur dist. 982.

BOLBITIDACEAE (Pic. Ser.) Ching

With regard to the taxonomic startus of the genera *Bobitis* Schott and *Egenolfia* Schott of the family Bolbitidaceae there are many views among the Pteridologists. Schott (1834) has accomodated the free vein species in *Egenolfia* and species with anastomosing veins in *Bolbitis*. Smith (1875) also considered both the genera as distinct from each other. Iwatsuki (1959) and Hennipman (1977) united the two genera and all the species of *Egenolfia* have been included under *Bolbitis*. Nayar & Kaur (1964a, 1964b) and Dixit (1984) maintained separate generic status of *Egenolfia* and *Bolbitis*. In the present account both the genera have been recognised as distinct.

Terrestrials or lithophytes. Rhizome creeping or erect, roots arising from the ventral surface, scaly. Stipes tufted or scattered, grooved adaxially. Lamina dimorphic, simple or pinnate ; veins free, simple or forked once or copiously anastomosing with or without included veinlets ; fertile lamina much contracted, usually with longer stipes than sterile frond. Sori exindusiate, acrosticho-id ; sporangia stalked, paraphyses absent ; annulus with 10 - 20 thickened cells. Spores bilateral, monolete, exine smooth.

KEY TO GENERA

1a. Veins anastomosing ---------- --- --- ***Bolbitis***
1b. Veins free ---------- --- --- ***Egenolfia***

Bolbitis Schott
Gen. Fil. 3. t. 14. 1834.

Dixit (1984) has listed 12 species of *Bolbitis* for India. Only three species of the genus have been recorded from Assam in the present investigation.

Terrestrials or lithophytes. Rhizome short creeping or erect, sparsely scaly. Stipes crowded, not articulate to rhizome, scaly at base. Lamina dimorphic, simple or pinnate, often proliferate ; sterile pinnae oblong or oblong-lanceolate, margin crenate or lobed ; veins anastomosing with or without included veinlets ; texture herbaceous to coriaceous ; pinnae glabrous, fertile lamina much contracted. Sori acrostichoid, spores bilateral with distinct perispore.

KEY TO SPECIES

1a. Rhizome short creeping ; lateral pinnae at least 5 pairs ; roots scattered in many irregular rows on the ventral surface of rhizome ---------- --- ------- --- ***costata***

1b. Rhizome long creeping ; lateral pinnae usually one or two, rarely four ; roots borne in two rows on the ventral surface of rhizome

2a. Scales upto 10 mm long, ovate ; fertile pinnae broad lanceolate, more than 2 cm broad ---------- ---------- --- --- --- ***subsimplex***

2b. Scales less than 3 mm long, ovate-lanceolate ; fertile pinnae narrowly linear, less than 2 cm broad ---------- --- --- --- ***heteroclita***

Bolbitis costata (Wall. ex. Hook.) Ching, C. Chr. Ind. Fil. Suppl. 3. 47. 1934. *Acrostichum costatum* Wall. ex. Hook. Sp. Fil. 5. 262. 1864. *Paecilopteris costata* (Wall.) Bedd. Ferns Brit. Inidia, t. 113. 1866. *Gymnopteris costata* (Wall.) Bedd. Handb. Ferns Brit. India, 438. t. 266. 1883.

Rhizome short creeping, *ca* 1.5 cm thick, hard, densely scaly at apex ; scales *ca* 0.4 - 0.1 cm, ovate-lanceolate, apex acuminate, margin glandular hairy. Stipes *ca* 35 - 45 x 0.5 - 0.7 cm, thick, abaxially rounded, adaxially grooved, sparsely scaly. Lamina *ca* 60 x 45 cm, simple pinnate with a single terminal pinna larger than the lateral ones which sometimes bears vegetative bud at the apex ; lateral pinnae upto 5 - 8 pairs, subopposite, subsessile or shortly stalked, largest one *ca* 15 - 30 x 4 - 7 cm, oblong-lanceolate, apex suddenly contracted and acuminate, base tapering, margin entire and undulate, sometimes faintly crenate and cartilagenous ; primary veins prominently raised, areoles numerous, varying the size of pinnae, costal ones small and with included veinlets, others with included veinlets which may be free or anastomosing ; midrib prominently raised on both surfaces and sparsely scaly at the lower surface ; texture coriaceous ; lamina glossy green when fresh but become reddish on drying ; fertile pinnae similar to sterile one but much contracted, *ca* 6 - 8 x 1 cm. Sporangia cover the whole under surface except the margin. Spores light-brown, exine faintly granulose (Pl. 202).

Fertile : May - June.

Distrib : (a) Nepal, Bangladesh ; (b) Northeast India.

Occur : Rare ; in moist, shady places along river banks in dense forest. Borail hills, Nort Cachar Hills dist. 1967.

Bolbitis heteroclita (Presl) Ching in C. Chr. Ind. Fil. Suppl. 3. 48. 1934 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 121. 1982 ; Jamir & Rao, Ferns Nagaland, 376. 1988. *Acrostichum heteroclitum* Presl, Rel. Haenk. 1. 15. t. 2. f. 2. 1885. *Leptochilus heteroclitus* (Presl) C. Chr. Ind. Fil. 11. 1906.

Rhizome long creeping, *ca* 1 cm across, soft, brittle, apex clothed with ovate-lanceolate, dark-brown scales ; scales *ca* 2 - 3 mm long. Stipes *ca* 6 - 30 x 0.2 - 0.4 cm (longer in the fertile leaf), green, sparsely covered by scales. Fronds usually in two alternate rows but may be in three rows ; they vary from simple to pinnate and loosely placed ; pinnae usually trifoliate, rarely with 4 pairs of lateral pinnules ; simple leaves and terminal pinna of pinnate leaves similar, *ca* 30 x 7 cm, usually extended to a long, narrowly linear, caudate prolongation, *ca* 10 - 30 x 0.3 - 1 cm ; lateral pinnae *ca* 5 - 18 x 2 - 5 cm, ovate-lanceolate, glabrous, lowest shortly stalked, otherwise sessile, cuneate at base, apex acuminate, margin entire to undulate ; texture thin, rachis and costae prominent on lower surface with many adpressed scales ; veins prominent, lateral veins raised, secondary veins anastomosing without included veinlets, marginal veins free. Fertile lamina simple or pinnate ; apical pinna *ca* 15 x 2.5 cm, lateral fertile pinnae *ca* 6 - 8 x 1 - 1.5 cm, lanceolate with acute apex, margin smooth and shortly stalked. Sori covering the whole lower surface and brown (Pl. 203).

Fertile : May - Aug.

Distrib : (a) South China, Taiwan, Malaysia, New Guinea ; (b) Northeastern Himalayas, Meghalaya, Nagaland.

Occur : Growing in densely shaded forest beds at low elevations. Rowta forest, Darrang dist. 1874 ; Nambar forest, Golaghat dist. 1666.

Bolbitis subsimplex (Fée) Ching, in Chr. Ind. Fil. Suppl. 3. 50. 1934. *Gymnopteris subsimplex* Fée Acrost. 46. 1845. *Paecilopteris subrepanda* (Presl) Bedd. Ferns Brit. India, t. 339. 1866. *Gymnopteris subrepanda* (Hook.) Bedd. Handb. Ferns Brit. India, 434. 1883.

Rhizome long creeping, *ca* 0.8 - 1.5 cm thick, hard, densely scaly ; scales *ca* 1 x 0.5 cm, ovate, apex acuminate, hair-tipped, glandular, base broad, margin hairy. Stipes *ca* 10 - 30 x 0.8 cm, abaxially rounded, adaxially grooved, scaly and dark-brown at the base, glabrous and stramineous above. Lamina simple or pinnate with 1 - 3 pairs of lateral pinnae and with a single apical pinna similar to lateral ones but somewhat largest, sometimes the terminal pinna bears a vegetative bud often on whip-like prolonged apical region ; lateral pinnae subopposite, shortly stalked, largest one *ca* 25 x 6 cm, oblong-lanceolate, apex acuminate, base oblique, the superior base being about twice or broad as the inferior one, margin undulate ; main lateral veins distinct on both surfaces, a single costal areole extends between main lateral veins without included veinlets, there are another three rows of areoles between successive main lateral veins with free included veinlets out of which middle row less regular in size and shaped ; costae distinctly raised above and below ; texture subcoriaceous ; lamina glabrous, green ; fertile lamina similar to sterile one but much contracted, which is *ca* 10 x 2 - 3 cm. Sori cover the whole under surface of fertile lamina except the midrib and main lateral veins. Spores globose (Pl. 204).

Fertile : May - June.

Distrib : (a) Sri Lanka, Sikkim, Bhutan ; (b) Northeast India.

Occur : Occasional, on shady moist places of dense forest. Nambar forest, Golaghat dist. 1687 ; Goalpara, Goalpara dist. 1075.

Egenolfia Schott
Gen. Fil. t. 16. 1834.

Dixit (1984) has listed eight species and two varieties of *Egenolfia* for India. Only two species have been recorded in the present investigation.

Rhizome short creeping, thick, hard or soft, scaly. Stipes stramineous, sparsely scaly. Lamina simple pinnate or bipinnatifid ; dimorphic. Sterile lamina lanceolate, ovate-lanceolate ; apex acuminate, ending with a small vegetative bud at tip or not. Lateral pinnae upto 30 pairs, sessile or shortly stalked ; margin crenate or lobed ; veins free, occasionally one pair of basal veins anastomosing in *E. bipinnatifida* ; texture herbaceous. Fertile lamina simple pinnate, oblong-lanceolate. Sori entirely covering the lower surface ; sporangia stalked ; spores monolete, bilateral, planoconvex.

KEY TO SPECIES

1a. Lamina simple pinnate ; veins free ---------- --- --- ***appendiculata***
1b. Lamina bipinnatifid ; one pair of basal veins anastomosing --- --- --- ***bipinnatifida***

Egenolfia appendiculata (Willd.) J. Sm. Ferns Brit. & For. 111. 1886 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 121. 1982 ; Jamir & Rao, Ferns Nagaland, 372. 1988. *Acrostichum*

appendiculatum Willd. Sp. Pl. 5. 114. 1810 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 577. 1880. *Polybotrya appendiculata* (Willd.) J. Sm. J. Bot. 4. 150. 1841 ; Bedd. Ferns South. India, t. 194. 1864 ; Handb. Ferns Brit. India, 424. 1883. *Bolbitis appendiculata* (Willd.) K. Iwats. Acta Phytotax. Geobot. 18. 48. 1959 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 291. t. 224.

Rhizome short creeping, *ca* 0.8 cm thick, soft, scaly at the apex ; scales *ca* 4 x 1 mm, ovate-lanceolate, apex acuminate, base sinuate, margin entire. Stipes *ca* 9 - 20 x 0.1 - 0.3 cm, abaxially rounded, adaxially grooved, sparsely scaly at base, glabrous above, dark-green . Lamina simple pinnate, dimorphic; sterile lamina *ca* 15 - 25 x 5 - 10 cm, lanceolate, widest at the subbasal region, gradually narrowed towards the apex, which often rooting by a small vegetative bud, acuminate ; lateral pinnae upto 30 pairs, subopposite or alternate, sessile or shortly stalked, one or two pairs of basal pinnae *ca* 9 x 1.5 cm, oblong, apex acute or short acuminate, truncate and auricled at base, margin crenate or shallowly lobed, pointed bristles borne from the base of the each sinus ; veins not prominent, free, forked twice or thrice ; costae slightly raised below ; texture herbaceous, firm ; lamina dark-green ; small, toothed scales scattered all over the rachis of fertile and sterile lamina ; stipe of fertile frond longer than the sterile ones, fertile lamina *ca* 12 - 30 x 2 - 4.5 cm, oblong-lanceolate ; pinnae *ca* 0.5 - 2.5 x 0.3 - 0.8 cm, oblong, apex rounded, base subtruncate, margin crenate. Sori acrostichoid, covering the lower surface ; sporangia blackish-brown. Spores monolete, pale-brown (Pl. 205).

Fertile : Oct. - Feb.

Distrib : (a) Philippines, Hongkong ; (b) throughout India.

Occur : Common, along fully or partially shaded rocks of stream banks. Harmati, Lakhimpur dist. 1810.

Egenolfia bipinnatifida J. Sm. Hist. Fil. 132. 1875. *Acrostichum appendiculatum* var. *costulata* Hook. Sp. Fil. 4. 252. 1860 ; Bedd. Ferns Brit. India, t. 110. 1866. *Polybotrya appendiculata* var. *costulata* (Hook.) Bedd. Handb. Ferns Brit. India, 426 t. 257. 1883. *Bolbitis bipinnatifida* (J. Sm.) K. Iwats. Acta Phytotax. Geobot. 18. 49. 1959 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 121. 1982 ; Jamir & Rao, Ferns Nagaland, 376. 1988.

Rhizome short creeping, *ca* 1 cm thick, hard, densely scaly ; scales *ca* 0.6 x 0.2 cm, ovate-lanceolate, apex acuminate, base broad, margin hairy, dark-brown. Stipes *ca* 8 - 45 x 0.3 cm, abaxially rounded, adaxially grooved, sparsely scaly, pale-greenish. Lamina dimorphic, bipinnatifid ; sterile lamina *ca* 20 - 65 x 10 - 30 cm, ovate-lanceolate, apex acuminate, basal pinnae not reduced ; lateral pinnae upto 30 pairs, loosely placed, subopposite to alternate, sessile or subsessile ; largest basal pinnae *ca* 7 - 20 x 2 - 5 cm, oblong-lanceolate, apex acuminate, base truncate, margin deeply lobed half or more way to the costae, lobes crenate ; veins reticulate, one pair of basal veins anastomosing, others free ; costae prominent on both surfaces, small scales occur sparsely all over the costae, rachis and main lateral veins ; texture herbaceous ; lamina dark-green, dark-brown glandular hairs are scattered all over on both the surfaces of the lamina ; fertile lamina *ca* 10 - 30 x 4 - 10 cm, simple pinnate, pinnae *ca* 2 - 7 x 0.6 - 1 cm, alternate to subopposite, shortly stalked, oblong, apex rounded, cordate base, margin entire or faintly lobed. Sori entirely covering the lower surface except the costae ; sporangia slender stalked, blackish-brown (Pl. 206).

Fertile : July - Nov.

Distrib. : (a) Myanmar ; (b) Eastern India.

Occur : Occasional ; on moist, shady places of forest along the stream banks. Haflong, North Cachar Hills dist. 1970 ; Dirgheswari, Kamrup dist. 1167.

Suborder : **DAVALLIINEAE**

NEPHROLEPIDACEAE (Ching) Pic. Ser.

Nephrolepis Schott
Gen. Fil. 1. t. 3. 1834.

Dixit (1984) has listed eight species for India. Three species of *Nephrolepis* have been encounted in the present investigation.

Terrestrials or epiphytes. Rhizome semierect or erect, short, covered by scales. Stipes tufted, glabrous or scaly. Lamina pinnate ; pinnae sessile or shortly stalked ; margin entire, serrate or crenate ; texture thin, herbaceous or subcoriaceous ; veins free, forked, not reaching the margin. Lamina pale-green, glabrous or scaly. Sori round or reniform, submarginal ; indusia round or reniform, glabrous. Spores bilateral, translucent.

KEY TO SPECIES

1a. Pinnae truncate or rounded at base, not auricled on acroscopic base ;
stipes sparsely scaly at base, glabrous above ; indusia round ---------- --- --- --- ***biserrata***
1b. Pinnae cordate or broadly cuneate at base, auricled on acroscopic base ;
stipes densely scaly at base, sparsely above ; indusia reniform
2a. Rhizome erect ; roots bearing fleshy tubers ; pinnae *ca* 1.5 - 4 x 0.5 cm --- -- --- ***cordifolia***
2b. Rhizome semierect ; roots without tubers ; pinnae *ca* 6 - 10 x 1.5 cm --- --- --- ***exaltata***

Nephrolepis biserrata (Sw.) Schott, Gen. Fil. ad. t. 3. 1834 ; Jamir & Rao, Ferns Nagaland, 383. 1988. *Aspidium biserratum* Sw. Schard. Journ. Bot. 1800 (2). 32. 1801. *Nephrolepis acuta* Presl, Tent. Pterid. 79. 1836 ; Bedd. Ferns. South. India, t. 94. 1864 ; Handb. Ferns Brit. India, 284. 1883.

Rhizome erect, short *ca* 0.8 - 1.5 cm long, covered by scales ; scales *ca* 0.1 - 0.9 cm long, copious, narrow, thin, shining, linear, hair-pointed, dark-brown. Stipes *ca* 15 - 25 x 0.5 - 0.7 cm, tufted, erect, stout, glabrous or slightly scaly at base, olive-brown when dry. Lamina *ca* 100 - 200 x 1.5 - 2.5 cm, pinnate ; pinnae *ca* 7 - 18 x 1.5 - 3 cm, oblong, acuminate, truncate or rounded at base, sometimes shortly petiolate ; basal pinnae gradually shortened and more widely spaced ; margin serrate or crenate ; texture thin, both surfaces hairy when young, as is the rachis, but quite glabrous in age ; veins free, forked once or twice, ending in hydathodes near margin on the upper surface. Sori round, in a submarginal row ; indusia round with a narrow sinus. Spores brownish, translucent (Pl. 207).

Fertile : Feb. - Mar.

Distrib : (a) Bangladesh, Sri Lanka, Tropical Africa ; (b) North India and Northeast India.

Occur : Not common, cultivated as pot plant. Guwahati, Kamrup dist. 1931 ; Darranga, Nalbari dist. 1271.

Uses : Plant is used in the treatment of wounds (Dixit & Vohra 1984). Tender shoots and rhizomes are eaten (Ambasta 1986).

Nephrolepis cordifolia (L.) Presl, Tent. Pterid. 79. 1836 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 541. 1880 ; Bedd. Handb. Ferns Brit. India, 282. t. 144. 1883 ; Dhir, Ferns N.W. Himalayas, 59. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 105. 1982 ; Jamir & Rao, Ferns Nagaland, 385. 1988. *Polypodium cordifolium* L . Sp. Pl. 2. 1089. 1753. *Nephrolepis tuberosa* Presl, Tent. Pterid. 79. 1836 ; Bedd. Ferns South. India, t. 92. 1864. *N. auriculata* (L.) Trimen, J. Linn. Soc.

Lond. Bot. 24. 152. 1887 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 140. t. 108. 1992.

Rhizome erect, *ca* 1 - 10 x 2 cm, densely clothed with scales ; scales *ca* 8 x 1 mm, linear-lanceolate, acuminate, hair-pointed, margin fimbriate, yellowish-brown ; roots bear *ca* 0.5 - 2.5 x 1 cm, spherical, fleshy tubers. Stipes *ca* 5 - 15 x 0.1 - 0.4 cm, tough, shining, densely scaly below, glabrous or sparsely scaly above, dark-olive brown when dry. Lamina *ca* 20 - 70 x 4 - 8 cm, linear-oblong-lanceolate, progressively narrowed at both ends, simple pinnate ; pinnae numerous, close set, alternate, sessile, spreading ; largest pinnae *ca* 1.5 - 4 x 0.5 - 1 cm, oblong, subacute or rounded at apex, base unequal, cordate, acroscopic base auricled and overlapping the rachis and adjacent pinna, auricle acute, margin serrulate to crenate ; rachis grooved with small, dark-brown, scales ; costae and veins distinct, veins simple or forked once, free, ending in hydathodes, not reaching the margin ; texture herbaceous ; lamina pale-green, glabrous above and below. Sori submarginal, arranged in a single row, rounded ; indusia reniform, dark-brown towards base, pale-brown towards edge, margin entire, glabrous. Spores brown, translucent (Pl. 208).

Fertile : July - Oct.

Distrib : (a) Tropics and Subtropics of the World ; (b) throughout India.

Occur : Cultivated as an ornamental plant and also occurs wild. Jalukbari, Kamrup dist. 565, Orang, Darrang dist. 1876.

Uses : Tubers and tender leaves are used as vegetable in Garhwal, Darjeeling and Bhutan ; decoction of fronds used for cough in Philippines ; people of Nagaland chew the washed tubers for sinus trouble, toothache and also for diseases of liver ; juice of fresh green leaves checks the bleeding of cuts and also results in coagulations of blood. (Islam 1983 ; Dixit & Vohra 1984 ; Ambasta 1986 ; Jamir & Rao 1988 ; Jain 1991).

Note : Variations in pinna margin ranging from entire to serrate with intermediates like crenate or wavy margin have been observed among the plants of the gatherings of the present study.

Nephrolepis exaltata (L.) Scott, Gen. Fil. t. 3. 1834 ; Bedd. Ferns South. India, t. 93. 1864 ; Handb. Ferns Brit. India, 283. 1883. *Polypodium exaltatum* L. Sp. Pl. 2. 1088. 1753.

Rhizome semierect, *ca* 2 cm thick, densely scaly ; scales *ca* 3 x 1 mm, ovate-lanceolate, apex acuminate, margin hairy, brown. Stipes *ca* 10 - 15 x 0.5 cm, tufted, abaxially rounded, adaxially grooved, densely scaly at base, sparsely above, grey-brown. Lamina *ca* 75 x 12 cm, oblong-lanceolate, simple pinnate, apex short-acuminate ; lateral pinnae upto 25 pairs, rather close, subopposite or alternate, sessile, largest one *ca* 6 - 10 x 1.5 cm, oblong-lanceolate, apex acute, base broadly cuneate, auricled on the acroscopic base, margin entire or crenate, veins slightly distinct, free, forked once to thrice, not reaching the margin ; texture subcoriaceous ; lamina pale-green, glabrous or scaly when young. Sori submarginal in two rows, reniform, at the tip of veins, one per two or three veinlets ; indusia reniform, firm, glabrous, dark-brown. Spores reniform or planoconvex, exine granulose (Pl. 209).

Fertile : July - Oct.

Distrib : (a) Tropics and Subtropics of the World ; (b) Northeastern and South India.

Occur : Common, on moist but exposed situations along forest margins. North Lakhimpur, Lakhimpur dist. 1902 ; Rowta forest, Darrang dist. 1892.

OLEANDRACEAE Ching ex Pic. Ser.

Oleandra Cav.
Anal. Hist. Nat. 1 (2). 115. 1799.

Dixit (1984) has listed four species of *Oleandra* for India. Two species have been recorded from Assam in the present investigation.

Terrestrials, rarely epiphytes. Rhizome long creeping, densely covered by scales. Stipes tufted, scaly at base, glabrous above. Lamina simple, oblong or oblong-lanceolate, apex acuminate, margin entire ; veins distinct, free, forked, parallel from costa to margin ; texture thin chartaceous or coriaceous. Sori round or reniform, in one or two rows on either side of the midrib ; indusia reniform, entire or ciliate. Spores oval or reniform, winged or spinulose.

KEY TO SPECIES

1a. Lamina oblong ; stipes *ca* 2 - 5 cm long ; sori in a single row along the midrib, compact ---------- --- --- --- ***wallichii***

1b. Lamina oblong-lanceolate ; stipes *ca* 0.5 - 1 cm long ; sori in two irregular rows along the midrib, not compact ---------- --- --- --- ***musifolia***

Oleandra musifolia (Bl.) Presl, Epim. Bot. 42. 1849 ; Bedd. Handb. Ferns Brit. India, 287. 1883 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 139. t. 107. 1992. *Aspidium musifolium* Bl. Enum. Pl. Java. 141. 1828. *Oleandra neriiformis sensu* Bedd. Ferns South. India, t. 91. 1864.

Rhizome long creeping, *ca* 0.5 cm thick, densely covered by scales ; scales *ca* 0.6 x 0.2 cm, lanceolate, apex acuminate, base cuneate, margin entire, hairy, polished, golden-brown. Stipes *ca* 0.5 - 1 x 0.3 cm, polished, sparsely scaly at base. Lamina simple, generally single, scattered, rarely in tufts, *ca* 30 - 60 x 3 - 5 cm, oblong-lanceolate, slightly falcate, apex acuminate, cuneate at base, margin entire ; veins distinct, forked once or twice, free, reaching the margin ; midrib distinctly raised above and below, grooved above, rounded and scaly below ; texture thin, chartaceous ; lamina yellowish-green, glossy, glabrous on both surfaces. Sori reniform, in two irregular rows along the midrib leaving the extreme apex and base, indusia reniform, entire, dark-brown. Spores pale-green, exine winged (Pl. 210).

Fertile : Aug. - Dec.

Distrib : (a) Sri Lanka, Java ; (b) South India.

Occur : Rare ; in moist dense forest. Nameri forest, Sonitpur dist. 1744 ; Jaypoore forest, Tinsukia dist. 661.

Uses : Stipes used as emmenagogue and rhizome used in snake bite in Philippines (Dixit & Vohra 1984).

Note : Dixit (1984) has shown only South India as the distribution of this species in India. Baishya & Rao (1982) and Jamir & Rao (1988) have not encounted this species in Meghalaya and Nagaland respectively. Thus, probably, it is for the first time from Northeastern India in the present investigatigation.

Oleandra wallichii (Hook.) Presl, Tent. Pterid. 78. 1836 ; Bedd. Ferns Brit. India, t. 265. 1866 ; Handb. Ferns Brit. India, 287. t. 147. 1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 542. 1880 ; Dhir, Ferns N.W. Himalayas, 59. 1980 ; Jamir & Rao, Ferns Nagaland, 387. 1988. *Aspidium wallichianum* Hook. Exot. Fl. 1. t. 5. 1823.

Rhizome long creeping, *ca* 0.2 - 0.5 cm thick, densely covered by scales all over ; scales *ca* 0.4 x 0.1 cm, lanceolate, apex long-acuminate, hair tipped, subulate, ferruginous, light-brown. Stipes, *ca* 2 - 5 x 0.2 - 0.4 cm, abaxially rounded, adaxially grooved, scaly at base, glabrous above, brown. Lamina *ca* 20 - 35 x 3 - 5 cm, simple oblong, apex suddenly and sharply acuminate, base obtuse or rounded, margin entire, wavy ; midrib distinctly raised above and below, grooved above rounded below, sparingly pubescent with lanceolate scales ; veins free, forked once or twice near the base, parallel from midrib to margin, pubescent on the ventral surface ; texture coriaceous ; lamina dark-brown when dry. Sori round, compact, in a single row on either side of the midrib, nearly touching the midrib ; indusia reniform, ciliated, opening towards the margin. Spores oval, hyaline, dark-brown, exine spinulose (Pl. 211).

Fertile : Aug. - Dec.

Distrib : (a) Nepal, Bhutan, Myanmar, Indo-China, Malay Peninsula, China, Taiwan ; (b) Himalayas, Punjab to Assam.

Occur : Rare ; in moist, dense forest. Nameri forest, Sonitpur dist. 1769.

Uses : Rhizome rejuvenating, used by the aged (Ambasta 1986).

DAVALLIACEAE Mett. ex. Frank

Epiphytes or terrestrials. Rhizome long creeping, covered with peltate scales or hairs. Stipes glabrous, articulate to rhizome. Lamina variously compound, usually deltoid in outline ; veins free, reticulate. Sori terminal on veins, submarginal or superficial, round to oblong, indusiate ; indusia half cup-shaped, elongate or ovate, usually attached by base ; sporangia long stalked ; annulus of 10 - 16 thickened cells. Spores monolete.

KEY TO GENERA

1a. Rhizome covered by both scales and hairs ---------- --- --- ***Leucostegia***
1b. Rhizome covered by scales only
  2a. Lamina quadripinnatifid ; indusia attached by base only ---------- --- --- ***Araiostegia***
  2b. Lamina tripinnate or tripinnatifid ; indusia attached by base and sides
    3a. Rhizome scales brown to chestnut brown, ovate-lanceolate ; lamina tripinnatifid ---------- --- --- ***Davallia***
    3b. Rhizome scales white to yellowish, linear-lanceolate ; lamina tripinnate ---------- --- --- ***Humata***

Araiostegia Copel.

Philip. Journ. Sci. 34. 240. 1927.

Of the nine species of *Araiostegia* listed for India by Dixit (1984), only one species has been encounted in the present investigation.

Araiostegia pulchra (D. Don) Copel. Philip. Journ. Sci. 34. 241. 1927 ; Dhir, Ferns N.W. Himalayas, 57. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 100. 1982 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 135. t. 104. 1992. *Davallia pulchra* D. Don, Prod. Fl. Nepal, 2.1825 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 144. 1980. *Acrophorus pulchra sensu* Bedd. Ferns South. India, t. 10. 1864. *Leucostegia pulchra* (D. Don) J. Sm. Lond. J. Bot. 1. 26. 1842 ; Bedd. Handb. Ferns Brit. India, 52. t. 25. 1883.

Rhizome wide creeping, *ca* 0.7 cm thick, scaly ; scales *ca* 3 x 1.5 mm, ovate, apex obtuse, margin entire, pale-brown. Stipes *ca* 8 - 15 x 0.3 cm, abaxially rounded, adaxially grooved, scaly at base, glabrous above, stramineous or pale-brown. Lamina *ca* 35 x 25 cm, quadripinnatifid, deltoid-lanceolate, progressively narrowed towards the distal part, apex acuminate ; primary pinnae upto 10 pairs,

subopposite at base, alternate above, petiolate, upto 5 cm apart, largest one *ca* 20 x 10 cm, ovate-lanceolate, apex acuminate, base cuneate ; secondary pinnae numerous, alternate, shortly stalked, largest one *ca* 8 x 3 cm, apex acute, acroscopic base truncate, basiscopic base cuneate ; tertiary pinnae upto 10 pairs, shortly stalked, alternate, largest one *ca* 1.5 x 1 cm, ovate, apex acute, bifid, acroscopic base truncate, basiscopic base cuneate ; ultimate pinnules upto 4 pairs, alternate, adnate, apex acute, bifid or simple, base cuneate, margin deeply lobed ; veins slightly prominent, free, forked, not reaching the tip of the lobes, rachis, rachules narrowly winged ; texture thin, rather falcate ; lamina pale-green, glabrous. Sori on the veins at the ultimate forking point of each lobe, upto 1 mm wide ; indusia reniform, attached by base only, membranaceous, glabrous, margin entire, pale-brown. Spores reniform, light-brown, exine finely tuberculate (Pl. 212).

Fertile : Oct. - Dec.

Distrib : (a) Nepal, Bhutan, Sri Lanka, Myanmar ; (b) throughout India in mountainous region.

Occur : Common, on shady tree trunks or on moss-covered rocks in dense forest. Nameri forest, Sonitpur dist. 1746 ; Bandardewa, Lakhimpur dist. 948.

Davallia Sm.

Mém. Acad. Sci. Turin, 5. 414. t.9(6). 1793.

Of the five species of *Davallia* listed for India (Dixit 1984), only one species has been encounted in the present investigation.

Davallia divaricata Bl. Enum. Pl. Jav. 237. 1828 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 445. 1880 ; Bedd. Handb. Ferns Brit. India, 60. 1883 ; Jamir & Rao, Ferns Nagaland, 398. 1988. *D. polyantha* Hook. Sp. Fil. 1. 168. t. 59. A. 1846 ; Bedd. Ferns Brit. India, t. 107. 1866.

Rhizome creeping, *ca* 1 cm thick, densely scaly all over ; scales *ca* 1 x 0.4 cm, deltoid to ovate-lanceolate, apex long acuminate, base broad, thin, transparent, brown. Stipes *ca* 15 - 30 x 0.2 - 0.4 cm, firm, erect, scaly at base, glabrous above, chestnut brown. Lamina *ca* 25 - 60 x 15 - 25 cm, tripinnatifid, deltoid-lanceolate, apex acute or acuminate ; primary pinnae numerous, alternate, basal pinnae stalked, upper ones sessile ; largest basal pinnae *ca* 20 x 10 cm, deltoid-lanceolate, apex acuminate, base cuneate ; secondary pinnae upto 12 pairs, alternate, sessile or shortly stalked, largest one *ca* 6 x 3 cm, deltoid, apex acute, acroscopic base truncate, basiscopic base cuneate, margin deeply cut down to lobe nearly to the costules ; lobes *ca* 1.5 x 0.6 cm, oblong, apex rounded, margin sharply toothed or crenate ; veins not conspicuous, uniform, free, not reaching the margin ; costae and costules slightly winged ; texture subcoriaceous ; lamina dark reddish-brown when dry, glabrous. Sori half cup-shaped, obliquely placed as regards the central veins in the tooth, submarginal, brownish ; indusia tubular or half cup-shaped, as long as broad (Pl. 213).

Fertile : Nov. - Jan.

Distrib : (a) Myanmar, Malay Peninsula, Malay Islands, China ; (b) Northeast India.

Occur : Rare ; on shady, moist tree trunks of forest. Harmati, Lakhimpur dist. 1830.

Humata Cav.

Desc. 1. 272. 1802.

Of the four species of *Humata* listed for India by Dixit (1984), only one species has been encounted in the present study.

Humata griffithiana (Hook.) C. Chr. Contr. U. S. Nat. Herb. 26. 293. 1931. *Davallia griffithiana* Hook. Sp. Fil. 1. 168. t. 49 B. 1864 ; Bedd. Ferns Brit. India, t. 106. 1866 ; Handb. Ferns Brit. India,

60. 1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 445. 1880 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 100. 1982 ; Jamir & Rao, Ferns Nagaland, 400. 1988.

Rhizome long creeping, *ca* 0.8 cm thick, fleshy, densely covered by scales all over ; scales *ca* 1 x 0.2 cm, linear-lanceolate, apex acuminate, hair-tipped, caudate, margin with long hairs, white or yellowish. Stipes *ca* 10 - 20 x 0.3 - 0.5 cm, erect, fleshy, scattered, rounded below, grooved above, glabrous. Lamina *ca* 15 - 45 x 8 - 30 cm, tripinnate, deltoid, apex acuminate ; primary pinnae numerous, subopposite or alternate, stalked, basal one largest, *ca* 25 x 10 cm, delto-lanceolate, apex blunt or acute ; secondary pinnae upto 12 pairs, alternate, shortly stalked, largest one *ca* 8 - 3.5 cm, delto-lanceolate, apex rounded ; pinnules alternate, sessile or adnate, largest one *ca* 4 x 2 cm, ovate-lanceolate, lobed nearly to costae, margin toothed, apex obtuse, base obliquely cuneate ; veins obscure, free, simple or forked ; texture coriaceous ; lamina pale-green, glabrous when mature. Sori large, glabrous, submarginal or marginal ; indusia cup-shaped, glabrous, attached at base and sides, white (Pl. 214).

Fertile : June - Oct.

Distrib : (a) Bhutan, Myanmar, South China, Taiwan ; (b) Northeast India.

Occur : Rare ; on moist, shady and open tree trunks, also on humous-mossy ground surface. Haflong, North Cachar Hills dist. 1982.

Leucostegia Presl
Tent. Pterid. 94. t. 4. f. 11. 1836.

The type species of the genus viz. *Leucostegia immersa*, the only species listed for India by Dixit (1984 and Dixit & Vohra 1984) has been encounted in the present study.

Leucostegia immersa (Wall. ex Hook.) Presl, Tent. Pterid. 95. t. 4. f. 11. 1836 ; Bedd. Handb. Ferns Brit. India, 51. 1883 ; Dhir, Ferns N. W. Himalayas, 58. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 103. 1982 ; Jamir & Rao, Ferns Nagaland, 389. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 131. t. 102. 1992. *Davallia immersa* Wall. ex Hook. Sp. Fil. 1. 156. 1846 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 443. 1880. *Acrophorus immersum* (Moore) Bedd. Ferns South. India, t. 11. 1864.

Rhizome long creeping, *ca* 0.5 cm thick, densely clothed with scales and hairs ; scales *ca* 0.4 x 0.1 cm, lanceolate, apex acuminate, margin entire, pale-brown. Stipes *ca* 15 - 30 x 0.3 - 0.5 cm, abaxially rounded and pale-brown, adaxially grooved and stramineous, shining, glabrous. Lamina *ca* 20 - 40 x 5 - 25 cm, deltoid to ovate, tripinnate to quadripinnatifid, apex acute, base cuneate ; primary pinnae upto 9 pairs, alternate, stalked, largest one *ca* 20 x 8 cm, narrowly deltoid, apex acuminate, base cuneate, ascending ; secondary pinnae upto eight pairs, alternate, stalked, largest one *ca* 5 x 3 cm, ovate, acute at apex, acroscopic base truncate, basiscopic base cuneate ; tertiary pinnae upto 5 pairs, alternate, sessile to adnate, largest one *ca* 2 x 0.8 cm, obovate to ovate, apex rounded, base cuneate, margin deeply cut down nearly to costae into lobes ; lobes *ca* 1 cm long, apex blunt, margin crenate ; veins slightly distinct above, indistinct below, forked once or twice, ending submarginally into an elliptic dot ; texture herbaceous ; lamina yellowish-green, glabrous. Sori large, terminal on basal acroscopic veinlet, impressed ; indusia suborbicular, pale-brown. Spores oblong or reniform, yellow (Pl. 215).

Fertile : June - Sept.

Distrib : (a) Indo-China, West China, Taiwan, Malay Peninsula, Philippines, Malay Islands, New Guinea ; (b) throughout India in mountainous regions.

Occur : Rare ; on fully or partially exposed dry places and also grows on rocks of shady forest.

Haflong, North Cachar Hills dist. 1971 ; Kaziranga, Golaghat dist. 1123.

Uses : Young fronds are cooked with potato and eaten with rice in Darjeeling district of West Bengal (Dixit & Vohra 1984 ; Ambasta 1986 ; Jain 1991).

Order : **BLECHNALES**

BLECHNACEAE (Presl) Copel.

Blechnum L.
Sp. Pl. 2. 1077. 1753.

Dixit (1984) has listed only *Blechnum orientale*, the type species of the genus for India and this species has olso been encounted in the present investigation.

Blechnum orientale L. Sp. Pl. 2. 1077. 1753 ; Bedd. Ferns South. India, t. 89. 1864 ; Handb. Ferns Brit. India, 132. t. 86. 1883 ; Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 474. 1880 ; Dhir, Ferns N.W. Himalayas, 114. 1980 ; Baishya & Rao, Ferns & Fern-allies Meghalaya, 118. 1982 ; Jamir & Rao, Ferns Nagaland, 403. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 299. t. 229. 1992.

Haththazori (Hind.)

Rhizome erect, *ca* 1.2 cm thick, densely scaly, massive ; scales *ca* 2 x 0.3 cm, linear-lanceolate, apex acuminate, hair-pointed, margin entire, shining, dark-brown. Stipes *ca* 15 - 75 x 1 cm, tufted, erect, scaly at base, glabrous above, reddish-brown at the base, grey-brown above, tubercles present along the stipe. Lamina *ca* 20 - 175 x 15 - 75 cm, ovate to linear-lanceolate, apex acute, base subtruncate or broadly cuneate, simple pinnate ; pinnae numerous, spreading, sessile or adnate at lower side, free above, alternate, upto 4 cm apart ; largest pinna *ca* 8 - 35 x 1 - 2 cm, linear-lanceolate, apex acuminate, base broadly cuneate, margin entire ; costa grooved above, rounded below ; veins slightly distinct, simple or forked once or two times, free ; texture coriaceous ; lamina pale-green, glabrous above and below, glossy. Sori linear along either side of the costa, continuous nearly to the apex, dark-brown ; indusia narrow, firm with entire margin. Spores round to oval, translucent, yellowish-brown (Pl. 216 ; Ph. 8).

Fertile : July - Nov.

Distrib : (a) Sri Lanka, China, Malay Peninsula, Malaysian Islands, Polynesia and Australia ; (b) throughout India.

Occur : Very common along moist and shady forest margins, often forming extensive patches (Ph. 8). Changsari, Kamrup dist. 447 ; Karimganj, Karimganj dist. 1393 ; Mayang, Marigaon dist. 2012.

Uses : Fresh fronds used as poultice for boils in Malay ; rhizome used as anthelmintic in China ; eaten during scarcity of food in Malay ; as cure for intestinal worms, bladder complaints in India, Polynesia and as diaphoretic, aromatic, aperative in Philippines (Chopra *et al.* 1956 ; Dixit & Vohra 1984 ; Ambasta 1986 ; Jain 1991). Rhizomes are used for urinary troubles and as a cure of delirium (Asolkar *et al* 1992).

STENOCHLAENACEAE Ching

Stenochlaena J. Sm.
Hook. Journ. Bot. 4. 149. 1841.

The only species *Stenochlaena palustris* recorded for India (Dixit 1984 ; Dixit & Vohra 1984) has

been encounted in the present study.

Stenochlaena palustris (Burm.) Bedd. Ferns Brit. India Suppl. 26. 1876 ; Handb. Ferns Brit. India, 421. t. 253. 1883 ; Jamir & Rao, Ferns Nagaland, 404. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 303. t. 232. 1992. *Polypodium palustre* Burm. Fl. Ind. 234. 1768. *Acrostichum palustre* (Burm.) Clarke, Trans. Linn. Soc. Lond. II. Bot. 1. 577. 1880. *Stenochlaena scandens* (Sw.) J. Sm. in Hook. Journ. Bot. 3. 401. 1841 ; Bedd. Ferns South. India, t. 201. 1864.

Allheal, Marsh Woundwort (Eng.) ; *Lata dhekia, Dhekia lata* (Ass.)

Rhizome scandant, long creeping, *ca* 8 mm thick, sparsely scaly, often climbing on trees ; scales *ca* 3 x 1.5 mm, ovate, apex acuminate, margin ciliated, dark-brown at the centre, pale-brown at the periphery. Lamina dimorphic ; stipe of sterile lamina *ca* 20 x 0.7 cm, stramineous, glabrous, adaxially grooved, abaxially rounded ; sterile lamina *ca* 30 - 90 x 40 cm, ovate to oblong-lanceolate, simple pinnate ; pinnae 8 - 15 pairs, articulate, alternate or subopposite, upto 4 cm apart ; largest pinna *ca* 10 - 25 x 2 - 3 cm, lanceolate, apex acuminate, base cuneate, margin serrate with thick, hard, pale-brown sclerotic border ; rachis similar to stipe ; costa raised above and below, shallowly grooved above and below ; veins distinct, simple or rarely once forked, reaching the margin ; texture thick coriaceous, lamina green, glabrous on both surfaces, shining. Fertile lamina borne at the distal part of the plant, more or less same size and shape with the sterile one, but pinnae much contracted, *ca* 25 x 0.5 cm. Sori densely covering the lower surface except midrib and the extreme apex ; sporangia large, stalked, crowded. Spores monolete, pale-green, exine sparsely spinulose (Pl. 217).

Fertile : July. - Oct.

Distrib : (a) Malay Peninsula, Queensland, Fiji, China, Sri Lanka and Australia ; (b) South, North and Northeast India.

Occur : Very common ; densely covering tree trunk along shady places. Kamalpur, Kamrup dist. 1317 ; Mangaldai, Darrang dist. 2072.

Uses : The young shoots are eaten either raw as salad or cooked. Owing to their durability when submerged in salt water, the rhizomes are utilized as cordage in binding fish traps and as anchor ropes. They are also used for making baskets. The decoction of leaves is taken in fever (Manickam & Irudayaraj 1992). Fronds are used to treat fever and skin diseases and leaves to treat throat and gastric ulcer (Jain 1991). Stipes are also used as substitute for ropes, strings, etc. in Assam. Tender shoots are eaten cooked as vegetable and also sold in markets (Borthakur 1996).

Subclass : **SALVINIIDAE**
Order : **SALVINIALES**

AZOLLACEAE Wett.

Azolla Lam.
in Lam. *et* Poir. Encycl. Méth. Bot. 1. 343. 1783.

Of the two species *viz. Azolla imbricata* (Roxb. ex Griff.) Nakai and *A. pinnata* R. Br. listed for India (Dixit 1984), only the later species has been encounted in Assam in the present study.

Azolla pinnata R. Br. Prodr. Fl. Nov. Holl. 167. 1810 ; Dhir, Ferns N. W. Himalayas, 52. 1980 ; Jamir & Rao, Ferns Nagaland, 405. 1988 ; Manickam & Irudayaraj, Pterid. Fl. West. Ghats-S. India, 345. t. 261. 1992.

Aquatic. Plant *ca* 2 x 1 cm, triangular. Stem horizontal, profusely branched. Roots *ca* 4.5 cm long,

unbranched, densely covered by hairs. Leaves *ca* 1 x 0.7 mm, sessile, alternate, dorsal lobe aerial, more or less rectangular, margin entire with a membranaceous border, thick, grey-green, upper surface with dense, short, blunt trichomes ; veins indistinct ; ventral lobes *ca* 1 x 1 mm, submerged, ovate, apex blunt or rounded, base cuneate, margin entire, veins distinct, copiously anastomosing ; texture thin membranaceous, glabrous and brown. Megasporocarp ovoid, smaller than microsporocarp, with a single megasporangium ; microsporocarp *ca* 1 mm in diameter, glabrous, brown, containing numerous stalked microsporangia. Spores small, round, translucent (Pl. 218 ; Ph. 18).

Fertile : May - Aug.

Distrib : (a) Africa, Australia, Asia, Taiwan, Malay ; (b) throughout India.

Occur : Common in paddy fields ; also found in stagnant water bodies like ditches, ponds, swamps, etc. (Ph. 18). Jalukbari, Kamrup dist. 567 ; Dalgaon, Darrang dist. 2083.

Uses : Used as a good ration for poultry and ducks. Also used as biofertilizer to the rice crops and now a days to some extent in other crops (Islam 1983 ; Ambasta 1986 ; Manickam & Irudayaraj 1992).

SALVINIACEAE Séguier

Salvinia Séguier
Fl. Veron. 3. 52. 1754.

Dixit (1984) has listed four species of *Salvinia* for India. Two species have been recorded in the present investigation.

Small aquatic, free-floating, annual ferns. Rhizome dorsivental, branched, hairy, rootless. Leaves two types, floating leaves and submerged leaves ; floating leaves green, exposed to the air in pairs, midrib distinct, veins anastomose, hairy ; submerged leaves finely dimided, root like. Sori in special seed like bodies, called sporocarps, which are globose, borne on submerged leaves in clusters ; sporocarps contains two types of sporangia, micro and megasporangia.

KEY TO SPECIES

1a. Lamina crowded, wider than long, upper surface papillate ---------- --- --- --- ***natans***
1b. Lamina distant, longer than wide, upper surface tufted hairy ---------- --- --- --- ***cuculata***

Salvinia cucullata Roxb. ex Bory, Bel. Voy. Bot. 2. 6. 1833.

Aquatic, free floating plants. Stem *ca* 3 mm thick, spongy, terete, branched with nodes and internodes, hairy. Floating leaves *ca* 1.5 - 2 x 0.5 - 1 cm, sessile, opposite, horizontally spreading, oblong, rounded or slightly cordate at base, margin entire, upper surface tufted hairy ; lower surface thinly matted like the stem with shining pellucid brown hairs ; veins anastomosing, forming elongated areoles; texture soft herbaceous ; pale-green. Submerged leaves root-like, *ca* 5 cm long, covered by hairs, brown. Sporocarps borne in clusters on submerged leaves, ovoid, sesslie, *ca* 2 mm in diameter, densely hairy, all alike but some containing microsporangia and other megasporangia (Pl. 219).

Fertile : May - Dec.

Distrib : (a) Europe, Africa, North America and Australia ; (b) Eastern India.

Occur : Very common in ponds, paddy fields and in stagnant waters in lower elevation. Dibrugarh, Dibrughar dist. 646 ; Mariani, Jorhat dist. 1264 ; Sipajhar, Darrang dist. 2188.

Uses : Used as good ration for ducks and as biofertilizer (Islam 1983).

Salvinia natans (L.) All. Fl. Pedem. 2. 289. 1785 ; Dhir, Ferns N. W. Himalayas, 51. 1980 ; Jamir & Rao, Ferns Nagaland, 406. 1988. *Marsilea natans* L. Sp. Pl. 2. 1099. 1753.

Aquatic, free floating plants. Stem *ca* 2 mm thick, horizontal, terete, branched with nodes and internodes. Floating leaves *ca* 0.8 - 1.5 x 1 - 1.8 cm, borne at the nodes, opposite, sesslie, slightly erect, crowded, oval, apex rounded, base cuneate or cordate, margin entire, intercurved so that the leaves become funnel-shaped, upper surface closely papillose, under surface nearly nacked ; veins anastomosing to form parallel, elongated areoles ; texture soft herbaceous ; pale-green ; submerged leaves root-like, 4 - 8 in a cluster, arising from the nodes of stem, *ca* 5 cm long, covered by brown, septate hairs. Sporocarps quite alike in external appearance but some containing microsporangia and others megasporangia ; sporocarps ovoid or globose, covered by multicellular hairs (Pl. 220).

Fertile : May - Dec.

Distrib : (a) Europe, Africa, North America, Asia ; (b) Indo-Gangatic plains, Northeastern India.

Occur : Common in ponds, paddy fields and stagnant water bodies in lower elevations. One of the major aquatic weeds in low lands. Tangla, Darrang dist. 2192 ; Rangia, Kamrup dist. 1314.

Uses : Used as good ration for ducks and also used as biofertizer by some villagers of the plain areas in the cultivated fields (Islam 1983).